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Research article

When planning is not enough: Fighting unhealthy snacking habits by mental contrasting with implementation intentions (MCII)

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Abstract

In two experiments a self-regulatory strategy combining mental contrasting with the formation of implementation intentions (MCII) was tested for its effectiveness in diminishing unhealthy snacking habits. Study 1 (N = 51) showed that participants in the MCII condition consumed fewer unhealthy snacks than participants in a control condition who thought about and listed healthy options for snacks. In Study 2 (N = 59) MCII was more effective than mental contrasting or formulating implementation intentions alone and mental contrasting was found to increase perceived clarity about critical cues for unhealthy snacking. Together, these findings suggest that MCII is an effective strategy for fighting habits and that one of the underlying processes making MCII superior to implementation intentions alone may be that mental contrasting produces clarity about the critical cues for the unwanted habitual behavior. Copyright © 2010 John Wiley & Sons, Ltd.

Maintaining a healthy diet is presently one of the most often adopted health goals (e.g., for the Netherlands see: Covenant Obesity, 2007). However, most people adopting healthy eating goals experience difficulties with changing their eating behavior (Jeffery et al., 2000). Acknowledging the problems associated with changing unhealthy eating patterns, the present studies tested a new approach combining two established self-regulation strategies (i.e., mental contrasting with implementation intentions, MCII), for its utility in fighting unhealthy snacking habits.[1]

MCII: MENTAL CONTRASTING WITH IMPLEMENTATION INTENTIONS

MCII combines two established self-regulatory strategies (mental contrasting and implementation intentions) to form one powerful strategy for behavior change (e.g., Schramm, Oettingen, Dahme, & Klinger, in press; Stadler, Oettingen, & Gollwitzer, 2009). In mental contrasting people think about an important wish regarding behavior change (e.g., 'eating

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[1]A snack is defined as any type of food that is consumed between the three regular meals (De Graaf, 2006). A focus on snacking was deemed relevant because identification of the cues that habitually elicit unhealthy eating (which is essential for formulating effective plans) might be difficult for snacking (Adriaanse, De Ridder, & De Wit, 2009). This makes changing unhealthy snacking habits difficult, and hence likely to benefit from MCII rather than from mental contrasting or from implementation intentions alone. Moreover, several studies have indicated that the consumption of unhealthy snacks is one of the main contributors to overweight (De Graaf, 2006; Zizza, Siega-Riz, & Popkin, 2001).

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fewer unhealthy snacks'), imagine the positive future in the event of successful behavior change (e.g., 'fitting into a favorite pair of jeans again'), and then mentally contrast their images of the positive future with the negative reality that stands in the way of reaching this desired future (e.g., 'having the tendency to eat chocolate when bored'). In mental contrasting, both the positive future and the negative reality become mentally accessible and they form a strong mental association. In addition, the negative reality is perceived as an obstacle that potentially hinders attaining the desired future. If attaining the desired future is perceived as feasible, a person forms a strong goal commitment to realize the desired future (e.g., Oettingen, 2000; Oettingen, Mayer, Sevincer, Stephens, Park, & Hagenah, 2009; Oettingen, Pak, & Schnetter, 2001).

Additionally, it has been argued that mental contrasting aids the identification of obstacles, or critical cues, that hinder goal realization (Oettingen et al., 2001; Oettingen, Mayer, & Thorpe, in press; Stadler et al., 2009). Specifically, mental contrasting has been proposed to be an effective tool for identifying critical cues that hinder goal realization, as it ''puts a person in touch with her past experiences and knowledge'' (Oettingen, Mayer, Thorpe, Janetzke, & Lorenz, 2005, p. 263). Indeed, a recent study (Kappes & Oettingen, 2009) indicated that the aspects of negative reality that were elaborated during mental contrasting of a feasible wish were perceived as unpleasant and as something ''standing in the way'' of their desired future that hence needed to be overcome. Moreover, the results indicated that this perception of the generated reality as something that needs to be overcome fostered persistence in goal striving.

After going through the mental contrasting procedure, MCII requires that implementation intentions are formulated. Implementation intentions are simple action plans specifying when, where, and how a goal should be acted upon. An implementation intention supporting the goal to eat more fruit could for example be ''If I get hungry in between meals, then I will eat an apple.'' By specifying one's goal striving in this manner, a critical situation (getting hungry in between meals) is linked to a specific action (eating an apple), with the result that one becomes perceptually ready to encounter this situation and is hence less likely to miss it as a good opportunity to act. Moreover, since the situation is automatically linked to a specific behavior, one no longer has to decide *in situ* what goal-directed behavior to perform when the situation arises (Gollwitzer, 1999; Parks-Stamm, Gollwitzer, & Oettingen, 2007). In MCII, implementation intentions are formulated in such a manner that the obstacles that hinder wish fulfillment, which were identified during mental contrasting, are specified as the critical cues in the 'if-part' of the implementation intention.

Mental contrasting and implementation intentions mutually support each other to form one powerful strategy for behavior change in two important respects. First of all, implementation intentions need to be based on strong goal commitment in order to be effective (Sheeran, Webb, & Gollwitzer, 2005) and mental contrasting can create this strong goal commitment. Secondly, implementation intentions provide the tool to put one's goals into action. Mental contrasting aids in recognizing the obstacles for behavior change and these obstacles are subsequently addressed by implementation intentions in which the obstacle (if-part) is linked to actions to overcome the obstacle (then-part; Oettingen & Gollwitzer, in press; Stadler et al., 2009).

So far, four studies have shown the efficacy of MCII compared to a control condition in different domains; increasing exercise behavior in healthy adults (Stadler et al., 2009) as well as in chronic back pain patients (Schramm et al., in press), practicing PSAT questions (Duckworth, Grant, Loew, Oettingen, & Gollwitzer, 2009), and improving time-management (Oettingen, Barry, Guttenberg, & Gollwitzer, 2009). However, all of the described studies focused on promoting the *initiation* of new behaviors rather than *changing* existing habits. Changing existing habitual behaviors is arguably more difficult than initiating new behaviors (Holland, Aarts, & Langendam, 2006) and is of particular relevance in the domain of eating behavior, where one of today's most pressing problems is reducing unhealthy eating habits, such as unhealthy snacking (De Graaf, 2006; Jahns, Siega-Riz, & Popkin, 2001; Zizza et al., 2001).

FIGHTING HABITS

One approach that has been proposed for changing habits is to link a critical cue that generally triggers the unwanted, habitual behavior to a new, desired behavior by means of implementation intentions (Gollwitzer, 1999; Gollwitzer & Sheeran, 2006; Holland et al., 2006). To illustrate, if a person is aware that (s)he has a tendency to snack on chocolate when bored, this awareness of one's 'situation-behavior profile' (Gollwitzer & Sheeran, 2006) could be used to link the critical cue ('being bored') to a new, desired response (e.g., 'making myself a fruit salad'), resulting in the implementation intention: ''If I am bored and I want a snack, then I will make myself a fruit salad.'' Although this approach to fighting

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habits makes intuitive sense, the few studies that investigated it gave mixed results (Adriaanse et al., 2009; Holland et al., 2006, Webb, Sheeran, & Luszczynska, 2009), and imply that for fighting habits MCII might be more effective than implementation intentions alone.

Holland et al. (2006) tested the effectiveness of forming counter-habitual implementation intentions in a study on recycling habits. These authors found that implementation intentions were effective in breaking the old habit of throwing plastic cups and wastepaper into a bin and in creating the new habit of recycling these items. However, in two other studies where goal striving concerned changing more *complex* behaviors (i.e., smoking or eating unhealthy foods) results were less straightforward.

Webb et al. (2009, Study 2) found in their study on smoking cessation that implementation intentions were only effective in decreasing smoking among participants with weak smoking habits, but not among participants with strong habits. Moreover, Adriaanse et al. (2009) found in a study on snacking habits that for counter-habitual implementation intentions to be effective participants needed to specify *personally* critical cues for the unwanted behavior in the if-part of the implementation intention; participants who were assigned cues for making implementation intentions proved unable to change their habits. In addition, personal implementation intentions were only effective when participants specified underlying reasons (e.g., 'feeling bored') for their unwanted behavior rather than simple context cues related to the unwanted behavior (e.g., 'being at home').

The finding by Adriaanse et al. (2009) that for implementation intentions to be effective in changing habits, individuals should specify their *personal* critical cues for the habitual behavior could explain the lack of findings for participants with strong smoking habits in the study by Webb et al. (2009). In this study participants were assigned four specific cues for the if-part of their implementation intentions rather than being allowed to identify their own personal cues, which could have had the result that the implementation intentions did not directly target *critical* cues for smoking.

MCII AND FIGHTING HABITS

Adriaanse et al.'s (2009) findings suggest that for implementation intentions to be effective in changing habits, individuals should specify their personal critical cues for the habitual behavior. However, although identifying critical cues may be straightforward for simple behaviors that can be directly linked to context cues (e.g., throwing away a cup), for more complex behaviors such as snacking or smoking, this can be more complicated. For these types of behaviors, critical cues might reflect more subjective internal states (e.g., 'boredom') rather than objective situational cues regarding time or place (e.g., 'being at home' or 'having an empty cup'), which require accurate introspection regarding the cues triggering one's behavior (Adriaanse et al., 2009).

Unfortunately, people generally have poor introspection regarding the antecedents of their own behavior (Nisbett & Wilson, 1977). This problem is illustrated by findings showing that when people are in cold states (e.g., not hungry, not sexually aroused), as is most likely the case when formulating plans, they systematically underestimate the effect of future hot states (e.g., feeling hungry or sexually aroused) on their behavior (e.g., Loewenstein, 1996; Loewenstein, Nagin, & Paternoster, 1997).

Based on these findings it seems that without any help people will have a difficult time specifying critical cues for their unhealthy snacking habits and therefore will not be able to formulate effective implementation intentions. Considering that mental contrasting has been proposed to aid clarity about one's critical cues (Oettingen et al., 2001, 2009, in press), an intervention where MC is combined with II (MCII) might therefore be particularly effective for fighting unhealthy snacking habits.

RESEARCH OVERVIEW

The present research investigates the effectiveness of combining mental contrasting with implementations intentions in altering snacking behavior. In Study 1, MCII will be compared to a control condition for its efficacy in decreasing unhealthy snack intake over a period of 1 week, as measured by a food diary. In Study 2, MC, II, and MCII conditions will

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be compared to rule out the possibility that the effects of MCII were based on the mental contrasting or implementation intention part of the intervention alone. Additionally, this study investigates our hypothesis that MC aids the efficacy of II by increasing clarity about the cues that trigger the unwanted behavior.

STUDY 1: FIGHTING HABITS BY MCII

Method

Participants

Fifty-two female students aged 17–27 years participated in our study (MCII: $N = 26$; Control: $N = 25$). After excluding one participant with a BMI [body mass index = weight/height × height] < 18, the final sample consisted of 51 female students with a mean BMI of 21.40 ($SD = 2.15$) and a mean age of 20.76 years ($SD = 2.18$). There were no obese participants in the sample.[2]

Procedure

Participants were recruited by means of flyers which invited female students who were interested in reducing their unhealthy snack intake to come to our lab. When arriving at the lab, all participants were informed about the experiment and told that it entailed (a) filling out a questionnaire, (b) performing a mental exercise which might help them to attain their goal of eating fewer unhealthy snacks (MCII or control, randomly assigned), and (c) keeping a food diary for a period of 1 week. Upon returning their diaries, participants received 5 € or course credit.

Questionnaire

The questionnaire included some general questions about age, education, and living situation. In addition, habit strength, intention, and expectations were measured. Habit strength was measured by the self-report habit index (SRHI; Verplanken & Orbell, 2003). The SRHI consists of 12 items, which, for the present study, reflected the habit of eating unhealthy snacks. Each item consisted of a statement about eating unhealthy snacks (e.g., 'Eating unhealthy snacks is something I do without thinking about it', Cronbach's $\alpha = .90$), and participants were asked to indicate the extent to which they agreed with each statement. Responses ranged from 1 (*not at all*) to 7 (*very much*).

Intention to eat fewer unhealthy snacks was measured by the item: ''I intend to eat fewer unhealthy snacks in the coming week.'' Expectation about eating fewer unhealthy snacks was measured by the item ''I expect to eat fewer unhealthy snacks in the coming week.'' Participants answered on 7-point Likert scales ranging from 1 (*totally disagree*) to 7 (*totally agree*).

Mental Exercise

Participants in both conditions were told that most students eat too many unhealthy snacks and that in order to help them eat fewer unhealthy snacks they would be asked to go through a mental exercise.

MCII Condition Instructions for the MCII exercise were derived from Oettingen, Barry, et al. (2009) and Stadler et al. (2009), and were read out loud to all participants. Participants were provided with a form to write down keywords or

[2]Underweight (BMI < 18) and obese (BMI > 30) people might differ from normal weight and overweight people in the way they regulate their eating behavior and can be considered to have a pathological relationship with food (i.e., Nasser, 2001; Vaidya & Malik, 2008).

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thoughts when asked to do so during critical parts of the exercise. At the start of the MCII exercise participants were asked to relax and close their eyes. Then, they had to name a wish concerning a specific unhealthy snacking habit they wanted to change. They were told to specify a wish that would be challenging for them to realize, but also possible to implement in the coming week. After participants wrote the wish on their form, they were asked to elaborate a positive aspect they associated with having successfully realized their wish and an obstacle standing in its way. The oral instructions for naming and elaborating the positive aspect were

> Please consider the most positive outcome you associate with successfully realizing your wish and write it down in one keyword. Now try to depict in your thoughts the events and experiences that you associate with the most positive outcome. Give your thoughts and images free reign and write them down.

The oral instructions for naming and elaborating the obstacle were

> Sometimes a wish does not become fully realized, even if one is very motivated to realize the wish. What situations could make it hard for you to diminish your bad snacking habit? Think about which is the most important obstacle to eating fewer unhealthy snacks for *you personally* and write it down in one keyword. Now depict in your thoughts the events and experiences that you associate with this obstacle. Give your thoughts and imagination full scope and write them down.

Then the implementation intention component of the MCII intervention followed (adapted from Adriaanse et al., 2009), in which participants were asked to plan to eat a piece of fruit whenever they encountered their earlier specified most critical obstacle for eating unhealthy snacks in the coming week. Participants completed the following statement: ''If I [obstacle] and I feel like having a snack, then I will eat a(n) [choice of fruit].'' After sentence completion was verified by the experimenter, participants were encouraged to visualize acting out their plan for about 2 minutes.

Control Condition The instructions for the control condition were derived from Adriaanse et al. (2009, Study 3). Participants were told that in order to help them eat fewer unhealthy snacks, we would like them to think about options for *healthy* snacks that they liked and could consume whenever they wanted to eat a snack. Participants were asked to think carefully about this, and then to list their top ten healthy snacks. This control condition was chosen in order to eliminate the possibility that any superior effects of the MCII condition were caused merely by thinking about eating fewer unhealthy snacks by participants in this condition. Moreover, this type of active control condition allowed us to introduce both exercises similarly; that is, by stating that they would go through an exercise which could *help them eat fewer unhealthy snacks* we tried to keep experimenter demand equal between the two conditions.

Food Diary

After going through the exercise, participants received their food diary which was similar to the diary used by Adriaanse et al. (2009). The food diary was constructed together with a registered dietician and consisted of six tables for each of 7 days (so a total of 42 tables). During seven consecutive days participants were asked to fill out a table in the diary for each snacking occasion (defined as a 30 minute period in which snacks were consumed).

Each table consisted of one column with 12 categories of unhealthy snacks and one column with 13 categories of healthy snacks. For both healthy and unhealthy snacks 'other' options were also provided. Categories were constructed based on advice from the dietician to ensure that only snacks that were about equal in their caloric value were grouped together into one category. In other words, although categories of snacks were used, care was taken to ensure that the labels used for these categories discriminated between snacks that have a different caloric value. To illustrate, rather than using one category for cakes, cookies and biscuits, the diary included separate categories for (a) small biscuits/cookies, (b) large cookies, and (c) cakes and pies.

Participants were asked to indicate the amount of each category of snacks they consumed by using the portion size that was indicated for each category, like 'units/pieces' for candy bars, and 'handful' for chips. The diary was orally explained to participants, but also included instructions and an example of a completed table on the first page of the diary.

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Results

Descriptives

On average, participants had moderately strong unhealthy snacking habits ($M = 4.12$, $SD = 1.00$), strong intentions to eat fewer unhealthy snacks ($M = 5.49$, $SD = 1.33$), and high expectations about eating fewer unhealthy snacks ($M = 4.94$, $SD = 1.26$). Results from the food diary showed that participants consumed on average 6.80 pieces of fruit during the week ($SD = 4.63$). As the categories of unhealthy snacks that were used in the diary varied considerably in size and calories (e.g., one candy bar cannot be considered equal to one small cookie), scores for each category were 'weighed' by the average number of kilocalories (kcal) it contained (based on guidelines from the Dutch Nutrition Centre; http://www.caloriechecker.nl, and validated by a professional dietician). In this manner, the mean number of kcal derived from unhealthy snacks was calculated and used as the dependent measure. The mean number of kcal per week derived from unhealthy snacks was 2296.61 kcal ($SD = 1595.50$). Table 1 presents the means, standard deviations, and correlations for the variables under study.

Randomization Check

A one-way multivariate analysis of variance (MANOVA) with age, BMI, habit strength, intention and expectation as the dependent variables and condition (control vs. MCII) as the independent variable was performed to check whether randomization was successful. The MANOVA did not reveal a significant multivariate effect and no significant univariate effects, indicating successful randomization (all ps $> .13$).

Unhealthy Snack and Fruit Consumption

A one-way multivariate analysis of covariance (MANCOVA) with condition (MCII vs. control) as the independent variable and unhealthy snack intake (in kcal) and fruit intake as the dependent variables was performed to investigate the effectiveness of the MCII strategy on snacking behavior. As habit strength was strongly related to unhealthy snack consumption ($r = .39$, $p < .01$), it was entered as a covariate. Unhealthy snack intake (in kcal) was log-transformed before entering into the analysis as this variable was positively skewed. However, for the sake of interpretation, mean scores are presented for the non-transformed variable.

The MANCOVA revealed a significant multivariate effect for condition, $F(2, 47) = 3.51$, $p < .05$, $\eta_p^2 = .13$, and a significant effect of the covariate habit strength, $F(2, 47) = 7.10$, $p < .01$, $\eta_p^2 = .23$. Univariate effects were significant for unhealthy snack intake, $F(1, 48) = 7.17$, $p < .01$, $\eta_p^2 = .13$, with participants in the MCII condition on average consuming less calories on unhealthy snacks than participants in the control condition, but not for fruit intake, $p = .67$ (see Table 2).

Table 1. Study 1: Means, standard deviations, and correlations

	1	2	3	4	5	6	7
BMI (1)	—						
Age (2)	−.07	—					
Habit strength (3)	.11	−.27	—				
Intention (4)	.13	−.26	.05	—			
Expectation (5)	−.07	−.05	−.09	.77**	—		
Fruit intake (pieces) (6)	.02	−.19	.14	.13	.13	—	
Unhealthy snack intake (kcal) (7)	−.20	−.12	.39**	−.12	−.26	−.09	—
M	21.40	20.76	4.12	5.49	4.94	6.80	2296.61
SD	2.15	2.18	1.00	1.33	1.26	4.63	1595.50

**$p < .01$.

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Table 2. Mean fruit and unhealthy snack intake (kcal)

		MCII	Control
Fruit	*M*	7.1	6.5
	SE	0.9	0.9
Unhealthy snacks (kcal)	*M*	1745	2870
	SE	269	274

Potential Moderators of MCII Effects

Habit Strength To rule out the possibility that the MCII intervention was only effective among participants with weak habits, multiple linear regression analyses with habit strength as a continuous, mean centered predictor, condition as a categorical predictor, and the interaction term of habit strength × condition were conducted for unhealthy snack intake (in kcal) and fruit intake separately. For unhealthy snack intake, the model was significant, with condition and habit strength as significant predictors. The interaction term did not significantly predict unhealthy snack intake (see Table 3). No significant effects were found for fruit intake, $ps > .49$.

Intention To assess whether the effects of the MCII intervention were moderated by intention strength, two multiple linear regression analyses for unhealthy snack intake and fruit intake were also performed with intention as a continuous, mean centered predictor, condition as a categorical predictor, and the intention × condition interaction term as the third predictor while controlling for habit strength. For unhealthy snack intake, the model proved to be significant ($p < .01$) and explained 20.5% of the variance (adj. R^2), with condition ($\beta = -.33$, $p < .05$) and habit strength ($\beta = .46$, $p < .01$) as significant predictors. Intention, and the intention × condition interaction did not significantly predict unhealthy snack intake, $ps > .73$. No significant effects were found for fruit intake, $ps > .27$.

Expectation Moderation effects of expectation were also assessed in separate multiple linear regression analyses for unhealthy snack intake and fruit intake. Expectation was entered as a continuous, mean centered predictor, condition as a categorical predictor, and the expectation × condition interaction term as a third predictor while controlling for habit strength. For unhealthy snack intake, the model was significant ($p < .01$) and explained 22.3% of the variance (adj. R^2). Condition ($\beta = -.30$, $p < .05$) and habit strength ($\beta = .44$, $p < .01$) were significant predictors. Expectation, and the expectation × condition interaction did not significantly predict unhealthy snack intake, $ps > .50$. No significant effects were found for fruit intake, $ps > .29$.

Discussion

Study 1 showed that participants in the MCII condition consumed significantly fewer calories from unhealthy snacks than participants in the control condition, suggesting that the MCII strategy was successful in diminishing habitual unhealthy snacking behaviors. The lack of interaction effects with habit strength further indicated that this beneficial effect of MCII was not restricted to participants with weak unhealthy snacking habits.

Intentions to reduce snacking behavior did not moderate MCII effects either. This finding implies that the MCII exercise has beneficial effects for those who strongly intend to reduce snacking as well as for those whose intentions are less strong. However, note that for the present study we specifically recruited participants who wanted to decrease their unhealthy snack intake. Consequently, most participants had very strong intentions (only 9.8% of participants in Study 1

Table 3. Results of regression analysis of habit strength on unhealthy snack consumption in kcal

	β	ΔF	ΔR^2
Model		5.61	26.4%**
Condition	−.35**		
Snack habit strength	.41**		
Condition × snack habit strength	.08		

Note: Final βs are presented. $^{**}p < .01$.

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had intentions <4.00). It might very well be that people with very low intentions to reduce snacking would not benefit from the MCII exercise. They may not be able to positively fantasize about a future of reduced snacking, and thus MC would not engender high commitment for the particular snacking behavior picked for the mental contrasting exercise (a prerequisite for implementation intentions to be effective).

Similar explanations apply to the lack of moderation effects by expectation. In view of the fact that previous studies have indicated that mental contrasting is more effective when people hold high expectations of success (Oettingen, 2000), we asked participants to specify a wish that would be challenging for them to realize, but which they also expected to be able to realize in the coming week. As a result, most participants had high expectations of success (only 19.8% of participants had expectations <4.00). Thus the absence of an interaction effect with expectation is not surprising.

Although the focal goal of the study was to decrease unhealthy snack intake, considering that the then-part of all implementation intentions referred to eating more fruits, it has to be noted that fruit consumption did not differ significantly between the two conditions. Certainly, this does not imply that participants in the MCII condition failed to achieve their goal of eating fewer unhealthy snacks by substituting their unhealthy snacks with fruits. Rather, it seems possible that *both* the control group and the MCII group increased their fruit intake. All participants in this study were highly motivated, and were actively encouraged, to eat less unhealthily which might have been sufficient to increase fruit consumption (e.g., Jackson et al., 2005, 2006). Alternatively, the procedure could have led control participants to form spontaneous implementation intentions to increase their fruit intake (Gollwitzer & Brandstätter, 1997; Jackson et al., 2005, 2006). However, because in Study 1 we did not assess participants' snacking behavior at baseline by using a diary measure, we cannot check whether the explanation that both groups increased their fruit intake is valid or not. Also, the effects on fruit intake were rather small and our study was underpowered for detecting a small effect.

Despite the fact that fruit intake did not differ from the control group, Study 1 provides convincing evidence for the effectiveness of MCII in diminishing unhealthy snack intake (a difference of 1125 kcal per week), which was the main goal of the MCII intervention. However, the results from Study 1 do not demonstrate that both components (MC and II) of the manipulation are needed for this effect to occur. It is possible that the effects were based on the mental contrasting, or, implementation intention part only.

As stated in the introduction, it is expected that mental contrasting increases clarity about the cues triggering one's unwanted habit. This clarity may by itself not be enough to change habits as one also needs the 'tools' (i.e., implementation intentions) to translate this clarity into action. On the other hand, for formulating effective implementation intentions people should benefit from mental contrasting as it provides clarity about the critical cues. Specifically, mental contrasting should provide clarity about the cues that trigger the unwanted behavior (e.g., boredom as the critical cue for eating chocolate) which is needed to formulate implementation intentions that are effective in substituting this unwanted habit with a new response (e.g., when bored consuming a healthy instead of an unhealthy snack). Following these considerations, we therefore expect that an MCII intervention will be more effective in fighting unhealthy snacking habits than MC or II alone. In order to test this assumption, we conducted a second study separating the two components of MCII. Additionally, this study investigated the role of cue clarity as one of the mechanisms underlying the expected superiority of MCII compared to MC or II alone.

STUDY 2: DISENTANGLING THE TWO COMPONENTS OF MCII

In the second study, the effectiveness of separate MC, II, and MCII interventions were compared. Although the instructions for MC and II were essentially the same as instructions for the MC and II components from the MCII intervention in Study 1, Study 2 differed in three important respects. First of all, in order to further standardize the MCII procedure, all instructions were provided in written form. Secondly, to allow for a stricter test of our hypotheses, our dependent measures specifically addressed the one habit that participants aimed to decrease rather than looking at an aggregate of their unhealthy snack consumption in general. Lastly, in order to increase the chance that the then-part of the implementation intention specified a response that was applicable to the specific obstacle, participants in the second study were entirely free in formulating the then-part of their plan.

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Method

Participants

For this study, 77 female participants were drawn from New York University's research pool. Of the initial 77 participants, 64 participants (83%) returned after 1 week for their appointment to fill out a final questionnaire with our dependent measures. After excluding one obese (BMI > 30) and two underweight (BMI < 18) participants, one participant who reported having several food allergies, and one participant who failed to indicate which unhealthy food/drink item she wanted to reduce, the final sample consisted of 59 participants (MCII: $N = 19$; MC: $N = 20$; II: $N = 20$) with a mean BMI of 21.65 ($SD = 2.43$) and a mean age of 19.36 years ($SD = 1.21$).

Procedure

Participants were invited to the lab and were randomly assigned to the MCII, MC, or II condition. Participants in all conditions received a booklet which started with several general questions and a practice mental exercise (MC, II, or MCII, depending on condition). This practice exercise concerned a wish in a domain that was not associated with the topic of the study (academia) and intended to give participants the opportunity to familiarize themselves with the procedure of the exercise. After these general questions and the practice exercise, the booklet continued with some questions and the actual mental exercise concerning participants' unhealthy snacking habit. When participants finished the booklet, they made an appointment to fill out the final questionnaire 1 week later. Participants received course credit upon finishing the first session in which they completed the booklet and $10 for returning to the lab and filling out the final questionnaire 1 week later.

Booklet

The booklet started with questions about age, weight, and height. Then participants were asked to go through the practice exercise for their most important academic wish. After that, the focal part of the experiment concerning participants' most important unhealthy snacking habit started.

Questions About Unhealthy Snacking Habit Participants were asked to name their single most important unhealthy snacking habit that they felt they would be able to diminish in the next week, but that was also challenging for them to change. It was explained that ''unhealthy snacking habit'' referred to an unhealthy food or drink that they regularly consumed and of which they wanted to consume less (e.g., junk food, soda, cookies), and not a healthy food or drink of which they wanted to consume more (e.g., vegetables, fruit, water).

After naming their unhealthy snacking habit, participants answered several questions regarding this habit; the *extent* to which they wanted to diminish the food or drink they specified in their habit (''By how much would you like to diminish the consumption of the food or drink you just specified above?''), their *expectations* of achieving this (''Within the next week, how likely is it that you will diminish the consumption of your food/drink to the extent you just indicated?'') and the *importance* of diminishing their bad habit (Within the next week, how important is it to you to diminish the consumption of your food/drink to the extent you just indicated?''). Responses on all three items ranged from 1 (*not at all*) to 7 (*very much*). In addition, the SRHI (Verplanken & Orbell, 2003) was administered. The SRHI was adapted so that participants could fill in their own specific unhealthy habit and showed excellent reliability (Cronbach's $\alpha = .89$).

Mental Exercise Then, participants went through the mental exercise for their unhealthy snacking habit. The MC instructions for the positive future read:

> Please consider the best aspect you associate with diminishing your bad habit. What is it that would make it so good for you personally if you diminished your bad habit? Please keep this best aspect in the front of your mind and really think

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about it. Imagine the relevant events and experiences as vividly as possible! Let your mind go! Do not hesitate to give your thoughts and images free reign.

The MC instructions for naming and elaborating the obstacle read:

Sometimes things do not work out as well as we would have liked. What is the most important obstacle that stands in the way of diminishing your bad habit? What could make it hard for you to diminish your bad habit? What is it in you personally that might impede you from diminishing your bad habit? Please name the central obstacle. Please keep this obstacle in the front of your mind and really think about it. Imagine the relevant events and experiences as vividly as possible! Let your mind go! Do not hesitate to give your thoughts and images free reign.

The II instructions were adapted from Study 1 in such a manner that participants could now name any behavior that could help them overcome their obstacle in the then-part of the plan. In the MCII condition instructions referred to the obstacle *that participants had just named in the MC part*:

Now please make an if-then plan in which you link the obstacle that you just named to a response which will help you to overcome this obstacle when it occurs. The if-then plan has the following format: ''*If* (here you refer to the obstacle you specified) *then I will* (here you name the behavior to overcome the obstacle).'' Now please complete the if-then plan below.

If. . . . . , *then I will*. . . . . .

Now say this plan slowly in your head one more time.

In the II condition, participants were asked to choose an obstacle:

Please make an if-then plan in which you link an obstacle to diminishing your bad habit to a response which will help you to overcome this obstacle when it occurs. The if-then plan has the following format: "*If* (here you name your obstacle) *then I will* (here you name the behavior to overcome the obstacle)." Now please complete the if-then plan below.

If. . . . . , *then I will*. . . . . .

Now say this plan slowly in your head one more time.

Participants in the MCII and II condition were then asked to make sure that their plan had the format of: ''*If* (your personal critical obstacle), *then I will* (your behavior to overcome the obstacle).''

Upon finishing their mental exercise, participants were asked to try to be successful in diminishing their bad habit in the coming week by going through the exercise every morning when they woke up. The booklet ended with the same expectation and importance items that participants filled out before going through the exercise.

Final Questionnaire

The final questionnaire was administered approximately 1 week after the mental exercise. It contained three items regarding the *success in diminishing* the habit, two items regarding *clarity* about the content of the habit and two *control items.* The two control items were added to ensure that any possible effects were due to the nature of the exercise (MC, II, or MCII), and not to a more frequent use of the exercise, or demand effects.

Success in Diminishing the Habit Success in diminishing the habit was measured by three items that addressed the extent participants were able to diminish the consumption of their chosen food item. The first item: ''Compared to the week before you did the exercise, how well did you do on overcoming your unhealthy habit in the week after you did the exercise?'', could be answered on a 7-point Likert scale ranging from 1 (*much worse*) to 7 (*much better*). The other two items were: ''Compared to the week before you did the exercise, how many times were you able to not consume your unhealthy food/drink when you had the urge to in the week after you did the exercise?'', and ''Compared to the week before you did the exercise, how many times did you consume your unhealthy food/drink in the week after you did the

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exercise?''. These items were answered on scales ranging from 1 (*much less*) to 7 (*much more*). The last item was reverse coded so that an index in which higher scores reflect more success in diminishing the habit could be calculated using these three items (Cronbach's $\alpha = .67$).

A pilot study ($N = 41$) targeting the habit of eating chocolate tested the predictive validity of these items. This pilot study showed that these three items (adapted to address the success in diminishing chocolate consumption) negatively correlated with actual caloric intake on chocolate, $r = -.46$, $p < .01$, and with the frequency of eating chocolate, $r = -.34$, $p < .05$, as measured during a 1 week period in a food diary.

Clarity Clarity was measured by two items; ''To what extent did the exercise help you get a better understanding of your unhealthy habit?'' and ''To what extent did the exercise help you think about your unhealthy habit in a different way?'' (Cronbach's $\alpha = .71$). 7-point scales ranged from 1 (*not at all*) to 7 (*very much*).

Control Items The control items referred to participants' frequency of using the exercise (''How often did you use the exercise in regard to diminishing your unhealthy food/drink?''), and to potential demand effects (''How much did the experimenter want you to succeed in diminishing your unhealthy food/drink item in the week after the exercise?''). Scales ranged from 1 (*not at all*) to 7 (*very much*).

Results

Descriptives

Prior to the mental exercise, participants wanted to reduce their unhealthy habit by quite a lot ($M = 5.59$, $SD = 1.51$), had high expectations of success ($M = 4.80$, $SD = 1.42$), and thought it was important to diminish their bad habit ($M = 5.34$, $SD = 1.37$). After the exercise, overall, mean expectations were higher ($M = 5.28$, $SD = 1.28$; $F(1, 55) = 8.38$, $p < .01$) than before the exercise, but mean importance remained the same ($M = 5.29$, $SD = 1.24$). A MANOVA showed that the extent to which participants wanted to diminish their habit, their expectations of success, the importance of diminishing the habit before the exercise, and the expectations and importance of diminishing the habit after the exercise did not differ between conditions (all ps $> .26$). An overview of means, standard deviations, and correlations of the variables under study can be found in Table 4.

Randomization Check

A MANOVA with age, BMI and habit strength as the dependent variables and condition (MCII vs. MC vs. II) as the independent variable was performed to check whether randomization was successful. The MANOVA did not reveal any significant effects (all ps $> .31$), indicating successful randomization.

Success in Diminishing the Habit

A one-way analysis of variance (ANOVA) was performed with condition (MCII, MC, II) as the independent variable and participants' success in diminishing the habit as the dependent variable. This ANOVA revealed a significant main effect of

Table 4. Study 2: Means, standard deviations, and correlations

	1	2	3	4	5	6	7	8
BMI (1)	—							
Age (2)	.03	—						
Habit Strength (3)	.32*	.27*	—					
Extent of Reducing Habit (4)	−.14	.21	.27*	—				
Expectation (5)	.02	−.10	−.14	.18	—			
Importance (6)	.05	.13	.20	.67**	.45**	—		
Success in Diminishing the Habit (7)	.04	−.21	−.02	.15	.21	.18	—	
Clarity (8)	.16	−.11	.08	.04	.01	.08	.18	—
M	21.65	19.36	4.14	5.59	4.80	5.34	4.63	4.66
SD	2.43	1.21	1.21	1.51	1.42	1.37	1.31	1.40

Note: Expectation and Importance refer to the level of these variables before the mental exercise. *$p < .05$; **$p < .01$.

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condition, $F(2, 56) = 5.68$, $p < .01$, $\eta_p^2 = .17$. Planned contrasts showed that the MCII condition ($M = 5.37$, $SD = .99$) significantly outperformed the II ($M = 4.08$, $SD = 1.25$), $p < .01$, $\eta_p^2 = .25$, and the MC ($M = 4.47$, $SD = 1.37$), $p < .05$, $\eta_p^2 = .13$, conditions.[3] The difference between MC and II was not significant, $p = .32$.

Potential Moderators for Success in Diminishing the Habit

Habit Strength Similar to Study 1, moderating effects of habit strength were investigated by means of a multiple linear regression analysis. This analysis included two dummy variables for condition (MC and II), habit strength as a continuous, mean centered predictor, and interaction terms of habit strength with each of the two dummies. The model was significant, with the MC and II dummies as significant predictors. Habit strength and the interaction terms with habit strength did not predict success in diminishing the habit (see Table 5).

Importance A similar regression analysis was performed to investigate interaction effects with goal importance. The model proved to be significant ($p < .05$) and explained 14.1% of the variance (adj. R^2), with the MC ($\beta = -.33$, $p < .05$) and II dummies ($\beta = -.46$, $p < .01$) as significant predictors. Goal importance and the interaction terms with goal importance did not predict success in diminishing the habit, $ps > .20$.

Expectation Moderation effects of expectations were also assessed in a similar multiple linear regression analysis. The model was again significant ($p < .05$), explaining 15.6% of the variance (adj. R^2). Dummy variables for MC ($\beta = -.34$, $p < .05$) and II ($\beta = -.47$, $p < .01$) were again the significant predictors. Expectation and the MC × expectation and II × expectation interactions did not predict success in diminishing the habit, $ps > .40$.

Clarity

Planned contrasts were conducted to compare the two conditions that included MC (i.e., MCII and MC) to the group that did not (i.e., II) on scores for clarity. As clarity was not normally distributed, planned contrasts were computed by means of Mann-Whitney *U*-tests. Corresponding effect sizes were calculated from the Mann-Whitney *U*-test by applying the formula $\theta = U/mn$ (Newcombe, 2006). The value of θ is equal to 0.5 when no difference between two groups exists and is either 0 or 1 in case of a perfect effect (i.e., when there is no overlap between the two groups, meaning that the independent variable has perfect discriminatory ability).

A first contrast comparing the two conditions that included MC (i.e., MCII and MC) with the condition that did not (i.e., II) revealed that participants in the conditions that included MC reported more clarity ($M = 4.88$, $SD = 1.50$) than participants in the condition that did not include MC ($M = 4.23$, $SD = 1.11$), $z = 2.25$, $p < .05$, $\theta = .32$. Follow up contrasts then compared the MCII and MC condition separately to the II condition. Participants in the MCII condition reported more

Table 5. Results of regression analysis of habit strength on success in diminishing the habit

	β	ΔF	ΔR^2
Model		2.60	19.7%*
MC	−.34*		
II	−.46**		
Unhealthy snack habit strength	−.04		
MC × unhealthy snack habit strength	.17		
II × unhealthy snack habit strength	−.05		

Note: Final βs are presented. *$p < .05$; **$p < .01$.

[3]To make sure that this effect could not be attributed to one or two items in the index, one-tailed, one-way ANOVA's were performed for the three items separately. These three analyses showed a significant main effect of condition (all $ps < .05$). Additionally, one-tailed planned comparisons showed that for all three items the MCII condition significantly outperformed the II and the MC condition (all $ps < .05$), and the difference between MC and II was not significant.

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clarity ($M = 4.95$, $SD = 1.35$) compared to participants in the II condition, $z = 2.09$, $p < .05$, $\theta = .31$. Participants in the MC condition reported marginally more clarity ($M = 4.83$, $SD = 1.66$) compared to participants in the II condition, $z = 1.79$, $p = .07$, $\theta = .34$. The MCII and MC conditions did not differ significantly from each other, $p = .94$.

Within-cell Correlations[4]

To investigate our hypothesis that the increased clarity in the MCII and MC condition would only be translated into better outcomes in the MCII condition, as only in this condition participants received the 'tools' to help translate their clarity into actions, within-cell correlations were conducted. Within-cell correlations for each of the conditions indicated that, as expected, clarity was only related to success in diminishing the habit in the MCII condition, $r = .46$, $p < .05$, but not in the other two conditions (MC: $r = .10$, ns; II: $r = -.16$, ns).

Control Items

To make sure that the effects of condition were not due to differences in frequency of performing the exercise or experimenter demand, a MANOVA with condition as the independent variable was performed for these two control variables. The MANOVA revealed no significant multivariate or univariate effects (all ps $> .53$).

Discussion

Participants in the MCII condition reported being more successful in diminishing their unhealthy snacking habit than participants in the MC or II only conditions. Similar to Study 1, the effect on success in diminishing the habit was not moderated by habit strength, goal importance, or expectations. The lack of interaction effects with habit strength again strengthens our findings as it rules out the possibility that the obtained effects on success in diminishing the habit were restricted to participants with weak unhealthy snacking habits. The fact that no moderation effects were found for goal importance and expectations may, similar to Study 1, be explained by the fact that most participants scored high on importance to eat less unhealthy snacks (in Study 2 only 6.8% of the participants scored <4.00) and had high expectations of success (in Study 2 only 20.3% of the participants scored <4.00). Moreover, the results indicated that the superior effect of MCII compared to II could be related to more clarity about the critical cues for the unwanted habit: Participants who went through an MC procedure (MCII and MC condition) reported more clarity, and when they were allowed to make plans based on this clarity (MCII condition), clarity was related to success in diminishing the unhealthy snacking habit.

In order to address the particular habit that participants aimed to change, our dependent measure concerned three items tapping into participants' evaluation of their success in fighting the specific habit rather than a food diary assessing their overall unhealthy snack consumption (Study 1). As this measure necessarily relied on participants' retrospective memory of their performance over a 1 week period rather than being based on multiple diary entries per day, responses may have been subject to self-presentation biases or demand characteristics. However, our findings that participants in the three conditions did not differ in (a) expectations of being able to diminish their unhealthy snack consumption, (b) importance of diminishing their unhealthy snack consumption before or after the exercise, (c) retrospectively reported frequency of using the exercise, or (d) experimenter demand indicate that this dependent measure should not have been affected by such methodological problems.

One limitation of Study 2 is that there were no respective control conditions for the MC, the II, and the MCII conditions. Hence, the present data do not permit conclusions about whether the combined MCII intervention has additive or interactive effects compared to the MC and II interventions in isolation. Future research is required to investigate this question.

[4]As we expected the relation between the mediator (clarity) and the dependent variable (success in diminishing the habit) in the MCII condition to differ from the relation of these variables in the MC and II condition, a standard Baron and Kenny (1986) simple mediation analysis was considered inappropriate for testing the proposed underlying effect of clarity in Study 2 (Spencer, Zanna, & Fong, 2005). Specifically, we expected clarity to only be related to success in diminishing the habit when participants had gained increased clarity as a result of MC and additionally had received the tools (II) to be able to translate this increased clarity into actual behavior (MCII condition). In such instances where the effect of the mediator on the dependent variable is expected to differ between levels of the independent variable, Spencer et al. (2005) propose that looking at within-cell correlations is more appropriate.

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GENERAL DISCUSSION

In two studies the effectiveness of a new strategy combining MCII for fighting snacking habits was investigated. In the first study, the effectiveness of MCII in diminishing unhealthy snack intake was compared to a control condition in which participants thought about and listed ten options for healthy snacks. Results indicated that participants in the MCII condition consumed on average 1125 kcal less per week than participants in the control condition, suggesting that the MCII intervention was effective in achieving the focal goal of the intervention: Decreasing unhealthy snack intake. Fruit intake did not differ between the two conditions, which is somewhat unexpected, but this could be due to a lack of power. Alternatively, it could be a reflection of both groups increasing their fruit intake. All participants were highly motivated and actively encouraged to eat less unhealthily, which may have been sufficient for increasing fruit consumption (e.g., Jackson et al., 2005). Moreover, their high motivation could even have led participants in the control condition to form spontaneous implementation intentions to increase their fruit intake (e.g., Gollwitzer & Brandstätter, 1997).

Our second study was designed to test whether the power of MCII to fight unhealthy habits is indeed due to the combination of MC with II rather than one of the components alone. Additionally, it was investigated whether the superiority of MCII to II could be related to an increased clarity regarding the cues that drive the unwanted habit. Confirming our expectations, participants in the MCII condition reported more success in diminishing their unhealthy snacking habits than participants in the MC or II conditions. Moreover, participants who went through mental contrasting (MCII or MC) reported higher levels of clarity regarding critical cues for their habit, but only in the MCII condition was this clarity related to the outcome measure.

Our results suggest that mental contrasting and forming implementation intentions are complementary mental strategies that together can help fight unwanted habits. Earlier studies already suggested that MC and II are complementary mental strategies (Duckworth et al., 2009; Oettingen, Barry, et al., 2009; Schramm et al., in press; Stadler et al., 2009), but the present study is the first to actually compare the effectiveness of MC, II, and MCII strategies. Additionally, the present research was the first to apply MCII to fighting habits and to show that mental contrasting fosters clarity about the cues driving the unwanted habit. Moreover, the results suggest that this increased clarity may be partially responsible for MCII being more effective than II alone.

The present studies address recent suggestions in the literature that implementation intention interventions might not, on their own, be sufficient to diminish habits (Webb et al., 2009). In particular, our research shows that mental contrasting as a strategy aimed at helping to identify critical cues for the unwanted behavior increases the effectiveness of counter-habitual implementation intentions. Additionally, our studies employing MCII as a strategy to fight habits are an important extension to the approach of using person-specific situation-behavior profiles to formulate counter-habitual implementation intentions (Adriaanse et al., 2009; Gollwitzer, 1999; Gollwitzer & Sheeran, 2006). The MCII strategy allows participants to identify their cues for action, increasing the chance that participants use their personally critical cues which in turn increases the chance that the implementation intentions are effective in diminishing habits.

Our results also have important applied implications. The effect of the MCII intervention in the first study is promising considering that the average difference per day in unhealthy snack intake between the MCII and control condition was about 160 kcal, and a consistent reduction of caloric intake of 100 kcal prevents weight gain in most populations (Hill, Wyatt, Reed, & Peters, 2003). As the MCII technique is easily applicable, our results suggest that the MCII strategy could ultimately be taught as a meta-cognitive strategy aiming to eat more healthily; people could then apply and adapt the strategy to different circumstances without much help from others (Oettingen, Barry, et al., 2009; Stadler et al., 2009).

There are some limitations of the current study. First, both studies only included women, limiting the generalizability of our findings. A second concern with regard to the population of both studies is that they consist of college students with a normal BMI ($18 < \text{BMI} > 30$). It could be argued that decreasing unhealthy eating habits was not particularly relevant for these relatively healthy women. However, the present sample concerns young female students who are at the beginning of their lives as independent young adults. As these women are often moving into their own living situation for the first time this is a period when personal eating habits are created. Unfortunately, the eating habits that these college students tend to develop during their college years are often rather unhealthy and result in weight gain (Gores, 2008). In fact, students aged 18–29 years are at greatest risk for weight gain (Mokdad, Serdula, Dietz, Bowman, Marks, & Koplan, 1999).

Even though only 11.2% of the participants could be classified as overweight ($\text{BMI} \geq 25$) in Study 2, young people such as those studied here are at risk for weight gain and thus constitute important targets for intervention. Support for this idea

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comes from Anderson, Shapiro, and Lundgren (2003), who showed that about one quarter of college students gained at least 5 pounds from September to mid December in their freshmen year. If the students in our second study each gained 5 pounds, the proportion of overweight participants would be 16.7%. Moreover, as BMI in early adulthood is strongly predictive of overweight later in their adult life (Guo, Roche, Chumlea, Gardner, & Siervogel, 1994), prevention of weight gain before participants are already overweight is of particular importance for this population.

This being said, it of course remains an important question whether the MCII intervention could also be beneficial for students for whom their unhealthy eating habits have already resulted in an unhealthy weight. Additionally, it still needs to be established whether the MCII technique will be equally effective when it is delivered in applied settings (but see Stadler et al., 2009, for evidence regarding the efficacy of an MCII intervention for increasing physical activity among women in their midlife in applied settings), and whether adherence to the MCII technique will be equally high in such a setting. As these questions cannot be answered in the present study, future research should replicate our findings for overweight and obese participants in applied settings.

A second limitation concerns the fact that we cannot claim that very strong habits were diminished in the present studies. As mean scores for habit strength were around the midpoint of the scale, it could be argued that snacking was not very habitual for the present sample. However, the frequency items from the SRHI (i.e., 'unhealthy snacking' is something that I do frequently/ is something that I have been doing for a long time), had a mean score of 4.90 in Study 1 (62.7% scored 5.0 or higher) and 5.52 in Study 2 (71.2% scored 5.0 or higher), indicating that participants had a high frequency of performing the behavior that was the topic of the MC/II/MCII intervention. Additionally, the fact that in both studies participants were specifically instructed to pick a specific unhealthy snacking *habit* they wanted to change also strengthens our confidence that the interventions did target habitual behaviors.

Nevertheless, it has to be noted that firm conclusions regarding the extent to which habits were actually 'broken' cannot be drawn from the present data. In order to strictly show that MCII can break habits, the change in behavior needs to be lasting and stable, and the link between past behavior and future behavior needs to be consistently reduced (Holland et al., 2006). Future research should therefore measure snacking behavior for a longer time period, as well as employ a pre–post test design to provide conclusive evidence that MCII is an effective approach to breaking unhealthy snacking habits.

Lastly, although the present study is the first to show that MCII can diminish habitual behaviors and to indicate that clarity concerning the cues driving one's habit may play an important role in MCII's effectiveness, measures of clarity need to be improved in future research. In the present study, participants were asked about the clarity regarding their habit in general, rather than about the cues driving their habit specifically. This was done in order to make these items easier to understand for participants, and in order to make these items also meaningful for participants in the II condition, who did not do a specific exercise to identify their critical cue. In order to reliably conclude that clarity concerning the cues driving one's habit is the underlying mechanism of MCII effects, future research should measure clarity more directly, for example by using procedural measures instead of only self-report measures as used in the present research. Future research would also benefit from assessing clarity right after the MCII intervention to rule out the possibility that—as may have happened in the present study—clarity scores were driven by changes in behavior rather than being the mechanism of MCII effects. Alternatively, to provide an even more direct test, future research could also manipulate the difficulty of identifying cues or use an individual difference measure of introspective ability or metacognition.

CONCLUSION

MCII can be an effective strategy for decreasing unhealthy snack intake and it is more effective in fighting habits than MC or II alone. Our results also showed that this superiority of MCII over II alone may relate to an increased clarity concerning the cues driving the unwanted habit. These findings are important as they suggest that MCII may be a promising strategy for fighting unwanted habits, which is a type of behavior change that was perceived as difficult to achieve by implementation intentions only or by other self-regulatory strategies (e.g., Verplanken & Wood, 2006). Moreover, our findings provide evidence for the notion that although planning (forming implementation intentions) can be helpful in fighting habits, its utility can be increased by taking additional measures such as engaging in MC prior to plan formation. In order to make *effective* plans, one first needs to obtain a clear picture of the cue that triggers one's habit by MC, and then formulate plans tailored to this insight.

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REFERENCES

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.

Anderson, D. A., Shapior, J. R., & Lundgren, J. D. (2003). The freshman year of college as a critical period for weight gain: An initial evaluation. *Eating Behaviors*, *4*, 363–367.

Covenant Obesity. (2007). *Helft Nederlanders wil 16 kilo kwijt*. Retrieved 21 August 2008 from http://www.convenantovergewicht.nl/index.php?page=nieuws/helft-nederlanders-wil-zestien-kilo-kwijt

De Graaf, C. (2006). Effects of snacks on energy intake: An evolutionary perspective. *Appetite*, *47*, 18–23.

Duckworth, A. L., Grant, H., Loew, B., Oettingen, G., & Gollwitzer, P. M. (2009). Self-regulation strategies improve self-discipline in adolescents: Benefits of mental contrasting and implementation intentions, Manuscript submitted for publication.

Gollwitzer, P. M. (1999). Implementation intentions: Strong effects of simple plans. *American Psychologist*, *54*, 493–503.

Gollwitzer, P. M., & Brandstätter, V. (1997). Implementation intentions and effective goal pursuit. *Journal of Personality and Social Psychology*, *73*, 186–199.

Gollwitzer, P. M., & Sheeran, P. (2006). Implementation intentions and goal achievement: A meta-analysis of effects and processes. *Advances in Experimental Social Psychology*, *38*, 69–119.

Gores, S. E. (2008). Addressing nutritional issues in the college-aged client: Strategies for the nurse practitioner. *Journal of the American Academy of Nurse Practitioners*, *20*, 5–10.

Guo, S. S., Roche, A. F., Chumlea, W. C., Gardner, J. D., & Siervogel, R. M. (1994). The predictive value of childhood body mass index values for overweight at age 35 y. *American Journal of Clinical Nutrition*, *59*, 810–819.

Hill, J. O., Wyatt, H. R., Reed, G. W., & Peters, J. C. (2003). Obesity and the environment: Where do we go from here? *Science*, *299*, 853–855.

Holland, R. W., Aarts, H., & Langendam, D. (2006). Breaking and creating habits on the working floor: A field-experiment on the power of implementation intentions. *Journal of Experimental Social Psychology*, *42*, 776–783.

Jackson, C., Lawton, R., Knapp, P., Raynor, D. K., Conner, M., Lower, C., et al. (2005). Beyond intention: Do specific plans increase health behaviours in patients in primary care? A study of fruit and vegetable consumption. *Social Science and Medicine*, *60*, 2383–2391.

Jackson, C., Lawton, R., Raynor, D. K., Knapp, P., Conner, M., Lower, C., et al. (2006). Promoting adherence to antibiotics: A test of implementation intentions. *Patient Education and Counselling*, *61*, 212–218.

Jahns, L., Siega-Riz, A. M., & Popkin, B. M. (2001). The increasing prevalence of snacking among US children from 1977 to 1996. *Journal of Pediatrics*, *138*, 493–498.

Jeffery, R. W., Epstein, L. H., Wilson, G. T., Drewnowski, A., Stunkard, A. J., Wing, R. R., et al. (2000). Long-term maintenance of weight loss: Current status. *Health Psychology*, *19*, 5–16.

Kappes, A., & Oettingen, G. (2009). Mental contrasting and the processing of goal-relevant information. Manuscript submitted for publication.

Loewenstein, G. (1996). Out of control: Visceral influences on behavior. *Organizational Behavior and Human Decision Processes*, *65*, 272–292.

Loewenstein, G., Nagin, D., & Paternoster, R. (1997). The effect of sexual arousal on predictions of sexual forcefulness. *Journal of Research in Crime and Delinquency*, *32*, 443–473.

Mokdad, A. H., Serdula, M. K., Dietz, W. H., Bowman, B. A., Marks, J. S., & Koplan, J. P. (1999). The spread of the obesity epidemic in the United States, 1991–1998. *Journal of the American Medical Association*, *282*, 1519–1522.

Nasser, J. (2001). Taste, food intake and obesity. *Obesity Reviews*, *2*, 213–218.

Newcombe, R. G. (2006). Confidence intervals for an effect size measure based on the Mann-Whitney statistic. Part 1: General issues and tail-area-based methods. *Statistics in Medicine*, *25*, 543–557.

Nisbett, R., & Wilson, T. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological Review*, *84*, 231–259.

Oettingen, G. (2000). Expectancy effects on behavior depend on self-regulatory thought. *Social Cognition*, *18*, 101–129.

Oettingen, G., Barry, H., Guttenberg, K. B., & Gollwitzer, P. M. (2009). Self-regulation of time management: Mental contrasting with implementation intentions. Manuscript submitted for publication.

Oettingen, G., & Gollwitzer, P. M. (in press). Strategies of setting and implementing goals: Mental contrasting and implementation intentions. In J. E. Maddux, & J. P. Tangney (Eds.), *Social psychological foundations of clinical psychology.* New York: Guilford.

Oettingen, G., Mayer, D., Sevincer, A. T., Stephens, E. J., Pak, H., & Hagenah, M. (2009). Mental contrasting and goal commitment: The mediating role of energization. *Personality and Social Psychology Bulletin*, *35*, 608–622.

Oettingen, G., Mayer, D., & Thorpe, J. (in press). Self-regulation of commitment to reduce cigarette consumption: Mental contrasting of future and reality. *Psychology and Health.*

Oettingen, G., Mayer, D., Thorpe, J. S., Janetzke, H., & Lorenz, S. (2005). Turning fantasies about positive and negative futures into self-improvement goals. *Motivation and Emotion*, *29*, 236–266.

Oettingen, G., Pak, H., & Schnetter, K. (2001). Self-regulation of goal setting: Turning free fantasies about the future into binding goals. *Journal of Personality and Social Psychology*, *80*, 736–753.

DOI: 10.1002/ejsp

Parks-Stamm, E. J., Gollwitzer, P. M., & Oettingen, G. (2007). Action control by implementation intentions: Effective cue detection and efficient response initiation. *Social Cognition*, *25*, 248–266.

Schramm, S., Oettingen, G., Dahme, B., & Klinger, R. (in press). Self-control of goal pursuit: A randomized clinical trial of a cost effective intervention for improving physical capacity in chronic back pain patients. *Pain.*

Sheeran, P., Webb, T. L., & Gollwitzer, P. M. (2005). The interplay between goal intentions and implementation intentions. *Personality and Social Psychology Bulletin*, *31*, 87–98.

Spencer, S. J., Zanna, M. P., & Fong, G. T. (2005). Establishing a causal chain: Why experiments are often more effective than mediational analyses in examining psychological processes. *Journal of Personality and Social Psychology*, *89*, 845–851.

Stadler, G., Oettingen, G., & Gollwitzer, P. M. (2009). Effects of a self-regulation intervention on women's physical activity. *American Journal of Preventive Medicine*, *36*, 29–34.

Vaidya, V., & Malik, A. (2008). Eating disorders related to obesity. *Therapy*, *5*, 109–117.

Verplanken, B., & Orbell, S. (2003). Reflections on past behavior: A self-report index of habit strength. *Journal of Applied Social Psychology*, *33*, 1313–1330.

Verplanken, B., & Wood, W. (2006). Interventions to break and create consumer habits. *Journal of Public Policy and Marketing*, *25*, 90–103.

Webb, T. L., Sheeran, P., & Luszczynska, A. (2009). Planning to break unwanted habits: Habit strength moderates implementation intention effects on behaviour change. *British Journal of Social Psychology*, *48*, 507–523.

Zizza, C., Siega-Riz, A. M., & Popkin, B. M. (2001). Significant increase in young adults' snacking between 1977–1978 and 1994–1996 represents a cause for concern. *Preventive Medicine*, *32*, 303–310.

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