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Research report

Peak and end effects on remembered enjoyment of eating in low and high restrained eaters☆

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ABSTRACT

Memory is likely to be important in food choice because many food likes and dislikes are learnt. Evidence suggests that the final few moments of an experience ('end effect') and the most intense moments of an experience ('peak effect') have a disproportionately large influence on hedonic memories. In Study 1 we examined whether the end effect bias is applicable to remembered enjoyment of a food and whether this holds true for restrained and unrestrained eaters. One hundred and four participants ate the same yoghurt but half the participants experienced a pleasant end and half a bland end (control condition). Although both the 'pleasant ending' and control group had a similar online enjoyment of the yoghurt, unrestrained eaters who experienced a pleasant end remembered it to have been significantly more enjoyable than those in the control condition. No end effect was observed for restrained eaters. In Study 2 we examined predictors of remembered enjoyment of a multi-item meal. Forty-six participants consumed and rated 5 buffet style food items as part of a lunch time meal. For unrestrained eaters, remembered enjoyment of the meal was only predicted by 'peak' online enjoyment of the most liked item. Participant's enjoyment of the first, last and least liked items did not predict remembered enjoyment. For restrained eaters, remembered enjoyment was not predicted by any of the four predictor variables. These results suggest that for unrestrained eaters key moments in eating experiences have disproportionately large influence on remembered enjoyment of eating.

Introduction

The importance of learning and memory processes for the acquisition of food likes and dislikes has been appreciated for some time (Rozin & Zellner, 1985). Extensive evidence has been found that that associative conditioning (which relies on memory processes) is the most likely mechanism underlying this learning (Sclafani, 1997). More recently, evidence has accumulated that episodic memory for specific recent eating occasions also influences food intake (Higgs, 2005). For example, recall of recent eating decreases later snack consumption and disruption of meal encoding is associated with increased intake later that day (Higgs, 2002; Higgs, Williamson, & Attwood, 2008; Higgs & Woodward, 2009), suggesting that information about a recent meal is factored into decisions about future intake.

Episodic memories of eating experiences are also likely to influence food choice because food selection often occurs in the absence of direct sensory contact with foods and so must rely to some extent on memories of previous experiences of consumption. Hence, it is likely that in the case of food choice, remembered enjoyment plays a more significant role than actual 'online' enjoyment (Rode, Rozin, & Durlach, 2007). In support, remembered enjoyment of hedonic experiences has been shown to be predictive of future intentions and behaviour (Kahneman, 1994; Wirtz, Kruger, Napa-Scollon, & Diener, 2003). For example, Kahneman and colleagues reported that memory for a painful medical procedure and not actual experienced pain predicted likelihood of returning for repeat surgery (Redelmeier, Katz, & Kahneman, 2003). When thinking about how enjoyable future experiences will be, it is likely we base such expectations on our episodic memories of similar past experiences (Gilbert & Wilson, 2007; Schacter, Addis, & Buckner, 2007). Thus, how individuals form memories of eating experiences would seem to be important in explaining food choice.

The relationship between experienced and remembered affect is complex (Ariely & Carmon, 2000; Kahneman, Fredrickson, Schreiber, & Redelmeier, 1993). Indeed, episodic memory for past experiences is far from an exact replica of what was actually experienced (Conway, 2009) and remembered and online enjoyment of an experience can be discrepant (for example; Wirtz, Kruger, Napa-Scollon, & Diener, 2003). A rational approach to the formation of an affective memory for a past experience might be some form of averaging heuristic across all moments of the

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experience. However, research suggests that this is not the case and instead, specific moments and/or characteristics of the experience appear to have a disproportionately large influence on overall memory (Ariely & Carmon, 2000; Redelmeier & Kahneman, 1996). For example, Redelmeier and Kahneman (1996) found evidence suggesting that patient's memories of medical procedures tended to be shaped by the intensity of pain at the worst and final moments of the experience.

The 'end effect' bias, which is a tendency for the final few moment of an experience to have a disproportionately large influence on overall memory, has been well studied. For example, the final moments of a pleasant experience, such as listening to music, have been shown to have a large influence on remembered enjoyment of the overall experience (Rozin & Goldberg, 2004). In addition, the amount of pain experienced in the final moments of a painful experience strongly influences memory of overall discomfort (Kahneman et al., 1993). The most intense moments of an experience (the 'peak') have also been shown to play a disproportionately large role in shaping memory (Redelmeier & Kahneman, 1996; Rozin & Goldberg, 2004). Yet, there is some evidence that when experiences are partitioned into separate components, individuals are more likely to average across the partitioned sections (Ariely & Zauberman, 2000). However, the circumstances that might promote this effect are unclear (Ariely & Carmon, 2000).

A study by Rozin and colleagues investigated remembered enjoyment for meals and found little support for peak or end effects (Rode et al., 2007). One reason for this might be because individual differences in eating behaviours were not taken into account. It has been reported that individual differences in cognitive restraint of food intake influence learning about flavour–flavour and flavour–nutrient consequences (Brunstrom, Downes, & Higgs, 2001) possibly because restrained eaters' beliefs about foods interfere with learning (Brunstrom, Higgs, & Mitchell, 2005). Hence, it is also possible that individual differences in dietary restraint influence remembered enjoyment of eating experiences.

The present studies build on previous work by examining the relationship between online and remembered enjoyment of eating experiences in two laboratory based studies. In Study 1 we examined whether the 'end effect' bias is applicable to remembered enjoyment of a food item, by manipulating the ordering of the components of fruit yoghurt so that all participants ate the same yoghurt but half the participants experienced a pleasant end and half a bland end. In Study 2 we examined which parts of a multi-item meal shape remembered enjoyment of the meal. Participants consumed a five item lunch time meal and made online ratings of enjoyment for each item. We examined which parts of the meal predicted remembered enjoyment. For both studies, we accounted for level of dietary restraint by categorising participants as either high or low in dietary restraint according to scores on the restraint scale of the Three Factor Eating questionnaire (TFEQ; Stunkard & Messick, 1985). We hypothesised that cognitive processing of the food stimuli by restrained eaters might interfere with encoding or retrieval of hedonic food memories and that restrained eaters responses might be more influenced by semantic knowledge and beliefs about foods than episodic details related to a recent eating experience.

Study 1

Method

Participants

One hundred and four participants (undergraduate students from the University of Birmingham) were recruited in exchange for course credit (85 female and 19 male; average age = 20.0 years, s.d. = 2.2). Six participants were removed from analyses as they were classified as being clinically obese. To disguise the aims of the study it was advertised as 'research examining mood and eating'. BMI was within normal range; 22.9 (s.d. = 2.6), and the average restraint score was 7.0 (s.d. = 5.0). Participants gave informed signed consent and the study protocol was approved by University of Birmingham research ethics committee.

Test food and experimental conditions

Participants ate a Sainsbury's tip & mix strawberry yoghurt dessert (175 g, 181 kcal). The dessert consisted of two separate components; a probiotic plain yoghurt and a strawberry compote. A pilot study indicated that the compote section was rated as more enjoyable than the plain yoghurt section. The dessert was served in a small opaque pot and participants were provided with a plastic spoon to eat with. In the 'pleasant ending' condition the pot was prepared so that the strawberry compote section was the bottom of the pot with the yoghurt on top. The order was reversed in the control condition; the pot was prepared so that the compote came first followed by the yoghurt.

Online enjoyment ratings

To measure online enjoyment of eating the dessert, participants rated their enjoyment of every other spoonful as they ate (i.e., 1st spoonful, followed by 3rd, etc.). Participants were provided with a small booklet in which to make the ratings. Each page asked participants 'How enjoyable is spoon X' and participants recorded their responses on a 10 cm visual analogue scale (V.A.S.), anchors from left to right 'not at all enjoyable' and 'extremely enjoyable'. Instructions provided with the booklet informed participants to make their first rating after eating the first spoonful and then turn to the next page to rate the third spoonful and to continue in this manner until they had finished the dessert. Participants were informed to make a rating on the next available page of the booklet if they finished on an even number.

Procedure

Participants attended two sessions; the first was between 12 and 1.30pm and the second session was 2 h after the end of the first session. On arrival, participants were seated in a testing cubicle and answered demographic questions and rated their mood. The following items; happy, hungry, tired, anxious and alert, were rated using a 10 cm visual analogue line rating scale (V.A.S.) with "not at all" and "extremely" as end anchors e.g., "How happy do you feel right now?" (centred above the line scale).

Participants were then provided with a sandwich to eat as their lunch (Sainsbury's UK Ham Sandwich 370 kcal). After eating the sandwich participants were provided with the dessert pot and rating booklet and left alone. When the rating task had been completed the researcher returned and provided participants with the same mood ratings as earlier in the session. The researcher asked participants not to eat in the 2 h break between sessions.

At the beginning of the second test session, the participant was asked to rate her appetite and mood using the line rating scales described previously. Participants were then asked 'Overall, how enjoyable was the yoghurt you ate in the earlier session' and indicated their response using a tick box measure (9 boxes), with anchors from left to right; 'not at all enjoyable' and 'extremely enjoyable'. The scale used to measure remembered enjoyment was different to that of the online measurements of enjoyment to reduce response bias. The cognitive restraint scale of the TFEQ (Stunkard & Messick, 1985) was then completed. This scale has been shown to possess good validity, internal consistency and test–retest reliability (Stunkard & Messick, 1985). The scale