Memory

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/pmem20

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MEMORY
https://doi.org/10.1080/09658211.2023.2257010

Effects of cueing multiple memories of eating on people's judgments about their diet

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ABSTRACT

Past research shows that recalling a single positive health-related experience, such as exercising, can encourage people's subsequent healthy behaviours. In contrast, we reasoned that attempting to recall *many* healthy experiences might elicit a metacognitive experience of difficulty that would lead people to perceive themselves as less healthy, and perhaps to make other health-related judgments based on this perception. In two pre-registered experiments (combined $N = 729$), participants recalled either "few" or "many" instances of eating either healthily or unhealthily, before rating the healthiness of their diets and completing measures of their eating preferences and choices. Contrary to our predictions, our pre-registered analyses provided minimal evidence that the number of memories people retrieved affected their judgments. However, exploratory mediation analyses suggested that two counteracting effects may have occurred, whereby retrieving more (un)healthy memories led people to identify as more (un)healthy, yet also created a sense of subjective difficulty that partially or wholly negated these effects. These findings suggest that whereas probing people's dietary memories might sometimes lead to healthier self-perceptions and dietary choices, we should also consider the possibility of backfire effects.

ARTICLE HISTORY
Received 11 March 2023
Accepted 28 August 2023

KEYWORDS
Eating behaviour; dietary health; memory retrieval; ease-of-retrieval

Are you a healthy eater? After remembering the huge salad you ate yesterday, your answer might be "yes". But what if we probed your memory further, asking you to recall additional examples of eating healthily? Would retrieving these memories lead you to feel more healthy, or less healthy? And might these judgments affect whether you would consider having a slice of cake tomorrow? In this paper, we ask how people's self-appraised healthiness, and their subsequent food preferences, are shaped by the number of "healthy" or "unhealthy" eating experiences they try to recall.

Autobiographical memory researchers have amply demonstrated that people's memories of past experiences inform their present and future behaviour (Bluck, 2003; Cohen & Conway, 2007; Higgs, 2008; Wilson & Ross, 2003). In the domain of health, research shows that prompting people to recall just one positive health-related experience can lead them to make healthier choices in the future. In one study, participants who recalled an autobiographical memory relating to either successful dietary control, or exercising, later reported higher intentions to control their food intake over the following two weeks, as compared with participants who recalled a memory of trying to achieve a work-related goal (Merson & Pezdek, 2019). In another study, participants were asked to recall either a motivating memory of being satisfied following exercise, a memory of being dissatisfied following exercise, or no memory (Biondolillo & Pillemer, 2015). Of those asked to recall a satisfying experience, 61% increased their physical activity over the following 2 weeks, compared to 49% of participants who recalled a dissatisfying experience, and 37% of those not asked to recall a memory. To explain their findings, Biondolillo and Pillemer (2015) drew upon the active-self account, which theorises that people have both a *chronic* self-concept, and an *active* self-concept (Wheeler et al., 2007). The chronic self encompasses all aspects of one's self-concept stored in long-term memory, many of which can be mutually conflicting. By comparison, the active self consists of temporarily salient aspects of the chronic self. According to Biondolillo and Pillemer, remembering exercising meant that healthiness became a salient aspect of participants' active self-concept (e.g., "I am an avid gym-goer") and their subsequent behaviour was in turn guided by this self-concept.

From an applied perspective, findings such as these highlight a possible role for cueing people's memories as a technique for promoting healthier decisions. However, when people make judgements about their past behaviours, it stands to reason that they will frequently have

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Supplemental data for this article can be accessed online at https://doi.org/10.1080/09658211.2023.2257010.

more than just one relevant autobiographical memory to inform these judgements. Whereas memory researchers have tended to focus on what kinds of memories people retrieve – such as whether they remember instances of successful or unsuccessful dietary control (e.g., Merson & Pezdek, 2019) – what might also matter then, is the *number* of memories they retrieve.

On the one hand, successfully remembering more instances of being (un)healthy should provide us greater evidence of our prior (un)healthiness, and indeed, the act of generating this additional evidence should activate health-related aspects of our active self-concept more strongly (Wheeler et al., 2007). Based on this line of reasoning, generating more (vs. fewer) memories of being "healthy" should therefore make people judge themselves to be healthier, whereas generating more (vs. fewer) memories of being unhealthy should make people judge themselves as less healthy. However, other research might also lead us to an entirely different prediction. According to the availability heuristic, a key source of information we draw upon when formulating judgments is the subjective ease with which we recall past experiences (Tversky & Kahneman, 1973). As such, attempting to retrieve more past episodes from memory might evoke a sense of difficulty, especially among people for whom those past episodes are more rare, which could have the opposite effect on people's judgements than if they relied on the recalled content alone (Schwarz, 1998, 2004). That is to say, people who try to generate more (vs. fewer) memories of being healthy may find it subjectively difficult to do so, which in turn may mean they judge themselves as *less* healthy.

In one classic study that demonstrates this ease-of-retrieval effect, people were asked to recall either four or twelve childhood memories. Despite successfully retrieving more memories overall, those who tried to recall twelve memories – and who therefore experienced greater subjective difficulty – judged their general recollections of childhood as less "complete" than did those in the four-memories group (Winkielman et al., 1998). There is some evidence that ease-of-retrieval shapes people's judgments in the domain of health, too. For instance, healthy participants in one study judged themselves at greater risk for developing heart disease after recalling three, rather than eight, of their risk-increasing behaviours (Rothman & Schwarz, 1998). Similarly, participants who tried to list many treatment options for hemorrhoids expressed lower confidence in their ability to remedy the condition, compared with participants who tried to list just a few treatment options (Chang, 2010).

Effects of retrieval difficulty on downstream health judgments

Studies such as those described above illustrate how retrieval difficulty can shape people's initial judgments that are directly related to the memories they retrieve. However, these studies rarely examine the effects upon more "downstream" health judgments. This is an important gap from a health perspective, because changes in self-perceptions of dietary healthiness could have consequences for people's subsequent dietary behaviour. On the one hand, people might behave in line with their active self-concept, such that perceiving oneself as more (un)healthy would lead people to plan to eat more (un)healthily in future (Wheeler et al., 2007). Alternatively, people's appraisals of their dietary healthiness may lead them to compensate (e.g., Rabiau et al., 2006). In one study, for instance, participants who initially consumed an unhealthy snack, rather than a healthier alternative, were significantly more likely to partake in a subsequent bout of exercise as opposed to a sedentary activity (Petersen et al., 2019). Put differently, someone who forms a less-favourable opinion of their dietary healthiness may look to rectify their behaviour by planning to eat healthier foods in future. Likewise, people who judge that they have eaten healthily might justify "treating" themselves to a less-healthy snack (Knäuper et al., 2004). In short, whereas a person who struggles to recall instances of eating healthily might – correctly or incorrectly – infer that they are an "unhealthy" eater, it is unclear whether this inference would lead them to make less-healthy downstream judgments (e.g., "I am an unhealthy eater, so I shall continue to eat unhealthily"), or whether they would be led to compensate via more-healthy downstream judgments (e.g., "eating a healthy snack now will offset my prior unhealthy eating").

The present research

In sum, research on how memory cueing influences people's health-related judgments has given little attention to the subjective ease or difficulty of retrieving those memories. Based on prior findings from the ease-of-retrieval literature, we predicted that participants would appraise their own diets more favourably after being asked to recall few "healthy" eating experiences, rather than many "healthy" eating experiences. Likewise, we anticipated the reverse pattern for those asked to recall few vs. many "unhealthy" eating experiences. We also sought to explore how these different memory-cueing conditions would affect people's judgments of the foods they might choose to eat in future, and their motivations for those choices. Because people's appraisals of their dietary healthiness could feasibly have positive or negative effects on these downstream health-related judgments, we made no directional predictions about these judgments.

In Experiment 1, participants were asked to recall either few or many recent occasions when they had eaten either "healthily" or "unhealthily". We then asked them to rate the healthiness of their diets, both recently and in general, and complete measures of their eating preferences and motivations. For all our dependent variables, we predicted significant two-way interactions between the number of events cued and the type of food recalled (i.e., "healthy" or "unhealthy").

Experiment 1

Method

Both of the experiments reported in this paper received approval from the authors' university ethics committee. The procedure, hypotheses, and analysis plan for Experiment 1 were pre-registered prior to data collection through AsPredicted.org, and can be found at https://aspredicted.org/PLA_VKD.

Participants and design. Initially, we recruited 441 UK residents via Prolific.co in exchange for a small fee (£3.00). We used Prolific's inbuilt pre-screening filters to recruit participants with no known food allergies or dietary restrictions, and whose BMI based on their self-reported height and weight at the time of registering with Prolific fell between 20 and 29.9. Per our pre-registered criteria, 76 participants were removed from analysis: specifically, 27 failed to provide the minimum number of valid responses during the recall task described below, and 49 had a BMI that fell outside 20-29.9 based on their self-reported height and weight at the time of participating in the study. These removals left a final sample of 365 participants (147 males, 216 females, 2 others; $M_{age} = 38.0$, $SD = 12.0$, range = 18–75; $M_{BMI} = 24.42$, $SD = 2.47$, range = 20.0–29.8), in line with our pre-registered target of 364 participants.

The study used a 2 (events cued: few vs. many) × 2 (food type: healthy vs. unhealthy) between-subjects design, with participants randomly allocated to one of the four experimental conditions; few-healthy ($n = 92$), many-healthy ($n = 88$), few-unhealthy ($n = 88$), many-unhealthy ($n = 97$). *A priori* power analysis indicated that this sample size would permit detection of small- to medium-sized main and interaction effects ($f = .15$, given $\alpha = .05$, two-tailed, and power = .80), and detection of medium-sized post hoc pairwise differences between cells, using an alpha level corrected for multiple tests (i.e., $n = 91$ per cell would afford detection of $d = .50$, given $\alpha = .0125$, two-tailed, and power = .80).

Measures

Party Behavior Questionnaire. To measure people's food preferences, participants completed a modified version of the Party Behavior Questionnaire (PBQ; Bernstein et al., 2005), in which they were instructed to imagine they were at a buffet serving a variety of foods. Participants used 7-point Likert scales to rate their willingness to consume 30 different foods at this buffet, presented in a random order (1 = Definitely would not consume; 7 = Definitely would consume). Of these, 15 were high energy-dense (HED) foods (e.g., chocolate), and 15 were low-energy dense (LED) foods (e.g., grapes) according to the values used by Epstein et al. (2018; see Table S1 of the supplementary materials). Participants' PBQ ratings were averaged across all HED foods and across all LED foods separately, before subtracting the mean HED rating from the mean LED rating to produce a single score that could range from −6 to +6, with higher scores indicating a tendency to choose more of the healthier (LED) than the less-healthy (HED) foods.

Food Choice Questionnaire. We assessed participants' food choice motives using a subset of items from Steptoe et al.'s (1995) Food Choice Questionnaire (FCQ). Specifically, we used the six items from the "health" factor of this scale, which concern people's health-related motives for choosing which foods to consume (e.g., "It is important to me that the food I eat on a typical day contains lots of vitamins and minerals"). Items are rated on a scale from 1 (Not at all important) to 4 (Very important). We averaged these ratings into a single score, where higher scores signified stronger importance of health motives.

Hunger/Fullness. Participants rated their current hunger and fullness using visual analog scales (VAS; 0 = Not Hungry/Full at all; 100 = Very Hungry/Full). These ratings served only to ensure there were no baseline differences between conditions that might have affected our main dependent variables.

Dutch Eating Behavior Questionnaire. As another secondary measure unrelated to our pre-registered predictions, participants completed the Dutch Eating Behaviour Questionnaire (DEBQ; van Strien et al., 1986), which measures three aspects of self-reported eating behaviour: (1) *dietary restraint* (10-items), the extent to which people consciously restrict their food intake to achieve or maintain a particular weight; (2) *external eating* (10-items), people's drive to eat in response to food-related stimuli (e.g., a food's smell), irrespective of their current hunger or satiety; (3) *emotional eating* (13-items), people's tendency to eat to alleviate negative emotions, rather than to satisfy hunger. Participants rate their agreement with each statement (e.g., "Do you have a desire to eat when you are irritated?") from 1 (never) to 5 (very often), from which we calculated average scores for each subscale.

Procedure. Participants completed the study online through the survey provider, Qualtrics. After giving informed consent, participants first completed the two VAS scales and then proceeded to the main experimental task. There, each participant was instructed to reflect on their recent eating experiences, and to provide a number of memories based on the experimental condition they had been randomly assigned: those in the "few-events" conditions were asked to recall two memories, whereas those in the "many-events" conditions were asked to recall eight memories. Likewise, the condition they were assigned determined whether participants were asked to recall eating healthy or eating unhealthily. Specifically, participants were instructed as follows:

> Please try to recall [two/eight] recent occasions, for example in the past month, when you have eaten something [healthy/unhealthy]. Use each textbox below to give a different example, and provide a brief description of what you remember eating. Roughly when was this? Where were you when you ate it? What did it taste like?

Participants saw either two or eight empty text boxes, dependent on experimental condition, and no time limit was imposed on completing the recall task in either the few-events or many-events conditions. If participants tried to continue the survey before they had entered text in all of the boxes, they were reminded that they had not yet provided the requested number of examples, but they were otherwise permitted to continue without completing every box if they wished. Note that we did not define "(un)healthy" for participants, instead leaving it to their own judgments. Immediately after completing the memory task, participants rated how difficult they had found it to recall the requested number of eating experiences (1 = Very easy; 7 = Very hard).

On the next screen, participants completed our two primary dependent measures. Specifically, they were first asked to appraise their *recent* dietary healthiness i.e., "To what extent do you agree with the following statement": "In recent weeks and months I have had a healthy diet" (1 = I have eaten very unhealthily; 7 = I have eaten very healthily), and then asked to rate the *general* healthiness of their diets i.e., "To what extent do you believe that you normally eat healthily in your day-to-day life?" (1 = I normally eat very unhealthily; 7 = I normally eat very healthily). Participants then completed our two "downstream" measures of their food preferences and choices: the PBQ, and the FCQ. Finally, participants completed the DEBQ, reported their age, sex, height and weight, and were debriefed.

Results

Main analysis

Coding of recalled eating experiences. We coded each of the participants' memory responses as "valid" if they named at least one food or beverage item, and provided at least one episodic detail about the event (e.g., where they were at the time). Any participant in the few-events condition who failed to provide two valid memories was excluded from analysis and replaced. Similarly, any many-events participant who did not provide at least three memories was excluded and replaced.

Manipulation checks. In the final sample of 365 participants, a series of one-way ANOVAs found no significant differences between conditions in terms of baseline hunger, $F(3, 361) = 0.12$, $p = .95$, and fullness, $F(3, 361) = 0.09$, $p = .97$, or the DEBQ subscales of dietary restraint, $F(3, 361) = 0.51$, $p = .68$, external eating, $F(3, 361) = 0.73$, $p = .53$, or emotional eating, $F(3, 361) = 0.11$, $p = .96$.

Many-events participants recalled an average of 7.36 events ($M_{\text{Healthy}} = 7.31$, $SD = 1.29$; $M_{\text{Unhealthy}} = 7.41$, $SD = 1.05$; range = 3–8), with 67% of those participants providing the eight examples requested. We also wanted to check that, as intended, being asked to retrieve more events caused participants to experience greater subjective difficulty. This was the case: as shown in the top row of Table 1, a 2 (events cued: few vs. many) × 2 (food type: healthy vs. unhealthy) between-subjects ANOVA showed that participants found it significantly less difficult to recall few events ($M = 2.24$ out of 7, $SD = 1.60$), than many events ($M = 3.88$, $SD = 1.98$), $F(1, 361) = 79.26$, $p < .001$, $\eta_p^2 = .18$. There was also a significant effect of food type, with participants finding it less difficult to remember eating unhealthily ($M = 2.75$, $SD = 1.85$), than healthily ($M = 3.40$, $SD = 2.05$), $F(1, 361) = 14.48$, $p < .001$, $\eta_p^2 = .04$. The two-way interaction was not significant, $F(1, 361) = 0.04$, $p = .84$, $\eta_p^2 < .001$.

Perceptions of healthiness. Having determined that our few-vs-many manipulation successfully influenced task difficulty, we next examined whether this manipulation affected participants' ratings of their recent and/or general dietary healthiness. Recall that we predicted significant two-way interactions in this analysis and for all other dependent variables. A 2 (events cued: few vs. many) × 2 (food type: healthy vs. unhealthy) between-subjects ANOVA revealed that the number of events cued had no overall main effect on people's appraisals of their recent diets, ($M_{Few} = 3.79$, $SD = 1.60$); $M_{\text{Many}} = 3.47$, $SD = 1.54$; $F(1, 361) = 3.44$, $p = .06$, $\eta_p^2 < .01$. There was a significant main effect of food type, with participants forming more favourable judgments of their recent dietary healthiness after recalling instances of eating healthily ($M = 3.96$, $SD = 1.49$), rather than unhealthily ($M = 3.31$, $SD = 1.60$), $F(1, 361) = 15.39$, $p < .001$, $\eta_p^2 = .04$. Crucially, the predicted two-way interaction was also significant, $F(1, 361) = 9.60$, $p < .01$ $\eta_p^2 = .03$ (see the second row of Table 1). However, post-hoc *t*-tests revealed that participants who tried to recall many instances of eating healthily formed similar impressions of their recent healthiness ($M = 4.06$, $SD = 1.34$), as did those who recalled few examples of eating healthily ($M = 3.86$, $SD = 1.61$), $t(178) = 0.89$, $p = .37$, $d = 0.13$. Contrary to our predictions based on reasoning about ease-of-retrieval, participants who tried to recall many instances of eating unhealthily rated their recent diets as less healthy ($M = 2.94$, $SD = 1.52$), than did those who recalled few examples of eating unhealthily ($M = 3.73$, $SD = 1.69$), $t(183) = 3.45$, $p < .001$, $d = 0.51$.

Looking to participants' ratings of their general dietary healthiness, we found no significant main effect of the number of events cued, ($M_{\text{Few}} = 4.85$, $SD = 1.33$; $M_{\text{Many}} = 4.62$, $SD = 1.40$; $F(1, 361) = 2.47$, $p = .12$, $\eta_p^2 < .01$), no main effect of food type, ($M_{\text{Healthy}} = 4.77$, $SD = 1.31$; $M_{\text{Unhealthy}} = 4.70$, $SD = 1.42$; $F(1, 361) = 2.47$, $p = .12$, $\eta_p^2 < .01$), and no two-way interaction, $F(1, 361) = 0.52$, $p = .47$, $\eta_p^2 < .01$ (see third row of Table 1).

Food preferences. We repeated these ANOVAs using participants' PBQ scores to determine whether cueing people's memories of eating affected their reported food

Table 1. Means (SDs) for recall difficulty, perceptions of healthiness, food preferences and motives in Experiment 1.

	Number of events recalled			
	Few		Many	
	Healthy	Unhealthy	Healthy	Unhealthy
Task difficulty	2.61 (1.82)	1.86 (1.24)	4.23 (1.97)	3.56 (1.95)
Recent healthiness	3.86 (1.61)	3.73 (1.59)	4.06 (1.34)	2.94 (1.52)
General healthiness	4.83 (1.35)	4.88 (1.31)	4.70 (1.27)	4.55 (1.51)
PBQ score	−0.11 (1.32)	−0.25 (1.23)	−0.13 (1.31)	−0.64 (1.45)
FCQ score	2.85 (0.56)	2.87 (0.66)	2.85 (0.62)	2.66 (0.64)

PBQ = Party Behavior Questionnaire; FCQ = Food Choice Questionnaire.

preferences from a hypothetical buffet. There was no significant main effect of the number of cued events on participants' food choices, ($M_{Few} = -0.18$, $SD = 1.28$; $M_{Many} = -0.40$, $SD = 1.40$; $F(1, 361) = 2.22$, $p = .14$, $\eta_p^2 < .01$). Participants did choose a higher ratio of healthier, LED snacks after recalling instances of eating healthily ($M = -0.12$, $SD = 1.31$), rather than unhealthily ($M = -0.45$, $SD = 1.36$), $F(1, 361) = 5.29$, $p = .02$, $\eta_p^2 = .01$. However, the predicted two-way interaction was not significant, $F(1, 361) = 1.74$, $p = .19$, $\eta_p^2 < .01$ (see the fourth row of Table 1).

Food choice motives. Finally, we analysed participants' health-related motives for choosing the foods that they consume, as assessed by the FCQ subscale. A between-subjects ANOVA showed no significant main effect of the number of cued events, $F(1, 361) = 2.50$, $p = .12$, $\eta_p^2 < .01$, no main effect of food type, $F(1, 361) = 1.74$, $p = .19$, $\eta_p^2 < .01$, and no interaction, $F(1, 361) = 2.63$, $p = .11$, $\eta_p^2 < .01$ (see the fourth row of Table 1).

Exploratory analysis. In short, our pre-registered analyses appear to offer no evidence in support of our predictions relating to ease-of-retrieval. Indeed, of our four dependent variables, the predicted interaction effect was only significant for one, and even for this variable – ratings of recent dietary healthiness – the number of cued events significantly affected only those participants in the unhealthy condition, and in the opposite direction than we predicted.

However, through exploratory analysis we observed that participants' ratings of task difficulty were associated significantly with several of our outcome variables, in the direction that fit with our predictions (see Table 2). That is to say, when participants found it difficult to recall instances of eating healthily, they rated themselves and their dietary choices as less healthy; the reverse was also true for some but not all dependent variables when participants tried to recall eating unhealthily. To explore the data further, we conducted exploratory mediation analyses using jamovi's (Version 2.3) Advanced Mediation Models module (Gallucci, 2020). Specifically, for each dependent variable we ran separate mediation models for the healthy and unhealthy conditions respectively, entering events cued (few vs. many) as the predictor, and participants' ratings of task difficulty as the mediator (see Figure 1). The results of all models are summarised in Table 2.

To begin, we entered participants' ratings of their recent dietary healthiness as the outcome variable. Starting with the healthy-foods participants, the total effect of the number of events cued was not significant. There was, however, a significant direct effect of the number of events cued, which was countered by a significant indirect effect via task difficulty, in the opposite direction (see the first row of data in Table 2). These results fit with the idea that generating more examples of healthy eating gave participants more evidence to suggest that they have eaten healthily of late, yet also evoked a sense of cognitive difficulty that participants interpreted as a sign they had *not* been healthy. Looking to the unhealthy-foods participants, mirroring the results of our pre-registered analyses above, there was a significant total effect of the number of events cued. But when this total effect was broken down, both the direct effect of the number of events cued, and the indirect effect via task difficulty were significant, in opposing directions. A similar pattern of results emerged when we entered participants' ratings of their general dietary healthiness as the outcome variable (see Table 1). Specifically, in both the healthy-foods and the unhealthy-foods models, there was no significant total effect of the number of events cued upon ratings of general healthiness, yet both the direct effects and the indirect effect via task difficulty were significant, in opposing directions.

We next repeated these mediation analyses with participants' PBQ scores as the outcome variable. In the healthy-foods condition, the total effect of the number of events cued was not significant. Similarly, there was no direct effect of the number of events cued, but the indirect effect via task difficulty was significant. By comparison, in the unhealthy-foods conditions, the total effect of the number of events cued was significant, and both the direct effect and the indirect effect via task difficulty were significant, in opposing directions.

Looking last at participant's FCQ scores, neither the total effect, nor the direct effect of number of cued events were significant in the healthy-foods conditions. However, the indirect effect via task difficulty was significant. Conversely, in the unhealthy-foods conditions, the total effect of number of events cued was significant, as was the direct effect, but the indirect effect via task difficulty was not significant.

Table 2. Mediation models showing the total, direct and indirect effects of the number of events cued on participants' dietary appraisals, eating preferences and intentions.

Experiment	Food type	Outcome variable	Mediation model path (as depicted in Figure 1): Total effect (Path c)	Direct effect (Path c′)	Indirect effect (Path a*b)	Events → Task difficulty (Path a)	Task difficulty → Outcome (Path b)
Exp. 1	Healthy	Recent healthiness	*B* = 0.20 [−0.23, 0.63], β = .07	*B* = 0.85 [0.44, 1.25], β = .29***	*B* = −0.65 [−0.92, −0.38], β = -.22***	*B* = 1.62 [1.07, 2.17], β = .40***	*B* = −0.40 [−0.50, −0.30], β = -.55***
		General healthiness	*B* = −0.12 [−0.50, 0.26], β = -.05	*B* = 0.40 [0.03, 0.77], β = .15*	*B* = −0.52 [−0.75, −0.29], β = -.20***	*B* = 1.62 [1.07, 2.17], β = .40***	*B* = −0.32 [−0.41, −0.23], β = -.50***
		PBQ score	*B* = −0.02 [−0.41, 0.36], β = -.01	*B* = 0.30 [−0.09, 0.70], β = .12	*B* = −0.33 [−0.52, −0.14], β = -.13***	*B* = 1.62 [1.07, 2.17], β = .40***	*B* = −0.20 [−0.30, −0.11], β = -.32***
		FCQ score	*B* = 0.00 [−0.17, 0.17], β = .00	*B* = 0.17 [−0.01, 0.34], β = .14	*B* = −0.17 [−0.26, −0.08], β = -.14***	*B* = 1.62 [1.07, 2.17], β = .40***	*B* = −0.10 [−0.15, −0.06], β = -.36***
	Unhealthy	Recent healthiness	*B* = −0.79 [−1.24, −0.34], β = -.25***	*B* = −1.31 [−1.78, −0.84], β = -.41***	*B* = 0.52 [0.26, 0.78], β = .16***	*B* = 1.69 [1.22, 2.17], β = .46***	*B* = 0.31 [0.18, 0.44], β = .36***
		General healthiness	*B* = −0.33 [−0.74, 0.08], β = -.12	*B* = −0.76 [−1.20, −0.32], β = -.27***	*B* = 0.43 [0.20, 0.66], β = .15***	*B* = 1.69 [1.22, 2.17], β = .46***	*B* = 0.25 [0.14, 0.37], β = .33***
		PBQ score	*B* = −0.39 [−0.78, 0.00], β = -.15*	*B* = −0.72 [−1.14, −0.30], β = -.27***	*B* = 0.33 [0.11, 0.54], β = .12**	*B* = 1.69 [1.22, 2.17], β = .46***	*B* = 0.19 [0.08, 0.31], β = .27***
		FCQ score	*B* = −0.21 [−0.39, −0.02], β = -.16*	*B* = −0.25 [−0.46, −0.04], β = -.19*	*B* = 0.04 [−0.05, 0.14], β = .03	*B* = 1.69 [1.22, 2.17], β = .46***	*B* = 0.02 [−0.03, 0.08], β = .07
Exp. 2	Healthy	Recent healthiness	*B* = 0.62 [0.22, 1.03], β = .23**	*B* = 1.18 [0.82, 1.54], β = .43***	*B* = −0.56 [−0.81, −0.30], β = -.20***	*B* = 1.29 [0.76, 1.81], β = .34***	*B* = −0.43 [−0.53, −0.34], β = -.58***
		General healthiness	*B* = 0.21 [−0.19, 0.60], β = .08	*B* = 0.64 [0.26, 1.02], β = .24***	*B* = −0.44 [−0.65, −0.22], β = -.16***	*B* = 1.29 [0.76, 1.81], β = .34***	*B* = −0.34 [−0.44, −0.24], β = -.48***
		PBQ score	*B* = 0.53 [0.16, 0.89], β = .21**	*B* = 0.83 [0.47, 1.20], β = .34***	*B* = −0.31 [−0.48, −0.13], β = -.12***	*B* = 1.29 [0.76, 1.81], β = .34***	*B* = −0.24 [−0.34, −0.14], β = -.36***
		VPCT score	*B* = 10.10 [1.04, 19.16], β = .17*	*B* = 17.05 [7.92, 26.19], β = .28***	*B* = −6.96 [−11.20, −2.72], β = -.11**	*B* = 1.29 [0.76, 1.81], β = .34***	*B* = −5.41 [−7.86, −2.96], β = -.33***
	Unhealthy	Recent healthiness	*B* = −0.35 [−0.77, 0.07], β = -.12	*B* = −0.92 [−1.42, −0.42], β = -.31***	*B* = 0.57 [0.25, 0.89], β = .19***	*B* = 2.49 [2.02, 2.96], β = .60***	*B* = 0.23 [0.11, 0.35], β = .32***
		General healthiness	*B* = −0.16 [−0.52, 0.21], β = -.06	*B* = −0.46 [−0.91, −0.01], β = -.18*	*B* = 0.30 [0.02, 0.57], β = .12*	*B* = 2.49 [2.02, 2.96], β = .60***	*B* = 0.12 [0.01, 0.23], β = .19*
		PBQ score	*B* = 0.13 [−0.21, 0.47], β = .05	*B* = 0.08 [−0.34, 0.51], β = .03	*B* = 0.04 [−0.21, 0.30], β = .02	*B* = 2.49 [2.02, 2.96], β = .60***	*B* = 0.02 [−0.08, 0.12], β = .03
		VPCT score	*B* = −1.60 [−9.53, 6.32], β = -.03	*B* = 0.73 [−9.12, 10.59], β = .01	*B* = −2.34 [−8.25, 3.58], β = -.04	*B* = 2.49 [2.02, 2.96], β = .60***	*B* = −0.94 [−3.30, 1.43], β = -.07

Note. * $p < .05$; ** $p < .01$; *** $p < .001$. PBQ = Party Behavior Questionnaire; FCQ = Food Choice Questionnaire; VPCT = Virtual Portion Creation Task.

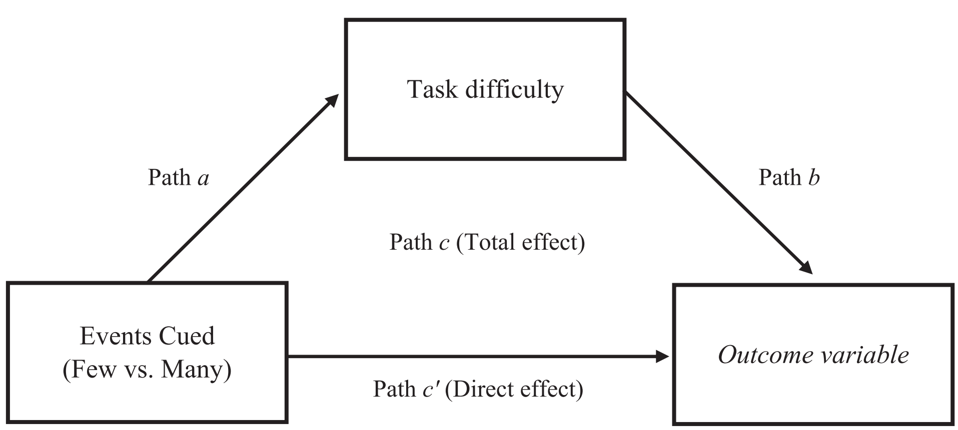

Figure 1. Conceptual mediation model.

To summarise, looking beyond the findings of our pre-registered analysis, these exploratory results are generally consistent with the idea that when appraising the healthiness of their eating behaviours, people rely partly on the amount of evidence they can retrieve from memory and partly on the subjective ease with which they retrieve that evidence. Put differently, these analyses provide some preliminary evidence that the weak overall effects seen in our pre-registered ANOVAs could be attributed to there being two opposing effects that partially or wholly counteract one another. The results from this mediation approach must be interpreted with caution, because even though we experimentally manipulated the number of events cued, we cannot infer the direction of causality between retrieval difficulty (i.e., the mediator) and our outcome variables. We return to elaborate further on this important point later, after attempting to replicate the findings of Experiment 1.

Experiment 2

Contrary to our initial hypotheses, the results of the pre-registered analyses in Experiment 1 provide minimal evidence that people's appraisals of their dietary healthiness were shaped by the number of memories of eating (un)healthily that they attempted to recall. One possible explanation is that many-events participants in Experiment 1 did not experience sufficient difficulty when trying to recall eight instances of (un)healthy eating (i.e., on average they rated the difficulty as $M = 3.88$ out of 7). For this reason, our number of cued events manipulation could have been too weak to yield overall effects upon perceptions of healthiness. In Experiment 2 we tested our original hypotheses again, whilst making the task somewhat more challenging for many-events participants.

One additional limitation of Experiment 1 concerns the use of the PBQ as a measure of participants' eating preferences. This measure originates from the false-memory literature (Bernstein et al., 2005), but it provides a metric of participants' willingness to consume various foods rather than their eating *intentions* per se. This is an important distinction to make, given that frameworks such as the Theory of Planned Behavior suggest that it is people's behavioural intentions that ultimately predict their behaviour (Ajzen, 1991). In Experiment 2, participants therefore completed a validated measure of their eating intentions, a Virtual Portion Creation Task (VPCT), which has been shown to be a good predictor of actual food consumption (Wilkinson et al., 2012). Experiment 2 was otherwise a direct replication of Experiment 1.

Method

The procedure, hypotheses, and analysis plan for this experiment were pre-registered prior to data collection through AsPredicted.org, and can be found at https://aspredicted.org/KEF_YPI.

Participants and design. Initially, 426 UK residents were recruited via Prolific in exchange for a small fee (£3.00). We created custom pre-screening criteria to recruit participants with no known food allergies or dietary restrictions, who had not taken part in Experiment 1. Per our pre-registered criteria, 60 participants were removed from the analysis: 30 who reported a BMI outside 18.5–29.9,[1] and 30 who failed to provide the minimum number of "valid" events during the memory task, using the same event-coding criteria as Experiment 1. An additional two participants were removed for not providing their weight, thus making it impossible to calculate their current BMI. This left a final sample of 364 participants (165 males, 198 females, 1 other; $M_{age} = 34.8$, $SD = 12.9$, range = 18–75; $M_{BMI} = 24.08$, $SD = 2.60$, range = 18.59–29.70). Again, the study used a 2 (events cued: few vs. many) × 2 (food type: healthy vs. unhealthy) between-subjects design, whereby participants were randomly allocated to one of the four experimental conditions; few-healthy ($n = 89$), many-healthy ($n = 82$), few-unhealthy ($n = 95$), many-unhealthy ($n = 98$).

Materials

Virtual Portion Creation Task. As a measure of people's eating intentions – which could be administered online – participants completed the VPCT. Participants were asked to imagine that they were going to receive a meal tomorrow comprised of six snacks; three were LED foods (apples, carrots, grapes), and three were HED foods (chocolate chip cookies, Doritos, M&M's). For each snack, we created a set of 21 photographs depicting different quantities of the snack on a white plate, starting at 0 g and increasing in 10 g increments to a maximum of 200 g (see Figure 2 for examples). Per Charbonnier et al. (2016), each photo was taken from a tripod mounted camera-phone set to a 45° downward angle so as to mimic a person's point-of-view during a meal. To minimise variations in lighting conditions across stimuli, the photo subject was illuminated by light boxes placed either side of the tripod. These images were subsequently mapped onto separate 21-point horizontal sliders for each food, so that each interval on the slider revealed a different image of that food in increasing quantities.

Initially, participants saw images of six empty plates, each of which was labelled as a different snack. Underneath each image was a slider that could be used to adjust the depicted portion size of the corresponding foodstuff. Moving the slider to the right increased the pictured portion size, whereas moving the slider to the left decreased the pictured portion size. For each snack, participants were instructed to adjust the slider to represent the amount of that food they would want to receive as part of their fictitious meal. We recorded their selections for each foodstuff as the weight (in grams) of the chosen portion size. Having made their selections, participants were instructed to review their choices carefully before

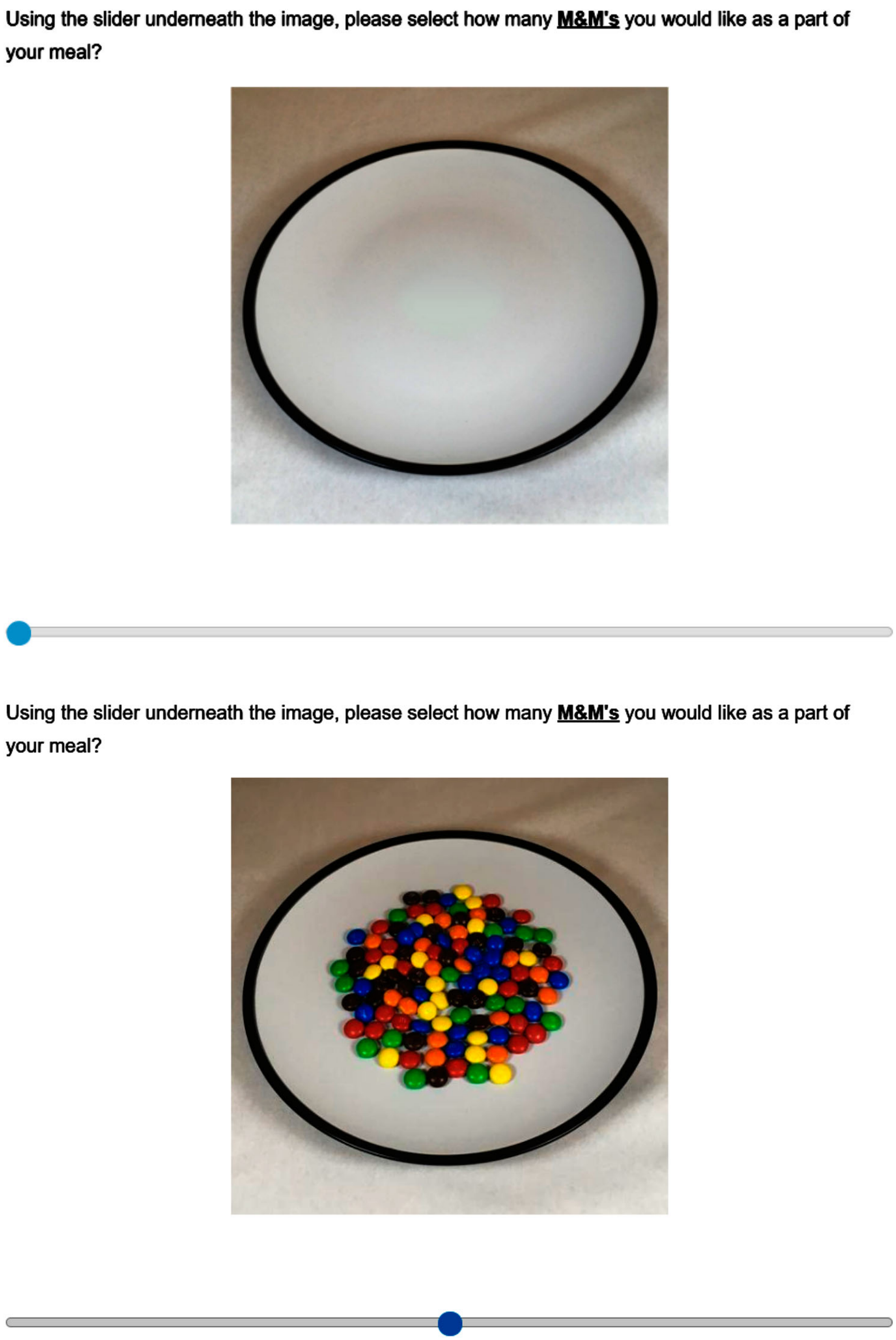

Figure 2. Example of two differently selected portion sizes on the Virtual Portion Creation Task.

continuing. Responses were averaged across all the HED foods and all the LED foods respectively, before subtracting the HED_{Mean} from the LED_{Mean} to produce a single score, whereby higher scores indicated meals that comprised more "healthy" than "unhealthy" foods.

Procedure. Participants completed the study online through Qualtrics via a desktop computer. They followed the same procedure as in Experiment 1, the main difference being that participants completed the VPCT instead of the FCQ. Participants assigned to the many-events conditions in Experiment 1 had found the memory task to be only mildly challenging; therefore, to increase the difficulty of the task, many-events participants were now asked to recall 10, rather than eight, examples of eating "healthily" or "unhealthily". In addition, the findings of a small pilot study suggested that participants found it harder to generate examples of *meals* as compared with the less specific prompt used in Experiment 1; therefore, across all conditions in Experiment 2 we changed the wording of the memory task to read: "Please try to recall [two/ten] examples of recent occasions, for example in the past month, when you have eaten a [healthy/unhealthy] meal".[2]

Results

Main analysis

Manipulation checks. We coded memory responses as per Experiment 1. In the final dataset, there were no significant differences between conditions in terms of baseline hunger, $F(3, 360) = 0.87$, $p = .46$, and fullness, $F(3, 360) = 0.81$, $p = .49$, or the DEBQ subscales of dietary restraint, $F(3, 360) = 1.52$, $p = .21$, external eating, $F(3, 360) = 1.22$, $p = .30$, or emotional eating, $F(3, 360) = 0.03$, $p = .99$.

Many-events participants recalled an average of 8.61 memories across both conditions ($M_{Healthy} = 8.82$, $SD = 1.98$; $M_{Unhealthy} = 8.43$, $SD = 2.39$; range = 3-10), with 58.1% of participants providing all 10 requested examples. Again, we wanted to ensure that our few-vs-many manipulation influenced subjective task difficulty, and this was the case: a 2 (number of events cued: few vs. many) × 2 (food type: healthy vs. unhealthy) between-subjects ANOVA of participants' task difficulty ratings again found a significant main effect of the number of events cued, in that participants found it easier to recall a few examples of meals eaten ($M = 2.38$, $SD = 1.62$), than many examples ($M = 4.31$, $SD = 1.87$), $F(1, 360) = 109.68$, $p < .001$, $\eta_p^2 = .23$. There was again a significant effect of food type; however, this time participants found it slightly easier to recall healthy ($M = 3.11$, $SD = 1.87$) than unhealthy meals ($M = 3.53$, $SD = 2.09$), $F(1, 360) = 4.25$, $p = .04$, $\eta_p^2 = .01$. In addition, the two-way interaction was significant, $F(1, 360) = 11.17$, $p < .01$, $\eta_p^2 = .03$ (see first row of Table 3). Post-hoc *t*-tests showed that participants in both the healthy and unhealthy conditions found it easier to recall few events than many events, but that this effect was larger in the unhealthy-foods conditions, $t(191) = 10.33$, $p < .001$, $d = 1.49$, than in the healthy-foods conditions, $t(169) = 4.77$, $p < .001$, $d = 0.73$.

Perceptions of healthiness. A 2 (number of events cued: few vs. many) x 2 (food type: healthy vs. unhealthy) between-subjects ANOVA of participants' healthiness ratings of their recent diets found no significant main effect of the number of events cued ($M_{Few} = 4.32$, $SD = 1.43$; $M_{Many} = 4.41$, $SD = 1.49$; $F(1, 360) = 0.85$, $p = .36$, $\eta_p^2 < .01$). The main effect of food type was again significant, with participants forming more favourable appraisals of their recent diets after recalling healthy meals ($M = 4.60$, $SD = 1.39$), rather than unhealthy meals ($M = 4.15$, $SD = 1.49$), $F(1, 360) = 9.50$, $p < .01$, $\eta_p^2 = .03$. Importantly, the predicted two-way interaction was also significant, $F(1, 360) = 10.46$, $p < .01$, $\eta_p^2 = .03$ (see second row of Table 3). Contrary to our initial hypotheses, post-hoc *t*-tests found that participants who tried to recall many examples of eating healthily formed healthier impressions of their recent diets ($M = 4.93$, $SD = 1.28$), than did those who recalled few examples of eating healthily ($M = 4.30$, $SD = 1.42$), $t(169) = 3.01$, $p < .001$, $d = 0.47$. But this time, participants who tried to recall many examples of eating unhealthily formed similar appraisals of their recent dietary healthiness ($M = 3.98$, $SD = 1.53$), as did those who recalled few examples of eating unhealthily ($M = 4.33$, $SD = 1.45$), $t(191) = 1.62$, $p = .11$, $d = 0.23$.

A separate ANOVA of participants' appraisals of the general healthiness of their diets again found no main effect of the number of events cued ($M_{Few} = 4.76$, $SD = 1.34$; $M_{Many} = 4.77$, $SD = 1.29$; $F(1, 360) = 0.03$, $p = .87$, $\eta_p^2 < .001$). Likewise, there was no main effect of food type ($M_{Healthy} = 4.78$, $SD = 1.33$; $M_{Unhealthy} = 4.74$, $SD = 1.30$; $F(1, 360) = 0.11$, $p = .74$, $\eta_p^2 < .001$), nor a two-way interaction, $F(1, 360) = 1.73$, $p = .19$, $\eta_p^2 < .01$ (see the third row of Table 3).

Food preferences. There was a significant main effect of the number of eating memories recalled on participants' PBQ scores, in that many-events participants chose a greater proportion of healthier, LED snacks ($M = -0.03$, $SD = 1.27$), than few-events participants ($M = -0.33$, $SD = 1.17$), $F(1, 360) = 6.58$, $p = .01$, $\eta_p^2 = .02$. The main effect of food type was also significant, with participants making healthier selections after recalling instances of eating healthily ($M = -0.01$, $SD = 1.24$), rather than unhealthily ($M = -0.33$, $SD = 1.21$), $F(1, 360) = 7.05$, $p < .01$, $\eta_p^2 = .02$. However, the interaction between the number of eating memories recalled and food type was not significant, $F(1, 360) = 2.48$, $p = .12$, $\eta_p^2 < .01$ (see the fourth row of Table 3).

Food intentions. Lastly, we repeated this analysis with participants' VPCT scores. There was no significant main effect of the number of events cued on the healthiness of people's food choices ($M_{Few} = 39.9$, $SD = 29.0$; $M_{Many} = 43.6$, $SD = 30.3$; $F(1, 360) = 1.92$, $p = .17$, $\eta_p^2 < .01$). There was, however, a significant main effect of food type, in that healthy foods participants chose a greater proportion of LED snacks ($M = 46.94$, $SD = 30.62$), than unhealthy-events participants ($M = 37.12$, $SD = 28.10$), $F(1, 360) = 10.68$, $p < .01$, $\eta_p^2 = .03$. The two-way interaction was, however, not significant, $F(1, 360) = 3.64$, $p = .06$, $\eta_p^2 = .01$ (see fifth row of Table 3).

Exploratory analysis.[3] Based on the findings of Experiment 1, we repeated the exploratory mediation analyses, running separate mediation models for the healthy-foods and unhealthy-foods conditions for each of our dependent variables. Again, the results of all models are summarised in Table 2.

Starting with participants' ratings of their recent dietary healthiness as our outcome variable, the total effect of the number of events cued in the healthy-foods conditions was significant. As in Experiment 1, there was a significant direct effect of the number of events cued, as well as a significant indirect effect via task difficulty in the opposite direction. Thus, recalling multiple examples of eating healthily could possibly have been construed as evidence

Table 3. Means (SDs) for recall difficulty, perceptions of healthiness, and eating preferences and intentions in Experiment 2.

	Number of events recalled			
	Few		Many	
	Healthy	Unhealthy	Healthy	Unhealthy
Task difficulty	2.49 (1.64)	2.26 (1.60)	3.78 (1.89)	4.76 (1.75)
Recent healthiness	4.30 (1.42)	4.33 (1.45)	4.93 (1.28)	3.98 (1.53)
General healthiness	4.69 (1.32)	4.82 (1.36)	4.89 (1.33)	4.66 (1.24)
PBQ Score	−0.26 (1.21)	−0.40 (1.14)	0.27 (1.22)	−0.27 (1.27)
VPCT Score	42.10 (28.70)	37.93 (29.28)	52.20 (31.91)	36.33 (27.02)

PBQ = Party Behavior Questionnaire; VPCT = Virtual Portion Creation Task.

of a person's prior healthiness, yet also evoked a sense of difficulty that led to an opposite effect on participants' judgments. By comparison, in the unhealthy-foods conditions, the total effect of the number of events cued was not significant. But upon breaking down this total effect, we see a significant direct effect of the number of events cued that is countered by a significant indirect effect via task difficulty, in opposing directions. Again, the same pattern of results emerged when entering participants' ratings of the general healthiness of their diets as the outcome measure.

Looking next to participants' food preferences and intentions, we repeated these analyses with participants' PBQ scores and VPCT scores respectively. Starting with participants' PBQ scores, the total effect of the number of cued events was significant in the healthy-foods conditions. The direct effect of the number of events cued was also significant, as was the indirect effect via task difficulty in the opposite direction. The same pattern was true when entering participants' VPCT scores as the outcome variable. But contrary to the findings of Experiment 1, in the unhealthy-foods conditions neither the total, direct, or indirect effects were significant for either the PBQ or VPCT.

Exploratory covariate analysis. Collectively, the findings from our exploratory mediation models fit with the notion that people's appraisals of their dietary healthiness and subsequent food preferences and choices are informed by *both* the number of remembered eating experiences and the subjective difficulty of recalling those memories. However, one problem with these exploratory analyses is that the experienced difficulty of retrieving instances of (un)healthy eating may be confounded with participants' *actual* healthiness. That is to say, habitually "healthy" eaters might legitimately find it difficult to recall examples of eating unhealthily, irrespective of the experimental manipulation, and vice versa for habitually "unhealthy" eaters.

Were this confound playing a major role in the findings of our mediation analyses, we might expect that perceived task difficulty would correlate with our closest proxy measure of participants' habitual healthiness, namely their self-reported BMI. But this was not the case, as in both food type conditions of both experiments, the correlations between BMI and the various outcome measures were all non-significant (all $p > .22$). To further test this counter-explanation for our findings, we reran all our mediation models for both experiments, adding participants' self-reported BMI as a covariate (see Tables S2–S5 of the supplementary materials). In all but one case, the statistical significance of the total, direct, and indirect effects remained unchanged from the analyses reported above; the only notable difference being that for unhealthy-foods participants in Experiment 2, after adding BMI as a covariate, the direct and indirect effects of the number of events cued upon participants' ratings of general healthiness were no longer statistically significant (both $p > .12$), although the overall pattern of results was unchanged. These covariate analyses lend some further support to the argument that perceived task difficulty plays a role in the people's health-related judgments, rather than it being entirely confounded with participants' baseline healthiness.[4]

General discussion

The present experiments set out to understand how cueing people to recall many – rather than few – memories of eating (un)healthily would shape their self-appraised dietary healthiness, and their subsequent food choices and preferences. Overall, our pre-registered analyses provide little support for our prediction that retrieving many memories of eating healthily would lead people to perceive themselves as *less* healthy, nor for our prediction that retrieving many memories of eating unhealthily would lead people to perceive themselves as *more* healthy. Indeed, in both experiments we found significant interaction effects only for people's self-appraised recent healthiness, and not for their general healthiness or any of their "downstream" judgments of food choices and preferences. Moreover, even where those significant interactions did occur, the effects fell in the opposite direction to that predicted by the ease-of-retrieval account. Taken together, our pre-registered analyses provide surprisingly weak evidence that attempting to retrieve multiple memories of eating (un)healthily affected people's dietary judgments.

But contrary to these findings, the results from our follow-up exploratory analyses suggest that retrieval difficulty might in fact have played a sizeable role in shaping participants' dietary appraisals, as well as their "downstream" food choices and preferences. Specifically, our mediation analyses suggest that the null total effects of the number of cued events (as indicated in our pre-registered analysis), could in many instances be explained by the existence of both a significant direct effect in the non-predicted direction, plus a significant indirect effect – via retrieval difficulty – in the predicted direction. Put differently, participants who tried to recall many memories of eating healthily may have appraised their diets more favourably and made healthier food choices (i.e., the direct effect). Yet attempting to recall more memories might have also increased their subjective sense of retrieval difficulty, which was associated with a tendency to perceive themselves as *less* healthy and to make unhealthy food selections.

This interpretation of our findings aligns well with the findings of Michael et al. (2014), who used a similar few-vs-many-memories methodology to prime participants' perceptions of how much regret they had experienced in the past. Similar to our present findings, Michael et al.'s overall results pointed in the opposite direction than would be predicted by an ease-of-retrieval account, indicating that what mattered most in determining people's judgments of regret was the amount of evidence (of regretfulness) they retrieved from memory. But like ours, their data also pointed to a counteracting role for ease-of-retrieval. Specifically, people who found it easy to recall regret tended to estimate their regretfulness as higher, and people who were asked to recall regrets of inaction (which tended to be easier) considered themselves more regretful than did people asked to recall regrets of action (which tended to be more difficult). Our present findings therefore fit with the emerging literature in suggesting that both quantity of evidence (number of memories) and ease-of-retrieval could play counteracting roles in people's judgments.

Building upon previous studies in which participants recalled a single health-related memory, our findings have practical implications for health practitioners seeking to understand, and ultimately improve, people's health behaviours. Whereas studies have previously advocated the use of cueing people's health-related memories to improve their subsequent behaviour (e.g., Biondolillo & Pillemer, 2015; Merson & Pezdek, 2019), the present findings suggest that the subjective ease with which those memories are retrieved could in fact have a nullifying effect on the desired behavioural outcome. Indeed, prompting a person to recall multiple examples of eating healthily might – as indicated by the significant direct effect in our mediation analysis – lead them to infer that they are a "healthy" eater, and to therefore make healthier food choices than if they were asked to recall just one memory. The temptation then might be to press people to recall increasingly greater detail about their past eating experiences, in order to promote future healthiness. The problem is that should this repeated probing elicit a sense of retrieval difficulty, then it could potentially eliminate, or even reverse, the desired effect. In this way, delving into people's prior experiences of eating healthily might counterproductively lead them to eat *less* healthily in future. Given that obesity-related factors, such as an unhealthy diet, are associated with poorer episodic memory (Loprinzi & Frith, 2018), those most likely to benefit from such an intervention might find it especially difficult to recall instances of eating healthily. Careful attention should therefore be paid when probing people's memories to avoid these potential backfire effects when memory retrieval is experienced as difficult. These data also suggest that prompting people to remember past dietary lapses might actually encourage further unhealthy eating if recall is experienced as easy. Therefore, for cued memory retrieval to function as a possible intervention strategy to improve people's health-related behaviours, careful attention should be paid to these pitfalls.

As we noted above, we must be reasonably cautious in the conclusions we draw from our exploratory mediation analyses. Crucially, these analyses raise questions about causation in that we cannot determine with certainty the extent to which participants' subjective sense of retrieval was a cause of, rather than a consequence of, their health-related judgments. In support of the former explanation, our exploratory findings were largely unchanged when we controlled for baseline differences in participants' self-reported BMI (and the DEBQ subscales, see Footnote 4). Nevertheless, BMI is not always considered a good proxy for healthiness (e.g., Nuttall, 2015). Future research should therefore take steps to account for the confound between people's actual baseline healthiness and the number of episodes of being (un)healthy they might easily retrieve. One approach could be to gather informative baseline data about participants' eating preferences, more objective measures of dietary intake (e.g., skin carotenoids), and indeed, measures of participants' episodic memory ability in general, such that these individual differences can be statistically controlled. In taking this statistical-control approach it may also help to more tightly constrain the memories that participants retrieve. For instance, many-events participants in this cueing paradigm may retrieve memories spanning a wider time-period than would few-events participants. For the purposes of reducing statistical noise in the data it may therefore be useful to cue memories of events that occurred within a narrower time-frame than we did here (i.e., "the past month"). Aside from this statistical-control approach, an alternative approach to tackling this problem would be to manipulate task difficulty in ways that are unlikely to be associated with pre-manipulation individual differences in the outcome variable (a limitation that applies to most "few vs. many" memory-cueing studies, e.g., Michael et al., 2014). For example, we might ask all participants to recall the same number of eating experiences, but to describe more vs. less *specific detail* about those experiences. Describing cued memories in great detail might, in principle, increase the subjective difficulty of the task, yet should not be any more difficult for baseline unhealthy individuals than for their healthy counterparts.

One further limitation of these analyses concerns our use of single-item measures to assess people's perceived dietary healthiness, which might not assess the construct in sufficient detail to represent a reliable and valid index of perceived healthiness. Whereas our approach represents an important first step, future research should use more comprehensive and validated measures (e.g., the healthy-eater identity questionnaire, Strachan & Brawley, 2008). In addition, it could be argued that by measuring task difficulty immediately before participants rated their dietary healthiness, our procedure might have biased their responses by making their metacognitive sense of difficulty especially salient. However, a recent meta-analysis speaks against the likely seriousness of this limitation, finding that the timing of the task-difficulty question has no meaningful impact on effect sizes in ease-of-retrieval studies (Weingarten & Hutchinson, 2018). Finally, it is important to note that measures of people's hypothetical food choices and motivations do not necessary correspond to their *actual* eating behaviour. Future memory research should seek to build upon our memory-cueing procedure by using follow-up behavioural tasks in which participants can choose to actually consume (un)healthy snacks.

In conclusion, the present findings shed light on how the episodic memories that people retrieve can shape their judgments about the healthiness of their diets. We suggest that although people's judgments may be based, in part, on the amount of evidence they can recall of eating (un)healthily, if retrieving this evidence feels subjectively difficult then it might negate or altogether reverse this effect. Whereas these findings suggest that prompting people to retrieve multiple examples of eating healthily, or of dietary lapses, might be successful in encouraging healthier self-perceptions and food choices, we should also be aware of the possibility of backfire effects.

Notes

1. Due to the large number of exclusions in Experiment 1 based on participants' self-reported BMI, we reduced the lower bound to 18.5 in line with common standards for a "healthy" BMI range.
2. In hindsight, the prompts used in both Experiments 1 and 2 leave room for participants to misinterpret that our focus was on them remembering the occasion itself, rather than the foods they consumed. Whereas this possibility could be remedied with amended wording in future studies, our data showed that in the vast majority of cases participants in both experiments responded as intended, by describing the foods they had consumed.
3. Note these analyses remain "exploratory" in nature, as the decision to look at task difficulty as a possible mediator was only taken after data collection for both experiments was completed.
4. As a means to further control for individual differences in eating behaviour, we also ran covariate analyses that included each of the three DEBQ subscales (restrained eating, emotional eating, and external eating) as covariates in addition to BMI. These analyses produced results that were very closely comparable to those of the models with BMI as the only covariate. Specifically, for perceptions of recent healthiness, the statistical significance of all mediation paths was identical. The same was true for perceptions of general healthiness, except that the direct effect of number of events cued was no longer significant for participants in the "healthy" conditions of Experiment 1 ($p = .08$). In terms of food preferences, the four-covariate analyses led to identical conclusions as the one-covariate analyses, with the exception that the total effect of the number of events cued on PBQ scores was no longer significant in the "unhealthy" conditions of Experiment 1 ($p = .07$; although the direct and indirect pathways in these models remained significant in opposing directions). In terms of food intentions, the conclusions from the FCQ data in Experiment 1 were unchanged by adding these three extra covariates. The VPCT results in Experiment 2 were also unchanged by adding these three extra covariates, except that in the "healthy" conditions, the total effect of the number of events cued on VPCT scores was no longer significant ($p = .09$; although again, the direct and indirect pathways in these models remained significant in opposing directions).

Open Scholarship

This article has earned the Center for Open Science badge for Preregistered. The materials are openly accessible at https://aspredicted.org/PLA_VKD, and https://aspredicted.org/KEF_YPI.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The author(s) reported there is no funding associated with the work featured in this article.

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