



Short Communication

Attention and recognition memory bias for alcohol-related stimuli among alcohol-dependent patients attending residential treatment

Audrey A. Klein*, Lindsay M. Nelson, Justin J. Anker

Butler Center for Research, Hazelden Foundation, United States

HIGHLIGHTS

- ▶ Alcohol stimuli impaired attentional processing among alcohol-dependent patients.
- ▶ Alcohol-dependent patients showed recognition memory bias for alcohol information.
- ▶ Alcohol-related attentional bias decreased across stimuli repetitions.

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ABSTRACT

Though studies have examined attentional bias for alcohol-related information among alcohol-dependent individuals, few have examined memory bias. This study examined attention and recognition memory biases for alcohol-related information among patients recently admitted to residential alcohol treatment ($n = 100$; 40% female). Participants completed a computerized attentional task wherein they classified a centrally-presented digit as odd or even. On some trials, an alcohol word, neutral word, or anagram was presented along with the digit. On these dual trials participants first classified the digit and then classified the other stimulus as a word or nonword. Participants took longer to classify digits that appeared with alcohol words compared to neutral words; suggesting the alcohol words distracted them from processing the digit. In a subsequent recognition memory test, participants showed significantly higher hit rates (i.e., correctly classifying an old item as old) and false alarm rates (i.e., incorrectly classifying a new item as old) to the alcohol words compared to the neutral words, and they also showed a more liberal response bias to alcohol words. The findings suggest that alcohol-dependent individuals exhibit both attention and memory bias for alcohol-related information.

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1. Introduction

Several studies using a variety of cognitive processing tasks have shown that individuals with a substance use disorder (SUD) preferentially attend to drug-related stimuli and appear to process these stimuli more efficiently than neutral stimuli (Bradley, Mogg, Wright, & Field, 2003; Franken, Kroon, Wiers, & Jansen, 2000). This attentional bias has been associated with craving (Marissen et al., 2006), quantity and frequency of substance use (Field, Mogg, Zetteler, & Bradley, 2004; Townshend & Duka, 2001), and relapse risk among individuals receiving treatment for an SUD (Cox, Hogan, Kristian, & Race, 2002; Marissen et al., 2006).

Few studies of attentional bias have examined whether an alcohol stimulus actually disrupts processing of a concurrent stimulus. This issue has a great deal of clinical relevance because if a drug-related

attentional bias is disruptive to ongoing processing, then an individual may not be able to successfully direct processing to a more beneficial stimulus or task. Indeed, relapse prevention strategies involve teaching abstinent individuals a variety of cognitive and behavioral coping skills for managing situations that pose a high risk for resumption of alcohol or drug use (such as direct exposure to drug cues). Coping strategies include deep breathing exercises and thinking about the negative consequences of substance use (Marlatt & Witkiewitz, 2005). If alcohol or drug-related stimuli attract attention, then an individual may not be able to successfully employ these coping strategies, potentially placing them at increased risk for substance use.

In a study of 25 alcohol-dependent males attending treatment, Waters and Green (2003) found that reaction times to classify a digit as odd or even were significantly longer when the digit appeared with an alcohol as opposed to neutral word, suggesting that the appearance of the alcohol word may have distracted participants from classifying the digit. In addition, participants took significantly longer to make lexical decisions on alcohol words, suggesting that the meaning of the word distracted them from the word/nonword

* Corresponding author at: Butler Center for Research, Hazelden Foundation, 15251 Pleasant Valley Road, Center City, MN 55012, United States. Tel.: +1 651 213 4106; fax: +1 651 213 4536.

E-mail address: aklein@hazelden.org (A.A. Klein).

classification. The present study sought to replicate these findings using a large, gender-inclusive sample of individuals attending residential treatment.

Compared to attentional bias, very few studies have examined memory bias among alcohol-dependent individuals, though explicit cognitive processes like memory are presumed to contribute to substance use (Reich, Below, & Goldman, 2010; Stacy & Wiers, 2010). In one study free recall was better for alcohol words than neutral words (Franken, Rosso, & van Honk, 2003), but no study has used a recognition memory task, which differs from free recall and involves both a memory and decision-making component (Mandler, 1980; Yonelinas, 1994). In the present study, we gave participants a surprise recognition test to determine whether alcohol dependent participants show biased memory and decision-making for alcohol words.

In summary, the first goal of the present study was to examine attentional bias for alcohol-related stimuli among individuals attending residential treatment for alcohol dependence and more specifically to examine whether the appearance of an alcohol stimulus interrupted processing of another stimulus. The second goal was to examine memory and decision-making bias for alcohol-related stimuli using a recognition memory task.

2. Method

2.1. Participants

One-hundred patients (60 men; 40 women) attending residential treatment for alcohol dependence participated in the study. Participants were recruited and tested between 3 and 13 days of admission to treatment. All participants were successfully detoxed and free from acute withdrawal at the time of testing. The main criterion for inclusion in the study was a primary diagnosis of alcohol dependence (i.e., the patient identified alcohol as his or her drug of choice). If the participant met dependence criteria for more than one substance, alcohol had to be the primary diagnosis. Participants did not have a history of recent psychosis or psychotic disorders. No other exclusion/inclusion criteria were employed in this study.

Table 1 shows demographic and baseline clinical characteristics of the sample. Average length of stay was 26.30 days ($SD = 5.34$) and 93% of the sample successfully completed the treatment program. Substance dependence and mental health diagnoses were made during the course of routine clinical operations through a comprehensive baseline assessment conducted by an interdisciplinary team of licensed alcohol and drug counselors, psychiatrists, and doctoral-level clinical psychologists. All diagnoses were based on the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) criteria (American Psychiatric Association, 2000). All participants were alcohol dependent and 15% were dependent on at least one other drug.

2.2. Materials

2.2.1. Attentional bias task

Based on Waters and Green (2003), this computerized task presented a centrally-located digit (1–8) and participants were required to classify it as odd or even (reaction times were recorded via SuperLab 4 software). On some trials the digit appeared with an alcohol word, on other trials it appeared with a categorically-related neutral word (a gemstone: diamond, emerald, etc.) and on others it appeared with an anagram. Neutral words were matched to alcohol words on length, number of syllables, and frequency in the English language. Participants were asked to first classify the digit and then classify the other stimulus as a word or nonword. Alcohol and neutral trials were presented twice in blocked format (i.e., the two types of trials were not intermixed within a block) in a counterbalanced

Table 1
Demographic and clinical characteristics at baseline.

Variable	% or mean (SD)
Gender	
Male	60%
Female	40%
Age (in years)	42.72 (11.95)
Education	
Didn't complete high school	2%
High school diploma/GED	15%
Associate degree	9%
Some college	22%
College graduate	29%
Graduate degree	23%
Marital status	
Married	50%
Single, never married	24%
Divorced	18%
Separated	1%
Widowed	2%
Cohabiting	2%
Employment status	
Full-time	55%
Part-time	5%
Unemployed	9%
Self-employed	7%
Retired	7%
Student	4%
Homemaker	4%
Military	9%
Dependence diagnosis	
Alcohol	100%
Marijuana	12%
Cocaine	6%
Amphetamines	8%
Co-occurring disorder	39%
Anxiety disorder	23%
Depressive disorder	20%

order (i.e., half of the participants received the alcohol blocks before the gemstone blocks).

2.2.2. Recognition memory test

This computerized test presented words and asked participants to indicate whether they had seen the word in the earlier attentional task. Sixteen words had appeared in the task (8 alcohol words and 8 gemstone words) and 16 words were new words (i.e., distractors or lures) that had not appeared previously. Four of these new words were related to alcohol (wine, whiskey, pub, vodka) and four were related to gemstones (jade, silver, garnet, quartz). These words allowed us to measure the extent to which people would falsely remember words that belonged to the same category as the previously presented words. The other 8 distractor words were unrelated to either word type or to each other (brother, school, person, game, office, doctor, number, trouble).

We calculated the hit rate (percentage of old items correctly classified as old) and false alarm rate (the percentage of new items incorrectly classified as old) for each word type. We also calculated a statistic called *d* prime, which represents how accurate a person is in discriminating between old and new items (Huh, Kramer, Gazzaley, & Delis, 2006). Higher levels of *d* prime represent higher recognition memory accuracy. In addition, we calculated a statistic called *beta*, a response bias measure assessing a general propensity to call an item old, regardless of whether it appeared previously (Huh et al., 2006; Macmillan & Creelman, 2005). Lower levels of *beta* indicate a liberal response bias (i.e., a strong propensity to call any test item old). To assess whether memory and response bias differed for alcohol vs. neutral words, we examined whether *d* prime and *beta* differed for the two word types.

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