



Cue reward salience and alcohol cue reactivity



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ARTICLE INFO

Article history:

Received 29 January 2014

Received in revised form 25 April 2014

Accepted 5 June 2014

Available online 28 June 2014

Keywords:

Reinforcement expectancies

Alcohol cue reactivity

Positive affect

Negative affect

Motivational state

BAS

ABSTRACT

Alcohol cue-reactivity research has revealed substantial variability in the degree to which individuals react to alcohol-related cues (e.g., sight and smell of alcohol). One factor which may account for this variability in reactivity to alcohol cues is the perceived reward value of the cue, termed cue-reward salience, which previous research suggests may reflect the activation of a general appetitive motivational state. The current study aimed to formally test whether cue-reward salience reflects the activation of a general appetitive motivational state by examining the role of activated positive affect in the relationship between cue-reward salience and reactivity to alcohol cues. A total of 100 regular social drinkers were exposed to a neutral and alcohol cue in a standard cue-reactivity design. Consistent with prior research, cue-reward salience was found to account for significant additional variance in predicting positive urge to drink alcohol after accounting for drinking history and personality. Importantly and as hypothesised, activated positive affect was found to mediate the relationship between cue-reward salience and cue-reactivity. This finding uniquely demonstrates that a general appetitive motivational state is generated when stimuli are experienced as more rewarding than expected.

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1. Introduction

The cue-reactivity paradigm has been widely used to investigate the role of craving and affective states in maintaining alcohol use (e.g., Curtin, Barnett, Colby, Rohsenow, & Monti, 2005; Kambouropoulos & Staiger, 2004). This approach is based on the observation that stimuli or cues repeatedly paired with the positively or negatively reinforcing effects of alcohol, through classical conditioning, can come to elicit a variety of appetitive motivational responses, such as increased positive affect or increased urge to drink for the positive effects of alcohol, or aversive motivational responses such as increased negative affect or increased urge to drink for the negatively reinforcing effects of alcohol (see Carter & Tiffany, 1999; Niaura et al., 1988, and Schacht, Anton, & Myrick, 2013, for meta-analyses). However, there exists substantial variability in the extent to which individuals react to alcohol-related cues with increased craving or changes in affect (Rees & Heather, 1995). That is, while some individuals show only marginal responses to alcohol cues, or no response at all, others have demonstrated substantial reactivity to alcohol cues (e.g., Bradizza et al., 1999).

A number of factors have been investigated to explain this variability in responses to alcohol cues. One factor shown to influ-

ence levels of reactivity has been individual differences in levels of consumption, with studies showing heavy drinkers exhibit greater craving in response to alcohol cues than lighter drinkers (e.g., White & Staiger, 1991). Personality has also been found to influence the magnitude of cue-elicited responses. For example, research drawing on Reinforcement Sensitivity Theory (RST; Gray, 1994; Gray & McNaughton, 2000) suggests that heightened reward sensitivity is associated with greater alcohol cue-reactivity (e.g., Franken, 2002; Glautier, Bankart, & Williams, 2000). According to RST, heightened reward sensitivity reflects increased activation of the neurologically based Behavioural Approach System (BAS; Gray, 1994). The theory states that the BAS is activated when rewarding stimuli are encountered, leading to increases in positive affect and approach behaviour (i.e., appetitive motivation; Corr, 2004; Smillie, Pickering, & Jackson, 2006). Appetitive motivational theories of substance abuse propose that drug-related cues can 'take-on' the rewarding properties of drug use via classical conditioning (e.g., Stewart, de Wit, & Eikelboom, 1984). Therefore, individuals with heightened BAS sensitivity may be particularly prone to experiencing craving in response to alcohol-related cues due to a greater sensitivity to the rewarding properties of alcohol-related cues.

Although trait reward sensitivity has been associated with greater cue-reactivity (e.g., Franken, 2002; Kambouropoulos & Staiger, 2001), current thinking suggests that individuals' expectations of reward may be a critical factor influencing the relationship

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between reward sensitivity and responses to appetitive stimuli (Corr, 2002). Specifically, it has been suggested that a stimulus will only be experienced as rewarding, and hence lead to appetitive motivation, if the experience of reward associated with the stimulus is equal to, or greater than initial expectations of reward (Corr, 2002). Extending this argument to alcohol cue-reactivity, appetitive responses to alcohol cues should be greatest in individuals whose experience of reward following presentation of alcohol is at least equal to, or greater than, their initial expectations of reward. Appetitive responses to alcohol cues would not be expected to ensue for individuals whose experience of reward following presentation of alcohol was less rewarding than initial expectations. Therefore individual's reward expectations are likely to be an important factor in explaining variability in reactivity to alcohol cues.

Only one study has considered how reward expectations, and the extent to which such expectations coincide with the actual experience of reward, may further our understanding of appetitive motivational responses to alcohol-related cues. In this study, Kambouropoulos and Staiger (2009) presented regular drinkers with an alcohol cue (glass of alcohol) and neutral comparison cue in a standard cue-reactivity design. Participants were asked to rate how rewarding they expected the presentation of alcohol to be (i.e., before the alcohol was presented) and to report how rewarding they found the alcohol to be (i.e., following presentation of the alcohol). Ratings of experienced reward were subtracted from ratings of expected reward, and this difference, termed cue-reward salience, was used to indicate how rewarding the cue was found to be relative to expectations. The results demonstrated that cue-reward salience predicted unique variance in appetitive responses to alcohol cues (i.e., urge to drink for the positive effects of alcohol) above and beyond that predicted by drinking history and personality (i.e., reward sensitivity; Kambouropoulos & Staiger, 2009). Thus, previous research has found cue-reward salience to be associated with heightened urge to drink in response to alcohol.

One reason for this finding may be that the extent to which an individual perceives the alcohol as more rewarding than initially expected is associated with a heightened general appetitive motivational response and this may then explain subsequent urges to drink. Given that appetitive motivation has been demonstrated to be important in explaining responses to alcohol cues (e.g., Field, Mogg, & Bradley, 2005; Kambouropoulos & Staiger, 2001), if cue-reward salience predicts reactions to alcohol cues, it is likely that this occurs via the generation of a general appetitive motivational state. Thus, the relationship between cue-reward salience and alcohol use observed in previous research may reflect the activation of a general appetitive motivational state. Whether cue-reward salience is actually associated with a general appetitive motivational state however, remains to be formally tested. It will be proposed that this assumption can be explicitly tested by examining the associations between cue-reward salience and positive affect following exposure to alcohol cues.

This is suggested on the basis of considerable evidence which links the experience of positive affect to activation of the neurolog-

ical system which mediates appetitive motivation (i.e., BAS; Carver & White, 1994; Zelenski & Larsen, 1999). Therefore, given that a key feature of appetitive motivation is an increase in the experience of positive affect (e.g., Corr, 2004; Smillie et al., 2006), one way in which fluctuations in appetitive motivation could therefore be operationalised is in terms of changes in positive affect (Watson, Wiese, Vaidya, & Tellegen, 1999). Thus, it is proposed that positive affect may be used as a marker to examine the extent to which cue-reward salience is associated with a general appetitive motivational state. If the mechanism through which cue-reward salience predicts responses to alcohol cues is via the generation of a general appetitive motivational state, it can thus be hypothesised that increased cue-reward salience will predict greater positive urge to drink in response to alcohol cues and that this association will be mediated by levels of positive affect. See Fig. 1 below for a graphical representation of these relationships.

In conclusion, the current study aims to extend upon the Kambouropoulos and Staiger (2009) study which found cue-reward salience to significantly predict appetitive responses to alcohol-related cues by examining a potential mechanism (i.e., activated positive affect) through which cue-reward salience may predict cue-reactivity. Following the approach taken by Kambouropoulos and Staiger (2009), cue-reward salience was measured by asking participants to indicate how rewarding they expected the presentation of alcohol to be and how rewarding they actually found the presentation of alcohol to be, where the difference between these two values represents the degree of cue-reward salience. It was hypothesised that cue-reward salience will be a unique predictor of alcohol cue-reactivity after accounting for factors previously shown to predict cue-reactivity (i.e., drinking history and personality). It was also predicted that activated positive affect (change in activated positive affect from neutral to alcohol cue) will mediate the relationship between cue-reward salience and alcohol cue-elicited positive urge to drink.

2. Methods

2.1. Participants

Participants were 100 regular social drinkers and ranged in age from 19 to 55 ($M = 26.32$, $SD = 6.82$), with 47 males and 53 females. Average age at first drink was 15.26 ($SD = 1.74$). The majority of the sample reported their nationality as Australian (83%). The sample consisted of 56% students (undergraduate and postgraduate) and 44% non-students.

2.2. Materials

2.2.1. Alcohol use

The 10 item Alcohol Use Disorders Identification Test (AUDIT) was utilized in this study as a measure of alcohol use (Saunders, Aasland, Amundsen, & Grant, 1993). The AUDIT is widely used to assess levels of alcohol consumption, dependence-related behaviours and alcohol-related problems with items such as 'How often

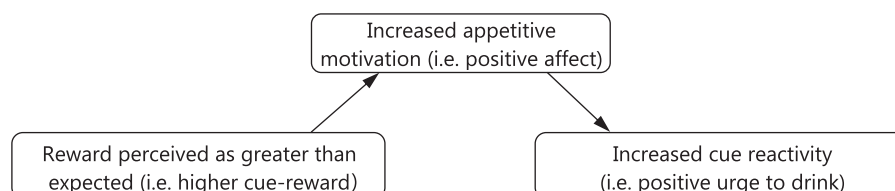


Fig. 1. Graphical representation of proposed relations between cue-reward salience, appetitive motivation and cue-reactivity.

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