

Pleasure in the mind: Restrained eating and spontaneous hedonic thoughts about food [☆]

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Abstract

Two experiments examined the impact of exposure to social food cues on the spontaneous activation of hedonic thoughts about food in restrained and unrestrained eaters. Consistent with hypotheses, it was found that restrained eaters, but not unrestrained eaters, spontaneously activate hedonic food thoughts upon reading behavior descriptions that involved a palatable food item. Moreover, it was shown that the activation of hedonic food thoughts in restrained eaters occurred on-line. These findings are discussed in the context of a motivational account of eating-regulation and the possible role of the spontaneous activation of hedonic thoughts about food in the self-regulation of restrained eaters.

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Introduction

In Western societies, dieting has become a popular means of weight-regulation. Recent data indicate that of a large sample of US adults, 24% of men and 38% of women were trying to lose weight (Kruger, Galuska, Serdula, & Jones, 2004). However, it seems that most dieters are not able to follow their diet consistently, as there are only a few able to reduce their body weight in the long term (Jeffery et al., 2000). It has been suggested that a so-called “toxic environment”, promoting unhealthy eating and activity patterns, contributes to these difficulties in weight-regulation and to the development of obesity in industrialized societies (Hill & Peters, 1998; Wadden, Brownell, & Foster, 2002). Indeed, in daily life we are surrounded by other

people eating and by cues that indicate the availability of all kinds of tasty treats. How do dieters react to the continuous presence of such temptations? We propose that the exposure to palatable food cues makes the pleasurable, hedonic aspects of food particularly accessible in the mind of dieters, and that this process makes the consumption of palatable food more likely. In the present article, two studies are reported which tested whether the activation of spontaneous hedonic thoughts about food is more likely to ensue in dieters than in non-dieters. Moreover, we examine whether not only palatable food itself, but also the perception of other people eating it can act as such a hedonic cue.

The impact of external food cues on chronic dieters

Research on the behavioral and physiological reactions to food cues has shown that dieters respond more strongly to stimuli representing palatable food than non-dieters. Much of this research was inspired by the concept of “restrained eating” (i.e., chronic dieting, Herman & Polivy, 1980) and the counterintuitive finding that restrained eaters have a tendency to overeat after having been induced by the

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experimenter to consume a prescribed amount of palatable and typically highly calorific food (a so-called “preload”; Herman & Mack, 1975; for an overview, see Ruderman, 1986). Herman and Polivy argued that while unrestrained eaters regulate their eating behavior by responding to internal cues such as hunger and satiety, restrained eaters regulate their food consumption cognitively by adhering to self-set dieting rules (Herman & Polivy, 1984). Once they have violated these rules, for example by consuming an experimental “preload” such as a high-calorie milkshake, they overeat because they feel that their diet is ruined anyway. This motivational explanation of overeating has been termed the “what-the-hell-effect” (Herman & Mack, 1975).

However, later studies indicated that restrained eaters could be induced to overeat not only by the consumption of an actual preload, but also by the mere perception of palatable food. Restrained eaters who were confronted with the smell or sight of palatable food or who had been instructed to imagine a palatable food, ate more after this experimental manipulation than unrestrained eaters. Unrestrained eaters were not influenced by the food cues or even reduced their consumption (Fedoroff, Polivy, & Herman, 1997; Jansen & Van den Hout, 1991; Rogers & Hill, 1989). Moreover, restrained eaters were found to respond with higher levels of salivation to the presence of palatable food (Brunstrom, Yates, & Witcomb, 2004; Tepper, 1992) and to the smell of food (LeGoff & Spigelman, 1987). Finally, olfactory and cognitive food cues were also shown to elicit stronger cravings for the presented food in restrained than in unrestrained eaters (Fedoroff et al., 1997; Fedoroff, Polivy, & Herman, 2003).

The work reviewed above shows that external cues representing palatable food trigger stronger eating-oriented reactions in restrained eaters than in unrestrained eaters, even when no preload has been consumed. These data may suggest that restrained eaters’ behavioral reactions are the result of hedonic thoughts about food (e.g., delicious, tasty) that are triggered by the processing of palatable food cues (e.g., pizza). Such hedonic thoughts represent the evaluative meaning of a stimulus in terms of pleasure, which is one of the basic evaluative dimensions that is accessed when people perceive and categorize stimuli in their environment (Tesser & Martin, 1996). Hedonic thoughts about food refer to the pleasure that can be derived from eating the food, and as such, they might be a powerful trigger of actual eating behavior (Epstein, Truesdale, Wojcik, Paluch, & Raynor, 2003). The findings reviewed above suggest that these hedonic thoughts of restrained eaters are triggered spontaneously, that is without the conscious intent of the perceiver, since they potentially interfere with the conscious dieting goal of restrained eaters. In order to test this possible mechanism underlying the overeating of restrained eaters, the present studies examined the spontaneous activation of the hedonic concept in response the processing of palatable food cues.

The work on delay of gratification by Mischel and his colleagues (e.g., Mischel, Cantor, & Feldman, 1996;

Mischel, Shoda, & Rodriguez, 1989) lends support to the notion that the difficulties of restrained eaters in resisting palatable food could be due to the way in which they cognitively represent it. Mischel’s work has amply demonstrated that a focus on the “hot”, consummatory features of food stimuli makes delay of gratification much more difficult (Mischel et al., 1996). In line with these findings, we suggest that restrained eaters are more likely to access such hedonic representations of palatable food when they are exposed to food cues, and therefore to give in to the temptations of palatable food.

Palatable food itself may not be the sole cue that triggers hedonic mental processes in dieters. Another external cue that has been found to exert strong effects on eating behavior is the presence of other people eating. It is a well-established finding that humans eat more in a group than when alone, and that the presence of another person eating a lot or eating little can similarly facilitate or inhibit our eating behavior (for an overview, see Herman, Roth, & Polivy, 2003). Accordingly, to more fully understand and appreciate the role of food cues in the spontaneous activation of hedonic processes, it is important to examine how the processing of eating behavior and specific food objects interact in the elicitation of hedonic thoughts in unrestrained and restrained eaters.

The present research

We report two experiments designed to investigate whether restrained eaters activate hedonic thoughts when they perceive another person enjoying good food. Previous research has shown that, upon perceiving the behavior of another person, people infer or activate certain psychological characteristics (e.g., traits or goals) implied by, or associated with the behavior (Hassin, Aarts, & Ferguson, 2005; Uleman, Newman, & Moskowitz, 1996), even without explicit instructions or conscious intentions to do so. Although the activation of these characteristics is mainly studied in isolation, recent research shows that it has direct implications for the perceiver’s own behavior (Aarts, Gollwitzer, & Hassin, 2004). In the present research, we specifically examined whether restrained eaters activate hedonic thoughts when they perceive someone eating palatable food. As hedonic thoughts refer to the pleasure-related dimension of evaluations, they will make the consumption of palatable foods more likely (Aarts et al., 2004; Mischel et al., 1996). Accordingly, examining the impact of social food cues on the activation of hedonic thoughts about food in restrained eaters may help to better understand the process that leads restrained eaters to abandon their diet and overeat in response to cues such as the sight, smell or taste of palatable food.

Study 1

The first study serves as an initial test of our hypothesis that restrained eaters, but not unrestrained eaters,

spontaneously think about the hedonic aspects of food when perceiving palatable food or the eating behavior of another person. In this study, we used the probe recognition task (McKoon & Ratcliff, 1986), which assesses the spontaneous activation of certain concepts during text comprehension. In the probe recognition task, participants are presented with a number of behavior descriptions. Each behavior description is immediately followed by a probe word, and participants are asked to respond to the probe word as quickly and accurately as possible by indicating whether it has been part of the preceding sentence or not. On the critical trials, the probe word may be suggested by the preceding sentence without being explicitly mentioned in it. Upon reading the behavior description, the accessibility of the implied concept increases, thereby interfering with the required “no”-answer. The processes assessed by the probe recognition task can be considered spontaneous because participants are not instructed to think about certain concepts when they read the behavior descriptions, rather, they are merely instructed to read the text (McKoon & Ratcliff, 1986).

In the present study, we presented participants with behavior descriptions which involved an actor and a food item. However, these behavior descriptions varied systematically on two dimensions, namely the palatability of the food item mentioned, and whether the actor was actually eating the food. This way, we not only tested for the spontaneous occurrence of hedonic thoughts about food, but we also examined whether such thoughts are activated by the processing of both palatable food words and the eating behavior of another person.

Given the empirical evidence showing that restrained eaters display stronger eating-oriented reactions to palatable food cues than unrestrained eaters, we hypothesized restrained eaters’ response latencies to be higher on trials involving palatable food compared to trials with neutral food. Reading about palatable food should activate in restrained eaters hedonic thoughts about food, thereby slowing down the correct “no”-answer to the hedonic food word following the behavior description.

Methods

Participants and design

One hundred and seven students (84 women, 23 men) of Utrecht University participated in the study in exchange for course credit or €4. The experiment had a 2 (food object: palatable vs. neutral) \times 2 (actor’s behavior: eating vs. other) design with the last factor as a within participants factor, and with dietary restraint as a continuous variable. Participants were randomly assigned to either the palatable food condition or to the neutral food condition. The experimental sentences contained behavior that explicitly refers to eating, and behavior that does not explicitly refer to eating. Dietary restraint was measured by means of the Concern for Dieting subscale of the Revised Restraint Scale (Herman & Polivy, 1980, see Appendix A). Gender had no effects on the results reported below.

Materials

Participants were presented with 24 experimental trials and 108 filler trials, with each trial consisting of a sentence followed by a probe word. Of the experimental sentences, there were 6 sentences with an eating behavior and palatable food (e.g., “Bill is eating a big piece of apple pie.”), 6 sentences with an eating behavior and neutral food (“Bill is eating a big piece of rye bread.”), 6 sentences with no eating behavior and palatable food (“Bill is giving away a big piece of apple pie.”), and 6 sentences with no eating behavior and neutral food (“Bill is giving away a big piece of rye bread.”; see Appendix B). Sentences with and without an eating behavior were on average equally long. All experimental sentences were followed by a hedonic probe word that had not been part of the sentence, such as “tasty”, thus requiring a “no”-response (see Appendix B).

Of the 108 filler trials, 12 trials were eating-related sentences followed by a non-food probe that had been part of the sentence, thereby requiring “yes” as the correct response. These sentences were included in order to prevent participants from expecting that all eating-related sentences required “no” as the correct response. The remaining 96 filler trials were unrelated to food or eating. In total, half of all trials required “yes” and half required “no” as the correct answer. All eating-related trials were presented in random order and interspersed between the filler trials in order to conceal from participants the true purpose of the study.

Procedure

Upon arrival at the laboratory, participants were seated in individual cubicles containing a desktop computer. All materials and instructions were presented on the computer. Participants were instructed to read each sentence carefully and to indicate as quickly and as accurately as possible whether the probe word that followed the sentence had been part of the sentence or not. This could be done by pressing the clearly labeled “yes”- or “no”-key on the keyboard of the computer. The probe recognition task began with 5 practice trials in order to familiarize participants with this procedure.

Each trial consisted of a fixation line in the middle of the screen for 1000 ms, the presentation of the sentence for 2000 ms, a blank screen for 1000 ms and another fixation line for 500 ms. Subsequently, the probe word was presented and remained on the screen until the participant had responded by pressing the “yes”-button or the “no”-button.

After completing the probe recognition task, participants were asked to fill out the Revised Restraint Scale (Herman & Polivy, 1980). Finally, they were debriefed, paid, and thanked.

Results

Response latencies

The main dependent variable was the time it took participants to indicate whether the hedonic probe word had been part of the preceding sentence or not. Response

latencies of incorrect responses or larger than three standard deviations above the mean were excluded from analyses (2%, no differences between conditions; see also Hassin et al., 2005).

Response latencies were analyzed in the General Linear Model in a 2 (food object: palatable vs. neutral) \times 2 (actor's behavior: eating vs. other) design with dietary restraint as a continuous variable. This analysis revealed the expected though only marginally significant interaction between restraint and food object, $F(1, 103) = 3.52$, $p = .06$, $\eta^2 = .03$. In order to examine this interaction and test our specific hypothesis, the effect of food object was assessed for restrained eaters (one standard deviation above the mean; see Aiken & West, 1991) and for unrestrained eaters (one standard deviation below the mean) separately. These contrast analyses showed that restrained eaters responded more slowly to hedonic food words if they followed sentences that contained palatable rather than neutral food objects ($M_s = 726$ and 650 ms, respectively), $F(1, 103) = 5.82$, $p = .02$, $\eta^2 = .05$, while the palatability of the food objects did not influence the reactions of unrestrained eaters ($M_s = 662$ and 670 ms, respectively), $F(1, 103) = .06$, ns .

The initial analysis also revealed an unexpected main effect of actor's behavior, $F(1, 103) = 4.56$, $p = .04$, $\eta^2 = .04$, such that response latencies were higher when the sentence described an actor's eating behavior, relative to an unrelated behavior. This effect was qualified by a marginally significant actor's behavior \times restraint interaction effect, $F(1, 103) = 3.43$, $p = .07$, $\eta^2 = .03$. Contrast analyses showed that the reactions of unrestrained eaters to hedonic probe words were slowed down when the preceding sentence described an actor's eating behavior rather than a behavior unrelated to eating ($M_s = 681$ and 651 ms, respectively), $F(1, 103) = 7.89$, $p < .01$, $\eta^2 = .07$. The reactions of restrained eaters were unaffected by the type of behavior displayed by the actor ($M_s = 689$ and 687 ms), $F(1, 103) = .04$, ns . These results are displayed in Fig. 1.

Error rates

Error rates were analyzed in the same design as the response latencies. This analysis revealed only a marginally significant effect of food object, $F(1, 103) = 3.66$, $p = .06$, $\eta^2 = .03$, such that slightly more errors were made in trials with palatable food objects compared to trials with neutral food objects ($M_s = 1.4\%$ and 0.3% , respectively). This result suggests that longer response latencies after sentences with palatable food objects cannot be attributed to greater accuracy on such trials.

Discussion

Study 1 showed that restrained eaters' reactions to hedonic probe words were slowed down after sentences that contained a palatable food object, irrespective of whether the actor was explicitly said to be eating the food or not. This suggests that behaviors including palatable food items activated hedonic thoughts about food in

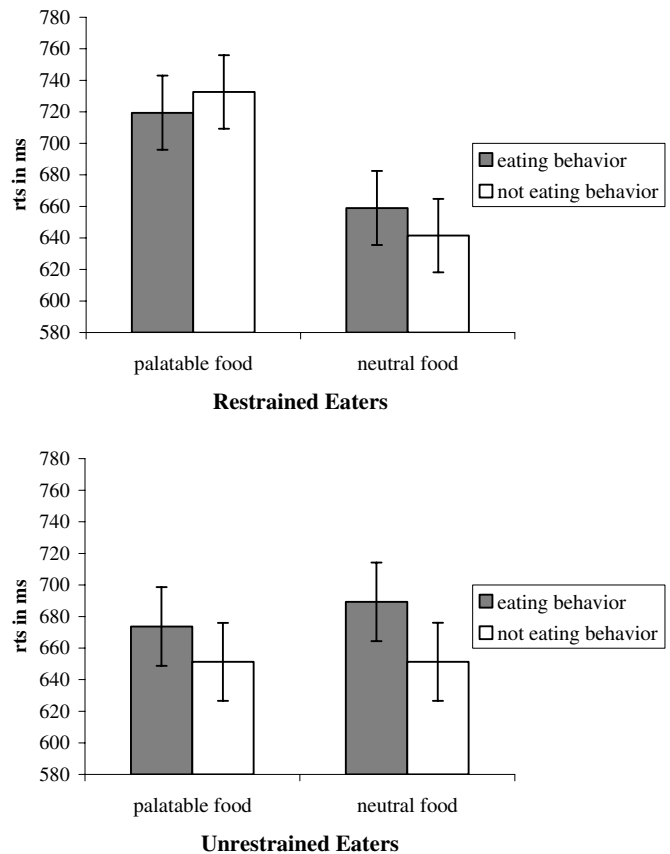


Fig. 1. Mean response latencies in the probe recognition task as a function of the palatability of the food object and actor's behavior for restrained eaters (one standard deviation above the mean, see Aiken and West, 1991) and unrestrained eaters (one standard deviation below the mean). Error bars represent one standard error.

restrained eaters. For restrained eaters, the palatability of the food is the most salient characteristic of the behavior that they perceive, and reading about palatable food leads to the activation of hedonic thoughts about food.

Study 1 also revealed an effect of the actor's behavior on the response latencies of unrestrained eaters, such that they reacted more slowly to hedonic food words when these were preceded by sentences that described an actor's eating behavior, relative to sentences with no eating behavior. This pattern of reaction times was not influenced by the palatability of the food object mentioned in the sentence. Although we did not specifically predict this effect to occur for the unrestrained eaters, this activation of hedonic thoughts in response to eating behavior descriptions can be explained in terms of the logical inferences described by McKoon and Ratcliff (1986). Regardless of the food object being eaten, unrestrained eaters thought of "tasty" as the logical consequence of the actor's eating behavior.

While the pattern of results obtained in Study 1 confirmed our hypothesis that restrained eaters activate hedonic thoughts about food in response to the processing of palatable food items, the current findings are not conclusive as to whether these thoughts indeed occur on-line, i.e.,

during encoding of the behavior. It has been suggested that the probe recognition paradigm used in Study 1 may measure inferences about the text that occur off-line, i.e., at a later stage of information processing (Hassin et al., 2005; Keenan, Potts, Golding, & Jennings, 1990; McKoon & Ratcliff, 1986; Wigboldus, Dijksterhuis, & Van Knippenberg, 2003). The testing procedure requires research participants to compare the probe word with the preceding sentence in order to determine whether the probe had been part of that text. This process could lead them to activate concepts that they may not have activated while first reading the text (Hassin et al., 2005). Therefore, Study 2 was set up to replicate the finding that restrained eaters respond to palatable food cues with hedonic thoughts about food with a paradigm that allows for a more stringent test of the hypothesis that these thoughts are indeed activated on-line. In addition, Study 2 also included a measure of perceived hunger in order to test the alternative explanation that restrained eaters activate hedonic thoughts about food because they feel more hungry than unrestrained eaters (cf. Cabanac, 1971).

Study 2

In order to measure the activation of hedonic thoughts at the initial encoding of behavior information, in Study 2 we employed an experimental paradigm that has been used in text comprehension research for probing the on-line status of spontaneous goal inferences (Long & Golding, 1993; Long, Golding, & Graesser, 1992). Specifically, a rapid serial visual presentation procedure (RSVP) was used to present the experimental material, which means that the behavior descriptions appear on the screen one word at a time at a rapid pace. After the final word, a lexical decision target is presented in order to assess directly the accessibility of the concept in question. A short stimulus-onset-asynchrony (SOA) is used to rule out controlled processing. As in Study 1, we expected restrained eaters to spontaneously activate hedonic thoughts in response to sentences with palatable food objects. This should be reflected in shorter reaction times in the lexical decision task, due to the increased accessibility of the hedonic words.

Methods

Participants and design

Eighty students (65 women, 15 men) of Utrecht University participated in the study in exchange for course credit or €4. The design of the study was the same as in Study 1. Gender had no effect on the results reported below.

Materials

The same experimental sentences and hedonic probe words were used as in Study 1, with only slight changes undertaken in order to ensure that the food object was placed on average in the same position within the sentences describing eating behavior and other behavior.

The 12 experimental sentences were presented to participants in random order and interspersed between 60 filler sentences. Filler sentences were constructed the same way as the experimental sentences and followed by either an unrelated word target or a pronounceable non-word target. Among the filler sentences were 12 eating-related sentences followed by a non-word target in order to preclude participants' expectancy that an eating-related sentence would invariably be followed by an existing target word. Of the total of 72 sentences, half were followed by an existing target word, and half were followed by a non-word target.

Procedure

Upon arrival at the laboratory, participants were seated in individual cubicles containing a desktop computer. All materials and instructions were presented on the computer. Participants were instructed to read each sentence carefully and to respond to the target words as quickly and accurately as possible by pressing the clearly labeled "yes"- or "no"-keys.

The lexical decision task began with 10 practice trials. Each trial consisted of a row of asterisks presented in the center of the screen for 1000 ms, followed by the sentence presented word by word, with each word remaining on the screen for 200 ms and followed by a blank screen for 50 ms. The last word in each sentence was followed by a period, signaling the end of the sentence to the participant. Subsequently, a letter string was presented between four asterisks on each side, signaling to participants that this was the target word requiring a lexical decision. The target remained on the screen until the participant responded. The next trial commenced after an interval of 1000 ms.

After the lexical decision task, participants were asked to fill in the Restraint Scale. Then, participants' self-reported hunger was recorded by means of a 7-point scale. Finally, participants were debriefed, paid, and thanked.

Results

Response latencies

The main dependent variable was participants' average response latency for indicating that the hedonic target words were existing Dutch words. Response latencies of incorrect responses (3.5%) or correct responses larger than three standard deviations above the mean (1.7% of trials, no differences between conditions) were excluded from analyses.

Response latencies were analyzed in the General Linear Model in a 2 (food object: palatable vs. neutral) \times 2 (actor's behavior: eating vs. other) design with dietary restraint as a continuous variable. This analysis revealed an interaction between food object and dietary restraint, $F(1, 76) = 8.93$, $p < .01$, $\eta^2 = .11$. Consistent with our hypothesis, contrast analyses showed that restrained eaters (one standard deviation above the mean, see Aiken & West, 1991) responded faster to hedonic food words when the preceding behavior description contained a palatable food object rather than a neutral food object ($M_s = 615$ and 701 ms, respectively),

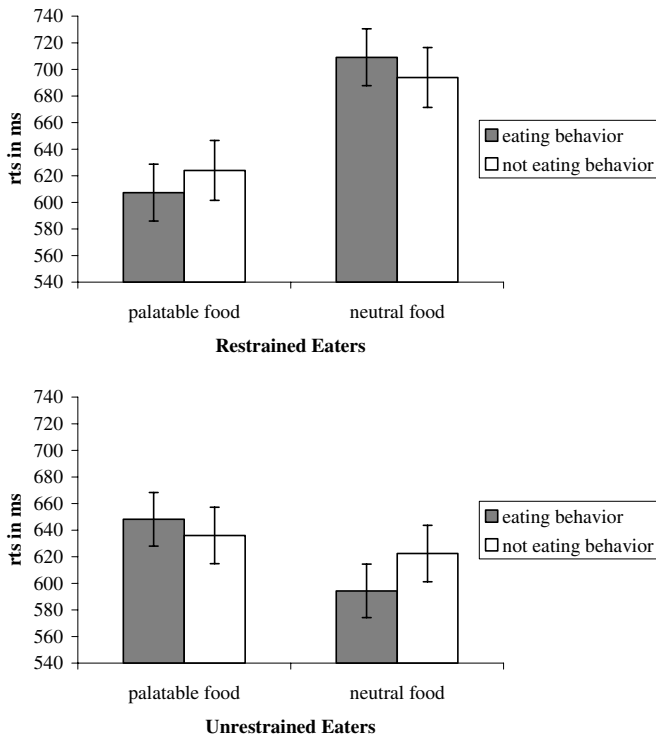


Fig. 2. Mean response latencies in the lexical decision task as a function of the palatability of the food object and actor's behavior for restrained eaters (one standard deviation above the mean, see Aiken and West, 1991) and unrestrained eaters (one standard deviation below the mean). Error bars represent one standard error.

$F(1, 76) = 9.26, p < .01, \eta^2 = .11$. The response latencies of unrestrained eaters (one standard deviation below the mean) did not differ between sentences with palatable and neutral food objects ($M_s = 642$ and 608 ms, respectively), $F(1, 76) = 1.43, ns$ (see Fig. 2).

Moreover, the two-way interaction between food object and restraint was qualified by an interaction with actor's behavior, $F(1, 76) = 5.91, p = .02, \eta^2 = .07$. Contrast analyses showed that the difference between response latencies after sentences with palatable food objects and sentences with neutral food objects for restrained eaters was stronger for sentences explicitly referring to eating behavior ($M_s = 607$ and 709 ms, respectively), $F(1, 76) = 12.08, p < .01, \eta^2 = .14$, than for sentences not explicitly referring to eating behavior ($M_s = 624$ and 693 ms), $F(1, 76) = 5.13, p = .03, \eta^2 = .06$.

In sum, restrained eaters responded faster to hedonic food words when the behavior description contained a palatable food object rather than a neutral food object. The effect of the palatability of the food object was enhanced by the social cue of another person eating the food. Unrestrained eaters' responses to hedonic targets were not influenced by the actor's behavior or food objects mentioned in the experimental sentences.

Error rates

Error rates were analyzed in the same design as the response latencies, which revealed a significant interaction between actor's behavior and food object, $F(1, 76) = 6.57,$

$p = .01, \eta^2 = .08$. On trials describing eating behavior, less errors were made when the sentence contained a palatable food object relative to a neutral food object ($M_s = 1.2\%$ and 5.7% , respectively), $F(1, 76) = 5.76, p = .02, \eta^2 = .07$. On not-eating trials, there was no effect of food object, $F(1, 76) = .45, ns$. These effects suggest that the faster responses after eating behavior descriptions with palatable food objects were not made at the cost of accuracy.

Potential effects of hunger

Perceived hunger was not associated with restraint scores, $r = .07, ns$. In order to rule out hunger as a potential confound in our results, we replaced restraint scores with hunger scores in the full factorial model. These analyses revealed no main effects of hunger and no interaction effects with the other factors on response latencies (all $p > .5$) or error rates (all $p > .3$).

Discussion

The results of Study 2 replicated our earlier finding showing that restrained eaters activate hedonic thoughts in response to processing behavior descriptions involving palatable food. Importantly, because the paradigm used here allows us to assess the activation of hedonic thoughts at the encoding stage of information processing, these findings show that restrained eaters encode behavioral information that involve palatable food objects in terms of hedonic concepts. When measured on-line, there was no evidence of the activation of hedonic thoughts in unrestrained eaters in response to the behavioral information.

General discussion

Our research was designed to investigate the spontaneous activation of hedonic thoughts triggered by the processing of food and eating behavior descriptions in restrained eaters. Several earlier studies have shown that chronic dietary restraint can easily be disrupted by the perception of food cues, such as the smell or sight of pizza or the eating behavior of other people. The studies reported here examined whether restrained eaters activate hedonic thoughts in response to such food cues. These hedonic thoughts could be the mechanism that triggers the overeating of restrained eaters.

The results of Study 1 showed that restrained eaters think hedonically about food when they read about a behavior that involves palatable food. Study 2 replicated these results with a different paradigm, showing that restrained eaters activate hedonic thoughts about food in response to reading about palatable food, especially when it concerns eating behavior. Moreover, this study confirmed our hypothesis that these hedonic thoughts were activated on-line. Although the present studies confronted participants merely with food words and verbal behavior descriptions rather than actual food and eating behavior, the results are instructive about the spontaneous occurrence of hedonic thoughts in restrained eaters.

Our findings suggest that restrained eaters strongly connect palatable food with the pleasure that can be derived from eating it. This specific relation of food with food-specific pleasure can be distinguished from a more general association between palatable food and positive affect. Studies that examined general attitudes towards palatable food with implicit attitude measures could not find systematic differences between restrained eaters' and unrestrained eaters' evaluation of palatable food (Roefs, Herman, MacLeod, Smulders, & Jansen, 2005). On explicit measures, restrained eaters even rate palatable food less positively than unrestrained eaters (Papies, Stroebe, & Aarts, 2006). However, the current studies show that restrained eaters do spontaneously think about the hedonic properties of palatable food. This activation of the food-specific rewarding qualities of food might be a better predictor of actual consummatory behavior than the more general evaluation of food. Thus, our findings point towards an interesting motivational, rather than evaluative account of the eating-regulation of restrained eaters.

What are potential consequences of restrained eaters' hedonic thoughts about food? We would argue that these thoughts can interfere with restrained eaters' attempts at dieting in several ways. Earlier studies have shown that the activation of hedonic food thoughts in restrained eaters can inhibit dieting. For example, Stroebe and colleagues (Stroebe, Mensink, Aarts, Schut, & Kruglanski, 2006) showed in a sequential priming task that the subliminal presentation of hedonic thoughts about food decreases the activation of dieting thoughts, but only for restrained eaters. This process has important behavioral implications for restrained eaters, since it makes it less likely that subsequent eating behavior will be guided by the goal of eating restraint.

The present studies may also shed a new light on the results of the classic preload studies that showed that restrained eaters overeat when they have received a preload by the experimenter. In all preload studies reported in the literature, the food that participants were required to eat prior to the taste test was not only high in calories, and thus a violation of their diet, but also very palatable, such as milkshakes or chocolate cake (e.g., Herman & Mack, 1975; Polivy, Herman, Hackett, & Kuleshnyk, 1986). In this sense, the preload could function as a palatable food cue and automatically trigger hedonic thoughts about food in restrained eaters. Restrained eaters will then use the subsequent taste test as an opportunity to pursue the goal of hedonic enjoyment of eating and, most likely, overeat. The same reasoning can be applied to interpret the findings of other studies in which overeating in restrained eaters was induced by means of the smell of food, the sight of food, or thoughts of palatable food. Therefore, our findings are also in line with the work on delay of gratification (Mischel et al., 1996, 1989) that has shown that encoding tempting stimuli in terms of their "hot", consummatory features makes it more difficult to resist them.

From the present studies, we may conclude that the abundance of food cues in our environment is likely to be detrimental for the dieting goal of restrained eaters. The processing of palatable food cues makes restrained eaters think about the hedonic pleasure to be gained from it and may trigger restrained eaters to seek this pleasure. The current studies thus identified a possible mechanism that could explain why restrained eaters easily overeat when they are confronted with palatable food.

Appendix A

Concern for Dieting Subscale of the Revised Restraint Scale (Herman & Polivy, 1980). For the present studies, a Dutch translation of this scale was used (Jansen, Oosterlaan, Merckelbach, & van den Hout, 1988).

1. How often are you dieting?
2. Do you have feelings of guilt after overeating?
3. Do you eat sensibly in front of others and splurge alone?
4. Do you give too much time and thought to food?
5. Would a weight fluctuation of 5 lb affect the way you live your life?
6. How conscious are you of what you are eating?

Appendix B. Stimulus materials used in Study 1 (translated from Dutch)

B.1. Experimental sentences

Words in parentheses denote food objects presented in the neutral food condition.

- 1 (a) Bill is eating a big piece of apple pie. (rye bread)
- (b) Bill is giving away a big piece of apple pie. (rye bread)
- 2 (a) Janice is having a couple of chocolate cookies during the movie. (peeled carrots)
- (b) Janice is putting a couple of chocolate cookies into a bag. (peeled carrots)
- 3 (a) Tom sates his appetite with French fries. (Brussels sprouts)
- (b) Tom forgets the plate of French fries. (Brussels sprouts)
- 4 (a) Sandra is taking a handful of M&M's from the bowl. (raisins)
- (b) Sandra is putting the M&M's in the cupboard. (raisins)
- 5 (a) Lucy tries three kinds of chocolates. (oatmeal)
- (b) Lucy sells three kinds of chocolates. (oatmeal)
- 6 (a) Ben is taking a bite of the warm pizza. (kidneys)
- (b) Ben is giving away the warm pizza. (kidneys)

B.2. Hedonic probe words

delicious, tasty, good, indulging, scrumptious, delectable

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