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Good intentions, bad habits, and effects of forming implementation intentions on healthy eating

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Abstract

A field experiment demonstrated that forming implementation intentions was effective in changing complex everyday behavior, in this case establishing a healthier diet. Implementation intentions concerned a specific plan for when *and* how *to act. The effect of implementation intentions was additive to the prediction of healthy eating by behavioral intentions to eat healthily. Implementation intentions were pitted against individual differences in counterintentional (unhealthy) habits. The effects of implementation intentions and counterintentional habits were independent, suggesting that implementation intentions did not break the negative influence of unhealthy habits, and yet managed to make those with unhealthy habits eat healthier in habit-unrelated respects.*
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INTRODUCTION

The will is a powerful asset of the human mind, which enables us to reach goals and fulfil desires. Behavioral intentions represent our strivings to achieve a goal or desire. It is not surprising then that behavioral intentions have been considered as a direct predictor of goal-directed behavior, such as is postulated in the theory of reasoned action (Ajzen & Fishbein, 1980), and the theory of planned behavior (Ajzen, 1985, 1991). The predictive value of behavioral intentions has been demonstrated in several meta-analyses and literature reviews (e.g. Ajzen, 1991; Armitage & Conner, unpublished manuscript; Godin & Kok, 1996; Sheppard, Hartwick & Warshaw, 1988; van den Putte, unpublished dissertation, University of Amsterdam). The implicit assumption underlying this model is that the likelihood of enacting a behavioral intention is a linear function of the extent to which we hold a behavioral

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intention. Yet we all know that we don't always enact our intentions, despite the fact that an intention may be strongly held: we may postpone the onset of behaviors that are needed to achieve an intended goal, we may be distracted by other activities, or we may simply forget an intention. Instead of enacting our intentions, we may find ourselves guided by old habits that we may have wished to overcome.

Several perspectives may provide more insight in the relationship between intentions and behavior. First, there may be other variables than intentions that relate to behavior. These may be direct predictors of behavior in addition to behavioral intentions. For instance, the theory of planned behavior postulates perceived behavioral control as a potential additional predictor of behavior. Some variables have been identified as moderators in the relationship of behavioral intentions and behavior, for instance the degree to which intentions are well considered (e.g. Bagozzi & Yi, 1989; Davidson, Yantis, Norwood & Montano, 1985), or the extent to which competing behavioral choice options are considered (Pieters & Verplanken, 1995). In the present study we looked at habits, and in particular habits that go against one's intentions, which we will denote as *counterintentional habits*, as an additional predictor of behavior.

A second perspective is to look at mechanisms that may operate in the intention–behavior relationship. Once we have an intention to achieve something, self-regulation mechanisms may be involved in the process of actual goal achievement (cf. Scheier & Carver, 1988). Bagozzi and Warshaw (1990), for instance, postulated the process of trying as an intervening process. In the present study we focused on effects of planning, and in particular on effects of forming *implementation intentions* (Gollwitzer, 1993, 1996; Gollwitzer & Brandstätter, 1997; Gollwitzer & Schaal, 1998) as an example of such a self-regulation mechanism, which is part of the model of action phases (Gollwitzer, 1990, 1996; Heckhausen & Gollwitzer, 1987). As we will argue, habits and implementation intentions have much in common, and in the case of counterintentional habits, these may act as direct competitors of implementation intentions. The joint impact of implementation intentions and counterintentional habits was studied concerning healthy eating as behavior of interest. Before turning to our hypotheses, we first elaborate on the concepts of implementation intention and counterintentional habit, respectively.

IMPLEMENTATION INTENTIONS

In the model of action phases a distinction in the process of goal achievement is made between principles that are related to setting and committing to a goal from those that relate to the execution of actions that lead to goal achievement. In the first phase a particular goal is selected on the basis of preferences, which are guided by perceptions of feasibility and desirability. Competing goals are considered, and chances of successful goal fulfillment are judged. In this phase an open orientation is needed (a 'deliberative mind-set', see e.g. Gollwitzer, Heckhausen & Steller, 1990), which, for instance, promotes the comparison of utilities, attention to alternative options, and relatively objective information processing. The result of this phase is the formation of a goal intention, which is very similar to the concept of behavioral intention. A necessary condition for further actions toward actual goal achievement is

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a certain degree of commitment to achieve the goal. Given a goal intention and a sufficient level of goal commitment, actions that should lead to goal fulfillment may be undertaken. Rather than a deliberative mind-set, an 'implemental mind-set' is helpful in this phase, i.e. a cognitive orientation focused on the execution of the appropriate actions on the right time and the right place. This orientation promotes, for instance, the processing of information that directly relates to goal-directed actions, and makes the person pay less attention to distracting information. If a person is fully experienced in executing the necessary acts, situational cues will automatically draw the individual's attention and elicit the appropriate responses that lead to goal fulfillment. However, when there is no routine that guides goal fulfillment, the forming of *implementation intentions* may do so (Gollwitzer, 1993, 1996). Implementation intentions are concrete plans of action that specify when, where, and which actions should be taken to achieve an intended goal. In other words, implementation intentions link specific behavioral responses to specific cues within a specified time and spatial frame. Implementation intentions thus take the form 'I intend to do X when I encounter situation Y'. For instance, once I feel committed to adopt a healthier diet, I would help to achieve this by intending to buy lots of vegetables next time I am in the supermarket, or by taking an apple instead of chocolate when I feel hungry. Implementation intentions thus install contingencies between situational cues and goal-fulfilling responses. Once such contingencies are present, actions that lead to goal fulfillment have gained a degree of automaticity by being under the control of relevant situational cues (Bargh & Gollwitzer, 1994; Gollwitzer, 1993, 1996).

Empirical evidence builds up that demonstrates the power of forming implementation in the process of turning a goal intention into actions to achieve that goal (e.g. Gollwitzer & Brandstätter, 1997; Orbell, Hodgkins & Sheeran, 1997; Orbell & Sheeran, unpublished manuscript; Sheeran & Orbell, unpublished manuscript). For instance, in one study Gollwitzer and Brandstätter (1997) asked participants to write a report on how they spent their Christmas holidays, and return it within a specified period. Half of the participants were instructed to form implementation intentions, i.e. they were asked to think and specify when and where they intended to write their report, whereas the other half of the participants did not receive these instructions. The proportions of participants who returned their report within the critical time period was higher among those who had formed implementation intentions than among control participants, which was a substantial effect in terms of effect size ($r = 0.39$). The beneficial effects of implementation intentions seem to be quite persistent in time. For instance, Orbell *et al.* (1997) demonstrated that behavioral intentions to perform breast self-examination that had been supplemented by implementation intentions (i.e. where and when to perform it) were more likely to be enacted when measured one month later than intentions without implementation plans. In addition, they also showed that the predictive power of previous behavior disappeared when implementation intentions were formed.

Implementation intentions state when, where, and which behavior should be executed in order to achieve a goal (Gollwitzer, 1993). Most studies that have been reported to date, however, have focused on implementation intentions in terms of *when* and *where* goal-directed action should be taken. The target behaviors in these studies were relatively simple. Therefore, the *how* of the intended actions was always unequivocal, and, unlike the when and where question, was not necessary to be

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incorporated explicitly in implementation intentions otherwise than already had been defined by the goal intention. However, many goals may be achieved through a variety of different actions, or may only be achieved through relatively complex patterns of behavior. For instance, adopting a healthier diet can be achieved in many ways, and demands many different acts (e.g. concerning shopping, eating schedules, cooking, and so on), rather than executing a single act. We would argue that in such contexts implementation intentions that specify *how* to act are particularly helpful in goal achievement, in addition to implementation intentions that specify when and where to act. In the present study participants who formed implementation intentions thus specified which actions they would take (i.e. the exact composition of their menu) on specific points in time. We expected that participants who formed implementation intentions would eat healthier compared to a no-implementation intentions control group.

HABITS

When behavior is sufficiently and satisfactorily repeated, a habit may develop. Habits can be considered as automatic acts in the sense that these are operating outside our awareness and are cognitively efficient (cf. Bargh, 1994). Furthermore, habits are functional in obtaining certain goals or end states (see for a more extensive discussion, Verplanken & Aarts, 1999). Habits thus are specific behavioral responses to specific cues in the environment. Note that this formulation very much resembles the description of the mechanism of implementation intentions. Both implementation intentions and habits involve automatic cue–response links, and in both cases behavior is thus under the control of the environment in which the behavior takes place. Like implementation intentions, habits go along with a convergent cognitive orientation, which focuses attention on one behavioral option (Aarts, Verplanken & van Knippenberg, 1997; Verplanken, Aarts & van Knippenberg, 1997), and thus increases the likelihood of acting at specified times and places. While such a cognitive orientation is referred to as an implemental mind-set in the case of implementation intentions, in the case of habits we might think of a habitual mind-set with very much the same properties as an implemental mind-set. The difference between habits and implementation intentions, of course, is that implementation intentions are formed by deliberate planning, whereas habits form through (satisfactory) repetition of behavior (Gollwitzer & Brandstätter, 1997; Orbell *et al.*, 1997; Verplanken & Aarts, 1999).

Counterintentional habits

Habits may develop that are perfectly in line with once-formed attitudes and intentions concerning a behavior (cf. Ouellette & Wood, 1998). Habits may also become the main driving force of behavior, while attitudes and intentions become unrelated to behavior (e.g. Verplanken, Aarts, van Knippenberg & Moonen, 1998; Verplanken, Aarts, van Knippenberg & van Knippenberg, 1994). However, little attention has been given to habits that *counteract* a particular attitude, intention, and

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behavior. Behavior is often challenged by motives or other driving forces that interfere with the accomplishment of wishes and desires which attitudes and intentions are aimed at (cf. Kuhl, 1984). Such forces may be present in the form of *counterintentional habits*. Counterintentional habits may be especially formed when behavior involves short-term hedonistic-driven motives at the expense of long-term benefits of attaining valued goals. We are familiar with many such habits, for instance, the thrill of speeding, the fun of playing computer games, or sweet temptations of high-calorie bites. These habits interfere with long-term goals that we may be committed to, in these examples driving safely, being a productive scientist, and living healthily, respectively. Because the type of counterintentional habits that we focus on involve specific acts, rather than, for instance, forgetting, or not doing things that promote goal achievement (e.g. Mittal, 1988), it can be assumed that counterintentional habits operate through the same mechanisms as do prointentional habits. That is, by satisfactorily repeating a behavior, relatively chronic contingencies between situational cues and habitual responses are formed, which bring behavior under the control of specific situational cues. Therefore, while in the case of prointentional behavior habits might develop from repeatedly executing goal-directed actions (e.g. actions that were specified in implementation intentions), counterintentional habits can be expected to compete with implementation intentions (cf. Gollwitzer & Oettingen, 1998). In other words, implementation intentions and counterintentional habits may constitute opposite forces, which are will-based and experience-based, respectively.

While we may have many specific (unhealthy) habits, we were particularly interested in more general unhealthy habitual eating patterns. For instance, taking your Super-Milky-Lion chocolate bar every day may be a habit because the stuff happens to give you that creamy and yet energizing taste, but need not necessarily indicate a general unhealthy eating habit of taking too much sweet and fatty foods. On the other hand, the guy that takes this candy bar only as an instance of his everyday hunt for sweet and fatty foods may have a general unhealthy habit (Verplanken & Aarts, 1999; Verplanken *et al*., 1994). Obviously the latter is more pervasive, and in the case of unhealthy eating habits, more dangerous in the long run, than the former type of habit. In the present study we therefore focused on general counterintentional (i.e. in this context unhealthy) eating habits.

What will be the joint effect of forming implementation intentions and existing counterintentional habits? In general, this will depend on the strength of the respective cue–response links. Habits or implementation intentions may win this battle to the extent that there has been extensive previous repetition of behavior, or that a strong motivation to achieve a goal is present, respectively. However, in the case of goals that can be achieved through multiple courses of action, predictions are less straightforward. In the present study healthy behavior was defined in terms of a number of indicators, such as variation, taking a sufficient amount of fruit, or avoiding too much fat. A particular implementation plan may thus comprise behaviors related to one or more of these aspects. Counterintentional (i.e. unhealthy) habits concerned eating fatty snacks and sweets. Whether or not the unhealthy habits are overruled by implementation intentions thus depends on the exact mix of acts that are incorporated into the implementation plan. If the plan contains specific intentions to leave fatty snacks and sweets, habit may have a chance to be overruled. However, if the plan aims exclusively at other aspects (e.g. eating more fruit), the unhealthy habits may be left untouched, while the general level of healthiness of eating may be enhanced.

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OVERVIEW OF THE STUDY

The study consisted of two phases. In the first phase all participants responded to a questionnaire that contained measures of the constructs that are postulated as antecedents of behavior in the theory of planned behavior (i.e. attitude, subjective norm, perceived behavioral control, and behavioral–goal–intention) toward healthy eating, and in addition a measure of individual differences in counterintentional habits, i.e. habits to eat fatty snacks and sweets. Half of the participants were then asked to generate implementation intentions to eat healthily on a particular day, i.e. what exactly they would eat and drink for breakfast, lunch, dinner, and in-between meals. The definition of healthy eating was left to the participants. Subsequently, all participants kept a diary for five days, in which they recorded what they ate and drank each day. A professional dietician judged the degree of healthiness of the five days menus. This behavioral measure thus served as the dependent variable.

It was expected that attitude, subjective norm, and perceived behavioral control concerning healthy eating would predict behavioral intentions to eat healthily, and that intentions and perceived control would predict the degree of actual healthy eating. Unhealthy habits were expected to be inversely related to the degree of healthiness of eating. Implementation intentions were expected to raise the degree of healthiness of eating. A significant contribution of implementation intentions in the prediction of behavior was expected *in addition* to the variance accounted for by behavioral intentions and unhealthy habits. Concerning the interaction of implementation intentions and unhealthy habits we anticipated two possible outcomes, as was suggested above. If implementation intentions would actually overrule unhealthy habits (e.g. if this was explicitly part of participants' implementation plans), this would be revealed by a significant interaction of the implementation intentions manipulation and unhealthy habits in the prediction of behavior. In case implementation intentions were not specifically aimed at kicking unhealthy habits, two main effects were expected, i.e. of the implementation intentions manipulation and unhealthy habits, respectively.

METHOD

Participants, Procedure, and Design

Participants were 102 undergraduate students, who were given a lottery ticket for participation. They were told that the goal of the study was to examine how students deal with their limited financial budgets. This cover story was used in order to reduce socially desirable response tendencies. Participants were told that the study focused on two aspects of students' life, i.e. how much money students spend on going out and how much they spend on food consumption. They were told that they participated in the part on food consumption. Each participant filled out a questionnaire, which contained the measures of attitude, subjective norm, perceived behavioral control, and behavioral intention toward healthy eating, and the measure of unhealthy eating habits. In order to maintain the cover story, the questionnaire also contained a number of items about participants' monthly financial budget, which will not be

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further discussed. For half of the participants (the experimental condition) the end of the questionnaire contained the manipulation of implementation intentions formation (see below for details). The design of the study thus comprised one two-level factor (experimental versus control condition). All participants were then instructed to keep a diary during five days, which was meant to obtain a measure of healthy eating behavior (see ahead for details). Participants were asked to note down every day what they had eaten and drank. They were told that experts would estimate how much money the food during those days had cost. In fact, a professional dietician judged the diaries on degree of healthiness.

The Questionnaire

Attitude toward healthy eating was measured by a semantic differential, which was composed of six bipolar seven-point items. The anchoring adjectives were good–bad, important–unimportant, positive–negative, pleasant–unpleasant, useful–useless, responsible–irresponsible, respectively, coefficient alpha = 0.84. The items were averaged into a measure that ranged from 1 (unfavorable) to 7 (favorable).

Subjective norm was measured by asking to what extent participants felt that people who are important to them think that he or she should eat healthily. Responses were given on a 7-point scale, which was anchored by certainly not (1) and certainly yes (7).

Perceived behavioral control was measured by asking the extent that participants felt that they were able to eat healthily. Responses were given on a 7-point scale, which was anchored by certainly not (1) and certainly yes (7).

Behavioral intention was measured by asking the extent to which participants intended to eat healthily. Responses were given on a 7-point scale, which was anchored by certainly not (1) and certainly yes (7).

Unhealthy eating habits were measured by presenting participants with a list of sixty-seven different foods. Thirty-seven of these products were notably unhealthy, either because of high percentages of saturated fats (e.g. fried pork-based snacks, chips, pizza), sugar (e.g. candies, ice-creams), or both (e.g. candy bars). Participants were asked to check which products they had consumed during the previous week. The number of checked unhealthy products was taken as a measure of unhealthy eating habits. The measure thus incorporated past behavioral frequency of unhealthy eating, which may be considered as the core characteristic of habit. In addition, the measure captured the degree to which unhealthy eating had generalized across instances and products.

The Manipulation of Implementation Intentions

Participants were randomly assigned to an experimental or control condition. In the experimental condition participants were asked to form implementation intentions. At the end of the questionnaire and before the diary instruction, these participants were asked to select one of the subsequent five days, and plan to make that a healthy eating day. The instruction at this point read as follows: 'We want you to choose one of the next five days, and plan to eat healthily that day. You are free to choose your

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day. Write down on the next page which day you chose, and formulate in as much detail as possible what exactly you will eat and drink during the specified moments. Thus compose your own menu, and try to do this as realistically as possible'. The form they used for their implementation intentions contained six entries, namely breakfast, in-between breakfast and lunch, lunch, in-between lunch and dinner, dinner, and after-dinner. In the control condition participants were only instructed to keep a diary. Two participants in the experimental condition had failed to write down implementation intentions, and were removed from the analyses.

The Behavioral Measure

In order to obtain a measure of healthy eating behavior, participants kept a diary during five consecutive days, starting the day after they filled out the questionnaire. The diary contained one page for each day. Each page contained six entries.

- Breakfast
- In-between breakfast and lunch
- Lunch
- In-between lunch and dinner
- Dinner
- After-dinner

Participants were asked to write down each day during the five subsequent days, if appropriate, everything they ate or drank, inside or outside home. The instruction emphasized being accurate and detailed. Because the questionnaires were taken during working days, each five-day period contained at least one day in the weekend and three working days.

A professional dietician, who was unaware of the purpose of the study, and blind to conditions, judged the diaries on degree of healthiness. A diary was rated on six aspects: variety, amount of vegetables, amount of fruit, dairy products, fat avoidance, and regularity of meals (meal frequency). For each aspect the complete diary was rated as bad (0), reasonable (1), or good (2). The scores of the six aspects were summed into an overall composite score of healthiness of behavior across the five days.

RESULTS

Descriptive Data and Randomization Check

In Table 1 the means, standard deviations, and intercorrelations of attitude, subjective norm, perceived behavioral control, intention toward healthy eating, unhealthy eating habits, and healthiness of eating during the five-day period are presented. All antecedents of behavior, as postulated by the theory of planned behavior, were very favorable toward healthy eating. Actual behavior across the five days was rated as moderately healthy on average, and participants had consumed five unhealthy products on average during the week before. Healthiness of eating behavior correlated

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Table 1. Means, standard deviations, and correlations between attitude, subjective norm, perceived behavioral control, and behavioral intention toward healthy eating, unhealthy eating habits, and healthy eating behavior

Variable and range	*M*	*sd*	2	3	4	5	6
1. Attitude (1–7)	6.32	0.60	0.31**	0.40***	0.53***	−0.27**	0.29**
2. Subjective norm (1–7)	5.95	1.20	–	−0.06	0.21*	−0.19	−0.06
3. Perceived control (1–7)	5.53	1.28		–	0.53***	−0.23	0.24*
4. Intention (1–7)	5.72	0.88			–	−0.17	0.29**
5. Unhealthy habits (0–37)	5.01	2.56				–	−0.32***
6. Behavior (0–12)	6.03	2.53					–

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

significantly with all variables, except subjective norm. As expected, unhealthy habits correlated negatively with healthy behavior.

As a check on the randomness of assignment to conditions t-tests were conducted between participants in the experimental and control groups with respect to the variables measured previously to the manipulation, i.e. attitude, subjective norm, perceived behavioral control, behavioral intention, and habit. None of these variables differed significantly between the conditions ($ts < 1$), which suggests that the randomization had been successfully accomplished.

The Prediction of Behavioral Intentions

Behavioral intentions were regressed on attitude, subjective norm, perceived behavioral control, and unhealthy habits. As can be seen in Table 1, attitude, subjective norm, and perceived behavioral control were significantly related to intention. In the multiple regression analysis ($R^2 = 0.41$) both the beta weights of attitude and perceived behavioral control were highly significant, $\beta = 0.33$, $p < 0.001$, and $\beta = 0.41$, $p < 0.001$, respectively, demonstrating that both variables contributed uniquely to the prediction of intention. The beta weight of subjective norm was not significant $\beta = 0.13$. Unhealthy eating habits were not significantly related to intention anyway, and thus did not contribute to the prediction of the criterion, $\beta = 0.05$.

The Prediction of Behavior

Healthy eating behavior was regressed on intention, perceived behavioral control, and unhealthy habits. All predictors were significantly related to the criterion (see Table 1). In the multiple regression analysis ($R^2 = 0.16$) unhealthy eating habits was the strongest predictor, $\beta = -0.27$, $p < 0.006$, and made a significant contribution to the prediction of healthy eating in addition to the predictors of the model of planned behavior. As could be expected, unhealthy eating habits were negatively related to healthy eating. The beta weight of intention was marginally significant, $\beta = 0.24$, $p < 0.07$, while the beta weight of perceived control was not significant, $\beta = 0.07$.

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Including the intention × perceived control, habit × intention and habit × perceived control interaction terms did not raise R^2 significantly, F-change = 0.12.

Effects of Implementation Intentions on Behavior

As expected, participants who had been engaged in forming implementation intentions for a healthy eating day exhibited a higher degree of healthy eating behavior during the next five days compared to control participants. The mean healthiness judgments were 6.63 and 5.45 in the experimental and control conditions respectively, $F(1, 98) = 5.70$, $p < 0.02$, $r = 0.23$, $d = 0.47$. Importantly, the effect of implementation intentions was additive to the predictive value of both behavioral intention and unhealthy habits. This was shown by a significant increase in R^2 when the manipulation of implementation intentions was included in the regression equation after intention and habit, F-change = 3.97, $p < 0.05$, β-intention = 0.21, $p < 0.04$, β-habits = −0.28, $p < 0.004$, β-implementation intentions = 0.19, $p < 0.05$. The effect of the implementation intention manipulation was *not* dependent on the strength of behavioral intention or habits, as was shown by non-significant F-changes when the respective interaction terms were included in the regression equations. It thus appeared that habits were not overruled by implementation intentions. In other words, participants who formed implementation intentions ate more healthily, irrespective of their level of unhealthy habits. Possibly, those with relatively strong unhealthy habits may not have changed their habitually eating fatty snacks and sweets, but did improve the healthiness of their eating on other aspects.

An objection to the interpretation of these results might be that participants who had formed implementation intentions simply might have repeated their implementation plan on the chosen day in their diary. In other words, their diary protocols might be biased by tendencies to be or seem consistent, or to generate socially desirable records. Therefore for each participant the match between the implementation plan and diary protocol of the chosen healthy eating day was inspected. If perfect matches were prevalent one could be suspicious with respect to the operation of consistency tendencies or impression-related biases. Two independent judges judged the matches between the implementation plans and respective diary protocols. They categorized each plan–diary combination into one of three categories: an (almost) perfect match, a conceptual match, and no match. The first category comprised almost identical plan–diary protocol combinations. The second category were plan–diary combinations that reflected the execution of the idea of the implementation plan, but did not necessarily contain the same foods and drinks (e.g. the planned chicken turned out to be beef, and eating an apple became eating an orange). The third category were combinations that showed no correspondence whatsoever. Judgments were reliable, as was indicated by 87.2 per cent agreement ($kappa = 0.75$), and discrepancies were resolved by discussion. The distribution of plan–diary matches across the three categories was 6, 31, and 10, respectively. The low number of (almost) literal matches demonstrated that there is little reason to suspect the operation of consistency or social desirability motives. Importantly, if the six participants who showed literal consistency were removed from the data set (assuming that their data are invalid), there remained a significant effect of implementation intentions, $F(1, 92) = 3.99$, $p < 0.05$.

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DISCUSSION

In this study we demonstrated that implementation intentions to eat healthily were effective in establishing a more healthy diet. Participants who planned in detail one healthy eating day ate healthier during a five-day period according to *post-hoc* judgments of an independent professional dietician than participants who did not form implementation intentions. The effect of implementation intentions was *additive* to the prediction of healthiness of eating by behavioral intentions. There was no significant interaction between behavioral intentions and the implementation intentions manipulation, which might be attributed to the fact that all participants intended to eat healthily. The effect of implementation intentions was also independent of previous unhealthy eating behavior.

Implementation intentions in most studies to date focused on *where* and *when* to perform the target behavior (e.g. Gollwitzer & Brandstätter, 1997; Orbell *et al*., 1997; Sheeran & Orbell, unpublished manuscript). Implementation intentions in the present study specified *when* and *how* to perform goal-achieving behaviors, and may thus contribute to a more complete account of implementation intention theory. Implementation intentions that specify where and when to act seem particularly effective in assisting an individual to initiate behavior. Implementation intentions *how* to act may especially be necessary when goals can be achieved through different courses of action, or by adopting a relatively complex pattern of acts, as in the present case of composing a healthy diet. In these cases implementation intentions how to act may be helpful to initiate as well as to maintain goal-directed behavior, and thus promote goal achievement in addition to implementation intentions where and when to act. Note that the effect of planning one particular healthy eating day is likely to have generalized to the whole five-day diary period. However, this could not be tested directly, because the dietician provided judgments for each participant for the five days combined.

In addition to forces that promote goal achievement (i.e. behavioral intentions and implementation intentions), we also looked at tendencies that are incompatible with the goal of healthy eating in the form of unhealthy eating habits (i.e. habits of eating fatty snacks and sweets). As was argued in the Introduction section, habits and implementation intentions have much in common, in particular with respect to the operating mechanisms. Both habits and implementation intentions encompass automatic links between cues in the environment and behaviors that are associated with these cues. In the case of habits cue-response links are established by recurrent and satisfactory co-occurring, while these associations are installed by deliberate planning in the case of implementation intentions. Whereas habits and implementation intentions thus seem natural allies (note that habits may even be the result of the repetitive and successful execution of implementation intentions), counterintentional habits seem potential competitors. In the present study implementation intentions and counterintentional habits appeared to affect behavior independently. Thus, forming implementation intentions to eat healthily was beneficial *both* for those with and without unhealthy habits. One reason for this pattern may be that leaving or replacing unhealthy snacks may not have been explicitly part of implementation intentions of those with unhealthy habits. Those participants' new diet may have been healthier on other dimensions than fat avoidance (e.g. eating more fruit), and thus still contained their unhealthy habits. It could also be that implementation intentions to act are more effective than implementation intentions to leave things. In other words,

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implementation intentions might be more effective when these involve approach behavior than avoidance behavior (P. M. Gollwitzer, personal communication, 2 May 1997). In any way, implementation intentions apparently resisted the potential obstruction of goal achievement by counterintentional habits. On the other hand, implementation intentions seemed not able to break the negative influence of unhealthy habits.

It could be argued that the results reflected carry-over effects or tendencies to report consistently or in socially desirable ways, rather than a true effect of implementation intentions. There are several arguments against such explanations. First, compared to the one-item retrospective self-report measures of behavior that are traditionally used in the attitude–behavior domain, the present five-day measure undoubtedly was much more reliable. Although reliability is no guarantee for validity, our multi-period measure might have been less vulnerable for threats to its validity compared to one-item self-reports. This holds in particular since our measure did not ask for self-reports of healthy eating, but asked for reporting concrete behaviors. In addition, the cover story (how students deal with their restricted budgets) was maintained all the way through the study, and if it had any impact it probably worked against our hypothesis. Importantly, the inspection of the generated implementation intentions and matching diary entries revealed only a small number of (almost) literal matches, and the effect of implementation intentions remained reliable without these participants. The reports of a vast majority suggested that the basic idea of their implementation plans had been executed, and that they had not simply repeated the wording of their implementation intentions. Another argument against a consistency or social desirability bias explanation is that participants were completely unaware of the criteria that were used by the dietician to judge the degree of healthiness of their diaries, if at all they expected any external judge.[1] Finally, although only experimental participants generated implementation intentions, *all* participants had been engaged in responding to questions about healthy eating in the questionnaire, and were thus made aware of the issue of healthy eating. In all, although alternative explanations cannot completely be ruled out, these seem implausible.

Whereas most studies on implementation intentions to date focused on relatively simple behaviors, the present study demonstrated that forming implementation intentions is also beneficial when it concerns complex everyday behavior, such as healthy eating (cf. Gollwitzer & Oettingen, 1998). In these contexts implementation intentions *how* to achieve an intended goal seems an important element, in addition to *where* and *when* to act. Further research might focus on the question which implementation intentions are effective for achieving different types of goals.

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[1]Note, that the potential discrepancy between the dietician's professional criteria and participants' lay-people norms of healthy eating may have seriously attenuated the effect size of the implementation intentions manipulation. The more these norms converge, for instance as a result of education, the more effective implementation intentions can be expected to be.

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