DRINKING AND FUTURE-ORIENTED COGNITION: ACUTE ALCOHOL EFFECTS ON EPISODIC FUTURE THINKING IN SOCIAL DRINKERS

MARIE BROWN

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University College London

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Thesis declaration form

I confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis. This was a joint project with Xiao Liu, an MSc student at University College London; (see Appendix 1 for a breakdown of contributions).

Signature: 

Name: Marie Brown

Date: 14.06.19

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PART I: CONCEPTUAL INTRODUCTION

DRINKING AND FUTURE-ORIENTED COGNITION: ACUTE AND CHRONIC EFFECTS OF ALCOHOL ON EPISODIC FUTURE THINKING

ABSTRACT

Part I of this thesis is presented as a conceptual introduction which aims to provide the reader with a broad contextual overview of the empirical paper that forms the substantive body of Part II. It is divided into the following four sections:

- *Section 1: Contextual overview* – this section provides an insight into the rationale and objectives underpinning the empirical research contained within Part II.
- *Section 2: Theoretical and conceptual overview:* this section provides the reader with a detailed theoretical and conceptual understanding of Episodic Future Thinking (EFT) – a form of future-oriented cognition. The wider taxonomy of prospective thinking is also considered.
- *Section 3: Literature review:* this section provides a narrative synthesis of the existent literature examining the impact of alcohol on various forms of future-oriented cognition. A total of 343 relevant papers were identified in the literature review search, of which seven met the inclusion criteria for review.
- *Section 4: Summary:* this section summarises the research discussed in section 3 and sets out the aims for the empirical study.

Part II of this thesis is an empirical paper which reports a study examining the impact of acute alcohol ingestion on EFT in social drinkers. The study used an independent group design, whereby one group was administered alcohol and the other received a matched placebo. Both groups were required to imagine future-oriented events in relation to a cue sentence and then perform various cognitive tasks, including an imagination task. The results indicated that EFT remains relatively robust against acute alcohol effects. The implications of this finding are considered within the context of clinical interventions for alcohol dependent individuals. EFT simulations were also found to include episodic memory content, thereby providing support for the Constructive Episodic Simulation hypothesis (Schacter, Addis & Buckner, 2008).

Part III of this thesis provides an appraisal of the research process, including a critical reflection on the methodology used, as well as reflections on the author's experiences of the research process.

SECTION 1: CONTEXTUAL OVERVIEW

Background information and study rationale

It is well established that alcohol misuse can result in physiological and cognitive impairments that vary in terms of both severity and chronicity (Ganguli et al., 2005; Sher, 2006). Epidemiological data suggests that approximately 29 million people in the United Kingdom (UK) report drinking alcohol during the preceding week, equating to 58% of the population (Health and Social Care Information Centre, 2016). It is therefore not surprising that alcohol is thought to be the most commonly used "recreational drug" in Western societies (Heffernan, 2008). Between 2011 - 2014 it was reported that 16.5% of adults in England engaged in "binge drinking", (consuming more than 6 units of alcohol in one session), whilst 25.7% stated that they regularly consumed an amount of alcohol that exceeds the current Department of Health's current guideline of 14 units of alcohol per week (Public Health England, 2017).

The high prevalence of excessive alcohol consumption among the adult population within the UK provides a strong rationale for investigating the ways in which alcohol use impacts upon neurocognitive function. The effects of chronic alcohol misuse on the function and structure of the brain have been widely documented, and include brain shrinkage, neurotransmitter impairment, inhibition of the frontal cortex, and reduced functioning of the hippocampus (García-Moreno *et al.*, 2001; Kril & Halliday, 1999; Moselhy, Georgiou, & Kahn, 2001; Alderazi & Brett 2007; Harper & Matsumoto, 2005). However, the implications of acute alcohol consumption are less well understood, though research suggests that acute

alcohol ingestion in social drinkers can reduce blood flow to the cerebellum and disrupt the metabolic activity of the brain (Wong *et al.,* 2003).

Most of the research into the effects of alcohol on memory has primarily focussed upon retrospective memory (i.e. memory for past events) and other areas of cognition (e.g. executive function, attention, etc.) with little examination of the means by which alcohol impacts upon future-oriented cognition, including Episodic Future Thinking (EFT). In brief, EFT is a form of prospection and refers to the ability to project oneself into the future and mentally simulate situations and outcomes (Hudson, Mayhew & Prabhakar, 2011). An individual's subjective experience of an event is thought to impact upon their ability to recall, or access a memory (Tulving, 1985). Research suggests that the more detailed the mental representation, the more likely it is that person will remember it and express a vivid sense of re-experiencing the event (Brewer, 1986; Tulving, 1985). To date, however, there has been little research investigating whether or not the same is true when an individual imagines the future. Accordingly, the empirical study contained within Part II of this thesis aimed to analyse the relationship between acute alcohol ingestion, EFT and phenomenological experience, thus contributing to the emergent literature within this area.

The practical value of research within this area is clear: EFT allows an individual to mentally navigate into the future, and one might speculate that this form of cognition plays an important role in future-oriented decision-making. Impaired EFT has been associated with a tendency to over rely on the present, which is a characteristic of addictive behaviours (Noël, Jaafari & Bechara 2017). Accordingly, the ability to mentally simulate future events in order to make calculated (adaptive) choices about future behaviour merits further investigation. In more specific terms, gathering a more detailed understanding of the relationship between alcohol use and future-oriented decision making may be useful in shaping interventions for

alcohol-independent individuals given that such interventions often involve the use of future-oriented cognition; (e.g. implementing learning strategies in order to deal with future 'high risk' situations where alcohol cues may be encountered).

The empirical paper contained within Part II implemented a double-blind independent group design, whereby one group was administered alcohol whilst the other received a placebo. Both groups were required to carry out a battery of cognitive tests, which included imagining future-oriented events in relation to a cue sentence. For example, if the participant was presented with the cue word "coffee", they might imagine meeting a friend for coffee at a café on their local high street at some point in the coming week. Participants rated the phenomenological characteristics of the simulated events using a 7-point Likert scale, giving regards to sensorial detail, clarity of context and subjective experience, (i.e. the vividness of the imagined imagery and the extent to which they felt as though they experienced the event). In addition to this subjective rating of EFT, the experimenter also rated the quality of simulated events.

SECTION 2: EPISODIC FUTURE THINKING: A THEORETICAL AND CONCEPTUAL OVERVIEW

A Taxonomy of prospection

Prospection is defined as "the ability to represent what might happen in the future" (Szpunar, Spreng & Schacter, 2014). Broadly speaking, the term "prospection" encapsulates a wide range of future-orientated cognition including intention formation, autobiographical planning, prospective memory (PM), temporal discounting, EFT, and so forth. Due to the fact that this term has been broadly constructed within the literature pertaining to future-oriented cognition, it has been difficult to differentiate between different types of future thinking and investigate them independently. Szpunar *et al.,* (2014) sought to address this prevailing conceptual ambiguity by developing a taxonomy of prospection. Their organisational framework

delineates the episodic and semantic forms of four types of future thinking: planning, prediction, intention and simulation, (see *figure 1*). Szpunar *et al.*, (2014) state that these four modes support prospection from the initial stage of imagining a potential future event (simulation) through to the process of achieving a specific goal (planning). This taxonomy may be used in order to provide a framework for understanding EFT, which may be interchangeably referred to as "episodic simulation", or "episodic foresight". In essence, this framework situates EFT as a construct that is distinct from other forms of prospection, providing a good rationale for examining it independently of other forms of future-oriented cognition.

[FIGURE REMOVED DUE TO COPYRIGHT PROTECTION]

Figure 1: A Taxonomy of Prospective Cognition; (image taken from Szpunar *et al.*, 2014).

Episodic future thinking

As discussed above, EFT is a specific type of prospection. It refers to an individual's ability to remember past personal experiences and embellish upon these memories so as to project themselves into imagined hypothetical future experiences (Atance & O'Neill, 2001). Episodic memory underpins EFT, and is conceptualised as the memory system responsible for encoding, storing, and retrieving personally experienced events associated with a precise spatial and temporal context (Tulving, 1985). In essence, the simulation of future events is thought to involve the extraction of elements of pre-existing memories based on past episodes (episodic memory), which are then used as the basis for the flexible construction of a future episode. Schacter, Addis & Buckner (2008) referred to this as the Constructive Episodic Simulation Hypothesis, (referred to herein as the CESH). For example, if an individual were to imagine themselves going to the cinema, they might draw upon their existing knowledge of where their local cinema is located, how to get there, where to purchase their ticket on arrival, and so on.

Neuroimaging investigations into the neural correlates of past and future thought have produced findings that support this CESH. Studies conducted by Addis, Wong & Schacter (2007) and Szpunar, Watson & McDermott (2007) examined the role of memory in imagination and future thinking, and revealed a prominent overlap in the brain activity associated with remembering actual past experiences and imagining possible future experiences. Comparable levels of activity were observed during both remembering and imagining in regions including the medial temporal and frontal lobes, posterior cingulate and retrosplenial cortex, and lateral parietal and temporal areas. These studies suggest that the aforementioned regions comprise a "core" network, (referred to as the "default mode network"; Raichle *et al.,* 2001), which is said to underlie the processes of both remembering and imagining (Buckner & Carroll, 2007; Schacter & Addis, 2007a, Okuda *et al.,* 2003).

Similarities between remembering past events and imagining future events have also been documented in clinical populations (i.e. depressed patients), (Williams *et al.*, 1996) as well as in behavioural studies of healthy individuals (D'Argembeau & Van der Linden, 2004, 2006; Spreng & Levine, 2006).

Further evidence to support the notion that there exists an interrelationship between past and future thought comes from an investigation of amnesic patients with hippocampal damage. It is well established that the hippocampus plays a key role contextual binding and the formation of episodic memories (Boyer *et al.*, 2007), and it is therefore unsurprising that individuals with amnesia often experience substantial impairments when asked to imagine novel experiences; (Hassabis *et al.*, 2007b). Evidence of amnesic patients experiencing problems with imagining the future was first reported by Tulving (1985), and then later by Klein & Loftus (2002). The associations between the retrieval of past memory and imagining the future may be explained by the fact that remembering the past and imagining the future require an individual to draw on similar types of information. For example, events in an individual's past and future are intrinsically personal and will therefore contain autobiographical information. In addition, both instances involve the construction of mentally represented events which include conceptual and visuospatial information (Greenberg & Rubin, 2003).

Tulving (1999) further contends that it is a combination of autonoetic consciousness and episodic memory that permits an individual to engage in EFT. In addition to self-awareness, EFT requires that an individual possesses the ability to simulate meta-representations (Bulley, Henry & Suddendorf, 2016). Though EFT draws on episodic memory in order to generate potential future scenarios, such simulations are not limited to being mere repetitions of past events. In fact, entirely novel imagined scenarios with a multitude of possible trajectories can be created by reconstructing various elements of an existing memory, (e.g.

changing the individual's present, or the actions undertaken); (Gilbert & Wilson, 2007; Suddendorf & Corballis, 2007; Suddendorf & Redshaw, 2013; Bulley, Henry & Suddendorf, 2016). As such, both past and future event representations can be episodic in nature, containing rich phenomenological and contextual details about events that are specific in time and place (Addis, Wong & Schacter, 2007). Such simulations are thought to be valuable in the context of daily life as they are thought to play a role in guiding future directed behaviour.

SECTION 3: LITERATURE REVIEW

Literature search

A systematic search for all relevant empirical literature, (published from database inception to September 2017), was conducted in order to retrieve papers investigating the relationship between alcohol and EFT. A combination of electronic and citation searches were performed – in regards to the former, two categories of keywords were used: (1) terms related to alcohol, and (2) terms related to EFT; (see Table 1 for a summary of the search terms used; also see Appendix 2 for further detail). The following databases were searched: PsychINFO, PubMed (Medline) and Web of Science. Table 2 contains the inclusion and exclusion criteria used in order to ascertain whether studies retrieved would be include in the present review.[1]

[1] Clinical psychology doctoral students at UCL are presented with the opportunity to undertake either a systematic review or literature review for Part I of their doctoral thesis. Due to the fact that there were simply too few published papers relating to EFT to facilitate a comprehensive systematic review, a literature review was carried out instead, and reported herein.

Table 1. *Search terms*

Key concepts	(1) Future event thinking	(2) Alcohol
Alternative search terms	1. Future event thinking 2. Future thinking 3. Future thought 4. Future event simulation 5. Future simulation 6. Future episodic thinking 7. Episodic foresight 8. Episodic simulation of future events 9. Simulation of future events 10. Mental time travel 11. Mental projection 12. Future projection 13. Envisioning the future	1. Alcohol 2. Alcoholism 3. Alcoholic 4. Korsakoffs syndrome 5. Hazardous alcohol 6. Hazardous drinking 7. Alcohol abuse* 8. Alcohol drinking patterns* 9. Alcohol intoxication* 10. Alcoholism* 11. Cognitive impairment* 12. Drinking behaviour* 13. Binge drinking* 14. Alcohols*

*These terms were included as they were flagged as MeSH terms in the PsycINFO search.

Table 2. *Inclusion/exclusion criteria*

Inclusion criteria	Exclusion criteria
• Studies must include an EFT task in which participants are required to generate and describe an episodic future simulation. • Studies must include either participant or researcher-rated measures of simulation characteristics (e.g. specificity, coherence, phenomenology). • Studies measuring other forms of future-orientated cognition such (e.g. prediction, anticipatory pleasure, etc.) will be included as long as they also include a measure of simulation characteristics. • The clinical sample will include individuals diagnosed with (1) alcohol misuse, (2) hazardous drinkers, and (3) social drinkers. • Studies must be published in a peer reviewed journal article, in the English language.	• Studies will be excluded if they do not feature an experimental measure of EFT involving either researcher or participant ratings. • Studies that include participant's with comorbid substance misuse, intellectual disability, known neurological disorder, or traumatic brain injury will be excluded. • Literature reviews, books, unpublished articles, doctoral theses, commentaries, abstracts of conferences and congresses, case-reports, and qualitative studies will not be considered in this review.

A total of 343 relevant papers were identified. Following the removal of duplicates, the main electronic database searches returned 167 papers. Two additional papers were identified through citation searches. The titles and abstracts of these papers were screened by the author in order to determine whether they met the inclusion criteria detailed above; this resulted in the removal of 154 papers. The remaining 15 papers were read in full, and any remaining queries regarding eligibility were resolved through discussion with project supervisors. Subsequently, eight studies were removed, leaving a total of seven papers for review.

Results pertaining to the effects of chronic alcohol use on EFT performance will be discussed first. Thereafter, literature examining the impact of EFT in regards to moderating the effects of alcohol on PM will be considered. Finally, the effects of EFT on the demand for alcohol will be discussed. Key characteristics and a summary of the results of studies referred to in this section are presented in Table 3.

Table 3. *Summary of included studies*

(a) Studies assessing the effects of chronic alcohol use on EFT

Study	Participant details	Independent variables	Dependent variables	Methodological details and key findings
(1) Moustafa *et al.* (2018)	**Experimental group:** (1) Individuals participating in an opiate substitution program (*n* = 31); (2) individuals diagnosed with alcohol dependence (*n* = 21). **Control group:** Healthy controls (*n* = 21). The two groups did not differ significantly on gender. The opiate group had a significantly lower mean age than the alcohol and control group. The opiate group were significantly less educated than the alcohol and control group. The alcohol group was significantly less educated than the control group.	**IV[1]** = Group status (experimental vs control). **IV[2]** = Temporal direction; episodic memory (past) vs. episodic foresight (future).	**DV[1]** = Episodic specificity: The simulated events were scored out of four on levels of episodic specificity, with higher scores indicating greater levels of specificity, and a greater ability to elicit episodic memories and future scenarios. **DV[2] =** Participants rated the phenomenological experience of having spoken about an event on a 9-item questionnaire using a five-point scale; higher scores indicated a greater ability to experience events. **Rating of EFT**: *Researcher*: Responses were transcribed and rated by an independent individual, blind to participant group membership. *Participant*: See DV[2].	**Methodology:** *Task name*: Imagination task *Overview*: Participants were required to generate 8 episodic events – 4 past (= "past few years"), and 4 future (= "next few years") – in response to randomly generated cue words presented on a computer screen. The same cue words were used for both the past and future conditions. Three minutes were allocated for each response. Participants were encouraged to describe a precise and specific event, not lasting more than 1 day. They were asked to imagine who they were with and what they were doing, as well as detail the feelings and emotions they experienced. **Key findings:** (1) The alcohol group performed higher in episodic specificity in the past condition compared to the future condition (p <0.001). (2) There was not a statistically significant effect of group membership on levels of past episodic specificity, (p = 0.168). (3) The opiate group individuals imagined significantly less-specific episodic future details than the alcohol group (p = 0.001). (4) No statistically significant differences between the self-rated phenomenological experience of past episodic events between groups (p = 0.209). No statistically significant differences between the self-rated phenomenological experience of future episodic events between groups (p = 0.231)

b) Studies assessing the impact of EFT in regards to moderating the effects of alcohol on PM.

Study	Participant details	Independent variables	Dependent variables	Methodological details and key findings
(2) Griffiths *et al.* (2012)	**Experimental groups:** (1) Abstinent individuals with alcohol dependence (n = 24); (2) social drinkers (n = 24). The two groups were matched on age, gender and years of education.	**IV[1]** = Group status. **IV[2]** = Strategy (EFT/simulation vs. no EFT) **IV[3]** = Task regularity (regular vs. irregular time-based). **IV[4]** = Task type (time-based vs. event-based)	**DV** = Prospective Memory (PM), assessed by performance on the Virtual Week (VW) task, Rendell & Craik (2000)* Scores for each task type were calculated by dividing the number of tasks of that particular type completed correctly by the total number of tasks of that type administered. **Rating of EFT**: *Researcher*: N/a *Participant*: Participants rated imagined scenarios on an anchored 5-point scale, giving regards to the vividness of their image and their impression of living the experience.	**Methodology:** *Task name*: VW task (with/without EFT) *Overview*: The VW is a computerised virtual board game used to measure PM. Participants moved around the board by rolling an electronic die. One round of the board represented the completion of a virtual "day". During the virtual day participants were required to undertake both time-based tasks and event-based tasks. They completed 2 VW days without using an imagination technique, followed by 2 VW days in which the technique was used. The imagination technique required participants to imagine themselves carrying out a task for 10 seconds, setting the imaged scenario in their real life. Phenomenological experience was rated after each imagined event. **Key findings:** *PM performance without EFT:* (1) Significant impairments in the alcohol-dependent group compared to the social drinker group in both regular and irregular event-based task performance, ($p < 0.001$) respectively. (2) In contrast, the two groups did not differ significantly in their performance on either regular or irregular time-based tasks. *PM performance with EFT:* (1) time-based PM task performance in the social drinker group improved significantly with the introduction of EFT at encoding (p = 0.005). (2) No significant improvements in event-based PM in the social drinker group, and no significant improvement in either event-based or time-based PM in the alcohol-dependent group.

				No significant group differences in mean vividness ratings and mean impression of living the experience ratings for the four time-based tasks in which participants applied imagining.
(3) Leitz *et al.* (2009)	**Experimental group:** Alcohol group; (*n* = 20; 10 women) **Control group:** Placebo group; (*n* = 20; 10 women). Participants in each group were healthy social drinkers, (average weekly consumption of 2 – 14 units of alcohol); random allocation to groups. There were no group differences in age, number of years in education, alcohol usage or alcohol binge scores.	**IV[1]** = Group status (experimental vs control). **IV[2]** = Strategy (standard condition vs rehearsal condition vs EFT/simulation condition). **IV[3]** = Task regularity (regular vs. irregular and time-based). **IV[4]** = Task type (time-based vs. event-based)	**DV** = Prospective Memory (PM), assessed by performance on the Virtual Week (VW) task, Rendell & Craik (2000)* **Rating of EFT**: *Researcher*: N/a *Participant*: Participants rated imagined scenarios on a 5-point scale, giving regards to the vividness of their image and their impression of living the experience.	**Methodology:** *Task name*: VW task (with/without EFT) *Overview*: see Griffiths *et al.* (2012) for a description of the VW task. For this study the VW task was adapted to allow the investigation of PM through the completion of 3 additional days of the virtual week. Day 1 was a standard day of the week (standard condition); Day 2 and 3 – participants were instructed to either verbally rehearse PM tasks out loud (rehearsal condition), or to mentally simulate the PM tasks for 10 seconds (EFT/simulation condition). **Key findings:** *PM performance without EFT (standard condition):* (1) Main effect of group status, reflecting poorer PM performance following alcohol compared to placebo across all three tasks. (2) Bonferroni corrections revealed that the main effect of PM task was attributable to poorer performance on the irregular ($p < 0.001$) and time-check ($p < 0.001$) tasks compared to the regular task, but no differences between the irregular and time-check tasks were observed. (3) Significant main effect of group on task type ($p < 0.001$), reflecting poorer performance across both tasks following alcohol compared to placebo. *PM performance with EFT:* (1) There were no significant differences between event-based and time-based tasks for any of the three strategies in the alcohol and placebo groups. (2) Although not significant following Bonferroni correction, in the placebo group, there was a trend for improved performance under the EFT/simulation strategy ($p = 0.021$), reflecting better performance for event-based tasks following the EFT strategy than time-based tasks.

				Due to ceiling effects, no group differences were found in ratings of vividness and impression of living the experience of imagery during EFT.
(4) Paraskevaides *et al.* (2010)	**Experimental group:** Alcohol group; (*n* = 16; 8 women). **Control group:** Placebo group; (*n* = 16; 8 women). Participants in each group were healthy social drinkers, (average weekly consumption of 2 – 14 units of alcohol); random allocation to groups. There were no group differences in gender, years in education, alcohol usage or alcohol binge scores. However, the alcohol group were slightly older.	**IV[1]** = Group status (experimental vs control). **IV[2]** = Strategy (standard condition vs EFT/simulation condition). **IV[3]** = Day type (recent context vs remote (past) context). **IV[4]** = Task regularity (regular vs. irregular). **IV[5]** = Task type (time-based vs. event-based)	**DV** = Prospective Memory (PM), assessed by performance on the Virtual Week (VW) task, Rendell & Craik (2000)* **Rating of EFT**: *Researcher*: N/a *Participant*: Participants rated imagined scenarios using a 16-item questionnaire, with each question using a 5-point scale to rate vividness; (The Vividness of Visual Imagery Questionnaire, Marks, 1972)**	**Methodology:** *Task name*: VW task (with/without EFT) *Overview*: See Leitz *et al*. (2009) for description of the simulation condition; see Griffiths *et al.* (2012) for a description of the VW task. For this study the VW task was adapted such that days were divided into *recent* context (university) and *remote* context (senior school). This dictated the structure of each virtual day in terms of the types of events they had to attend, the tasks they had to remember, and the friends they met. **Key findings:** *PM performance without EFT (standard condition):* (1) The placebo group performed significantly better than the alcohol group overall ($p = 0.024$). *PM performance with EFT:* (1) a significantly greater improvement through EFT was found in event-based compared with time-based tasks ($p < 0.001$). (2) There was greater improvement in performance following the EFT condition in the alcohol compared to the placebo group on event-based tasks ($p = 0.037$). (3) No significant differences were found on time-based tasks. (4) A trend was found for day type × task interaction ($p = 0.073$). (5) A trend was found for better PM performance on event-based tasks in a recent context compared with remote but not for time-based tasks ($p = 0.09$). (6) Analyses of performance over days of the VW showed no significant effect of day ($p = 0.456$) on irregular tasks reflecting an absence of practice effects. There was a significant main effect of context ($p = 0.017$) with greater vividness in the recent context. There was also a trend for a main effect of group ($p = 0.099$), reflecting somewhat greater vividness ratings in the placebo group

				overall. In regards to the impression of living the experience, there was a main effect of context ($p < 0.001$), reflecting greater impression of living the experience in the recent context but no significant effect of group or interaction.
(5) Platt *et. al* (2016)	**Experimental group:** Heavy social drinkers; (n = 19; 8 women) **Control group:** non-dependent (social) drinkers; (n = 18; 5 women). The heavy drinkers were significantly younger than controls. As expected, heavy drinkers had higher scores on the AUDIT compared to controls and reported a greater number of drinking days per week than controls. Groups did not differ significantly in premorbid scores, anxiety or depression.	**IV[1]** = Group status (experimental vs control). **IV[2]** = Strategy (past episodic thinking vs EFT/simulation). **IV[3]** = Task regularity (regular vs. irregular). **IV[4]** = Task type (time-based vs. event-based).	**DV** = Prospective Memory (PM), assessed by performance on the Virtual Week (VW) task, Rendell & Craik (2000)* **Rating of EFT**: *Researcher*: N/a *Participant*: Participants rated imagined scenarios on a 5-point Likert scale, giving regards to the vividness of their image and their impression of living the experience.	**Methodology:** *Task name*: VW task (with/without EFT) *Overview*: see Griffiths *et al.* (2012) for a description of the VW task. Participants completed 2 VW days without using an imagination technique, followed by 2 VW days in which the technique was used. **Key findings:** (1) Heavy drinkers had significantly fewer correct responses for time-based tasks than controls (p = 0.002). (2) EFT improved heavy drinkers' performance only on event-based tasks (p = 0.002), and improved control participants' performance only on time-based tasks (p = 0.003). (4) Within the heavy drinkers, there were no correlations between performance on time-based or event-based tasks and any index of alcohol use including AUDIT scores. Within the control group, there was only a negative correlation between performance on event-based tasks EFT and AUDIT scores (rs = −0.42, p = 0.04), although this effect would not be considered significant if an appropriate adjustment for multiple testing was applied. There was no difference in vividness of imagery ratings during EFT between the heavy drinkers and control participants. There was also no difference in the impression of living ratings during EFT between the heavy drinkers.

*Rendell, P. G., & Craik, F. I. (2000). Virtual week and actual week: Age-related differences in prospective memory. *Applied Cognitive Psychology: The Official Journal of the Society for Applied Research in Memory and Cognition*, *14*(7), S43-S62.

** Marks, D. F. (1973). Visual imagery differences and eye movements in the recall of pictures. *Perception & Psychophysics*, *14*(3), 407-412.

c) Studies assessing the effects of EFT on the demand for alcohol

Characteristics of studies assessing the role of EFT in relation to the demand for alcohol				
Study	Participant details	Independent variables	Dependent variables	Methodological details and key findings
(6) Bulley & Gullo (2017)	Repeated measures design, (n = 48; 33 women). Undergraduate students	**IV[1]** = Imagination condition; (EFT/simulation vs. control imagery).	**DV[1]** = Performance on Intertemporal choice task (ICT), (relating to financial reward; not discussed here). **DV[2]** = Performance on Alcohol Purchase Task (APT), which assessed demand for alcohol. **Rating of EFT**: *Researcher*: N/a *Participant*: At the end of each session, participants rated the vividness, positive emotionality, and personal relevance of each event cue on scale from 1 (not at all) to 6 (very). Participants also rated how frequently each event cue evoked their imagination during the	**Methodology:** *Task name*: ICT; APT. *Overview*: Participants engaged in a hypothetical APT, in which they indicated how many drinks they would consume at various price intervals. Participants were presented with cues to engage in either (i) episodic foresight or (ii) control imagery before each decision point, with the order of this manipulation counterbalanced between sessions. The episodic or control cues were drawn from either (i) personally relevant events that participants listed they were looking forward to in the future (episodic), or (ii) events from a story with vivid imagery that they were instructed to read (control). **Key findings:** (1) There was a small but significant effect of condition on intensity of demand, which was significantly lower in the EFT condition relative to the control condition, (p < 0.049).

			tasks, from1 (never) to 6 (every time).	
(7) Snider, LaConte & Bickel (2016)	**Experimental group:** Episodic future thinking (EFT) group; (*n* = 25). **Control group:** Episodic recent thinking (ERT); (*n* = 25). Participants were alcohol dependent; random allocation to each condition. The EFT group was significantly younger than the control group.	**IV[1]** = Group status (experimental vs control).	**DV[1]** = Performance on Intertemporal choice task (ICT), (relating to financial reward; not discussed here). **DV[2]** = Performance on Alcohol Purchase Task (APT), which assessed demand for alcohol. **Rating of EFT**: *Researcher*: N/a *Participant*: Participants rated each cue for enjoyment, importance, excitement and vividness on a 5-point Likert scale.	**Methodology:** *Task name*: ICT; APT *Overview*: Participants with alcohol dependence were allocated to either the EFT or ERT (episodic recent thinking; control) group. Those in the EFT group were to generate positive future events for five different time points, whilst those in the control were asked to think about five positive events that had occurred the previous day. Participants then completed a delay-discounting task, during which event cues were displayed, and a hypothetical alcohol purchase task (APT). **Key findings:** (1) Initial purchase behaviour for alcoholic drinks was lower in the EFT group as compared to the control, indicating lower demand intensity for the reward, ($p < 0.0001$).

Narrative overview of the literature

1. The effect of chronic alcohol misuse on EFT

One study assessing the effects of chronic alcohol use on EFT met the inclusion criteria for the present review. Moustafa *et al.,* (2018) compared the performance of opiate and alcohol-dependent individuals with that of healthy controls in relation to an imagination-based task. Participants were required to generate eight episodic events in response to randomly generated cue words presented on a computer screen; (four past and four future-oriented cues were presented to each participant). The same cue words (e.g. family, holiday, etc.) were used for both the past and future conditions, and three minutes were allocated for each response. Participants' phenomenological experience was evaluated using a 9-item questionnaire which took into account their subjective experience of reliving, visual/auditory imagery, emotion and spatiotemporal specificity. Items were rated using a 5-point Likert scale. Episodic specificity was marked by the researcher.

Results indicated that alcohol-dependent individuals performed significantly better than opiate users in relation to the EFT task, thus suggesting that EFT is differentially affected by these substances in chronic-users. This finding may be attributable to a decreased activation in the anterior cingulate cortex in the latter group (Langleben *et al.,* 2008) – this cortical region is thought to be responsible for the anticipation of future tasks, and has also been linked to episodic thinking (Addis *et al.,* 2008), which is said to influence EFT performance; (see below). It is worth noting that no significant differences were observed between either of the clinical groups and controls. However, these findings should be interpreted with caution due methodological concerns regarding low statistical power; indeed, the difference between the opiate and control group appeared to be approaching significance, suggesting that increased power may have resulted in detectable effects.

Moustafa *et al.,* (2018) found no significant difference in the phenomenological experiencing of episodic events across the three groups. This finding implies that individuals diagnosed with alcohol or opiate-dependence do not suffer from observable deficits in regards to constructing mental images of imagined scenarios; nor do they appear to possess impairments to autonoetic consciousness, (which is considered to be a key component of EFT; Tulving, 1999). However, this contention is contradicted by (Noel *et al.*, 2012), who reported that autonoetic consciousness was in fact impaired in alcohol-dependent individuals. Future research is recommended in order to explore these incongruent findings.

More broadly speaking, the aforementioned findings are also inconsistent with what one might expect on the basis of the CESH (Schacter, Addis & Buckner, 2008). It may be recalled that this hypothesis contends that the use of EFT involves the extraction of elements of pre-existing memories based on past episodes (i.e. episodic memory), which are then used as the basis for constructing future imagined episodes. Given that chronic alcohol misuse is known to impair episodic memory (Pitel *et al.*, 2007), one would expect this to correspondingly result in poor EFT performance for the alcohol-dependent group, relative to the controls. However, this was not the case. These discrepant findings create a somewhat confused picture, thus demonstrating a need for further empirical investigation within this area so as to fully explicate the underlying mechanisms by which EFT operates. The empirical study contained within Part II aims to do precisely that, as well as expand upon Moustafa *et al.,* (2018) findings by undertaking a more detailed investigation of different phenomenological sub-components, (i.e. visual imagery, emotion, temporal, and spatial details).

Whilst significant differences in EFT were observed between the substance-use disorder groups, it is worth noting that participants were not screened for depression or anxiety. Depression is highly prevalent in individuals with opiate-dependence (Rounsaville *et al.,* 1982), and it is widely understood that depressive illnesses negatively impact upon episodic

memory, often resulting in overgeneralisation and few episodic details being recalled (Söderlund *et al.,* 2014). As such, it is difficult to ascertain whether the observed results in the present study were influenced by an existing mood disorder rather than chronic substance misuse. The empirical study in Part II has aimed to address this methodological flaw by screening participants for anxiety and depression and excluding individuals with clinically significant levels of either disorder.

Another point worth noting is that poly-substance misuse in the opiate users was higher than in alcohol patients, and it may be speculated that this could have confounded the results. Additionally, the present findings might have derived from a difference in narrative style (i.e. the ability to create fictitious events) between the groups. The role of semantic memory, too, demands consideration. Irish *et al.,* (2012) concluded that semantic knowledge played a critical role in the construction of novel future events, and thus, differences pertaining to semantic memory might have influenced EFT ability. Further exploratory research is necessary so as to elucidate the precise contribution of semantic memory to future thinking.

Whilst the study by Moustafa *et al.,* (2018) highlights the effects of long-term alcohol use on EFT, it fails to provide an insight into the impact of alcohol on EFT in healthy individuals, or consider acute (as opposed to chronic) effects of alcohol on EFT performance. As such, there appears to exist a vast gap in the literature within this area of emergent interest.

2. <u>The role of EFT in moderating the effects of alcohol on prospective memory</u>

Four studies examining the role of EFT as a moderator of chronic and acute alcohol effects on PM met the inclusion criteria: Leitz *et al*., (2009), Paraskevaides *et al.,* (2010), Griffiths *et al.,* (2012), and Platt *et al.,* (2016).

The role of EFT as a moderator of acute alcohol effects on PM

Leitz *et al*., (2009) used an independent-group design in order to evaluate acute alcohol effects on PM, whilst also assessing whether EFT served to moderate any of the deleterious effects associated with alcohol consumption. Participants (healthy social drinkers) were randomly allocated to either the placebo or alcohol condition; those in the latter group received a dose of alcohol corresponding to 4 – 5 units. This experiment used an adapted version of the Virtual Week (VW) task; (please refer to Rendell & Henry (2009) for a full explanation of the procedure). In brief, this task consisted of a virtual board game which allowed participants to move around the board by rolling an electronic die; one circuit of the board represented the completion of a virtual "day". As participants moved around the board they were required to remember to undertake lifelike activities (PM tasks). Each virtual day included (1) *regular tasks* – some of these tasks were *time-based* (i.e. they needed to be executed at a specific time), whilst the others were *event-based*, (i.e. they needed to be executed in conjunction with the occurrence of a specific event); (2) *irregular tasks* – these tasks simulated occasional tasks of everyday life – they were both time-based and event-based; (e.g. "collect dry-cleaning when shopping", or "phone a plumber at 4.00pm"). When a task was due to be completed participants were required to click on a button which displayed a list of tasks (including distracters), and then select the correct task they wished to perform from the list.

Leitz *et al.,* (2009) varied the original VW task in order to investigate PM through the completion of 3 additional days of the virtual week. Day one was a standard day of the week *(standard condition)*; for days two and day three, participants were given two different strategies (one for each day) during the encoding stage of the PM task instructions for irregular time-based and event-based events. They were instructed to either verbally rehearse PM tasks out loud *(rehearsal condition)*, or to mentally simulate the PM tasks for 10 seconds *(EFT/simulation condition)*. In the EFT condition participants were asked to set the event in

their own everyday life and given specific instructions to include as many sensorial details as possible, (i.e. objects, people, environment, sequence of events). Participants then rated their phenomenological experience after each imagined event (using an anchored 5-point Likert scale), giving regards to the vividness of the image and their "impression of living" the experience. The results revealed a trend for improved performance for event-based tasks as compared to time-based tasks in the EFT condition for the placebo group; however, this result proved non-significant following a Bonferroni correction. Due to ceiling effects there were no significant differences between groups in relation to the vividness of the images they had simulated, or the degree to which they felt like they had "lived the experience". For ease of reference, these results will be considered in conjunction with the findings of Paraskevaides *et al.,* (2010), below.

Paraskevaides *et al.,* (2010) sought to replicate the findings of Leitz *et al.,* (2009). Again, an independent-group design was used in order to evaluate the acute effects of alcohol on PM, whilst also assessing whether EFT served to moderate any observed effects in healthy social drinkers. Participants were randomly allocated to either the alcohol or placebo condition. This study deviated from the protocol in Leitz *et al.,* (2009) in that the adapted VW task divided the virtual days into *recent* context (university) and *remote* context (senior school). The context dictated the structure of each virtual day in terms of the types of events participants attended, the tasks they had to execute, and the friends they met. The number of different PM tasks remained constant, as did the times of regular activities (e.g. waking up, meal times, etc.). The context of the days regularly alternated between university and senior school, but remained constant for the entire day. Participants first completed two days in the control condition followed by two days in the EFT condition, whereby they simulated each of the irregular PM task for 10 seconds, (as in Leitz *et al.,* 2009). They were specifically instructed to set imagined events in their own everyday life. Again, participants rated their phenomenological experience

using an anchored 5-point Likert scale, giving regards to the vividness of their image and their impression of living the experience. This study found that EFT significantly improved PM performance on event-based tasks, (as compared to time-based tasks). Moreover, a greater improvement in performance was observed following EFT in the alcohol group relative to the placebo group on event-based tasks. Consequently, these results suggest that EFT served to attenuate acute alcohol effects, thereby reducing deficits to PM. There was also a (non-significant) trend for greater vividness ratings for the imagined scenarios in the placebo group overall.

It is worth noting both the similarities and discrepancies between the aforementioned findings and those reported in Leitz *et al.*, (2009). The latter found a (non-significant) trend for improved performance on PM tasks following EFT in the control group, and it was speculated that the consumption of alcohol may have prevented participants from adequately engaging in mental simulation, thus rendering the technique ineffective for the experimental group. Accordingly, the results were interpreted as evidence that EFT does not aid PM following the ingestion of alcohol. By contrast, Paraskevaides *et al.,* (2010) found that the experimental group demonstrated improved performance on PM tasks following the use of EFT (relative to the control group), thus contravening the findings in Leitz *et al.*, (2009).

These contradictory results might be attributable to methodological differences, which could have confounded the results. In Leitz *et al.*, (2009) participants only completed one day in the EFT condition; in addition, the regular tasks were excluded from the analysis, (thus leaving only four irregular tasks available to assess EFT). Consequently, the VW task may not have been sensitive enough to detect causal effects, suggesting that these findings should be interpreted with caution. There were also methodological limitations in Paraskevaides *et al.*, (2010) that merit consideration. In particular, all participants in this study completed the control condition prior to the experimental condition; this was necessary as it would be impossible to

mitigate the risk of carry-over effects should the EFT condition precede the control condition. Thus, it was not possible to counterbalance the order in which the conditions were completed so as to control for practice effects. Again, this may have detrimentally impacted upon the validity of the reported findings. However, Paraskevaides *et al.,* (2010) maintained that this was unlikely due to the fact that the irregular PM tasks on each day were unique, and as such, practice effects were unlikely to occur.

Despite these methodological concerns, the findings in Leitz *et al.,* (2009) provide support for the CESH, (Schacter, Addis & Buckner, 2008), (discussed in detail above). As previously noted, this hypothesis proposes that EFT requires the recombination of past episodic memories in order to construct unique future episodes. It is well established that acute alcohol impairs episodic memory, (Nilsson *et al.,* 1989; Curran & Hildebrandt, 1999); indeed, both Leitz *et al.,* (2009) and Paraskevaides *et al.,* (2010) observed significant impairments to episodic memory in the experimental groups within their respective studies. Accordingly, one would predict that participants who are administered a placebo would be better able to utilise EFT (as evidenced by improved PM scores relative to the experimental group), owing to the fact that former are not subject to induced episodic memory impairments. The findings in Leitz *et al.,* (2009) trend in the expected direction according to this theory, however, the findings of Paraskevaides *et al.,* (2010) are incongruent with what one might expect. The discrepant findings in Leitz *et al.,* (2009) and Paraskevaides *et al.,* (2010) creates a somewhat confused picture. As such, there is scope for further investigation within this area so as to explicate the underlying mechanisms underpinning EFT.

Nevertheless, both studies reported convergent findings in that they both observed improvements on the event-based tasks following the use of EFT, as compared to time-based tasks. These findings support the argument that PM performance is improved by associating goal-directed behaviour with the specific environment in which the intended action is likely to

take place, (Gollwitzer, 1999; Sheeran & Orbell, 1999; McDaniel *et al.*, 2008). More specifically, these results suggest that creating a link between an intended action and a situational cue facilitates the automatic triggering of the goal related intention when the relevant cue is encountered. Leitz *et al*., (2009) hypothesised that EFT may play a pivotal role in this process due to the fact that future event simulation allows an individual to pre-experience the visuospatial contexts in which intention completion will take place; accordingly, when the specified environment is encountered the simulation is reactivated, thereby prompting the completion of an intended action.

The role of EFT as a moderator of chronic alcohol effects on PM

Griffiths *et al.*, (2012) explored the relationship between chronic alcohol effects, EFT and PM in relation to alcohol-dependent inpatients in a psychiatric hospital who had recently completed a detoxification treatment. These patients were compared with social drinkers on VW task performance. In their adapted version of the VW experiment participants in both groups completed two virtual days in the *simulation condition* (using the EFT technique), and two in the *control condition* (no EFT technique). The EFT condition required participants to imagine themselves carrying out a task for 10 seconds, setting the imaged scenario in their real life. Participants also rated their phenomenological experience using an anchored 5-point Likert scale, giving regards to the vividness of their image and their "impression of living" the experience. The results revealed that EFT improved social drinkers' time-based PM, however, there were no significant improvements in event-based PM in this group. Furthermore, there were no significant improvements in either event-based or time-based PM in the alcohol-dependent group. And finally, there were no significant group differences in the vividness and impression of living ratings. The improvement to performance on time-based (rather than event-based) tasks is contrary to expectation, as it is argued that event-based tasks are easier to execute as they are more likely to be triggered by environmental cues (Gollwitzer, 1999;

Sheeran & Orbell, 1999; McDaniel *et al.*, (2008). By contrast, time-based tasks are more difficult as they require effortful monitoring; (see above). Griffiths *et al.*, (2012) proposed that these findings might be attributable to the possibility that EFT served to enhance memory for the times at which tasks needed to be carried out, (rather than enhancing automatic cue detection). This interpretation of the results requires further explanation as it fails to clarify the means by which memory for specific time-points can be enhanced using the EFT technique.

The poor performance of alcohol-dependent individuals relative to social drinkers again serves to support the CESH, (Schacter, Addis & Buckner, 2008). As mentioned above, it is well established that alcohol exerts a negative influence over episodic memory. With regards to alcohol-dependent individuals, research highlights the fact that such individuals are likely to experience neurocognitive dysfunction, including deficits to problem-solving and decision-making abilities, as well as episodic memory impairments, (Bechara *et al.*, 2001; Leckliter & Matarazzo, 1989). Hence, the poor performance of the alcohol-dependant group in this study may be explained with reference to the notion that chronic alcohol users are more likely to experience long-standing impairments to episodic memory, which is a central component to future event simulation. Consequently, EFT is less likely to be an effective technique for aiding prospective remembering within this clinical group. However, it is worth noting that this study failed to exclude patients with a history of other substance misuse; this methodological concern might arguably undermine the validity of the reported findings in so far as it cannot be concluded that the observed impairments in the alcohol-dependent group were solely attributable to chronic alcohol misuse.

That there were non-significant group differences with respect to the vividness and impression of living ratings merits consideration. This perhaps suggest that participants in both groups created simulations of comparable quality in relation to these variables. As such, it could be argued that although participants within both groups were able to create detailed

mental simulations of future events, the alcohol-dependent group may have experienced impairments to their ability to encode and retrieve these simulations (Pitel *et al.,* 2007), resulting in poorer performance on PM tasks (in the EFT condition) relative to the social drinkers.

Again, it is worth noting methodological issues that may have impacted upon the observed findings in Griffiths *et al.,* (2012). Given that this study relied on self-reported measures in order to evaluate the vividness of simulations and the impression of living, there is a possibility that the observed group differences potentially derive from qualitative differences in simulation ability that are unlikely to have been detected by the subjective measures used. Support for this argument comes from Pitel *et al.,* (2007), who suggest that autonoetic consciousness – a core feature of EFT (Tulving, 1999) – is in fact impaired in alcohol-dependent individuals.

Platt *et al.,* (2016) explored the relationship between alcohol, EFT and PM in relation to heavy social drinkers and social drinkers using the VW task. The procedure in Griffiths *et al.,* (2012) was adhered to, such that both groups completed two virtual days with the use of the EFT technique *(simulation condition),* and two without *(control condition)*. Participant's phenomenological experience was again rated on a 5-point Likert scale. The results revealed that heavy drinkers performed significantly worse than controls on time-based PM tasks. By contrast, EFT improved heavy drinkers' performance on event-based PM tasks. There were no significant group differences in relation to the vividness ratings of simulated events.

It is worth noting that the findings in Griffiths *et al.,* (2012) showed that social drinkers demonstrated a significant improvement in time-based (but not event-based) PM tasks, following future event stimulation. The replication of this finding in Platt *et al.,* (2016) serves to provide a more detailed understanding of precisely which type of PM is most likely to be

enhanced by such strategies in social drinkers. The enhancement of PM performance on event-based tasks following EFT (Platt *et al.,* 2016) is a promising finding; the implications of such are considered below.

Clinical implications

The experimental findings discussed above have important implications for individuals across the spectrum of alcohol use. Given that alcohol has been demonstrated to adversely affect PM, the use of EFT promises to be an effective adjunct to clinical interventions for the treatment of alcohol misuse in individuals ranging from binge-drinkers to those considered to be dependent-users. In fact, Heffernan *et al*., (2002) outlined that PM abilities are central to the majority of learning-based therapies routinely used in the treatment of alcohol misuse; as such, enhancing PM ability through the use of EFT may be of significant benefit. In more specific terms, the ability to pre-experience an imagined event conveys an adaptive advantage as it allows a person to encounter an imagined future scenario with some insight into what emotions they may experience (McLelland *et al.,* 2015). Within the context of clinical interventions for alcohol misuse, the ability to pre-experience alcohol related future events may be useful in preparing individuals for the anticipated obstacles to relapse, as well as providing them with the ability to rehearse strategies that may be useful in such contexts.

It is also worth noting that there is a high rate of non-attendance for clinical appointments among individuals with substance misuse (Sparr *et al.,* 1993), and the most common reason for people missing follow-up appointments appears to be related to a failure of prospective remembering, (Killaspy *et al.,* 2000). As such, the effective use of EFT strategies in relation to alcohol-dependent individuals could enhance engagement with services and treatment programmes; this in turn may improve patient outcomes whilst minimising the likelihood of relapse.

3. The role of EFT in Relation to the Demand for Alcohol

Two studies examining the role of EFT in relation to the demand for alcohol met the inclusion criteria: Snider, LaConte & Bickel (2016), and Bulley & Gullo (2017). These studies will be discussed in turn.

Snider, LaConte & Bickel (2016) examined the effects of EFT on the demand for alcohol in relation to alcohol-dependent individuals. Participants were allocated to either the EFT or control (episodic recent thinking; ERT) group. Individuals allocated to the former group were asked to describe the most positive event that could realistically happen at five different time-points in the future, whilst those in the latter group were asked to describe the most positive event that had occurred at five specified time points from the previous day. Participants were encouraged to include as much sensorial detail as possible, (giving regards to visual, auditory, olfactory and gustatory details, as well as the people present, events, and emotion). Thereafter, participants completed the Alcohol Purchase Task (APT) which required them to imagine themselves in a hypothetical scenario (being at a bar with friends) and indicate how many standard alcoholic drinks they would purchase for the night when drinks cost a specified amount of money, (which increased incrementally).

The results showed that the initial consumption of (hypothetical) alcoholic drinks was significantly lower in the EFT group as compared to the control, thereby indicating lower demand intensity when this technique was used. In fact, when alcoholic drinks were free or available at a very low cost, participants in the EFT condition still purchased significantly less than the control group. This finding suggests that EFT reduced impulsivity and the corresponding preference for immediate rewards. It is speculated that the process of generating future events using prospective thought serves to enhance an individual's contemplation of the value of future rewards (Daniel, Stanton & Epstein, 2013a). In this instance, the widening of

the temporal window may have encouraged participants to forgo the immediate reward of cheap alcohol by encouraging them to consider positive future events that were not associated with alcohol consumption. Correspondingly, these results support the contention that EFT serves to reduce delay discounting – (i.e. the preference for immediate smaller rewards over larger future benefits) – in relation to alcohol.

These findings may be interpreted within the framework of the Competing Neurobehavioral Decision Systems (CNDS) theory, (Bickel *et al.,* 2007, 2012a). This theory speculates that decisions are influenced by the relative strength of two competing neural systems; the impulsive system, (which involves the limbic and paralimbic regions), and the executive system (which is associated with the frontal cortices). When an individual is presented with a delay-discounting task, greater relative brain activation occurs in the impulsive decision system in instances where the immediate choice is given preference, whereas greater activation of the executive system occurs when an individual demonstrates a preference for the delayed choice (McClure *et al.,* 2004, 2007; Peters & Buchel, 2009, 2010). Research establishes that alcohol-dependent individuals who engage in the delay-discounting of future rewards tend to exhibit increased activation in the precuneus, insula, orbitofrontal cortex, and inferior frontal gyrus; these areas are part of the impulsive decision-making system and are also related to emotional control (Claus *et al.,* 2011). Future event simulation is said to reduce delay discounting through the activation of the medial rostral pre-frontal cortex, (contained within the executive decision system), (Okuda *et al.,* 2003; Benoit, Gilbert, & Burgess, 2011). As such, it may be inferred that EFT serves to strengthen the executive decision-making system through the aforementioned mechanism, thereby facilitating the inhibition of the impulsive reward system in individuals with alcohol-dependence.

Bulley & Gullo (2017) replicated the study conducted by Snider, LaConte & Bickel (2016) using a sample drawn from an undergraduate population. Again, participants were

required to engage in a hypothetical APT, during which they indicated how many drinks they would consume at various price intervals. Participants were presented with cues to engage in either EFT or control imagery before each decision point. For the EFT session participants were initially asked to imagine and list personally relevant future events that they were "looking forward to" over the next year. They were then asked to rate the vividness, emotional valence and personal relevance of these events on a 6-point Likert-scale, and the events with the highest average rating across these scales were selected as cues for the EFT manipulation. As with Snider, LaConte & Bickel (2016), this study found that the demand for alcohol was significantly reduced by the use of EFT.

Collectively, the aforementioned studies demonstrate a causal influence of cued future thinking on the demand for alcohol. However, the small effect size and marginal significance value of the 'intensity' index in Snider, LaConte & Bickel (2016) suggests that these results should be interpreted with some degree of caution. Additionally, none of the other four APT demand indices were attenuated in the EFT condition, relative to the control. This implies that the influence of EFT may only extend to certain aspects of alcohol-related decision making.

Clinical implications

These results support the contention that EFT could be used to good effect within the context of treatment programmes for alcohol-dependent individuals. It may be speculated that sensory imagery impacts upon behavioural motivation due to the fact that the continual elaboration of imagery ensures that the imagined event stays in mind, often increasing anticipatory pleasure (Andrade, May & Kavanagh, 2012). If an individual is in a state of craving, one might speculate that intervening so as to interfere with alcohol related imagery (by distracting individuals with pleasant alternative imagined scenarios) may result in the decreased demand for alcohol.

However, it is important to note that a correlational analysis of the participants in Snider, LaConte & Bickel (2016) suggested that alcohol-dependent individuals with more severe alcohol misuse, (as evidenced by higher scores on the Alcohol Use Disorder Identification Test), were less readily influenced by EFT. This finding might derive from individual differences in working memory capacity, which is said to moderate the impact of EFT (Lin & Epstein, 2014). Additionally, D'Argembeau *et al.,* (2006) found that participants with alcohol dependence produced autobiographical memories with significantly poorer contextual details in relation to possible future events, as compared to controls. Thus, EFT may have limited efficacy in regards to the treatment of alcohol-dependence in individuals with more severe or chronic use, and this should be borne in mind when considering the use of EFT as an intervention for specific target populations.

SECTION 4: SUMMARY

The present paper has considered literature pertaining to: i) the effect of chronic alcohol misuse on EFT performance; ii) the impact of EFT in regards to moderating the effects of alcohol on PM, and finally iii) the effects of EFT on the demand for alcohol. Overall, the studies referred to above have provided promising evidence to suggest that EFT may prove to be an effective therapeutic component of clinical interventions for the treatment of alcohol misuse for individuals ranging from binge-drinkers to those considered to be dependent-users.

However, on closer analysis, the relatively small body of reviewed literature revealed discrepant and somewhat contradictory findings, thereby providing a good rationale for further empirical investigation within this under researched area. It is worth noting the incongruities between the results of Leitz *et al.,* (2009) and Paraskevaides *et al.,* (2010), whereby the former found a (non-significant) trend for improved performance on PM tasks following EFT in the control group, whilst the latter found that it was the experimental group who demonstrated improved PM performance following the EFT manipulation. Whilst the findings in Leitz *et al.,*

(2009) provide support for the CESH, (Schacter, Addis & Buckner, 2008), the observations in Paraskevaides *et al.,* (2010) and Moustafa *et al.*, (2018) are incongruent with what one might expect on the basis of the aforementioned theory. Consequently, the precise mechanisms by which EFT operates remains unclear, and further investigation is needed in order to create a larger data set from which more robust inferences may be drawn. Moreover, the relationship between acute alcohol ingestion, EFT and phenomenological experience demands further consideration.

The empirical study contained within Part II aims to expand upon the research reviewed here, whilst also addressing some of the methodological concerns that may have impinged upon the validity and reliability of the results of previous studies. Whereas the design in Paraskevaides *et al.,* (2010) precluded counter-balancing, the study contained within Part II ensured the completion of conditions in a random order, thus controlling for practice effects. Additionally, whereas Moustafa *et al.,* (2018) failed to consider the confounding effects of depression and anxiety in regards to episodic memory, (and by implication, the impact of mood-related disorders on EFT performance), the empirical study within this thesis ensured that participants were screened for mood disorders and excluded in instances of clinically significant anxiety or depression. Lastly, Griffiths *et al.,* (2012) failed to exclude participants with co-morbid substance misuse, resulting in difficulties ascertaining whether the observed results were due to chronic alcohol effects or other substances. Accordingly, the empirical study excluded participants with current substance misuse or alcohol-dependence.

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PART II: EMPIRICAL STUDY

DRINKING AND FUTURE-ORIENTED COGNITION: ACUTE EFFECTS OF ALCOHOL ON EPISODIC FUTURE THINKING IN SOCIAL DRINKERS

IMPACT STATEMENT

The objective of the empirical study reported in this thesis was to examine the effects of acute alcohol ingestion on an individual's ability to engage in Episodic Future Thinking (EFT) – a form of future-oriented cognition. The practical value of research within this area is clear: EFT allows an individual to mentally navigate into the future, and it is speculated that this form of cognition plays an important role in future-based decision-making – particularly in the context of addictive behaviours. The results reported herein establish that EFT is relatively robust against acute alcohol effects; accordingly, these findings serve to highlight the potential for EFT to be used as an effective adjunct to clinical interventions for the treatment of alcohol misuse.

ABSTRACT

Aims: The primary aim of the present study was to analyse acute alcohol effects on Episodic Future Thinking (EFT), with regards to the quality of phenomenological experience and the vividness of the imagined event, as well as visual/auditory imagery, emotion and spatiotemporal specificity. A secondary aim was to evaluate whether the mechanisms underpinning EFT draw on episodic memory so as to evaluate evidence that may support or refute the Constructive Episodic Simulation Hypothesis (CESH) proposed by Schacter, Addis & Buckner (2008).

Method: An independent groups design was used to compare the EFT performance of healthy social drinkers who were randomly allocated to either the control (placebo; n = 17) or the experimental (alcohol, 0.6g/kg; n = 17) condition. Both groups were required to carry out a series of cognitive tests, and also imagine future-oriented events in response to a cue sentence. A questionnaire (using a 7-point Likert scale) was administered to participants so that they could rate the phenomenological characteristics of each simulated event. In addition to this subjective rating of EFT, the experimenter also rated the quality of simulated events.

Results: The results of the present study indicated that EFT remains relatively unimpaired by acute alcohol effects, with between group differences being observed in relation to only one researcher rated EFT variable (clarity of context, p = .001), out of a total of 17 variables. EFT simulations were found to include episodic memory content, thereby providing support for the CESH.

Conclusions: The results reported herein contribute to the small but growing literature on the effects of psychoactive drugs on EFT, and provide some insight into the mechanisms that underly EFT processes.

INTRODUCTION

Alcohol

There exists a vast amount of research demonstrating that alcohol misuse can result in physiological and cognitive impairments that vary in terms of both severity and chronicity (Ganguli *et al.,* 2005; Sher, 2006). Epidemiological data suggests that approximately 29 million people in the United Kingdom (UK) report drinking alcohol during the previous week, equating to 58% of the population (Health and Social Care Information Centre, 2016). The high prevalence of excessive alcohol consumption among the adult population within the UK provides a strong rationale for investigating the ways in which alcohol use impacts upon neurocognitive function, since impairments might affect everyday cognitive functioning in drinkers. The effects of chronic alcohol misuse on the function and structure of the brain have been widely documented, however, the implications of acute alcohol consumption are less well understood.

Episodic future thinking

Prospection is defined as "the ability to represent what might happen in the future" (Szpunar, Spreng & Schacter, 2014). Broadly speaking, the term "prospection" encapsulates a wide range of future-orientated cognition, including intention formation, autobiographical planning, prospective memory (PM), temporal discounting, Episodic Future Thinking (EFT), and so forth. Due to the fact that this term has been broadly constructed within the literature pertaining to future-oriented cognition, it has been difficult to differentiate between different types of future thinking and investigate them independently. Szpunar *et al.'s* (2014) taxonomy of prospection situates EFT as a construct that is distinct from other forms of prospection, providing a good rationale for examining it independently of other forms of future-oriented cognition; (see Part I for a more detailed discussion of this area).

EFT is a particular type of prospection and refers to an individual's ability to remember past personal experiences and embellish these memories so as to project themselves into imagined hypothetical future experiences (Atance & O'Neill, 2001). In other words, EFT allows individuals to 'pre-experience' simulated scenarios in their imagination. The Constructive Episodic Simulation Hypothesis proposed by Schacter, Addis & Buckner (2008), (herein referred to as the CESH), suggests that EFT involves two stages: in the initial "construction" stage, past episodic memories are drawn upon in order to form the foundation of hypothetical future simulations. In the secondary "elaboration" phase, executive functions are engaged so as to flexibly reconfigure these fragments of past memories into unique simulated (i.e. imagined) events. Tulving (1999) suggests that it is a combination of autonoetic consciousness and episodic memory that permits an individual to engage in EFT. In addition to self-awareness, EFT requires that an individual possesses the ability to simulate meta-representations (Bulley, Henry & Suddendorf, 2016).

Aims of the current study

To date, the majority of research examining the effects of alcohol on memory has largely focussed upon retrospective (rather than prospective) memory, with little examination of the means by which alcohol impacts upon future-oriented cognition. Moreover, of the seven studies discussed in Part I of this thesis, only one paper investigated the impact of chronic alcohol use on phenomenological aspects of EFT, whilst the other six examined the role of EFT in moderating the effects of alcohol on PM or the (future) demand for alcohol. Thus, the subject matter of this empirical study (EFT following acute alcohol ingestion) has not been investigated previously. This gap in the literature is somewhat surprising, not least because research suggests that acute alcohol ingestion is associated with a range of neurocognitive impairments, including deficits to episodic memory (Curran & Hildebrandt, 1999; Söderlund *et al.,* 2005), which is said to underpin the ability to engage in EFT (Atance & O'Neill, 2001).

As such, it seems appropriate to further investigate this area in order shed light on the relationship between acute alcohol ingestion and the phenomenological aspects of EFT; this may in turn may be useful in shaping interventions for alcohol-independent individuals. Indeed, such interventions often involve the use of future-oriented cognition, (e.g. implementing learning strategies in order to deal with future 'high risk' situations where alcohol cues may be encountered), and an enhanced understanding of this area may prove invaluable for clinicians. Equally, this study will provide a broader characterisation of the neuropsychological effects of alcohol in relation to EFT more generally.

Aims:

1. The primary aim of the present study was to analyse acute alcohol effects on EFT, giving regards to the quality of phenomenological experience and the vividness of the imagined event, as well as visual/auditory imagery, emotion and spatiotemporal specificity.
2. A secondary aim was to evaluate evidence that may support or refute the CESH (Schacter, Addis & Buckner, 2008) by examining whether the future event simulations constructed by participants would draw on elements of episodic memory, (in line with this hypothesis).

Hypotheses:

1. It was hypothesised that there would be a significant main effect of group on EFT, such that individuals in the experimental group would create future event simulations containing fewer phenomenological details than those constructed by participants in the placebo group. This hypothesis draws on the assumption that alcohol induced impairments are likely to adversely effect global cognitive function and impair EFT ability. This is consistent with Hassabis *et al.,* (2007) who found that individuals who

had sustained damage to the hippocampal area – a part of the brain implicated in EFT and also adversely affected by alcohol (Givens, Williams & Gill, 2000) - demonstrated an impaired ability to construct new imagined experiences.

2. It was further hypothesised that future event simulations constructed by participants would draw on episodic memory (as indexed by participant self-report on the EFT quality questionnaire). Moreover, it was speculated that there would be a main effect of group, such that participants in the placebo group would create future event simulations drawing on significantly more episodic content than those in the experimental group (owing to the fact that the latter group would be subject to induced episodic memory impairments as a result of alcohol ingestion).

METHOD

Design

The present study implemented a double-blind randonmised independent group design; one group were administered ethanol, whilst the other received a placebo. The performance of each group was compared across a battery of cognitive tests. Thereafter each group completed three EFT trials (described in detail below), allowing for a within subjects (individual comparison of performance across the three experimental trials) and between subjects (placebo vs. experimental group) analysis of their performance.

The study was part of a larger research project examining alcohol and future cognition. Thus, the protocol involved a separate section assessing prospective memory, the results of which were partially reported elsewhere (Liu, 2018; UCL MSc thesis). The study received ethical approval from the UCL Research Ethic Committee, (ethical approval number: 5929/004).

Participants

Power analysis

A power analysis was conducted using G*power (Faul, Erdfelder, Buchner & Lang, 2009) in order to determine the sample size needed, specifying alpha and desired power as 5% and 80% respectively. The estimated effect size (Cohen's d = 0.7) was based on a study conducted by Paraskevaides *et al.,* (2010), who investigated the acute effects of alcohol on future cognition in a population of healthy social drinkers. Specifically, the effect size relates to the differences in vividness ratings (i.e. impression of 'pre-living'), between the alcohol and placebo groups when asked to imagine events that might feasibly occur in the near future. The rationale for using this study was based on the fact that it sought to examine the same independent (acute alcohol dose) and dependent variables (EFT) as the present empirical paper, within the same population (healthy social drinkers). They also used a similar dose of ethanol. The power calculation indicated that the current study would require a minimum sample of 20 participants in total so as to detect a significant between-subjects effect on the EFT task, should one exist. Given that the actual effect size for the variables of interest in the current study may have diverged from Paraskevaides *et al.,* (2010), a slightly larger sample size was used (total n = 34; 17 in each group). This is the same sample size used in Paraskevaides *et al.,* (2010).

Recruitment

Participants were recruited between April 2018 and January 2019; recruitment and testing were carried out concurrently. Posters were placed in public areas around University College London (UCL) (Appendix 3), and an advert was placed online inviting individuals to participate. Individuals who were interested in participating in the study were able to contact the researchers via email. Enquiries were responded to with the provision of an Information Sheet (Appendix 4) and an invitation to participate in a telephone screening (lasting approximately

15 minutes) so as to assess eligibility for participation; (see Appendix 5 for telephone script and Table 4 for the inclusion/exclusion criteria).

Following the screening of 90 people in total, 34 healthy social drinkers were invited to participate in the study. Individuals were randomly allocated to either the experimental group, (n = 17; 10 female) or the placebo group (n = 17; 8 female). See the Results section for further detail of participant characteristics.

Table 4. *Inclusion/exclusion criteria*

Inclusion criteria	Exclusion criteria
• 18 years old or above. • Social drinker; (i.e. must consume alcohol at least twice per week). • Score seven or less on the AUDIT questionnaire, (indicating no risk of alcohol misuse).[2] • Fluent in English.	• Current substance misuse, or previous substance dependency. • Clinically significant levels of either depression or anxiety above a moderate level, (i.e. a score 10 or more on the PHQ-9 and/or GAD-7). • Traumatic brain injury. • Stroke. • Learning difficulty. • Sensory impairments (excluding visual impairments, provided that vision could be corrected to normal).

Procedure

Preliminaries

Participants who were deemed eligible to participate in the study were invited to attended a one-off individual testing session at the UCL, which lasted approximately two and a half to three hours. They were asked to refrain from consuming alcohol on the day of testing. On arrival, participants were asked to read the information sheet containing details of the study

[2] *Note:* Due to an adverse participant event (vomiting following alcohol consumption in the 25th participant; a female with an AUDIT score of two), the AUDIT cut-off score was subsequently increased to 13 (indicating an increased risk of hazardous drinking). The adverse event was promptly reported to the ethics committee, who then re-reviewed the protocol and field notes. They subsequently approved the change in AUDIT cut off score and testing was resumed. At the point of this change in the protocol, 13 participants (seven female) had been tested in the experimental condition, whilst 12 participants (seven female) had been tested in the placebo condition.

and given the opportunity to ask any further questions prior to signing the consent form (Appendix 6). Additional demographic data were collected, (participant's weight and height; this information was used for the preparation of the ethanol solution for individuals in the experimental group.

Alcohol and placebo administration

Participants allocated to the experimental group were administered ethanol at a dose of 0.6g/kg (a dose of alcohol corresponding to 4 – 5 units). This dose was chosen as previous research demonstrates that it impairs episodic memory whilst leaving executive functions intact (Finn *et al.* 1999; Townshend & Duka 2002). The procedure used was similar to that of Knowles & Duka's (2004); 96% ethanol was diluted with tonic water (Schweppes Ltd., Uxbridge, UK) and then the solution was equally divided between ten cups (each containing 50ml). Two drops of Tabasco sauce (McIlhenny Co., Avery Island LA, USA) were then added to each cup so as to conceal the taste of the ethanol. The placebo beverage consisted of tonic water and Tabasco sauce only, though ethanol was sprayed on the outside of each cup in order to improve condition concealment. The placebo drinks were also equally divided between ten cups (each containing 50ml). Participants consumed the ten beverages at two-minute intervals in the presence of the experimenter. In order to maintain a consistent blood alcohol concentration (BAC) over the entire testing period, participants were given top-up drinks containing a 0.1g/kg dose of ethanol at three intervals during the remainder of the testing period, (see Figure 2 for the administration time of each top-up). Each top-up drink was prepared in the same way as the initial batch of drinks, and divided between three cups (each containing 50ml).

Experimental protocol

The testing session required participants to complete a battery of cognitive tests, (see Appendix 7 for the study protocol). The order in which the tasks were completed is outlined in Figure 2.

In brief, participants began the test battery by completing a prose recall task (index of episodic memory), which was immediately followed by the verbal fluency task (index of executive function), and then the Spot the Word Task (index of premorbid IQ). The administration of alcohol or placebo drinks took place thereafter, and participants were given a comfort break at the completion of this stage. A research assistant measured participant breath alcohol concentration (BAC reading), which ensured the experimenter remained blind to condition. Participants then completed another prose recall and verbal fluency task, followed by two EFT trials. Thereafter, participants consumed the first batch of top-up drinks and then completed the final EFT trial. Participants were then asked to recall the two stories they had heard during the earlier prose recall tasks (index of delayed episodic memory). After the third BAC reading was taken, participants completed the Virtual Week Task. During this period they received two more batches of top-up drinks, and two more BAC readings were taken. At the end of the testing session participants were asked if they would like to be contacted with a summary of the study's findings upon its completion. Participants were paid £20 for their participation. (See below for more detail in relation to the measures used).

TASK	**Time from 0 (mins)**
BAC1 (Breath Alcohol Concentration pre drink)	**+2**
Information Sheet + Consent Form	+8
Collect additional demographics	
Story 1 (immediate recall) pre drink	+ 11
Verbal Fluency 1 (phonemic)	+ 15
Spot the word	+ 18
Start drinking protocol; (placebo or ethanol)	**+ 19**
Finish drinking protocol	**+ 39**

BREAK	+ 49
BAC2 (post drink 1)	**+ 51**
Story 2 (immediate Recall) post drink	+ 55
Verbal Fluency 2 (phonemic)	+ 59
EFT trial description + practice trial	+ 65
EFT Trial 1	+ 70
EFT Trial 2	+ 75
Top-up 1 (0.1g/kg)	**+ 77**
EFT Trial 3	+ 86
Story 1 + 2 (delayed recall)	+ 89
BAC3 post drink 2	**+ 90**
Virtual Week (VW) trial run[3]	+ 105
Top-up 2 (0.1g/kg)	**+ 107**
VW day 1	+ 120
BAC4	**+ 122**
VW day 2	+ 136
Top-up 3 (0.1g/kg)	**+ 138**
VW day 3	+ 152
BAC5	**+ 154**
VW day 4	+ 168
Payment Form	

Figure 2. *Summary of the experimental protocol*

[3] The details of the VW task are not reported here.

Measures

1. Alcohol use

Alcohol use was ascertained at screening using the Alcohol Use Disorders Identification Test (AUDIT), Berner *et al.,* (2007). Hays, Merz & Nicholas (1995) found that this measure possessed better internal consistency and a lower standard error of measurement than comparable measures, such as the CAGE Questionnaire (Mayfield, McLeod & Hall, 1974). More broadly speaking, the AUDIT possesses good levels of reliability and validity, overall (Hays, Merz & Nicholas, 1995).

2. Episodic future thinking task

Standardised (pre-recorded audio instructions) outlining the specifics of the EFT task were played to each participant so as to ensure procedural standardisation. After hearing the audio instructions (which lasted approximately 2 minutes), participants were then provided with a written summary of the instructions (Appendix 8) and invited to ask questions in order to clarify any ambiguities relating to the task.

The EFT task was adapted from the Mental Time Travel Task (MTT task; D'Argembeau & Van der Linden, 2004; 2006). Participants were required to imagine a specific event (lasting not more than a day), in response to a cue sentence said aloud by the researcher. They were told that the event had to be something that could feasibly happen between six to 12 months in the future. In the practice trial participants were presented with the following cue: *"I would like you to imagine an event relating to coffee"*. They were then instructed to imagine an event relating to coffee (e.g. meeting a friend at a coffee shop). Once they were ready to continue, they were invited to verbally describe their imagined event to the researcher in as much detail as possible. Participants were given feedback in regards to the contextual and sensorial details

contained within their imagined events during the practice trial so as to clarify the level of detail required for their simulations (Appendix 8). (They received no prompts or feedback during each of the three experimental trials; details below).

After providing a description of the event, participants were then asked to close their eyes and mentally pre-experience it in as much detail as possible for a period of 30 seconds. Thereafter, they completed a 19-item questionnaire rating their simulated future event on a range of phenomenological characteristics (Appendix 9) using a 7-point Likert scale (*strongly disagree* to *strongly agree*). Participants rated their simulated events in relation to: the clarity of context (spatial and temporal); sensorial details (visual, auditory, olfactory and gustatory); emotional intensity and valence; autonoetic awareness (i.e. the ability to mentally place themselves in the future); observational perspective (i.e. whether they experienced the simulation from an outside observer perspective, or saw it through their own eyes); episodic content (i.e. whether the imagined event related to a memory of a previous event that they had experienced in real life, or whether it had taken place in a venue known to them in real life); and finally, distractibility. There were three experimental trials requiring participants to imagine events in relation to the following cues: *"food", "alcohol"* and *"money".* The order in which these cue words were presented was counterbalanced so as to reduce possibility of order effects.

Researchers also rated the EFT simulations. The researcher-rating scale (Appendix 9) comprised 10 binary (yes/no) items, and was used to evaluate the content of the simulations in relation to: the clarity of context (spatial and temporal), sensorial details (visual, auditory, olfactory and gustatory); and emotional content. The inclusion of the researcher-rating scale was consistent with an unpublished study that is similar to the present paper (Mansell, 2017 UCL), and drew on a specificity rating scheme previously used by William, Teasdale, Segal & Soulsby's (2000).

3. Executive functioning

Executive functioning was evaluated using a phonemic fluency task adapted from the Delis-Kaplan Executive Function System (D-KEFS), (Delis, Kaplan, & Kramer, 2001). This task required participants to name as many words beginning with the letter 'B' or 'D' as they could think of within a period of 60 seconds. The names of people, places or numbers were prohibited. The order in which these fluency tasks were completed was counterbalanced across participants. Participants were required to complete this test before and after the administration of alcohol (or matched placebo).

4. Episodic memory

Episodic memory was indexed using The Story Recall Task from the Rivermead Behavioural Memory Test (Wilson, Cockburn & Baddeley, 1985). Prose recall tasks are demonstrated to have a high correlation with everyday memory performance (Sunderland, Harris & Baddeley, 1983), and are therefore considered to possess good external validity. The Story Recall Task required participants to listen to two brief pre-recorded news reports of an accident relating to an oil spill, or an incident relating to a forest fire. The order in which the stories were presented was counterbalanced. Thereafter, participants were required to repeat everything they could remember immediately after hearing each of the reports (immediate recall), both before and after the administration of alcohol (or matched placebo). Later they were asked to recall the stories once again after a 35 and 80 minute delay (delayed recall). Participant responses were recorded, transcribed and marked using a standardised score sheet. The prose was broken down into 21 idea units; one point was allocated for the correct recall of each unit, and half a point was awarded for partial recall or a synonym.

5. Mood

Self-reported depression was assessed using the Patient Health Questionnaire (PHQ-9), whilst self-reported anxiety was evaluated using the Generalised Anxiety Disorder Scale (GAD-7). Both measures score DSM-IV criteria on a Likert-scale so as to evaluate the severity of depressive or anxiety related symptomatology over the preceding 14 days. The PHQ-9 and GAD-7 are recognised as a reliable and valid measures of depression and anxiety severity, respectively; (Kroenke *et al.,* 2001; Spitzer *et al.,* 2006).

6. Premorbid functioning

Premorbid functioning was assessed using the Spot the Word task (Baddeley, Emslie & Nimmo-Smith, 1993). This test required participants to select the real word from a dyad comprised of one real and one fictitious word. There were 60 dyads in total, and participants were awarded a point for each correct word selected. Baddeley, Emslie & Nimmo-Smith (1993) demonstrated that this test correlates highly with other premorbid verbal measures, such as the National Adult Reading Test (NART; Nelson & Willison, 1991). As such, it is said to possess good concurrent validity.

7. Prospective memory

Participants completed the Virtual Week Task (Rendell & Craik, 2000). This is an ecologically valid computerised task designed to evaluate prospective memory within the context of everyday tasks. These results were reported by another researcher on the project, and will not be discussed in the present report.

Data analysis

Initially the data were examined for missing values. One participant had failed to complete one of the three EFT tasks, resulting in missing data for both the researcher-ratings and participant-

ratings of the simulation characteristics for the food trial. In addition, due to technical error audio recorded data were lost for two participants, resulting in missing data for The Story Recall Task and the phonemic fluency test for these individuals. The missing values in each instance were replaced with the average score across all participants on the variable in question. Once the matter of missing values had been addressed, the data were then examined for outliers, (defined as a value having a *z* score of +/- 3 standard deviations from zero). Values identified as outliers were subsequently winsorised, (replaced with the largest value plus one), which is consistent with standard practice (Field, 2013).

The assumption of normality was examined by visually inspecting histograms and using the Kolmogorov-Smirnov (K-S) test. Variables with a significant K-S test statistic ($p < 0.01$) were considered to violate the assumption of normality. Several participant-rated variables pertaining to EFT quality violated the normality criterion. Transformation of the data were ruled out on the basis that the *F*-test in ANOVA is fairly robust against departures from normality (Glass *et al.* 1972); furthermore, research suggests that the *F*-test performs as it should in skewed distributions, and transforming the data may impede accurate analysis (Games & Lucas, 1966). Accordingly, parametric analyses were undertaken on the current data set.

1. Participant characteristics

Gender, education, ethnicity and English language proficiency were classified as categorical variables; accordingly, between group difference were evaluated using chi-square tests. Age, alcohol use, PHQ-9 score, GAD-7 score, premorbid IQ, executive function and episodic memory were classified as continuous variables; as such, *t*-tests were used in order to evaluate between group differences on these variables.

2. Experimental data

Group differences on EFT task

The primary objective of this empirical study was to evaluate between group differences (experimental vs. placebo) on three episodic future event simulation tasks, (in regards to imaging future-oriented events relating to food, money and alcohol). The variables analysed were: Alcohol vs. placebo (independent variable); EFT quality (dependent variable), which consisted of participant and researcher rather variables.

The researcher-rating scale (Appendix 9) comprised 10 binary (yes/no) items. The items were then coded such that a value of 1 was given to "yes" and zero for "no". Six of these items were summed together and averaged so as to create a composite measure of the spatial and temporal items, *(Clarity of Context Index).* A further three items were summed together and averaged so as to create a composite measure of visual, auditory, olfactory/gustatory details, *(Sensorial Index).* The remaining researcher rating for the presence or absence of emotion was considered to be conceptually distinct from the other items, and it was therefore analysed independently as a discrete categorical variable (*Emotion*), using Cochran's Q. This test is used in instances where the data are dichotomous and a repeated measures design has been implemented.

The participant-rating scale comprised 19-items (Appendix 9), allowing participants to subjectively rate the phenomenological characteristics of their simulations using a 7-point Likert scale (*strongly agree* to *strongly disagree*). Four of the items were summed together and averaged so as to create a composite measure of the spatial and temporal items, *(Clarity of Context Index).* Three items were summed together and averaged so as to create a composite measure of visual, auditory, olfactory/gustatory details, *(Sensorial Index).* Two items (Q11 and

Q12) were analysed together as they both measured emotional valence *(Emotion - Valence).* The remaining items were analysed individually.

The aforementioned researcher-rated and participant-rated variables were treated as continuous variables and analysed using a mixed 2 x 3 mixed ANOVA. The between-subjects factor of *Condition* had two levels (experimental vs placebo), whilst the within-subjects factor of *Simulation Type* had three levels (food, money, alcohol). Mauchley's test was used in order to ascertain whether the assumption of sphericity was met. In instances where the test statistic was significant ($p < 0.05$) it was concluded that the assumption of sphericity had been violated, and the degrees of freedom were adjusted using the Huynh-Feldt estimate so as to make the *F*-ratio more conservative in light of this violation. Levene's test was used in order to evaluate whether the homogeneity of variance assumption was met.

Constructive Episodic Simulation Hypothesis

A secondary aim of this study was to evaluate evidence that may support or refute the CESH by examining whether the future event simulations constructed by participants would draw on episodic memory, in line with this hypothesis. Episodic memory was indexed by participant self-report on the EFT quality questionnaire and analysed in the same manner as the other participant rated EFT variables, (see above).

Type 1 error

There were planned analyses for a total of 14 participant-rated variables, (of which three were composite measures), and three researcher-rated variables, (all of which were composite measures). Due to the large number of comparisons, consideration was given to mitigating the risk of finding results of false significance (Type 1 error). In line with standard practice, all observed significant results were Bonferroni corrected in order to reduce the risk of false

positives. All data were analysed using the IBM Statistical Package for the Social Sciences (SPSS), Version 25.

Table 5. *Participant characteristics*

	Experimental group; (*n* = 17)		**Placebo group**; (*n* = 17)		**Statistic**	
	n	**%**	***n***	**%**	x^2	***p* value**
Gender						
Male	7	41.18	9	52.94	.472	.492
Female	10	58.82	8	47.06		
Highest Level of Education						
GCSE or A-level	2	11.76	2	11.76	.687	.709
Undergraduate degree	10	58.82	12	70.58		
Postgraduate/ Masters	5	29.41	3	17.64		
Doctorate	0	0	0	0		
Ethnicity						
Black	1	5.88	3	17.64	1.780	.619
White	10	58.82	7	41.17		
Asian (British Asian, Pakistani, Bangladeshi, Chinese or Other Asian)	4	23.52	4	23.52		
Mixed Race or Other	2	11.76	3	17.64		
English Language Proficiency						
Native speaker	8	47.05	14	82.35	4.636	.031*
Non-native speaker	9	52.94	3	17.64		
	Mean	**SD**	**Mean**	**SD**	***t***	***p* value**
Age	28.24	8.22	25.24	3.97	$t(23.102) = 1.355$	1.89
Alcohol use (AUDIT score)	5.59	2.79	5.94	2.93	$t(32) = -.360$	.721

PHQ-9	2.18	1.84	2.24	2.89	$t(32) = -.072$	.943
GAD-7	2.06	1.64	1.47	1.62	$t(32) = 1.051$	.301
Premorbid IQ	48	7.00	48.35	7.83	$t(32) = -.138$	.891
Executive Function						
Phonemic fluency (1)	15.29	4.52	17.00	5.40	$t(32) = -.999$	.326
Phonemic fluency (2); (post alcohol ingestion)	12.59	4.91	16.18	5.02	$t(32) = -2.107$	.043*
Episodic Memory						
Story recall; immediate (1)	8.06	3.55	7.74	4.53	$t(32) = .232$	.818
Story recall; immediate (2)	7.85	2.97	7.82	3.73	$t(32) = .025$	.980
Story recall; delayed (1)	6.15	2.77	5.82	4.33	$t(32) = -.259$	.797
Story recall; delayed (2)	4.82	3.01	6.24	3.70	$t(32) = -1.215$	.233

*Significant at $p < 0.05$

Participant characteristics

The majority of the sample were drawn from an undergraduate population (65%), with half the total sample identifying as Caucasian. The mean age of the total sample was 26 years old, with a range of 18 to 48 years. The groups were well matched in regards to gender, education, ethnicity, age, alcohol use, depression, anxiety, premorbid IQ and episodic memory. However, the groups differed in regards to English language proficiency, such that a significantly greater proportion of the experimental group were non-native English speakers (52.9%), as compared to the placebo group (17.6%). This may explain the significantly better performance of the placebo group on a measure of executive function, (phonemic fluency 2), which required participants to generate words when provided with a specific letter. (See Table 5 for participant characteristics).

Table 6. *Means, standard deviations and test statistics for participant ratings of EFT simulations*

	Food event M (SD)		Money event M (SD)		Alcohol event M (SD)		Main effect - group		Main effect - Simulation type		Group*simulation type interaction	
Simulation characteristic	**Alcohol**	**Placebo**	**Alcohol**	**Placebo**	**Alcohol**	**Placebo**	**F statistic**	***p***	**F statistic**	***p***	**F statistic**	***p***
Clarity of context index[1]	4.82 (1.18)	4.99 (.73)	4.54 (.79)	5.30 (.67)	4.48 (1.02)	4.93 (1.10)	5.016	.075	.740	.481	1.099	.339
Sensorial index[2]	4.13 (1.16)	4.67 (.99)	3.51 (1.05)	4.08 (1.44)	3.80 (1.27)	4.47 (1.29)	2.923	.097	4.890	.011*	.064	.938
Emotion (valence Q11)	.88 (1.41)	.41 (1.06)	1.53 (2.03)	2.06 (2.16)	1.24 (1.79)	.53 .943	.262	.612	7.149	.002**	2.095	.131
Emotion (valence Q12)	4.59 (1.62)	4.18 (2.24)	4.12 (1.80)	3.71 (1.96)	4.71 (1.76)	4.76 (1.60)	.265	.610	2.937	.060	.318	.712
Emotion (feeling – Q10)	4.65 (1.11)	4.22 (1.27)	3.88 (1.83)	4.24 (1.48)	4.76 (1.52)	4.47 (1.28)	.124	.727	1.822	.170	.987	.378
Emotion (significance Q17)	3.65 (1.69)	3.41 (2.27)	3.12 (1.62)	3.53 (2.07)	3.94 (1.79)	4.29 (1.57)	.150	.701	2.325	.106	.438	.647
Motion vs static image (Q9)	4.71 (1.49)	4.41 (1.80)	5.29 (.99)	5.29 (1.16)	5.06 (1.03)	5.06 (1.44)	.073	.789	4.562	.019*	.233	.758
Autonoetic awareness (experiencing the event Q13)	4.12 (1.69)	4.05 (1.68)	3.82 (1.67)	4.24 (1.60)	4.59 (1.12)	4.00 (1.90)	.026	.873	.696	.502	2.253	.113
Autonoetic (experience –	4.06 (2.08)	3.82 (1.59)	3.59 (2.09)	3.35 (2.23)	3.41 (2.15)	3.65 (2.09)	.016	.899	1.476	.236	.414	.663

"mental time travel" Q14)												
Observer perspective (outside observer Q15)	1.65 (1.69)	2.29 (2.11)	2.29 (1.65)	1.76 (2.07)	2.29 (2.23)	1.24 (2.02)	.321	.575	.338	.714	3.334	.042±
Observer perspective ("own eyes" perspective Q16)	4.59 (1.58)	4.53 (1.70)	4.41 (1.66)	4.71 (1.69)	3.94 (1.98)	5.59 (.71)	1.961	.171	.369	.665	5.298	.011±
Episodic memory content (real life venue Q5)	5.29 (1.31)	5.88 (.49)	3.71 (2.51)	4.82 (2.01)	5.71 (.99)	5.71 (.59)	3.604	.067	9.221	.002**	1.125	.315
Episodic memory content (relevant previous event Q18)	3.06 (2.19)	4.52 (2.03)	2.65 (2.18)	3.94 (2.25)	3.82 (2.30)	4.76 (1.78)	5.789	.022*	2.468	.093	.179	.836
Distractibility (Q19)	1.29 (1.45)	1.82 (2.00)	1.59 (2.12)	1.53 (2.10)	1.71 (1.86)	2.47 (2.58)	.491	.488	1.686	.198	.812	.430

[1]Items 4, 6, 7 and 8 from the participant questionnaire were summed together and averaged so as to create a composite measure of the spatial and temporal items, *(Clarity of Context Index).*

[2]Items 1, 2 and 3 were summed together and averaged so as to create a composite measure of visual, auditory, olfactory and gustatory details, *(Sensorial Index).*

*Significant at $p < 0.05$

**Significant at $p < 0.01$

± Not significant after Bonferroni correction.

See Appendix 9 for participant rating scale.

Table 7. *Means, standard deviations and test statistics for researcher ratings of EFT simulations*

	Food event M (SD)		Money event M (SD)		Alcohol event M (SD)		Main effect - group		Main effect - Simulation type		Group*simulation type interaction	
Simulation characteristic	**Alcohol**	**Placebo**	**Alcohol**	**Placebo**	**Alcohol**	**Placebo**	**F statistic**	***p***	**F statistic**	***p***	**F statistic**	***p***
Clarity of context index[1]	4.06 (1.20)	4.65 (.99)	3.82 (1.13)	5.06 (.83)	4.29 (1.10)	5.18 (1.02)	12.912	.001**	1.363	.212	.892	.359
Sensorial index[2]	1.82 (1.07)	2.29 (1.05)	1.24 (1.20)	1.71 (1.11)	1.47 (.94)	2.12 (1.17)	4.184	.049[±]	3.152	.049[±]	.094	.910
Emotion[3]	.59 (.51)	.76 (.44)	.59 (.51)	.71 (.47)	.65 (.49)	.53 (.51)	.209	.650	.465	.63	1.394	.255

[1]Six items were summed together and averaged so as to create a composite measure of the spatial and temporal items, *(Clarity of Context Index).*

[2]Three items were summed together and averaged so as to create a composite measure of visual, auditory, olfactory and gustatory details, *(Sensorial Index).*

[3]The presence or absence of emotion was analysed independently as a discrete categorical variable, *(Emotion).*

*Significant at $p < 0.05$

**Significant at $p < 0.01$

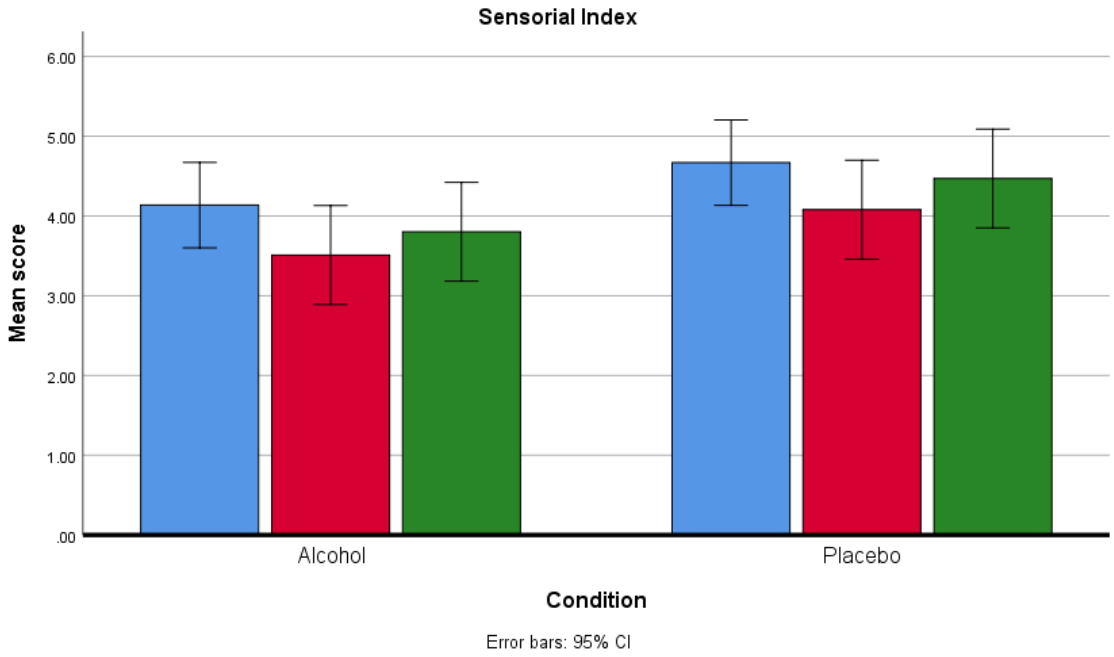
[±] Not significant after Bonferroni correction.

Participant rated simulation scores

Table 6 contains the means, standard deviations and test statistics for participant-ratings of EFT simulations.

1. Sensorial index

There was a significant main effect of simulation type (food, money, alcohol) in relation to the sensorial details contained within participant simulations ($F(2, 64) = 4.890$, $p = .011$). However, there was no significant main effect of group ($F(1, 32) = 2.923$, $p = .097$), and no significant interaction between group and simulation type ($F(2, 64) = .064$, $p = .938$). Bonferroni corrected post-hoc pairwise tests were used to examine the main effect of simulation type, and revealed that participants across both groups reported that their food related simulations contained more sensorial details than those pertaining money; (mean scores averaged 4.40 (SD = 1.10) and 3.80 (SD = 1.27) respectively; $p = 0.018$).



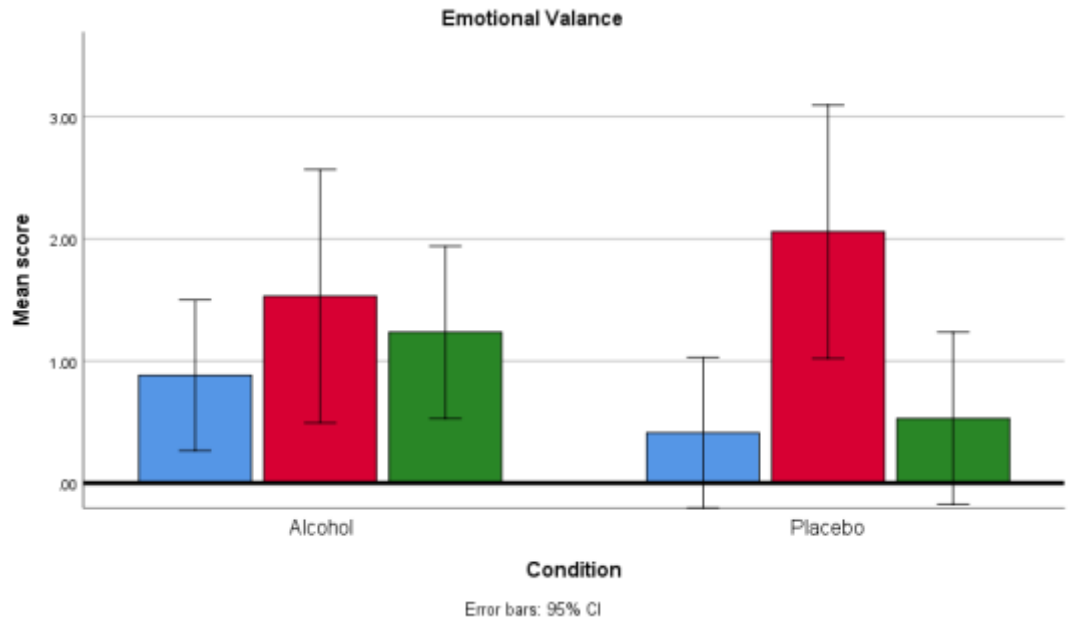
Key:

1 = food (blue)
2 = money (maroon)
3 = alcohol (green)

Figure 3. *Main effect of simulation type on sensorial index*

2. Emotional valence

There was a significant main effect of simulation type on emotional valence, ($F(2, 64) = 7.149$, $p = .002$). However, there was no significant main effect of group ($F(1, 32) = .262$, $p = .612$), and no significant interaction between group and simulation type ($F(2, 64) = 2.095$, $p = .131$). Bonferroni corrected post-hoc pairwise tests were used to examine the main effect of simulation type, and revealed that participants across both groups created simulations that were more positively valenced for events pertaining to money as compared to food; (mean scores averaged 1.79 (SD = 2.09) and .65 (SD = 1.25) respectively; $p = .007$). Additionally, participants across both groups tended to imagine more positive simulations relating to money as compared to alcohol; (mean scores averaged 1.79 (SD = 2.09) and .88 (SD = 1.45) respectively; $p = .026$).

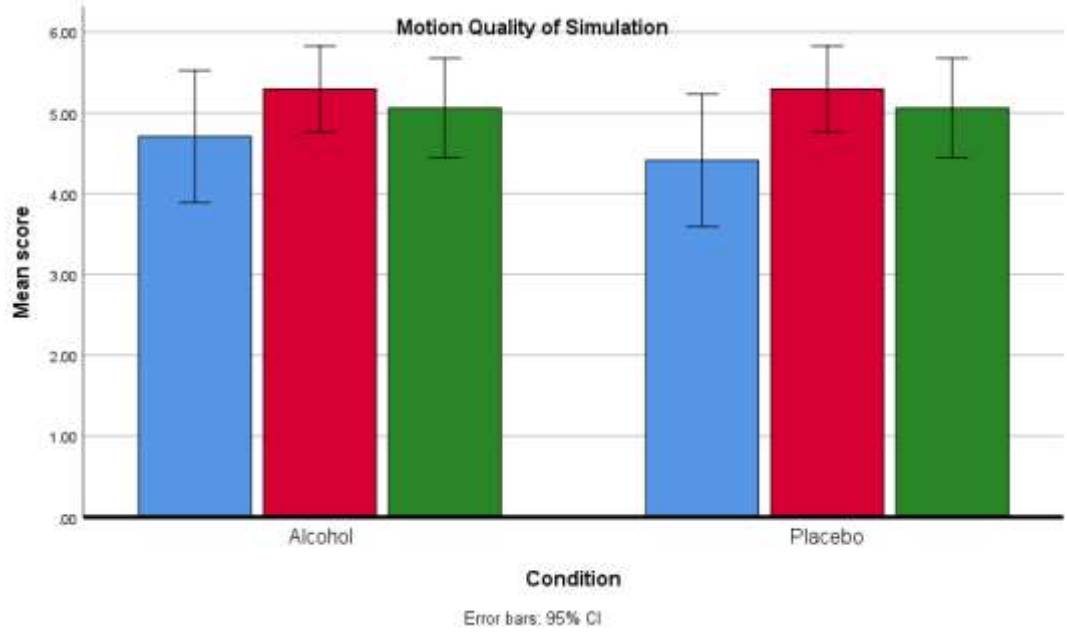


Key:
1 = food (blue)
2 = money (maroon)
3 = alcohol (green)

Figure 4. *Main effect of simulation type on emotional valence*

3. Motion vs static

There was a significant main effect of simulation type ($F(1.706, 54.590) = 1.232$ $p = .019$) in regards to the extent to which participants imagined simulations occurring more like a film (i.e. occurring in motion) as compared to appearing to be more like a photograph (i.e. static). However, there were no significant interactions between simulation type and group ($F(21.706, 54.590) = .233$, $p = .758$), nor were there any significant effects of group ($F(1, 32) = .245$, $p = .789$). Bonferroni corrected post-hoc tests were used to examine the main effect of simulation type, revealing that participants across both groups tended to create money related simulations with greater motion quality than food related simulations; (mean scores averaged 5.29 (SD = 1.06) and 4.55 (SD = 1.63) respectively; $p = 0.05$).



Key
1 = food (blue)
2 = money (maroon)
3 = alcohol (green)

Figure 5. *Main effect of simulation type motion quality of simulation*

4. Observer perspective

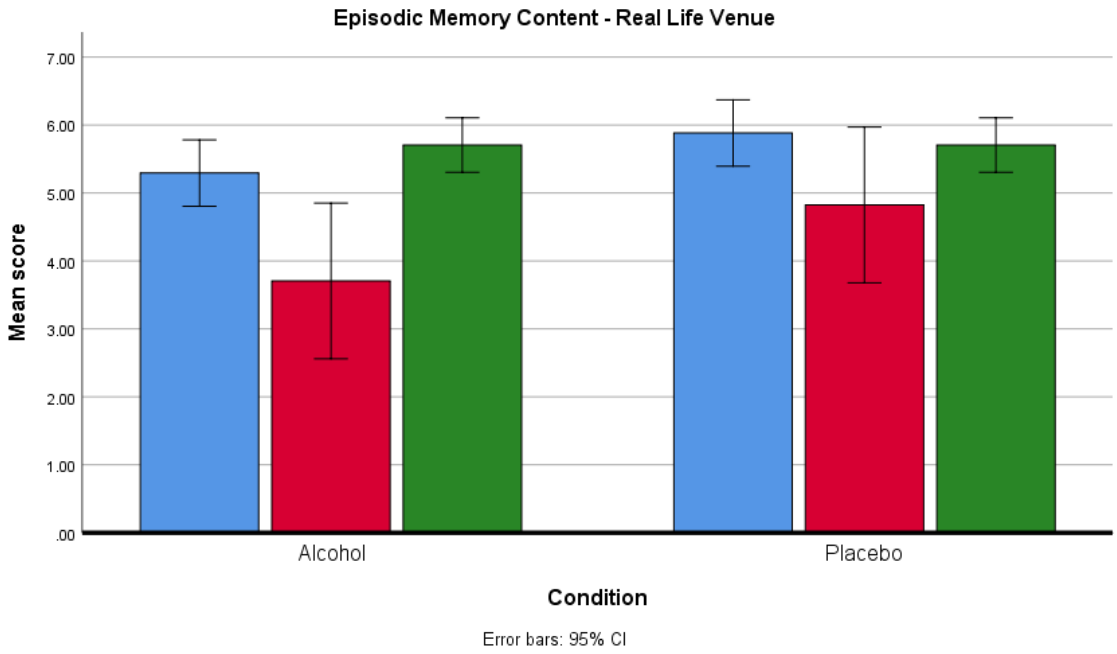
There was a significant interaction between group and simulation type ($F(1.672, 53.495) = 5.298$ $p = .011$) on observer perspective ratings, (i.e. the extent to which participants imagined simulations as being seen through their *"own eyes"*). However, there were no significant main effects of simulation type ($F(2, 64) = .369$, $p = .693$), or group ($F(1, 32) = 1.961$, $p = .171$). Post-hoc tests were used to examine the interaction between group and simulation type, however following Bonferroni corrections no pairwise comparison reached significance ($p = 1.00$); accordingly these findings will not be discussed further.

There was a significant interaction between group and simulation type ($F(2, 64) = 6.480$ $p = .042$) on observer perspective, (i.e. the extent to which participants experienced simulations from an outsiders' perspective). However, there were no significant main effects of simulation type ($F(2, 64) = .657$, $p = .714$), or group ($F(1, 32) = .321$, $p = .575$). Post-hoc tests were used to examine the interaction between group and simulation type, however following Bonferroni corrections the observed effects were rendered non-significant ($p = 1.00$); accordingly, these findings will not be discussed further.

5. Episodic memory content

There was a significant main effect of simulation type on the episodic memory content contained within imagined events, ($F(1.391, 44.509) = 9.221$, $p = .002$). However, there was no significant main effect of group ($F(1, 32) = 3.604$, $p = .067$), and no significant interaction between group and simulation type ($F(1.391, 44.509) = 1.125$, $p = .315$). Bonferroni corrected post-hoc pairwise tests were used to examine the main effect of simulation type and revealed that participants across both groups reported that their food related simulations were more likely to take place at a venue known to them in real life, as compared to money related simulations; (mean scores averaged 5.59 (SD = 1.02) and 4.26 (SD = 2.35), respectively; $p =$

0.20). Additionally, across both groups, participants reported that their alcohol related simulations were more likely to take place in a venue known to them, as compared to their money related simulations; mean scores averaged 5.71 (SD = .80) and 4.26 (SD = 2.35), respectively; p = .004).



Key
1 = food (blue)
2 = money (maroon)
3 = alcohol (green)

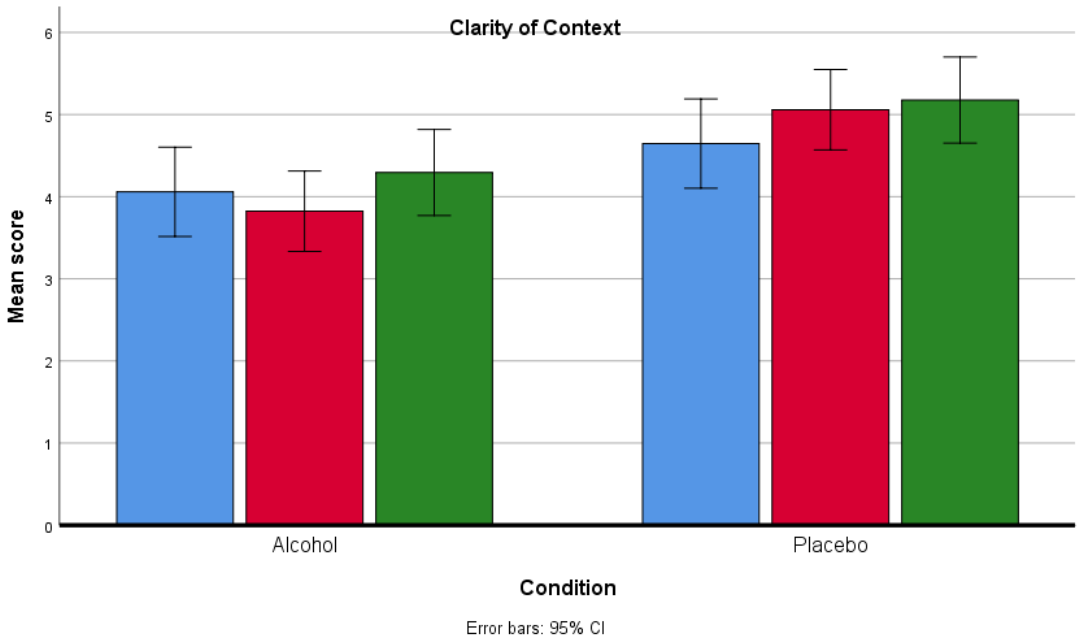
Figure 6. *Main effect of simulation type on episodic content – venue known to participant in real life*

Researcher rated simulation scores

1. Clarity of context

There was a significant main effect of group (F(1, 32) = 12.912, p = .001) in relation to the contextual details contained within participant simulations. There was no significant main effect of simulation type (F(2, 64) = 1.591, p = .212), and no significant interaction between group and simulation type (F(2, 64) = 1.041, p = .359). Bonferroni corrected post-hoc pairwise tests were used to examine the main effect of group and revealed that participants within the placebo group imagined events containing more contextual details (irrespective of the

simulation type), than participants in the experimental group; (mean scores averaged 4.96 (SE = .18) and 4.05 (SE = .18) respectively; p = .001).



Key
1 = food (blue)
2 = money (maroon)
3 = alcohol (green)

Figure 7. *Contextual clarity for each simulation type*

DISCUSSION

The primary aim of the present study was to analyse acute alcohol effects on EFT, giving regards to the quality of phenomenological experience and the vividness of the imagined event, as well as visual/auditory imagery, emotion and spatiotemporal specificity. It was hypothesised that that there would be a significant main effect of group on EFT, such that individuals in the alcohol group would create future event simulations containing significantly less phenomenological detail than those constructed by participants in the placebo group. Broadly

speaking, the present findings failed to support this hypothesis as significant between-group differences were only observed in relation to one researcher rated variable of EFT quality (clarity of context) out of a total of 17 variables. Accordingly, it was concluded that EFT remains relatively robust against acute alcohol effects.

A secondary aim of this empirical investigation was to evaluate evidence that may support or refute the CESH by examining whether future event simulations constructed by participants would draw on episodic memory, (in line with this hypothesis). It was hypothesised that future event simulations would contain episodic content; furthermore, it was speculated that there would be a main effect of group, such that participants in the placebo group would create future event simulations drawing on significantly more episodic content than those in the experimental group. The present findings did not support the latter prediction, though a significant main effect of simulation type on episodic content was observed, thereby providing broad support for the CESH. These results are discussed in more detail below.

Acute alcohol effects on EFT – participant EFT ratings

1. Sensorial index

There was a significant main effect of simulation type, such that participants across both groups reported that their food related simulations contained significantly more sensorial details than those involving money. This finding may be explained with reference to an evolutionary perspective. Organisms are highly sensitised to reward stimuli (e.g. food – a basic necessity required to meet one's primary physiological needs), thus explaining increased attention and behavioural motivation when they are presented with such stimuli (Lang, Bradley & Cuthbert, 1997). Given that food possesses a stronger appetitive salience than money (Maslow, 1970), it follows that imagined scenarios involving the former stimulus may draw on more cognitive resource (attention), and be more richly elaborated than scenarios involving the latter. It is

worth noting, however, that participants across both groups created simulations that were more positively valenced for events pertaining to money as compared to food; this finding contravenes expectation as one might predict that simulations relating to appetite satiation would be associated with positive emotions; (see below for further discussion).

2. Emotional valence

There was a significant main effect of simulation type on emotional valence, such that participants across both groups created simulations that were more positively valenced for events pertaining to money as compared to food or alcohol. Consideration was given to the possibility that this result might be attributable to attitudes towards food. Eating disorders are the most prevalent psychiatric disorders in females aged between 14 and 26 years (Zipfel *et al.*, 2000), and cognitive-behavioural models hypothesise that such disorders are precipitated and maintained by maladaptive thoughts about food, body shape and weight (Garner & Bemis, 1985; Fairburn & Brownell, 2002). Given that 53% of the participants in the present study were female, with 65% of that number falling within the at-risk age group for a diagnosis of eating disorder, it was speculated that negative attitudes towards food may have diminished positive affectual responses for food related simulations. However, data regarding participants' Body Mass Index (BMI) failed to support this supposition – 28 participants were found to have BMI's considered to be within the normal range, whilst the remaining 6 were considered to be in the obese category. Consequently, there was little evidence to suggest that food may have been an aversive stimulus. Conversely, however, it could be argued that having a BMI within the normal range does not necessarily preclude the possibility that a person might suffer from a preoccupation with body image, or negative cognitions in relation to food. This contention is supported by the results of Cotrufo *et al.*, (1998) who found that 10.7% of a sample of 919 female students aged 13 to 19 years old met the criteria for subclinical eating disorders. As such, one might infer that a proportion of the participants in the present sample may have fallen

within a subclinical population for eating disorder by virtue of their age and gender. As such, they would be likely to possess negative attitudes towards food, and possibly experience food related simulations as aversive. The impact of attitudes towards food on EFT should be considered in future research.

Alternatively, it was speculated that this finding might be attributable to the possibility that participants were already satiated prior to taking part in the study as they were advised to eat a small meal two hours before testing. As such, it is feasible to suggest that the appetitive salience of food was diminished, resulting in the attribution of more importance (and positive affectual responses) to money.

That participants in the present study created more positively valenced simulations involving money as compared to alcohol is thought to be attributable to the characteristics of the sample. Research demonstrates that the presentation of alcohol related cues to heavy social drinkers activates brain regions putatively involved in the acquisition and expression of incentive salience (Filbey, 2008). However, given that the present sample were social drinkers, it is hypothesised that the alcohol cue lacked the same degree of incentive salience for this particular population (as compared to heavy social drinkers). Accordingly, it follows that simulations relating to alcohol would be less likely to elicit positive affectual responses, which in turn might result in less positively valenced alcohol related simulations.

The results also revealed a non-significant main effect of group, such that the emotional valence of the EFT simulations was found to be unaffected by alcohol. This finding may be broadly interpreted as suggesting that the ingestion of alcohol seemingly failed to influence the affective state of participants. This contention runs contrary to expectation as it is widely believed that alcohol often serves to reduce negative affect (e.g. in instances where an individual is anxious or aroused), or simply enhance positive affect more generally (Wills &

Shiffman, 1985). As such, these findings conflict with the reasonably held expectation that participants in the experimental group should have experienced greater mood elevation than those in the placebo group; this in turn would be presumed to increase the likelihood of the experimental group creating comparatively more positively valenced simulations. This was not the case in the present instance. Further examination of literature in this area revealed that laboratory findings relating to positive emotional enhancement after alcohol ingestion have proven to be inconsistent. Whilst some research suggests that alcohol consumed within a laboratory setting can induce elation (e.g. whilst on the ascension limb of the BAC curve; Lukas & Mendelson, 1988; Martin, *et al.,* 1993), other studies (using social drinking participants) have failed to observe positive emotion-enhancement effects (Sher, 1987). In fact, some research suggests that individuals consuming alcohol in an isolated setting (such as a laboratory) tend to report primarily physiological changes (e.g. feeling dizzy), whilst those who consume alcohol in a group setting are more likely to experience positive affectual responses (Pliner & Cappell, 1974). These studies provide an explanation for the non-significant between-subjects effect on the emotional valence of the simulations.

3. Dynamic vs. static simulations

There was a significant main effect of simulation type on the "motion vs. static" variable, such that participants across both groups tended to create money related simulations with greater motion quality than food related simulations (i.e. appearing more like *"a film than a photograph"*). Further research is needed in order to fully explicate this finding, though it may be speculatively attributed to the difference in the narrative content of money related simulations, as compared to those relating to food. In regards to the former, participants tended to simulate events that involved moving between imagined scenes (e.g. going from home to the bank), whilst the latter scenarios tended to take place in one venue (e.g. at a restaurant). As such, it is tentatively suggested that imagined scenarios involving venue changes are more

likely to be experienced in motion. This hypothesis suggests that such simulations also involve greater levels of autonoetic experience as participants are more likely to have a realistic experience of the event; however, this contention was not substantiated in the current study as no significant effects were observed in regards to the participant rating for variables indexing autonoetic awareness.

4. Episodic memory content

There was a significant main effect of simulation type on episodic memory content, such that participants across both groups reported that their alcohol and food related simulations were more likely to take place in a venue known to them, as compared to their money related simulations. Intuitively this would appear to make sense as it is likely that social drinkers would possess a vast number of memories relating to occasions during which they have previously consumed alcohol, and thus use these memories as the foundation of their simulations. Similarly, they are also likely to have experienced memorable food related experiences (e.g. dinner dates, dinner parties, etc.), which can readily be drawn upon to construct simulations. By contrast, however, real life situations relating to money may be presumed mundane (e.g. visiting the bank), and therefore less memorable (Finkenauer *et al.,* 1998). By implication, given that participants are less likely to possess money related episodic memories, it seems feasible that that they would construct money related simulations that are less reliant on episodic content.

There was a non-significant main effect of group, suggesting that the acute dose of alcohol exerted no observable impact on participants' ability to draw on their episodic memory so as to create simulated future events. This finding contravenes the experimental hypothesis, which predicted that participants in the alcohol group would be subject to induced episodic memory impairments, and would correspondingly rely on episodic memory to a significantly lesser extent (whilst constructing future event simulations), than participants in the placebo

group. These findings might be best understood with reference to the differential impact of acute alcohol on episodic memory at various points of cognitive processing. Literature in this area demonstrates that alcohol tends to impair episodic memory at the point of encoding to a far greater extent than at the point of retrieval (e.g. Goodwin *et al*. 1969; Birnbaum *et al.* 1978; Petersen 1977; but see Fillmore *et al.,* 1999). Accordingly, the fact that participants were able to retrieve existing episodic memories so as to engage in EFT – irrespective of whether they had consumed alcohol or not – is consistent with previous findings.

Broadly speaking, these results support the notion that the simulation of future events involves the extraction of elements of pre-existing episodic memories which are then used as the basis for constructing a future imagined event; this is in line with the propositions of the CESH. The aforementioned process is said to be underpinned by executive function capabilities; accordingly, whilst some elements of executive function may be impaired by alcohol (e.g. set shifting and response inhiation; Day *et al.,* 2015), the executive processes which underlie the extraction of episodic memories and the construction of future event simulations remain relatively unimpaired by acute alcohol ingestion. Further investigation is recommended in order to fully elucidate these mechanisms.

However, some of the data are inconsistent with the theoretical propositions of the CESH. Tulving (1999) states that autonoetic consciousness (self-projection into the future) is necessary for an individual to engage in EFT; yet, participants across both groups in the present study failed to report a significant level of autonoetic consciousness, thus contravening this proposition. The findings of Hassabis *et al.,* (2007) and Conway, Whitecross & Sharpe (2003) might shed some light on this anomaly. These studies found that richly imagining fictitious experiences is not intrinsically connected to the self or a subjective experience of time; this invites the possibility that participants in the present study might have simulated future events

that failed to fully captured the first-person perspective (despite being instructed to do so), thus explaining the absence of significant levels of autonoetic consciousness.

Acute alcohol effects on EFT – researcher EFT ratings

1. Clarity of context

There was a significant main effect of group in relation to the contextual details contained within participant simulations, such that participants within the placebo group imagined events containing more contextual details (irrespective of the simulation type), than individuals in the experimental group. One explanation for this group-based difference is that it may have resulted from the impact of acute alcohol on the hippocampus – a region of the brain that has an established role in supporting spatial memory (i.e. memory pertaining to the location of people and objects, and other topographical information). Even at moderate doses, alcohol is widely understood to disrupt hippocampal functioning (Givens, Williams & Gill, 2000). Accordingly, whilst participants in the experimental condition were able to broadly draw on elements of their episodic memory so as to create simulations that included venues well known to them (see above), it is possible that acute alcohol effects impaired their ability to recall the more detailed topographical information relating to those locations, (in comparison to participants in the placebo group). Moreover, the present findings suggest that the hippocampus plays an important role in influencing the contextual clarity of simulations, which is consistent with other research in this field. For example, Hassabis *et al.,* (2007) found that individuals who had sustained damage to the hippocampal area demonstrated an impaired ability to construct new imagined experiences in response to short verbal cues that outlined a range of simple common scenarios. Such individuals imagined scenarios that lacked spatial coherence, consisting instead of fragmented images of the environmental setting.

Methodological considerations

An independent-groups design was used for the present experimental study, and participants were well matched on age, alcohol use, levels of depression and anxiety, IQ, episodic memory and executive function. Participants were randomly allocated to either the experimental or control group. The use of a matched sample and randomised group allocation served to reduce the possibility of individual differences between groups exerting a confounding effect on the findings. In addition, order effects were controlled for by ensuring that participants carried out the EFT trials in a randomised order, and a double-blind method was used so as to reduce experimenter effects and demand characteristics.

Reliability and validity were further enhanced by collecting data relating to both participant and researcher ratings of EFT simulations, thus reducing the risks associated with relying solely on subjective participant self-reported data, (e.g. a failure to understand task instructions, which would confound the results). The study also used participant-rating scales that were anchored with both numbers and text (e.g. 7 = strongly agree), so as to ensure that each number on the Likert-scale was interpreted consistently across all participants. Lastly, the task instructions were audio recorded, allowing them to be presented to all participants in a consistent manner.

There existed several methodological limitations that merit consideration. Given that the EFT task was administered by two different researchers, there may be some degree of inconsistency in relation to the researcher ratings of the EFT simulations. Future research might therefore benefit from establishing levels of inter-rater reliability. This was not done in the present instance as the second researcher relocated abroad prior to the completion of this study. Another limitation of this study relates to the fact that the sample largely consisted of university students; generalising the findings to the wider population may therefore be limited.

It is also worth noting that men and women process alcohol at different metabolic rates, such that women achieve higher concentrations of alcohol in the blood after drinking equivalent amounts of alcohol (Frezza *et al.,* 1990; Taylor *et al.,* 1996). Though the unequal distribution of male and female participants across groups was not found to be statistically significant, there nevertheless remains a possibility that the results may have been confounded by the fact that the experimental group contained more female participants than the placebo group. Further research in this area may benefit from ensuring equal numbers of male and female participants in each group. Lastly, it is unclear as to how female participants may have experienced food related cues as aversive, and whether or not the sample contained participants with subclinical eating disorders. Epidemiological data suggests that eating disorders are the most prevalent psychiatric disorder for young adult females (Zipfel *et al.,* 2000), and adverse attitudes towards food may have impaired some female participants' ability to engage in simulating future events in relation to food. Future research might benefit from screening participant's for eating disorders, or using non appetitive EFT cues.

Summary of research findings and clinical implications

The findings of the present empirical investigation have important implications for individuals across the spectrum of alcohol use. It has been widely established that alcohol adversely affects prospective memory – defined as the ability to remember to perform an intended action in the future (Einstein & McDaniel, 2005) – which is vitally important in our daily lives; (see Part I of this thesis for a more detailed discussion of this area). As such, the use of EFT promises to be effective in the context of clinical interventions for the treatment of alcohol misuse in alcohol-dependent individuals. More specifically, interventions that use EFT so as to enhance prospective memory capability could prove useful in relation to treating alcohol misuse using learning-based therapies. For example, if an individual is able to mentally simulate an imagined event, they would then be better able to anticipate their affectual and behavioural responses

should they encounter the imagined event in real life (McLelland *et al.,* 2015). The ability to pre-experience alcohol related future events might be useful in preparing individuals for the anticipated obstacles to relapse, as well as providing them with the ability to rehearse strategies that may be useful in such contexts. Furthermore, the present study establishes that EFT is robust against acute alcohol effects; these findings are supported by Paraskevaides *et al.,* (2010). This implies that the strategy could be useful for individuals who desire to reduce alcohol use (rather than completely abstain), as it may be employed after the consumption of a pre-determined quantity of alcohol.

Further support for the use of EFT in a therapeutic context comes from the results of a study conducted by Snider, LaConte & Bickel (2016), who found that the use of EFT in alcohol-dependent individuals resulted in a decline in impulsivity (which is a feature of addictive behavior), whilst also reducing the corresponding preference for immediate rewards, (i.e. delay discounting in relation to alcohol).

The observed results are also useful as they provide substantive empirical support for the theoretical assumptions that underpin the CESH by establishing that participants (across both groups) included episodic memory content within their constructed simulations. Accordingly, it is hoped that these findings may contribute to a greater understanding of the mechanism that underlie EFT.

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PART III: CRITICAL APPRAISAL

INTRODUCTION

The following critical appraisal is a reflection of my experiences over the course of conducting the empirical study contained within Part II of this study. Overall, this process has been challenging, and at times exasperating. However, it has also been an insightful and rewarding journey that has pushed me to challenge myself.

My decision to undertake this piece of research was accidental – my initial research proposal related to post-traumatic stress disorder in veterans, however, despite the fact that I was able to find an external supervisor with surprising ease, my proposal was rejected by every member of the academic faculty at UCL. Feeling somewhat deflated by my failed efforts to develop my own project idea, I began to consider a change of course. Luckily for me, Val and Sunjeev offered me one of the few projects that were still available. Initially unsold on the idea of researching Episodic Future Thinking (EFT), it later became a project that I genuinely enjoyed being a part of, and I am grateful for having the opportunity to work with two individuals who were able to provide expert knowledge and guidance throughout this process. The late addition of an MSc student to the project was also a great help, and her energetic enthusiasm and contributions were much appreciated.

When I began conducting some preliminary research so as to gain a greater understanding of the wider area of future-oriented cognition it became clearly apparent that I had underestimated how broad this field of research actually was. Due to the fact that the term "prospection" has been broadly constructed within the literature pertaining to future-oriented cognition, I initially found it difficult to differentiate between different types of future thinking; thus, as I trawled through published material in various databases I found myself tangled in a web of literature that I struggled to make sense of, and I could not help but feel a bit lost. It

was not until I stumbled across a paper published by Szpunar *et al.*, (2014) that I was able to make sense of this conceptual ambiguity. Not only did their taxonomy of prospection create an organisational framework that delineated the episodic and semantic forms of four modes of future thinking, (simulation, prediction, intention and planning), but this paper finally resulted in the "penny drop" moment I was waiting for – things were beginning to make sense! From that point onwards I was able to engage with the literature in the area of EFT with a much more detailed understanding of the nuanced differences between different types of future-oriented cognition, and unsurprisingly, my interest in the area began to grow significantly.

METHODOLOGICAL ISSUES

Literature review

Clinical psychology doctoral students at UCL are now presented with the opportunity to undertake either a systematic review or literature review for Part I of their doctoral thesis, and I initially aimed to undertake a systematic review of studies relating to the effects of alcohol on EFT. My decision was underpinned by my hope to improve my research skills by developing a more detailed understanding of how to systematically review a data-set. I was also mindful that I would not have the opportunity to do a piece of work such as a systematic review once I had finished the course, so I felt that it was important to be able to learn these skills before completing my final year. Accordingly, I began conducting a systematic search for all relevant empirical literature in order to retrieve relevant papers – a task which far exceeded the time I had allocated for this part of the research process (approximately three months). The reason for this delay resided in the fact that there were simply too few published papers in this area to facilitate a comprehensive systematic review, and despite reconfiguring my research question several times so as to broaden the scope of my search, I only found a handful of papers (some of which were only tangentially related to EFT). I felt a sense of upset

due to the fact that I had invested a substantial amount of time in trying to pull together a systematic review, but had been unable to complete one. In hindsight this was perhaps a realistic insight into tumultuous (and sometimes disappointing) process of academic research – despite my interest in various research questions, the absence of the relevant data precluded any meaningful exploration of those areas, leaving me feeling somewhat stuck.

As a result of not being able to complete a systematic review I opted to complete a conceptual introduction (i.e. a literature review) instead. Drafting the literature review nevertheless allowed me to develop a detailed understanding of the effects of alcohol on EFT, and I was able to use the papers I had retrieved during my previous database searches. This was a relief as it meant that my prior searches were still useful.

Sample

The recruitment of participants proved to be far more challenging than I had initially anticipated. In total, 90 individuals were screened in a 15-minute telephone interview so as to ascertain suitability for participation. This process was incredibly time consuming, and I was often left feeling frustrated due to a high proportion of interviews having to be rebooked as a result of non-responsive participants (despite the interviews being scheduled beforehand and reminder emails being sent). Once participants were deemed eligible to participate they were promptly allocated to a testing slot. However, several participants failed to attend, (often without contacting the researcher beforehand in order to cancel their session). Not only did non-attendance result in wasted laboratory time, it led to inevitable delays in the testing process.

The majority of the sample were drawn from an undergraduate population (65%), with half the total sample identifying as Caucasian. On reflection, it may have been beneficial to have recruited a broader sample of participants; this could have been achieved by making a greater effort to advertise the study in public places beyond the university campus, and perhaps

include more ethnically diverse participants. In doing so there might have been greater generalisability of the results, thus enhancing the external validity of the findings. Another issue that merits consideration relates to the propensity for individuals to under-report their alcohol use, (which is often the result of an under-estimation of consumption levels; Stockwell *et al.,* 2004). Future studies might therefore benefit from specifying the number of units of alcohol contained within standard alcoholic drinks when enquiring about consumption levels, serving to improve the accuracy of the responses gathered. This would allow researchers to establish that the participants recruited are truly representative of the group (e.g. social drinkers) they seek to investigate.

Measures

The EFT adapted participant rating-scales used for data collection (D'Argembeau & Van der Linden, 2004; 2006), were useful in gathering a broad data-set relating to the quality of phenomenological experience and the vividness of the imagined event, giving particular regards to the visual/auditory imagery, emotion and spatiotemporal specificity. However, some participants provided a vast amount of detail in one a particular domain (e.g. visual imagery), but ceiling effects meant that their scores did not adequately represent the rich detail provided. The lack of sensitivity in scales used for assessment could possibly be overcome by analysing the verbal accounts of simulated events using more sophisticated techniques (e.g. subjecting the entire verbal content of participant accounts to linguistic analysis, using software such as the Linguistic Enquiry and Word Count), and scoring in units that capture the true details contained within the narrative provided.

Adverse participant reaction

During the course of testing one participant suffered an adverse reaction following the administration of alcohol (vomiting and dizziness). As a result, the participant inclusion criteria were amended after a review of the study protocol by the UCL ethics committee, such that

participants were required to score between seven and 13 on the Alcohol Use Disorders Identification Test (AUDIT; Berner *et al.,* 2007). However, the previous inclusion criteria specified that participants should be excluded if their score exceeded seven. As a result, 68% of the study sample (recruited prior to the inclusion criteria being amended) were classified as having a "low risk" of alcohol misuse, whilst those recruited after the criteria amendment were classified as having an "increasing risk". It might therefore be argued that the participants recruited after the change to the inclusion criteria are characteristically different from those recruited beforehand, leading to a lack of homogeneity within the sample. The implications of a heterogeneous sample (in respect of clinical population) is that this could reduce the generalisability of the findings to the wider population of social drinkers (given that the sample contains two sub-sets of social drinkers).

It is recommended that future studies should consider the issue of participant alcohol consumption levels (and the criteria used to establish whether someone is classified as a social drinker) in great detail. Particular regards should be given to the fact that the term "social drinker" can be broadly constructed, and it is important to determine which end of the social drinking spectrum participants should be drawn from so as to facilitate the recruitment of a homogenous sample. Aside from methodological considerations, it is also important to protect participant welfare. As such, those considered naïve to alcohol should perhaps be administered a correspondingly lower dose of ethanol in alcohol related studies, whereas experiments using more experienced social drinkers might benefit from using the dose specified in Part II.

CONCLUSIONS

The research process which underpinned the empirical study in Part II of this thesis proved to be incredibly insightful, and I feel privileged to have been part of an innovative team seeking

to contribute to a developing understanding of EFT. Though the process was challenging at times, these challenges have enhanced my research skills and made me more confident in approaching research-based projects in the future.

Additionally, my research in this area has piqued my interest in the treatment of alcohol misuse, and I am hopeful that the findings of the empirical investigation may be of use in clinical settings. In fact, studies such as this demonstrate the ways in which experimental research can be applied to inform clinical practice, providing good justification for resources to be allocated to such endeavours. The observed results are also useful as they provide substantive empirical support for the theoretical assumptions that underpin the Constructive Episodic Simulation Hypothesis (Schacter, Addis & Buckner, 2008) by establishing that future-oriented simulations contained episodic memory content. Accordingly, I am hopeful that these findings may contribute to a greater understanding of the mechanism that underlie EFT.

Lastly, that there were methodological weaknesses of the empirical study goes without saying – errors are inherent in the process of conducting any experimental study. However, both the strengths and weakness of the research undertaken have been accurately documented and reflected upon herein, and it is hoped that any further research in this area may be more methodologically robust as a result of this candid critical evaluation.

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APPENDICIES

Appendix 1
Breakdown of contributions to data collection

The empirical study that forms Part II of this thesis was part of a joint project with an MSc student, Xiao Lin. Recruitment and screening of participants was undertaken jointly. Of the 90 participants screened, a final sample of 34 was included in the study. The experimental testing was split between myself and Xiao, and we tested 17 participants each. We processed the experimental data separately, such that Xiao reported data relating to prospective memory, whilst the empirical study contained within Part II of this thesis reports data relating to EFT.

Appendix 2
Search terms

1) <u>Keyword search</u>

Database: PsycINFO
Date of search: 14.09.18

Key concepts	(1) Future event thinking	(2) Alcohol
Alternative search terms	1. Future event thinking 2. Future thinking 3. Future thought 4. Future event simulation 5. Future simulation 6. Future episodic thinking 7. Episodic foresight 8. Episodic simulation of future events 9. Simulation of future events 10. Mental time travel 11. Mental projection 12. Future projection 13. Envisioning the future	1. Alcohol 2. Alcoholism 3. Alcoholic 4. Korsakoffs syndrome 5. Hazardous alcohol 6. Hazardous drinking
Search strings	"Future event thinking" "Future thinking" "Future thought*" "Future event simulation*" "Future simulation*" "Future episodic thinking" "Episodic foresight*" "Episodic simulation of future events" "Simulation of future events" "Mental time travel*" "Mental project*"	Alcohol* Alcohol "Korsakoffs syndrome" "Hazardous alcohol"

	“Future project*” “Envisioning the future”	

2) Index search

Database: PsycINFO
Date of search: 15.09.18; 04.10.18

CONCEPT 1 – Future event thinking			
Date of search	**Keyword**	**Index search (Subject headings)** *(Keyword mapped on to the following subject headings)*	**Broader and narrower terms; related terms**
15.09.18; 04.10.18	"Future event thinking"	• Thinking • Future • Episodic memory/EXP • Cognitive processes • Autobiographical memory • Imagery • Imagination • Cognitive development • Cognition • Goals • Major depression • Decision making • Cognitions • Memory • Temporal lobe	*Episodic memory:* Memory (BT) Eidetic imagery (RT) The term "episodic memory was exploded". *Autobiographical memory:* Memory (BT) Anniversary events (RT) Early experience (RT) Early memories (RT) Life experience (RT) (+NT) Life review (RT) Reminiscence (RT) Retrospective memory (RT) I considered including the term "autobiographical memory" within the search, however, the RT's appeared too remote from the relevant concept (future event thinking)]. *Imagination:* Cognitive processes (BT)

			Ideation (BT) Counterfactual thinking (NT) Conceptual imagery (RT) Fantasy (RT) Imagery (RT) Magical thinking (RT) Pretend play (RT) Various experiences (RT) [I considered including "cognitive processes" (BT) within the search, however, none of the NT's contained within this broader term were relevant; see below]. *Cognitive processes (BT):* *Narrow terms:* Accommodation (Cognitive Process) (NT) Assimilation (Cognitive Process) (NT) Associative Processes (NT) Catastrophizing (NT) Chunking (NT) Classification (Cognitive Process) (NT) Cognitive Appraisal (NT) Cognitive Bias (NT) Cognitive Discrimination (NT) Cognitive Generalization (NT) Cognitive Maps (NT) Cognitive Mediation (NT) Comprehension (NT) Concentration (NT) Concept Formation (NT) Counterfactual Thinking (NT) Decision Making (NT) False Beliefs (NT)

			Fantasy (NT) Ideation (NT) Imagination (NT) Intuition (NT) Lexical Access (NT) Mental Rotation (NT) Metacognition (NT) Naming (NT) Pattern Recognition (Cognitive Process) (NT) Problem Solving (NT) Rumination (Cognitive Process) (NT) Schema (NT) Semantic Generalization (NT) Social Cognition (NT) Task Switching (NT) Thinking (NT) Thought Suppression (NT) Transposition (Cognition) (NT) *Related terms:* Artificial Intelligence (RT) (+NT) Attentional Blink (RT) Cognition (RT) (+NT) Cognitive Assessment (RT) (+NT) Cognitive Dissonance (RT) Cognitive Processing Speed Cognitive Psychology (RT) Conflict Resolution (RT) (+NT) Connectionism (RT) Declarative Knowledge (RT) Generation Effect (Learning) (RT) Human Information Storage (RT) Information Processing Model (RT) Learning (RT) (+NT)

			Learning Strategies (RT) (+NT) Memory (RT) (+NT) Mind (RT) Neurocognition (RT) Procedural Knowledge (RT) Questioning (RT) Reality Testing (RT) Sense of Coherence (RT) Spatial Ability (RT) (+NT) Strategies (RT) (+NT) Word Associations (RT)
15.09.18	"Future thinking"	• Thinking • Future • Episodic memory/EXP • Autobiographical memory • Decision making • Major depression • Cognitive processing • Delay discounting • Hopelessness • Autism spectrum disorders • Cognitive development • Childhood development • Hippocampus • Temporal lobe • Delay of gratification	
15.09.18	"Future thought"	• Future • Thinking • Episodic memory/EXP • Autobiographical memory	

		• Cognitive processes • Amnesia • Intention • Theories • Time • Prediction • Cognitive impairment • Goals • Imagination • Cognitions • Functional magnetic resonance imaging	
15.09.18	"Future event simulation"	• Simulation • Future • Episodic memory/EXP • Memory • Imagination • Prospective memory • Cognitive processes • Experiences (events) • Prefrontal cortex • Brain • Thinking • Retention • Time • Functional magnetic resonance imaging • Health services	*Simulation:* Computer simulation (NT) Flight simulation (NT) Heuristic modelling (NT) Markov chains (NT) Mathematical modeling (NT) Simulation games (NT) Stochastic modelling (NT) Game theory (RT) [I considered including "simulation" within the search, however, the NT's appeared too remote from the relevant concept (future event thinking)]. *Prospective memory:* Memory (BT) Intention (RT) Retrospective memory (RT) [I considered including "prospective memory" within the search, however, the RT's and BT's appeared too

			remote from the relevant concept (future event thinking)]. The broader term of memory, which might be considered relevant, was previously searched for when the term "episodic memory" was exploded.
15.09.18	"Future simulation"	• Simulation • Episodic memory/EXP • Future • Imagination • Thinking • Hippocampus • Autobiographical memory • Computer simulation • Prospective memory • Memory • Functional magnetic resonance imaging • Cognitive processes • Human information storage • Age differences • Medical education	
15.09.18	"Future episodic thinking"	• Thinking • Episodic memory/EXP • Future • Decision making • Cognition • Brain • Autobiographical memory • Hippocampus • Delay discounting	

		• Childhood development • Time perception • Animal cognition • Theory of mind • Cognitive processes • Experiences (events)	
15.09.18	"Episodic foresight"	• Episodic memory/EXP • Future • Child development • Cognition • Cognitive processes • Cognitive development • Semantic memory • Drug abuse • Cognitive impairment • Cognitive ability • Thinking • Animal ethology • Memory • Animal motivation • Time perception	
15.09.18	"Episodic simulation of future events"	• Episodic memory/EXP • Future • Simulation • Thinking • Autobiographical memory • Imagination • Ageing • Retention • Temporal lobe	

		• Cognitive processes • Age differences • Hippocampus • Cognitive impairment • Major depression • Patients	
15.09.18	"Simulation of future events"	• Simulation • Future • Episodic memory/EXP • Thinking • Hippocampus • Autobiographical memory • Imagination • Memory • Functional magnetic resonance imaging • Prospective memory • Cognitive processes • Time • Temporal lobe • Alzheimer's disease • Experiences (events)	
15.09.18	"Mental time travel*"	• Episodic memory/EXP • Cognitive processes • Time • Autobiographical memory • Time perspective • Future • Cognition • Time perception • Cognitive ability	

		• Animal ethology • Animal models • Hippocampus • Memory • Comparative psychology • Decision making	
15.09.18	"Mental project*"	• Theories • Emotions • Mental disorders • Future • Memory • Empathy • Brain • Psychosis • Psychoanalysis • Judgment • Decision making • Awareness • Comorbidity • Consciousness states • Inference	
15.09.18	"Future project*"	• Autobiographical memory • Future • Decision making • Episodic memory/EXP • Methodology • Culture (anthropological) • Epidemiology • Health care costs • Memory	

		• Chronic illness • Self-concept • Learning difficulties • Social casework • Human development • Thinking	
15.09.18	"Envisioning the future"	• Future • Education • Grief • Professional organisations • Episodic memory/EXP • History • Cingulate cortex • Post-traumatic stress disorder • Collaboration • Life experiences • Counseling • Decision making • Medical education • Human machine systems • Sexual orientation	

Database: PsycINFO
Date of search: 15.09.18; 23.10.18

CONCEPT 2 – Alcohol			
Date of search	**Keyword**	**Index search (Subject headings)** *(Keyword mapped on to the following subject headings)*	**Broader and narrower terms; related terms**
15.09.18	Alcohol*	• Alcohol abuse/EXP • Alcohol drinking attitudes • Alcohol drinking patterns/EXP • Alcohol intoxication/EXP • Alcohol rehabilitation • Alcohol withdrawal • Blood alcohol concentration • Fetal alcohol syndrome	*Alcohol abuse:* Alcohol drinking patterns (BT) Drug abuse (BT) Alcoholism (NT) Binge drinking (NT) Alcohol intoxication (RT) (+NT) Alcohol withdrawal (RT) Blood alcohol concentration (RT) Co-dependency (RT) Drug abuse liability (RT) Polydrug abuse (RT) Substance abuse and addiction measures (RT) Underage drinking (RT) The broad term “alcohol drinking patterns” was exploded. The narrow terms were exploded, including alcohol intoxication (RT/NT). *Alcohol drinking patterns* Drinking behaviour (BT) Drug usage (BT) Alcohol abuse (NT) Alcohol intoxication (NT) Social drinking (NT) Alcoholism (RT)

			Binge drinking (RT) Blood alcohol concentration (RT) Underage drinking (RT) The broad term "drinking behaviour" was exploded. All narrow and related terms were exploded, except for "underage drinking" as I am looking at the adult population. *Alcohol intoxication* Alcohol drinking patterns (BT) Acute alcoholic intoxication (NT) Chronic alcoholic intoxication (NT) Alcohol abuse (RT) (+NT) Alcoholism (RT) (+NT) Binge drinking (RT) Blood alcohol concentration (RT) Driving under the influence (RT) Toxic disorders (RT) (+NT) Toxic psychoses (RT) All terms under "alcohol intoxication" were exploded.
15.09.18	Alcohol	• Alcohols/EXP	*Alcohols:* Drugs (BT) Ethanol (NT) Isoproterenol (NT) Methanol (NT) Methoxamine (NT) Acetaldehyde (RT) Alcohol dehydrogenases (RT) Blood alcohol concentration (RT) Solvents (RT)

			The narrow terms were exploded.
23.10.18	Korsakoffs syndrome	• Korsakoffs psychosis • Alcoholism/EXP • Amnesia • Memory • Memory disorders • Wernicke's syndrome • Cognitive impairment/EXP • Syndromes • Brain damage • Executive function • Psychometrics • Learning • Episodic memory • Cognitive ability/EXP • Retrograde amnesia	*Alcoholism:* Addiction (BT) Alcohol abuse (BT) Alcoholic psychosis (+NT) Acamprostate (RT) Alcohol drinking patterns (RT) Alcohol intoxication (RT) Alcohol withdrawal (RT) Children of alcoholics (RT) Fetal alcohol syndrome (RT) Nutritional deficiencies (RT) Sobriety (RT) Substance abuse and addiction measures (RT) Toxic disorders (RT) The broad terms of "addiction" and "alcohol abuse" were exploded. The terms "memory" and "episodic memory" were considered relevant, however, they were exploded in a previous search. *Cognitive impairment:* Brain damage (RT) Cognition (RT) Cognitive ability (RT) Dementia (RT) Dysexecutive syndrome (RT) Intellectual development disorder (RT) Memory disorders (RT) Thought disturbances (RT)

			The term “cognitive impairment” was exploded. *Cognitive ability:* Ability (BT) Brain training (NT) Mathematical ability (NT) Reading ability (NT) Spatial ability (NT) Verbal ability (NT) Cognitive assessment (RT) Cognitive impairment (RT) Cognitive processing speed (RT) Executive function (RT) Metacognition (RT) The BTs, NTs and RTs for the term “cognitive ability” were deemed to remote to be of relevance, and as such, the term was not included in the search.
23.10.18	Hazardous alcohol	• Alcohol abuse/EXP • Alcohol drinking patterns/EXP • Alcoholism/EXP • Intervention • College students • Risk factors • Stress • Sobriety • Epidemiology • Posttraumatic stress disorder • Drinking behaviour/EXP • Alcohol rehabilitation • Sexual risk taking	The terms “alcohol abuse”, “alcohol drinking patterns”, “alcoholism” and “alcohols” were considered relevant, however, they were exploded in a previous search. *Drinking behaviour:* Behavior (BT) Alcohol drinking pattern (NT) Animal drinking behaviour (NT) Water intake (NT) Alcoholic beverages (RT) Beverages (non-alcoholic) (RT) Diets (RT) Driving under the influence (RT)

		• Binge drinking/EXP • Alcohols/EXP	Fluid intake (RT) Ingestion (RT) Sucking (RT) Thirst (RT) The narrow term “alcohol drinking pattern” was exploded.

1) <u>Keyword and MeSH search</u>

Database: PubMed (Medline)
Date of search: 28.10.18

Key concepts	(3) Future event thinking	(4) Alcohol
Alternative search terms	14. Future event thinking 15. Future thinking 16. Future thought 17. Future event simulation 18. Future simulation 19. Future episodic thinking 20. Episodic foresight 21. Episodic simulation of future events 22. Simulation of future events 23. Mental time travel 24. Mental projection 25. Future projection 26. Envisioning the future	15. Alcohol 16. Alcoholism 17. Alcoholic 18. Korsakoffs syndrome 19. Hazardous alcohol 20. Hazardous drinking 21. Alcohol abuse* 22. Alcohol drinking patterns* 23. Alcohol intoxication* 24. Alcoholism* 25. Cognitive impairment* 26. Drinking behaviour* 27. Binge drinking* 28. Alcohols* *This terms were included as they came up as MeSH terms in the PsycINFO search.
Search strings	"Future event thinking" – keyword search "Future thought" – keyword search "Future thinking" – keyword search "Future event simulation" – keyword search "Future simulation" – keyword search "Future episodic thinking" – keyword search	Alcohol – MeSH term "Korsakoffs syndrome" – keyword search "Hazardous alcohol" – keyword search "Hazardous drinking" – keyword search "Alcohol abuse" – keyword search "Alcohol drinking patterns" – keyword search

	“Episodic foresight” – keyword search “Episodic simulation of future events” – keyword search “Simulation of future events” – keyword search “Mental time travel” – keyword search “Mental projection” – keyword search “Future projection” – keyword search “Envisioning the future” – keyword search	“Alcohol intoxication” – keyword search Alcoholism – MeSH term “Cognitive impairment” – too broad “Drinking behaviour” – keyword search “Binge drinking” – keyword search Alcohols – MeSH term
	Search ((((((((((((("Future event thinking") OR “Future thought”) OR "Future event simulation") OR “Future simulation”) OR "Future episodic thinking") OR “Episodic foresight”) OR "Episodic simulation of future events") OR "Simulation of future events") OR "Mental time travel”) OR "Mental projection") OR "Future projection") OR "Envisioning the future”)	Search ((((((((((alcohol) OR “Korsakoffs syndrome”) OR “Hazardous alcohol”) OR Hazardous alcohol) OR Hazardous drinking) OR “Alcohol abuse”) OR “Alcohol drinking patterns”) OR “Alcohol intoxication”) OR Alcoholism) OR “Drinking behaviour”) OR "Binge drinking") OR Alcohols

3) <u>Keyword and MeSH search</u>

Database: Web of Science
Date of search: 04.11.18

Key concepts	(1) Future event thinking	(2) Alcohol
Alternative search terms	1. Future event thinking 2. Future thinking 3. Future thought 4. Future event simulation 5. Future simulation 6. Future episodic thinking 7. Episodic foresight 8. Episodic simulation of future events 9. Simulation of future events 10. Mental time travel 11. Mental projection 12. Future projection 13. Envisioning the future	1. Alcohol 2. Alcoholism 3. Korsakoffs syndrome 4. Hazardous alcohol 5. Hazardous drinking 6. Alcohol abuse* 7. Alcohol drinking patterns* 8. Alcohol intoxication* 9. Alcoholism* 10. Cognitive impairment* 11. Drinking behaviour* 12. Binge drinking* 13. Alcohols* *This terms were included as they came up as MeSH terms in the PsycINFO search.
Search strings	ts** = "Future event thinking" ts = "Future thinking" ts = "Future thought*" ts = "Future event simulation*" ts = "Future simulation*" ts = "Future episodic thinking" ts = "Episodic foresight*" ts = "Episodic simulation of future events" ts = "Simulation of future events"	ts = Alcohol* ts = "Korsakoffs syndrome" ts = "Hazardous alcohol" ts = "Hazardous drinking" ts = "Alcohol abuse" ts = "Alcohol drinking patterns" ts = "Alcohol intoxication" ts = "Alcoholism" ts = "Cognitive impairment" – too broad

	ts = “Mental time travel*” ts = “Mental project*” ts = “Future project*” ts = “Envisioning the future” **ts = topic search	ts = “Drinking behaviour” ts = “Binge drinking” ts = “Alcohols”

Appendix 3
Recruitment poster

CLINICAL PSYCHOPHARMACOLOGY UNIT

RESEARCH DEPARTMENT OF CLINICAL, EDUCATIONAL AND HEALTH PSYCHOLOGY

Project ID: 5929/004

Do you want to take part in a study investigating memory and alcohol use ?

We are carrying out research at University College London (UCL) that explores the effect of alcohol consumption on different aspects of memory. In particular, we are looking at the way in which alcohol effects our ability to think about, plan and undertake future tasks or activities, (e.g. attend a doctor's appointment, remember to buy specific items whilst shopping, etc.).

Participants are invited to attend a 3-hour testing session involving both written and computerised tasks. We will provide payment of £20 to

This study has full ethical approval and your participation will be completely confidential. For more information please email:

alcoholstudy1@gmail.com

This study has full ethical approval and your participation will be completely confidential. For more information please

Appendix 4
Participant information sheet

CLINICAL PSYCHOPHARMACOLOGY UNIT
RESEARCH DEPARTMENT OF CLINICAL, EDUCATIONAL AND HEALTH PSYCHOLOGY
Project ID: [5929/004]

Information sheet for volunteers

An investigation into the impact of acute alcohol effects on future memory and future thinking

Please take time to read the following information carefully, and feel free to ask for clarification in relation to anything that you do not understand.

The purpose of this research

You are invited to participate in a study aimed at improving our understanding of the effects of alcohol on both *'future memory'* and *future thinking'*. The former term refers to the ability to create an intention to do something in the future, and then remember to actually perform that intended action - such as visit the dentist, for example. The latter concept refers to our ability to imagine ourselves in the future and mentally simulate situations and events that have not yet occurred. For example, when you think about a journey that you are about to make you might imagine yourself getting onto a train, finding a seat, and so on.

In order to investigate these areas we will compare one group of individuals who have consumed alcohol with another group who have not, and assess their performance in relation to a specific set of tasks. As well as helping us to better understand memory impairments following alcohol use, research of this nature is of value as it may provide us with a greater understanding of how we can improve our ability to remember to undertake intended future actions.

What happens if I decide to take part?

If you choose to take part then you will be invited to UCL's Clinical Psychopharmacology Unit, and asked to do the following:

- Read and sign a consent form indicating that you understand the aims of the study, are aware of how your data will be used and are willing to participate.
- Complete a questionnaire regarding your current alcohol use.
- Complete a set of cognitive tasks.

The session will last approximately **2.5 - 3 hours**.

Participation is voluntary and you may withdraw from the study at any time without the need to specify a reason.

Expenses and payments

You will receive £20.00 for taking part in this study.

What are the possible risks of taking part?

There are no foreseen risks in regards to your participation. However, participants must be social drinkers and consume approximately 2 – 3 large glasses of wine (or 3 pints of beer) per week without suffering adverse effects.

How will I find out the results?

If you would like to receive a copy of any reports or publications arsing from your participation once the study has been completed, then please indicate this on the consent form provided on the day and a copy of such will be sent to you via email.

Will my taking part in this study be kept confidential?

Yes – all of the information regarding your participation in this study will be kept confidential. Though the overall results may be published in a scientific journal, the data will be anonymised so that you will not be individually identifiable.

All data collected will be securely stored on UCL premises and computers, in accordance with the *General Data Protection Regulations 2018 (GDPR).*

As you are being paid to participate your name and address will be passed to the UCL Finance department for administration purposes.

Who is organising and funding the research?

This study is being organised and internally funded by University College London (Project ID: 5929/004). It has also received approval from the UCL Research Ethics Committee.

How do I voice any concerns or complaints?

You are encouraged to discuss any complaints or issues arising from your participation in this study with the researchers. Should you wish to make a formal complaint then it will be referred to the Joint Research Office, and subsequently reviewed by the Clinical Research Governance Committee and the UCL Research Governance Committee.

Contact details

1. Marie Brown (Trainee Clinical Psychologists at UCL) and Xiao Liu (MSc student at UCL) are conducting this study, and any questions you have regarding the nature of the research, or your potential participation, should be directed to either of the aforementioned persons; (alcoholstudyucl1@gmail.com)
2. Professor Valerie Curran (v.curran@ucl.ac.uk) and Dr Sunjeev Kamboj (sunjeev.kamboj@ucl.ac.uk) are supervising the study, and may also be contacted with any questions.

Appendix 5
Telephone screening script

Date…….

Participant Number…….

Estimated time: 20 minutes

Have you read the information sheet about the study and are you interested in taking part?

□ YES

□ NO (**If NO then END)**

Are you fluent in English?

□ YES

□ NO **(if NO then END)**

Please inform volunteers that as part of this telephone pre-screening they will be asked some detailed and sensitive questions to determine if they are eligible for the trial, and that if they feel uncomfortable about answering any of the questions they have the option not to answer.

Volunteer informed:

□ YES

□ NO (**If NO then END)**

Have you ever been diagnosed with a learning difficulty?

□ YES **(If YES then END)**

□ NO

Do you currently use any illicit (illegal) drugs? E.g. Cannabis/ MDMA/ Ketamine/ Cocaine/ Amphetamines How often do you use them?

□[1] At least one illicit drug is used more than twice per month **(If so, then END)**

□[o] No illicit drug is used more than twice a month

Have you ever been diagnosed/concerned about dependency on any illicit substance other than nicotine?

□ YES **(If YES then END)**

□ NO

Are you currently receiving psychiatric medication and/or therapy for a mental health problem?

□ YES

□ NO

If YES Provide details

Have you ever been diagnosed with a psychotic disorder (e.g. Schizophrenia, Bipolar) or experienced a psychotic episode in the past?

□ YES **(If YES then END)**

□ NO

Are you currently using any other prescribed medication?

□ YES

□ NO

If yes, list them:

Are you a smoker?

□ YES

□ NO

DEMOGRAPHICS

Age: _____

Date of Birth: _____

Gender: Male / Female (circle)

What is your highest level of education?

□ GCSE/HS Dropout

□ A Level/HS Diploma or GED

□ Vocational training course/Associates degree

□ Undergraduate degree

□ Postgraduate degree

□ Doctorate

□ Other ……..

What is your estimated current weight?

Weight: .....kg or …...stone ……pounds

What is your estimated height?

Height: .....metres or …...feet ……inches

Do you have high blood pressure, high cholesterol or other physical health problems such as diabetes?

□[1] Yes……..**(If so, then END)**

□[o] No

Do you have normal or corrected to normal vision? If they wear glasses/contacts remind them to bring them to all sessions.

□[1] Yes

□[o] No…….... **(If so, then END)**

Do you have a taste, smell or hearing impariments?

□[1] Yes **(If YES then END)**

□[o] No

Do you have any history of head trauma?

□[1] YES **(If YES then END)**

□[o] No

AUDIT

We're now going to ask a few questions about your alcohol use.

1. How often do you have a drink containing alcohol? **[If < 4 OR > 20 then END]**

[CONTINUE THROUGH ALL QUESTIONS AND SCORE]

AUDIT score _____

[If > 16 then END]

PHQ-9

We're now going to ask some questions about your general mental health and mood.

Over the last 2 weeks, how often have you been bothered by the following? And the answer choices are not at all, several days, more than half the days, nearly every day.

[CONTINUE THROUGH END OF SURVEY]

PHQ score _____

Thank you, now I'm going to ask you another set of questions in the same format.

GAD-7

Over the last 2 weeks, how often have you been bothered by the following?

[CONTINUE THROUGH END OF SURVEY]

GAD score _____

Would you be willing to refrain from using drugs/alcohol for 24 hours before the test session?

□ YES

□ NO

Would you be willing to refrain from driving for four hours after testing?

□ YES

□ NO

Would you be happy for your contact details to be passed on to other UCL researcher's within our group who are currently running studies for which you may be eligible to participate?

□ YES

□ NO

Thank you for answering these questions. Since you meet the criteria of this study, would you be willing to come to UCL for a testing session which will take approximately 2-2.5 hours? We are based near Goodge Street, just off Tottenham Court Road.

[SCHEDULE]

Appendix 6
Consent form

CLINICAL PSYCHOPHARMACOLOGY UNIT
RESEARCH DEPARTMENT OF CLINICAL, EDUCATIONAL
AND HEALTH PSYCHOLOGY

Project ID: 5929/004

Consent Form

How does alcohol affect adult drinkers?

An investigation of the impact of acute alcohol on future memory and future thinking

Researchers: Prof H Valerie Curran, Dr Sunjeev Kamboj, Marie Brown & Xiao Liu.

I …… confirm that I have read and understood the information sheet presented to me for the current study.	YES/NO
I have been given the opportunity to ask questions and clarify anything that I did not previously understand.	YES/NO
I understand that my participation is voluntary and that I am free to withdraw at any time without providing any explanation or reason. I understand that withdrawing from this study does not affect my statutory rights.	YES/NO
I understand that the personal information generated from this study will be treated as strictly confidential and handled in accordance with the provisions of the *General Data Protection Regulations 2018 (GDPR).*	YES/NO

I consent to the information that I have submitted being securely transferred to, and stored on, University College London premises and computers.	YES/NO
I understand that I am being paid for my assistance in this research and that some of my personal details will be passed to UCL's finance department for administration purposes.	YES/NO
I agree not to drive, cycle, make important decisions or operate heavy machinery for the rest of the day after I take part in the study.	YES/NO
I agree not to eat for 1 hour prior to taking part in the study.	YES/NO
I agree not to drink alcohol for 24 hours prior to taking part in the study.	YES/NO
I agree to take part in the above study.	YES/NO

If you would like to receive a copy of any reports or publications arising from your participation once the study has been completed then please provide your email address below:

Email address: ……

Signed (participant) …….. Date ……..

Signed (researcher) …….. Date ……..

Appendix 7
Research protocol

Protocol pack: alcohol and prospective memory study 2018

PLEASE INDICATE VERSION: 1 OR 2
PLEASE INDICATE EFT TASK ORDER

Date ……

Session Time ……

Participant Number ……..

TASK	Time from 0	Time Completed	RESULT
BAC1	**+2**		
Preliminaries	+8		
Consent Form			Y / N
Weight (kg)			
Height (cm)			
Smoker			Y / N
Age			
Ethnicity			
Story 1 (immediate recall)	+ 11		
Verbal Fluency 1 (phonemic)	+ 15		
Spot the word	+ 18		
START STOPWATCH			

Start drinking protocol	**+ 19**	**0:00:00**	
Finish drinking protocol	**+ 39**	**0:20:00**	
BREAK	+ 49		
BAC2	**+ 51**	**0:30:00**	
Story 2 (immediate Recall)	+ 55		
Verbal Fluency 2 (phonemic)	+ 59		
EFT task description + practice trial	+ 65		
EFT task 1	+ 70		
EFT task 2	+ 75		
Top-up 1 (0.1g/kg)	**+ 77**	**1:00:00**	
EFT task 3	+ 86		
Story 1 + 2 (delayed recall)	+ 89		
BAC3	**+ 90**	**1:10:00**	
Virtual Week trial run	+ 105		
Top-up 2 (0.1g/kg)*	**+ 107**	**1:30:00**	
VW day 1	+ 120		
BAC4	**+ 122**	**1:40:00**	
VW day 2	+ 136		
Top-up 3 (0.1g/kg)*	**+ 138**	**2:00:00**	
VW day 3	+ 152		
BAC5	**+ 154**	**2:10:00**	

VW day 4	+ 168		
Payment Form			
PART / EXP guess on condition +confidence 1-5			/

(if needed) Finish AUDIT questionnaire from screener

	0	1	2	3	4	
AUDIT-C QUESTIONS						
How often do you have a drink containing alcohol?	Never	Monthly or less	2-4 times per month	2-3 times per week	4+ times per week	
How many units of alcohol do you drink on a typical day when you are drinking?	1-2	3-4	5-6	7-9	10+	
How often have you had 6 or more units if female, or 8 or more if male, on a single occasion in the last year	Never	Less than Monthly	Monthly	Weekly	Daily or almost daily	
TOTAL						
AUDIT QUESTIONS						
How often during the last year have you found that you were not able to stop drinking once you had started?	Never	Less than Monthly	Monthly	Weekly	Daily or almost daily	
How often during the last year have you failed to do what was normally expected of you because of drinking?	Never	Less than Monthly	Monthly	Weekly	Daily or almost daily	

How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session?	Never	Less than Monthly	Monthly	Weekly	Daily or almost daily	
How often during the last year have you had a feeling of guilt or remorse after drinking?	Never	Less than Monthly	Monthly	Weekly	Daily or almost daily	
How often during the last year have you been unable to remember what happened the night before because you had been drinking?	Never	Less than Monthly	Monthly	Weekly	Daily or almost daily	
Have you or someone else been injured because of your drinking?	No		Yes, but not in the last year		Yes, during the last year	
Has a relative, friend, doctor, or other health care worker been concerned about your drinking or suggested you cut down?	No		Yes, but not in the last year		Yes, during the last year	
TOTAL						

Story Recall (Immediate) (1)

Navigate to: My Documents>Study Files

Open [Version B OR Version D]

Time started story: …….

"You're about to hear a short story through the headphones. Listen as carefully as you can, as you'll only hear it once. Afterwards I'd like you to tell me what you can remember, and I'll record your answer."

USE HEADPHONES AND TEST THE VOLUME (listen yourself) BEFORE YOU START!

PLAY STORY

"Now I'd like you to repeat the story back to me, as close to word for word as possible. If you can't remember the exact phrases then use your own words."

START AUDIO RECORDING

NO TIME LIMIT

For each unit score 1 for a word perfect recall 1 for an exact synonym1⁄2 for a partial recall1⁄2 for a close synonym The maximum score for each recall is 21.

Verbal Fluency (1)

*"In a minute I'm going to say a letter of the alphabet. When I say a letter, I want you to tell me as many words as you can that begin with that letter. You will have 60 seconds before I tell you to stop. None of the words can be the names of people, places or numbers. For example, if I gave you the letter T you could say **take**, **toy**, **tooth** and so forth, but you couldn't say **TOM** because that's a person's name; you couldn't say **TEXAS** because that's the name of a place, and you couldn't say **TWELVE** because that's a number. Also, you can't give me the same word with different endings. For example, if you say **TAKE**, you cannot say **TAKES** and **TAKING**.*

Do you have any questions? So, just to recap – when I say a letter I'd like you to say as many words as you can think of that begin with that letter. Ready?

[START AUDIO RECORDING]

The letter is: **[either B OR M]**

START TIMER: 60 seconds

Trial Letter:
Correct =
Errors =
Perseverative Errors =

END TIMER “Time is up”

Spot the Word

“Now we’ll move on to another brief test. This is a test of your knowledge of words. You’ll be asked to decide which of two items, such as ‘bread’ and ‘glot’, is a real word and which is an invented item; ‘bread’, of course, is the real word.

“Each of the pairs of items below contains one real word and one nonsense word, invented so as to look like a word but having no meaning. Please tick the item in each pair that you think is the real word. Some will be common words, most will be uncommon and some very rarely used. If you are unsure, guess. Do you have any questions?

Before you begin the main test I’d like you to do a practice trial.”

GIVE PARTICIPANT WORKSHEET 1 – [PRACTICE]

“Are there any questions?”

GIVE PARTICIPANT WORKSHEET 2 – [TEST]

ALCOHOL ADMINISTRATION

Provide first drink and START STOPWATCH. keep the stopwatch running throughout the session.

Participant can take sips at their own pace, but they should be encouraged to finish the drink within 2 minutes.

Do not provide the next drink until the full 2 minutes have elapsed, even if the participant finishes the drink early.

There are 10 drinks.

Drinks will be provided at 0 mins, 2 mins, 4 mins, 6 mins, 8 mins, 10 mins, 12 mins, 14 mins, 16 mins, and 18 mins.

The final drink should be completed by 20 minutes.

Then wait 10 minutes before continuing with testing - i.e. administer BAC2 when the stopwatch reads 30 minutes.

NB. Provide participant with 1 cup of water to consume during the alcohol administration. They can only drink this during the initial administration.

After the BAC2 they can drink more water if they wish, however remember that they can have nil by mouth 10 minutes prior to each breathalyser

"Now you will be given a short 10 minute break. Please refrain from drinking water during this time period."

[BREAK]

WAIT UNTIL STOPWATCH READS [30] MINUTES BEFORE DOING BAC2

BAC monitor: Time 2

Story Recall (Immediate) (2)

Navigate to: My Documents>Study Files
Open [Version B OR Version D]

Time started story: …….

USE HEADPHONES and TEST THE VOLUME (listen yourself) BEFORE YOU START!

"As with the last story task, you'll hear a short story through the headphones. Listen as carefully as you can, as you'll only hear it once. Afterwards I'd like you to tell me what you can remember, and I'll record your answer."

USE HEADPHONES AND TEST THE VOLUME (listen yourself) BEFORE YOU START!

PLAY STORY

"Now I'd like you to repeat the story back to me, as close to word for word as possible. If you can't remember the exact phrases then use your own words."

START AUDIO RECORDING

NO TIME LIMIT

For each unit score 1 for a word perfect recall 1 for an exact synonym1⁄2 for a partial recall1⁄2 for a close synonym The maximum score for each recall is 21.

Verbal Fluency (2)

"Remember the task we did where I gave you a letter of the alphabet and you had to say as many words as you can think of beginning with that particular letter? Now we're going to do the same task again, but this time with a different letter. I'll quickly recap the rules for you:

None of the words can be the names of people, places or numbers. Also, you cannot give me the same word with different endings. You will have 60 seconds before I tell you to stop. Do you have any questions?

Great – are you ready to begin?

[START RECORDING]

The letter is: **[either B OR M]**

START TIMER: 60 seconds

Trial Letter:
Correct =
Errors =
Perseverative Errors =

END TIMER "Time is up"

EFT TASK

Trial Description

PLAY AUDIO OF TRIAL DESCRIPTION [LISTEN FIRST]

"You're now going to complete a task that will require you to use your imagination. In a moment the researcher will ask you to think of an event once they have said a cue word out loud. In the practice trial the cue word will be "coffee". So, once you hear the word "coffee" you will then need to think about an event that relates to that particular cue word. When you've thought of an event, indicate this to the researcher by saying "ready". When you're ready to continue, the researcher will then ask you to describe the event out loud, and this will be audio recorded. You should aim to include the following details in the description of your imagined event:

- *Time of day (Does it take place in the morning, afternoon or evening?)*
- *Time of year (What season is it? What's the weather like?)*
- *People (Who's there?)*
- *Objects (What objects are around?)*
- *The overall environment.*
- *Things you can smell, hear and taste.*
- *Any emotions that you're feeling.*

Additionally, the event that you imagine must be something that might feasibly occur in real life at some point in the next 6 – 12 months. The event should last between several minutes or several hours, but not longer than a day.

After you've described the event, the researcher will then ask you to close your eyes and imagine it in your mind's eye for 30 seconds. You should aim to mentally experience the event in as much detail as possible. Lastly, you will be given a questionnaire and asked to answer some questions in relation to the event that you have imagined. Note: you will not complete the questionnaire during the practice trial.

There will be 1 practice trial, followed by 3 experimental trials.

You may now remove the headphones and ask the researcher any questions that you have."

TAKE HEADPHONES AWAY FROM THE PARTICIPANT

GIVE THEM THE IMAGINATION TASK INSTRUCTION SHEET

"Here's a summary of the instructions that you've just heard. Please read it carefully and ask me to clarify anything that you're not sure about".

AFTER THE PARTICIPANT HAS READ THE INSTRUCTIONS AND QUESTIONS HAVE BEEN ADDRESSED, SAY THE FOLLOWING:

Right, now we'll do a practice trial before moving onto the real experiment. Are you ready? Great, let's start".

Practice trial

*"I'd like you to think of an event relating to **"coffee".** Please indicate when you have thought of an event are ready to continue by saying 'ready'".*

When the participant says *"ready",* respond by saying the following:

"Now I'd like you to describe the event in as much detail as possible. In the real trial I'll record your description, but we won't record for the practice trial."

Score and feedback practice trial description

Specificity Domain	**Example**	**Present** (if No give feedback question)	**Feedback**
Less than day?	e.g. I pop into a coffee shop	Yes No	Can you tell me how long the event lasted (e.g. minutes, hours or day)? *If they provide response >1day then remind them "The event you imagine should be specific and last no longer than one day"*
Specific Location	e.g. The Starbucks on Tottenham Court Road	Yes No	Can you tell me where the event took place?
Specific Time of Day	e.g. it's early evening and…	Yes No	Can you tell me the time of day?
Specific Time of Year/Season	e.g. It's a summer's day	Yes No	Can you tell me what time of year it is? *Give a reminder about 6 months time.*

People	e.g. I'm sitting with my brother and sister	Yes	No	Can you tell me whether there are people around and who they are?
Objects	e.g. I'm drinking out of a starbucks coffee cup	Yes	No	Can you tell me whether there are any objects around and what they are?
Visual Detail/Environment	e.g. I can see everyone else walking past, the roads are busy, and the sun is shining down	Yes	No	Can you tell me a bit more about what you can see around you and the environment you are in.
Sound	e.g. I can hear the radio on and the chatter of the other people in the cafe	Yes	No	Can you hear any sounds?
Smell/Taste	e.g. I can smell the freshly ground coffee beans	Yes	No	Can you smell or taste anything?
Emotion	e.g. I am feeling relaxed and happy	Yes	No	Can you tell me how you are feeling; any emotions you are experiencing?

"Ok, so now we have had a practice and I've given you some feedback on how specific I want the event description to be, do you understand what you need to do?"

"Good."

"In the real trial, there will be a slight change from what we've just done: firstly, I won't be giving you prompts in order to ensure that you have imagined the event in sufficient detail. Secondly, after you've described the event to me, I'll ask you to close your eyes and imagine it for 30 seconds. After you've imagined the event, you'll then be asked to complete a questionnaire about it. Do you have any questions?"

"Before we move on, please re-read the instruction sheet in order to refresh your memory as to what should be included in your imagined scenario."

"Are you ready to begin the real trial now? Great – let's begin."

Experimental trial 1: [either FOOD OR MONEY OR ALCOHOL]

"Right, for the first trial I'd like you to think of a specific event or situation relating to ***[food OR money OR alcohol].***

Please indicate that you're ready to continue by saying "ready".

When the participant says "ready", respond by saying the following:

"Now I'd like you to describe the event in as much detail as possible – you don't need to close your eyes at this stage."

PRESS RECORD ON AUDIO RECORDER

SCORE DETAILS IN EXCEL SHEET BUT DO NOT GIVE FEEDBACK

Specificity Domain	**Example**	**Present** (if No give feedback question)
Less than day?	e.g. I pop into a coffee shop	Yes No
Specific Location	e.g. The Starbucks on Tottenham Court Road	Yes No
Specific Time of Day	e.g. it's early evening and…	Yes No
Specific Time of Year/Season	e.g. It's a summer's day	Yes No

People	e.g. I'm sitting with my brother and sister	Yes No
Objects	e.g. I'm drinking out of a starbucks coffee cup	Yes No
Visual Detail/Environment	e.g. I can see everyone else walking past, the roads are busy, and the sun is shining down	Yes No
Sound	e.g. I can hear the radio on and the chatter of the other people in the cafe	Yes No
Smell/Taste	e.g. I can smell the freshly ground coffee beans	Yes No
Emotion	e.g. I am feeling relaxed and happy	Yes No

"Thank you. Now we're going to do the other part to the task which was not included in the practice trial:

In a moment I'll ask you to close your eyes and mentally experience the event that you've just described. You'll have 30 seconds during which you should create the experience in your mind's eye in as much detail as possible, using all of your senses. I'll let you know when to stop.

Are you ready to continue?

Great – now close your eyes and imagine the event."

TIME 30 SECONDS.

"Time's up".

"Ok, now I'd like you to look at this questionnaire."

GIVE THE PARTICIPANT A PAPER COPY OF THE QUESTIONNAIRE [BELOW]

OPEN THE PARTICIPANT RATING SCALE IN EXCEL (19 QUESTIONS)

"Here's a questionnaire. There are 19 statements in total, and for each one there is a number that corresponds to the following statements: strongly disagree – 0; disagree – 1; slightly disagree – 2; neither agree nor disagree – 3; slightly agree – 4; agree – 5, and strongly agree – 6.

I'd like you to read the statement in the left-hand column and give me the number that corresponds with your answer. So, for example, if you strongly agreed with a statement you would give me the number 6. Does that make sense?"

"Great, let's begin"

ENTER PARTICIPANTS ANSWERS INTO THE EXCEL SHEET

Participant rating-scale

	Questions	**Score**						
		Strongly disagree	**Disagree**	**Slightly disagree**	**Neither agree nor disagree**	**Slightly agree**	**Agree**	**Strongly agree**
1.	My mental image of this event consisted of *visual elements*	0	1	2	3	4	5	6
2.	My mental image of this event contained *sounds*	0	1	2	3	4	5	6
3.	My mental image of this event contained *smells* and/or *tastes*	0	1	2	3	4	5	6
4.	My mental image of *where* the event took place is clear	0	1	2	3	4	5	6
5.	The location of the imagined event was a venue that is known to me in real life	0	1	2	3	4	5	6
6.	In my mental image of this event, the *positioning of people* was clear	0	1	2	3	4	5	6
7.	In my mental image of this event, the *positioning of objects* was clear	0	1	2	3	4	5	6

	Questions	**Score**						
		Strongly disagree	**Disagree**	**Slightly disagree**	**Neither agree nor disagree**	**Slightly agree**	**Agree**	**Strongly agree**
8.	In my mental image of this event, I was aware of what *time of day* it was (morning/afternoon/evening)	0	1	2	3	4	5	6
9.	In imagining this event, it came to my mind more like a *film* than a *photograph*	0	1	2	3	4	5	6
10.	Whilst imagining this event, I felt the *emotions* that I would have felt had it occurred in real life (Emotion – feeling)	0	1	2	3	4	5	6
11.	If this event were to occur in real life, it would cause me to feel *negative emotions*, (e.g. sad/angry/afraid) (Emotion – valence)	0	1	2	3	4	5	6
12.	If this event were to occur in real life, it would cause me to feel *positive emotions*, (e.g. happy/excited/content) (Emotion – valence)	0	1	2	3	4	5	6
13.	Whilst imagining this event I felt as though I was *really* experiencing it (Autonoetic experience – experiencing the event)	0	1	2	3	4	5	6

	Questions	**Score**						
		Strongly disagree	**Disagree**	**Slightly disagree**	**Neither agree nor disagree**	**Slightly agree**	**Agree**	**Strongly agree**
14.	Whilst imagining this event I had the feeling of being in the ***future***, at the point in time where the event was actually taking place (Autonoetic experience – "mental time travel")	0	1	2	3	4	5	6
15.	When I imagined this event, I saw the scene from the perspective of an ***outside observer***, and I could see myself in the imagined image	0	1	2	3	4	5	6
16.	When I imagined this event, I saw the scene from the perspective of ***being within it***, as though I was seeing it through my own eyes	0	1	2	3	4	5	6
17.	The imagined event would be ***important*** to me, and/or related to a ***special occasion*** (Emotion – significance)	0	1	2	3	4	5	6
18.	The imagined event related to a memory of a previous event that I have experienced in real life	0	1	2	3	4	5	6
19.	During the time that I was asked to imagine the event, my mind wandered onto unrelated thoughts/images	0	1	2	3	4	5	6

WHEN THEY HAVE FINISHED THE QUESTIONS

"Thank you. Now we're going to repeat that test again with another cue sentence."

Experimental trial 2: [either FOOD OR MONEY OR ALCOHOL]

"Right, now I'd like you to think of a specific event or situation relating to ***[food OR money OR alcohol].***

Please indicate that you're ready to continue by saying "ready".

When the participant says "ready", respond by saying the following:

"Now I'd like you to describe the event in as much detail as possible – again, you don't need to close your eyes at this stage."

PRESS RECORD ON AUDIO RECORDER

SCORE DETAILS IN EXCEL SHEET BUT DO NOT GIVE FEEDBACK

Specificity Domain	**Example**	**Present** (if No give feedback question)
Less than day?	e.g. I pop into a coffee shop	Yes No
Specific Location	e.g. The Starbucks on Tottenham Court Road	Yes No
Specific Time of Day	e.g. it's early evening and…	Yes No

Specific Time of Year/Season	e.g. It's a summer's day	Yes No
People	e.g. I'm sitting with my brother and sister	Yes No
Objects	e.g. I'm drinking out of a starbucks coffee cup	Yes No
Visual Detail/Environment	e.g. I can see everyone else walking past, the roads are busy, and the sun is shining down	Yes No
Sound	e.g. I can hear the radio on and the chatter of the other people in the cafe	Yes No
Smell/Taste	e.g. I can smell the freshly ground coffee beans	Yes No
Emotion	e.g. I am feeling relaxed and happy	Yes No

"Thank you. Now we're going to go through the same process as before - in a moment I'll ask you to close your eyes and mentally experience the event you have in mind.

As with the previous trial, you'll have 30 seconds during which you should create the experience in your mind's eye in as much detail as possible, using all of your senses. I will let you know when to stop, and then we'll do the questionnaire again. Are you ready to continue?

"Great – now close your eyes and imagine the event."

TIME 30 SECONDS.

"Time's up".

"Ok, now I'd like you to look at the questionnaire again."

COMPLETE THE QUESTIONNAIRE

ENTER PARTICIPANTS ANSWERS INTO THE EXCEL SHEET

WHEN THEY HAVE FINISHED THE QUESTIONS

"Thank you. Now I'm going to give you a top-up drink, and afterwards you'll do the same test again with another cue sentence."

WAIT UNTIL STOPWATCH READS [1:00:00]

Alcohol top-up 1

Use stopwatch to time the drinking protocol precisely. Please keep the stopwatch running throughout the session.

Provide drink and start stopwatch. Participant can take sips at their own pace, but they must finish the drink within 2 minutes.

Only 1 drink will be provided.
Continue with the testing session as soon as 2 minutes have elapsed.

Experimental trial 3: [either FOOD OR MONEY OR ALCOHOL]

"Are you ready to continue?

Ok, now we'll do the final trial. I'd like you to think of a specific event or situation relating to ***[food OR money OR alcohol].***

Please indicate that you're ready to continue by saying "ready".

When the participant says "ready", respond by saying the following:

Now I'd like you to describe the event in as much detail as possible."

PRESS RECORD ON AUDIO RECORDER

SCORE DETAILS IN EXCEL SHEET BUT DO NOT GIVE FEEDBACK

Specificity Domain	**Example**	**Present** (if No give feedback question)
Less than day?	e.g. I pop into a coffee shop	Yes No
Specific Location	e.g. The Starbucks on Tottenham Court Road	Yes No
Specific Time of Day	e.g. it's early evening and…	Yes No
Specific Time of Year/Season	e.g. It's a summer's day	Yes No

People	e.g. I'm sitting with my brother and sister	Yes No
Objects	e.g. I'm drinking out of a starbucks coffee cup	Yes No
Visual Detail/Environment	e.g. I can see everyone else walking past, the roads are busy, and the sun is shining down	Yes No
Sound	e.g. I can hear the radio on and the chatter of the other people in the cafe	Yes No
Smell/Taste	e.g. I can smell the freshly ground coffee beans	Yes No
Emotion	e.g. I am feeling relaxed and happy	Yes No

"Thank you. As with the previous trials, in a moment I'll ask you to close your eyes and mentally experience the event you have in mind.

Just to recap, you'll have 30 seconds during which you should create the experience in your mind's eye in as much detail as possible, using all of your senses. I will let you know when to stop, and then we'll do the questionnaire. Are you ready to continue?

"Great – now close your eyes and imagine the event."

TIME 30 SECONDS.

"Time's up".

"Ok, now I'd like you to look at the questionnaire again."

COMPLETE THE QUESTIONNAIRE

ENTER PARTICIPANTS ANSWERS INTO THE EXCEL SHEET

WHEN THEY HAVE FINISHED THE QUESTIONS

"Thank you. We've now finished with the imagination related tasks."

Story recall - DELAYED (1)

Navigate to: My Documents>Study Files

Open [Version B OR Version D]

"Now, remember the stories that you heard through the headphones, earlier? I would like you to tell me as much as you can remember about the one that you heard prior to drinking the batch of 10 drinks. Again, try to use the exact phrasing, but if you can't remember, put it in your own words."

[START AUDIO RECORDING]

PROMPT IF NECESSARY:

Version B = *"it was a story about a fire"*
OR
Version D = *"it was a story about an oil tanker"*

Story recall- DELAYED (2)

Navigate to: My Documents>Study Files

Open [Version **B** OR Version **D**]

"Now I would like you to tell me as much as you can remember about the second story. Again, try to use the exact phrasing, but if you can't remember, put it in your own words."

[START AUDIO RECORDING]

PROMPT IF NECESSARY:

Version B = *"it was a story about a fire"*
OR
Version D = *"it was a story about an oil tanker"*

For each unit score 1 for a word perfect recall 1 for an exact synonym1⁄2 for a partial recall1⁄2 for a close synonym The maximum score for each recall is 21.

WAIT UNTIL STOPWATCH READS [1:10:00] BEFORE DOING BAC3

NB. There needs to be nil by mouth (including water) for 10 minutes before the breathalyser

BAC monitor: Time 3

VW Trial Run

Pull up VW and enter participant number, hit OK so the game is open with Welcome message. **As you read, indicate on the screen where each item is**.

"You're now going to play a virtual board game that simulates your daily life and activities. Each time around the board represents one full day, and you must click the die to advance. Before you begin, you'll be given tasks that you must remember to do at specific points during the simulated day. When you pass green game squares, you'll be required to pick up an event card, which represents a typical activity that you may do on any given day. Some tasks are connected to events, so you must remember to execute them when you pick up the specific event card. Other tasks are time-based, and there is a timestamp in the center of the game. You execute these tasks by selecting them from a drop down at the corner of the screen.

'Your first run-through will be in training mode so you have a chance to familiarise yourself with the game. There are instructional pop-up windows to guide you through the first round; please ***read them aloud****."*

EVENT CARD

1. When they get to the first Event Card, **participant must read all text aloud**, including each choice
2. Participant must read aloud their decision.

START CARD

1. **Participant must read all text aloud**

TASK CARD

1. **Participant must read all text aloud**

After they finish training mode:

"*Now, do you have any further questions? The next run-through will not be in training mode, and there will be no instructional prompts or feedback during the game.*"

WAIT UNTIL STOPWATCH READS [1:30:00]

Alcohol top-up 2

Use stopwatch to time the drinking protocol precisely. Please keep the stopwatch running throughout the session.

Provide drink and start stopwatch. Participant can take sips at their own pace, but they <u>must</u> finish the drink within 2 minutes.

Only 1 drink will be provided.
Continue with the testing session as soon as 2 minutes have elapsed.

VW Condition 1

"*Whenever you're ready you can begin the game. Make sure to read the start cards and event cards aloud. Remember there will be no reminders or feedback in the actual game.*"

HEALTH TASKS

1. **Participants must read all text aloud**.

2. After participants read "During the game you will not get any reminders":

"*Now please look away from the computer and say each health task to me from memory TWICE."*

i. "*That is correct, you may continue*" Participant clicks OK
ii. "*That was incorrect, please read the start cards again, look away from the screen, and say them from memory twice*"

PAUSE GAME WHEN THEY HAVE FINISHED 1 VIRTUAL DAY

WAIT UNTIL STOPWATCH READS [1:40:00] BEFORE DOING BAC4

NB. There needs to be nil by mouth (including water) for 10 minutes before the breathalyser

BAC monitor: Time 4

VW Condition 1 (continued)

CONTINUE GAME UNTIL THEY HAVE FINISHED 2ND VIRTUAL DAY

WAIT UNTIL STOPWATCH READS [2:00:00]

Alcohol top-up 3

Use stopwatch to time the drinking protocol precisely. Please keep the stopwatch running throughout the session.

Provide drink and start stopwatch. Participant can take sips at their own pace, but they must finish the drink within 2 minutes.

Only 1 drink will be provided.
Continue with the testing session as soon as 2 minutes have elapsed.

VW Condition 2

"Thank you. Now we will repeat the game with a memory strategy."

GIVE THEM IMPLEMENTATION INTENTIONS HANDOUT

REVIEW WITH PARTICIPANT

"Now let's go over the health tasks again. Can you say what the tasks were?

If correct: *"Do you have any questions?*

If incorrect: remind participant it was to take antibiotics at lunch and dinner, and use asthma inhaler at 11am and 9pm. Have participant say from memory again until they get it right.

'If you are ready, please begin."

PAUSE GAME WHEN THEY HAVE FINISHED 1 VIRTUAL DAY

WAIT UNTIL STOPWATCH READS [2:10:00] BEFORE DOING BAC5

NB. There needs to be nil by mouth (including water) for 10 minutes before the breathalyser

BAC monitor: Time 5

VW Condition 2 (continued)

CONTINUE WITH 2ND VIRTUAL DAY OF VW TRIAL

Participant Guess on Condition + PAYMENT FORM

Appendix 8
EFT task instructions – participant handout

Imagination task description

- You will need to think of an event once the researcher has said a *cue* word out loud. In the practice trial the cue word will be *"coffee"*.

- You will then be asked to *describe an event*, (relating to the cue word), out loud to the researcher. Your verbal description will be recorded.

- After describing the event, you will be asked to close your eyes and *imagine it for 30 seconds*.

- The event that you chose must:

    - Be something that might *feasibly* occur in real life at some point in the next *6 – 12 months.*

    - It should last between *several minutes* or *several hours*, but *not longer than a day*.

    - You should imagine the event in as much detail as possible, giving regards to the following:
        - *Time of day* – does it take place in the morning, afternoon or evening?
        - *Time of year* – what season is it? What's the weather like?
        - *People* – who's there?
        - *Objects* – what objects are around?
        - The overall *environment.*
        - Things you can *smell*, *hear* and *taste*.
        - Any *emotions* you are feeling.

- After describing the event to the researcher, you will then be asked to close your eyes and *imagine it in your mind's eye for 30 seconds.*

- Lastly, you will be given a questionnaire and asked some questions about your imagined event.

- There will be 1 practice trial, followed by 3 experimental trials

Appendix 9
Participant and researcher rating scales

Participant rating scale

REMOVED DUE TO COPYRIGHT

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Appendix 10
Feedback form for the practice EFT trial

Practice trial

*"I'd like you to think of an event relating to **"coffee".** Please indicate when you have thought of an event are ready to continue by saying 'ready'".*

When the participant says *"ready",* respond by saying the following:

"Now I'd like you to describe the event in as much detail as possible. In the real trial I'll record your description, but we won't record for the practice trial."

Score and feedback practice trial description

Specificity Domain	**Example**	**Present** (if No give feedback question)	**Feedback**
Less than day?	e.g. I pop into a coffee shop	Yes No	Can you tell me how long the event lasted (e.g. minutes, hours or day)? *If they provide response >1day then remind them "The event you imagine should be specific and last no longer than one day"*
Specific Location	e.g. The Starbucks on Tottenham Court Road	Yes No	Can you tell me where the event took place?
Specific Time of Day	e.g. it's early evening and…	Yes No	Can you tell me the time of day?
Specific Time of Year/Season	e.g. It's a summer's day	Yes No	Can you tell me what time of year it is? *Give a reminder about 6 months time.*
People	e.g. I'm sitting with my brother and sister	Yes No	Can you tell me whether there are people around and who they are?

Objects	e.g. I'm drinking out of a starbucks coffee cup	Yes	No	Can you tell me whether there are any objects around and what they are?
Visual Detail/Environment	e.g. I can see everyone else walking past, the roads are busy, and the sun is shining down	Yes	No	Can you tell me a bit more about what you can see around you and the environment you are in.
Sound	e.g. I can hear the radio on and the chatter of the other people in the cafe	Yes	No	Can you hear any sounds?
Smell/Taste	e.g. I can smell the freshly ground coffee beans	Yes	No	Can you smell or taste anything?
Emotion	e.g. I am feeling relaxed and happy	Yes	No	Can you tell me how you are feeling; any emotions you are experiencing?

Appendix 11
Ethics amendment approval form

Amending an Approved Application

Should you wish to make an amendment to an approved study, you will need to submit an 'amendment request' for the consideration of the Ethics Chair of your Research Department. Applications can only be amended **after** ethical approval has been granted.

You will need to apply for an amendment approval if you wish to:

1. Add a new participant group;
2. Add a new research method;
3. Ask for additional data from your existing participants;
4. Remove a group of participants or a research method from the project, and have not yet commenced that part of the project;
5. Apply for an extension to your current ethical approval.

You do not need to apply for an amendment every time you add a new UCL researcher to the project. However, you need to keep a list of the researchers associated with your project and should be able to produce this list upon request. Furthermore, it is your responsibility to ensure that all researchers are trained appropriately, are familiar with the risk assessment issues and have completed a risk assessment form (again, you should be able to produce this upon request).

If you need to apply for an amendment approval, please complete the Amendment Approval Request Form on the next page.

When completing the form, please ensure you do the following:

- Clearly explain what the amendment you wish to make is, and the justification for making the change.
- Insert details of any ethical issues raised by the proposed amendments.
- Include all relevant information regarding the change so that the Chair can make an informed decision, and submit a copy of the sections of your application that have changed with all amendments highlighted/underlined for clarity.
- You do not need to submit your original application in full again. However, if the amendments you wish to make alter several sections of your application form, you are advised to submit this.

A pdf of a signed copy of the form (and any amended documents) must be submitted to the Ethics Chair of your Research Department.

Amendment Approval Request Form

1	**Project ID Number:** 5929/004	**Name and e-mail address of Principal Investigator:** H Valerie Curran - v.curran@ucl.ac.uk; Sunjeev Kamboj - sunjeev.kamboj@ucl.ac.uk
2	**Project Title:** How does alcohol affect adolescent and adult drinkers?	
3	**Type of Amendment/s (tick as appropriate)** Research procedure/protocol (including research instruments ☐ Participant group ☐ ☐ Sponsorship/collaborators ☒ Extension to approval needed (extensions are given for one year) Information Sheet/s ☐ Consent form/s ☐ Other recruitment document ☐ ☐ Other Please specify:	

4	**Justification** (give the reasons why the amendment/s are needed): We are seeking to add an additional arm to this study in which we will investigate a related goal, namely the extent of impairment in future-oriented memory after a single dose of alcohol.
5	**Details of Amendments** (provide full details of each amendment requested, state where the changes have been made and attach all amended and new documentation) The study will now include additional two neuropsychological tasks: <u>Future Event Simulation task</u> After a delay to allow for alcohol absorption, participants will complete the Future Episodic Thinking (EFT task). They will be asked to imagine future events (occurring in the near future), following one of three verbal cues. The cues will pertain to either the consumption of food or alcohol, or the receipt of monetary reward. For example, the alcohol cue will require the participant to imagine a situation in which they will consume alcohol in the next 7 days. Participants will be given 1 minute to imagine each event, during which time they will be encouraged to elaborate the event by imagining contextual details including sounds, tastes, smells, visual information, and so on. After this 'mental simulation' participants will be asked to verbally describe their simulation to the researcher and rate its phenomenological characteristics on separate scales that tap vividness, level of affect, 'living the experience' and 'nowness' in line with previous research; *(D'Argembeau & Van der Linden, 2004*; *D'Argembeau & Van der Linden, 2006).* Additional questionnaires related to the capacity for EFT will be administered: <u>Virtual week task</u> Immediately after the EFT task participants will be asked to complete a computerised version of the Virtual Week task *(Rendell and Craik, 2000).* The virtual week is a computerised board game in which each circuit of the board constitutes the passing of one day. Participants move around the board by rolling a die, and in doing so they are required to make plan/form intentions related to specific activities throughout the day. The intentions relate to activities to be carried out at specific times during the day or in response to specific cues. During the circuits participants are asked to recall the intentions, thus simulating everyday prospective memory. Participants will be randomised to one of two conditions: regular intention formation and 'implementation intention.' No additional instructions are given in the regular condition, whereas the implementation intention condition requires participants to generate specific verbal statements related to the when, where and how of the intention - for example, "I will pick up my dry cleaning in the afternoon when I go shopping" (= when); "I will need to go to the high street" (= where); "when I enter the shop I will present my ticket, pay and then take my dry-cleaning home (= how). As with the existing study, an analysis of variance (ANOVA) will be used to analyse the data. The within subjects factor will be PM type (event and time) and the between subjects factors will be drink (placebo, alcohol) and intention condition (regular and implementation intention)

6	Ethical Considerations (insert details of any ethical issues raised by the proposed amendment/s; in the case of adding a new researcher, please confirm in writing that you have discussed ethical issues of the project with this researcher and that you have taken them through the risk assessment form for the project, which they have signed) The ethical considerations from this arm of the project are largely the same as those in the existing project. Participants will be consuming the same amount of alcohol as in the existing study, and the same precautions will be employed so as to ensure safety and comfort of participants: • All participants will be monitored and will remain with researchers until alcohol effects have worn off and they are deemed to be in an appropriate condition to leave the premises. • A quiet place to sit will be provided, (with films and magazines), should a participant wish to wait for alcohol effects to wear off for a further period of time. • Levels of intoxication will be monitored objectively via visual analogue scales throughout test sessions. • Participants will be advised to inform a friend about their participation, who can then come and meet them after testing. • A taxi will be provided for anyone who does not feel comfortable travelling home on public transport. • Previous work has demonstrated that the proposed drinking protocol does not lead to blood alcohol concentrations above the UK legal driving limit (80 milligrammes of alcohol per 100 millilitres of blood), thereby limiting the risk of adverse events. • Furthermore, as previously stated, only weekly social drinkers (i.e. those who currently drink alcohol between 1 - 4 days per week, and who do not fulfil criteria for alcohol dependence) will be recruited - the doses of alcohol administered will be moderate for such drinkers. • Anyone experiencing prolonged effects of alcohol as judged by rating scales and breath levels will be asked to stay in the laboratory until these effects have worn off. • Participants will be compensated for their time and effort with a £20.00 voucher. A new researcher will be joining the study, (Marie Brown). She has read the original ethics application form and is aware of the above considerations.
7	**Other Information** (provide any other information which you believe should be taken into account during ethical review of the proposed changes)
	Declaration (to be signed by the Principal Researcher) • I confirm that the information in this form is accurate to the best of my knowledge and I take full responsibility for it.

- I consider that it would be reasonable for the proposed amendments to be implemented.

Signature: ……..

Date: ……