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The parallel impact of episodic memory and episodic future thinking on food intake

Lenny R. Vartanian [a, *], William H. Chen [a], Natalie M. Reily [a], Alan D. Castel [b]

[a] School of Psychology, UNSW Australia, Sydney, NSW, 2052, Australia
[b] Department of Psychology, University of California, Los Angeles, 1285 Franz Hall, Box 951563, Los Angeles, CA 90095-1563, USA

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ABSTRACT

This research examined the effects of both episodic memory and episodic future thinking (EFT) on snack food intake. In Study 1, female participants ($n = 158$) were asked to recall their lunch from earlier in the day, to think about the dinner they planned to have later in the day, or to think about a non-food activity before taking part in a cookie taste test. Participants who recalled their lunch or who thought about their dinner ate less than did participants who thought about non-food activities. These effects were not explained by group differences in the hedonic value of the food. Study 2 examined whether the suppression effect observed in Study 1 was driven by a general health consciousness. Female participants ($n = 74$) were asked to think about their past or future exercise (or a non-exercise activity), but thinking about exercise had no impact on participants' cookie consumption. Overall, both thinking about past food intake and imagining future food intake had the same suppression effect on participants' current food intake, but further research is needed to determine the underlying mechanism.

1. Introduction

Many people believe that we eat because we are hungry and stop eating because we are full (e.g., Hetherington, 1996; Mook & Votaw, 1992; Vartanian, Herman, & Wansink, 2008), but research indicates that cognitive factors play an important role in regulating people's eating behavior. In particular, memory for what one has recently consumed appears to influence subsequent food intake. In an early demonstration of the connection between memory and food intake, Rozin, Dow, Moscovitch, and Rajaram (1998) showed that patients with anterograde amnesia would consume multiple lunches offered at 10–20 min intervals. Subsequent research has demonstrated that memory also plays a role in the food intake of neurologically-intact individuals. For example, Higgs (2002) had participants recall what they had eaten for lunch earlier that day, or recall what they had eaten for lunch the previous day, prior to taking part in a snack-food taste test. That study found that recalling previous food intake resulted in decreased food intake, but only for those who recalled their lunch from earlier the same day. Furthermore, Higgs and Donohue (2011) found that asking participants to mindfully engage with their lunch by focusing on the sensory properties of the food led to enhanced memory for what was eaten, and also resulted in greater suppression of food intake at a subsequent snack.

Although there have been several demonstrations that recalling recent food intake can suppress subsequent food intake, less is known about the mechanisms underlying this effect. One possibility is that recalling previous food intake affects how hungry or full people feel (Brunstrom et al., 2012). Specifically, reminding participants that they have recently eaten might lead them to feel less hungry (or more full) and thus suppress intake. Higgs (2002), however, found no effect of recall instruction on participants' ratings of hunger, fullness, or general desire to eat. An alternative possibility (and one that we explored in the current research) is that recalling prior eating occasions changes the perceived hedonic value of the to-be-eaten food. Specifically, when thinking about what they have recently eaten, people might derive less pleasure from the food in front of them at the present moment and therefore eat less of it.

1.1. Episodic future thinking

Recent work has shown that recalling prior events engages similar neural mechanisms that are involved in thinking about the

* Corresponding author.
E-mail address: lvartanian@psy.unsw.edu.au (L.R. Vartanian).

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future (Schacter, Addis, & Buckner, 2007; Szpunar, Watson, & McDermott, 2007). Episodic Future Thinking (EFT) is the ability to mentally simulate hypothetical future scenarios, and may draw on prior experiences that then allow one to imagine the future (Szpunar, 2010). In the context of eating behavior, this could be particularly relevant because people may recall prior eating episodes when planning future eating behavior. Thus, the link between episodic memory and episodic future thinking may indicate an important parallel between how recalling the past and imagining the future could influence (and potentially reduce) food intake, suggesting a common mechanism that relies on cognitive factors related to memory and planning. One recent study (Daniel, Stanton, & Epstein, 2013) examined the impact of imagining future events on delay-discounting and food intake among individuals with obesity, and found that EFT led to decreased ad libitum food intake. However, the EFT used in that study was not related to food and thus it unknown whether thinking about one's future food intake has a parallel effect to thinking about one's past food intake.

1.2. The present research

The aim of the present research was to extend previous work by examining the role of *both* episodic memory and episodic future thinking on participants' food intake. In Study 1, participants first took part in a memory task in which they were asked to recall a recent meal, to think about a future meal, or to think about a non-food activity. We then examined the impact of the memory task on food intake by measuring the amount that participants ate during a cookie taste test. We also tested the possibility that any observed effects of the memory task on food intake would be accounted for by differences in the perceived hedonic value of the food. To do so, we assessed both cravings for the specific food prior to eating and liking of the food during the taste test. Study 2 examined whether the effects of episodic memory and future thinking on food intake extend to thinking about recent or future exercise. Together, these studies aimed to provide initial evidence that recalling the past and imagining the future can have a parallel impact on food consumption, illustrating the role of reconstructive memory and future planning when eating.

2. Study 1

Building on previous research examining the role of memory in food intake, Study 1 sought to determine whether EFT has the same inhibitory effects on participants' food intake as does recalling past food intake. Participants in the food recall group wrote about what they ate for lunch that day and participants in the EFT group wrote about what they were planning to have for dinner later that day. There were also three comparison groups: a non-food episodic memory group (who wrote about how they got to the experiment room), a non-food EFT group (who wrote about how they were going to get home at the end of the day), and a control group (who completed a descriptive writing task). All participants then took part in a cookie taste test. We predicted that both recall of past food intake and thinking about future food intake would lead to lower food intake compared to the three comparison groups. We also predicted that any group differences in food intake would be accounted for by differences in craving for and liking of the test food.

2.1. Method

2.1.1. Participants

Participants were 158 female unrestrained eaters who were recruited from an introductory psychology course at a large Australian university, or who were recruited from the community. Students received course credit for their participation, and community participants received AUD $10. Previous research on memory effects on food intake has found large effects (Higgs, 2002). A power analysis determined that, with alpha set at .05 and power set at .80, 80 participants were required to detect a large effect. However, because the episodic future thinking component of this study was novel, we took a more conservative estimate of the effect size and doubled the number of participants recruited for the study. Participants' mean age was 19.48 years ($SD = 2.27$). No other demographic information was recorded. This study was approved by the university's ethics committee.

2.1.2. Materials

2.1.2.1. Dietary restraint. Participants were prescreened using the Restraint Scale (Herman & Polivy, 1980). Only those participants who scored below 15 on this scale were eligible to participate in the study.

2.1.2.2. Memory manipulations. The memory manipulations were based on the procedures used in previous studies on memory and food intake (e.g., Higgs, 2002), as well as research on EFT (e.g., Schacter et al., 2007; Szpunar, 2010; Szpunar et al., 2007). Participants in the food-recall condition were asked to write about the lunch they had eaten that day. The specific instructions were as follows: “Remember what you ate for lunch today. Think about what you ate, where you ate, who you ate with, and anything related to the meal you ate earlier today. Please write down anything that comes to mind. Do not worry about spelling or grammar. You will have 5 min to complete this task.” Similar instructions were used in the food-EFT condition, but participants were instead asked to think about their plans for their dinner that night: “Think about what you plan to eat for dinner later today. Think about what you will be eating, where you will be eating, who you will be eating with, and anything related to the meal you plan to eat later today.” For the non-food-recall and non-food-EFT groups, participants were asked to write about how they got to the experimental room that day and how they planned to get home at the end of the day, respectively. Finally, participants in the non-memory control group were shown an abstract figure and were asked to describe the figure in as much detail as possible.

2.1.2.3. Taste test. The cookies used in the taste test were Arnott's Premier Chocolate Chip Cookies (Arnott's Australia). Each cookie weighed approximately 15 g, was 6.5 cm in diameter, and contained approximately 315 kJ (75 kcal). Each participant was presented with a bowl filled with 21 cookies to ensure that they could eat as much as they wanted without feeling self-conscious about their intake. Bowls of cookies were weighed before and after the experimental session to determine the amount that participants consumed (in grams). Participants were asked to taste and rate the cookies on a variety of factors (how salty, sweet, crunchy, bitter, and chewy). Only three items were of interest in the present study: “How much do you like this cookie”, “How good tasting is this cookie”, and “How satisfying is this cookie”. These items were rated on a 10-cm visual analogue scale anchored by *Not at all* and *Very much* and were combined to form an overall index of liking of the cookies (Cronbach's $\alpha = .90$).

2.1.2.4. Craving for cookies. After being shown the bowl of cookies, but prior to tasting any of them, participants were asked to rate the strength of their desire to eat the cookies and the strength of their craving for the cookies (1 = *Not at all*, 9 = *Extremely strong*). These two items were highly correlated ($r = .79$, $p < .001$) and were combined into an overall index of craving for cookies.