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The influence of episodic foresight on delay discounting and demand for alcohol

Adam Bulley [a,*], Matthew J. Gullo [b]

[a] The University of Queensland, St. Lucia, QLD 4072, Australia
[b] Centre for Youth Substance Abuse Research, The University of Queensland, Mental Health Centre, Royal Brisbane and Women's Hospital, Herston, QLD 4006, Australia

HIGHLIGHTS

- Imagining the future, known as episodic foresight, may attenuate impulsivity.
- Episodic foresight reduced delay discounting and alcohol demand intensity.
- The effect of episodic foresight on impulsivity may extend to alcohol decisions.

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ABSTRACT

Background: There is a near-universal tendency to discount the value of delayed rewards relative to those available in the here and now. The rate at which future rewards become devalued over time, delay discounting, is an important individual difference variable related to impulsivity and is elevated in externalising disorders, including alcohol use disorders. Recent research suggests that vividly imagining personally relevant future events (episodic foresight) during an intertemporal choice task can attenuate the rate at which delayed rewards are discounted.
Objectives: The present study sought to extend these findings by examining the effect of episodic foresight on both delay discounting and alcohol-related decision-making.
Methods: Forty-eight college students were administered both modified intertemporal choice and hypothetical alcohol purchase tasks during which personally relevant episodic future event cues or control imagery cues were presented.
Results: Engaging in episodic foresight reduced both the rate at which delayed monetary rewards were discounted and initial alcohol demand intensity (but not other demand indices) relative to control imagery.
Conclusions: Findings suggest that the attenuating effect of episodic foresight on impulsivity may be limited to particular aspects of impulsive choice.

1. Introduction

Making adaptive decisions often requires a decision-maker to suppress impulses towards immediate gratification in the pursuit of long-term goals. Difficulty doing so has been conceptualized as a key feature of impulsivity, and is characteristic of many behavioural disorders in which immediate gratification becomes highly prioritized over the pursuit of longer-term reinforcement (Bickel & Marsch, 2001; Gullo & Potenza, 2014; MacKillop et al., 2011). Thus, while there is a near-universal tendency to discount the value of future rewards relative to those in the here-and-now, individuals with substance abuse disorders, pathological gambling, obesity, and those who exhibit other risky health behaviours have been consistently found to more rapidly devalue rewards that are delayed in their receipt than healthy controls (Bickel & Marsch, 2001; Dixon, Marley, & Jacobs, 2003; Story, Vlaev, Seymour, Darzi, & Dolan, 2014). For this reason, responses to *intertemporal choices* between rewards available immediately and those available only after a delay can act as a 'behavioural marker' of addiction-relevant outcomes including the severity, and risk of developing, dependence (for review see Bickel, Koffarnus, Moody, & Wilson, 2014).

Individual differences in discounting rate have been tied to a number of factors, including genetic heritability and early life developmental experiences (Anokhin, Golosheykin, Grant, & Heath, 2011; Mauro & Harris, 2000; Odum, 2011; Peters & Büchel, 2011). However, the rate at which future rewards are devalued can also vary widely *within* individuals, as a

* Corresponding author.
E-mail addresses: adam.bulley@uqconnect.edu.au (A. Bulley), m.gullo@uq.edu.au (M.J. Gullo).

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function of the perceived certainty of a future reward, the framing of the choice question, current affect, alongside other situational or biological variables (for reviews see Gray & MacKillop, 2015; Lempert & Phelps, 2015). One critical set of psychological variables associated with variation in the discounting rate is the manner in which individuals mentally represent or imagine future rewards and the context of their receipt (Bulley, Henry, & Suddendorf, 2016).

A number of recent experimental studies suggest that imagining the future, so-called *episodic foresight* (Suddendorf & Corballis, 1997, 2007) or *episodic future thinking* (Atance & O'Neill, 2001), can reduce the rate at which future rewards are discounted in the process of making intertemporal choices. In general, these studies have provided participants with modified intertemporal choice tasks (ICTs) in which a personally relevant future event cue is provided alongside the choice question (Benoit, Gilbert, & Burgess, 2011; Daniel, Said, Stanton, & Epstein, 2015; Daniel, Stanton, & Epstein, 2013a, 2013b; Kwan et al., 2015; Lin & Epstein, 2014; Liu, Feng, Chen, & Li, 2013; Palombo, Keane, & Verfaellie, 2014; Peters & Büchel, 2010). For example, in Peters and Büchel (2010), participants indicated their preference for either 20€ now, or 35€ in 45 days, while in some trials being simultaneously cued with an actual event they had planned in around 45 days time. In the episodic cue condition, preferences shifted towards longer-term rewards, and the strength of this effect was associated with individual differences in the vividness of mental imagery about the episodic future event.

The effect of episodic foresight has been shown to extend to real-world behavioural indices of impulsive choice. When tempted with unrestricted access to immediately gratifying, densely caloric food, both obese women and children consumed less if concurrently imagining personally relevant future events (Daniel et al., 2015, 2013b). This effect of episodic foresight on impulsive eating has also recently been demonstrated in college women, such that food-related episodic future thinking led to more restricted consumption of freely and immediately available snacks (Dassen, Jansen, Nederkoorn, & Houben, 2016), and in a sample of obese or overweight women in a real-world food-court experiment (O'Neill, Daniel, & Epstein, 2015).

A large body of evidence suggests that problematic alcohol users tend to show steeper discounting rates than individuals who use alcohol at more moderate or less risky levels (MacKillop et al., 2011; Petry, 2001). While individuals may not be explicitly deciding between payoffs at different times when they choose whether or not to eat unhealthy foods or drink alcohol, there is commonality between the type of decision-processes tapped by the ICT, and the processes employed in such health-related consumption decisions (Yi, Mitchell, & Bickel, 2010). In both cases, the options exist to make either (i) a decision prioritizing immediate gratification (e.g. pleasure) or (ii) a decision that prioritizes longer-term gains (e.g. health). Purchase demand for alcohol is one measure than can be employed to investigate this decision-process, and is predictive of alcohol consumption (Dennhardt, Yurasek, & Murphy, 2015; Murphy et al., 2015) as well as problematic alcohol-related behaviours such as driving after drinking (Teeters, Pickover, Dennhardt, Martens, & Murphy, 2014).

Demand for alcohol can be directly assessed with hypothetical 'alcohol purchase tasks' (APTs) that ask participants to indicate their willingness to purchase hypothetical drinks at increasing costs (MacKillop et al., 2009, 2010; MacKillop & Murphy, 2007; Murphy, MacKillop, Skidmore, & Pederson, 2009). There is generally good correspondence between hypothetical tasks of this nature and tasks in which access to alcohol is provided (Amlung, Acker, Stojek, Murphy, & MacKillop, 2012). Given recent studies showing that episodic foresight can reduce not only delay discounting but also 'impulsive' eating, in the current study we aimed to explore the effect of episodic foresight on both standard monetary intertemporal choice, as well as alcohol demand using a hypothetical APT. Firstly, we hypothesized that engaging in episodic foresight during the ICT would attenuate the rate at which future rewards were subjectively devalued over time. Secondly, we hypothesized that engaging in episodic foresight would reduce 'impulsive' alcohol demand on the hypothetical APT.

2. Method

2.1. Participants

Fifty-two undergraduate students participated in the study for course credit. The study was approved by the relevant university human research ethics committee. Four (7.7%) participants were excluded because they did not attend both experimental sessions. This left a final sample of 48 participants (33 females, 68.8%). The mean age of the sample was 20.67 years ($SD = 5.36$).

2.2. Design and procedure

Participants attended two sessions timed roughly one week apart. In both sessions, participants completed a modified ICT, in which they made a series of choices between immediate (smaller) or delayed (larger) rewards available at five future time-points, and a hypothetical APT, in which they indicated how many drinks they would consume at various price intervals. During both tasks, 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 generated at the start of the respective session, and 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). Participants also completed the Alcohol Use Disorders Identification Test (AUDIT). At the end of each session, participants rated dimensions of their mental imagery during the tasks. Demographic information was collected at the start of the first session, and participants underwent a funnel debriefing procedure at the end of the second session.

2.3. Manipulations

2.3.1. Episodic foresight

At the start of the episodic foresight session, participants were asked to imagine and list personally relevant future events that they were "looking forward to" over the next year. Specifically, they were asked to provide two events for each of the time delays corresponding to the reward delays in the ICT, and to rate the vividness, positive emotionality, and personal relevance of these events on a scale from 1 (*not at all*) to 6 (*very*). For each time point (today, two-days, 30-days, 180-days, and 365-days), the events with the highest average rating across these scales were selected as cues for the episodic foresight manipulation. These episodic cues were inserted into the code of the computerized ICT, to be presented before each decision in a manner that synchronized the temporal distance to both the possible future event and the delayed reward. For example, participants would be presented with a cue to imagine an event they were looking forward to in around 180 days before making a choice about a reward that was delayed by that same amount of time. The episodic cues were also presented in the APT, though because this task lacks a temporal component, the cues appeared before each decision in an arbitrary order.

2.3.2. Control imagery

At the start of the control imagery session, participants read the first two chapters of "Pinocchio" (Collodi, 1995), which contains many highly vivid events (e.g. "Geppetto turned the colour of a red pepper"). The story was split into five pages, and participants were instructed to list two events from each page that they enjoyed and to rate the vividness, positive emotionality, and personal relevance of these events on a scale from 1 (*not at all*) to 6 (*very*). The events with the highest average