

Goal Priming and Eating Behavior: Enhancing Self-Regulation by Environmental Cues

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Objective: Several lines of research have shown that the confrontation with attractive food can trigger overeating, especially in restrained eaters. This effect may be driven by a hedonic orientation toward food which temporarily overrules the goal of dieting in the regulation of behavior. The present study was designed to provide an experimental demonstration of this effect in a naturalistic setting, and to show that reactivating the goal of dieting by a subtle prime in the environment can help restrained eaters to regulate their eating behavior in tempting situations. **Design:** In a local store where the smell of grilled chicken was present, we observed the number of free meat snacks customers sampled from a tray after they had been primed with the dieting goal or not. **Main Outcome Measures:** Number of snacks consumed. **Results:** Consistent with hypotheses, restrained eaters ate more than unrestrained eaters in the control condition. However, they reduced their eating behavior when primed with dieting, whereas this manipulation did not affect unrestrained eaters. **Conclusion:** This study shows that unobtrusively priming the goal of dieting can enhance self-regulation in tempting eating situations. These results are discussed in the context of recent advances in our understanding of nonconscious behavior regulation and their applications to health behavior.

Keywords: priming, eating behavior, self-regulation, restrained eating, behavior change

Dieting is a difficult task in the food-rich environment of most Western societies. While the prevalence of overweight and obesity is constantly increasing in Western societies and dieting has become a widespread method of weight control (Kruger, Galuska, Serdula, & Jones, 2004), dieting attempts are not associated with a lasting reduction of body weight over an extended period of time (Elfhag & Rössner, 2005; Jeffery et al., 2000). Indeed, once they have stopped dieting, many dieters may even regain more weight than they initially lost (Mann et al., 2007). Since the thin ideal is strongly represented as a cultural norm in Western societies, most dieters remain motivated to lose weight and pursue repeated attempts at dieting, which may eventually turn them into so-called restrained eaters, as Herman and Polivy (1980) have termed chronic dieters. Although restrained eaters are generally very concerned with their weight and motivated to control it by restricting their food intake, they are not very successful in these attempts, and their eating behavior is characterized by periods of food restriction as well as by repeated lapses of restraint (Gorman & Allison, 1995).

Why is it so difficult to consistently control one's food intake and pursue a weight loss diet? Recently, it has been suggested that a so-called "toxic environment," where highly palatable and calorically dense foods are very visible and easily available, plays a critical role in these difficulties in weight-regulation and in the

high prevalence of obesity (Hill & Peters, 1998; Wadden, Brownell, & Foster, 2002). When one's environment repeatedly confronts one with attractive, high-calorie food, successful weight regulation can become quite difficult, and the good intentions of many dieters are not sufficient to actually lead to consistent reductions in body weight. This observation fits well with the recent results of a meta-analysis by Webb and Sheeran (2006), who concluded that although intentions are somewhat predictive of behavior, this relationship is much weaker than commonly assumed and suggested by earlier studies. To deal with this issue, these authors suggest that behavior change research should focus much more on "nonintentional routes to action," such as the influence of prototypes, or automatic goal pursuit (p. 263). Based on these observations, the present paper will propose and test implications from a recent goal priming framework designed to understand the difficulties that restrained eaters experience in regulating their eating behavior in our food-rich environment. In addition, we will explore a subtle but effective intervention technique that may help restrained eaters control to their eating behavior in critical situations.

Earlier studies examining the role of the environment in the regulation of eating behavior have shown that the exposure to attractive food cues triggers especially strong appetitive response in restrained, compared to unrestrained eaters. For example, the sight, the smell, or thoughts of palatable food elicit in restrained eaters more salivation than in unrestrained eaters (Brunstrom, Yates, & Witcomb, 2004; LeGoff & Spigelman, 1987). Restrained eaters have also been found to experience stronger urges to eat the cued food, and they are more likely to overeat when exposed to such food cues (Collins, 1978; Cornell, Rodin, & Weingarten, 1989; Fedoroff, Polivy, & Herman, 1997, 2003; Harris, Bargh, & Brownell, 2009; Harvey, Kemps, & Tiggemann, 2005; Jansen &

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van den Hout, 1991; Rogers & Hill, 1989). These studies suggest that the attractive food cues in our “toxic environment” have a particularly strong impact on the eating behavior of restrained eaters, compared to unrestrained eaters. What are the mechanisms underlying these ironic effects of food cues on self-regulation?

Approaching this issue from a social-cognitive perspective, recent research has proposed a goal-conflict model to understand restrained eaters’ behavior with regard to palatable food (Papies, Stroebe, & Aarts, 2008c; Stroebe, Mensink, Aarts, Schut, & Kruglanski, 2008). This model suggests that restrained eaters have two conflicting goals with regard to food: the hedonic goal of enjoying palatable food (see also Lowe & Butryn, 2007), and the long-term goal of weight control. Because most palatable food is also high in calories, both of these goals cannot be pursued at the same time and are thus in conflict with each other (see also Papies, Stroebe, & Aarts, 2009). When restrained eaters are exposed to attractive food items, the hedonic goal of enjoying palatable food is activated spontaneously. As a result of this activation, the incompatible dieting goal is inhibited in mind (Stroebe et al., 2008). Subsequent behavior is then more likely to be guided by the goal of eating palatable food than by the long-term goal of dieting, which could explain why restrained eaters experience cravings and easily overeat when they are confronted with attractive food cues (e.g., Fedoroff et al., 1997, 2003; Harris et al., 2009).

A recent set of studies tested whether a hedonic orientation toward food and the inhibition of the dieting goal could indeed be underlying restrained eaters’ self-regulatory failures. In one set of studies (Papies, Stroebe, & Aarts, 2007), participants were exposed to a number of behavior descriptions, some of which mentioned another person eating a palatable food item (“Ben is taking a big piece of apple pie.”). After reading such a behavior description, participants were unobtrusively probed for the accessibility of hedonic, pleasure-related thoughts about food (e.g., “yummy,” “delicious”). Results showed that restrained eaters, but not unrestrained eaters, activated hedonic thoughts about food in response to reading about palatable food items, suggesting that they spontaneously think about good food in terms of the pleasure of eating it (Papies et al., 2007). As a result of this process, a hedonic orientation toward food may more strongly guide subsequent behavior, making overeating more likely.

Another set of studies examined the effect of hedonic cues on the accessibility of the dieting goal. Here, participants were exposed very briefly (for 23 ms) to hedonic food words (e.g., chocolate, delicious), before measuring the cognitive accessibility of their dieting goal. Results showed that after the exposure to hedonic food words, the dieting goal was cognitively inhibited in restrained eaters, while the primes had no effect on unrestrained eaters. These findings suggest that hedonic thoughts about food automatically lead restrained eaters to “forget about” the incompatible goal of dieting, outside of their conscious awareness (Stroebe et al., 2008). Together, these studies suggest that the exposure to attractive food triggers in restrained eaters a cognitive mechanism which can easily facilitate overeating: the activation of a hedonic eating goal, and the inhibition of the dieting goal.

Recent advances in social psychological research have demonstrated that accessible goals can indeed have a strong influence on behavior, while bypassing people’s conscious awareness. Priming a goal state that is desirable to attain (e.g., helping, performing well, making money), for example, by means of goal-related words

or cues in the environment, can trigger in participants motivated behavior in pursuit of that goal (see Aarts, 2007, for an overview). In a seminal study by Bargh, Gollwitzer, Lee Chai, Barndollar, & Troetschel (2001), for example, participants were unobtrusively exposed to words related to performing well (e.g., master, attain, achieve) in the first phase of the experiment. In the second phase of the experiment, primed participants found more words in a word-search puzzle than control participants, tried to work longer on the puzzles, and chose to continue working on their task after an interruption, indicating that they were highly motivated to perform well on the tasks presented to them. Similar effects were found when participants were primed in a subliminal manner, that is, when they could not consciously perceive the prime words presented on a computer screen (e.g., Custers & Aarts, 2005, 2007). Importantly, the motivational effects of priming a goal occur only when this goal is seen as desirable by participants, that is, when it is indeed a goal that they want to pursue (Custers & Aarts, 2005, 2007; Ferguson, 2007). Applying these insights to eating behavior, it has recently been shown that snack food advertisements on TV can serve as “real-world” primes and lead to increased eating behavior in participants (Harris et al., 2009), compared to participants exposed to nonfood advertisements or high-nutrition food advertisements. Interestingly, this effect occurred mainly for men. In addition, the effects of the snack food advertisements was most pronounced for restrained eaters, suggesting again that for this group, the hedonic eating goal is most pronounced.

As can be seen from the research on nonconscious goal pursuit briefly discussed above, priming a desirable behavior representation, even outside of awareness, can influence participants’ behavior in a variety of situations. While this perspective could explain how priming with attractive food cues can lead to increased eating behavior in participants with a strong hedonic eating goal, it also implies that priming the goal of dieting may actually increase dieting behavior in participants motivated to diet, that is, in restrained eaters. In other words, the research on nonconscious goal pursuit suggests that restrained eaters’ self-regulation may not only be thwarted, but also enhanced via priming by environmental cues.

There are indeed some indications that activating the dieting goal can reduce restrained eaters’ hedonic orientation with regard to food and thus enhance their self-regulation. In a recent study on visual attention for food (Papies, Stroebe, & Aarts, 2008a), participants were first exposed to palatable food, which, as in earlier studies (Papies et al., 2007), triggered a hedonic orientation toward food. However, this effect could be undone by subtly priming the dieting goal in restrained eaters (see also Papies, Stroebe, & Aarts, 2008b). While this provides some evidence that priming dieting can trigger the motivation to diet in restrained eaters, participants’ eating was not observed, so that this study remains inconclusive as to the effects of diet primes on actual eating behavior. In contrast, a recent study examining the effects of TV commercials with diet cues did examine eating behavior and showed that viewing such ads reduced the amount eaten by restrained eaters in a laboratory tasting session (Anschutz, Van Strien, & Engels, 2008). However, this study, too, was conducted in the laboratory, albeit in a naturalistic set-up, and only among female students, which is a rather restricted group to examine naturally occurring eating regulation. The same applies to an interesting experiment by Fishbach and colleagues (Fishbach, Friedman, & Kruglanski, 2003), who

showed that female weight-concerned students who were primed with the dieting goal by means of exposure to exercise- and diet-related magazines and flyers more often chose an apple rather than a chocolate bar as a parting gift. Finally, a laboratory experiment by Ward and Mann (2000) showed that restrained eaters' consumption of a milkshake could be reduced by reminding them of their diet, but this effect occurred only under cognitive load.

The present study attempts to extend these findings to a naturalistic setting, and to adults of the general population, to enhance our understanding of the effects of diet primes on naturally occurring eating behavior and test the applicability of goal priming methods to health behavior more generally. Thus, we examined whether unobtrusively priming the goal of dieting may lead participants to control their eating behavior, but only when they highly value the goal of dieting for themselves, that is, when they are actually dieters. Specifically, we observed the eating behavior of participants in a setting where they were exposed to attractive food cues, namely the smell of freshly grilled chicken, and had the opportunity to eat free meat snacks. In addition, half of the participants were primed with the dieting goal by an unobtrusive poster announcing the availability of a free diet-related recipe. This way, we could examine whether activating the dieting goal before participants entered the tempting eating situation could enhance their self-regulation, and thus reduce their eating behavior in comparison with unprimed participants. To sum up, in line with earlier studies we expected that restrained eaters would eat more than unrestrained eaters in the control condition where only tempting food cues are present. We also expected, however, that restrained eaters would eat less when primed with the dieting goal, while the priming manipulation should have no effect on the behavior of unrestrained eaters.

Method

Participants and Design

There were 156 customers (68 men, 88 women; mean age 56 years, $SD = 14.18$) of a local butcher's store in the small town of Ermelo, The Netherlands, that participated in the study. Mean Body Mass Index of the participants was 26.50, $SD = 4.45$, and mean dietary restraint was 12.32 ($SD = 2.53$). The study had a 2 (condition: recipe cue vs. control) \times 2 (dietary restraint: low vs. high) design, with dietary restraint as a continuous variable.

Experimental Manipulation

For half of the participants, the goal of dieting was primed by means of a poster that was attached to the glass entrance door of the butcher's store in such a way that it was clearly visible from the outside while entering the store. This poster announced a weekly recipe by the local butcher that was "good for a slim figure" and low in calories. The recipe itself was not displayed on the poster, but was announced to be available at the counter. The recipe poster was attached to the door of the store on two mornings and two afternoons of the four days that the experiment was run, so that customers visiting the store at those times were automatically assigned to the recipe cue condition. In the control condition, no poster was attached to the entrance door.

Procedure

Customers entered the store, where a tray with small meat snacks (e.g., meatballs) was presented on the counter as usual, accompanied by a small sign indicating that these were samples for tasting. The smell of grilled chicken was continuously wafting through the store from a large grill oven at the back. At the counter, customers were helped by the shop assistants as usual. The experimenter was also behind the counter and seemingly at work in the store, while she was unobtrusively registering the number of snacks that each participant took while standing at the counter. She also registered the total time that customers spent in the store. After the customer had paid and received her order from the shop assistant and was about to exit the store, the experimenter approached her and asked her to fill in a short questionnaire, which also contained the Revised Restraint Scale (Herman & Polivy, 1980). Only the information on the eating behavior of those participants who agreed to fill in the questionnaire was included in the study (about 90% of customers agreed to participate). After filling in the questionnaire, participants were debriefed and thanked, and they were asked not to discuss the study with other members of the local community.

Questionnaire

Participants completed the Dutch version of the Revised Restraint Scale (Herman & Polivy, 1980). In line with earlier research, we used the Concern for Dieting subscale in this study, which has been recommended to identify participants' chronic motivation to control their weight by dieting (Papiés et al., 2007; Stroebe et al., 2008; van Strien, Breteler, & Ouwens, 2002). We added two questions to assess participants' weight and height, and participants were also asked to report their age and sex. A final open question prompted participants to indicate if they had noticed anything special about the store.

Results

The number of snacks eaten by the participants was analyzed in a regression analysis in the General Linear Model with condition, restraint, and sex as predictors.¹ This regression analysis revealed a main effect of sex, $F(1, 148) = 5.87, p = .02, \eta_p^2 = .04$, such that men were found to eat more meat snacks than women. The analyses revealed also a main effect of restraint, $F(1, 148) = 4.22, p = .04, \eta_p^2 = .03$, such that participants with higher scores on the restraint scale ate more snacks than participants with lower scores. More importantly, however, this effect was qualified by the predicted interaction of restraint and condition, $F(1, 148) = 5.68, p = .02, \eta_p^2 = .04$. To probe the nature of this interaction, we examined the amount eaten by restrained eaters (i.e., 1 SD above the mean, see Aiken & West, 1991, for this method) and unrestrained eaters (1 SD below the mean) in both experimental conditions. As Figure 1 shows, restrained eaters ate more than unrestrained eaters in the control condition, $F(1, 81) = 8.40, p = .005, \eta_p^2 = .10$, but not in

¹ The mean number of meat snacks eaten was .63 ($SD = .83$). A number of participants consumed no snacks ($N = 86$), and we included these in our analyses since this could be the result of the diet prime, especially among restrained eaters.

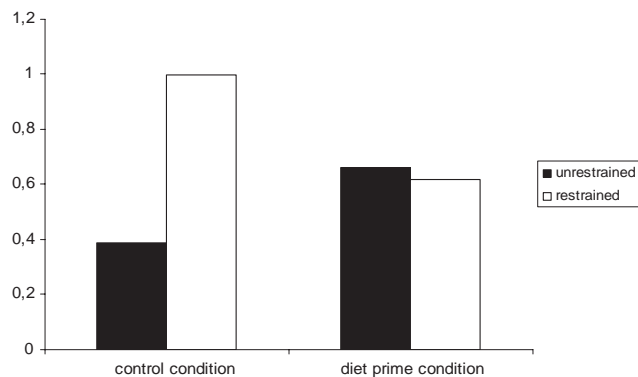


Figure 1. Mean number of meat snacks consumed by restrained eaters (1 *SD* above the mean, see Aiken & West, 1991) and unrestrained eaters (1 *SD* below the mean) in the control and diet prime conditions.

the diet prime condition, $F(1, 72) = .06$, *ns*. Moreover, restrained eaters ate less of the snacks in the diet prime condition than in the control condition, $F(1, 148) = 3.86$, $p = .05$, $\eta_p^2 = .03$, but the eating behavior of unrestrained eaters was not influenced by the diet prime, $F(1, 148) = 2.1$, *ns*. Although men ate more of the meat-snacks in general, the interaction of restraint and condition was not qualified by a three-way interaction with sex, $F(1, 148) = 1.7$, *ns*.

In an additional analysis, we also included the length of time that each participant stayed in the store to determine the influence of this variable on eating behavior. This analysis showed that although staying in the store longer was associated with eating more snacks, $F(1, 147) = 6.25$, $p = .01$, $\eta_p^2 = .04$, including the time spent in the store as a covariate left the interaction of restraint and condition and also the main effects of sex and restraint essentially unchanged. Thus, restrained eaters did not show this specific pattern of eating behavior because they spent more time in the store than unrestrained eaters. In response to the open question whether they had noticed anything special about the store, 20% of participants ($N = 15$) in the diet prime condition explicitly mentioned the recipe poster on the entrance door, while 3 participants actually asked for a recipe.

Discussion

In their influential meta-analysis of intention-behavior relationships, Webb and Sheeran (2006) concluded that “intentional control of behavior is a great deal more limited than previous meta-analyses of correlational studies have indicated” (p. 262) and called for a new trend in behavior change research that gives more consideration to “nonintentional routes to action”, such as the influence of nonconscious goals. The current study was designed to do just that. Based on the empirical observation that a conscious intention to diet is not sufficient to pursue long-term dieting behavior, we examined whether unobtrusively priming the goal of dieting can enhance self-regulation in tempting eating situations. In line with earlier studies, the results of our field experiment showed that restrained eaters overeat when exposed to attractive food cues, which have been shown to trigger a hedonic orientation toward food and eating. At the same time, however, our study showed that activating the dieting goal by a simple priming ma-

nipulation can enhance self-regulation in such situations and therefore prevent overeating.

The finding that restrained eaters consumed more meat snacks than unrestrained eaters in the control condition is in line with a number of related studies, which showed that restrained eaters are particularly sensitive to the presence of attractive food cues in the regulation of their eating behavior (e.g., Fedoroff et al., 1997, 2003; Harris et al., 2009). In addition, this result fits with the goal conflict approach to eating behavior, which proposes that restrained eaters’ hedonic eating goal can spontaneously be activated by subtle food cues and lead to the inhibition of the dieting goal, therefore making subsequent overeating more likely (Papies et al., 2007; Stroebe et al., 2008). The finding that men ate more of the snacks than women is also in line with earlier research (Harris et al., 2009) and might also be related to the fact that men have a stronger preference for meat than women in their food choices (e.g., Fagerli & Wandel, 1999).

In addition to these main effects, however, we found that priming the goal of dieting by means of a simple environmental cue reduced the eating behavior of restrained, but not of unrestrained eaters. It is important to note that priming the dieting goal lead not simply to goal-directed behavior, but in the course of it, overruled another behavioral tendency, namely the tendency to overeat on the presented snacks. This way, the priming manipulation truly enhanced self-regulation by helping restrained eaters to overcome their initial reactions in favor of the pursuit of a more long-term personal goal (see Muraven & Baumeister, 2000). However, although the priming manipulation was done in a rather unobtrusive way and integrated into the usual environment of the store, it is unclear to what degree the influence of this prime on eating behavior occurred outside of conscious awareness. Future studies could examine this aspect of behavior change interventions in a systematic way. However, the finding that the prime affected behavior even without most participants explicitly reporting awareness of the manipulation is very much in line with our goal conflict model and with earlier research on nonconscious processes, where even subliminal primes have been shown to have striking effects on cognition and behavior (e.g., Custers & Aarts, 2007; Papies et al., 2008b; Stroebe et al., 2008).

An important strength of the current study concerns the fact that participants’ behavior was both observed and manipulated in a naturalistic manner in the familiar store environment. This makes it unlikely that demand characteristics played a role in the presented findings, and also underlines the usability of the presented methods for other health domains in which unobtrusive interventions are desirable. In addition, the present study was conducted among both male and female middle-aged members of the general population. Most studies on eating behavior are conducted with student samples and often focus on female participants, which may reduce the generalizability of such findings. The present study used a different and possibly more diverse sample to replicate the finding that restrained eaters easily overeat when in a tempting food situation, and it shows that a priming manipulation also works for this group of dieters.

In conclusion, despite the surge of social-psychological research on goal priming and the great potential of applying these principles to problems of self-regulation in health behavior, only few studies so far have directly examined whether priming the dieting goal can enhance self-regulation in eating behavior. With the present study,

we attempt to reduce this void and demonstrate how the exciting literature on goal priming can be fruitfully applied to the domain of health psychology, which opens up a wealth of possibilities for subtle methods of effective behavior change in this domain.

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