



## Research report

## Who likes it more? Restrained eaters' implicit attitudes towards food

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## ABSTRACT

Previous work has been unclear as to how restrained eating is related to implicit attitudes towards food. The present paper introduces a new variant of the affective priming paradigm to measure implicit attitudes towards food among restrained and unrestrained eaters, using food pictures as primes and emoticons as targets. Results of two studies show that while unrestrained eaters evaluate palatable foods more positively than neutral and unpalatable foods, restrained eaters do not. In addition, it is shown that restrained eaters have stronger evaluations of the negative aspects of palatable food, and this influences their food attitudes. Thus, the present findings suggest that restrained eaters' chronic goal of dieting impacts their implicit attitude towards food items via their perception of the negative aspects of palatable food. These results are discussed with regard to the role of attitudes in the regulation of eating behavior.

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## Introduction

With the prevalence of overweight and obesity constantly increasing in Western societies (e.g., Flegal, 2005), dieting has become a widespread method of weight control (Kruger, Galuska, Serdula, & Jones, 2004). However, only few dieters are able to maintain their initial weight loss over an extended period of time (Elfhag & Rössner, 2005; Jeffery et al., 2000). Once they have stopped dieting, many dieters may even regain more weight than they initially lost (Mann et al., 2007). In their repeated attempts at dieting, dieters often become restrained eaters, as Herman and Polivy (1980) have termed chronic dieters who are concerned with their weight and chronically try to restrict the amount they eat. Although restrained eaters are generally very motivated to control their weight by dieting, they are not very successful in these attempts, and their eating behavior is characterized by periods of food restriction as well as by frequent lapses of restraint (Gorman & Allison, 1995).

Why do restrained eaters have such difficulties controlling their weight? The research reported in this article addresses a plausible explanation for restrained eaters' problems, namely that they have a more positive implicit attitude towards palatable food than unrestrained eaters and therefore experience greater difficulties in refraining from eating it. Even though restrained eaters might not

be aware that they have a stronger preference for palatable food, this might still have a pronounced influence on their eating behavior and inadvertently lead to overeating (cf. Aarts, Custers, & Marien, 2008). However, empirical evidence regarding this issue has not been supportive of this hypothesis, and some mixed findings have been reported. The present paper therefore introduces a new method to examine restrained and unrestrained eaters' implicit attitudes towards food.

The assumption that the difficulties that restrained eaters experience in resisting delicious, tempting food items are due to their greater implicit liking of this food would be consistent with recent theories on eating behavior, which converge on the idea that eating is to a large part driven by the hedonic, rewarding properties of food, rather than by a homeostatic mechanism to reduce hunger (e.g., Finlayson, King, & Blundell, 2008; Lowe & Butryn, 2007; Mela, 2006; Stroebe, 2000; Yeomans, 1998). Such reward-related mechanisms have been suggested to play a key role in failures of eating regulation, thus contributing to overeating and obesity (Blundell & Finlayson, 2004; Papies, Stroebe, & Aarts, 2008c; Pinel, Assanand, & Lehman, 2000; Stroebe, 2008; Stroebe, Papies, & Aarts, 2008).

Consistent with this approach, empirical studies on the triggers of eating behavior have shown that the rewarding properties of food play a crucial role in restrained eaters' overeating. The exposure to the smell or the sight of palatable food has been shown to trigger increased cravings and actual overeating in restrained compared to unrestrained eaters (e.g., Fedoroff, Polivy, & Herman, 1997, 2003; Rogers & Hill, 1989). Thinking about a favorite food can

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have the same effects (Fedoroff et al., 1997; Harvey, Kemps, & Tiggemann, 2005), and these processes are accompanied by increased salivation when a palatable food is perceived (Brunstrom, Yates, & Witcomb, 2004; LeGoff & Spigelman, 1987; Tepper, 1992). Thus, palatable food triggers particularly strong appetitive reactions in restrained compared to unrestrained eaters, and this could explain their difficulties in weight-regulation.

A number of recent studies addressing the psychological mechanisms underlying these failures of self-regulation have focused especially on the spontaneous cognitive processes that are triggered by the perception of palatable food. One set of studies (Papies, Stroebe, & Aarts, 2007) presented participants with behavior descriptions that included either palatable food (pizza, chocolate, etc.) or neutral food (oatmeal, carrots, etc.) and used reaction time measures to assess the activation of hedonic thoughts (e.g., tasty, delicious) in response to reading these behavior descriptions. These studies showed that restrained eaters (Herman & Polivy, 1980) spontaneously activated hedonic thoughts when they read about palatable food rather than neutral food, but unrestrained eaters did not. Thus, restrained eaters easily think about the pleasure they would have in eating the presented palatable food, which could influence their subsequent behavior.

Another set of studies examined the consequences of such hedonic thoughts for restrained eaters' dieting goal (Stroebe, Mensink, Aarts, Schut, & Kruglanski, 2008). Here, participants were presented very briefly (for the duration of 23 ms) with hedonic food words (e.g., tasty, delicious), before the cognitive accessibility of the goal of dieting was assessed with a computerized lexical decision task. Restrained eaters who had been presented subliminally with hedonic food words were subsequently slower to recognize dieting words than when they had been presented with food-unrelated words, indicating that hedonic food words triggered the inhibition of the dieting goal in these participants (see also Papies, Stroebe, & Aarts, 2008b). These findings were consistent with the goal conflict model of eating developed by Stroebe and colleagues (e.g., Stroebe, 2008; Stroebe, Papies, et al., 2008; Stroebe, Mensink, et al., 2008), which suggests that restrained eaters have a goal conflict between the goal of enjoying palatable food, represented by the hedonic thoughts about food, and their chronic goal of dieting. Once the goal of enjoying palatable food is activated by the perception of attractive food cues, the conflicting goal of weight control is inhibited and no longer available to guide restrained eaters' behavior. Although it is likely that this process occurs outside of restrained eaters' conscious awareness, this could be the mechanism underlying their self-regulatory failures in environments where attractive food is easily available.

The question remains, however, why restrained eaters react more strongly in this pleasure-oriented way to attractive food cues than unrestrained eaters do. The most plausible explanation would seem that restrained eaters like palatable food more than normal eaters. A number of studies have therefore tested the hypothesis that restrained eaters have more positive attitudes towards palatable food than unrestrained eaters (Hoefling & Strack, 2008; Roefs, Herman, MacLeod, Smulders, & Jansen, 2005), using procedures such as the affective priming task (Fazio, Sanbonmatsu, Powell, & Kardes, 1986) or the implicit association test (IAT; Greenwald, McGhee, & Schwartz, 1998) in order to obtain an implicit measure of participants' attitudes. These measurement procedures allow the researcher to assess participants' attitudes without asking them to self-assess and report these attitudes. Such self-reports of one's attitudes and mental processes have been shown to be unreliable and difficult for participants to do, as the processes underlying our behavior are often not accessible to introspection (e.g., Nisbett & Wilson, 1977; Wegner, 2002). Implicit attitude measures, on the other hand, are often obtained

by relying on reaction time tasks and therefore reflect the underlying attitude in a relatively automatic way, without the need for conscious reflection (see de Houwer, Teige-Mocigemba, Spruyt, & Moors, 2009, for a detailed discussion). This has the additional advantage that participants often have less control over the measurement outcome than with explicit questionnaire measures, and they may even be unaware that their attitudes toward a particular object are being assessed (de Houwer & Moors, 2007; but see Klauer & Teige-Mocigemba, 2007; Monteith, Voills, & Ashburn-Nardo, 2001). Therefore, implicit attitude measures can be especially relevant for issues where socially desirable responding might play a role (Fazio & Olson, 2003). This is indeed the case in the domain of dieting, where restrained eaters or obese individuals might be motivated to deliberately attenuate their evaluation of high-fat, palatable food.

To date, however, the results of studies using implicit measures of attitudes provide no consistent evidence that restrained eaters have more positive attitudes towards palatable food than unrestrained eaters. Roefs et al. (2005), for example, used two different implicit measures to assess attitudes towards food and found that, as expected, participants held more positive attitudes towards palatable compared to unpalatable foods. This effect, however, was equally pronounced for restrained and unrestrained eaters. In contrast, Hoefling and Strack (2008) who assessed attitudes towards high-calorie and low-calorie food attributes ("deep-fried", "creamy" vs. "steamed", "light") did find a marginally significant tendency for restrained eaters to evaluate the high-calorie attributes more positively than unrestrained eaters. Finally, Fishbach and Shah (2006) assessed restrained and unrestrained participants' approach and avoidance reactions with respect to food words and to dieting and fitness words and found that restrained eaters had a tendency to spontaneously avoid, rather than approach tempting food items. However, since the reactions towards diet-related words were assessed within the same task, participants were continuously primed with their dieting goal, which could explain why they avoided the high-fat food temptations. Thus, this study offers no clear evidence that restrained eaters associate high-fat, palatable food with an implicit avoidance tendency.

Studies examining implicit food attitudes among obese participants reveal a similarly mixed picture. While a study by Craeynest et al. (2005) showed that obese youngsters had more positive implicit evaluations of both healthy and unhealthy food items than their lean counterparts, another study showed that both overweight and lean youngsters have a more positive evaluation of healthy than of unhealthy food (Craeynest, Crombez, Haerens, & De Bourdeaudhuij, 2007). Among adults, it has been found that obese participants' implicit attitudes towards palatable food did not differ from those of lean participants (Roefs et al., 2006) or were even more negative (Roefs & Jansen, 2002). Although the present review of the relevant literature may not be exhaustive, it suggests that the empirical evidence so far does not provide us with a clear answer to the question whether their greater liking of palatable food could be the major reason for the difficulty restrained eaters experience in resisting tempting food. To address this issue, the present paper introduces a new variant of the affective priming paradigm (Fazio et al., 1986) to examine restrained and unrestrained eaters' attitudes towards food. The affective priming paradigm has been shown to be suited to reveal implicit measures of food attitudes (Lamote, Hermans, Baeyens, & Eelen, 2004; Roefs et al., 2005). Study 1 uses a new picture-symbol variant of the affective priming task to assess restrained and unrestrained eaters' attitudes towards different types of food, and Study 2 also investigates the role of attitudinal ambivalence in implicit measures of food attitudes.

## Study 1

This study introduces an innovative variant of the affective priming task that uses pictures as primes and nonverbal affective symbols as targets. In the affective priming paradigm (Fazio & Olson, 2003; Fazio et al., 1986), an attitude object (the prime) is presented briefly on the computer screen, followed by a positive or negative attribute (the target) that participants have to classify according to its valence. Because the primes automatically activate positive or negative affect, reactions to the targets are faster if their affective valence matches the valence of the prime (congruent trials) than if their valence differs from the valence of the prime (incongruent trials). Participants' attitudes towards the primes can then be inferred from the difference in reaction times between congruent and incongruent trials.

Most affective priming studies use words as both primes and targets (see Klauer & Musch, 2003, for an overview). However, in the present work we used food pictures instead of food names to measure food attitudes in a vivid and highly ecologically valid manner. In order to tap into participants' spontaneous affective reactions without them having to semantically process words, we used valenced symbols as targets, while most earlier studies with pictures as primes still used words as targets (see Klauer & Musch, 2003). Thus, we showed participants a picture of a food item followed by a positive or negative emoticon (☺ vs ☹), which they simply had to classify as positive or negative. This way, we tap into participants' spontaneous affective reactions to the food items without the need for lexical processing. In order to test for the occurrence of a general affective priming effect and therefore establish the validity of our variant of the paradigm, we also included positive and negative non-food pictures in the present task. In addition, this allows us to examine whether restrained eaters differ from unrestrained eaters specifically in their evaluation of food pictures, rather than in their evaluation of pictorial stimuli in general.

## Method

### Participants and design

Ninety-one female students of Utrecht University (mean age 20.5 years,  $SD = 2.2$ ) participated in the study in exchange for €3 or course credit. Mean BMI of the participants was 21.2,  $SD = 1.89$ . The study had a 3 (food type: palatable vs. neutral vs. unpalatable)  $\times$  2 (target: positive vs. negative) within-participants design, with dietary restraint included as a continuous variable.

### Materials

In the picture-symbol affective priming task, participants were presented with 5 pictures of high-fat, palatable food items (e.g., pizza, cake), 5 pictures of neutral food items (e.g., lettuce, soup) and 5 pictures of unpalatable food items (e.g., cooked cabbage, blood sausage). Five positive and 5 negative food-unrelated pictures were also included, as well as 5 neutral filler items. All items were selected on the basis of a pilot study ( $N = 137$ ), in which they were rated for valence on a 5-point scale. Mean ratings for palatable food items ( $M = 4.19$ ,  $SE = .06$ ) were higher than for neutral food items ( $M = 3.12$ ,  $SE = .06$ ),  $F(1, 136) = 174.92$ ,  $p = .000$ ,  $\eta_p^2 = .56$ , which were rated higher than unpalatable food items ( $M = 1.85$ ,  $SE = .06$ ),  $F(1, 136) = 331.06$ ,  $p = .00$ ,  $\eta_p^2 = .71$ . Likewise, mean ratings for positive pictures ( $M = 4.61$ ,  $SE = .04$ ) were higher than for the neutral filler pictures ( $M = 3.05$ ,  $SE = .05$ ),  $F(1, 136) = 655.16$ ,  $p = .00$ ,  $\eta_p^2 = .83$ , which were higher than for negative pictures ( $M = 1.57$ ,  $SE = .05$ ),  $F(1, 136) = 478.55$ ,  $p = .00$ ,  $\eta_p^2 = .78$ . We did not control for participants' familiarity with the items displayed in the pictures. As targets in the affective priming

study, we used two emoticons commonly used to denote positive and negative affect (☺ and ☹).

### Procedure

Participants were greeted by the experimenter and seated in individual cubicles containing a desktop computer, which presented all materials and instructions.

Participants were told that the experiment was designed to examine how people react to certain stimuli. They were instructed that they would see a picture, followed by a smiley symbol, and that their only task was to indicate whether the smiley was a positive or negative one, by pressing the clearly marked keys for their responses. Participants were asked to react as quickly and as accurately as possible. The affective priming task started with 10 practice trials with different, food-unrelated pictures, in which participants were given feedback if their response was incorrect.

The affective priming task consisted of 60 trials, of which 30 trials contained a food picture and 30 contained a food-unrelated picture. All trials were presented in random order, which was unique for each participant. Each of the 30 pictures was presented once followed by a positive emoticon and once by a negative emoticon. Each trial started with the presentation of the picture for 250 ms, followed by a blank for 50 ms, resulting in a stimulus-onset-asynchrony (SOA) of 300 ms (see Hermans, De Houwer, & Eelen, 1994). Then, the emoticon was presented, which stayed on the screen until participants gave a response. The intertrial interval was 1500 ms.

### Restrained eating scale

After the affective priming task, participants completed the Dutch version of the Revised Restraint Scale (Herman & Polivy, 1980). However, the Restraint Scale has been shown to consist of two separate subscales, namely Concern for Dieting and Weight Fluctuations (Gorman & Allison, 1995; van Strien, Breteler, & Ouwens, 2002; Wardle, 1986). In line with earlier research, we therefore used the Concern for Dieting subscale in this study, which has been recommended to identify participants' chronic motivation to control their weight by dieting (Papies et al., 2007; Stroebe, Mensink, et al., 2008; van Strien et al., 2002; see Table 1 for the statistics of these scales).

### Results and discussion

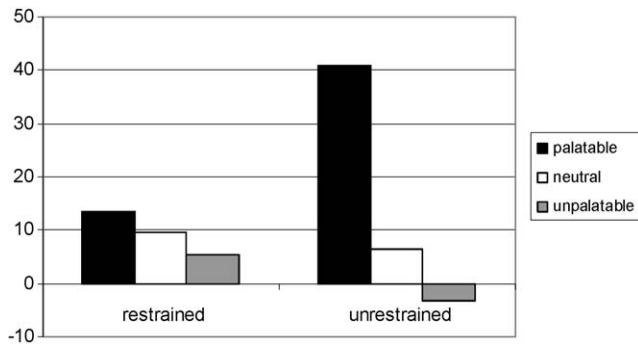
The computer recorded the time it took participants to indicate whether the presented emoticon was positive or negative. Reaction times on trials with errors or reaction times larger than two standard deviations from the trial mean were excluded from analyses. In order to determine participants' attitudes, a positivity index was constructed per item type by subtracting response latencies for positive targets from response latencies for negative targets. Thus, higher scores on this index indicate a more positive implicit attitude.

**Table 1**

Statistics of the measures used, and correlations between the Concern for Dieting subscale, the Weight Fluctuations subscale of the Restraint Scale (0) and BMI (Study 1).

|  | <i>M</i> | <i>SD</i> | 1     | 2     | 3   | 4 |
|--|----------|-----------|-------|-------|-----|---|
| 1. Restraint (Concern for Dieting; range 1–15) | 6.53     | 3.19      | –     |       |     |   |
| 2. Restraint (Weight Fluctuations; range 0–11) | 4.32     | 2.47      | .49** | –     |     |   |
| 3. Restraint (complete scale)                  | 10.85    | 4.90      | .90** | .82** | –   |   |
| 4. BMI   | 21.45    | 2.81      | .06   | .32** | .20 | – |

\*\*  $p < .01$  level (two-tailed).



**Fig. 1.** Affective priming scores for restrained and unrestrained eaters as a function of food type (Study 1). Higher scores indicate a more positive attitude. Affective priming scores are predicted with the regression model on the basis of values one standard deviation above and below the mean of the Concern for dieting scale (see Aiken & West, 1991, for this method).

In order to verify that our picture-symbol variant of the affective priming paradigm is suited for revealing implicit evaluations of pictorial stimuli, we first analyzed the affective priming scores for positive and negative non-food pictures<sup>1</sup>. This analysis revealed a main effect of trial type,  $F(1, 89) = 10.83, p = .001, \eta_p^2 = .11$ , such that affective priming scores for positive items ( $M = 7.51, SE = 5.51$ ) were higher than for negative items ( $M = -19.20, SE = 6.41$ ). Importantly, this effect was not qualified by an interaction of trial type with restraint,  $F(1, 89) = 2.03, p = .16, \eta_p^2 = .02$ . This suggests that the positive and negative non-food pictures were spontaneously evaluated, by both restrained eaters and unrestrained eaters alike. Additional analyses of the absolute reaction times, rather than the affective priming scores, showed that restrained eaters' general response speed on non-food trials ( $M = 514 \text{ ms}, SE = 8.26$ ) did not differ from the response speed of unrestrained eaters on non-food trials ( $M = 517 \text{ ms}, SE = 8.39$ ),  $F(1, 89) = .1, ns$ .

The main dependent variable was restrained and unrestrained eaters' affective priming score with regard to food stimuli, which we analyzed with a regression analysis in the General Linear Model. This revealed a main effect of food type,  $F(2, 88) = 7.03, p = .001, \eta_p^2 = .138$ , which was qualified by an interaction between restraint scores and food type,  $F(2, 88) = 3.89, p = .024, \eta_p^2 = .081$ . In order to examine the nature of this interaction, the effect of food type was tested for restrained eaters (one standard deviation above the scale mean; Aiken & West, 1991) and for unrestrained eaters (one standard deviation below the mean) separately. These analyses revealed that while there was a strong effect of food type among unrestrained eaters,  $F(2, 88) = 10.54, p = .000, \eta_p^2 = .19$ , there was no effect of food type among restrained eaters,  $F(2, 88) = .29, ns$ . As Fig. 1 shows, unrestrained eaters evaluated palatable food more positively than neutral and unpalatable food, whereas restrained eaters do not show this effect. In other words, restrained eaters were found to hold the same evaluation of palatable as of other kinds of food, while unrestrained eaters displayed a strong preference for palatable over other kinds of food. Again, additional analyses of the absolute reaction times, rather than the affective priming scores, showed that restrained eaters' general response speed on food-trials ( $M = 523 \text{ ms}, SE = 9.55$ ) did not differ from the response speed of unrestrained eaters on food-trials ( $M = 528 \text{ ms}, SE = 9.70$ ),  $F(1, 89) = .14, ns$ .

<sup>1</sup> Reliability analyses showed that the internal consistency of these summary scores was rather low (Cronbach's  $\alpha = .37$  for negative items and  $\alpha = .38$  for positive items), which is nonetheless comparable to reliability indices reported in other studies using the affective priming paradigm (e.g., Banse, 2001; Wentura et al., 2005). This could partially be due to the low number of stimuli per category (i.e., five), and to the randomization of trials which was different for each participant (Banse, 2001).

## Study 2

In Study 1, we introduced a new variant of the affective priming paradigm to provide us with an implicit measure of food attitudes. This picture-symbol affective priming task was suited for revealing attitudes towards positive and negative non-food stimuli, as it showed a general affective priming effect. In addition, it was sensitive to differences between types of food, and to individual differences in participants' attitudes towards these foods. We argue that the affective priming scores obtained with this new variant of the affective priming paradigm are an implicit measure of attitudes towards food in the sense that participants had less control over the processes leading to the affective priming scores than over the outcome of more explicit measures. In addition, the task allowed us to assess participants' food attitudes without asking them to evaluate the food objects (de Houwer & Moors, 2007).

Since restrained eaters were not found to hold more positive attitudes towards palatable food compared to other foods, our findings suggest that implicit attitude measures do not provide us with an explanation why these individuals easily overeat when confronted with palatable, high-calorie foods (see also Roefs et al., 2005; Roefs & Jansen, 2002). The question then arises, however, why restrained eaters do not seem to have a more implicit positive evaluation of palatable food compared to other food at all. Previous research has shown that for restrained eaters, their chronic goal of dieting is incompatible with enjoying palatable food (Papies, Stroebe, & Aarts, 2008a; Papies et al., 2008b; Stroebe, Mensink, et al., 2008). This goal conflict makes them highly ambivalent towards such food items (Stroebe, Mensink, et al., 2008). We suggest that this ambivalence causes their attenuated evaluations of palatable food, such that the differences between restrained and unrestrained eaters obtained in Study 1 may be mediated by their ambivalence towards food. In order to test this hypothesis, we included a measure of ambivalence in Study 2.

Attitudinal ambivalence refers to holding both strong positive and strong negative evaluations of an attitude object at the same time (Conner & Sparks, 2002), and it can be assessed in different ways. While measures of experienced ambivalence ask participants to indicate the degree of conflict that they experience with regard to a certain attitude object (Conner & Sparks, 2002), measures of structural ambivalence ask participants to rate their evaluation of the positive and the negative aspects of the attitude object separately (Conner & Sparks, 2002; Kaplan, 1972). These separate measures can then be combined into one measure of ambivalence. This way, structural ambivalence measures provide not only an overall measure of ambivalence, but it can also be determined whether this ambivalence is especially due to the evaluation of the positive or the negative aspects of the attitude object. Stroebe et al. (2008a), for example, found that restrained eaters' ambivalence towards palatable food was more strongly driven by their perception of the negative aspects than by the positive aspects of palatable food. In line with these findings, we included a measure of structural ambivalence in Study 2 and hypothesized that restrained eaters would differ from unrestrained eaters especially in their evaluation of the negative aspects of palatable food, as this most strongly reflects the fact that palatable food is incompatible with their dieting goal. This component of ambivalence might influence restrained eaters' attitudes towards food as measured in our variant of the affective priming task.

## Method

### Participants and design

One hundred students of Utrecht University (35 men, 65 women; mean age 20.07 years,  $SD = 2.60$ ) participated in the study

in exchange for €3 or course credit. Mean BMI of the participants was 21.73 ( $SD = 2.74$ ). The study had a 2 (food type: palatable vs. neutral)  $\times$  2 (target: positive vs. negative) within-participants design, with dietary restraint included as a continuous variable. None of the results reported below were qualified by the gender of the participants (all  $F < 1.4$ ), so gender is not discussed any further.

**Procedure**

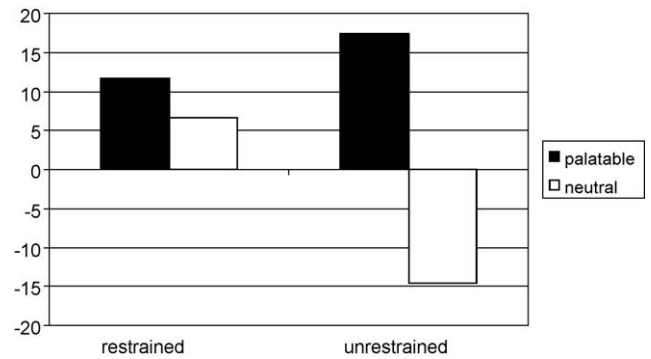
Participants were greeted by the experimenter and seated in individual cubicles containing a desktop computer, which presented all materials and instructions. Participants first completed the affective priming task and then filled in the Restrained eating scale and the measure of ambivalence. Finally, participants were debriefed, paid, and thanked.

**Affective priming task.** The affective priming task contained 5 pictures of high-fat, palatable food items and 5 pictures of neutral food items. Since no differences were found in Study 1 between neutral and unpalatable food items, only palatable and neutral items were included in Study 2. Five positive and 5 negative food-unrelated pictures were included, as well as 5 neutral pictures as filler items. Targets were the same as in Study 1. The pictures were again presented for 250 ms, followed by a 50 ms blank and then followed by the target stimulus. All trials were presented twice, resulting in a total of 100 trials presented in random order.

**Ambivalence towards food.** Next, we measured ambivalence towards high-fat, palatable food, since earlier research has shown that restrained eaters are ambivalent towards these foods because eating them interferes with their dieting goal (Stroebe, Mensink, et al., 2008; Stroebe, Papies, et al., 2008). To assess their structural ambivalence, participants were presented with the same high-fat, palatable food pictures as in the affective priming task. Using a 9-point scale, they were first asked to rate how positive they found the positive aspects of the presented food item, ignoring the negative aspects, and then to rate how negative they found the negative aspects of the item while ignoring the positive aspects. Cronbach's alpha was .76 and .89 for the positive and negative aspects of palatable food, respectively. These measures were combined into a measure of ambivalence towards palatable food ( $\alpha = .87$ ) using the Griffin formula (Thompson, Zanna, & Griffin, 1995). This formula calculates ambivalence in such a way that ambivalence scores increase as the positive and negative evaluations of the attitude object become more extreme, and as they become more equal in value (Ambivalence =  $(P + N)/2 - |P - N|$ ). Thus, higher scores on this measure indicate a greater degree of ambivalence.

**Results and discussion**

Table 2 presents the correlations between the measures of restraint and the measure of ambivalence and its separate components. Restrained eating was not correlated with the overall measure of structural ambivalence or with the positive component



**Fig. 2.** Affective priming scores for restrained and unrestrained eaters as a function of food type (Study 2). Higher scores indicate a more positive attitude. Affective priming scores are predicted with the regression model on the basis of values one standard deviation above and below the mean of the Concern for dieting scale (see Aiken & West, 1991, for this method).

of ambivalence, but, as in Stroebe, Mensink, et al. (2008), it was correlated with the negative component of ambivalence. This indicates that their chronic goal of dieting enhances restrained eaters' perception of the negative aspects of palatable food. Also as in Stroebe, Mensink, et al. (2008), structural ambivalence towards palatable food was especially driven by the negative evaluations of palatable food.

As in Study 1, the main dependent variable was the time it took restrained and unrestrained eaters to classify the targets in the affective priming task. A positivity index was again constructed based on reaction times in trials with correct answers no more than two standard deviations from the mean. Again, we first analyzed the affective priming scores on non-food items, which revealed the expected effect of trial type,  $F(1, 98) = 4.01, p = .048, \eta^2 = .039$ , such that positive items had a higher affective priming score ( $M = 5.65, SE = 3.98$ ) than negative items ( $M = -5.30, SE = 4.74$ ). As in Study 1, this effect was not qualified by an interaction with restraint,  $F(1, 98) = .99, ns$ .

Next, we analyzed affective priming scores with regard to food items. A regression analysis in the General Linear Model revealed a main effect of food type,  $F(1, 98) = 16.26, p = .000, \eta^2 = .14$ , which was qualified by an interaction between restraint scores and food type,  $F(1, 98) = 8.87, p = .004, \eta^2 = .08$ . While there was a strong effect of food type among unrestrained eaters,  $F(1, 98) = 25.11, p = .000, \eta^2 = .20$ , there was no effect of food type among restrained eaters,  $F(1, 98) = .58, p = .45, \eta^2 < .01$ . As Fig. 2 shows, unrestrained eaters evaluated palatable food more positively than neutral food, whereas restrained eaters did not show this effect. Thus, the findings of Study 1 were replicated.

**Effect of ambivalence**

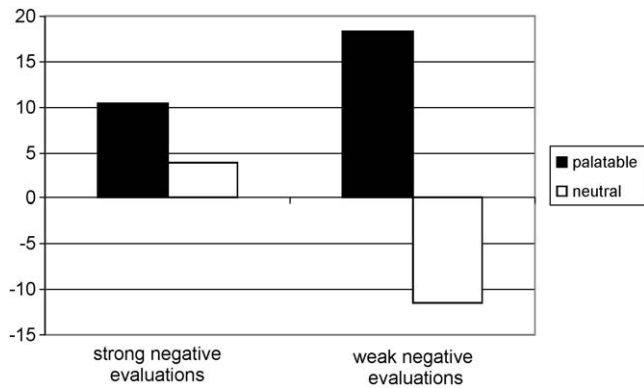
Next, we tested whether restrained eaters' ambivalence towards palatable food influenced their food attitudes measured in the

**Table 2**

Statistics of the measures used and correlations between restrained eating, the measure of ambivalence and its separate components, and the affective priming scores for food (Study 2).

|  | M     | SD    | 1     | 2   | 3    | 4    | 5     | 6 |
|--|-------|-------|-------|-----|------|------|-------|---|
| 1. Structural ambivalence pal. food      | 3.93  | 2.81  | –     |     |      |      |       |   |
| 2. Palatable food positive               | 7.19  | 1.33  | .37** | –   |      |      |       |   |
| 3. Palatable food negative               | 5.77  | 2.13  | .84** | .03 | –    |      |       |   |
| 4. Restraint (concern for dieting)       | 6.23  | 3.65  | .11   | .10 | .22* | –    |       |   |
| 5. Affective priming scores pal. food    | 14.57 | 41.44 | -.02  | .08 | -.10 | -.07 | –     |   |
| 6. Affective priming scores neutral food | -4.16 | 43.20 | .21*  | .10 | .18  | .25* | .37** | – |

\*  $p < .05$  level (two-tailed).  
 \*\*  $p < .01$  level (two-tailed).



**Fig. 3.** Affective priming scores as a function of food type and scores on the scale assessing negative aspects of palatable food (Study 2). Higher affective priming scores indicate a more positive attitude. Affective priming scores are predicted with the regression model on the basis of values one standard deviation above and below the mean of the scale assessing negative aspects of palatable food (see Aiken & West, 1991, for this method).

affective priming task. Because only the component of structural ambivalence that measured negative evaluations of palatable food was significantly correlated with restraint scores, we first tested whether this measure influenced attitudes towards palatable and neutral food. This analysis revealed a main effect of food type,  $F(1, 98) = 15.34, p = .00, \eta^2 = .14$ , which was qualified by an interaction with scores on the negative evaluations of palatable food,  $F(1, 98) = 6.40, p = .01, \eta^2 = .06$ . Among participants who scored high on this negative component of ambivalence, there was no effect of food type,  $F(1, 98) = .95, p = .33, \eta^2 = .01$ , while participants low on this measure had a much more positive affective priming score for palatable food than for neutral food,  $F(1, 98) = 21.88, p = .00, \eta^2 = .18$  (see Fig. 3). Thus, the negative evaluations of palatable food had the same effect on the implicit attitude measure as restrained eating.

Finally, we were interested to see whether the fact that restrained eaters show no affective priming effect towards food stimuli could be due to their enhanced evaluation of the negative aspects of palatable food. We decided to conduct an exploratory mediation analysis and hypothesized that the effect of restraint on affective priming scores for palatable and neutral food items might be attenuated when scores on the negative evaluation of palatable food are included in the analysis. At the same time, if the effect of these negative evaluations is also significant, then this might be an indication of a (partial) mediation of the effect of restraint on food attitudes by the negative evaluation of palatable food (Baron & Kenny, 1986). We therefore conducted a regression analysis on affective priming scores for palatable and neutral food in which we simultaneously entered both participants' restraint scores and their negative evaluations of palatable food. Results showed that indeed, when the negative evaluations were included in the analysis predicting affective priming scores from restrained eating, the effect of restraint was still significant, but reduced,  $F(1, 97) = 6.36, p = .013, \eta^2 = .06$ . At the same time, the effect of the negative evaluation of palatable food was also significant,  $F(1, 97) = 3.98, p = .049, \eta^2 = .039$ . Although exploratory and pointing only towards a partial mediation, together, these findings suggest that restrained eaters' enhanced negative evaluations of palatable food do play a role in the fact that in contrast to unrestrained eaters, they do not display more positive attitudes towards palatable food than towards neutral food.

## General discussion

Do restrained eaters have a more positive attitude towards high-fat, palatable food than unrestrained eaters, which could

explain their overeating? Or do they evaluate palatable food less favorably because it interferes with their dieting goal? The present work addressed these questions by means of a new picture-symbol variant of the affective priming paradigm, and by including the negative component of attitudinal ambivalence as an explanatory variable in the analysis of food attitudes.

The results of two studies showed that while unrestrained eaters evaluate palatable food more positively than neutral or unpalatable food, restrained eaters do not. Restrained eaters hold a more pronounced evaluation of the negative aspects of palatable food, most likely because it is incompatible with their chronic goal of dieting, and this influences their implicit attitudes towards food. Indeed, it was not structural ambivalence as a whole, but rather the negative component of ambivalence, which affected participants' scores on the implicit attitude measure, as this most strongly reflects restrained eaters' goal of dieting.

In the present study, we only found evidence for a partial mediation of affective priming scores by the negative evaluation of palatable food. This could be due to relatively low correlations between restraint on the one hand and ambivalence and its separate components on the other hand, compared to the results of Stroebe, Mensink, et al. (2008), who found a correlation of substantial size ( $r = 0.53$ ). These lower correlations might be attributable to the fact that we measured the positive and negative evaluations of separate palatable food items, presented in ten individual pictures, rather than towards palatable food as a category, as was done by Stroebe and colleagues. The negative evaluations themselves, however, were a strong predictor of affective priming scores that produced the same pattern of means as actual restraint scores. This suggests that while both of the measures influence participants' attitudes in a similar way and do overlap in the variance that they explain, they are also partially independent. Further research should examine the effect of a chronic dieting goal on ambivalence towards food, and the role of goal-dependent ambivalence on implicit attitude measures more generally, since to our knowledge, the present studies are the first to examine this relationship.

In addition, the present work could only provide a preliminary indication that ambivalence contributes to the affective priming effect. Future studies could make use of an experimental manipulation of ambivalence towards food objects to more thoroughly examine the role of stronger and weaker ambivalence on implicit attitude measures. In addition, the effect of individual differences in goal-dependent ambivalence could be weakened or enhanced by experimental manipulations that render either the hedonic aspects of food, or the conflicting dieting goal more salient. When hedonic thoughts about food are active in restrained eaters, the dieting goal should be inhibited and not influence their attitudes towards food. As a result, the implicit food attitudes of restrained eaters should resemble those of unrestrained eaters, with palatable food being evaluated more positively than neutral and unpalatable food.

Our findings on restrained eaters' food attitudes are in line with recent research by Stroebe and colleagues (Stroebe, Mensink, et al., 2008; Stroebe, Papies, et al., 2008), which suggests that restrained eaters experience a goal conflict between the goal of enjoying palatable food and the goal of dieting. The fact that in our studies, participants' awareness of the negative aspects of palatable food was related to implicit food attitudes suggests that the attitude measure that we used in the current studies reflects a "summary evaluation" of the presented food items, which indeed corresponds to the definition of the attitude concept (Eagly & Chaiken, 1993). Per definition, this summary evaluation also integrates information on the negative aspects of the otherwise highly attractive palatable food. In other words, restrained eaters' attitude towards palatable food is less positive than that of unrestrained eaters

because their attitudes also reflect the fact that the palatable food interferes with their goal of dieting (see also Hoefling & Strack, 2008). This could also explain why earlier studies found no evidence for the hypothesis that restrained eaters or overweight individuals hold more positive attitude towards high-fat palatable food (Roefs et al., 2005; Roefs & Jansen, 2002; Roefs et al., 2006), except for the discrepant findings by Hoefling and Strack (2008), who found a tendency for restrained eaters to evaluate high-fat food attributes more positively than unrestrained eaters. Overall, the findings from these studies might lead one to conclude that implicit attitude measures do not provide us with the explanation for restrained eaters' self-regulatory failures with regard to palatable food.

Recently, however, empirical evidence has accumulated that while the strength of implicit evaluations in itself is not always a strong predictor of actual behavior, its predictive value may depend on a number of boundary conditions that vary between persons and between situations. Hofmann, Rauch, and Gawronski (2007), for example, found that the amount of candy participants consumed in a "taste test" was determined by their implicit evaluations of this candy when they were exhausted after an emotion-suppression task, but not when they were not exhausted—then, the amount eaten was dependent on participants' standards of dietary restraint. Similar moderating effects have been reported for example for alcohol, cognitive load and low trait self-control (see Hofmann, Friese, & Wiers, 2008, for an overview). These findings suggest that for understanding failures of self-regulation, one should not focus only on the implicit attitudes per se, but also on the boundary conditions that make it more likely that these attitudes will actually influence behavior. Still, the question remains why restrained eaters have stronger appetitive responses and overeat on palatable foods when they are confronted with attractive food cues, while unrestrained eaters do not (e.g., Brunstrom et al., 2004; Fedoroff et al., 1997; Fedoroff, Polivy, & Herman, 2003). Even when assuming that behavior in these situations is not guided by restraint standards but rather by implicit attitudes towards the presented foods, this cannot fully explain why restrained eaters would eat more than unrestrained eaters, since their implicit attitudes towards high-fat, palatable food items have repeatedly been found not to be more positive than the attitudes of unrestrained eaters. Future research might consider the possibility that restrained eaters can more easily be triggered to act on their hedonic reactions by certain risk factors than unrestrained eaters, which makes their overeating more likely.

However, assuming that such failures of self-regulation are not due to a more positive implicit evaluation of palatable food, what are other possibilities for their underlying mechanisms? Based on recent developments, we would like to suggest that restrained eaters' overeating may be triggered by their more specific hedonic responses to palatable food, rather than their mere positive evaluations of the food, which guide their cognitions and behavior once they have been activated by the perception of palatable food. As recent studies have shown, reading behavior descriptions that involve palatable food, such as chocolate, cake, or pizza, spontaneously triggers in restrained eaters hedonic thoughts about the enjoyment of food, such as "delicious" or "yummy" (Papies et al., 2007; but see Roefs et al., 2005)<sup>2</sup>. Such hedonic

thoughts reflect specifically the expectation of pleasure to be gained from a stimulus and thus refer to an important component of the evaluation of a stimulus (Tesser & Martin, 1996). However, these hedonic thoughts are much more specific than the summary evaluation of food items that is tapped by an implicit attitude measure, and can therefore not be inferred from, for example, affective priming scores. Thus, even though restrained eaters do not seem to have a more positive summary evaluation of palatable food, they do have stronger associations between palatable food and hedonic pleasure, which could influence their behavioral reactions to such food.

Findings from other studies confirm that that these hedonic thoughts about food might play an important role in restrained eaters' regulation of eating behavior. Roefs et al. (2005) have argued that restrained eaters might not differ from unrestrained eaters in their general evaluation of food items, but rather in the specific motivation to eat them, which can also be experienced as increased cravings or "wanting" for food (see also Finlayson et al., 2008; Hill, Wardle, & Cooke, 2009). Hedonic thoughts about food might be the cognitive underpinnings of these reward-related mechanisms, which have been shown to play a central role in the regulation of eating behavior in general (e.g., Lowe & Butryn, 2007; Mela, 2006), and might be more pronounced in restrained than in unrestrained eaters (Papies et al., 2007).

In addition, hedonic thoughts about food have specific cognitive consequences that might influence the regulation of eating behavior. Recent studies by Stroebe, Mensink, et al. (2008; see also Papies et al., 2008b), as described earlier, have shown that hedonic food words lead to the inhibition of the dieting goal in restrained eaters. In a related set of studies, it has been shown that hedonic thoughts about food also direct restrained eaters' visual attention increasingly towards attractive food stimuli, thereby helping to maintain a hedonic orientation and interfering with the pursuit of the dieting goal (Papies et al., 2008a). These findings suggest that hedonic thoughts about food prepare restrained eaters to eat, rather than to diet, when they perceive palatable food. In line with our goal conflict theory of hedonic eating (Papies et al., 2008c; Stroebe, 2008; Stroebe, Mensink, et al., 2008; Stroebe, Papies, et al., 2008), we would like to suggest that via these cognitive mechanisms, hedonic thoughts about food can explain restrained eaters' overeating better than their overall attitudes towards palatable food. Future research might examine whether there are specific circumstances that make it especially likely that such hedonic thoughts will be triggered, or that they will indeed determine eating behavior (see also Roefs et al., 2006; Hofmann et al., 2008).

Although the present research does not point towards implicit attitude measures as the best method to understand restrained eaters' failures of self-regulation, it does introduce and test an innovative picture-symbol variant of the affective priming paradigm as an implicit measure of attitudes, which might be helpful to other researchers. This paradigm, using non-verbal affective symbols as targets, was apt to assess attitudes towards pictorial stimuli and was shown to be sensitive to differences between food types and to individual differences, such as restraint and ambivalence towards food. Our variant of the affective priming task offers two main advantages compared to more traditional implicit measures. First of all, it taps into the affective reaction triggered by the prime more directly than tasks that rely on lexical processing of the target stimuli. In addition, it makes the affective priming paradigm suitable for use with children, who are increasingly a group of interest for researchers examining the development of overweight and other habits related to obesity (see for example Aarts, Paulussen, & Schaalma, 1997; Craeynest et al., 2005; Hill et al., 2009; Nederkoorn, Braet, Van Eijs, Tanghe, & Jansen, 2006). We hope that our picture-symbol variant of the

<sup>2</sup> While it might seem inconsistent that Roefs et al. (2005, Study 2) did not find that restrained eaters had a stronger association between hedonic words and palatable food, this might be explained by the different set-up of the studies. In the Papies et al. (2007) study, a small number of food-related trials were presented among a high number of filler trials, while the Roefs et al. (2005) study presented only food-related words. This set-up might have triggered participants to be somewhat more aware of the purpose of the study and influenced their implicit reactions towards the tempting food stimuli.

affective priming paradigm can be helpful in studying cognitive processes in children and adults alike and thus foster our understanding of nonconscious mechanisms of self-regulation.

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## References

- Aarts, H., Custers, R., & Marien, H. (2008). Preparing and motivating behavior outside of awareness. *Science*, 319, 1639.
- Aarts, H., Paulussen, T., & Schaalma, H. (1997). Physical exercise habit: on the conceptualization and formation of habitual health behaviours. *Health Education Research*, 12, 363–374.
- Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Thousand Oaks, CA: Sage Publications Inc.
- Banse, R. (2001). Affective priming with liked and disliked persons. Prime visibility determines congruency and incongruency effects. *Cognition & Emotion*, 15, 501–520.
- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research. Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51, 1173–1182.
- Blundell, J. E., & Finlayson, G. (2004). Is susceptibility to weight gain characterized by homeostatic or hedonic risk factors for overconsumption? *Physiology & Behavior*, 82, 21–25.
- Brunstrom, J. M., Yates, H. M., & Witcomb, G. L. (2004). Dietary restraint and heightened reactivity to food. *Physiology and Behavior*, 81, 85–90.
- Conner, M., & Sparks, P. (2002). Ambivalence and attitudes. *European Review of Social Psychology*, 12, 37–70.
- Craeynest, M., Crombez, G., Haerens, L., & De Bourdeaudhuij, I. (2007). Do overweight youngsters like food more than lean peers? Assessing their implicit attitudes with a personalized implicit association task. *Food Quality and Preference*, 18, 1077–1084.
- Craeynest, M., Crombez, G., de Houwer, J., Deforche, B., Tanghe, A., & Bourdeaudhuij, I. D. (2005). Explicit and implicit attitudes towards food and physical activity in childhood obesity. *Behaviour Research and Therapy*, 43, 1111–1120.
- de Houwer, J., & Moors, A. (2007). How to define and examine the implicitness of implicit measures. In B. Wittenbrink & N. Schwarz (Eds.), *Implicit measures of attitudes: Procedures and controversies* (pp. 179–194). New York: Guilford Press.
- de Houwer, J., Teige-Mocigemba, S., Spruyt, A., & Moors, A. (2009). Implicit measures. A normative analysis and review. *Psychological Bulletin*, 135, 347–368.
- Eagly, A. H., & Chaiken, S. (1993). *The psychology of attitudes*. Fort Worth, TX: Harcourt Brace Jovanovich.
- Elfghag, K., & Rössner, S. (2005). Who succeeds in maintaining weight loss? A conceptual review of factors associated with weight loss maintenance and weight regain. *Obesity Reviews*, 6, 67–85.
- Fazio, R. H., & Olson, M. A. (2003). Implicit measures in social cognition research. Their meaning and uses. *Annual Review of Psychology*, 54, 297–327.
- Fazio, R. H., Sanbonmatsu, D. M., Powell, M. C., & Kardes, F. R. (1986). On the automatic activation of attitudes. *Journal of Personality and Social Psychology*, 50, 229–238.
- Fedoroff, I. C., Polivy, J., & Herman, C. P. (1997). The effect of pre-exposure to food cues on the eating behavior of restrained and unrestrained eaters. *Appetite*, 28, 33–47.
- Fedoroff, I. C., Polivy, J., & Herman, C. P. (2003). The specificity of restrained versus unrestrained eaters' responses to food cues: General desire to eat, or craving for the cued food? *Appetite*, 41, 7–13.
- Finlayson, G., King, N., & Blundell, J. (2008). The role of implicit wanting in relation to explicit liking and wanting for food: Implications for appetite control. *Appetite*, 50, 120–127.
- Fishbach, A., & Shah, J. Y. (2006). Self-control in action: Implicit dispositions toward goals and away from temptations. *Journal of Personality and Social Psychology*, 90, 820–832.
- Flegal, K. M. (2005). Epidemiologic aspects of overweight and obesity in the United States. *Physiology & Behavior*, 86, 599–602.
- Gorman, B. S., & Allison, D. B. (1995). Measures of restrained eating. In D. B. Allison (Ed.), *Handbook of assessment methods for eating behaviors and weight related problems: Measures, theory, and research* (pp. 149–184). Thousand Oaks, CA: Sage Publications, Inc.
- Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology*, 74, 1464–1480.
- Harvey, K., Kemps, E., & Tiggemann, M. (2005). The nature of imagery processes underlying food cravings. *British Journal of Health Psychology*, 10, 49–56.
- Herman, C. P., & Polivy, J. (1980). Restrained eating. In A. J. Stunkard (Ed.), *Obesity* (pp. 208–225). Philadelphia: Saunders.
- Hermans, D., De Houwer, J., & Eelen, P. (1994). The affective priming effect. Automatic activation of evaluative information in memory. *Cognition & Emotion*, 8, 515–533.
- Hill, C., Wardle, J., & Cooke, L. (2009). Adiposity is not associated with children's reported liking for selected foods. *Appetite*, 52, 603–608.
- Hoefling, A., & Strack, F. (2008). The tempting effect of forbidden foods. High calorie content evokes conflicting implicit and explicit evaluations in restrained eaters. *Appetite*, 51, 681–689.
- Hofmann, W., Friese, M., & Wiers, R. W. (2008). Impulsive versus reflective influences on health behaviour. A theoretical framework and empirical review. *Health Psychology Review*, 2, 111–137.
- Hofmann, W., Rauch, W., & Gawronski, B. (2007). And deplete us not into temptation. Automatic attitudes, dietary restraint, and self-regulatory resources as determinants of eating behavior. *Journal of Experimental Social Psychology*, 43, 497–504.
- Jeffery, R. W., Epstein, L. H., Wilson, G. T., Drenowski, A., Stunkard, A. J., & Wing, R. R. (2000). Long-term maintenance of weight loss: Current status. *Health Psychology*, 19, 5–16.
- Kaplan, K. J. (1972). On the ambivalence-indifference problem in attitude theory and measurement. A suggested modification of the semantic differential technique. *Psychological Bulletin*, 77, 361–372.
- Klauer, K. C., & Musch, J. (2003). Affective priming. Findings and theories. In J. Musch & K. C. Klauer (Eds.), *The psychology of evaluation: Affective processes in cognition and emotion* (pp. 7–49). Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.
- Klauer, K. C., & Teige-Mocigemba, S. (2007). Controllability and resource dependence in automatic evaluation. *Journal of Experimental Social Psychology*, 43, 648–655.
- Kruger, J., Galuska, D. A., Serdula, M. K., & Jones, D. A. (2004). Attempting to lose weight: Specific practices among U.S. adults. *American Journal of Preventive Medicine*, 26, 402–406.
- Lamote, S., Hermans, D., Baeyens, F., & Eelen, P. (2004). An exploration of affective priming as an indirect measure of food attitudes. *Appetite*, 42, 279–286.
- LeGoff, D. B., & Spigelman, M. N. (1987). Salivary response to olfactory food stimuli as a function of dietary restraint and body weight. *Appetite*, 8, 29–35.
- Lowe, M. R., & Butryn, M. L. (2007). Hedonic hunger. A new dimension of appetite? *Physiology & Behavior*, 91, 432–439.
- Mann, T., Tomiyama, A. J., Westling, E., Lew, A.-M., Samuels, B., & Chatman, J. (2007). Medicare's search for effective obesity treatments. Diets are not the answer. *American Psychologist*, 62, 220–233.
- Mela, D. J. (2006). Eating for pleasure or just wanting to eat? Reconsidering sensory hedonic responses as a driver of obesity. *Appetite*, 47, 10–17.
- Monteith, M. J., Voills, C. I., & Ashburn-Nardo, L. (2001). Taking a look underground. Detecting, interpreting, and reacting to implicit racial biases. *Social Cognition*, 19, 395–417.
- Nederkoorn, C., Braet, C., Van Eijs, Y., Tanghe, A., & Jansen, A. (2006). Why obese children cannot resist food: The role of impulsivity. *Eating Behaviors*, 7, 315–322.
- Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we can know. Verbal reports on mental processes. *Psychological Review*, 84, 231–259.
- Papies, E. K., Stroebe, W., & Aarts, H. (2007). Pleasure in the mind. Restrained eating and spontaneous hedonic thoughts about food. *Journal of Experimental Social Psychology*, 43, 810–817.
- Papies, E. K., Stroebe, W., & Aarts, H. (2008a). The allure of forbidden food: On the role of attention in self-regulation. *Journal of Experimental Social Psychology*, 44, 1283–1292.
- Papies, E. K., Stroebe, W., & Aarts, H. (2008b). Healthy cognition. Processes of self-regulatory success in restrained eating. *Personality and Social Psychology Bulletin*, 34, 1290–1300.
- Papies, E. K., Stroebe, W., & Aarts, H. (2008c). Understanding dieting. A social cognitive analysis of hedonic processes in self-regulation. *European Review of Social Psychology*, 19, 339–383.
- Pinel, J. P. J., Assanand, S., & Lehman, D. R. (2000). Hunger, eating, and ill health. *American Psychologist*, 55, 1105–1116.
- Roefs, A., Herman, C. P., MacLeod, C. M., Smulders, F. T. Y., & Jansen, A. (2005). At first sight. How do restrained eaters evaluate high-fat palatable foods? *Appetite*, 44, 103–114.
- Roefs, A., & Jansen, A. (2002). Implicit and explicit attitudes toward high-fat foods in obesity. *Journal of Abnormal Psychology*, 111, 517–521.
- Roefs, A., Quaedackers, L., Werrij, M. Q., Wolters, G., Havermans, R., Nederkoorn, C., et al. (2006). The environment influences whether high-fat foods are associated with palatable or with unhealthy. *Behaviour Research and Therapy*, 44, 715–736.
- Rogers, P. J., & Hill, A. J. (1989). Breakdown of dietary restraint following mere exposure to food stimuli. Interrelationships between restraint, hunger, salivation, and food intake. *Addictive Behaviors*, 14, 387–397.
- Stroebe, W. (2000). *Social Psychology and Health*. Buckingham, UK: Open University Press.
- Stroebe, W. (2008). *Dieting, overweight and obesity. Self-regulation in a food-rich environment*. Washington, DC: American Psychological Association.
- Stroebe, W., Mensink, W., Aarts, H., Schut, H., & Kruglanski, A. W. (2008a). Why dieters fail. Testing the goal conflict model of eating. *Journal of Experimental Social Psychology*, 44, 26–36.
- Stroebe, W., Papies, E. K., & Aarts, H. (2008b). From homeostatic to hedonic theories of eating. Self-regulatory failure in food-rich environments. *Applied Psychology: An International Review*, 57, 172–193.
- Tepper, B. J. (1992). Dietary restraint and responsiveness to sensory-based food cues as measured by cephalic phase salivation and sensory specific satiety. *Physiology and Behavior*, 52, 305–311.
- Tesser, A., & Martin, L. (1996). The psychology of evaluation. In E. T. Higgins & A. W. Kruglanski (Eds.), *Social psychology: Handbook of basic principles* (pp. 948–). New York, NY, US: Guilford Press.
- Thompson, M. M., Zanna, M. P., & Griffin, D. W. (1995). Let's not be indifferent about (attitudinal) ambivalence. In R. E. Petty & J. A. Krosnick (Eds.), *Attitude strength: Antecedents and consequences* (pp. 361–386). Mahwah: Erlbaum.

- van Strien, T., Breteler, M. H. M., & Ouwens, M. A. (2002). Restraint scale, its sub-scales concern for dieting and weight fluctuation. *Personality and Individual Differences*, 33, 791–802.
- Wardle, J. (1986). The assessment of restrained eating. *Behaviour Research and Therapy*, 24, 213–215.
- Wegner, D. M. (2002). *The illusion of conscious will*. Cambridge, MA: MIT Press.
- Yeomans, M. R. (1998). Taste, palatability and the control of appetite. *Proceedings of the Nutrition Society*, 57, 609–615.
- Wentura, D., Kulfanek, M., & Greve, W. (2005). Masked affective priming by name letters: Evidence for a correspondence of explicit and implicit self-esteem. *Journal of Experimental Social Psychology*, 41, 654–663.