

## Fast track report

# Implementation intentions as goal primes: Boosting self-control in tempting environments

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### Abstract

*People often forget their long-term strivings because their environment confronts them with attractive temptations. Previous research suggests that self-control failures can be prevented by reminding people of their higher-order goal. Therefore, we hypothesized that using implementation intentions as a tool to directly re-activate people's higher-order goal in tempting situations would effectively enhance self-control. We tested this in the domain of dieting behavior. Results demonstrated that this specific planning strategy activated the dieting goal for unsuccessful dieters when exposed to tempting food cues (Study 1) and reduced their consumption of calorically dense food across 2 weeks (Study 2) compared to those in control conditions. This suggests that preparing people to think of their higher-order goal when tempted can be used to protect ongoing goal striving. Appealing to higher-order goals potentially makes implementation intentions flexible instruments of self-regulation as this should trigger motivated behavior to reach goals and initiate various goal-instrumental actions. Copyright © 2011 John Wiley & Sons, Ltd.*

People often have to protect their higher-order goals that offer long-term benefits against temptations that promise immediate satisfaction. While keeping in mind one's higher-order goal greatly facilitates this process of self-control (Shah, Friedman, & Kruglanski, 2002), our environment often confronts us with temptations which make us forget our long-term strivings. The present research suggests using implementation intentions as a tool to re-activate one's higher-order goal in such situations, and thus to effectively enhance self-control.

One of the domains in which environmental cues often disrupt self-control attempts is the domain of dieting behavior. In most Western countries where overweight and obesity have been increasing dramatically, dieting has become a popular means of weight control (Kruger, Galuska, Serdula, & Jones, 2004). However, even though chronic dieters (i.e., restrained eaters; Herman & Polivy, 1980) continuously monitor their eating behavior and are highly motivated to restrict calorie intake, many fail in the long term (Mann, Tomiyama, Westling, Lew, Samuels, & Chatman, 2007). It has been proposed that a "toxic environment" where palatable foods are highly visible and available is responsible for these difficulties in weight control and the increase in obesity (Hill & Peters, 1998). Indeed, the eating behavior of dieters can be easily disrupted by attractive food cues in our environment such as the sight, smell, or taste of palatable food (e.g., Fedoroff, Polivy, & Herman, 1997; Harris, Bargh, & Brownell, 2009). Chronic dieters thus seem to forget that they are on a diet when exposed to tempting food cues.

Research on the psychological processes underlying these difficulties of dieters confirms the importance of the accessibility of the dieting goal for effective self-control. Recent studies have shown that when exposed to attractive food, dieters—but not normal eaters—think about this food in hedonic terms (Hofmann, Van Koningsbruggen, Stroebe, Ramanathan, & Aarts, 2010; Papies, Stroebe, & Aarts, 2007) and consequently inhibit the mental representation of the higher-order goal of dieting (cf. the goal conflict model of eating, see Stroebe, Mensink, Aarts, Schut, & Kruglanski, 2008). As a result, the eating behavior of dieters will be influenced by the goal to enjoy palatable food instead of their higher-order goal of dieting, herewith increasing the likelihood of overeating when encountering tempting food. To effectively control their eating behavior, dieters thus need to activate their dieting goal in situations of temptation.

Indeed, activating the dieting goal prevents dieters from processing food cues entirely in hedonic terms and thus boosts self-control. In one study, participants were exposed to tempting food cues prior to examining visual attention for food (Papies, Stroebe, & Aarts, 2008a). Results showed that the pre-exposure treatment triggered a hedonic orientation toward food in dieters, resulting in an attentional bias to palatable food. However, this bias disappeared when dieters were subtly primed with the dieting goal. Likewise, research showed the positive impact of a diet prime on dieters' perceptual processing of healthy food objects (Van Koningsbruggen, Stroebe, & Aarts, 2011). Furthermore, environmental diet primes help dieters to

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control their eating behavior, making them for example more likely to choose an apple over a Twix-bar (Fishbach, Friedman, & Kruglanski, 2003) and consuming less high-calorie snacks (Anschutz, Van Strien, & Engels, 2008; Papies & Hamstra, 2010).

Intriguingly, while most dieters tend to inhibit the dieting goal when encountering tempting food, a subgroup of successful dieters has been found to spontaneously activate the dieting goal themselves in such situations. Due to this spontaneous goal activation, these dieters are able to pursue the dieting goal and control their consumption of high-calorie food in tempting situations (Fishbach et al., 2003; Papies, Stroebe, & Aarts, 2008b). Indeed, research showed that whereas successful dieters behaved in line with their intentions not to eat certain palatable foods, unsuccessful dieters were not able to translate their good intentions into actual behavior (Papies et al., 2008b, Study 2). Thus, even strong goal intentions are ineffective among unsuccessful dieters. Moreover, successful dieters (identified with a self-report scale developed by Fishbach et al., 2003) have lower Body Mass Index (BMI; Papies et al., 2008b; Van Koningsbruggen et al., 2011). Thus, those dieters who are able to keep their dieting goal in mind when exposed to attractive food are indeed more successful in controlling their body weight. Increasing the accessibility of the dieting goal in dieters boosts their ability to resist tempting food, and while some dieters activate the dieting goal themselves, others could benefit from external diet primes.

Together, there is ample empirical evidence that priming the dieting goal both eliminates processes that are normally responsible for dieters' failures in self-control and positively affects their eating behavior. What remains lacking, however, is a technique by which dieters can activate the dieting goal themselves in tempting situations. This is all the more important since we are continuously exposed to tempting food in our food-rich environment, and studies on the impact of diet primes so far only assessed short-term responses. More important, however, is that it is not always possible to deliver diet cues in situations when dieters most need it (e.g., it is not likely that we can put posters with a diet-reminder on the door of every cake shop in town to help dieters). Put differently, whereas it can easily be arranged in experimental settings for dieting primes to precede tempting food cues, this sequence of events is more difficult to arrange in real life. The aim of the present research was therefore to test a technique by which dieters can boost their own self-control by activating the dieting goal in tempting situations. Specifically, we suggest that this may be achieved through preparatory planning by means of implementation intentions.

### IMPLEMENTATION INTENTIONS AS GOAL PRIMES

Implementation intentions are behavioral plans which specify the when, where, and how of what one will do to reach a certain goal. Such plans are formed to support the execution of one's normal goal intentions which merely specify what one intends to do (Gollwitzer, 1993, 1999). For instance, an implementation intention such as "If I order a dessert in the restaurant,

then I will order a fruit salad!" could be formed to support the goal intention "I want to eat less chocolate!" Implementation intentions thus follow the format of if-then plans specifying both crucial opportunity to act and a response instrumental for reaching the goal (Gollwitzer, 1993, 1999). Implementation intentions create a strong link between the specified situation and the goal-directed response, making people automatically select the specific response when entering the specified situation (Aarts, Dijksterhuis, & Midden, 1999; Brandstätter, Lengfelder, & Gollwitzer, 2001; Gollwitzer & Brandstätter, 1997; Webb & Sheeran, 2007). Forming implementation intentions has been shown to greatly facilitate goal attainment above the effects of mere goal intentions (Gollwitzer & Sheeran, 2006).

Research so far has merely considered the effects of planning a specific goal-instrumental action in the then-component. To the best of our knowledge, no published study to date has yet used implementation intentions to directly reactivate an abstract higher-order goal. Although it may sound trivial to just remind people of their higher-order goal, it is also the most straightforward answer to the self-control problem people experience in tempting situations (e.g., Shah et al., 2002). Therefore, we hypothesized that simply reminding dieters of their higher-order goal of dieting using implementation intentions should protect ongoing goal striving, and thus effectively enhance self-control. This way of planning may be quite efficient, as activating a desirable goal state triggers motivated behavior to reach that goal (e.g., see Aarts, 2007) and may thus trigger a whole repertory of different goal-instrumental actions. Accordingly, preparing dieters to think of dieting when exposed to tempting food cues using implementation intentions should help them to reduce their consumption of palatable food, particularly for unsuccessful dieters. Two studies were conducted to test this hypothesis. Whereas Study 1 was designed to test whether forming implementation intentions to "think of dieting" when tempted would indeed create a strong temptation-dieting goal association, Study 2 tested whether this planning strategy would effectively enhance the self-control of dieters.

## STUDY 1

In Study 1, we tested whether think-of-dieting implementation intentions would activate the dieting goal when exposed to tempting food cues. We hypothesized that think-of-dieting implementation intentions would create a strong cue-response linkage, particularly for unsuccessful dieters. We expected that think-of-dieting implementation intentions may have no effect for successful dieters because they automatically activate the dieting goal following tempting food cues (Fishbach et al., 2003; Papies et al., 2008b), and for normal eaters, because their eating behavior is not influenced by food or dieting cues (e.g., Fedoroff et al., 1997).

### Methods

This study used a condition (control vs. think-of-dieting) between-subjects design, with dieting and self-regulatory

success as continuous variables. To include a wider range of chronic dieters than is typical among students, we conducted this study via the Internet, and recruited participants via banners placed on various websites. In return for lottery tickets, 119 female participants ( $M_{\text{age}} = 28.74$  years,  $SD_{\text{age}} = 13.96$  years) were randomly assigned to one of two conditions. After the implementation intention manipulation, participants answered 21 filler questions. They then completed a word completion task—announced as a word game—to measure the strength of the temptation-dieting goal association. Finally, participants filled out the chronic dieting and self-regulatory success in dieting scales.

### Implementation Intention Manipulation

Participants formed implementation intentions for five palatable foods (chocolate, cookies, pizza, French fries, and chips, adopted from Papies et al., 2008b) separately. All participants were first asked to recall the last time they had been tempted to eat chocolate. They were then asked to briefly indicate why it was important for them to resist the temptation to eat chocolate. Participants in the think-of-dieting condition were then asked “Please tell yourself: ‘The next time that I am tempted to eat chocolate, then I will think of dieting!’ When you have said the line to yourself, tick this box.” Participants then completed these steps for the next food item. Participants in the no-treatment control condition did not receive instructions to form implementation intentions after they had indicated why it was important for them not to eat the food items.

### Word Completion Task

Participants were informed that a sequence of finished (e.g., printer) and unfinished words (e.g., pr\_nt\_r) would appear individually on the screen. For unfinished words, they were asked to provide the missing letters such that an existing word was formed. Participants responded to 34 words (in a predetermined random order), consisting of 20 finished and 14 unfinished words. Of the unfinished words, eight words could be completed as a word that was either related or unrelated to the dieting goal; the other six were filler words. For instance, in Dutch the fragment *\_ij\_e\_* can be completed as *lijnen* (dieting), or, for instance, *tijger* (tiger) or *kijken* (looking). To measure the temptation-dieting goal association, five of the diet-related word fragments were preceded by one of the food cues from the implementation intentions. The other three diet-related word fragments were preceded by a neutral word. A higher number of diet-related word completions indicate greater activation of the dieting goal.

### Chronic Dieting

Chronic dieting was assessed with the Concern for Dieting subscale of the Revised Restraint scale ( $\alpha = .77$ ; Herman & Polivy, 1980). Participants also reported their body weight and height.

### Perceived Self-Regulatory Success

Self-regulatory success in dieting was assessed by asking participants to indicate on a seven-point scale how successful they were in losing weight, watching their weight, and how difficult they found it to stay in shape ( $\alpha = .69$ ; Fishbach et al., 2003).

## Results and Discussion

Descriptives of the study variables are presented in Table 1. Participants' age, chronic dieting, success, and BMI did not differ between conditions, all  $F_s < 1$ .

The number of primed diet-related word completions (i.e., diet-related word fragments preceded by tempting food cues) was analyzed in the General Linear Model (GLM) as a function of condition, dieting, and success (both mean centered), and all interactions. This analysis revealed a main effect of dieting,  $F(1, 111) = 14.66, p < .001, \eta^2_p = .12$ , that was qualified by a significant Condition  $\times$  Dieting  $\times$  Success interaction,  $F(1, 111) = 4.96, p < .05, \eta^2_p = .04$ . To test our hypotheses, we examined the effects of condition and success for dieters and normal eaters separately (one  $SD$  above vs. below the mean of chronic dieting; see Aiken & West, 1991).

For dieters, the analysis revealed a significant Condition  $\times$  Success interaction,  $F(1, 111) = 5.38, p < .05, \eta^2_p = .05$ . As expected, condition only affected primed diet-related word completions for unsuccessful dieters (1  $SD$  below the mean of success),  $F(1, 111) = 7.67, p < .01, \eta^2_p = .07$ . Those who formed the think-of-dieting implementation intentions completed more word fragments as diet-related than those in the no-treatment control condition. For successful dieters (1  $SD$  above the mean of success), condition did not affect primed diet-related word completions,  $F < 1$ . For normal eaters, the analysis also revealed no significant main or interaction effects of condition and success. Relevant means are displayed in Figure 1.

Similar analyses on the number of neutral diet-related word completions (i.e., diet-related word fragments preceded by neutral words) yielded no significant effects, all  $F_s < 1$ .

The results from Study 1 suggest that planning to think of dieting indeed activates the dieting goal for unsuccessful dieters in tempting situations, as indicated by the higher number of diet-related word completions following tempting

Table 1. Means, standard deviations and correlations between Study 1 variables

	<i>M</i>	<i>SD</i>	1	2	3	4	5
1 Primed diet-related word completions	0.80	0.79	–				
2 Neutral diet-related word completions	0.23	0.48	.01	–			
3 Concern for Dieting	7.34	3.48	.31**	–.002	–		
4 Self-regulatory success	4.10	1.26	–.07	–.06	–.17 <sup>†</sup>	–	
5 Body Mass Index	22.08	2.86	–.04	.05	–.09	–.32***	–

<sup>†</sup> $p < .10$ ; \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

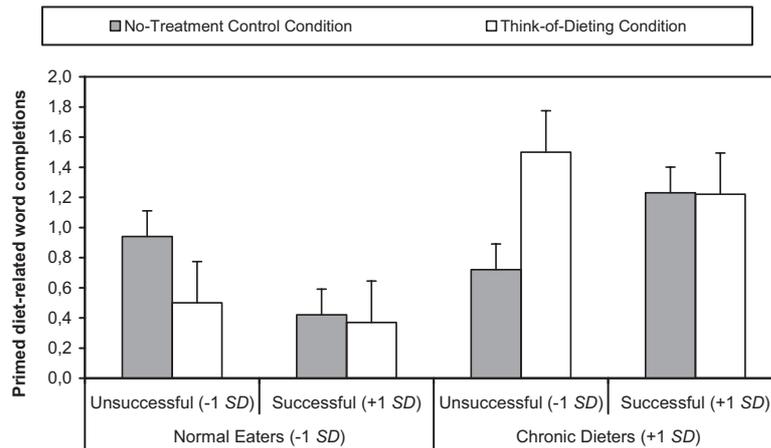


Figure 1. Mean primed diet-related word completions as a function of condition, chronic dieting and success. Error bars represent the standard error.

food cues. Consistent with earlier findings (Fishbach et al., 2003; Papies et al., 2008b), successful dieters were able to keep the dieting goal in mind, also without implementation intentions. However, think-of-dieting implementation intentions created a strong cue-response linkage that should help unsuccessful dieters to reduce their consumption of palatable food.

## STUDY 2

To test whether the proposed planning strategy would effectively enhance the self-control of dieters, we again used think-of-dieting implementation intentions and assessed participants' consumption of the critical food items after 2 weeks. The effectiveness of this manipulation was compared to two control conditions, namely a standard "no-treatment" condition as in Study 1 and an implementation intention control condition. In this latter control condition, we instructed participants to think of "not-eating" when exposed to tempting food cues. Although "not-eating" represents a means to an end, we expected that this implementation intention would not help dieters in resisting tempting food because it keeps their attention fixed on the food, which will keep hedonic thoughts about this food highly accessible.<sup>1</sup> This additional condition was run to control for possible non-specific effects of our dieting implementation intention induction. If "not-eating" appears to be ineffective, it would confirm the importance of dieting goal accessibility in resisting tempting food among dieters. Based on the findings of Study 1, we hypothesized that think-of-dieting implementation intentions would reduce consumption only for unsuccessful dieters.

## Methods

This study used a condition (control vs. think-of-dieting vs. won't eat control) between-subjects design, with dieting and self-regulatory success as continuous variables. In all, 236

<sup>1</sup>Quinn et al. (2010) show that saying "don't do it!" to yourself when noticing a lapse of restraint is effective in controlling strong habits, but ineffective in resisting strong temptations. Consistent with our argument, they argue that saying "don't do it!" heightens attention to the tempting stimulus, leading people once again into temptation.

participants—22 males, 214 females ( $M_{\text{age}} = 33.65$  years,  $SD_{\text{age}} = 14.66$  years)—recruited as in Study 1 were randomly assigned to conditions.<sup>2</sup>

At Time 1, participants answered some demographic questions, then completed the chronic dieting ( $\alpha = .77$ ) and self-regulatory success ( $\alpha = .72$ ) scales, rated the importance of dieting (1 = *unimportant* and 7 = *very important*), followed by the implementation intention manipulation. Participants in the no-treatment control and the think-of-dieting conditions engaged in the same manipulation used in Study 1. Whereas the if-part of the implementation intentions was exactly similar for participants in the won't eat control-condition, the then-part was replaced by "then I will not eat it!" After this, participants were thanked for their participation. They were unaware that they would be contacted again. A hyperlink to a follow-up questionnaire was sent by e-mail to each participant 15 days after initial participation in which they first indicated how often they had eaten the five food items in the past 2 weeks on a seven-point scale (1 = *never* and 7 = *very often*) and then reported how much they had eaten the food items during this period (1 = *nothing* and 7 = *a lot*). Mean ratings of frequency and amount of eating the food items were highly correlated ( $r = .90$ ,  $p < .001$ ) and were averaged and analyzed as a single measure of consumption.

## Results and Discussion

Descriptives of the study variables are presented in Table 2. Participants' age, gender, chronic dieting, success, dieting importance, and BMI did not differ between conditions,  $F_s < 1$ –1.78,  $p_s = .91$ –.17, all  $\eta^2_p s < .02$ .

A GLM analysis on consumption revealed a main effect of dieting,  $F(1, 224) = 14.74$ ,  $p < .001$ ,  $\eta^2_p = .06$ , and a two-way interaction between dieting and success,  $F(1, 224) = 10.98$ ,  $p < .01$ ,  $\eta^2_p = .05$ . These effects were qualified by the predicted Condition  $\times$  Dieting  $\times$  Success interaction,  $F(2, 224) = 4.37$ ,  $p < .05$ ,  $\eta^2_p = .04$ .<sup>3</sup> To test our hypotheses, we

<sup>2</sup>At Time 1, 304 people participated, but 68 did not complete the follow-up questionnaire. There were no differences on Time 1 measures between participants who did and those who did not participate at follow-up (all  $F_s < 1$ ).

<sup>3</sup>Age and gender did not affect the results across studies.

Table 2. Means, standard deviations and correlations between Study 2 variables

		<i>M</i>	<i>SD</i>	1	2	3	4	5
1	Consumption	2.59	0.89	–				
2	Dieting importance	5.06	1.75	–.28***	–			
3	Concern for Dieting	8.57	3.66	–.23***	.63***	–		
4	Self-regulatory success	3.48	1.47	–.01	–.17**	–.30***	–	
5	Body Mass Index	25.22	4.34	–.24***	.26***	.25***	–.50***	–

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

examined the effects of condition and success for dieters and normal eaters separately.

For dieters, the analysis revealed a main effect of success,  $F(1, 224) = 10.61$ ,  $p < .01$ ,  $\eta^2_p = .05$ , that was qualified by a significant Condition  $\times$  Success interaction,  $F(2, 224) = 3.55$ ,  $p < .05$ ,  $\eta^2_p = .03$ . As expected, condition only affected consumption for unsuccessful dieters ( $-1 SD$ ),  $F(2, 224) = 5.60$ ,  $p < .01$ ,  $\eta^2_p = .05$ . Unsuccessful dieters who formed the think-of-dieting implementation intentions consumed less than those in the no-treatment control condition,  $B = -.71$ ,  $t = -3.14$ ,  $p < .01$ , and won't eat control-condition,  $B = -.64$ ,  $t = -2.64$ ,  $p < .01$ . Consumption did not differ between participants in the no-treatment control and won't eat control conditions,  $t < 1$ . For successful dieters ( $+1 SD$ ), condition did not affect consumption,  $F < 1$ . For normal eaters, the analysis also revealed no significant main or interaction effects of condition and success. Relevant means are displayed in Figure 2.

The results of Study 2 confirm our hypothesis that preparing dieters to think of dieting when exposed to tempting food cues using implementation intentions helps unsuccessful dieters to reduce their consumption of palatable food. In contrast, "not-eating" instructions were insufficient in boosting the self-control of dieters. Successful dieters consumed less, regardless of implementation intentions (cf. Papies et al., 2008b).

## GENERAL DISCUSSION

Cues of attractive temptations in our environment can easily disrupt our self-control and long-term goal strivings. Previous research suggests that self-control failures can be prevented by reminding people of their higher-order goal (Shah et al., 2002). Applied to the domain of dieting, we demonstrate that

implementation intentions can be used as a tool to directly re-activate people's higher-order goal in tempting situations and effectively enhance self-control. Results show that planning to think of dieting activates the dieting goal for unsuccessful dieters when exposed to tempting food cues (Study 1) and indeed helps them to resist eating palatable food (Study 2). Since participants reported their eating behavior 2 weeks later, this specific way of planning seems to effectively protect ongoing goal striving of chronic dieters. Following the goal conflict model of eating (Stroebe et al., 2008) and the results of Study 1, we argue that the think-of-dieting planning strategy reinstated the dieting goal as the focal goal that subsequently influenced the eating behavior of unsuccessful dieters.

Consistent with previous research (e.g., Achtziger, Gollwitzer, & Sheeran, 2008; Adriaanse, De Ridder, & De Wit, 2009; Bayer, Gollwitzer, & Achtziger, 2010), our findings show that the formation of implementation intentions effectively shields goal striving and facilitates goal attainment. However, our findings extend this work by showing that simply appealing to higher-order goals in the then-component rather than specific behavioral responses is also highly effective in preventing people from straying off course during goal pursuit. Appealing to higher-order goals makes implementation intentions more flexible instruments of self-regulation as priming a desirable goal triggers motivated behavior to reach that goal (Aarts, 2007) and thus may initiate a whole repertory of goal-instrumental actions, as also was suggested by Gollwitzer and Sheeran (2006). Our findings also fit with research showing that priming the dieting goal helps dieters to control their eating behavior (Anschutz et al., 2008; Fishbach et al., 2003; Papies & Hamstra, 2010). While in these studies the goal primes were provided by the experimenter, the present research demonstrates an easy-to-use technique by which dieters can activate the dieting goal themselves when most needed.

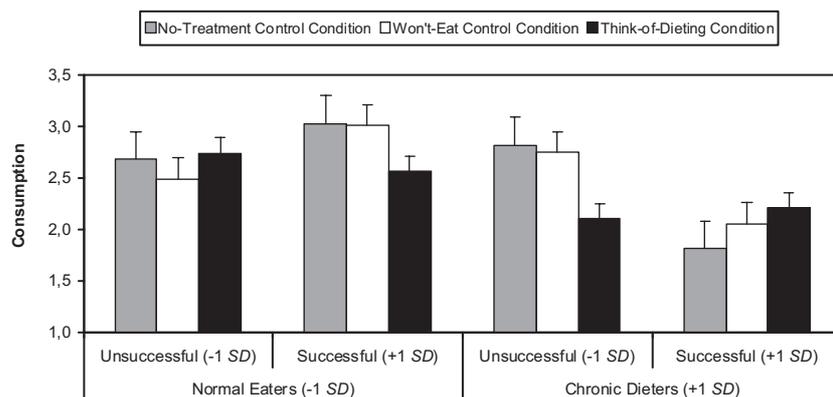


Figure 2. Mean consumption as a function of condition, chronic dieting and success. Error bars represent the standard error.

Whereas the think-of-dieting strategy successfully enhanced dieters' self-control, using the specific behavioral response of "then I will not eat it!" in the implementation intentions was not effective. One may ask whether "not-eating" should not also prompt thoughts of dieting as it represents a means to an end, knowing that means sometimes automatically prime ends (Shah & Kruglanski, 2003). However, "not-eating" keeps dieters' attention fixed on the tempting food (also see Quinn, Pascoe, Wood, & Neal, 2010) and hedonic thoughts about this food probably remain highly accessible. Thus, ironically, this instruction does not change the default reaction of dieters in tempting situations.

This does not mean, however, that specific behavioral responses cannot be used in the then-part of implementation intentions to fight temptations. We believe that as long as a specific response prevents the initiation of hedonic thoughts leading to the inhibition of the dieting goal, it can help dieters to reduce their consumption. Indeed, recent research demonstrated that participants who planned to *ignore* their thoughts about a favorite snack successfully reduced their snack consumption (Achtziger et al., 2008). Whether ignore-responses also improve dieters' self-control, and if appealing to higher-order goals outperforms ignore-responses should be addressed in future research. Such research might also investigate whether "not-eating" instructions are ineffective because they do not alter dieters' typical responses in situations of temptation. More broadly, a necessary condition for specific behavioral instructions to fight temptations in eating behavior—and probably other domains of self-control as well—may be that they should lower attention to the tempting stimulus and prevent the emergence of intrusive thoughts (Kavanagh, Andrade, & May, 2005).

Although a strength of the present research is the use of non-student samples who participated in non-lab situations, it is also a limitation in investigating the underlying mechanisms. Previous research suggests that implementation intention effects are driven by two processes—increased accessibility of specified cues and automatization of specified responses (e.g., Webb & Sheeran, 2007). Study 1 provides initial evidence for the latter process by showing that think-of-dieting implementation intentions create a strong cue-response link. An important avenue for future research would be to test whether the two processes together mediate the relationship between think-of-dieting implementation intentions and enhanced self-control among dieters.

Future studies may also benefit from including additional control conditions to more thoroughly examine the effectiveness of implementation intentions as goal primes. For instance, it seems important to compare conditions specifying higher-order goals versus detailed actions (e.g., specific healthy behaviors) for preparing self-control in highly dynamic situations and goal-setting without supporting implementation intentions. If goal-prime implementation intentions appear to be more effective, it would confirm that setting a goal alone does not suffice for controlling temptations and provide more support for the idea that appealing to higher-order goals may increase the flexibility of implementation intentions. Another limitation of the present research is that our measure of consumption relied on self-reported frequency and amount of eating the food items. Future research should therefore use more objective behavioral measures.

In conclusion, the present approach showed that preparing people to think of their higher-order goal when tempted using implementation intentions can be effectively used to protect ongoing goal striving. This specific planning strategy makes it easier for people to resolve conflicts between short-term temptations and long-term goals in favor of the latter. Since people often have to protect long-term goals against temptations, planning techniques such as the one used in this research may have great potential to shield goal striving and facilitate the pursuit of higher-order goals across a range of behaviors.

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## REFERENCES

- Aarts, H. (2007). Health and goal-directed behavior: The nonconscious regulation and motivation of goals and their pursuit. *Health Psychology Review, 1*, 53–82. DOI:10.1080/17437190701485852.
- Aarts, H., Dijksterhuis, A., & Midden, C. (1999). To plan or not to plan? Goal achievement or interrupting the performance of mundane behaviors. *European Journal of Social Psychology, 29*, 971–979. DOI:10.1002/(SICI)1099-0992(199912)29:8<971::AID-EJSP963>3.0.CO;2-A.
- Achtziger, A., Gollwitzer, P. M., & Sheeran, P. (2008). Implementation intentions and shielding goal striving from unwanted thoughts and feelings. *Personality and Social Psychology Bulletin, 34*, 381–393. DOI:10.1177/0146167207311201.
- Adriaanse, M. A., De Ridder, D. T. D., & De Wit, J. B. F. (2009). Finding the critical cue: Implementation intentions to change one's diet work best when tailored to personally relevant reasons for unhealthy eating. *Personality and Social Psychology Bulletin, 35*, 60–71. DOI:10.1177/0146167208325612.
- Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. London: Sage Publications.
- Anschutz, D. J., Van Strien, T., & Engels, R. C. M. E. (2008). Exposure to slim images in mass media: Television commercials as reminders of restriction in restrained eaters. *Health Psychology, 27*, 401–408. DOI:10.1037/0278-6133.27.4.401.
- Bayer, U. C., Gollwitzer, P. M., & Achtziger, A. (2010). Staying on track: Planned goal striving is protected from disruptive internal states. *Journal of Experimental Social Psychology, 46*, 505–514. DOI:10.1016/j.jesp.2010.01.002.
- Brandstätter, V., Lengfelder, A., & Gollwitzer, P. M. (2001). Implementation intentions and efficient action initiation. *Journal of Personality and Social Psychology, 81*, 946–960. DOI:10.1037/0022-3514.81.5.946.
- Fedoroff, I. C., Polivy, J., & Herman, C. P. (1997). The effect of pre-exposure to food cues on the eating behavior of restrained and unrestrained eaters. *Appetite, 28*, 33–47. DOI:10.1006/appe.1996.0057.
- Fishbach, A., Friedman, R. S., & Kruglanski, A. W. (2003). Leading us not unto temptation: Momentary allurements elicit overriding goal activation. *Journal of Personality and Social Psychology, 84*, 296–309. DOI:10.1037/0022-3514.84.2.296.
- Gollwitzer, P. M. (1993). Goal achievement: The role of intentions. *European Review of Social Psychology, 4*, 141–185. DOI:10.1080/14792779343000059.
- Gollwitzer, P. M. (1999). Implementation intentions: Strong effects of simple plans. *American Psychologist, 54*, 493–503. DOI:10.1037/0003-066X.54.7.493.
- Gollwitzer, P. M., & Brandstätter, V. (1997). Implementation intentions and effective goal pursuit. *Journal of Personality and Social Psychology, 73*, 186–199. DOI:10.1037/0022-3514.73.1.186.
- Gollwitzer, P. M., & Sheeran, P. (2006). Implementation intentions and goal achievement: A meta-analysis of effects and processes. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 38, pp. 69–119). San Diego, CA: Elsevier.
- Harris, J. L., Bargh, J. A., & Brownell, K. D. (2009). Priming effects of television food advertising on eating behavior. *Health Psychology, 28*, 404–413. DOI:10.1037/a0014399.

- Herman, C. P., & Polivy, J. (1980). Restrained eating. In A. J. Stunkard (Ed.), *Obesity* (pp. 208–225). Philadelphia: Saunders.
- Hill, J. O., & Peters, J. C. (1998). Environmental contributions to the obesity epidemic. *Science*, *280*, 1371–1374. DOI:10.1126/science.280.5368.1371.
- Hofmann, W., Van Koningsbruggen, G. M., Stroebe, W., Ramanathan, S., & Aarts, H. (2010). As pleasure unfolds: Hedonic responses to tempting food. *Psychological Science*, *21*, 1863–1870. DOI:10.1177/0956797610389186.
- Kavanagh, D. J., Andrade, J., & May, J. (2005). Imaginary relish and exquisite torture: The elaborated intrusion theory of desire. *Psychological Review*, *112*, 446–467. DOI:10.1037/0033-295X.112.2.446.
- Kruger, J., Galuska, D. A., Serdula, M. K., & Jones, D. A. (2004). Attempting to lose weight: Specific practices among U.S. adults. *American Journal of Preventive Medicine*, *26*, 402–406. DOI:10.1016/j.amepre.2004.02.001.
- Mann, T., Tomiyama, A. J., Westling, E., Lew, A. M., Samuels, B., & Chatman, J. (2007). Medicare's search for effective obesity treatments: Diets are not the answer. *American Psychologist*, *62*, 220–233. DOI:10.1037/0003-066X.62.3.220.
- Papies, E. K., & Hamstra, P. (2010). Goal priming and eating behavior: Enhancing self-regulation by environmental cues. *Health Psychology*, *29*, 384–388. DOI:10.1037/a0019877.
- Papies, E. K., Stroebe, W., & Aarts, H. (2007). Pleasure in the mind: Restrained eating and spontaneous hedonic thoughts about food. *Journal of Experimental Social Psychology*, *43*, 810–817. DOI:10.1016/j.jesp.2006.08.001.
- Papies, E. K., Stroebe, W., & Aarts, H. (2008a). The allure of forbidden food: On the role of attention in self-regulation. *Journal of Experimental Social Psychology*, *44*, 1283–1292. DOI:10.1016/j.jesp.2008.04.008.
- Papies, E. K., Stroebe, W., & Aarts, H. (2008b). Healthy cognition: Processes of self-regulatory success in restrained eating. *Personality and Social Psychology Bulletin*, *34*, 1290–1300. DOI:10.1177/0146167208320063.
- Quinn, J. M., Pascoe, A., Wood, W., & Neal, D. T. (2010). Can't control yourself? Monitor those bad habits. *Personality and Social Psychology Bulletin*, *36*, 499–511. DOI:10.1177/0146167209360665.
- Shah, J. Y., Friedman, R., & Kruglanski, A. W. (2002). Forgetting all else: On the antecedents and consequences of goal shielding. *Journal of Personality and Social Psychology*, *83*, 1261–1280. DOI:10.1037/0022-3514.83.6.1261.
- Shah, J. Y., & Kruglanski, A. W. (2003). When opportunity knocks: Bottom-up priming of goals by means and its effects on self-regulation. *Journal of Personality and Social Psychology*, *84*, 1109–1122. DOI:10.1037/0022-3514.84.6.1109.
- Stroebe, W., Mensink, W., Aarts, H., Schut, H., & Kruglanski, A. W. (2008). Why dieters fail: Testing the goal conflict model of eating. *Journal of Experimental Social Psychology*, *44*, 26–36. DOI:10.1016/j.jesp.2007.01.005.
- Van Koningsbruggen, G. M., Stroebe, W., & Aarts, H. (2011). Through the eyes of dieters: Biased size perception of food following tempting food primes. *Journal of Experimental Social Psychology*, *47*, 293–299. DOI:10.1016/j.jesp.2010.10.012.
- Webb, T. L., & Sheeran, P. (2007). How do implementation intentions promote goal attainment? A test of component processes. *Journal of Experimental Social Psychology*, *43*, 295–302. DOI:10.1016/j.jesp.2006.02.001.