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# From Homeostatic to Hedonic Theories of Eating: Self-Regulatory Failure in Food-Rich Environments

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Psychological theories of weight regulation are based on homeostatic feedback assumptions. They mostly attribute the cause of overweight and obesity to lowered sensitivity to internal hunger and satiety cues. Based on the assumption that human food consumption in food-rich environments is increasingly driven by pleasure rather than need for calories, a goal conflict theory of hedonic eating is presented. This theory is not only supported by the outcome of our own research programme but can also account for findings of the research conducted in the context of other psychological theories. Some implications for weight loss strategies are discussed.

Les théories psychologiques sur la régulation du poids sont basées sur des hypothèses d'une rétroaction homéostasique. Elles attribuent généralement la cause de la surcharge pondérale et de l'obésité à une sensibilité interne amoindrie à la faim et aux indicateurs de satiété. Reposant sur l'hypothèse que la consommation alimentaire humaine dans des environnements riches en nourriture est de plus en plus guidée par le plaisir plutôt que par le besoin de calories, une théorie "goal conflict theory of hedonic eating" est présentée. Cette théorie qui ne s'appuie pas seulement sur les résultats de notre propre programme de recherches, peut aussi expliquer les résultats d'études réalisées dans le cadre d'autres théories psychologiques. Des implications concernant des stratégies de perte de poids sont discutées.

## INTRODUCTION

Overweight and obesity have become world-wide problems. During the last three decades, there has been a dramatic increase in the prevalence of overweight and obesity in most industrialised countries. For example, since 1980 obesity rates have doubled in the USA (Ogden, Carroll, Curtin, McDowell, Tabak, & Flegal, 2006) and nearly tripled in Great Britain (Rennie & Jebb, 2005). This is a matter of grave concern, because obesity is associated with heightened risk of morbidity and mortality (McGee, 2005; Stroebe, 2008).

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Furthermore, obese individuals are also the target of prejudice and discrimination (e.g. Brownell, Puhl, Schwartz, & Rudd, 2005). In view of these negative consequences, it is not surprising that overweight and obese individuals try to lose weight (e.g. Hill, 2002; Kruger, Galuska, Serdula, & Jones, 2004). Such dieting efforts can result in substantial weight loss in the short run but are much less effective in the long run. Evidence from clinical weight loss studies suggests that most participants fail to maintain their weight loss over more than three to four years (Mann, Tomiyama, Lew, Samuels, & Chatman, 2007; Powell, Calvin, & Calvin, 2007).

Why do some people become overweight and even obese, whereas others appear to be able to keep their weight within normal range? This question has interested psychologists for many decades (e.g. Bruch, 1961; Herman & Polivy, 1984; Kaplan & Kaplan, 1957; Nisbett, 1972; Schachter, 1971). Most theorists agree that (a) weight is homeostatically regulated through bodily signals of hunger and satiety and that (b) for various reasons this homeostatic regulation malfunctions in individuals with weight problems (Bruch, 1961; Herman & Polivy, 1984; Kaplan & Kaplan, 1957; Schachter, 1971). The one exception is Nisbett (1972) whose set-point theory incorporates the first, but not the second principle. According to this theory overweight and obesity are due to inter-individual *variations* in people's set-point for weight rather than a malfunction in homeostatic control.

There is no question that food intake and body weight are homeostatically controlled and that hormonal and neural signals are critical to the regulation of individual meals and body fat (e.g. Woods, Schwartz, Baskin, & Seeley, 2000). What is increasingly questioned, however, is the importance of homeostatic regulation for the development of overweight and obesity (Lowe & Butryn, 2007; Lowe & Levine, 2005; Pinel, Assanand, & Lehman, 2000; Stroebe, 2000, 2002). For example, Pinel and colleagues argued that people living in food-replete environments rarely experience energy deficits but rather eat because of the anticipation of pleasure that can be derived from food. Lowe and Butryn (2007) suggested a distinction between homeostatic hunger, which is the result of the prolonged absence of energy intake, and hedonic hunger, which is strongly influenced by the availability and palatability of food in the environment. Lowe and Butryn (2007) proposed that people have weight problems because their eating is overly influenced by hedonic rather than homeostatic hunger. My colleagues and I have incorporated the idea of hedonic eating into the goal conflict theory of eating, a comprehensive theory of eating behaviour which can explain the difficulties in weight regulation (Papies, Stroebe, & Aarts, 2007, in press-a, in press-b; Stroebe, 2002; Stroebe, Mensink, Aarts, & Kruglanski, 2008).

The first part of this article will review classic psychological theories of obesity and eating regulation and discuss the shortcomings of explanations that attribute overweight and obesity to malfunctions in the homeostatic

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control of body weight. Then, we present our conflict theory of eating, which assumes that people overeat because of the pleasurable experience and not because of some malfunction in their homeostatic control mechanisms. Since weight-reducing diets as a strategy of weight control have come under serious criticism (e.g. Cogan & Ernsberger, 1999; Polivy & Herman, 1983), we will end this article with a discussion of the implications of our model for weight control strategies.

## PSYCHOLOGY AND THE HOMEOSTATIC REGULATION OF FOOD INTAKE

In their presentation of their psychosomatic theory of obesity, Kaplan and Kaplan (1957) expressed the then-novel view that obesity was not caused by a metabolic disorder but was the result of overeating. One reason for abnormal overeating was a "disturbance in hunger or appetite" (1957, p. 197) as a consequence of the fact that hunger and appetite had become classically conditioned to non-nutritional factors. For example, hunger and appetite may be elicited by previously neutral stimuli that have been regularly associated with hunger and eating (e.g. one's regular lunchtime or dinnertime). A second type of abnormal overeating occurred because eating (according to the Kaplans) reduces fear and anxiety. Fear and anxiety are negative drive states. Behaviour that reduces fear and anxiety will therefore be reinforced (i.e. instrumental conditioning). Individuals who have learned this association will be motivated to eat whenever they are anxious without feeling any "conscious increase in hunger or appetite" (1957, p. 189; comfort hypothesis). With these learning principles, Kaplan and Kaplan (1957) offered a theory-based analysis of the mechanisms through which non-nutritional factors could influence eating. They failed to explain, however, why the appetite of some individuals (i.e. the overweight or obese) and not of others becomes associated with stimuli such as lunchtime or dinnertime, and why only overweight and obese individuals, and not others, are expected to experience eating as fear-reducing.

Bruch (1961) offered an alternative explanation for the assumed tendency of obese individuals to overeat when experiencing anxiety or other strong emotions. On the basis of her clinical observations of patients with obesity, she concluded that these individuals were unable to differentiate sensations of hunger from other states of bodily arousal (differential sensitivity hypothesis). She attributed this inability to experiences in childhood, with the ultimate cause being the failure of parents to teach their children to recognise hunger signals. When mothers use food as an expression of love or to pacify or reward their child rather than in response to their nutritional needs, the child cannot learn to recognise internal hunger signals or to distinguish them from other states of bodily arousal.

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Early empirical support for the differential sensitivity hypothesis was provided by a study of Stunkard and Koch (1964) that showed that gastric motility was related to self-report of hunger in normal weight but not obese individuals. However, a more direct experimental test of the mechanisms through which anxiety was expected to stimulate eating in obese individuals did not support Bruch's hypothesis (Schachter, Goldman, & Gordon, 1968). Schachter et al. (1968) manipulated anxiety in their participants by letting them expect to receive either a strong or a weak electric shock. As a second factor, they manipulated satiety by having half of their participants eat roast beef sandwiches at the start of the experimental session (a so-called "preload"), whereas the other half remained unfed. The dependent measure in this study was the amount participants ate in an (alleged) taste test, in which they had to rate the taste of different types of crackers. In support of the differential sensitivity hypothesis, the preload reduced the amount eaten by normal weight but not obese participants. However, there was no support for Bruch's second assumption that obese participants overeat because they misinterpret fear as hunger sensation.

This pattern of finding led Schachter and colleagues (1968) to formulate the basic assumption of their "externality theory", namely "that internal state is irrelevant to eating by obese, and that external, food-relevant cues trigger eating for such people" (p. 97). Such food-relevant external cues could be a non-caloric property of food (e.g. palatability) or any aspect of the environment which signalled palatable food (e.g. sight or smell of food; salience of food cues) or in the past had been regularly associated with eating (e.g. dinnertime). A series of innovative and by now classic studies which assessed the impact of external eating-relevant cues on eating behaviour of obese individuals provided strong empirical support for many of the basic assumptions of externality theory (Goldman, Jaffa, & Schachter, 1968; McArthur & Burstein, 1975; Nisbett, 1968; Ross, 1974; Schachter & Friedman, 1974; Schachter et al., 1968; Schachter & Gross, 1968; Tom & Rucker, 1975).

With his externality theory, Schachter (1971) offered a plausible explanation for the tendency of obese individuals to overeat in response to external, food-relevant cues. However, he could not explain why obese individuals were overly sensitive to external cues in the first place.[1] Such an explanation was offered by Nisbett (1972) with his set-point theory of body weight. According to this theory, body weight is determined by a set-point, which regulates weight in the manner that the thermostat in a central heating

[1] He later offered an explanation (Schachter & Rodin, 1974). With this later theory, the sound insight that individuals with obesity are overly responsive to external food-relevant cues was overextended to a sensitivity to all external cues, food-relevant or not. It was this later assumption and not the original theory that has been refuted by Rodin (1981) in her influential article entitled "Current status of the internal–external hypothesis for obesity: What went wrong?".

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system regulates temperature. The wide inter-individual variation in body weight is explained by the assumption that different people have their weight set at different levels. In our culture, obese individuals face the unfortunate situation that their weight is set far above the cultural norm.

The most important derivation of set-point theory is that the organism will defend its body weight against any pressure to change, which would explain why overweight and obese individuals have such trouble in achieving normal weight. Furthermore, due to social pressures against overweight in our culture, most overweight and obese individuals are trying most of the time to reduce their food intake and lower their weight. As a result they are hungry. Their over-responsiveness to external, food-relevant cues is not due to their overweight but results from their chronic state of food deprivation (Nisbett, 1972).

Since a critique of set-point theory is beyond the scope of this article, we refer the reader to Pinel et al. (2000) or Stroebe (2008), who argue that there is little empirical support for some of the central assumptions of set-point theory. And yet the theory had a lasting impact on psychological thinking about obesity and provided the theoretical justification for the anti-dieting movement to be discussed later (e.g. Cogan & Ernsberger, 1999; Polivy & Herman, 1983). It also provided the impetus for the theory of restrained eating, which was originally conceived as an extension of externality theory (Herman & Polivy, 1980). By linking externality to food deprivation, the theory of restrained eating provided a rationale for the over-responsiveness of individuals to external food-relevant cues. Since food deprivation rather than obesity was now seen as the cause of over-responsiveness, dietary restraint promised to be a better predictor than body weight of an individual's sensitivity of food-relevant cues. When Herman and Mack (1975) developed the Restraint Scale (RS) as a measure of the degree of self-imposed restriction of food intake, this measure replaced obesity as the predictor of overeating. The RS consists of two moderately correlated subscales, one measuring concern for dieting, and the other weight fluctuations.

It soon became obvious that the dieters identified with the RS were unsuccessful dieters, who were more notable for their lapses of restraint than for their restraint per se (e.g. Herman & Mack, 1975; Herman & Polivy, 1980). In fact, the RS is moderately and positively correlated with percentage overweight and even obesity (Stroebe, 2008). Therefore, Herman, Polivy and their colleagues abandoned the idea that the RS would identify dieters who were below their biological set-point (for a discussion, see Heatherton, Herman, Polivy, King, & McGree, 1988). They also integrated the concept of restrained eating into their boundary model of the regulation of eating, which has dominated psychological eating research since the mid-1980s (Herman & Polivy, 1984). They proposed that biological pressures work to maintain food intake within a certain range: the aversive qualities of hunger

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keep consumption above a minimum and the aversive qualities of satiety keep it below a maximum. Between these two boundaries, there is a zone of biological indifference, where eating is regulated by psychological factors. Restrained eaters are chronic dieters who impose a diet boundary within their zone of biological indifference. This boundary consists of a set of diet rules which specify the kind of food and the amount of calories they allow themselves to eat. The purpose of these dieting rules is to limit food intake and to achieve or maintain a desirable body weight. In contrast to unrestrained eaters, who regulate their eating in response to bodily cues of hunger and satiation, restrained eaters regulate their food intake cognitively through the application of these dieting rules. Since they habitually negate their bodily signals, they have become more or less insensitive to sensations of hunger or satiation.

The cognitive control of food intake requires more cognitive resources than the automatic regulation in response to bodily feedback. As long as restrained eaters are motivated and able to concentrate on the regulation of their eating, they are capable of keeping to their diet boundary. However, if their motivation to restrict their food intake is impaired, physiological regulation takes over and they eat until they are full. Since, due to their (presumed) insensitivity to internal cues, their satiety boundary is supposed to be displaced upwards, they are likely to consume greater amounts of food than unrestrained eaters before they reach their satiety boundary. Two factors interfere with their ability or motivation to control their food intake, namely (a) emotional distress and (b) the realisation that they have already violated their dietary limits.

There is a great deal of support for the hypothesis that emotional distress induces overeating in restrained eaters (for reviews, see Heatherton & Baumeister, 1991; Stroebe, 2008). The mechanisms underlying this effect are less clear. In view of the substantial correlation between body weight and restrained scores, the finding that distressing emotions result in overeating in restrained eaters would be consistent with the comfort hypothesis suggested by Kaplan and Kaplan (1957). A somewhat different explanation has been suggested by Herman and Polivy (1984), who argued that emotional distress undermines the dieting motivation of restrained eaters by imposing concerns that seem more urgent than weight control. Finally, my colleagues and I have suggested an explanation in terms of cognitive load. Coping with distress requires cognitive resources and this impairs the ability of restrained eaters to focus on their dieting goal (Boon, Stroebe, Schut, & Jansen, 1997; Boon, Stroebe, Schut, & Ijtema, 2002; see also Mann & Ward, 2000; Lowe & Kral, 2006). According to this interpretation, not only distressing experiences but also extreme pleasure, even non-emotional experiences that are distractive, are likely to induce overeating in restrained eaters. The fact that distraction when participants were eating a high calorie ice cream (Boon

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et al., 2002) or comic films induced overeating in restrained eaters (Cools, Schotte, & McNally, 1992) tends to support our explanation in terms of cognitive load.

The effects of breach of the diet boundary of restrained eaters on overeating have been tested with a modified version of the preload paradigm, where respondents are preloaded with some rich, normally forbidden food. For example, in the preload conditions of Herman and Mack (1975), respondents were asked to consume either one or two creamy milkshakes, before having to rate the taste of different flavours of ice creams. Whereas unrestrained eaters ate less ice cream with than without a preload, restrained eaters ate more when preloaded (i.e. interaction between preload condition and eating restraint). Thus, restrained eaters were not only unaffected by the preloads in the amount they ate (nonregulation), but actually ate more with than without a preload (counterregulation). Although the interaction between eating restraint and preload on amount eaten has been frequently replicated, most studies found only nonregulation and only few found evidence of counterregulation (for a review, see Stroebe, 2008). Studies that demonstrated that it was not the actual number of calories in the preload but the (manipulated) beliefs about the calorie content that determine whether restrained eaters overeat, indicated that the preload effect was mediated by cognitive rather than physiological mechanisms (Polivy, 1976; Spencer & Fremouw, 1979; Woody, Constanzo, Liefer, & Conger, 1981).

Herman and Polivy (1984) attributed the tendency of restrained eaters to overeat, once they realise that they have breached their diet boundary, to so-called "what-the-hell" cognitions. Having violated their diet boundary, the dieters give up all attempts at eating control and eat until their satiety boundary is reached. However, studies that were specifically designed to test this assumption found no evidence for these cognitions (i.e. French, 1992, Experiment 2; Jansen, Oosterlaan, Merckelbach, & van den Hout, 1988). Furthermore, disinhibition effects have occurred under conditions to which this explanation could not apply. For example, Jansen and van den Hout (1991) found that restrained eaters who merely smelled a preload of palatable food items counterregulated in a subsequent taste test. Because smelling food does not involve transgression of a diet boundary, this finding is problematic for the boundary model. Even outcomes of studies conducted by Herman, Polivy and their colleagues themselves are inconsistent with their model. Thus, Fedoroff, Polivy, and Herman (1997, 2003), who exposed half of their respondents to the smell of pizza before they had to rate the taste of four freshly baked pizzas, found that this resulted in increased pizza consumption among restrained but not unrestrained eaters.

Why should the smell of palatable food undermine the dieting intentions of chronic dieters? We would suggest that these disinhibition effects do not result from "what-the-hell" cognitions combined with a decreased sensitivity

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to internal cues of satiation, but from the anticipated pleasure of eating delicious food. This assumption would also explain why all successful empirical demonstrations of disinhibition effects among restrained eaters used ice cream or some other highly palatable food (e.g. cookies, candies, or nuts; Stroebe, 2008). That overeating mainly occurs when the food to be eaten is highly palatable was further demonstrated by the fact that the only preload study that manipulated the taste of ice cream found a preload effect only on good-tasting ice cream (Woody et al., 1981). And yet, palatability and eating enjoyment are not considered major determinants of eating by the boundary model. These concerns led us to develop our goal conflict model which assumes that the anticipated pleasure of palatable food is the major force that tempts restrained eaters into violating their diet.

## A GOAL CONFLICT MODEL OF HEDONIC EATING

According to the goal conflict model of eating, the difficulty of restrained eaters in resisting the attraction of palatable food is due to a goal conflict between two *incompatible goals*, namely the goal of eating enjoyment and the goal of weight control (Stroebe, 2002, 2008; Stroebe et al., 2008). Restrained eaters would like to enjoy the pleasure of eating palatable food, but as chronic dieters they also want to lose (or at least not gain) weight. Goals are mentally represented as desirable future states that the individual wants to attain (Aarts & Dijksterhuis, 2000; Kruglanski, 1996; Shah & Kruglanski, 2002; Shah, Friedman, & Kruglanski, 2002). Even though the goal of eating enjoyment is much more desirable for restrained eaters than the goal of weight control, it usually is less cognitively accessible.[2] For example, when working on some engrossing task at their place of work, restrained eaters are unlikely to think about eating enjoyment and therefore have no need to shield their goal of weight control by inhibiting thoughts about eating. Unfortunately (at least from the perspective of restrained eaters), most of us live in food-rich environments, where palatable food is widely available and where we are surrounded by cues symbolising or signalling palatable food. Such cues are likely to *prime* the goal of eating enjoyment (i.e. increase its cognitive accessibility). Once the goal of eating enjoyment is instigated by such palatable food cues, the goal of eating control will be inhibited. As Aarts, Custers, and Holland (2007) argued, a goal that is accessible and competes for attention with another temporary more focal goal is inhibited to prevent interference during goal pursuit. Since eating enjoyment and eating control are incompatible goals, the

[2] *Cognitive accessibility* refers to the ease or speed with which information stored in memory comes to mind (i.e. can be retrieved).

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increased accessibility of eating enjoyment will result in inhibited access to the mental representation of the goal of eating control (Aarts et al., 2007; Shah et al., 2002). Thus, we might enter a restaurant with the intention of eating only a salad. However, after seeing all our favourite dishes on the menu we might forget our good intentions and order a three-course meal. It is important to note that both the goal priming and the inhibition processes can occur outside conscious awareness (e.g. Aarts et al., 2007; Shah et al., 2002).

In a first test of our theory, we primed restrained and unrestrained eaters[3] subliminally with adjectives (e.g. delicious, tasty) that should trigger the goal of eating enjoyment (Stroebe et al., 2008, Experiment 2). In a control condition, we used neutral primes (e.g. neither, nor). Since each word was presented for only 23 milliseconds on a computer monitor, participants were unable to read the word. We then assessed the accessibility of the concepts reflecting eating control with a lexical decision task. With this task, participants are presented with either words or non-word letter strings. They are asked to decide as fast as possible whether the set of letters represents a word or a non-word sequence. The critical words we used to represent the concept of dieting (e.g. slim, diet, weight) were interspersed with trials in which irrelevant words were used. There is empirical evidence that the time taken to recognise the behavioural concepts in this task reflects relative accessibility of representations of eating control behaviour (e.g. Aarts & Dijksterhuis, 2000; Neely, 1991). Consistent with predictions, priming with eating enjoyment words (but not with neutral words) significantly increased the time it took restrained eaters to recognise the dieting words. The eating enjoyment primes had no effect on reaction times of unrestrained eaters.

One could object that by using adjectives such as tasty or appetising which are descriptive of the experience of eating enjoyment, we primed eating enjoyment directly, whereas in everyday life eating enjoyment is primed by attractive food items that trigger hedonic thoughts in restrained eaters. We therefore conducted a second study in which we used both adjectives descriptive of eating enjoyment and words representing attractive food items (e.g. French fries, chocolate) as primes (Stroebe et al., 2008, Experiment 3). Results showed that both the attractive food words and the eating enjoyment words led to the inhibition of the dieting goal, but only in restrained eaters. These findings provide strong support for our model's central tenet that restrained eaters have two conflicting goals with respect to eating, and that cues that trigger the eating enjoyment goal resolve this conflict at the cost of weight control.

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[3] Restrained eating was assessed with the Concern for Dieting Subscale (CD) of the RS (Heatherton et al., 1988). We used only the CD-subscale, because it best reflects the goal of eating control.

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Researchers in the domain of eating behaviour usually prefer to use the amount eaten as their dependent measure and might therefore be reluctant to accept reaction times as the indicator of eating motives. The advantage of our procedure is that it allows us to study the cognitive processes that are likely to determine the eating behaviour. Studies which simply observe eating behaviour in experimental settings typically provide no information about underlying processes and thus do not permit us to test the process assumptions implied by theories of eating regulation. Moreover, the fact that priming eating enjoyment results in overeating by restrained eaters has already been amply demonstrated in studies that exposed participants to the smell of palatable food (e.g. Fedoroff et al., 1997, 2003; Jansen and van den Hout, 1991) or presented them with food pictures (Tom & Rucker, 1975).

Why do palatable food items have greater attraction for restrained than for unrestrained eaters? It would seem plausible that compared to unrestrained eaters, restrained eaters hold a more positive attitude towards palatable food. However, research assessing attitudes towards palatable food using explicit as well as implicit measures (e.g. EAST: Roefs, Herman, MacLeod, Smulders, & Jansen, 2005; affective priming: Mensink, 2005; Roefs et al., 2005) found no support for this assumption. Unrestrained eaters liked palatable food as much as did restrained eaters.

A more valid reason for the difficulty which restrained eaters experience in resisting palatable food could be the difference in the way they cognitively represent food items. This is suggested by the work on delay of gratification of Mischel and his colleagues (e.g. Metcalfe & Mischel, 1999; Mischel & Ayduk, 2004; Mischel, Shoda, & Rodriguez, 1989). Since restrained eaters have to decide whether to go for the immediate gratification of pleasurable eating or the delayed gratification of losing weight, the work of Mischel and colleagues has direct relevance for research on eating restraint. Extrapolating from their findings, one could assume that restrained eaters would be more likely than unrestrained eaters to access "hot" representations that reflect the consummatory features of palatable food (i.e. its taste and texture), whereas unrestrained eaters use "cool", informational representations of food items. As Mischel's work on delay of gratification has amply demonstrated, a focus on the hedonic features of food stimuli makes delay of gratification much more difficult.

Indirect support for these assumptions comes from studies of physiological and affective reactions to the perception of food. The presence or even the smell of palatable food induces more salivation in restrained than unrestrained eaters (e.g. Brunstrom, Yates, & Whitcomb, 2004; LeGeoff & Spigelman, 1987; Tepper, 1992). Furthermore, exposure to palatable food cues elicits stronger cravings in restrained eaters (Fedoroff et al., 1997). A more direct test of this hypothesis was conducted by Papies et al. (2007). In this study we used the probe recognition task (McKoon & Ratcliff, 1986), which

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assesses the spontaneous activation of concepts during text comprehension. Respondents are presented with a number of behaviour descriptions. Each behaviour description is immediately followed by a probe word and respondents have to decide as fast as possible whether or not this probe word was part of the sentence. On critical trials, the probe word is implied by a sentence without actually having been part of it. Reading the sentence can increase the accessibility of the implied probe word, so that respondents take longer to give the correct "no" response. In our studies, we used sentences like "Jim eats a piece of pizza", and hypothesised that these would activate the concept of "tasty" or "appetising" especially in restrained eaters, who represent palatable food in hedonic terms. Therefore, restrained eaters should take longer to decide that such hedonic adjectives were not part of the sentence. The findings of two studies using the probe recognition and a related paradigm supported the assumption that palatable but not unpalatable food items elicit such hedonic thoughts in restrained but not in unrestrained eaters (Papies et al., 2007). This supports our assumption that part of the problem for restrained eaters in resisting tempting food items is that they tend to imagine how good the food would taste, thus anticipating the pleasure of eating. Since these thoughts are incompatible with their goal of eating control, they are likely to result in the inhibition of eating control thoughts.

Attentional bias is another factor which was found to play an important role in impairing the ability of children to delay gratification (e.g. Metcalfe & Mischel, 1999; Mischel & Ayduk, 2004; Mischel et al., 1989). Children who fixed their attention on the rewards during the delay period were typically less able to delay gratification than were children who could disengage their attention. Applying this finding to the situation of restrained eaters, one would expect that by triggering hedonic thoughts and inhibiting thoughts about dieting, palatable food should attract and hold the attention of restrained eaters and thus make it more difficult for them to resist temptation and to control their food intake (see Figure 1). The relevance of this type of attentional bias in undermining eating control is underscored by the fact that evidence for attentional bias has also been found in many addiction-related disorders, including alcohol dependence, nicotine dependence, cocaine dependence, and opiate dependence (for a review, see Franken, 2003).

We used the probe identification task of MacLeod, Mathews, and Tata (1986) to assess attentional bias (Papies et al., in press-a). Participants were presented with word pairs on a computer screen. After a brief presentation, both words disappeared and a probe stimulus (arrow) appeared in the location of one of the two words. Participants were asked to respond as quickly as possible to this probe by indicating whether it is pointing up or pointing down, by using clearly marked keys on the computer keyboard. The critical word pairs used in our study were food words paired with

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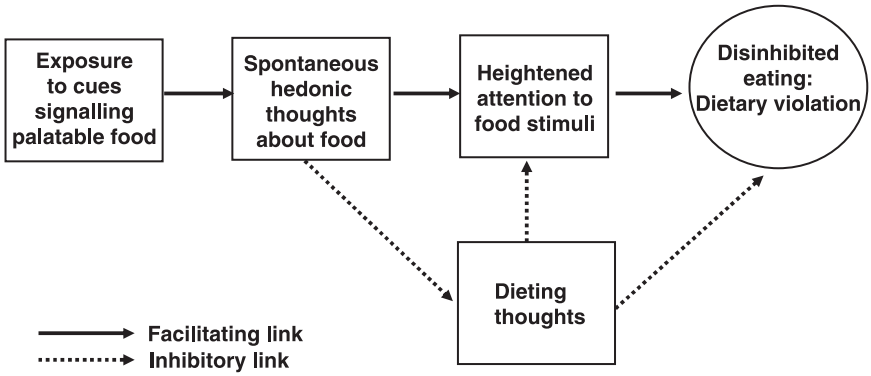


FIGURE 1. Why (chronic) dieters fail: a process model.

office-related words. If food words "grab" the attention of restrained eaters, these individuals should identify the probe more quickly when it is displayed in the position of the food rather than the office word. The difference in the time it takes participants to locate the probe in the food rather than the neutral word position was used as a measure of attentional bias.

As we mentioned earlier, we assume that exposure to attractive food cues triggers hedonic thoughts in restrained eaters and inhibits the mental representation of the dieting goal. We propose that this twofold reaction will influence restrained eaters' subsequent processing of food cues, which will be dominated by the highly accessible hedonic thoughts rather than their dieting goal. Thus, the allocation of selective attention will be influenced by hedonic thoughts about food, leading to increased attention for food items that match the current hedonic orientation. To initiate the hedonic orientation towards food, we manipulated pre-exposure to food cues before assessing attentional bias. Pre-exposure was manipulated by having participants respond to a lexical decision task, in which the target words were either 20 food or 20 neutral words. Next, participants had to perform the probe identification task described above. Finally, they were asked to indicate their liking of the food stimuli. Consistent with our hypotheses, attentional bias emerged only after food cue exposure and only for restrained eaters, but not unrestrained eaters. More specifically, after the food pre-exposure, restrained eaters had an attentional bias for palatable food as a function of their rated liking of this food, so that they allocated more attention to the palatable food if they liked it more. For unrestrained eaters, there was no association between attentional bias and palatability. In the condition without initial exposure to food words, no association emerged for restrained or unrestrained eaters.

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In a second study, we added an extra condition in which participants were primed with the goal of weight control during the assessment of attentional bias. We reasoned that this should re-activate the dieting goal in restrained eaters and therefore prevent them from allocating increased attention to palatable food. Indeed, no attentional bias for palatable food was found in this condition, whereas restrained eaters did have an attentional bias for palatable food when they were not primed with dieting.

The findings of the studies reported in this section are consistent with predictions from our goal conflict theory that food consumption of restrained eaters is dominated by the conflict between two incompatible goals, namely the goal of eating enjoyment and the goal of eating control. The difficulty of restrained eaters in resisting the attraction of palatable food is due to the fact that for them, exposure to palatable food elicits hedonic cognitions about the taste of the food and the pleasure of eating (Papies et al., 2007). These hedonic cognitions trigger the inhibition of the incompatible goal of eating control (Stroebe et al., 2008). Once this has happened, their attention appears to remain attached to the palatable food stimuli, unless they are reminded again of their dieting goal (Papies et al., 2007, in press-a).

We would like to point out that our theory is not only consistent with the findings of our own studies but also with all of the findings we have reviewed in this article. Since there is evidence that a high proportion of obese individuals are restrained eaters (Stroebe, 2008), and since restrained eaters are overly sensitive to cues that signal palatable food, the findings of research conducted on externality theory are compatible with the goal conflict theory (Goldman et al., 1968; McArthur & Burstein, 1975; Nisbett, 1968; Ross, 1974; Schachter & Friedman, 1974; Schachter et al., 1968; Schachter & Gross, 1968; Tom & Rucker, 1975). The goal conflict theory can also account for the findings of research guided by the boundary model. Like the boundary model, our model assumes that restrained eaters invest more cognitive effort than unrestrained eaters in regulating their eating. As a result, they are more affected by cognitive capacity restrictions due to cognitive load. Thus, if they experience strong emotions or are subject to other distractions while being exposed to palatable food, they are likely to overeat.

With regard to the preload studies, we would argue that the consumption of tasty milkshakes (or other palatable preloads) is likely to prime eating enjoyment in restrained eaters. As a consequence, they pay less attention to controlling their food intake in a subsequent taste test. Because this process operates below the individuals' awareness, it is not reflected by measures of conscious cognitions which would explain the failure of the studies of French (1992) and of Jansen et al. (1988) to find evidence for "what-the-hell" cognitions. Finally, since the smell of delicious food is a powerful eating enjoyment prime, our theory can also account for the findings of Fedoroff

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et al. (1997, 2003) and of Jansen and van den Hout (1991) that pizza smells or smelling the preload without actually eating it can result in overeating.

## IMPLICATIONS FOR WEIGHT-LOSS PRACTICE: IS DIETING HARMFUL?

As mentioned earlier, restraint theory was originally conceived as a link between set-point and externality theory. Restrained eaters were assumed to be unfortunate individuals with a set-point for their body weight that was fixed far above the cultural norm. In their futile attempt to lose weight to conform to cultural norms, these individuals became chronic dieters. When Herman, Polivy and their colleagues abandoned the link to set-point theory (Heatherton et al., 1988), they could no longer offer an explanation why people became restrained eaters. The boundary model takes the existence of eating restraint as given and offers no explanation for its development. As a result, eating restraint is considered dysfunctional and even dangerous because of its association with binge eating and its suspected role as a risk factor for the development of eating disorders (Polivy & Herman, 1983).

Although there is little support for set-point theory (Pinel et al., 2000; Stroebe, 2008), there is evidence for a genetically determined susceptibility to weight gain (Bouchard & Rankinen, 2008; Lowe & Kral, 2006). It therefore seems likely that restrained eaters are mostly individuals who have a disposition that favours weight gain and who therefore monitor their food consumption in order to counteract this disposition. The positive correlation between BMI and restraint indicates that these attempts are not always successful. However, without chronically restricting their food intake, these individuals might have been at risk of becoming obese. The fact that 8.6 per cent of normal weight men and 28.7 per cent of normal weight women report that they are trying to lose weight (Serdula, Mokdad, Williamson, Galuska, Mendlein, & Heath, 1999) is often considered a reflection of vanity due to the unrealistic body weight ideals propagated by the mass media. This may be true for some individuals; but others may have problems keeping their weight stable and are trying to lose weight they have recently gained.

There are two main objections against dieting, namely that it is ineffective and that it is unhealthy. Let us discuss each of those objections in turn. Knowledge about dieting as a method of weight control is based on findings of studies of the small minority of individuals who are extremely overweight and obese and who mostly participate in hospital- and university-based programmes. According to a non-representative US survey, these constitute approximately 5 per cent of those who are trying to lose weight (Brownell, 1994). There is also reason to believe that data based on these individuals paints too gloomy a picture of the efficacy of weight loss attempt. There is consistent evidence that persons with obesity who enrol in clinical weight

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loss programmes may represent the most severe cases and may be more resistant to treatment (e.g. Fitzgibbon, Stolley, & Kirschenbaum, 1994; French et al., 1995).

Information on weight loss and weight loss maintenance in the general population allows slightly more optimism (McGuire, Wing, & Hill, 1999; Wing & Hill, 2001). But even the few studies of the efficacy of dieting conducted with members of the general population focus on individuals who try to lose a substantial amount of weight. For example, members of the National Weight Control Registry in the United States have to have lost at least 13.6 kilograms and maintained this loss for at least 1 year to enrol in the registry (Wing & Hill, 2001). We know practically nothing about the success of individuals who became chronic dieters soon after they realised that their weight was creeping up and have tried all their life to keep near to their desired weight by exercising and monitoring their food intake.

There is no evidence that healthy weight loss practices that combine dieting with exercise impair health. In fact, weight loss due to such health practices has beneficial effects, particularly for individuals who are overweight or obese (Institute of Medicine, 2002). In contrast, weight-loss practices such as the use of over-the-counter pills, appetite suppressants, or laxatives, and vomiting for weight-control purposes are not only unhealthy but are also unlikely to result in weight loss (Stroebe, 2008).

The argument that dieting and weight loss increases the risk of psychological distress and depression seems far-fetched, because people go on diets when they are unhappy with their present weight. However, the fact that some dieters do not succeed in losing weight and that most of those who do succeed regain the lost weight within a few years following their dieting attempt could cause people to be distressed or even depressed. However, in an exhaustive review of the relevant literature, the US National Task Force on the Prevention of Obesity (2000) concluded that participants in behavioural weight-loss programmes typically experience improvements in symptoms of depression and anxiety.

The most serious concerns about harmful effects of dieting are based on findings of prospective studies of adolescents, particularly young girls, that dieting and weight concerns at intake predict disordered eating and even obesity at follow-up (e.g. Field, Austin, Taylor, Malspeis, Rosner, Rockett, Gillman, & Colditz, 2003; Killen, Taylor, Hayward, Haydel, Wilson, Kraemer, Blair-Greiner, & Strachowski, 1996; Neumark-Szainter, Rock, Thornquist, Cheskin, Neuhouser, & Barnett, 2000; Patton, Selzer, Coffey, Carlin, & Wolfe, 1999; Stice, Cameron, Killen, Hayward, & Taylor, 1999; Stice, Presnell, Shaw, & Rhode, 2005; Stice, Presnell, & Spangler, 2002). However, in contrast to findings from observational studies, results of randomised controlled trials testing behavioural weight loss interventions

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have consistently shown either improvement or no change in symptoms of eating disorders (e.g. Butryn & Wadden, 2005; Stice, 2002). The reasons for this discrepancy are not totally clear. The most plausible explanation has been offered by Stice (2002), who argued that "a tendency toward caloric overconsumption may lead to both self-reported dieting and eventual onset of binge-eating and bulimic pathology" (p. 836).

In summary then, there is no evidence that dieting that does not involve unhealthy practices is harmful. Weight loss is possible but becomes increasingly difficult the more weight people want to lose. Thus, the most effective strategy would be not to put on weight in the first place and to stay within the range of normal weight. There seem to be people who are fortunate to have no need for weight monitoring. However, the fact that nearly 50 per cent of men of normal weight and 70 per cent of women of normal weight in the United States report that they are either trying to lose weight or trying to maintain their present weight (Serdula et al., 1999) suggests that a great number of individuals of normal weight feel the need to monitor their weight. Unfortunately, not much is known about the weight-control practices of these individuals, because in the absence of serious weight problems, this group has never been studied. Based on the results of our own studies, however, we suggest that weight monitoring is more likely to be successful when the exposure to palatable food stimuli is reduced (Papies et al., 2007; Stroebe et al., 2008) and the dieter is instead reminded repeatedly, but subtly, of the goal of dieting (Papies et al., in press-a). Indeed, there is some first evidence suggesting that individuals who habitually think of their dieting goal in tempting situations are more successful at weight control (Fishbach, Friedman, & Kruglanski, 2003; Papies et al., in press-b). Such findings suggest that successful weight-monitors do exist, and that the accessibility of their long-term goal plays a crucial role in their success.

## CONCLUSIONS

With obesity rates increasing at a dramatic rate in most developed and even some developing countries, there is great need for effective programmes of prevention and intervention. Since the development of such programmes is guided or at least informed by our theories of weight regulation, validation of these theories has changed from being merely a theoretical issue to becoming of major practical importance. It is therefore unfortunate that practically all psychological theories of dieting, overweight, and obesity are based on the assumption that weight problems are due to some malfunction in homeostatic feedback, or in the case of set-point theory, to a set-point that is above the cultural norm. Although there has been increasing criticism of such homeostatic models (e.g. Lowe & Butryn, 2007; Lowe & Levine, 2005; Pinel et al., 2000), there have so far been no viable theories

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that are based on the notion that the anticipated pleasure of eating rather than a need for calories is at the root of many weight problems. With the goal conflict model of eating, we have developed such a theory. We have further tried to demonstrate that this theory is not only consistent with the findings of our own research programme, but also with most results of research that was guided by the other major theories. Finally, in our discussion of dieting and the anti-dieting movement, we argued that the assumption that dieting was harmful can be challenged on both theoretical and empirical grounds. While there can be no doubt that unhealthy dieting practices can lead to health problems, healthy dieting may be the only hope for weight control for people living in food-rich environments.

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