



Remembering Versus Imagining: When Does Episodic Retrospection and Episodic Propection Aid Decision Making?[☆]



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Problematic temporal discounting involves discounting the future (the inability to delay gratification) or the past (undervaluing past outcomes). Imagining future experiences (propection) reduces future discounting, but propection may be based on remembering the past (retrospection) through episodic memory. If both processes are similar, then retrospection may reduce temporal discounting. We tested retrospection's effect on discounting, and whether temporal orientation of memory processes (imagining the future versus remembering the past) and temporal aspects of discounting (past versus future discounting) need to be congruent. Eighty one adults were randomized to propection, retrospection or control conditions while engaging in past and future discounting tasks. Results showed propection reduced future discounting and retrospection reduced past discounting, suggesting that temporal congruency of episodic thinking and temporal discounting is important. Future and past discounting may also reflect different mechanisms. These results point to the potential for retrospection to help people benefit more from past experiences.

Keywords: Temporal discounting, Delay discounting, Retrospection, Propection, Future thinking, Immediate gratification

Remember last year's holiday party? Can you imagine what next year's holiday party will be like? People have the ability to vividly remember past experiences (episodic retrospection) and imagine future experiences (episodic propection) (Buckner & Carroll, 2007; Schacter, Addis, & Buckner, 2007). This adaptive ability to mentally time travel is thought to facilitate decision making, planning and performance of goal directed behaviors (Boyer, 2008). One hypothesis about episodic propection or the simulation of future events is that people recall past experiences and use them to enhance their construction of future scenarios (Schacter & Addis, 2007). This hypothesis is supported by research that shows that episodic memory (the memory for past

experiences) can support this by allowing for the retrieval and re-combination of stored information during event simulation (Schacter, 2012). Thus, a person might draw on their memory of last year's holiday party to construct their imagination of next year's holiday party.

Understanding the similarities or differences between these two memory based processes (retrospection and propection) may provide insight into how they might perform various adaptive functions such as improving decision making. Almost every day, people engage in intertemporal decision-making. When a person makes a myopic choice that devalues a larger delayed reward in favor of a smaller immediate reward as a function

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of the delay to its receipt, this is known as temporal discounting (Bickel, Yi, Kowal, & Gatchalian, 2008). A person often has to choose between immediately gratifying behaviors (e.g. eating a chocolate bar now), or avoiding these behaviors for larger future benefits (e.g. obtaining a healthy body weight later). High temporal discounting has been associated with multiple maladaptive behaviors like substance use (Bickel & Marsch, 2001; Kollins, 2003), problem drinking (Vuchinich & Simpson, 1998), smoking (Odum, Madden, & Bickel, 2002), overeating behaviors (Appelhans et al., 2012; Rollins, Dearing, & Epstein, 2010) and obesity (Epstein et al., 2014; Weller, Cook, Avsar, & Cox, 2008). An adaptive function of episodic prospection may be to reduce temporal discounting of the future (Boyer, 2008), and research shows that episodic prospection reduces future discounting (Daniel, Stanton, & Epstein, 2013a, 2013b; Kaplan, Reed, & Jarmolowicz, 2016; Lin & Epstein, 2014; Peters & Büchel, 2010) and maladaptive behaviors (Daniel, Said, Stanton, & Epstein, 2015; Daniel et al., 2013b; O'Neill, Daniel, & Epstein, 2015).

Another aspect of temporal discounting is past discounting. While future discounting reflects how people discount large future rewards in favor of smaller immediate rewards, past discounting reflects whether people favor small rewards in the near past over larger rewards in the distant past (Bickel et al., 2008; Yi, Gatchalian, & Bickel, 2006). Both past and future discounting have been found to be closely related (Yi et al., 2006) and are thought to both reflect a narrow temporal focus on immediate rewards. Take for example the case of a person who has achieved a positive outcome in the past (e.g. weight loss), but due to temporal focus on the immediate, discounts that past outcome and its health rewards in favor of the current gratification of unhealthy foods. Opting for the smaller immediate past reward may reflect an inability to learn from or appropriately value past experiences (Bickel et al., 2008). High past discounting may increase the risk of repeating maladaptive behaviors (Bickel et al., 2008) and has been associated with smoking and substance use (Bickel et al., 2008; Yi, Carter, & Landes, 2012).

Engaging in episodic retrospection (i.e. activating episodic memories) during decision making could reduce past discounting in the same way that prospection (episodic future thinking) reduces future discounting. Prospection is thought to reduce temporal discounting by either improving the valuation (Benoit, Gilbert, & Burgess, 2011) or the cognitive search for the value (Kurth-Nelson, Bickel, & Redish, 2012) of delayed outcomes during decision-making. Thus, it is possible that retrospection may similarly improve the valuation of temporally distant past outcomes during decision making.

If episodic retrospection and prospection are independent processes with regard to their effect on temporal discounting, the temporal aspect of the memory process may need to be congruent with the temporal aspect of the discounting. Accordingly, prospection would only impact future discounting while retrospection only impacts past discounting. However, episodic retrospection and prospection both utilize the episodic memory and share many similarities as a result. They respond similarly to event valence, temporal distance (D'Argembeau & Van der Linden, 2004), framing (Radu, Yi, Bickel, Gross, & McClure,

2011) and contextual imagery (Szpunar & McDermott, 2008). Furthermore, the temporal attention hypothesis (Radu et al., 2011) suggests that drawing attention away from "now" or the immediate reward during decision-making serves to reduce temporal discounting. Thus, thinking about either future or past events may reduce attention to the immediate or "now" and could similarly reduce both future and past discounting. This raises the question of whether similarities in retrospection and prospection would extend to their effect on temporal discounting regardless of temporal congruence. Could activating either retrospection or prospection reduce future and past discounting?

This study was designed to investigate the impact of episodic retrospection compared to episodic prospection on temporal discounting. We randomly assigned participants to retrospection, prospection and control recent thinking conditions while they engaged in past and future discounting tasks. Based on previous findings (Daniel et al., 2013a, 2013b; Lin & Epstein, 2014; Peters & Büchel, 2010) on prospection's impact on temporal discounting, we predicted that prospection will reduce future discounting compared to control. We also predicted that retrospection will reduce past discounting compared to control.

Method

Participants

Eighty-one adults (62% females) with no psychopathology participated (mean age = 26.07 years, SD = 5.31; 95% with at least some college education). The sample size was determined using the effect size from our previous study comparing the effect of prospection on delay discounting in lean and obese individuals (Daniel et al., 2013a).

Interested individuals were recruited through flyers posted around the University at Buffalo campus, community settings and web-based advertisements. Eligible participants were scheduled for a 90-minute laboratory session. An assessment of participant demographics was emailed via Survey Monkey to be completed prior to their session. Participants were compensated \$25 for their time. This study was approved by the Social and Behavioral Sciences Institutional Review Board at the University at Buffalo.

Experimental Design and Procedures

Participants were randomly assigned to either prospection ($N = 27$), retrospection ($N = 27$), or control recent thinking groups ($N = 27$). We used a mixed design with group (prospection, retrospection or control) as the between subject factor and type of temporal discounting (future or past discounting) as the within subject factor. An online assessment of demographics was emailed to participants via Survey Monkey to be completed prior to their session. Upon arrival to the laboratory session, participants were greeted and escorted to a private room. If demographic measures were not completed at this time, participants were given the opportunity to complete them to reduce the incidence of missing data. After participants signed consent forms, one of three variations of the episodic thinking cue generation task was administered to participants depending on

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