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# Testing a frequency of exposure hypothesis in attentional bias for alcohol-related stimuli amongst social drinkers

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ABSTRACT

*Aims:* To examine whether a group of social drinkers showed longer response latencies to alcohol-related stimuli than neutral stimuli and to test whether exposure to 1) an alcohol-related environment and 2) consumption related cues influenced the interference from alcohol-related stimuli.

*Methods:* A 2 × 2 × 2 × 5 factorial design with Exposure Group (high, low) and Consumption Group (high, low) as between-participant factors and Word Type (alcohol, neutral) and Block (1–5) as within-participant factors was used. Forty-three undergraduate university students, 21 assigned to a high exposure group and 22 to a low exposure group, took part in the experiment. Exposure Group was defined according to whether or not participants currently worked in a bar or pub. Consumption Group was defined according to a median split on a quantity–frequency measure derived from two questions of the Alcohol Use Disorders Identification Test (AUDIT) questionnaire. A modified computerised Stroop colour naming test was used to measure response latencies.

*Results:* Exposure and consumption factors interacted to produce greater interference from alcohol-related stimuli. In particular, the low consumption group showed interference from alcohol-related stimuli only in the high exposure condition. Exposure did not affect the magnitude of interference in the high consumption group.

*Conclusions:* Attentional bias is dependent upon exposure to distinct types of alcohol-related cues.



## 1. Introduction

A defining characteristic of incentive-motivational models of addictive behaviours is that ongoing use and misuse of substances leads to an increase in the salience of drug-related cues (Franken, 2003; Robinson & Berridge, 1993). It has been argued that with repeated behavioural enactment an attentional bias towards these concern-related stimuli develops, meaning that they are detected automatically (without conscious awareness), which results in the desire to undertake associated behaviour (see Field, Munafo, & Franken, 2009; Franken, 2003). Utilising various experimental tasks (e.g. modified Stroop, eye tracking technology, flicker induced change blindness, dot probe), attentional biases for concern-related stimuli have been identified in a variety of habitual behaviours including alcohol use (e.g. Sharma, Albery, & Cook, 2001), cannabis use (e.g. Cane, Sharma, & Albery, 2009), smoking (e.g. Attwood, O'Sullivan, Leonards, Mackintosh, & Munafò, 2008), and sex-related activity (Fromberger et al., 2012). The role of automatic processes for the cognition of addiction-related cues has been the subject of theoretical debate (Albery, Sharma, Niazi, & Moss, 2006; McCusker, 2001, 2006; Moss & Albery, 2009; Tiffany, 1990). It is argued that problem drinkers have a memory structure for alcohol-related concepts that is generated at an implicit level (Stacy, 1997; Stacy & Weirs, 2006; Weinstein & Cox, 2006; Wiers, Houben, Smulders, Conrod, & Jones, 2006). In other words, alcohol users, and other substance abusers, do not have control over attention to relevant stimuli and activation of appropriate memory structures that, in turn, may guide behavioural responses to such cues (Ingjaldsson, Thayer, & Laberg, 2003a; Leung & McCusker, 1999; Munafò, Mogg, Roberts, & Bradley, 2003; McCusker & Gettings, 1997). If this is the case then alcohol users should show greater pre-occupation with alcohol-related stimuli compared to non-alcohol-related stimuli. This effect has been shown to be consistent across studies using free association memory activation paradigms amongst alcohol users and other substance users (e.g. Leung & McCusker, 1999; Stacy, 1995), psychobiological measures (e.g. Ingjaldsson et al., 2003a, 2003b) and other implicit correlates of alcohol-related problems (e.g. Bruce & Jones, 2004; Cox, Brown, & Rowlands, 2003; Field, Mogg, & Bradley, 2005; Field, Mogg, Zetteler, & Bradley, 2004; Jones, Jones, Smith, & Copley, 2003; Moss, Albery, & Sharma, 2011; Pothos & Cox, 2002; Townsend & Duka, 2001; see Bruce & Jones, 2006).

In work which has utilised a modified Stroop task (Stroop, 1935), in which participants are asked to ignore a presented word and respond to the colour in which the word appears, it is found that alcohol-related

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words show increased response latencies in comparison to neutral words amongst problem drinkers (e.g. Bauer & Cox, 1998; Sharma et al., 2001). Theoretically, this effect has been explained in terms of the automatic activation of a semantic network related to alcohol (e.g. Cox, Fadardi, & Pothos, 2006; Field, 2006; Franken, 2003; Sharma et al., 2001). If this explanation were reasonable it would predict that such an effect would also be apparent amongst a subgroup of non-problem drinkers. Few studies have addressed this issue by comparing high and low consuming non-problem drinkers. Cox, Yeates, and Regan (1999) and Cox et al. (2003) reported no interference from alcohol-related words in either group whereas Sharma et al. (2001) and Bruce and Jones (2004) demonstrated that within a high consuming group of non-problem drinkers there was significant interference. One aim of the present study was to provide further evidence for an alcohol Stroop effect amongst high consuming social drinkers.

Although the preferred explanation for interference amongst problem and non-problem social drinkers is that repeated engagement in drinking behaviour strengthens the semantic network related to alcohol, other not incompatible explanations are possible. One relates to the frequency of exposure to alcohol-related stimuli. This frequency of exposure explanation suggests that problem drinkers have a greater pre-exposure to alcohol-related stimuli that acts to prime the related semantic network which manifests itself in increased interference compared to non-problem drinkers. Using a modified Stroop, Sharma et al. (2001) have provided some evidence against this hypothesis showing that amongst problem drinkers there was no increase in the interference (reaction time to alcohol stimuli minus neutral stimuli) when alcohol-related stimuli were repeated. This data suggested a reduction in this interference with repetition, which supports a habituation response, and is consistent with evidence from other studies that show a reduction in the modified Stroop effect (and other measures of attention) after intervention through repetition (see Waters & Leventhal, 2006; see Williams, Mathews, & Macleod, 1996). For example, Marissen et al. (2006) showed a decrease in attentional bias (using a modified Stroop) for heroin-dependent individuals after cue exposure treatment or placebo conditions. Similarly, Schoenmakers, Wiers, Jones, Brice, and Jansen (2007) found a decrease in attentional bias (measured with the dot probe task) amongst heavy drinkers who had undertaken an attentional retraining programme. This issue has also been investigated by comparing spouses of patients with a control group since spouses are assumed to have been exposed more frequently to concern-related cues than control participants. McCusker and Gettings (1997) showed no greater interference for gambling-related stimuli in a group of spouses of gamblers and a control group. The current paper attempts to address this version of the frequency of exposure explanation by comparing two groups of social drinkers. A control group of social drinkers was compared to an experimental group who worked in an alcohol-related environment. It is predicted that if frequency of exposure moderates the interference from alcohol-related stimuli then the experimental group should show greater interference than the control group.

A second explanation relates specifically to the drinking behaviour of individuals as a measure of frequency of exposure rather than to exposure to general alcohol cues in the environment. If drinking behaviour is a viable exposure cue there should be increased interference for alcohol related stimuli in comparison to neutral stimuli for those individuals who drink more alcohol on more occasions. In the present study a quantity–frequency measure of drinking behaviour was used to compare social drinkers. If interference from alcohol-related stimuli is greater amongst those who consumed greater amounts of alcohol on more occasions when compared to those who consume less on fewer occasions, it could be argued that drinking behaviour per se as a measure of frequency of exposure moderates any interference effects.

## 2. Method

### 2.1. Participants

Forty-five undergraduate university students took part in the study. Participants were divided into low exposure ($N = 22$) and high exposure ($N = 21$) groups on the basis of whether participants currently worked in a bar or pub. The high exposure group (mean = 18.14 h per week, SE = .90, range 11–26 h per week) reported a significantly greater number of hours spent in bars/nightclubs/pubs (including work time) than the low exposure group (mean = 7.77 h per week, SE = .61, 1–10 h per week), $t(41) = 9.62$, $p < .001$. For analyses involving the specific effects of participants' alcohol consumption a median split was carried out on a quantity–frequency measure of alcohol consumption derived from the multiple of two questions of the AUDIT questionnaire (i.e. 'How often do you have a drink containing alcohol?' (scored 0–4) and 'How many drinks containing alcohol do you have on a typical day when you are drinking?' (each scored 0–4)). Possible range of scores for this measure was 0–16. Participants were divided into either high consumption ($N = 21$, mean = 7.38, SE = .55, range 4–12) or low consumption ($N = 22$, mean = 1.22, SE = .25, range 0–3) groups accordingly.

### 2.2. Design

A $2 \times 2 \times 2 \times 5$ factorial design with Exposure Group (high, low) and Consumption Group (high, low) as between-participant factors and Word Type (alcohol, neutral) and Block (1–5) as within-participant factors was used. The first five neutral words were presented as part of one block, the second five as part of another block and so on for a total of five blocks (see the Materials section for the words used). In each of the five blocks a different set of five words were used. Words across the five blocks were counterbalanced using a Latin square design. Each of the words was presented in each of four ink colours, red, green, blue and brown giving 20 stimuli per block. These twenty stimuli were randomised with the restriction that an identical word or colour could not repeat itself on consecutive trials. This formed one block in the stimulus array. Five such blocks were formed to produce 100 neutral category stimuli. The same design was used for the alcohol related words producing 100 alcohol related stimuli. For half the participants the alcohol stimuli were presented before the neutral stimuli and for the other half the neutral stimuli were presented before the alcohol stimuli. There was a short break of about 1 min at the end of one stimulus set and the beginning of the second stimulus set.

### 2.3. Materials

The words used in the experiment were all presented in capital letters and were as follows.

Neutral category (environmental features) words: BOG, RAVINE, VALLEY, BRIDGES, PEBBLE, COVE, CRAGS, LEAVES, PLAIN, GEYSER, TRENCH, CANAL, INLET, HARBOR, TREE, SWAMP, MOSS, HILL, TUNNEL, CLIFF, HOLLOW, MEADOW, WINDS, FOG, OCEAN.

Alcohol words: PUB, LIQUEUR, WINE, COCKTAIL, BREWERY, BREW, CIDER, SPIRITS, LIQUOR, TAVERN, MEAD, STOUT, BOOZE, DRUNK, BITTER, SCOTCH, SHERRY, BAR, BOURBON, SALOON, ALCOHOL, WHISKEY, PORT, GIN, BEER.

Neutral words were selected from the category of environmental features, as used previously by McKenna and Sharma (1995) and Sharma et al. (2001). The words used for the environmental features and alcohol categories were selected as follows: First, a number of words that the authors thought might belong to this category were selected and then rated by four judges on a five point (0–4, bad–good) scale as to category membership. Using a criterion of at least three out of four judges giving a rating of 2 or more, the selected words were then matched for word frequency and word length using Kucera and