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Hot or not: Visceral influences on coping planning for weight loss attempts

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The current studies aimed to examine how either or not being hungry (hot vs. cold state) affects uninformed (i.e. without specific instructions) coping planning for maintaining goal-directed behaviour in weight loss attempts. We hypothesised that being hungry is beneficial both for (1) increasing awareness of potentially challenging situations and for (2) planning how to cope with these situations. The first hypothesis was supported, whereas the second was not, as it was found that satiated participants constructed better quality coping plans than hungry participants. It appears that awareness of potentially challenging situations when hungry does not necessarily translate into better coping planning. Although coping planning appears to be a promising strategy for maintaining goal-directed behaviour, future research should focus on visceral states to improve its use.

Keywords: coping planning; self-control; health goals; maintenance; visceral states; hunger

Introduction

Weight loss is a typical example of a health goal that many people easily adopt, but which they often fail to achieve. People who take up a weight loss goal often have high expectations of success, but tend not to consider ways to reach their goal or obstacles they may encounter (Polivy & Herman, 2000, 2002). They may experience difficulties both with initiating goal-directed behaviour and with maintaining this behavioural change. Ample research has shown that people have difficulty in translating good intentions into actions (Gollwitzer & Sheeran, 2006; Sheeran, Milne, Webb, & Gollwitzer, 2005) or abandon their initial attempts within a few weeks (Norcross, Mrykalo, & Blagys, 2002).

Fortunately, planning has been found to be a helpful self-regulation strategy, both for difficulties with initiating and with maintaining goal-directed behaviour. Implementation intentions, for example, are plans that specify when, where and how one will act upon one's intentions (Gollwitzer, 1999). Implementation intentions have been shown to be an effective strategy for acting upon one's intentions, both

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in situations that provide opportunities for goal-directed behaviour (e.g. 'If it is four o'clock and I feel like taking a snack, then I will eat an apple') and in situations that threaten goal-directed behaviour (e.g. 'If somebody offers me a piece of pie at a party, I will tell them that I am trying to eat more healthily') (Gollwitzer & Sheeran, 2006). While the first kind of planning has been found to be effective mainly for *initiating* behavioural change, the latter kind of planning has been found to be especially effective for *maintaining* these changes (Sniehotta, Scholz, & Schwarzer, 2006; Sniehotta, Schwarzer, Scholz, & Schüz, 2005; Van Osch, Lechner, Reubsæet, Wigger, & De Vries, 2008).

Research on implementation intentions, however, has been mostly conducted in experimental settings and intervention studies, where participants receive detailed and specific instructions on how to formulate their plans. Only a few studies have examined the use of implementation intentions that were not supported by specific and detailed instructions – to which we will refer as 'uninformed planning'. These studies suggest that the quality of such uninformed implementation intentions is generally poor (De Ridder, De Wit, & Adriaanse, 2009; De Vet, Oenema, & Brug, 2009; Ziegelmann, Lippke, & Schwarzer, 2006). This study examines whether the visceral state of either or not being hungry is responsible for the quality of uninformed planning. Planning for maintaining health behaviour change has received much less attention than planning for initiating such behavioural changes, yet it appears that especially the maintenance of initial weight loss successes is difficult to achieve (Jeffery et al., 2000; Rothman, 2000). Therefore, our focus is on plans for maintaining goal-directed behaviour.

Making plans for maintaining goal-directed behaviour in potentially challenging situations, such as competing activities or frustrations that are inevitable when striving for an ambitious long-term goal, is referred to as coping planning (Sniehotta et al., 2005). In the health domain, coping planning has been found to be an effective strategy for the maintenance of behavioural change. Self-reported coping planning has been found to positively influence the maintenance of increases in physical activity (Scholz, Schüz, Ziegelmann, Lippke, & Schwarzer, 2008). Additionally, coping planning interventions, in which participants received specific instructions to make coping plans, were effective in the maintenance of increase in physical activity (Sniehotta et al., 2005, 2006; Ziegelmann et al., 2006) and smoking cessation (Van Osch et al., 2008).

The above-mentioned studies show promising results. However, not much is known about the effects of spontaneous coping planning or to what extent coping planning without specific instructions is beneficial in maintaining goal-directed behaviour. There are indications that, when adopting a weight loss goal, people tend to underestimate the efforts that losing weight requires and that they do not determine strategies how to achieve and maintain their goal (Polivy & Herman, 2000, 2002). Food temptations are a daily challenge for people who want to lose weight, yet research suggests that most people do not spontaneously engage in coping planning for the prevention of this kind of everyday problems (Berg, Strough, Calderone, Meegan, & Sansone, 1997). Indeed, a study among people from a community sample who wanted to lose weight and had tried to lose weight before – and thus probably experienced challenging situations in their previous weight loss attempts – showed that more than half of the participants reported not to anticipate any challenging situations whatsoever (Aarts, De Ridder, & Ouweland, 2008). Of the participants who did anticipate goal-threatening situations, more than half

did not report any plans for how to handle these situations whereas the others generally wrote short plans, most of which could not be considered an effective solution for the challenging situations (Aarts et al., 2008).

The overall aim of our study, then, is to examine the quality of coping planning that is not supported by detailed instructions and evaluate its effectiveness in terms of (a) being able to anticipate challenging situations that might threaten the goal of weight loss and (b) finding solutions for it. We expect that the quality of planning is affected by the visceral state of being hungry, which will be explained in the following paragraphs.

One explanation why people may experience difficulties using coping planning as a self-regulatory strategy in losing weight is that they lack awareness of the challenging situations that they may encounter in their weight loss attempt. In the coping planning process, two important aspects can be distinguished: awareness of potentially challenging situations and planning in detail how to cope with these situations (Aspinwall & Taylor, 1997; Scholnick & Friedman, 1993). Before one can effectively construct a coping plan, one needs to think ahead and be aware of situations that might pose a threat to one's goal-directed behaviour. Awareness of potential challenging situations is thus a prerequisite for effective coping planning. It follows from this line of reasoning that a lack of spontaneous coping planning might be explained by a limited awareness of potential challenging situations.

People may lack the awareness of challenging situations because there is often a temporal discrepancy between the moment when they resolve to change their eating behaviour and the occurrence of situations that pose a challenge to these good intentions. What defines a challenging situation is that effort is needed to resist a temptation to eat. As a result, there is not much room for other effortful processes such as making resolutions and plans. These processes thus have to take place at a different moment, when one does not have to resist food temptation. The discrepancy between the moment of planning and the moment of challenge might be the reason why anticipation and planning are difficult tasks.

Framed in other terms, the difficulty of anticipating and planning for challenging situations may be caused by the effects of the so-called empathy gap (Loewenstein, 1996) that people experience between their current and future visceral state. Visceral states, such as fatigue, sexual arousal, and, most relevant to the current topic, hunger, have a strong, but often underestimated, influence on behaviour. When the intensity of a visceral state is low, people are in a neutral or 'cold' state. At higher intensities, visceral states have a strong influence on both cognition and behaviour, and people can be said to be in a 'hot' state – this applies to most challenging situations. It has been shown consistently that people who are in a cold state tend to underestimate the influence of hot states on both their past and their future behaviour – a tendency that is referred to as the cold-to-hot empathy gap (Loewenstein, 1996).

The cold-to-hot empathy gap also applies to hunger: satiated people tend to underestimate the influence of hunger craving on their future behaviour. In a classical study by Nisbett and Kanouse (1969), it was found that shoppers who were in a cold (satiated) state bought less food, and were better able to constrain their shopping, than shoppers who were in a hot (hungry) state (see also Gilbert, Gill, & Wilson, 2002). Moreover, satiated people were found to have less insight in their future snacking preferences than did hungry people; they more often chose healthy snacks for future consumption than hungry participants, but they also changed their

mind and switched to unhealthy snacks more often on the moment they could actually consume the snack (Read & Van Leeuwen, 1998). Recently, the cold-to-hot empathy gap has also been demonstrated with regard to self-regulation beliefs and strategies in the eating behaviour domain. When people were in a hot state (i.e. when they were hungry), people estimated hunger cravings as harder to overcome and had lower weight loss self-efficacy (Nordgren, Van der Pligt, & Van Harreveld, 2008). Consequently, they used more effective self-control strategies to resist snack temptations than when they were satiated. In a cold state, people underestimated the influence of hunger craving on their behaviour and used fewer self-control strategies: their inflated impulse-control beliefs led them to overexpose themselves to temptation for which they were not prepared to deal with (Nordgren, Van der Pligt, & Van Harreveld, in press; study 2).

In line with these results, we reason that when people are in a cold state, the cold-to-hot empathy gap prevents them from being fully aware of how strongly their future behaviour can be influenced by being in a hot state, and they are, therefore, limited in their awareness of potentially challenging situations. We expect that people will be better able to recognise or imagine goal-threatening situations when they are in a state that is similar to these situations, i.e. when they are in a hot state. Applied to the issue of weight loss, our first hypothesis states that hungry people will be more aware of the potential challenging situations they may encounter in their weight loss attempt, which relates to the first aspect of the coping planning process.

Regarding the second aspect of the coping planning process – the actual planning – we adopt the following line of reasoning: when awareness of potential challenges is a crucial condition for constructing a coping plan, it can be argued that if awareness is increased by being in a hot state, actual planning will benefit from this increased awareness. When a person in a hot state has a vivid, realistic idea of potential goal-threatening situations, he or she should also be better able to plan how to handle these situations in a hot state. Although we state that a vivid awareness of potential challenges is a prerequisite for effective coping planning, one could argue that this awareness is not sufficient and that in a hot state, the attentional and motivational resources necessary for cognitive tasks, such as planning (Loewenstein, 1996), might be lacking. Indeed, it has been suggested that being hungry may lead to a state of ego-depletion because of low blood glucose levels (Gailliot & Baumeister, 2007). However, the literature on the impact of low blood glucose levels on cognitive functioning suggests that effects are relatively limited (Gibson, 2006; Hoyland, Lawton, & Dye, 2008; Scholey, Laing, & O’Kennedy, 2006). In addition, the potential disadvantage of having fewer resources available as a result of being in a hot state has never been examined in the light of the advantage that being in a hot state might have on the first aspect of the coping planning process. We argue that cognitive resources alone do not necessarily lead to better coping plans. Thus, the second hypothesis that will be tested in our studies is that people who are in a hot state produce higher quality coping plans for potential challenging situations they may encounter throughout their weight loss attempts than people in a cold state. In doing so, we will also account for the influence of two personality characteristics that have been proposed as relevant for the process of coping planning and, consequently, the quality of the coping plans. The first characteristic is future temporal orientation, a concept that refers to a tendency and ability to be future-oriented and to imagine and anticipate future possibilities

(Jones, Banicky, Lasane, & Pomare, 2005). Future temporal orientation has been associated with proactive coping (Aspinwall & Taylor, 1997; Ouwehand, De Ridder, & Bensing, 2008) and may therefore also influence the quality of coping plans in this study. The second characteristic relates to non-pathological or everyday worry. It has been argued that non-pathological worry may be helpful in defining and analysing problems (Freeston, Rhéaume, Letarte, Dugas, & Ladouceur, 1994). On the other hand, it has also been found that worrying actually reduces concreteness of problem definitions (Stöber, Tepperwien, & Staak, 2000). Either way, non-pathological worry might influence the awareness of potential challenging situations and of the construction of coping plans.

Research overview

To investigate the research questions, two studies were conducted. Study 1 examined the hypothesis that being in a hot state has a beneficial effect on awareness of situations that challenge a weight loss goal. Study 2 subsequently examined the hypothesis that being in a hot state positively influences the quality of plans on how to cope with these situations. In both studies, hunger level was experimentally manipulated to create a deprived and a satiated condition. In study 1, participants read four vignettes describing situations that might challenge their weight loss goals and estimated how difficult these situations would be. In study 2, participants were asked to formulate a coping plan for a personally relevant challenging weight loss situation.

Study 1

This study examines the hypothesis that being in a hot state has a beneficial effect on the awareness of situations that could potentially threaten one's weight loss goal. More specifically, we will experimentally test whether people who are in a hot state (hungry) are better able to recognise potentially goal-threatening situations than people who are in a cold state (satiated). Hunger level was experimentally manipulated to create a deprived and a satiated condition. Next, participants read four vignettes describing situations that might challenge their weight loss goals, and estimated how difficult these situations would be.

Method

Participants

Participants were 78 female undergraduate students from a Dutch university, recruited by posters and flyers at the university. They received course credit for participating. Two participants were obese (BMI > 30) and were excluded from the analysis, which left a sample of 76 participants. The participants had a mean age of 22.2 (18–33, SD = 2.4), and a mean BMI of 21.2 (18.3–27.6, SD = 1.9).

Procedure

Participants were randomly assigned to either the satiated condition in which the experimental measures were completed after consuming breakfast, or to the deprived

condition in which the experimental measures were completed before consuming breakfast. The experimental sessions were planned at 9.30 am and took place in the university cafeteria. Participants were instructed to complete the experimental measures individually in a quiet corner. Before filling out these measures, they were requested to fill out how hungry they were on a 7-point Likert scale.

Participants in the satiated condition were offered breakfast (see 'Materials' Section for details) on the spot. Several filler questionnaires were included to let the participants get a satiated feeling before they completed all experimental measures. Participants in the deprived condition were instructed to refrain from eating and drinking (except water) from 11 pm prior to their session. Upon arrival at the experiment, they first completed all experimental measures. Afterwards, they were offered the same breakfast as the participants in the satiated condition. At the end of the experiment, participants' weight and height was recorded by the experimenter, after which they were fully debriefed and thanked for their participation.

Materials

Breakfast

The breakfast consisted of a buffet with bread rolls and different kinds of fillings: butter, cheese, bologna (sandwich meat), jam and chocolate sprinkles (a typical Dutch filling) and two drinks: milk and orange juice. Participants were told that they were free to eat and drink as much as they wanted.

Vignette questionnaire

The vignette questionnaire consisted of four descriptions of situations that pose a challenge to weight loss behaviour, and that would be familiar for most students. To cover a wide range of snacking moments, two dimensions were varied in the vignettes: social context (a person alone or together with others) and type of snack (sweet vs. salty) (Adriaanse, De Ridder, & De Wit, 2009). This resulted in four vignettes describing (a) feeling hungry after studying and walking past a snack machine with candy bars; (b) watching television at home and having appetite for crisps; (c) being offered a piece of pie at a friend's birthday party and (d) walking past a snack bar after a night of partying. For each of the vignettes, participants indicated on 100 mm VAS scales: (a) how probable it would be that they would take a snack (probability), (b) how easy/difficult it would be to resist the temptation (ease) and (c) how much discipline they would have in that situation (discipline). Then they indicated on two more VAS scales of how much they liked sweet and salty snacks.

In the analysis, participants' scores on the discipline question were reversed so that all scores were in the same direction, with low scores indicating that the participant perceived the situation as easy to handle, and high scores indicating that the situation was perceived as difficult to handle. The internal consistency of the questionnaire was adequate, with a Cronbach's alpha of 0.71. A total score was computed by averaging all three questions over all four vignettes. To be able to analyse whether the results differed for the aspects of probability, ease and discipline, three sub-scores were computed by averaging the scores over the four vignettes for each of the three aspects.

Table 1. Summary of multivariate analysis of visceral state on the vignette subscales.

Subscale ^a	<i>F</i>	η^2	<i>p</i>
Probability	4.49	0.06	0.04
Ease	14.02	0.16	0.000
Discipline	2.72	0.04	0.10

Note: ^adf = 1, 74.

Results

The hunger manipulation was successful; deprived participants were significantly more hungry ($M = 5.0$, $SD = 1.3$) than satiated participants ($M = 2.11$, $SD = 1.1$), $t(74) = 10.28$, $p < 0.001$, $\eta^2 = 0.59$. Independent samples *t*-tests showed that there were no differences between conditions regarding age, BMI and liking of sweet and salty snacks ($p > 0.14$).

An independent samples *t*-test showed that participants in the deprived condition had higher total scores on the vignette questionnaire ($M = 53.2$, $SD = 13.2$) than participants in the satiated condition ($M = 44.9$, $SD = 11.4$), $t(74) = 2.933$, $p < 0.005$, $\eta^2 = 0.10$, meaning that they estimated the situations as being more difficult to handle. To analyse whether this pattern occurred on all sub-scores, a one-way multivariate analysis of variance was performed. The multivariate effect of the three sub-scores was significant, $F(3, 72) = 4.584$, $p < 0.01$, partial $\eta^2 = 0.16$. When the results for the three items were considered separately (Table 1), deprived participants scored significantly higher than the satiated participants on both the probability and the ease items. A trend in the same direction was found for the discipline item.

Since the evaluation of the difficulty of the situations might be influenced by body mass index (BMI) or by liking for sweet and salty snacks, the analyses were repeated with these variables as covariates. None of the covariates were significant ($p > 0.20$).

Discussion

The results of study 1 showed that deprived participants perceived the situations described in the four vignettes to be significantly more difficult to handle than the satiated participants did. This difference was found for the total score and for the probability and ease scores, and a trend in the same direction was found for the discipline score. It can be concluded that the deprived participants estimated the situations as being more difficult to handle than the satiated participants: when hungry, people are more aware of situations that might threaten their personal health goal. As argued in the 'Introduction', we expect that because of a more vivid awareness of potential challenging situations (as found in study 1), people in a hungry state would also be able to make better plans for these situations. This hypothesis was tested in study 2.

Study 2

In study 2, hunger level was again manipulated. Participants were then asked to identify a challenging situation they might encounter in their weight loss attempt,

and to formulate a coping plan for this situation. We decided to let participants plan for a situation of their own choosing, since previous research has shown that planning works best when tailored to individual situations (Adriaanse et al., 2009). In addition, we argued that participants in a hot state could benefit more from their increased awareness of potential problems when planning for a personally relevant instead of a predefined situation.

The design of this study is similar to study 1, except for some minor methodological improvements. The experiment was conducted in a laboratory to ensure more privacy and control over potential confounding influences. The breakfast procedure was standardised to assure that participants in the satiated condition would consume a minimum level of calories (see 'Materials' Section for details). All participants were asked to refrain from eating from 11 pm before their session, and all participants received the same breakfast (either before or after completing the experimental measures). This made it possible to measure exactly how much the participants had eaten, as an extra manipulation check. Finally, two personality characteristics that might influence the quality of plans were measured: non-pathological worry and future temporal orientation.

Method

Participants

Participants were 55 undergraduate students from a Dutch university. They received a course credit or a monetary reward (€10) for participating. Two participants were obese (BMI > 30) and were excluded from the analysis (Endnote 1). One participant in the satiated condition scored 6 on the 9-point hunger scale after eating the breakfast and was also excluded. This resulted in an analytical sample of 52 participants (45 women and 7 men), 24 in the satiated condition and 28 in the deprived condition, with a mean age of 22.2 years (range 18–28, SD = 2.3). Their mean BMI was 22.7 (18.6–29.7, SD = 2.5).

Procedure

As in study 1, participants were randomly assigned to a satiated and a deprived condition. All participants were instructed to refrain from eating and drinking (except water) from 11 pm prior to their session. The experimental sessions were planned at 9.30 in the morning and took place in a laboratory. Per session, up to six participants were tested. For practical reasons, participants in the same session were all in the same condition. Participants were not able to see each other during the experiment.

Participants in the satiated condition received breakfast upon arrival in the laboratory. After consumption of the breakfast, they waited 15 min to get satiated. During this time, they could read in magazines that contained no food or weight loss related content (e.g., magazines about computers or home decoration). Then they completed the experimental measures. Participants in the deprived condition first completed the experimental measures and then received their breakfast. After participants finished their breakfast, the tray was taken away, and it was unobtrusively assessed how much the participants had eaten.

The experimental measures started with a 9-point Likert scale to assess hunger level ('How hungry are you at the moment?'). Since one could argue that affect might have an influence on the motivation or ability for anticipating potential challenges or planning for such situations, positive and negative affect were also measured.

Then, participants' ideas about potential challenging situations in their weight loss attempt were assessed. First, they were asked to list all of the challenging situations they expected and to choose the situation that they thought would be most challenging. Subsequently, they were asked to make a plan for how to cope with this situation: 'Describe how you would handle the problem you just specified. Take as much time as you need.' The plan itself, the number of words as well as the time participants took to complete it, were recorded by the computer.

Participants were then asked to write about a neutral topic, namely the room they were in ('Please give a detailed description of the room you are in at this moment'; for a comparable control condition, Pennebaker & Klihr Beall, 1986). Again, the number of words as well as the time participants took to complete the task were recorded. This measure enabled us to control for individual differences in tendency to elaborate in the analysis of the number of words and the time used for the coping plans. At the end of the experiment, participants' weight and height were measured, and they were fully debriefed and thanked for their participation.

Materials

Breakfast

The breakfast consisted of a croissant, two rolls, two tubs of butter (10 g each), two slices of cheese, one tub of jam (25 g), 200 mL of strawberry-flavoured yoghurt and a glass of water. The bread was fresh and the other foods were pre-packaged. All food was presented on a neutral white dishware with white napkins. Participants were asked to first finish the yoghurt, to assure a certain level of satiation. The yoghurt contained 202 calories, and was selected because it was quite a thick yoghurt and quickly gave a satiated feeling. After eating the yoghurt, participants were free to decide what else to eat.

Questionnaires

All questionnaires were programmed in E-Prime version 1.1 (Schneider, Eschman, & Zuccolotto 2002). To measure the affect, the Positive and Negative Affect Scale (Watson, Clark, & Tellegen, 1988) was used, which consists of 10 items measuring positive affect (e.g. 'At this moment, I feel enthusiastic') and 10 items measuring negative affect (e.g. 'At this moment, I feel distressed'). Items were answered on 5-point Likert scales. Cronbach's alpha was 0.84 for the positive affect subscale and 0.87 for the negative affect subscale.

To measure future temporal orientation, the future subscale of the Temporal Orientation Scale (Jones, Banicky, Lasane, & Lasane, 2005) was used, which consists of five items on planning and concern for the future. Items were answered on 9-point Likert scales. An example item is 'When I want to get something done, I make step by step plans and think about how to complete each step'. Cronbach's alpha was 0.79.

Non-pathological worry was measured with the Worry Domain Questionnaire (Tallis, Eysenck, & Mathews, 1992), a questionnaire consisting of 15 items

concerning everyday worries. Items were answered on 9-point Likert scales. An example item is 'I worry that I make mistakes at work'. Cronbach's alpha was 0.95.

Plan quality

Because participants sometimes did not make a clear distinction between the problem situation and the solution – for example, their plan was a repeated statement of their intention (cf. Study 1) – we decided to merge these two components and analyse them as a whole. The quality of the plans was assessed with a coding scheme consisting of 15 dichotomous criteria that can be found in the Appendix. The scheme was based on the literature in the field of self-regulation (De Vet et al., 2009; Gollwitzer, 1999; Gonzales, Burgess, & Mobilio, 2001; Raabe, Frese, & Beehr, 2007; Van Osch et al., 2008; Ziegelmann et al., 2006) and on consultation sessions with experts in the field of self-regulation.

The first seven criteria concerned the description of the problem situation. Surprisingly, not all participants actually identified a problem. Therefore, the first criterion measured whether participants named a challenging situation (e.g. 'being offered a piece of pie at a party'). If no problem was anticipated, the remaining criteria were not scored. The second criterion concerned whether participants recognised the self-control challenge involved in the situation (e.g. 'It will be hard to refuse the pie'). The other five criteria were based on the idea that more detailed plans generally are easier to adhere to (Gollwitzer, 1999; Ziegelmann et al., 2006). Planning to eat an apple instead of chocolate when watching television is more likely to lead to a behavioural action than simply planning to eat more healthily. The five specificity criteria measured whether the participants described the following aspects of the problem: time, place, social situation, feelings involved and specific food.

The second part of the scheme consisted of eight criteria and concerned the solution for the stated problem. Some plans were not actual solutions to the difficulty at hand (but, e.g. a repetition of the goal/intention or a solution for another situation). This was assessed with the first criterion. If a plan was no solution to the problem, the remaining criteria were not scored. The second criterion measured flexibility of the plan (e.g. a plan stating that the participant would *never* eat *any* sweets anymore would be considered not flexible). The third criterion measured whether the plan could be applied in more than one situation (e.g. a plan concerning all lunch breaks would be considered applicable to various situations, a plan concerning only the first lunch break of the year would not). The remaining five criteria measured the specificity of the solution, similar to the five criteria measuring specificity of the problem description.

All criteria were dichotomously scored by two independent raters who were blind to the condition. After the first coding, the raters discussed any discrepancies and came to an agreement on all cases. The 15 criteria were then summed per plan into a total score ranging from 0 (low quality) to 15 (high quality).

Because of the standard measure for interrater reliability, Cohen's kappa, is very sensitive to fluctuations with items that are scored dichotomously (Adèr, Mellenbergh, & Hand, 2008), we used Pearson's correlation instead. Correlations between the ratings were computed for all single criteria as well as for the total score. The average correlation for the single criteria was 0.86. The correlation between the total scores was 0.91.

Results

Descriptives

The hunger manipulation was successful: deprived participants were significantly more hungry ($M=5.3$, $SD=2.3$) than satiated participants ($M=1.1$, $SD=1.0$), $t(50)=-8.683$, $p < 0.001$, $\eta^2=0.60$. There were no differences between conditions regarding the amount of calories they ate during the breakfast, BMI, positive or negative affect, non-pathological worry or future temporal orientation ($p > 0.15$). Participants in the satiated condition were somewhat older than the participants in the deprived condition (22.9 years vs. 21.5 years, $t(51)=2.326$, $p < 0.05$). All analyses were repeated with age as a covariate. However, since age was not significantly related to the dependent variables and was not significant as a covariate, results of these analyses are not reported here. In the total sample, participants spent on average 4 min and 9 s on making their plan. The average length of the plans was 109 words. The average quality of the plans was 5.5 ($SD=2.4$).

Tests of the hypothesis

The effect of condition on the quality of the plans was examined with an independent samples t -test. There was a significant difference between conditions, $t(50)=2.695$, $p < 0.01$, $\eta^2=0.13$. Looking at the direction of the effects, it turns out that participants in the satiated condition made higher quality plans ($M=6.3$, $SD=2.4$) than the participants in the deprived condition ($M=4.9$, $SD=2.2$).

With regard to potential confounders, it was checked whether non-pathological worry and future temporal orientation were significantly correlated with the quality of the plans. No such correlations were found ($p > 0.17$). In addition, it was checked whether general tendency to elaborate influenced the results, by adding as covariates the number of words used and time spent on describing the neutral topic. These covariates did not reach significance ($p > 0.40$).

To check whether the effects of condition on the quality of coping plans could be explained by how much words participants used in their plans or how much time they spent on writing their plans, a multivariate ANOVA was conducted on these two variables. The multivariate effect was not significant ($p=0.46$). Similar results were found for the number of words used and time spent on describing the neutral topic ($p=0.20$). This indicates that there was no effect of condition on how much participants tended to elaborate in general.

Finally, as the quality of plans might have been influenced by the weight status of the participants, the analyses were repeated with BMI as a covariate that proved to be not significant ($p=0.25$).

Discussion

The results of study 2 show that deprived participants made coping plans of a lesser quality than satiated participants. Although in study 1 we found that hungry participants were more aware of potential challenging situations, in this study it appeared that this increased awareness does not necessarily lead to better coping plans for such situations. This unexpected finding could not be explained by a general effect of condition on the number of words that participants used or the amount of time they spent on writing their plan, ruling out the explanation that

hungry participants were less able or motivated to elaborate on their plans because they were less able or motivated to elaborate in general. There seems to be a specific effect of condition on the quality, but not on the quantity, of coping plans, albeit not in the direction we had expected.

General discussion

Previous research has shown that coping planning is an effective strategy for the maintenance of health goals (Snihotta et al., 2005, 2006; Van Osch et al., 2008), yet indications are that this strategy is not often used spontaneously (Berg et al., 1997; Polivy & Herman, 2000, 2002). The current studies aimed to examine the influence of the visceral state of hunger on two aspects of coping planning, namely the awareness of potential challenging situations and the making of a plan to deal with these situations. In two studies, it was tested whether being in a hot state (being hungry) was beneficial for awareness of potential challenging situations (Study 1) and for the actual construction of a coping plan (Study 2). Both studies used an effective manipulation of visceral state, which had the desired result of a sharp distinction between the conditions regarding hunger level. Results of study 1 were in line with our hypothesis; people who were in a hot state were more aware of the difficulty of handling potential challenging situations than people in a cold state. In Study 2, however, it was found that individuals who were in a hot state actually made coping plans of a lesser quality than those in a cold state. It thus appears that being in a hot state indeed makes people more aware of the potential challenges they might encounter in their weight loss attempt, but that this does not necessarily translate into more effective coping planning.

There are several possible explanations for the differential effects of visceral state on the two parts of coping planning that were examined in Study 1 and Study 2. It can be argued that a heightened awareness of potential challenges, resulting from being in a hot state, might not solely have beneficial effects. We argue that such awareness is crucial in the coping planning process, yet at the same time it might also lead to discouragement. In Study 2, heightened awareness of potential challenging situations might have led individuals in a hot state to think that they would not be able to overcome these situations, and, therefore, that planning would be useless. Indeed, it has been suggested that awareness of the difficulties one may encounter during striving for health goals can reduce commitment to that goal (Sheeran et al., 2005). This discouragement might have blocked the beneficial effects of awareness on the coping planning process.

It can also be argued that hungry people have less resources available than satiated people, since hot states tend to focus attention and motivation on actions related to the visceral state at hand (Loewenstein, 1996). In a similar vein, being hungry may result in a state of ego-depletion due to a lack of blood glucose (Gailliot & Baumeister, 2007) and thereby affect the capability to carefully plan how to cope with challenging situations. In Study 1, participants were to answer a series of VAS scales, a task that can be considered to be fairly simple because it requires participants to recognise the challenging aspects of a *given* threatening situation. A lack of cognitive resources might not have had a great detrimental effect on this measure. In contrast, the coping planning task used in Study 2 can be considered a much more complex and demanding task because it required participants to

imagine a threatening situation by themselves. Therefore, a reduction in cognitive resources caused by being in a hot state might have influenced the participants' performance in the second study much more than in the first study, thereby explaining the differential effects of being in a hot state in Study 1 and Study 2. This possibility, as well as the discouragement explanation suggested above, poses interesting avenues for further research.

A strong point of the present studies is that they make a valuable contribution to the knowledge about the use of coping planning that is not informed by specific instructions, a topic that has not received much attention until now. Results of the second study indicate that people who try to lose weight hardly use coping planning as a strategy in maintaining their goal-directed behaviour: participants in both conditions made coping plans of fairly low quality. The perspective emerging from these studies is that coping planning is a strategy with great potential for maintaining health behaviour changes. However, coping planning does not seem to be used to its full potential without proper instruction. Bearing in mind that we asked people to report on their coping plans instead of collecting truly spontaneous plans, the coping plans in this study may even be an overestimation of how much and in what way people would plan in their daily lives without researchers asking them to reflect on them.

Another important contribution of the current studies is the development of a solid coding scheme for rating coping plans that are not supported by detailed instructions. To the best of our knowledge, it was the first time that coping plans were subjected to a thorough content analysis. The coding scheme was based on theory and evidence from the field of planning, and was discussed at great length with experts in the field of self-regulation. The criteria showed a high interrater reliability. This makes the coding scheme a powerful tool that may be used in future research on coping planning and related areas. Future research using the coding scheme could also focus on establishing the relationship between quality of coping plans and actual coping behaviour in challenging situations.

In relation to this, one limitation of the present studies is that no actual behaviour was measured. In Study 1, individuals in a hot state estimated the situations described in vignettes as being more difficult, and without a behavioural measure, these results may be explained in two ways. It can be argued that the deprived individuals were more realistic (and the satiated individuals overly optimistic), or that they were overly pessimistic (and the satiated individuals more realistic). The first explanation is supported by a comparable study (Nordgren et al., 2008) in which participants' estimations of their weight loss in the next week were compared to the weight loss they actually achieved in that week. It was found that deprived participants made more realistic weight loss estimations, whereas satiated participants overestimated the amount of weight they would lose. This is in line with the suggestion of Polivy and Herman (2000, 2002), mentioned in the 'Introduction', that people generally underestimate the efforts required to lose weight. Therefore, we argue that the results of this study support the hypothesis that people in a hot state have a more realistic estimation of the situations that might pose a challenge to their weight loss goals, an assumption that may be further tested in future research.

The insights gained in the present study form a starting point for research on the process, use and benefits of coping planning. In contrast to coping planning as used in an experimental setting or in intervention studies, which have been demonstrated

to be an effective strategy for the maintenance of health goals, uninformed coping planning (i.e. without specific instructions) is a relatively unexplored research area. Visceral states and the related concept of the cold-to-hot empathy gap may provide useful insight into why people have difficulty using coping planning spontaneously. Studying coping planning in the light of hot or cold visceral states therefore offers fruitful opportunities for improving the use of this promising self-regulation strategy.

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Note

1. Obese people might differ from normal weight and overweight people regarding their regulation of their eating behaviour (Mela, 2006; Nasser, 2001; Vaidya & Malik, 2008). Therefore, they might also differ in their perception of potential challenging situations and in coping planning for these situations.

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Appendix: Coding scheme for quality of coping plans

Description of problem situation: score 1 if the participants mention

- (1) a challenging situation (if no → criteria 2–7 were scored 0)
- (2) that the problem has a self-control character
- (3) a specific time (e.g. ‘at lunch’)
- (4) a specific place (e.g. ‘at school’)
- (5) a social situation (e.g. ‘at a party’)
- (6) feelings that are involved (e.g. ‘when I’m bored’)
- (7) specific food (e.g. ‘chocolate cookies’).

Solution for the problem situation: score 1 if the plan is

- (8) a solution to the problem described (if no → criteria 9–15 were scored 0)
 - (9) flexible
 - (10) applicable in more than one situation
- or when the plan mentions
- (11) a specific time (e.g. ‘at lunch’)
 - (12) a specific place (e.g. ‘at school’)
 - (13) a social situation (e.g. ‘at a party’)
 - (14) feelings that are involved (e.g. ‘feel proud’)
 - (15) specific food (e.g. ‘cucumber’).