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Reversing the sequence: Reducing alcohol consumption by overcoming alcohol attentional bias

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ABSTRACT

The aims of the research were to (a) compare the alcohol attentional bias (AAB) of social, hazardous, and harmful drinkers and (b) assess the effects of alcohol attention-control training on the AAB and alcohol consumption of hazardous and harmful drinkers. Participants were social drinkers ($N = 40$), hazardous drinkers ($N = 89$), and harmful drinkers ($N = 92$). Paper-and-pencil measures were used to collect information about participants' socio-demographic characteristics, health status, motivational structure, drinking-related locus of control and situational self-confidence, readiness to change, affect, and alcohol consumption. Computerized classic, alcohol- and concerns-Stroop tests were administered. All participants were tested individually, with the order of tests counterbalanced across participants. After the baseline assessment, the hazardous and harmful drinkers were trained with the Alcohol Attention-Control Training Program (AACTP) for two and four sessions, respectively. Both samples completed a post-training assessment, and the harmful drinkers also completed 3-month follow-up. Results indicated that (a) the harmful drinkers had larger AAB than the hazardous and the social drinkers; (b) the attentional training reduced the hazardous and harmful drinkers' AAB; and (c) the harmful drinkers showed post-training reductions in alcohol consumption and improvements on the other drinking-related indices. The harmful drinkers' improvements were maintained at the 3-month follow-up.

1. Introduction

Alcohol abuse is a serious, ongoing public-health problem. Excessive drinkers cause much emotional and physical harm to themselves and others; alcohol abuse is also linked to fatal accidents and loss of productivity. Among abusive drinkers who complete treatment, approximately 50% relapse within 3 months (Whitworth et al., 1996). These high failure rates are perplexing, especially because problem drinkers readily acknowledge the negative consequences of their drinking and appear strongly motivated to stop. It would appear that abusive drinkers who relapse after treatment have lost control over their drinking (Tiffany, 1990). In fact, unintentional preoccupation with alcohol despite knowledge of its adverse consequences is one of the criteria for defining alcohol abuse (e.g., Morse and Flavin, 1992; Roberts and Koob, 1997). This question remains: Why are abusive drinkers often unsuccessful at their attempts to control their drinking.

According to one account, abusive drinking is the outcome of faulty decision making (Bernheim and Rangel, 2002). For example, decisions about drinking can be highly automatic (Drobes et al., 2001; Marlatt, 1996; Tiffany, 1990; Tiffany and Conklin, 2000), with drinkers often being unaware of the factors that influence their decisions to drink (e.g., Wiers et al., 2002a). In their motivational model, Cox and Klinger (1988, 1990, 2004) suggest that decisions to drink alcohol result from both conscious and nonconscious processes. For example, in the early stages of excessive drinking, decisions to drink might be intentional, but later drinking might become a major goal in the person's life, with its corresponding motivational state called *current concern* (Cox and Klinger, 1988, 1990, 2004). Current concerns activate, direct, and maintain goal-related cognitive processes in implicit, automatic ways (Klinger and Cox, 2004). Having a current concern about drinking alcohol energizes and directs drinkers' thoughts and behavior toward procuring alcohol. As a result, drinkers develop attentional bias for stimuli related to alcohol of which they might be unaware.

According to Robinson and Berridge's (1993, 2000, 2001) incentive-sensitization theory, repeated administration of alcohol causes the brain to become sensitized to alcohol and its associated stimuli. In turn, these stimuli can trigger a conditional motivational state in the sensitized brain, leading the organism to search for alcohol and ingest it, without experiencing the pleasure previously

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associated with doing so ("drug wanting" in the absence of "drug liking"). The brain responses to alcohol cues involve evaluative processes in the limbic system and ventromedial prefrontal cortex, which contribute to the flawed decisions to drink too much or to break abstinence (Bernheim and Rangel, 2002; Damasio Antonio, 1994). In an fMRI study, Park et al. (2007) showed that when alcohol abusers were exposed to alcohol cues, activation of specific brain areas (i.e., fusiform gyri, temporal gyri, parahippocampal gyrus, uncus, frontal gyri, and precuneus) was correlated with the level of craving that the participants reported. Field and Eastwood (2005) trained one group of participants to attend to alcohol cues and another group to avoid attending to alcohol cues. The results showed that, compared to the later, the former group showed greater distractibility for alcohol-related stimuli, which was associated with increases in their urges to drink and their actual consumption of alcoholic beer during a taste test.

To conclude, alcohol and other substance abusers' attentional bias for addiction-related stimuli has been well documented. The bias is related to the maintenance of and relapsing to the addictive behavior, abusers' craving for the substance, and their actual decisions to use it. Consequently, studying attentional bias for addiction-related stimuli (e.g., alcohol attentional bias; AAB) is necessary for better understanding substance abusers' impaired control over their addictive behavior. For a comprehensive review of the theories of addiction-related attentional bias, see Cox et al. (2006).

Various techniques have been developed to study addiction-related cognitive biases, including memory association (e.g., Stacy, 1997) and implicit-association tasks (e.g., Wiers et al., 2002b); Artificial Grammar Learning (e.g., Pothos and Cox, 2002); and dot-probe (Hogarth et al., 2003), change blindness (Jones et al., 2003), and dual-task (Waters and Green, 2003) paradigms. Various versions of the addiction-Stroop test have also been used extensively to measure attentional bias for addiction-related stimuli (Cox et al., 2006). The addiction-Stroop test is a modified version of the classic-Stroop test (Stroop, 1935) and is often regarded as a variant of the emotional Stroop test (Williams et al., 1996), which is used to study attentional bias for emotional stimuli.

Heavy drinkers' sensitivity to alcohol stimuli has been widely studied with the alcohol-Stroop test. It consists of two categories of stimuli—alcohol-related (e.g., beer, wine) and emotionally neutral (e.g., chair, envelop)—that are written in different font colors. The participant's task is to name the colors while ignoring the meaning of the stimuli. Interference, or attentional bias, is calculated as participants' mean reaction time to the alcohol stimuli *minus* their mean reaction time to the neutral stimuli. The alcohol-Stroop test has been used to assess AAB in both heavy social drinkers (e.g., Cox et al., 1999, 2007; Stewart and Samoluk, 1997) and alcohol abusers (e.g., Bauer and Cox, 1998; Cox et al., 2000, 2002; Fadardi and Cox, 2006; Johnsen et al., 1994; Ryan, 2002; Stetter et al., 1995, 1994; Stormark et al., 2000). The degree of AAB is proportional to the amount of alcohol that participants habitually consume (e.g., abusers > heavy drinkers > social drinkers; Cox et al., 2006; Fadardi and Cox, 2006). In addition, AAB is inversely related to abusive drinkers' ability to control their drinking (Cox et al., 2003, 2007; McCusker, 2001; Roberts and Koob, 1997).

Having an attentional system that is highly sensitized to alcohol, heavy drinkers have alcohol at the focus of their attention, and alcohol-related stimuli thus act as triggers for cognitive, emotional, and behavioral responses, which might be inconsistent with the person's conscious, rational decision not to drink. Moreover, with repeated practice, the act of drinking becomes increasingly automatic, so that the person is unaware of the chain of processes leading to drinking after he or she has encountered the triggering stimuli. For example, when a habitual drinker sees an advertisement for beer on television, a series of cognitive processes is triggered that may lead the person to go through the act of drinking. The sequence begins with exposure to alcohol stimuli, which causes (a) attentional resources to be disproportionately allocated to alcohol-related stimuli, while attention simultaneously is focused away from other stimuli that require controlled processing, and (b) emotional responses to be emitted that fuel the motivation to enact the well-practiced behavioral sequence that culminates in the act of drinking. Such a person would be left feeling perplexed about why he or she drank, having broken the resolve not to do so. This causes the person either to justify the drinking episode, engage in further resolve not to drink but this time with greater hesitation, or loose self-confidence in the ability to control the drinking behavior and feel disappointed. In the person's attempt to cope, these negative emotions might lead to further drinking, initiating a vicious cycle that is very difficult to break. Of course, the importance of attentional bias in the continuation of and relapsing to addictive behaviors is not limited to alcohol use. In fact, theories explaining the origin of addiction-related attentional bias and its relationship to addictive behaviors do not make a distinction between the various substances of abuse (Cox et al., 2006). For reviews of the literature on substance-related attentional bias and the theories explaining it, we refer interested readers to Cox et al. (2006), Field and Cox (2008), and Wires et al. (2007).

Although the evidence for the cognitive basis for the uncontrollability phenomenon is compelling, there is a wide gap between existing knowledge and its practical applications to problematic drinking. Prior researchers using the alcohol-Stroop test have focused on variables related to drinkers' AAB, while not taking into account the potentially important role of drinkers' cognitive reactions to alcohol stimuli in explaining their preoccupation with alcohol (e.g., Stetter et al., 1994). Nevertheless, the prior research clearly suggests the feasibility of training problem drinkers to overcome their attentional bias for alcohol-related stimuli as a means of helping them control their excessive drinking (e.g., Wiers et al., 2006).

There have been various attempts to change drinking behaviors by changing alcohol-related cognitive processes. For example, the expectancy challenge seeks to reduce harmful drinking by changing drinkers' expectations about drinking-related outcomes (Darkes and Goldman, 1993, 1998; Musher-Eizenman and Kulick, 2003; Wiers and Kummeling, 2004). Both Field et al. (2007) and Schoenmakers et al. (2007) used a visual probe task to train heavy drinkers in a single session to avoid attending to alcohol-related stimuli. In both of these studies, the heavy drinkers showed post-training reductions in AAB as measured with the visual probe test, but the reduction in AAB was shown neither to generalize to other measures of attentional bias nor to affect the participants' drinking behavior in the real world.

1.1. Alcohol Attention-Control Training Program (AACTP)

The AACTP is a computerized intervention designed to help hazardous and harmful drinkers overcome their AAB and, thereby, to gain more control over their drinking. As Noel et al. (2001) reported, inhibition and working-memory deficits interfere with drinkers' ability to maintain short-term abstinence from alcohol. Specifically, these deficits, measured at the end treatment, predicted relapse to abusive drinking after 2 months. Thus, it would be expected that an intervention aimed at improving drinkers' inhibitory processes would help reduce their risk for relapse. Bowden et al. (2001) demonstrated that alcohol abusers could be trained to gain better control of their executive functions in general (but distraction for alcohol was not the focus of the training). It is noteworthy, however, that apart from a few studies (e.g., Fadardi, 2003; Field et al., 2007; Schoenmakers et al., 2007; Wiers et al., 2006), prior research has not assessed the impact of AAB training on trainees' alcohol