

# Dieting in a food-rich environment: Nonconscious mechanisms of failure and success\*

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*Overweight is a serious health issue in most Western societies, and many people are highly motivated to diet. However, in our food-rich environments, most dieting efforts are doomed to fail. The present chapter provides a new, social psychological perspective on this issue. In particular, we present research on the nonconscious processes by which attractive environmental food cues lead to failures of dieting. Based on the recent goal-conflict model of eating, we show how attractive food cues, such as the sight or smell of good food, trigger in dieters a hedonic orientation towards food. This hedonic orientation in turn inhibits the conflicting goal of dieting, and thus facilitates overeating. However, based on recent advances in research on nonconscious goal pursuit, we also present research showing how external cues can be used as goal primes to facilitate dieting success. Specifically, re-activating the dieting goal when one is confronted with attractive food, either by internal learned mechanisms or by goal primes subtly positioned in the environment, can offset the influence of attractive food cues and contribute to healthier choices among dieters. This perspective on dieting behavior provides important practical implications for how successful self-regulation can be enhanced, and we will discuss ideas for both individual strategies as well as structural changes that can be derived from this research.*

*Key words: self-regulation, overweight, goal conflict, dieting, nonconscious processes*

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**((DEUTSCHER TITEL - bitte ergänzen))**

*Übergewicht ist in westlichen Gesellschaften ein weit verbreitetes Gesundheitsproblem. Deshalb bemühen sich viele Menschen, ihr Gewicht durch Diät zu reduzieren oder zu kontrollieren. Da sie aber im täglichen Leben ständig mit schmackhaftem und kalorienreichen Essen konfrontiert werden, bleiben diese Bemühungen meist erfolglos. In diesem Kapitel stellen wir mit dem Ziel-Konflikt-Modell des Essverhaltens eine neue Theorie vor, die erklärt, durch welche unbewussten Prozesse schmackhafte Essreize in unserer Umgebung diätbewusstes Essen erschweren. Ausgehend von diesem Modell zeigen wir wie solche Essreize, wie zum Beispiel der Anblick oder der Geruch von schmackhaftem Essen, in gezügelten Essern (d.h. Menschen die permanent bemüht sind, ihr Gewicht zu reduzieren) eine hedonische (d.h. auf Essgenuss ausgerichtete) Motivation auslösen. Diese hedonische Motivation ist mit dem Ziel, das Gewicht zu kontrollieren, unvereinbar und reduziert deshalb die mentale Zugänglichkeit dieses Zieles, was zu ungesundem Essverhalten führen kann. Wir präsentieren weiterhin neue Befunde die zeigen, dass Umgebungsreize auch dazu eingesetzt werden können, erfolgreiches Diätverhalten zu stimulieren. So können zum Beispiel subtile Hinweise auf das eigene Diätziel in der Umgebung dafür sorgen, dass dieses Ziel bei gezügelten Essern zugänglich bleibt und hilft, der Versuchung schmackhaften Essens zu widerstehen. Unsere Perspektive bietet sowohl neue theoretische Einsichten als auch verschiedene praktische Anwendungsmöglichkeiten um gesundes, diätbewusstes Essverhalten zu erleichtern.*

*Schlüsselwörter: Selbst-Regulation, Übergewicht, Ziel-Konflikt, Diät, unbewusste Prozesse*

Overweight is a serious health issue in most Western societies. In 2007-2008, for example, more than two thirds of US adults were overweight or obese (Flegal, Carroll, Ogden, & Curtin, 2010), and similar figures have been reported for Germany (Mensink, Lampert, & Bergmann, 2005). Based on the expected increase in these numbers, projected health care costs associated with overweight and obesity may reach more \$ 900 billion by 2030, making up about 16-18% of the total of US health care costs (Wang et al., 2008). Overweight and obesity are associated with a number of health issues (Mokdad et al., 2003), but also with psychological and social consequences that have a strong impact on quality of life, such as body dissatisfaction and experiences of bias and discrimination (Puhl & Brownell, 2001; Schwartz & Brownell, 2004).

Not surprisingly, therefore, efforts at controlling and even reducing one's body weight are wide-spread in our societies. According to the 2002 National Health and Nutrition Examination Survey conducted on a nationally representative sample of the U.S population, 51 percent of adults reported that they tried to control their weight in the previous year (Weiss, Galuska, Khan & Serdula, 2006). With a multitude of commercial diet programs available to consumers, together with a wealth of information from public health institutes, one could argue that it should be quite easy to control one's eating behavior and diet. However, dieting is not rewarded with success for most people (French, Jeffery, & Murray, 1999), as many dieters regain the lost weight after a certain period, or even regain more weight than they initially lost (Elfhag & Rössner, 2005; Mann et al., 2007). When this happens repeatedly, and the individual still remains motivated to lose weight due to cultural influences (Chernyak & Lowe, 2010), this can result in the pattern of dieting concern and behavior of so-called restrained eaters (i.e., chronic dieters; Herman & Polivy, 1980). Although restrained eaters are very motivated to control their weight, they are not very successful at this on the long term and often overeat, resulting in weight fluctuations (e.g., Gorman & Allison, 1995).

What makes it so difficult to engage in healthy, effective weight-control behaviors over an extended period of time? The abundance of tasty, high-calorie food in our current living environments may play a crucial role in these difficulties in self-regulation (Hill & Peters, 1998; Story, Kaphingst, Robinson-O'Brien, & Glanz, 2008; Stroebe, 1998; Wadden, Brownell, & Foster, 2002). Together with the reduced need for physical exercise, this food-rich environment stimulates indulgence in the pleasures of good food much more than the long-term health benefits of exercising and controlling one's eating (Hill & Peters, 1998; Stroebe, 2008). Indeed, perceiving palatable food in our environment items triggers neural responses in gustatory and reward-related regions in the brain, and these neural responses are especially pronounced in individuals who experience difficulties in weight regulation (e.g., Stice, Spoor, Bohon, Veldhuizen, & Small, 2008). In line with this, behavioral research has shown that restrained eaters, who indeed struggle with their weight-regulation, react especially strongly to such cues signaling the presence of tasty food. Specifically, food cues trigger in restrained eaters stronger cravings, more salivation, and more eating and over-eating behavior than in unrestrained eaters, despite their reported intentions to control their weight by dieting (e.g., Brunstrom, Yates, & Witcomb, 2004; Fedoroff, Polivy, & Herman, 2003; Harvey, Kemps, & Tiggeman, 2005; Papies & Hamstra, 2010, see also Papies, in press).

In this chapter, we will examine how attractive food cues can have such strong effects on the behavior of restrained eaters. To this end, we will provide an overview of recent research on the nonconscious effects of food cues on self-regulatory processes in restrained eaters (see also Papies, in press, for a brief

review). This may provide a useful, social psychological perspective on why dieting attempts – and other good intentions – often fail. At the same time, this analysis provides useful practical implications for how to facilitate more successful regulation of eating behavior, and we will discuss recent studies demonstrating this. Together, the research discussed in this chapter illuminates the psychological mechanisms of how attractive food cues in our living environment trigger hedonic processes which lead to failures of self-regulation, but it also shows that environmental cues activating the goal of dieting can be powerful tools for offsetting these effects and stimulating healthier behavior.

## A goal conflict perspective on eating and dieting behavior

In order to understand why restrained eaters can so easily be enticed into giving up on their dieting goal, recent research has built on the social psychology of nonconscious motivational processes and proposed a goal-conflict model of eating and dieting behavior (Papies, Stroebe, & Aarts, 2008c; Stroebe, Mensink, Aarts, Schut, & Kruglanski, 2008; Stroebe, 2002, 2008; see also Papies, in press). From this goal-conflict perspective, it is argued that restrained eaters hold two conflicting goals with regard to eating: the hedonic goal of enjoying tasty (i.e., palatable) food, and the long-term goal of weight control. As most palatable food is rather high in calories, both goals usually cannot be pursued at the same time. Indeed, restrained eaters, due to their concern for regulating their weight, hold a less positive overall attitude towards palatable food than unrestrained eaters, and this is driven by their perception that such attractive food items are incompatible with pursuing the goal of dieting (Papies, Stroebe, & Aarts, 2009; see also Roefs & Jansen, 2002; Stroebe et al., 2008). However, once restrained eaters are exposed to attractive food cues, they spontaneously activate the hedonic goal of enjoying good food. Since this is incompatible with the goal of dieting, this competing goal is temporarily inhibited in mind (Shah, Friedman, & Kruglanski, 2002; Stroebe et al., 2008). As a result, restrained eaters' subsequent cognition and behavior is determined more strongly by the goal of enjoying good food than the goal of dieting, making unhealthy food choices and overeating more likely. This could explain why restrained eaters experience food cravings and are more likely to overeat when confronted with attractive food cues (e.g., Fedoroff et al., 2003; Papies & Hamstra, 2010).

## A hedonic orientation towards food

Perceiving attractive food cues triggers stronger hedonic reactions in restrained than in unrestrained eaters. In one line of research (Papies, Stroebe, & Aarts, 2007), restrained and unrestrained eaters were presented with behavior descriptions involving another person eating a palatable or neutral food item (e.g., “Bill is eating a big piece of apple pie.”), intermixed with a number of food-unrelated behavior descriptions (e.g., “Peter is buying tickets for the concert.”) to mask the specific purpose of the study. After each food-related behavior description, we measured the cognitive accessibility of participants’ hedonic thoughts about food (e.g., “yummy”; “tasty”). Results showed that for restrained eaters, hedonic food words were more accessible after reading behavior descriptions involving palatable food compared to neutral food, while this effect did not occur for unrestrained eaters. This suggests that restrained eaters spontaneously think about the pleasure of enjoying good food when prompted with attractive food cues. More recent research has shown that among restrained eaters, these hedonic reactions to attractive food are maintained over time, whereas unrestrained eaters quickly downregulate the hedonic responses they may experience with regard to food. These maintained hedonic responses, in turn, seem to be responsible for restrained eaters’ enhanced cravings and wanting for high-fat, palatable food (Hofmann, van Koningsbruggen, Stroebe, Ramanathan, & Aarts, 2010).

Hedonic thoughts about food, triggered by the exposure to attractive food cues, also lead to more subtle, cognitive indicators of food motivation, such as attentional bias. Measures of attentional bias have been used widely in psychological research on addiction, and have been found to correlate with cravings for, among others, cigarettes, alcohol, and cannabis (Field, Mogg, & Bradley, 2004; Mogg & Bradley, 2002; Townshend & Duka, 2001). In addition, attentional bias has been found to predict actual drug use, as well as relapse after therapy (for an overview, see Franken, 2003). Thus, attentional biases may reflect participants’ motivation towards a particular substance, without relying on direct self-reports of motivation on this often sensitive issue. We hypothesized that restrained eaters’ hedonic orientation towards food may be reflected in biases in attention in a similar way. Thus, restrained eaters may display increased attention towards tasty food items, when they have been pre-exposed to attractive food, which triggered hedonic thoughts about enjoying food.

In order to test this hypothesis, we conducted two studies on restrained eaters’ attentional bias towards food (Papies, Stroebe, & Aarts, 2008a). Here, restrained and unrestrained eaters were subtly exposed to attractive food cues or not by presenting them with a word recognition task that either contained palatable food words (e.g., pizza, chocolate, cake) or only food-unrelated words. Then, participants’ visual attention for food was measured by means of

a visual probe task (MacLeod, Mathews, & Tata, 1986). Finally, we assessed their explicit liking of the food items presented in the visual attention task. The results of these two studies showed that when restrained eaters had been pre-exposed to attractive food in the first phase of the study, they then allocated more visual attention to attractive food items, correlated with their liking of the food. In other words, when they indicated to like these items more, they looked at them longer – but only when they had been exposed to tasty food in the first phase of the experiment.

These findings suggest that the pre-exposure to attractive food triggers in restrained eaters increased visual attention towards liked food, reflecting their desire for the presented food. Importantly, however, this increased visual attention also keeps restrained eaters focused on the tasty food, at the expense of other, potentially healthier cues, and thus serves to maintain their hedonic orientation towards food and to make overeating more likely (see also Hofmann et al., 2010). Van Koningsbruggen and colleagues (van Koningsbruggen, Stroebe, & Aarts, 2011) recently reported similar, intriguing effects of the exposure to attractive food cues in restrained eaters. With an inventive research paradigm asking participants to estimate the size of objects, they showed that after pre-exposure to attractive food cues, restrained eaters perceive attractive food items as bigger. This again reflects a visual processing bias and may also increase the chances of restrained eaters actually approaching and consuming the perceived food. Thus, biases in attention towards attractive food may be seen as both a reflection of restrained eaters' hedonic eating goal, as well as a maintaining mechanism of this motivation, because attentional and behavioral disengagement of the hedonic cues becomes less likely (cf. Franken, 2003).

## The inhibition of the dieting goal

However, what happens to restrained eaters' goal of dieting in this process? The goal-conflict model of eating behavior described above suggests that attractive food cues not only activate restrained eaters' hedonic eating goal, but also inhibit their conflicting goal of dieting. Recent studies indeed confirm these predictions (Papies, Stroebe, & Aarts, 2008b; Stroebe et al., 2008). In one set of experiments (Stroebe et al., 2008), for example, participants were exposed very briefly (i.e., for 23 ms) to hedonic food words, such as "pizza", "chocolate", or "delicious" as so-called primes in a lexical decision task. At the same time, the cognitive accessibility of the concept of dieting was assessed by presenting diet-related words in this task. To this end, participants are instructed to indicate as quickly and accurately as possible whether a word which is presented on the computer screen is an existing word or not, and faster reactions indicate that the concept is more accessible in mind. Results showed

that for restrained eaters who had been primed with hedonic food words, the goal of dieting was less accessible in mind compared to a baseline measure of its accessibility, as indicated by slower responses in the lexical decision task. The hedonic primes had no effect on unrestrained eaters. In line with the goal-conflict model, this finding suggests that restrained eaters spontaneously inhibit their dieting goal, or, in other words, they “forget” about dieting when they are confronted with attractive food cues.

## Examining the mechanisms of dieting success

The research reviewed so far has provided insight into the mechanisms leading to failures of dieting in an environment exposing us to attractive food cues. However, one may argue that not all dieters are unsuccessful, and that some people are able to regulate their eating behavior such as to maintain a healthy body weight. Indeed, research has shown that persistently engaging in specific weight control strategies is associated with successful weight control. For example, the National Weight Control Registry in the USA collects data from individuals, who have lost substantial amounts of weight and maintained this weight loss. The 3000 members, who on average have lost 30 kg and maintained this weight loss for more than 5 years, report eating a very low calorie diet and engaging in a high level of exercise (Wing & Hill, 2001). Other work suggests that successful weight loss is associated with specific weight control behaviors that are often experienced as difficult, such as consistently eating very few calories, eating more fruit and vegetables, and completely refraining from eating sweets (French, Jeffery, & Murray, 1999). It is unclear, so far, which predispositions or mechanisms make it possible for some dieters to consistently follow such dieting rules (see Papies et al., 2008b). In other words, what makes it possible for some dieters to be successful and remain slim despite the exposure to attractive food in our food-rich environment, while others do not manage this? While much more work needs to be done to answer this question, we will discuss some initial and promising research.

We examined this issue in a series of studies testing the automatic reactions to food cues in dieters with different levels of dieting success and body weight. In one study (Ouweland & Papies, 2010), restrained eaters with different levels of BMI were unobtrusively pre-exposed to attractive or neutral food cues by doing a puzzle task with attractive or neutral food words. Then, their “wanting” for tasty food was examined. For this, we used a forced-choice method (Finlayson, King, & Blundell, 2007), in which participants had to indicate quickly which of two food items they felt like eating at that moment. On several trials, they had to choose between a high-fat, palatable snack (e.g., pizza, French fries, chocolate) and a low-fat, neutral food item (e.g., cucumber, crackers,

tomato), and we were interested how the pre-exposure to attractive food would affect participants' choices for the palatable food options.

As can be seen in Figure 1, results of this study showed that the pre-exposure to attractive food cues had quite different effects on restrained eaters with a low BMI compared to restrained eaters with a high BMI. For rather lean restrained eaters, we found that the pre-exposure to attractive food cues lead them to make healthier choices, compared to the pre-exposure to neutral food items. Relatively heavy restrained eaters, however, showed the opposite pattern: after pre-exposure to attractive food they made less healthy choices compared to the pre-exposure to neutral food. Thus, the exposure to tasty food cues triggered more wanting for high-fat, palatable food in heavier restrained eaters, but less wanting for this food in lean restrained eaters. These findings seem to suggest that while in some dieters, attractive food cues trigger the hedonic goal of eating good food, for others, these cues may also serve as a reminder of the dieting goal. This intriguing difference may explain why some dieters are better able to consistently perform diet-congruent behaviors in a food-rich environment than others.

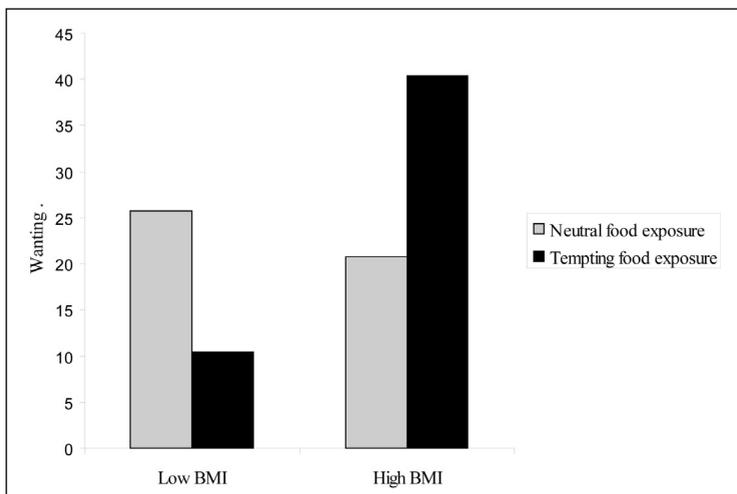


Fig. 1: Wanting for high-calorie snacks over low-calorie snacks of restrained eaters with a high vs. a low BMI after exposure to neutral food words (grey bars) or tempting food words (black bars) in a puzzle task (Reprinted with permission from Ouwehand, C., & Papiés, E. K. (2010). Eat it or beat it: The differential effect of food temptations on overweight and normal-weight restrained eaters. *Appetite*, 55, p. 59).

Taking a closer look at the psychological mechanisms underlying these mechanisms of dieting success, a social-cognitive study examined the cognitive accessibility of the dieting goal in successful and unsuccessful restrained eaters after the exposure to attractive food cues (Papies, Stroebe, & Aarts, 2008b). Here, participants completed a lexical decision task to assess the accessibility of the dieting goal, while on some trials, they were very briefly exposed to attractive food words as primes. Afterwards, in addition to measures of restrained eating, we also assessed participants self-reported dieting success. This was done by means of three questions, such as “How successful are you in controlling your weight?” (based on Fishbach, Friedman, & Kruglanski, 2003). Results showed that for unsuccessful restrained eaters, the attractive food primes lead to the inhibition of the dieting goal, thus replicating the findings of Stroebe et al. (2008) described above. For successful restrained eaters, however, a different pattern again emerged, as the attractive food primes activated, rather than inhibited, the goal of dieting. This finding is in line with research by Fishbach et al (2003), showing that successful self-regulation is associated with a pattern of temptation-elicited goal activation, such that encountering a short-term temptation can activate the overriding goal and thus facilitate self-control even in tempting situations.

Our findings suggest that participants’ self-reported success is a strong predictor of whether the pattern of goal activation or goal inhibition occurs. Successful dieters, who activate the dieting goal in response to food temptations, may thus be able to make healthier choices and maintain a lower BMI (Ouweland & Papies, 2010). Indeed, self-reported dieting success moderates the relation between dieting intentions and dieting behavior of restrained eaters: over a one-week period, only the dieting intentions of successful restrained eaters predicted their actual behavior, whereas for unsuccessful restrained eaters, there was no relationship between intentions and behavior (Papies et al., 2008b). The activation vs. inhibition of the dieting goal in tempting situations could thus be the crucial determinant of whether a restrained eater is successful or not.

What determines, then, whether a restrained eater will activate or inhibit the goal of dieting in the first place? The association between food cues and the mental representation of one’s dieting goal seems to play crucial role in dieters’ self-regulation. As discussed by Fishbach et al. (2003) and Papies et al. (2008b), research on the cognitive mechanisms underlying nonconscious goal pursuit (see Bargh, 1990) suggests that situations become strongly associated with certain behavioral goals by often pursuing them successfully in those situations. Applied to dieting, an association of the dieting goal with tempting food could be the result of repeatedly pursuing the goal of dieting when one is exposed to tempting food. This may be the recipe for developing dieting success. In other words, when a restrained eater who has thus learned to associate tasty food

with dieting, later encounters a food temptation, this may automatically lead to the activation of the dieting goal, and thus facilitate actual dieting behavior.

## Creating mechanisms of dieting success

Recent advances in social psychological research on behavior regulation have shown, however, that strong associations with certain situational cues can be created not only by frequent co-activation, but also by the one-time act of planning. Gollwitzer (1999) has introduced the planning tool of implementation intentions, which are specific plans constructed according to an if-then format. Using this planning tool in addition to mere goal intentions results in a strong association between the specified, critical situation (e.g., “If my partner offers me some chocolate while watching TV tonight”) and the behavior one should perform then (e.g., “then I will ask for a cup of tea instead”). As a result, when the situation actually arises, this automatically activates the planned behavior, making its pursuit more likely. By relying on this simple but highly effective mechanism, implementation intentions are powerful tools for instigating new behaviors and creating new habits, also in the domain of health behavior (Gollwitzer & Sheeran, 2006).

Implementation intentions are mostly used to plan a certain behavior. Recently, however, we used slightly modified implementation intentions, in order to create an association of a tempting situation with the overarching goal (dieting), rather than one specific behavior to achieve it (van Koningsbruggen, Stroebe, Papiés, & Aarts, 2011). This may have the additional advantage that once the goal is activated, a wide array of different behaviors are available to pursue it, making this way of planning more flexible than the traditional way of planning one specific behavior. Thus, we instructed restrained eaters to plan to think of dieting when they were tempted to eat an attractive food item, and examined how this one-time planning would modulate their reactions to attractive food cues. We hypothesized that creating associations between food temptations and the dieting goal by implementation intentions may imitate the effects of repeatedly pursuing one’s dieting goal in tempting situations. Therefore, restrained eaters using implementation intentions may actually behave like successful restrained eaters in tempting situations (van Koningsbruggen et al., 2011).

In our first study to test this, successful and unsuccessful restrained eaters formed implementation intentions to “think of their dieting goal” when they were tempted to eat a high-fat, palatable food. We instructed them to form implementation intentions with regard to five tempting food items (pizza, chips, chocolate, French fries, cookies). Then, participants performed a word-stem completion task that was designed to measure the accessibility of the goal of

dieting, while they were unobtrusively exposed to attractive food cues. Here, participants were presented with several word-stems (e.g., we...), which could be completed either as diet-related words (e.g., weight) or diet-unrelated words (e.g., weird). The number of diet-related words provided by participants then served as a measure of the cognitive accessibility of the goal of dieting. The results of this study showed that successful restrained eaters thought of their dieting goal in response to attractive food equally often in both conditions, i.e., independent of whether they had formed implementation intentions to think of dieting or not, which is in line with our earlier findings (Papies et al., 2008b). Unsuccessful restrained eaters, however, did benefit from planning to think of dieting: they thought of dieting in response to attractive food items only when they had planned to do so. This is in line with earlier findings, suggesting that only successful restrained eaters spontaneously think of dieting when they encounter food temptations. However, it also suggests that planning by means of implementation intentions can achieve the same effects in unsuccessful restrained eaters.

Importantly, in a second study, we extended this effect to actual behavior over a two-week period. Again, participants in the critical condition planned to think of dieting when they were tempted to eat one of five tempting food items (pizza, chips, chocolate, French fries, cookies). After two weeks, participants were asked to report their actual consumption of each of these items over the past two weeks. As expected, our results showed that successful restrained eaters ate less of these high-fat, palatable food items than unsuccessful restrained eaters. Again, however, unsuccessful restrained eaters benefited from planning to think of dieting in response to tempting food, as this reduced their consumption to the level of successful restrained eaters (van Koningsbruggen et al., 2011). Together, these studies suggest that dieting success can be induced by experimentally creating mental associations between tempting food and one's dieting goal.

## Goal priming in daily life to facilitate health behavior

The work discussed so far has shown that the accessibility of the goal of dieting in tempting eating situations is of crucial importance for successful self-regulation. Restrained eaters who automatically activate this goal are more successful self-regulators, and inducing this activation by a simple planning manipulation can similarly create dieting success. Consciously anticipating tempting situations and planning one's behavior accordingly may not, however, be a feasible way of dealing with any kind of situation in which one may encounter attractive food. Extending the social psychological principles of goal pursuit to health behavior, we have recently examined whether activating the dieting goal

by means of environmental goal primes can effectively facilitate dieting behavior among restrained eaters in tempting situations.

Social-psychological research on nonconscious goal pursuit has shown that environmental cues associated with a goal representation can effectively activate this goal and then, if the situation allows it, trigger goal-directed behavior. Bargh and colleagues (2001), for example, showed this by exposing participants to words related to performing well (e.g., master, attain, achieve) by means of a simple puzzle task in the first phase of an experiment. They then measured how much effort participants exerted on an academic task, and they found that primed participants tried harder to perform well than non-primed participants. Later debriefing suggested that participants were not consciously aware of these priming processes or their effects on their behavior. Over the last decade, these initial goal priming findings have been replicated in many domains, and it has been shown that such subtle environmental cues only lead to goal-directed behavior when the primed behavior is associated with positive affect, and thus seen as desirable to pursue by participants, i.e., when a true goal is primed (Aarts, Gollwitzer, & Hassin, 2004; Custers & Aarts, 2005, 2007; Ferguson, 2007; see Papies & Aarts, 2010, for an overview).

The research on the effects of environmental food cues discussed so far is in line with this approach, as it shows that such cues triggers the activation and pursuit of the goal of enjoying good food mainly in restrained eaters. However, one may argue that features of the environment could in principle lead not only to the activation and pursuit of hedonic goals, but may also serve to activate health goals, in this case the conflicting long-term goal of weight control. Thus, primes of the dieting goal in one's environment should stimulate the pursuit of diet-congruent behaviors, but only in those individuals for whom dieting is indeed a personally relevant goal. In other words, when restrained eaters are primed with the goal of dieting, they may make healthier food choices or eat less of an available tasty, high-fat food, even in a tempting situation where attractive food cues may otherwise trigger the pursuit of the hedonic eating goal (see also Papies et al., 2008a, Study 2, and van Koningsbruggen et al., 2011, as discussed in Papies, in press).

Papies and Hamstra (2010) report a field experiment to test this hypothesis in a tempting real-life eating setting. Here, restrained and unrestrained eaters were primed unobtrusively with the goal of dieting before they entered a tempting eating situation, and we observed their eating behavior. Specifically, in a local butcher's shop with a large grill oven, which dispersed the savory smell of grilled chicken through the shop, customers were free to taste little meat snacks offered by the butcher, which were presented on a tray on the counter. To prime the goal of dieting for half of the participants, a poster was mounted on the glass door of the shop at regular times, announcing the availability of a low-calorie recipe available in the store, so that participants would see this before

they actually entered the store and were exposed to the food temptations. The control condition did not prime participants. Then, we unobtrusively measured the number of meat snacks that customers sampled while being served. We analyzed these as a function of experimental condition and participants' restraint scores, which were obtained by administering a brief questionnaire before they left the store.

As is observed often in the study of restrained eaters, we found that restrained eaters ate more than unrestrained eaters in the control condition, when they were tempted by the smell of grilled chicken and the free snacks (see also Fedoroff et al., 1997, 2003). In the goal priming condition, however, where the poster with the recipe announcement was placed on the door, restrained eaters ate significantly less than in the control condition. Interestingly, the poster had no effect on the consumption of unrestrained eaters. These findings are displayed in Figure 2. These findings suggest that rather than serving as a mere behavioral prime, the poster served as a goal prime: it affected the amount eaten only for those participants who actually hold weight control as

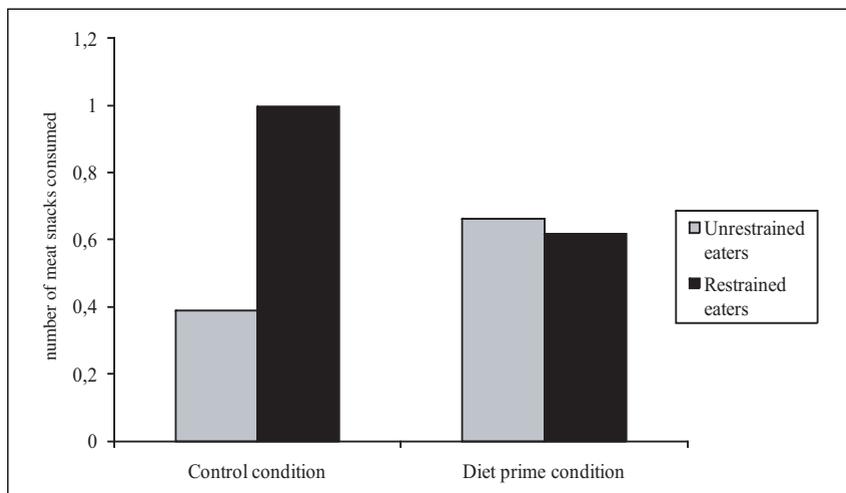


Fig. 2: Mean number of meat snacks consumed by restrained and unrestrained eaters in the control condition, when the smell of grilled chicken was present in the store, and the diet prime condition, where customers were reminded of their dieting goal by means of a poster before entering the store (Reprinted with permission of the APA from Papies, E. K., & Hamstra, P. (2010). Goal priming and eating behavior: Enhancing self-regulation by environmental cues. *Health Psychology, 29*, p. 387).

a personally relevant goal (Papies & Hamstra, 2010; see also Anschutz, van Strien, & Engels, 2008 and Fishbach et al., 2003, for similar findings).

Later, we applied goal priming in an even more challenging, real-life context, namely among customers of a restaurant. This may be especially interesting given the recent developments to provide calorie information and health labels on menu's in some countries, which at the same time do not always seem to be effective in affecting caloric intake (see Papies & Veling, 2012; Roberto, Schwartz, & Brownell, 2009, for discussions). In addition, eating out is a very "hedonic" situation: most people go to a restaurant in order to enjoy a tasty meal in good company. Environmental cues such as other people eating, (see Papies et al., 2007), the sight and smell of food (Fedoroff et al., 1997, 2003; Papies & Hamstra, 2010), and the description of food on the menu (see Roefs et al., 2005) keep this goal accessible before one makes one's choice. When ordering, consumers also find it difficult to estimate how much fat and calories restaurant food contains, especially for high-calorie food; in one study, participants underestimated the amount of calories in a certain menu item by 246% (Burton, Creyer, Kees & Huggins, 2006). Thus, people who eat out often, especially in buffet-style or fast-food restaurants, consume too many calories, and are at increased risk of overweight (Casey et al., 2008; Kant & Graubard, 2004). Therefore, applying diet goal primes in a restaurant setting allowed us to test their effectiveness in a particularly challenging situation, in which keeping one's dieting goal in mind is both very important and very difficult.

In a field experiment in another small town in the Netherlands, we therefore tested the effectiveness of a similar diet-goal prime as described above (Papies & Hamstra, 2010). More specifically, we slightly modified the menu of a café-style restaurant to prime half of the customers with dieting. To do this, we printed words related to the goal of dieting (e.g., "weight", "calories") on one part of the menu, thus priming participants directly "at the point of purchase". We then recorded customers' choices via the waiting staff, and compared them to choices in the no-prime control condition. Since the restaurant offered only a very restricted menu consisting of burgers and sate (on the less healthy side), and salads and a special of steamed fish (on the healthier side), we simply analyzed whether customers made a healthy or an unhealthy food choice for dinner. As hypothesized, analyses of menu choices revealed that the diet prime led to more low-calorie, healthy dinner choices among restrained eaters. Independent of their dieting goal, overweight customers were also stimulated to choose more healthily in the diet-prime condition, which may be due to the fact that they more strongly pursue the dieting goal in the first place (see Papies & Veling, 2012). Unrestrained and normal-weight participants were not affected by the primes.

These findings confirm that diet goal primes may be effective tools to facilitate self-regulation even in highly tempting, hedonic situations, where it is both very

important and very difficult to keep one's dieting goal in mind and pursue it consistently. Future studies will need to explore the boundary conditions of such effects, such as the possible habituation to the priming stimuli. We suggest that for goal primes to be effective, they need to be attended to, even if they are not processed with conscious awareness (Koch & Tsuchiya, 2007). Therefore, if a diet reminder becomes too integrated in one's environment, it may not be processed with sufficient attention to activate the associated goal representation and thus affect one's behavior. Further studies need to examine this possibility and outline the features of the most effective priming method for daily life.

However, we suggest that goal priming may be particularly promising for health behavior change because in contrast to health cues in other domains, such as fear appeals on cigarette packages, they are unlikely to induce defensive processing (see Witte & Allen, 2000): due to their association with a desired state (Custers & Aarts, 2005), goal reminders are associated with positive affect, rather than threat. In addition, it is unlikely that goal primes induce reactance, since they only affect those perceivers who are committed to pursuing the primed goal. In sum, therefore, we suggest that goal priming, which has mostly been employed in social psychological laboratories to study the fundamental processes underlying goal-directed behavior, can also be used effectively to enhance self-regulation in highly relevant, real-life settings, for example by counteracting the effects of attractive temptations in our food-rich environments.

## Conclusions and implications

In this chapter, we have used a goal-conflict perspective to show how attractive food cues in our living environment interfere with the pursuit of the dieting goal which many people attempt. Chronic dieters who are exposed to attractive food cues develop a hedonic orientation towards food, which focuses them on food temptations in their environment and influences their food choices and eating behavior, at the cost of the conflicting dieting goal. However, restrained eaters can become more successful by relying on mechanisms that activate the goal of dieting in critical situations, i.e., when attractive food cues would otherwise inhibit the dieting goal. In this context, we discussed how dieters can learn to spontaneously think of dieting when they are tempted by attractive food, so that this goal then leads to healthier choices. In addition, we discussed field experiments which show that unobtrusive goal primes in the environment can facilitate healthy choices of dieters even in the most tempting situations. In sum, this work provides us with a thorough understanding of the processes underlying dieting failures, but it also provides useful implications for

how to enhance self-regulation in the important domain of eating behavior. Our studies have shown that environmental cues activating the goal of dieting can be powerful tools for offsetting the effects of tempting food cues and stimulating healthier behavior. These findings could be translated into a number of strategies to help dieters to become more successful (see also Papies, in press, for these and further strategies). They may, for example, plan how to regulate their behavior more effectively, such as by using implementation intentions to think of their dieting goal in tempting situations. Similarly, they could benefit from personalized diet-reminders in places that are otherwise associated with overeating, such as on the refrigerator or the cookie cupboard, to give the dieting goal a chance to influence one's behavior in such critical situations. Based on our findings, we also suggest that preventing exposure to tempting foods, for example by not placing them in sight, or by not buying high-fat snacks or not taking them along to one's workplace, will also make dieting easier (see also Painter, Wansink, & Hieggelke, 2002). However, given the abundance of easily available, attractive-looking and high-calorie food which we cannot evade in our living environment, such strategies are unlikely to suffice to fight the large-scale obesity epidemic Western societies are facing.

Our research once again suggests that environmental changes are needed to facilitate the successful regulation of eating behavior and prevent further large-scale weight gain (see also Hill & Peters, 1998; Visscher & Seidell, 2001). Indeed, it has often been argued that the abundance of attractive, high-calorie food contributes to overeating and thus to failures in weight regulation. The work presented in the current chapter has identified the psychological mechanisms by which such food cues influence behavior, especially among weight-concerned individuals, and it thus confirms the decisive role of attractive food cues in our environment.

Based on our findings, we suggest that obesity prevention efforts should attempt to reduce the influence of such food cues. While it may not be feasible to reduce the abundance of tasty-looking, high-fat food in our living environment, the effects of such food cues could be curbed by simple diet-reminders, as in the field experiments described above. In addition, diet reminders could be combined with clear information about the calories contained in a food item (see Papies & Veling, 2012), and on the percentage of one's daily intake that would be covered by eating the food. This may be particularly important for situations in which people typically overeat, such as in restaurants. Indeed, research has shown that simple – and often surprising – calorie information can reduce customers' ordering intentions and actual choices of unhealthful items (Burton et al., 2006, but see also Roberto et al., 2009). However, once a determined dieter decides against a tempting, high-calorie food, there needs to be a similarly priced, convenient alternative available to revert to. Importantly, therefore, obesity prevention efforts also need to ensure the availability of

healthy choices in supermarkets and convenience stores close to people's homes, as well as in cafeterias, vending machines, and other purchase locations where people easily overeat on high-fat snacks. Recent work has revealed that access to healthy food such as fresh fruit and vegetables is especially difficult in low income neighborhoods, which contributes to unhealthy eating behavior and higher levels of BMI among their residents (e.g., Cummins & Macintyre, 2006; Faith, Fontaine, Baskin, & Allison, 2007; Gittelsohn et al., 2008).

While comprehensive health efforts targeting such problems may require political courage and could initially be unpopular with the food and restaurant industry, the rising costs of obesity and the well-documented failures of dieters to regulate their intake in our food-rich environment suggest that sooner or later, such measures will be inevitable (Story et al, 2008). In addition, many consumers may be willing to pay extra for products supporting their dieting efforts, such as smaller portion-packages, making such consumers' health goals profitable for food producers (see Wansink & Peters, 2007). Moreover, comprehensive programs to battle childhood obesity, such as the EPODE approach in France (see van Koperen & Seidell, 2010), have suggested that remarkable success for all stakeholders can be achieved when parents, schools, restaurants and local authorities cooperate to make healthy choices attractive, available, and salient. Based on the available research, we suggest that public health efforts to curb the impact of attractive food cues can be effective to enhance weight regulation in food-rich environments (Story et al., 2008). While social psychological research can help us identify the mechanisms contributing to dieting failures, it can also inform us on strategies to create dieting success.

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