



# Alcohol related mental imagery: The effects of a priming dose in at risk drinkers<sup>☆, ☆ ☆</sup>



Michael Yates<sup>a</sup>, Sunjeev K. Kamboj<sup>a,b,\*</sup>

<sup>a</sup> Research Department of Clinical Educational and Health Psychology, University College London, UK

<sup>b</sup> Clinical Psychopharmacology Unit, University College London, UK

## ARTICLE INFO

### Keywords:

Mental imagery  
Elaborated intrusion theory  
Alcohol  
Alcohol priming  
Craving  
Mind wandering

## ABSTRACT

**Objectives:** Drug related mental imagery is proposed to play a central role in addictive behaviour. However, little is known about such cognition or how it is pharmacologically modulated. Here, we test theoretical predictions of the ‘elaborated intrusion’ theory by comparing neutral with alcohol related mental imagery, and examine the effects of low dose alcohol on phenomenological aspects of this imagery.

**Methods:** Alcohol related and neutral imagery was assessed after at risk drinkers (n = 40) consumed alcohol (0.3 g/kg) or placebo, in a crossover design. Sensory and visuospatial qualities of imagery, along with associated craving, positive affect and ‘mind wandering’ were assessed.

**Results:** Alcohol related mental imagery was rated as more vivid and sensorially rich, effects that were larger following the priming dose of alcohol. In addition, mind wandering was substantially *lower* during alcohol versus neutral imagery, especially after alcohol consumption. First person perspective was more prevalent for alcohol imagery after alcohol, although the Drink × Imagery type interaction did not reach statistical significance. However, first person imagery was associated with higher levels of craving during alcohol related imagery.

**Conclusions:** Alcohol related mental imagery differs phenomenologically from neutral imagery on a number of dimensions. Priming with alcohol may enable cognitive elaboration by biasing the output of controlled cognitive processing towards enhanced sensory elaboration and increased attention to alcohol related cognition. These feedforward effects may be involved in focusing cognitive and behavioural resources on alcohol acquisition/consumption through the elaboration and rehearsal of relevant goals and plans.

## 1. Introduction

Recent conceptualisations of disorders of reward suggest a critical role for visuospatial/sensory cognition in craving and drug use (Kavanagh, May, & Andrade, 2012). Sensory cues and internal physiological states are proposed to serve as inputs to cognitive processes that maintain and intensify craving through drug related intrusive imagery, which becomes increasingly elaborated through controlled cognitive processes (elaborated intrusion theory; May, Andrade, Panabokke, & Kavanagh, 2004). Elaboration serves as motivational driver, gearing behaviour towards acquisition of appetitive targets (May, Andrade, & Kavanagh, 2015). The elaborated intrusion (EI) theory provides the basis for a number of predictions in relation to the occurrence of intrusive desire related thoughts and controlled, elaboration processes (Kavanagh, Andrade, & May, 2005).

For example, craving is predicted to increase when there are a

greater number of environmental and/or interoceptive cues available to assist the development of vivid appetitive imagery (May et al., 2004). Potent cues relevant to imagery elaboration include the interoceptive effects of the ingested drug (Paulus & Stewart, 2014), especially at low doses that do not interfere with the cognitive processes upon which mental imagery relies (e.g. working memory; Dry, Burns, Nettelbeck, Farquharson, & White, 2012). EI theory makes specific predictions in this regard: “More vivid imagery is likely when there are more environmental cues to assist its development, with the best set of cues provided by consuming a priming dose of the substance” (p. 449, Kavanagh et al., 2005). Given the proposed effects of drug related imagery on craving, a natural prediction is that drug priming should produce higher craving during drug related, versus neutral mental imagery. However, no study that we are aware of has examined such predictions experimentally using an acute drug dose.

Given the proposed role of mental imagery in motivating drug

<sup>☆</sup> Acknowledgement of funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

<sup>☆☆</sup> Conflicts of interest: None.

\* Corresponding author at: Research Department of Clinical Educational and Health Psychology, University College London, UK.

E-mail address: [Sunjeev.kamboj@ucl.ac.uk](mailto:Sunjeev.kamboj@ucl.ac.uk) (S.K. Kamboj).

acquisition through the generation of drug related plans and goals (May et al., 2015) a reasonable additional prediction is that off target cognitive activity that interrupts elaboration would be less likely to (spontaneously) occur during drug related imagery compared to neutral imagery. Assessing the extent of off target mental activity (mind wandering) during drug related mental imagery may therefore be a method for gauging persistence or maintenance of elaborated drug related mental imagery, reflecting a narrowing of perceptual and cognitive activity (e.g. alcohol myopia; Steele & Josephs, 1990).

Studies of mental imagery in mood and anxiety disorders suggest that deliberate switching of imagery perspective from first to third person reduces emotional intensity in mood and anxiety disorders (Wallace-Hadrill & Kamboj, 2016). If this observation reflects a general relationship between visuospatial perspective and affect, egocentric perspective should be more prevalent and associated with higher levels of craving during drug related imagery in those for whom the drug has motivational salience.

Here we examine alcohol related and neutral mental imagery following a placebo drink and low dose alcohol in at risk drinkers. A low dose was used to instantiate a relevant physiological context to support imagery formation and elaboration (Kavanagh et al., 2005) without interfering with cognitive processes required for this imagery. A low dose also has the advantage of maximising concealment of treatment allocation (see blinding procedure below). Based on EI theory we predicted that alcohol imagery would be associated with higher levels of sensory features, greater vividness, craving and egocentricity, consistent with greater elaboration. Moreover, given that a priming dose of alcohol provides the interoceptive context for enhanced elaboration (Kavanagh et al., 2005), we predicted that alcohol consumption will be associated with more vivid, sensorially rich and egocentric alcohol imagery. We also examined mind wandering during neutral and alcohol imagery although given the exploratory nature of this assessment, no a priori directional hypotheses were made.

## 2. Materials and method

The study was approved by the University College London (UCL) Research Ethics Committee.

### 2.1. Participants

Participants were recruited based on risk of alcohol related harm through advertisements placed in the UCL campus and wider London area. Participants ( $n = 42$ ) completed the first experimental session and  $n = 40$  (20 men) returned for the second session and were included in the final analysis. Inclusion criteria were: age 18–65 years, fluency in English; scoring  $> 8$  on the Alcohol Use Disorders Identification Test (AUDIT; Saunders, Aasland, Babor, De la Fuente, & Grant, 1993); exceeding UK government guidelines for alcohol consumption (2–3 units or 3–4 units/day for women and men respectively on  $\geq 4$  days/week; 1 unit = 8 g alcohol). In this sample, men consumed 21–25 units ( $n = 1$ ), 26–30 units ( $n = 15$ ) or,  $> 30$  units ( $n = 4$ ) and women consumed 14–20 units ( $n = 14$ ), 21–25 units ( $n = 1$ ), 26–30 units ( $n = 2$ ) and  $> 30$  units ( $n = 3$ ) per week. Participants' ethnicities were: white ( $n = 30$ ); nonwhite ( $n = 10$ ). Exclusion criteria were: AUDIT scores indicating more severe alcohol problems ( $> 20$ ), history of alcohol or other substance dependency or current/past treatment seeking for alcohol problems. Participants received £20 compensation.

### 2.2. Measures

Baseline craving was assessed using the 12-item Alcohol Craving Questionnaire-Short-Form (ACQ-SF; Singleton, Henningfield, & Tiffany, 1994) prior to the imagery procedure and interview on both sessions. Episodic craving during imagery was also assessed as part of the imagery assessment schedule using the 'urge' item (0 = no urge;

5 = extremely strong) from the Mood and Physical Symptom Scale (MPSS; West & Hajek, 2004).

Drinking motives were assessed using the Drinking Motives Questionnaire (DMQ-R; Cooper, 1994) to quantify maladaptive enhancement and coping, as well as social and conformity motives.

The Spontaneous Use of Imagery Scale (SUIS; Reisberg, Pearson, & Kosslyn, 2003) assessed mental imagery in everyday life. Additionally, the Positive and Negative Affect Schedule (PANAS; Watson & Clark, 1999) was used to assess stability of mood (previous week) on both sessions.

### 2.3. Mental imagery procedure

The mental imagery procedure consisted of two phases: i) a description of, and prompts to generate imagery and ii) an assessment schedule that tapped various phenomenological and subjective aspects of the elicited imagery (Winfield & Kamboj, 2010). Participants first listened to a standardised audio recorded description of the nature of mental imagery, emphasising its multisensory nature. Participants were then given a neutral or alcohol related verbal prompt, with order randomised and balanced across session. The alternative prompt was given immediately after assessment of imagery from the first prompt.

Alcohol and neutral imagery prompts respectively were: "imagine drinking your favourite alcoholic drink" and "imagine watching your favourite television programme" (adapted from Tiggemann & Kemp, 2005). Participants closed their eyes to indicate when they started the imagery task. After 1 min, they provided responses to items on the imagery assessment schedule (~5-min per prompt) in the order listed below after each imagery condition.

*Mind wandering.* This was described as a tendency to spontaneously engage in task irrelevant mentation. This was rated on a 0 = not at all to 10 = continuously. As in other mind wandering research, no probes were used to assess content of task unrelated thoughts.

*Imagery suppression* was described as a deliberate attempt to disengage from imagery (0–10 scale). Since participants scored at floor levels on suppression ( $Mean = 1.28$ ,  $SD = 1.81$ ) this data will not be discussed further.

*Vividness* related to "clarity, crispness, sense of 'realness' of the image" and was rated on a 0 = not at all to 10 = extremely vivid scale.

*Pleasantness/unpleasantness* was also rated on a 11-point scale:  $-5 = very unpleasant$ ;  $+5 = very pleasant$ ;  $0 = neutral$ .

*Sensory features.* Participants indicated the presence of visual, auditory, olfactory, and taste features, each scoring '1' (range: 0–4).

*First/third person perspectives* was assessed as in similar studies (see Wallace-Hadrill & Kamboj, 2016) and treated dichotomously.

*Previous experience of imagery, prospection versus memory and dynamism:* Participants indicated whether the image had been (i) experienced previously outside of the experiment (old versus novel), (ii) a memory or a future scenario (iii) dynamic versus static, all rated on binary scales. However, for the prospection versus memory item, there was a significant amount of 'missing data' ( $\leq 17.5\%$  across conditions) because participants were unable to categorise imagery as a future event or memory. The remaining responses were primarily future events across conditions (80–94%). Given overall ceiling levels and frequency of nonresponding, analyses of this data was not justified and is not discussed further. Similarly, dynamism was not analysed due to limited variability between conditions (75–80% of imagery was rated as dynamic across conditions).

### 2.4. Beverage preparation and administration

Various volumes of 37.5% vodka - depending participant weight - were diluted with tonic to achieve a final volume of 500 ml at 0.3 g/kg. This was divided into three ~166 ml portions, each containing four drops of Tabasco as a masking agent. Placebo contained only tonic and Tabasco, with vodka mist sprayed around, and 2–3 drops added to the

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