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Context Effects and False Memory for Alcohol Words in Adolescents

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Abstract

This study assessed incidental recognition of Alcohol and Neutral words in adolescents who encoded the words under distraction. Participants were 171 (81 male) 10th grade students, ages 14–16 ($M = 15.1$) years. Testing was conducted by telephone: Participants listened to a list containing Alcohol and Neutral (Experimental – Group E, $n = 92$) or only Neutral (Control – Group C, $n = 79$) words, while counting backwards from 200 by two's. Recognition was tested immediately thereafter. Group C exhibited higher false recognition of Neutral than Alcohol items, whereas Group E displayed equivalent false rates for both word types. The reported number of alcohol TV ads seen in the past week predicted higher false recognition of Neutral words in Group C and of Alcohol words in Group E. False memory for Alcohol words in Group E was greater in males and high anxiety sensitive participants. These context-dependent biases may contribute to exaggerations in perceived drinking norms previously found to predict alcohol misuse in young drinkers.

Keywords

alcohol; adolescents; false memory; recognition; advertising; context

1.1 Introduction

Social learning theory asserts that learned associations between situations, actions and outcomes are stored in memory (Bandura, 1989). Stacy, Leigh, and Weingardt (1994) proposed that memory networks can mediate alcohol use. That is, activation of the memory network is the functional link between exposure to alcohol-related stimuli and drinking behavior. This proposition is supported by empirically-derived models (e.g., Rather et al., 1992).

Frequent exposure can promote heightened reactivity to drug-relevant stimuli. This bias has been likened to a 'cocktail party effect' (Munafò et al., 2003), whereby the mention of one's

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name amidst a background of noise involuntarily recruits attention (cf. Cherry, 1953). By increasing the perceived pervasiveness of alcohol stimuli, such a bias could inflate estimates of ‘normative’ alcohol use. Conformity to these inflated norms could, in turn, increase drinking behavior (Martens et al, 2006).

Recent research has found that heavy drinking university students incorrectly report having seen alcohol expectancy words (e.g., uninhibited, mellow) when exposure to the words occurred in a drinking context (a mock bar) but not a neutral one (a conference room) (Reich, Goldman, & Noll, 2004). No significant context effects were found for light drinkers or non-drinkers. Although the causal effects of these memory biases cannot be established from this study, other research has found a prospective relation between biased responses to ambiguous alcohol cues and subsequent heavy drinking in youth (Kelly, Masterman, & Marlatt, 2005). Thus, a better understanding of false memory for alcohol stimuli could facilitate efforts to prevent heavy drinking.

The present study assessed incidental recognition of Alcohol and Neutral words in a diverse sample of adolescents. Testing was conducted by telephone, with half of the sample receiving Alcohol plus Neutral words during the study phase (experimental group: Group E) and half receiving Neutral words only (control group; Group C). Environmental exposure to alcohol stimuli was operationally defined as the number of alcohol ads seen on TV in the week before testing. Additional risk factors for problem drinking in adolescents were also incorporated in the model.

2.1 Methods

2.2 Participants

Participants were 171 (87 male) ethnically diverse 10th grade students, ages 14–16 ($M = 15.1$) years, chosen at random from high schools in southern California. Their parents provided consent for their children’s participation and the participants themselves provided assent prior to testing. Participants were assigned randomly to the Group E ($n = 92$, 46 male) or Group C ($n = 79$, 41 male) and assessed individually by a trained interviewer.

2.3 Materials and Apparatus

Level of alcohol use (beer, wine, liquor) in the preceding 30 days was assessed by retrospective self-report (cf. Kann, 2001). Alcohol outcome expectancies were assessed by scales previously validated with this population (Leigh & Stacy, 1993; Winters, Stinchfield, & Henly, 1993). Exposure to alcohol ads was assessed by the question: “In the past week, how many TV commercials have you seen for alcohol drinks, like beer, wine, or liquor?” (Schooler, Feighery, & Flora, 1996). The Anxiety Sensitivity Index-R (ASI; Peterson & Reiss, 1992) measured anxiety sensitivity.

2.4 Procedure

The recognition task occurred first, followed by the interview, which assessed background characteristics, exposure to alcohol ads, alcohol expectancies, and alcohol problems.

2.4.1. Recognition: Study Phase—Participants were told to listen to a list of 24 words presented at a standard rate (1/sec) and volume. To simulate real-world distraction, they counted backwards by two’s from 200 while the list was presented. They were not advised of the forthcoming recognition task.

Group E received Alcohol words (e.g., cocktail, gin), Alcohol sound-alike words (e.g., campaign) and categorized (building) Neutral words (e.g., doorway). Group C received a

study list of exclusively Neutral words. They heard the same building words as Group E, but instead of Alcohol and Alcohol sound-alike words, they heard a list of Clothing words (e.g., vest) and Clothing sound-alike words (e.g., shirk for shirt). Words are listed in the Appendix. Words in each category were matched on length; frequency of occurrence in print, and concreteness (cf. Hirshman & Arndt, 1997).

2.4.2 Recognition: Test Phase—Testing occurred immediately after the study phase. Both groups heard the same set of words at Test. Half of the test stimuli were Alcohol words, and half Neutral.

2.5 Data Compilation and Statistical Analysis

Correct (Hits) and incorrect (False Alarms) ‘yes’ responses to Alcohol and Neutral test words were analyzed. Mean rates of each response type for each group and gender were assessed with analysis of variance (ANOVA).

Within each group, prediction of Hits and False Alarms for Alcohol and Neutral test words was assessed by multiple linear regression analyses. Predictors were: reported number of alcohol TV ads seen in the preceding week, reported alcoholic drinks consumed in preceding month, alcohol expectancy score, ASI, and gender ($m = 1$, $f = 2$). Per Wilkinson and Dallal (1981) for model building, predictors were entered by forward selection, with .05 as the criterion for entry and .10 the criterion for removal from the model. Signal Strength (d') and Response Bias (β) scores were also assessed by ANOVA and regression, using standard formulae for these measures (Donaldson, 1992).

Chi-square analyses assessed relative frequency of drinkers for each group and gender. Skewed distributions (d' and level of alcohol use) were rank-transformed prior to analysis.

3.1 Results

3.2 Participant Characteristics

Table 1 reports mean (SD) background characteristics. The proportion of drinkers was 24% and did not differ by group or gender. In drinkers, mean consumption (range: 1–6 drinks) in preceding month was modest and uniform across groups and genders. Anxiety sensitivity was higher in females, $p = .007$. There were no other significant effects.

3.3 Mean Recognition Performance

Mean (SD) Hit rate (%) for Neutral words was higher in Group C, 48.3 (24.1) than Group E 39.9 (23.0), $p = .023$. Mean Response Bias for Neutral words was smaller (more liberal) for Group C, 0.04 (0.65) than Group E, 0.35 (0.55), $p < .001$. Mean Hit rate for Alcohol words (Group E only) was 34.6 (24.0) %, and did not differ by gender. Mean Response Bias for Alcohol words was more liberal in males, 0.25 (0.60), than females, 0.55 (0.55), $p = .016$. There were no significant effects involving Signal Strength (d').

3.3.1 Group Difference in False Alarms: Alcohol vs. Neutral Words—A main effect of Gender indicated a higher mean false alarm rate for both types of words in males 38 (23)% than females 33 (22) %, $p = .046$. A Group $\times$ Word Type interaction indicated equivalent rates of false alarms for Neutral and Alcohol words in Group E, but significantly more Neutral than Alcohol false alarms in Group C, $p < .001$. These results confirm the effectiveness of the Word Type manipulation.

3.4 Bi-variate Inter-correlations

Inter-correlations among predictors are given in Table 2. Alcohol use and alcohol expectancy were significantly inter-correlated in the full sample and each group alone. The correlation between gender and anxiety sensitivity recapitulates the analysis of means. In Group E but not Group C, alcohol use also correlated positively with reported number of alcohol ads seen on TV.

3.5 Multiple Linear Regressions

Multiple R scores and Beta weights of the predictors for each dependent measure are shown in Table 3. R scores indicate that, in Group C, predictors collectively explained significant variance in responses to Neutral but not Alcohol words, whereas in Group E, predictors explained significant variance in responses to Alcohol but not Neutral words.

Of the individual predictors, only Alcohol Ads consistently predicted recognition. The negative correlations between Alcohol Ads and β indicate that participants who reported seeing more Alcohol Ads also were more likely to say 'yes' to Neutral words (Group C), and to Alcohol words (Group E).

In Group C, there were no other significant predictors. In Group E, gender was negatively related to False Alarms and positively related to β to Alcohol words. These results reflected a general tendency for males to say 'yes' to Alcohol words. Of the other predictors, only ASI was significantly related to False Alarms to Alcohol words. Thus, high anxiety sensitive participants more often reported having seen an Alcohol distracter word than low anxiety sensitive participants did.

4.1 Discussion

This study assessed incidental recognition for Alcohol and Neutral words in a diverse sample of male and female adolescents. Exposure to Alcohol words at study was expected to promote false recognition of Alcohol words, and moderating effects of risk factors for alcohol misuse were explored.

As predicted, the presence of Alcohol words at study increased false recognition of Alcohol distracters whereas the presence of a second set of Neutral words at study increased false recognition of Neutral distracters. Thus, encoding context biased memory in a semantically-congruent manner.

Bi-variate correlations revealed that the predictors were largely unrelated to one another. However, recent alcohol use did correlate with stronger alcohol expectancies, in line with the literature. Also in line with the literature, females reported higher anxiety sensitivity than males. Only one other inter-correlation was significant: Participants who reported more alcohol use in the past month also reported having recently seen more alcohol ads on TV, but only in Group E. In Group C this association was completely absent. Thus, in participants exposed to alcohol cues amid distraction (in the study), reported exposure to alcohol ads and reported alcohol use tapped a common construct.

In the regression analyses only one variable consistently predicted recognition performance—reported number of alcohol ads seen on TV. In Group C, this variable predicted more Hits, False Alarms and more liberal response bias to Neutral words, reflecting a stronger tendency to say 'yes' to Neutral words. Responses to Alcohol words were not related to any predictor in Group C. Conversely, in Group E, reported alcohol ads predicted more Hits, False Alarms and liberal response bias to Alcohol, but not Neutral words. Thus, the tendency to report having encountered an alcohol stimulus (TV ad) outside the laboratory predicted the

tendency to report having encountered a stimulus that was *congruent with its semantic context* inside the laboratory.

Two other significant results emerged in the regressions. Males displayed a stronger bias to say 'yes' to Alcohol words in Group E (i.e., when primed). Gender was unrelated to memory in Group C. High anxiety sensitive participants reported having seen more Alcohol distracters in Group E (i.e., when primed) but not Group C.

This pattern of effects is complex. Interpretation can be facilitated by considering the assessment situation. Recognition was assessed first and background characteristics immediately thereafter. In the test, participants exhibited a response bias consistent with the semantic context they encountered during the study phase. In each group, this bias was directly related to the number of alcohol ads participants subsequently reported having seen in the previous week. The two phases (recognition test, interview) provided two contexts: the first characterized by semantic context, and the second characterized by questions about alcohol use, expectancies and exposure to alcohol ads – i.e., an alcohol-related context. The pattern of correlations raises the possibility that false memory in the recognition test and reported exposure to alcohol ads both reflected a common process – a response bias to report having encountered a stimulus that was congruent with its context. The finding that reported exposure to alcohol ads and reported alcohol use correlated in Group E but not Group C is consistent with this interpretation. That is, reported alcohol use may be a recollection bias primed by prior exposure to alcohol cues. Alternatively reported alcohol use may be veridical but linked with greater susceptibility to context-dependent priming by alcohol cues.

Taken together, the findings indicate that adolescents who are more susceptible to priming effects in general are also more prone to the priming effects of alcohol cues in particular. Males and high anxiety sensitive individuals appear more inclined to such distortions. Context-dependent priming may partly explain how exposure to alcohol ads and other environmental cues translate into distorted perceptions of alcohol use. Disabusing these distortions may help impressionable adolescents revise their drinking behaviour to conform to lower, more accurate estimates of alcohol use.

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Table 1

Mean (*SD*) participant characteristics.

	<u>Control Group</u>		<u>Experimental Group</u>	
	<u>Males</u>	<u>Females</u>	<u>Males</u>	<u>Females</u>
N	41	38	46	46
Age	15.1 (0.3)	15.1 (0.4)	15.1 (0.4)	15.1 (0.4)
Alcohol Use (Drinkers only)	2.8 (1.7)	1.8 (0.7)	2.0 (1.7)	2.6 (1.5)
Alcohol Use (All participants)	0.7 (1.5)	0.4 (0.8)	0.2 (0.8)	0.5 (1.2)
Expectancy	49.5 (9.3)	46.0 (12.1)	48.7 (11.9)	48.7 (11.5)
ASI	17.5 (10.1)	22.3 (11.1) *	17.2 (10.3)	21.2 (10.3) *
Alcohol Ads	3.4 (2.0)	3.1 (2.4)	3.2 (2.2)	2.8 (2.3)

Alcohol Use: Number of alcohol drinks (beer, wine, liquor) consumed in preceding 30 days. Alcohol Outcome Expectancy score ranges from 21–70. ASI = Score on Anxiety Sensitivity Index-Revised (Peterson & Reiss, 1992), ranges from 0–64. Alcohol Ads = reported number of alcohol advertisements seen on TV in the week before testing, 0–6 (≥ 6 ads in preceding week).

* Main effect of Gender, $p < .05$.

Table 2

Pearson inter-correlations among predictors of Yes/No recognition in adolescents exposed to Neutral (Control - Group C, n = 79) or Alcohol (Experimental - Group E, n = 92) words in study phase.

	Full Sample			
	1	2	3	4
1. ALCUSE				
2. GEN	.05			
3. ALCAD	.13	-.08		
4. ASI	-.04	.20*	-.01	
5. EXP	.25*	-.06	-.06	-.03

	Group C			
	1	2	3	4
1. ALCUSE				
2. GEN	-.03			
3. ALCAD	-.01	-.08		
4. ASI	-.05	.21	-.03	
5. EXP	.26*	-.18	-.09	-.18

	Group E			
	1	2	3	4
1. ALCUSE				
2. GEN	.13			
3. ALCAD	.26*	-.08		
4. ASI	-.05	.19	.01	
5. EXP	.25*	.04	-.03	.10

ALCUSE = Rank-transformed number of alcohol drinks (beer, wine, liquor) consumed in past 30 days (all participants); GEN = gender (m: 1, f: 2); ALCAD = TV Alcohol Ads Seen in Past Week; ASI = Score on Anxiety Sensitivity Index-Revised; EXP = Alcohol Expectancy.

* p < .05.

Table 3

Multiple R, adjusted R² and Beta (semi-partial correlation) for linear regression of Yes/No recognition to Neutral and Alcohol targets in adolescents exposed to Neutral (Group C, n = 79) or Alcohol words (Group E, n = 92) in study phase.

	Group											
	Control (C)					Experimental (E)						
	Word Type											
	Neutral		Alcohol		Neutral		Alcohol					
	H	FA	d'	β	H	FA	d'	β	H	FA	d'	β
R	.279*	.262*	ns	.337*	ns	ns	ns	ns	.320**	.437***	ns	.426***
R ² (adj)	.066	.056	--	.102	--	--	--	--	.092	.162	--	.163
<u>Predictor</u>												
ALCUSE	.004	.032	--	.016	--	--	--	--	-.042	-.009	--	-.004
GEN	-.019	-.034	--	-.036	--	--	--	--	-.105	-.269**	--	.207*
ALCAD	.279*	.262*	--	-.337*	--	--	--	--	.320**	.271**	--	-.357***
ASI	.185	.208	--	-.197	--	--	--	--	.119	.239*	--	-.180
EXP	-.162	-.151	--	.190	--	--	--	--	.127	.041	--	-.126

H = Hits, FA = False Alarms, d' = Signal Strength, β = Response Bias, ALCUSE = number of alcohol (beer, wine, liquor) drinks consumed in past month (includes participants who consumed 0 drinks); GEN = gender (m: 1, f: 2), ALCAD = Alcohol TV Ads Seen in Past Week, ASI = Score on Anxiety Sensitivity Index-Revised, EXP = Alcohol Expectancy score.

* p < .05,
 ** p < .01,
 *** p < .001

Appendix

Word Stimuli for Recognition Task

Group	Study List			
	Targets	Foils	Targets	Foils
Experimental	Cocktail	Campaign	Hall	Root
	Gin	Deer	Doorway	Shore
	Shot	Brink	Board	Bank
	Keg	Pine	Beam	Pouch
	Bourbon	Wispy	Closet	Foam
	Booze	Battle	Carpet	Match
	Ale	Litter	Basement	Flower
	Brew	Drift	Vent	Freight
	Blouse	Shirk	Hall	Root
	Uniform	Dance	Doorway	Shore
	Dress	Sack	Board	Bank
	Suit	Toy	Beam	Pouch
	Vest	Goat	Closet	Foam
	Outfit	Setter	Carpet	Match
Control	Gown	Racket	Basement	Flower
	Slipper	Rope	Vent	Freight

Group	Test List					
	Targets	Auditory Distracters	Semantic Distracters	Targets	Auditory Distracters	Semantic Distracters
Both	Cocktail	Champagne	Alcohol	Hall	Roof	Building
	Gin	Beer	Vodka	Doorway	Floor	Platform
	Shot	Drink	Scotch	Board	Plank	Lodge
	Keg	Wine	Pitcher	Beam	Porch	Warehouse
	Bourbon	Whisky	Brandy	Closet	Dome	Stair
	Booze	Bottle	Rum	Carpet	Latch	Cellar
	Ale	Liquor	Stein	Basement	Tower	Cabinet

Group	Test List			
	<u>Targets</u>	<u>Auditory Distracters</u>	<u>Semantic Distracters</u>	<u>Targets</u>
	Brew	Draft	Pint	Vent
				Frame
				Lobby