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Cheung, Tracy T.L.; Kroese, Floor M.; Fennis, Bob M.; de Ridder, Denise T. D.

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The Hunger Games: Using hunger to promote healthy choices in self-control conflicts

Tracy T.L. Cheung^{a, *}, Floor M. Kroese^a, Bob M. Fennis^b, Denise T.D. De Ridder^a

^a Social, Health & Organizational Psychology, Utrecht University, The Netherlands

^b University of Groningen, The Netherlands

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ABSTRACT

The majority of existing research and conventional wisdom would advise against shopping on an empty stomach as hunger is assumed to encourage impulsive choices that typically lead to self-control failure (i.e., favouring short-term gratifications at the expense of long-term goals). Nonetheless, through two studies the current research aims to demonstrate that hungry consumers would not always be disadvantaged when encountering a self-control conflict involving a trade-off choice between a healthy vs. a more palatable but unhealthy choice. Particularly we posit that the choice outcome of the self-control conflict is dependent on contextual cues, such that hungry consumers with the tendency to make fast decisions could benefit from following a social proof heuristic promoting the healthy options. In Study 1, we indeed observed participants' self-reported hunger to be negatively associated with state self-control, but as most participants generally experienced low levels of hunger we did not observe apparent effects of hunger on food choice (DV), and correspondingly the potential influence of the social proof heuristic in moderating the choice outcome. However, in Study 2 where hunger was manipulated, we found hungry participants making significantly less healthy choices than satiated participants, but a social proof heuristic mitigated this effect (i.e., in the presence of social proof heuristic hungry participants made just as many healthy food choices as satiated participants; and hungry participants made more healthy choices in the social proof condition than in the no heuristic condition). These findings support our approach of providing contextual cues in the environment in order to work with, rather than against, the impulsivity triggered by hunger to promote successful self-control behaviours.

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Self-control, or commonly known as willpower, is the capacity to override or alter predominant response tendencies in support of the pursuit of long-term goals (Baumeister, Vohs, & Tice, 2007). That said, successful self-control involves the ability to bring behaviours in line with long-term interests, whereas giving into short-term cravings is considered as self-control failure. To illustrate, a consumer aiming to act in line with long-term health interests would need to settle with a lean green salad for lunch and resist the temptation to eat a double cheeseburger. Yet despite having good intentions to pursue long-term goals, consumers' self-control often fails. This is not surprising seeing that even visceral states such as hunger, thirst, and fatigue, which are part of the mundane daily experience, could all become obstacles that impede

self-control (Loewenstein, 1996). Indeed, dual-process models suggest that people's choices and behaviours arise from two distinct, but interacting modes of processing: System 1 processing that is fast, automatic, and highly susceptible to environmental influences; and System II processing that is slow, deliberative, and operative under explicit goals and intentions (e.g., Evans, 2008; Kahneman, 2011). When viscerally aroused, such that consumers are motivated towards behaviours that satisfy the immediate physical needs of the body, consumers become increasingly reliant on the swift, automatic and intuitive thinking mode of System I, and less on the slow, reflective and deliberate processing of System II (Kahneman, 2011). Visceral states thereby trigger what is commonly regarded as 'impulsive' behaviour as they leave consumers prone to acting quickly in response to immediate situational demands with little reservation for the deliberate contemplation of how their actions may interfere with long-term goals (Loewenstein, 1996).

Indeed, scientific literature has provided ample evidence

* Corresponding author. Postbus 80.140, 3508 TC Utrecht University, The Netherlands.

E-mail address: t.t.l.cheung@uu.nl (T.T.L. Cheung).

highlighting the negative consequences of making decisions when experiencing a visceral state such as hunger. For instance, research has shown that hungry shoppers, compared to satiated shoppers, bought more food than they had initially anticipated (Nisbett & Kanouse, 1968). More contemporary work by Tal and Wansink (2013) has, however, revealed that hungry shoppers do not necessarily purchase a greater volume of food than satiated shoppers, but that they tend to buy more high-caloric foods relative to low-caloric food. Furthermore, hunger could also impact people's cognitive consideration of long-term goals and evaluation of future events. Under the visceral experience of hunger, dieters underestimated their self-efficacy for weight loss and consequently weakened their dieting intentions temporarily (Nordgren, van der Pligt, & van Harreveld, 2008). Moreover, researchers have found that hunger led people to mistakenly overestimate their enjoyment from eating the next day (Gilbert, Gill, & Wilson, 2002) and that when feeling hungry people were more likely to select more junk food for future consumption (Read & Van Leeuwen, 1998). Complementing these findings, evidence from neuroimaging research (e.g., Goldstone et al., 2009; Siep et al., 2009) and behavioural research (Cameron, Goldfield, Finlayson, Blundell, & Doucet, 2014; Lozano, Crites, & Aikman, 1999) has also suggested that increased levels of hunger heightened the attractiveness and subjective reward value of food, especially high-caloric food. The aforementioned examples illustrate that the response to a visceral state such as hunger, though adaptive in fulfilling the immediate physical needs of the body, often engenders impulsive behaviour that compromise the pursuit of long-term health goals.

Nevertheless, contrary to the traditional view and the bulk of existing research forecasting detrimental effects of impulsivity, the current research aims to highlight the benefits of deciding swiftly with minimal forethought. Specifically, we propose that impulsive decisions made in a state of hunger could result in choices that align with consumers' long-term interests when there are suitable cues in the environment promoting them. Particularly in the domain of healthy eating promotion, research has demonstrated success in employing environmental cues to steer consumers' impulsive and mindless food decisions towards more healthy choices in line with long-term health interests (Marteau, Hollands, & Fletcher, 2012). To name a few examples, simply relocating fresh fruits to a more convenient location at the cashier register increased consumers' purchases of fruits at train station snack shops (Kroeze, Marchiori, De Ridder, 2016); decreasing the size of plates at restaurants or downsizing portion sizes led consumers to reduce their food servings (Freedman & Brochado, 2010; Schwartz, Riis, Elbel, & Arieli, 2012); and exposing restrained eaters (i.e., chronic dieters) to dieting magazines and dieting commercials helped remind them of dieting goals, and consequently reduced their expected and actual food intake (Versluis & Papies, 2016). Important to note is that the use of these strategies does not require consumers to engage in effortful thinking to warrant healthy food choices.

In the current research we also take the approach of using environmental cues to promote healthy food choices. However, in extension to earlier research, which has relied on environmental cues as primes (i.e., increasing the mental accessibility of certain representation; Papies, 2016), we focus on environmental cues as simple guides to action. In particular, we propose to install heuristics, which are decisional shortcuts or mental rules-of-thumb that reduce time and cognitive effort (Shah & Oppenheimer, 2008), in the choice setting to promote healthy food choices for hungry consumers who are impulsive. Based on the theoretical premise that the visceral arousal heightens the propensity for System 1 processing (Kahneman, 2011), we predict that hungry consumers would increasingly use heuristics to expedite their decision-making. Accordingly, we propose that when there are

heuristics installed in the environment to promote outcomes that favour long-term interests, this would be particularly beneficial for hungry consumers. Thus, as long as heuristics guide consumers towards choices in line with long-term interests, hungry consumers would perform just as well as satiated consumers in making decisions that favour long-term interests.

An example of a heuristic is the social proof heuristic, which refers to people's tendency to look at the behaviour of others as a reference guide for their own behaviour (Cialdini, 2009). We posit that the social proof heuristic would be potent in influencing people's food choices considering the extensive literature that has documented the effects of social influences on food choice and intake (see Higgs, 2015 for a review). For example, when led to believe that earlier participants in the study had typically chosen a healthy snack, participants were likely to also choose a healthy snack for themselves (e.g., Burger et al., 2010; Prinsen, de Ridder, & de Vet, 2013). Intriguingly, relevant for the current research there is emerging evidence that the social proof heuristic could be effective in helping impulsive consumers especially to successfully exercise self-control in making decisions that align with long-term interests. Consider the recent research by Salmon, Fennis, de Ridder, Adriaanse, and de Vet (2014) that used a social proof heuristic to promote healthy food choices for consumers, who assumedly became impulsive due to previous exertions of self-control (i.e., ego-depletion; Baumeister, Bratslavsky, Muraven, & Tice, 1998). In their study, participants engaged in a product choice task, in which they had to choose between healthy and unhealthy food products. In normal circumstances the authors observed that ego-depleted participants opted for more tasty, but unhealthy choices. This was expected because ego-depletion is also considered as a precursor that leads to 'impulsive' decision-making (i.e., System 1 processing; Kahneman, 2011). However, this trend reversed when there was a pie chart conveying the descriptive norm that the majority of previous participants had chosen the healthy option. Because a descriptive norm communicates what is perceived as typical behaviour in a situation, it often provides a social proof heuristic for decision-makers especially when they are not inclined to engage in effortful processing (Jacobson, Mortensen, & Cialdini, 2011). In the context of Salmon and colleague's study, the pie chart therefore activated the social proof heuristic for ego-depleted individuals, leading them to follow the behaviour of perceived others in adopting the healthy options as their own choice. These findings hence suggest that impulsivity does not invariably lead consumers to suboptimal choices that compromise self-control, but could be facilitated by heuristics towards outcomes that are in line with long-term interests. Building on these findings, the present study tests whether these results would generalize to other impulsive states triggered by different factors besides ego-depletion. Critically, we test the effectiveness of the social proof heuristic in promoting healthy food products in a state of *hunger*, an even more challenging scenario considering hunger directly triggers the impulsive behaviour of consuming high caloric, unhealthy food (e.g., Tal & Wansink, 2013).

1. The present research

The current research takes the innovative approach of working *with*, rather than *against*, impulsive decision-making tendencies to promote successful self-control. We aim to extend the research by Salmon, et al. (2014) by examining whether the social proof heuristic would also be effective in influencing the decisions of consumers experiencing *hunger*, a typical visceral hot state that is notorious for triggering impulsive decision-making (Loewenstein, 1996). Accordingly, in the current study we employ naturally occurring hunger experienced outside the laboratory to induce impulsivity.

In the present research we investigated hungry participants' (vs. satiated participants') choice behaviour when confronted with a food choice task involving a self-control conflict: unhealthy food (i.e., a hedonic temptation not conducive for long-term health goals) vs. healthy food (i.e., a choice that is in line with long-term health goals). We predicted the choice outcome of such self-control conflict to be dependent on the presence of a social proof heuristic in the choice setting to influence the decision-maker. Specifically, we expected hungry (vs. satiated) participants to be less inclined to make healthy choices but *only* when there is no heuristic promoting the healthy products. However, our prediction is that this effect would be eliminated in the presence of a social proof heuristic promoting the healthy products.

We tested these hypotheses through two experiments in the current research. Specifically in Study 1, we aim to first establish that the experience of hunger would trigger more System 1 processing. Because System 1 processing is often a precursor for self-control failure, we expected participants self-reporting higher levels of hunger to also report having lower levels of state self-control. Importantly, while we expected participants experiencing greater levels of hunger and hence lower levels of self-control to select more unhealthy choices (vs. healthy choices) from a three-course meal menu, we predicted that the presence of a social proof heuristic promoting the healthy options would influence their preference for more healthy choices. In Study 2 we again tested the effect of a social proof heuristic in influencing the food choices of hungry (vs. satiated) participants. However, rather than relying on participants to self-report their hunger, we recruited participants at a cafeteria, which enabled us to compare the food choices of participants who were hungry as they were just about to eat lunch versus those who were satiated because they had just eaten. In Study 2 participants made trade-off choices between healthy vs. unhealthy food products in a product choice task (rather than meal choices in Study 1), and we expected that the presence of a social proof heuristic promoting the healthy options would help hungry participants to prefer healthy choices.

2. Study 1

Study 1 was an online study that assessed the effects of consumers' self-reported levels of hunger, state self-control (as measured by the State Self-Control Capacity Scale (SSCCS; Ciarocco, Twenge, Muraven, & Tice, 2012), and the presence of a social proof heuristic on their food choices. First, we expected that hungrier participants would exhibit lower self-control, and subsequently make more unhealthy choices when deciding from two three-course meal menus. However, we predicted that this trend for self-control 'failure' due to increased levels of hunger would no longer be apparent in the presence of a social proof heuristic promoting the healthy option. In effect, Study 1 tested a moderated mediation model of the relationships between self-reported hunger, state self-control, the presence of a social proof heuristic, and food choices (see Fig. 1). Summarizing, we hypothesized that: 1) greater hunger would lead to less healthy choices, because 2) this

relationship is mediated by self-control capacity that is 3) potentially moderated by the presence of a social proof heuristic.

2.1. Method

Participants and design. A sample of 201 participants, consisting of 95 males and 106 females, were recruited online from Amazon Mechanical Turk ($M_{age} = 37.67$, $SD_{age} = 12.72$). All participants were residents in the United States. Participants were only eligible to participate if they have a record of have an approval rate of 97% and higher for tasks completely previously on Amazon Mechanical Turk. In regards to participants' highest level of education level, 26.9% had a high school qualification, 57.2% had a college or university degree, and 15.9% had a post bachelor degree. Moreover, 62.2% of participants were employed for wages, 10.9% were self-employed, 3% were out of work and looking for work, 2.5% were out of work but currently not looking for work, 6% were students, 6% were retired, 2.5% were unable to work and 7% were homemakers. The average Body Mass Index (BMI) of participants in the sample was 26.38 ($SD = 7.20$).

Study 1 had a between-subjects design consisting of three predictors. Hunger and self-control were measured as continuous predictors, and the presence of the heuristic (control vs. social proof) was a categorical predictor manipulated in the food choice task. The dependent variable was the number of healthy choices made in a food choice task, which ranged from zero to six.

Procedure. Participants first read an information letter regarding the online study. As a cover story for the experiment, participants were informed that they would be completing two unrelated studies with the first being the State Self-Control Capacity Scale (SSCCS; Ciarocco, Twenge, Muraven, & Tice, 2012) described as a mood questionnaire and the second being the food choice task presented a marketing survey that assessed consumer preferences. After reading this information, participants indicated their consent for participation.

The study began with participants answering questions regarding their age, gender, BMI, level of education as well as occupation. Subsequently they responded to filler questions asking about their current state (i.e., physical and mental fatigue, stress, alertness, affect). Critically, embedded within the filler questions, participants responded to a one-item question enquiring their current levels of hunger (i.e., "How hungry are you feeling at the moment?") with a seven-point Likert scale ranging from 1 (*not at all*) to 7 (*very much*).

Participants proceeded to completing the SSCCS (Ciarocco, Twenge, Muraven, & Tice, 2012; see Measures), which was presented as a mood questionnaire under ongoing development. The cover story was that participants' recorded responses would help validate and improve the reliability of the scale. After completing the SSCCS, participants were introduced to a separate marketing survey, which was in fact the food choice task. Participants were informed that the marketing survey assessed consumer preferences, and that they had to select their choice of a starter, a main and a dessert for two different restaurant menus (see Appendix). Importantly, for each course of meal (i.e., starter, main, and dessert) participants had to make a trade-off choice between a healthy vs. an unhealthy option that presented a self-control conflict. The healthy options (e.g., House Salad) were pretested (with a convenient student sample; $n = 36$) to be perceived as significantly more healthy but less tasty than the unhealthy alternative (e.g., Quesadilla; see pre-test results in Table 1). In effect, after selecting their choice of starter, main, and dessert for two different menus, participants would have had made a total of six trade-off choices.

Depending on random assignment, participants completed either one of the two heuristic conditions (no heuristic vs. social

Fig. 1. Proposed moderated mediation model of the relationships between hunger, self-control, and heuristic on healthy choices.

Table 1
Study 1: Perceived healthiness and tastiness of food choices presented in Menu 1 and Menu 2.

Menu 1	Healthiness		Tastiness	
	<i>M (SD)</i>	<i>t</i> -test	<i>M (SD)</i>	<i>t</i> -test
House Salad	7.72 (1.23)	$t(35) = 12.70, p < 0.001$	5.78 (1.64)	$t(35) = -2.07, p < 0.05$
Quesadilla	4.75 (1.59)		6.78 (2.18)	
California Flatbread	5.97 (2.04)	$t(35) = 4.46, p < 0.001$	5.69 (1.98)	$t(35) = -4.73, p < 0.001$
Chicken Parmigiana	4.36 (1.96)		7.44 (1.61)	
Fruit Sorbet	4.58 (2.02)	$t(35) = 6.26, p < 0.001$	6.36 (1.99)	$t(35) = -4.35, p < 0.001$
Cheesecake	2.61 (1.63)		7.81 (1.79)	
Menu 2	Healthiness		Tastiness	
	<i>M (SD)</i>	<i>t</i> -test	<i>M (SD)</i>	<i>t</i> -test
Roasted Garlic & Tomato Soup	6.53 (1.54)	$t(35) = 5.32, p < 0.001$	5.61 (1.84)	$t(35) = -2.20, p = 0.03$
Calamari	4.44 (2.29)		6.50 (2.14)	
Tuscan Turkey Wrap	5.69 (1.58)	$t(35) = 6.06, p < 0.001$	6.28 (1.50)	$t(35) = -2.56, p = 0.02$
Chicken Fingers	3.67 (1.76)		7.06 (1.57)	
Mixed Fruit Tart	4.81 (2.14)	$t(35) = 8.58, p < 0.001$	6.33 (2.01)	$t(35) = -3.94, p < 0.001$
Chocolate Fudge Brownie	1.69 (1.35)		7.89 (1.60)	

proof) of the food choice task. In the social proof condition, a social proof heuristic always promoted the healthy option in the food choice task. Similar to the study by [Salmon et al. \(2014\)](#), participants were told the cover story that some initial data had been collected for the marketing survey and that the preliminary results based on the responses of previous participants would be presented. Accordingly, a social proof heuristic in the form of a poll (e.g., bar chart) reporting the majority of previous participants (e.g., ranging from 66% to 83%) choosing the healthy option was displayed above the two options for each course of meal on the menus. That said, before making their own choice participants would be able to see how alleged previous participants had chosen based on the information provided by the social proof heuristic. Contrastingly, in the no heuristic condition, participants made their choices for each course of meal without seeing any additional information. In both conditions, after participants had made their food choices from the two menus, they were asked a few more questions regarding consumer characteristics including their intentions of healthy eating with a one-time question (i.e., “To what extent do you try to eat healthily?” 1 = *not at all* to 7 = *very much*) amongst other filler questions regarding their experience of dining at restaurants. Finally, participants were thanked, debriefed and compensated for their participation (\$0.40 for approximately 4 min).

2.2. Measures

State Self-Control Capacity Scale. The State Self-Control Scale (SSCS; [Ciarocco, Twenge, Muraven, & Tice, 2012](#)) was presented as a mood questionnaire that was under ongoing development. Participants were asked to indicate the degree to which they agreed with the 25 statements of the SSCS that described their current state such as “I feel motivated” and “I feel like my willpower is gone” (reverse coded) using a seven-point Likert-scale (1 = *not true*; 7 = *very true*). To ensure that the scale was capturing levels of state, rather than trait, self-control, participants were prompted to indicate how they felt currently, and not how they would usually feel. A final SCS score was calculated by as an average score of all the statements, where a higher score represented a higher level of state self-control. The SSCS had a Cronbach's alpha (α) of 0.95 in the current study.

3. Results

Descriptives and randomization check. Overall, participants reported relatively low levels of hunger ($M = 2.89, SD = 1.71$), and

chose an average of 3.10 ($SD = 1.53$) out of six healthy choices. Participants also reported of having a moderate level of intention for healthy eating ($M = 4.83, SD = 1.27$), and intention of healthy eating was significantly correlated with the number of healthy choices made ($r = 0.44, p < 0.001$). Moreover, healthy choices made (DV) was not correlated with other demographic variables including age ($r = -0.03, p = 0.71$), gender ($r = 0.06, p = 0.44$), education level ($r = 0.13, p = 0.06$), employment status ($r = -0.09, p = 0.23$), BMI ($r = -0.07, p = 0.32$). An analysis of variance (ANOVA) with participants' intention for healthy eating as the dependent variable revealed no significant difference between the two conditions, $F(1, 198) = 1.45, p = 0.23$, hence indicating the randomization of participants was successful.

Effects of hunger, self-control and the interaction of self-control and heuristic on healthy choices. We conducted PRO-CESS macro for SPSS (Model 14) by [Hayes \(2013\)](#) in order to examine the effects of hunger, self-control, and the interaction of self-control and heuristic (no heuristic vs. social proof) on healthy choices in a moderated mediation. We included intention for healthy eating as a covariate. The results are presented in [Table 2](#), and the beta's reported are unstandardized.

In line with predictions, hunger had a significant negative relationship with self-control ($b = -0.18, SE = 0.05, p < 0.001$), $F(1, 198) = 15.46, p < 0.001, R^2 = 0.07$. With regard to the number of healthy choices as a dependent variable, the model included hunger, self-control, heuristic (no heuristic vs. social proof), the interaction between self-control and heuristic as predictors, and the intention of healthy eating as a covariate, $F(5, 194) = 11.06, p < 0.001, R^2 = 0.22$. Results indicated that the direct effect of hunger on healthy choices was negative, but non-significant ($b = -0.10, SE = 0.06, p = 0.10$). Moreover, the predicted self-control $\times$ heuristic interaction was also non-significant ($b = 0.07, SE = 0.17, p = 0.67$). Likewise, the index of moderated mediation was not significant ($-0.01, 95\% \text{ CI: } -0.07, 0.05$), further indicating that the conditional indirect effect of hunger on healthy choices through self-control was not moderated by the condition of heuristic.¹

¹ The current analysis included all participants recruited for the study, including four participants who did not pass a one-item attention check (i.e., “Are you clicking randomly at the moment?” 1 = *not at all* to 7 = *very much*). Excluding these four participants did not affect the results of the moderated mediation analyses as currently reported in the manuscript, such that the significant pathways in the moderated mediation model did not become non-significant (i.e., hunger remained a significant predictor of self-control level, $p < 0.001$; intention of healthy eating remained a significant predictor of food choice, $p < 0.001$).

Table 2

Study 1: Results of the moderated mediation analysis.

	Self-control			Number of healthy choices		
	<i>b</i> (SE)	<i>t</i>	<i>p</i>	<i>b</i> (SE)	<i>t</i>	<i>p</i>
Constant	0.52 (0.15)	3.39	<0.001	0.70 (0.42)	1.70	0.09
Hunger	-0.18 (0.05)	-3.93	<0.001	-0.10 (0.06)	-1.65	0.10
Self-control				-0.17 (0.09)	-1.91	0.06
Heuristic				-0.23 (0.20)	-1.16	0.25
Self-control x Heuristic				0.07 (0.17)	0.42	0.67
Intention of healthy eating				0.56 (0.08)	7.22	<0.001

3.1. Discussion

In Study 1 we tested the influence of hunger on people's choices when encountering a self-control conflict between a healthy food that offers long-term health benefits and an unhealthy food that gives immediate consumption pleasure. We first predicted that a stronger experience of hunger would lead to less healthy choices, and this effect should be (at least partially) mediated by increased System 1 processing as manifested through a lower capacity for self-control. Second, we posited that the presence of a social proof heuristic promoting the healthy choices would moderate this outcome, such that lower levels of self-control (i.e., greater System 1 processing) would increase the susceptibility to the influence of the heuristic thereby resulting in more healthy choices. Although we indeed observed that participants who reported higher levels of hunger also reported lower levels of state self-control, we did not obtain further evidence to support our proposed moderated mediation model. On one hand, there was no evidence that hunger directly affected the number of healthy choices made; on the other hand a non-significant self-control x heuristic interaction indicated that the effect of self-control on healthy choices was not contingent on the presence of a social proof heuristic. Intention for healthy eating as the covariate was the only significant predictor that strongly influenced the choice outcome.

Nonetheless, before ruling out our hypotheses we discuss potential factors that may have contributed to the current (null) findings. First, judging from the low average of self-reported hunger levels accompanied by a relatively small standard deviation, we could deduce that most participants were not experiencing hunger. Hence it could have been possible that we did not observe apparent direct effects of hunger (i.e., negative association between hunger and healthy choices) simply because most participants were not hungry. In contrast, participants reported having considerably high intentions for healthy eating and correspondingly results also indicated that as a covariate it was the only significant predictor of healthy food choices. Taking this into consideration, we could speculate that in the absence of hunger, more deliberate and reflective precursors such as intention of healthy eating could be more effective in inhibiting the impulses or overriding prepotent responses that are typically triggered by the visceral sensation of hunger. This reasoning is line with previous research showing that reflective precursors such as restraint standards or deliberative evaluations play a more directive role in behavioural outcomes when individuals are not hampered by ego-depletion, cognitive load, or time pressure (see Hofmann, Friese, & Strack, 2009 for a review).

4. Study 2

Following up on Study 1, Study 2 similarly tested the hypotheses that hunger leads to less healthy choices made in food choices involving a self-control conflict but that the presence of a social proof heuristic promoting the healthy option would mitigate this

effect. However in this study we made specific modifications to the experimental design to overcome the limitations of Study 1. Critically to ensure greater variability in the levels of hunger experienced by our sample of participants, in Study 2 we recruited participants at a cafeteria who had not yet eaten or were just about to eat (hunger condition), and as a comparison group we recruited participants who had just finished a meal (satiation condition). Additionally, in the product choice task where we measured the outcome variable of healthy choices made from a trade-off between a healthy vs. unhealthy food product, we included additional filler product pairs that do not involve such a self-control conflict to mask the true purpose of the study. Finally, considering that previous research has suggested that females are more likely to diet and attach stronger importance to healthy eating (Wardle et al., 2004), we recruited a homogenous sample of exclusively females to ensure that the food-related self-control dilemmas were relevant to all participants.

4.1. Method

Participants and design. Participants were 188 female students ($M_{\text{age}} = 20.66$, $SD_{\text{age}} = 2.47$) recruited at a university campus cafeteria in The Netherlands. The average BMI of participants in the sample was 21.70 ($SD = 2.60$). The study was based on a 2 (hunger: satiated vs. hungry) x 2 (heuristic: no heuristic vs. social proof) between-subjects design. The dependent variable was the number of healthy choices made in a food choice task, which ranged from zero to seven.

Procedure. A research assistant recruited participants at a university campus cafeteria. For the hungry condition, the research assistant approached individuals who had come to the cafeteria to eat a meal (e.g., individuals with a tray full of uneaten food). In contrast, for the satiated condition, the research assistant approached individuals who had just eaten a meal (e.g., individuals with empty bowls or plates on their tray). The research assistant asked potential participants if they would be willing to participate in a brief marketing study, which was in fact a food choice task that required participants to make healthy vs. unhealthy food choices.

The product choice task included a total of ten food pairs. Critically, seven of these product pairs presented a self-control conflict, where a healthy option was paired with an unhealthy alternative. The seven trade-off product pairs presenting a self-control conflict were constructed based on the results of a pre-test (with an Amazon Mechanical Turk sample consisting of US residents; $n = 87$) showing the healthy option (e.g., salad) as perceived as more healthy but less tasty than the unhealthy alternative (e.g., pizza) (See Table 3). The remaining three food pairs were filler pairs (e.g., grapes vs. Hershey's Kisses chocolate) that did not pose a self-control conflict, such that both healthy and unhealthy options were perceived to be as equally tasty (see Table 3).

Participants willing to take part in the study first filled out an informed consent then were randomly assigned to one of the two heuristic conditions (control vs. social proof) of the product choice

Table 3

Study 2: Perceived healthiness and tastiness of food products for trade off pairs and filler pairs.

Trade-off Pairs	Healthiness		Tastiness	
	<i>M (SD)</i>	<i>t</i> -test	<i>M (SD)</i>	<i>t</i> -test
Salad	5.63 (1.22)	$t(83) = 21.91, p < 0.001$	4.87 (1.63)	$t(83) = -5.09, p < 0.001$
Pizza	1.83 (1.04)		5.93 (1.33)	
Fruit snacks	3.84 (1.57)	$t(82) = 11.81, p < 0.001$	4.60 (1.77)	$t(82) = -4.14, p < 0.001$
M&M's	1.59 (0.88)		5.55 (1.71)	
Ricecakes	4.83 (1.48)	$t(82) = 19.27, p < 0.001$	2.55 (1.58)	$t(82) = -12.29, p < 0.001$
Donuts	1.23 (0.67)		5.82 (1.60)	
Dried apricots	5.35 (1.16)	$t(82) = 23.75, p < 0.001$	3.63 (1.72)	$t(82) = -8.12, p < 0.001$
Ferrero Rocher chocolate	1.54 (0.75)		5.71 (1.69)	
Mixed fruit	5.36 (1.22)	$t(83) = 15.85, p < 0.001$	4.83 (1.56)	$t(83) = -4.35, p < 0.001$
Popcorn	2.25 (1.38)		5.64 (1.37)	
Cereal bar	4.35 (1.44)	$t(83) = 13.65, p < 0.001$	4.37 (1.79)	$t(83) = -6.49, p < 0.001$
Twix chocolate bar	1.58 (0.95)		5.93 (1.39)	
Chicken and vegetable soup	4.15 (1.53)	$t(82) = 9.24, p < 0.001$	4.39 (1.48)	$t(82) = -2.58, p = 0.012$
Chicken nuggets	2.41 (1.25)		4.80 (1.77)	
Filler Pairs	Healthiness		Tastiness	
	<i>M (SD)</i>	<i>t</i> -test	<i>M (SD)</i>	<i>t</i> -test
Apple Juice	4.60 (1.55)	$t(81) = 6.31, p < 0.001$	5.13 (1.50)	$t(81) = 1.37, p = 0.17$
Iced Tea	3.23 (1.35)		4.87 (1.62)	
Grapes	6.31 (1.05)	$t(82) = 25.15, p < 0.001$	5.53 (1.28)	$t(82) = -1.20, p = 0.24$
Hershey's Kisses chocolate	1.71 (0.94)		5.75 (1.57)	
Cashew, cranberry, & almond mix	5.41 (1.09)	$t(81) = 23.44, p < 0.001$	4.87 (1.55)	$t(81) = -0.68, p = 0.50$
Rice Crispie Squares	1.77 (0.89)		5.01 (1.74)	

task. In both conditions, prior to the actual product choice task participants were asked about their age, current level of hunger (1 = *not at all hungry* to 7 = *very hungry*), as well as their intention to eat healthily (i.e., “How much do you intent on eating healthily?” 1 = *not at all* to 7 = *very much*) along with eight other filler questions. In the social proof condition, a social proof heuristic always promoted the healthy food in the product choice task. Modeled after the study by Salmon et al. (2014), the social proof heuristic was shown as a pie chart next to each food pair, allegedly displaying the preliminary results of the marketing study where the majority of previous participants (e.g., ranging from 69% to 85%) had chosen the healthy choice. In the no heuristic condition, the product pairs were presented without extra information. Subsequent to the product choice task, an open-ended question probing for potential suspicion asked participants what they thought the research topic of the ‘marketing study’ was about (while not all participants responded, of those who did respond no one explicitly expressed suspicion over the authenticity of the cover story or knowledge of the full hypothesis). Finally, participants returned the completed ‘marketing survey’ to the research assistant, and they were verbally debriefed and thanked for their participation.

4.2. Results

Descriptives, manipulation check, and randomization check.

On average, participants chose 3.10 ($SD = 1.74$) out of seven healthy products. Participants also reported of having a fairly high intention for healthy eating ($M = 5.68, SD = 0.96$), and intention of healthy eating was significantly correlated with the number of healthy choices made ($r = 0.15, p < 0.05$). Participants in the hungry condition self-reported having higher hunger levels ($M = 4.13, SD = 1.64$) than participants in the satiated condition ($M = 3.10, SD = 1.61$), $t(186) = 4.35, p < 0.001$. Moreover, the number of healthy choices made was positively correlated age ($r = 0.187, p = 0.01$), but not with BMI ($r = 0.020, p = 0.795$). An analysis of variance (ANOVA) with participants’ intention for healthy eating as the dependent variable revealed no significant difference between the four conditions, $F(3, 184) = 0.87, p = 0.46$, hence indicating the

randomization of participants was successful.

Effect of hunger and heuristic on healthy choices. In order to test the effect of hunger, heuristic, and their interaction on healthy choices made, a 2 by 2 between-subjects analysis of covariance (ANCOVA) was performed, with intention for healthy eating as a covariate. There was no main effect of heuristic, $F(1, 183) = 0.57, p = 0.45$. The main effect of hunger was significant, $F(1, 183) = 6.81, p = 0.01, \eta^2 = 0.04$. As a covariate, intention for healthy eating was marginally significant, $F(1, 183) = 3.39, p = 0.07$. Furthermore, there was a significant hunger $\times$ heuristic interaction, $F(1, 183) = 4.99, p = 0.03, \eta^2 = 0.03$ (Fig. 2).

Simple main effects showed that in the no heuristic conditions, hungry participants ($M = 2.43, SE = 0.24$) made significantly less healthy choices than satiated participants ($M = 3.62, SE = 0.25$), $p = 0.001$. Contrary in the social proof conditions, the healthy choices of hungry participants ($M = 3.16, SE = 0.24$) did not differ from the healthy choices of satiated participants ($M = 3.25, SE = 0.25$), $p = 0.79$. Furthermore, as expected hungry participants made more healthy choices in the social proof condition ($M = 3.16, SE = 0.24$) compared to hungry participants in the no heuristic condition ($M = 2.43, SE = 0.24$), $p = 0.03$; whereas for satiated participants, there was no significant difference between the number of healthy choices made in the social proof condition ($M = 3.25, SE = 0.25$) compared to the no heuristic condition ($M = 3.61, SD = 0.25$), $p = 0.31$.²

4.3. Discussion

In Study 2 we recruited participants at a cafeteria, and we compared the food choices of hungry participants who were just about to eat and satiated participants who had just consumed a meal. Hungry vs. satiated participants made trade-off choices between a healthy vs. a more palatable but unhealthy food product in

² We have conducted additional analyses that controlled for the potential effects of BMI and age respectively. In both analyses, neither BMI ($p = 0.45$) nor age ($p = 0.08$) nor were significant covariates in the ANCOVA that examined the effects of hunger, heuristic and their interaction on the number of healthy choices made.

Fig. 2. Healthy choices made as a function of hunger and heuristic. ** $p = 0.001$ * $p < 0.05$.

a product choice task. Particularly half of the participants were exposed to a version of the product choice task containing a social proof heuristic that always promoted the healthy products. Although in Study 2 we did not assess participants' current state self-control levels to avoid drawing attention to the true purpose of the study, we could infer from the results of Study 1 that hunger is associated with lowered self-control. The results acquired in Study 2 were in line with predictions in showing that hungry participants made significantly less healthy choices than satiated participants when no heuristic was present. However, a social proof heuristic effectively reversed this trend and led hungry participants to make just as many healthy choices as satiated participants. Moreover, seeing that hungry participants made more healthy choices in the social proof condition than in the no heuristic control condition, we obtained evidence to support our prediction that hungry participants would prefer healthy choices when there is a social proof heuristic promoting them. Lastly, it should be acknowledged that in the present study we also accounted for participants' intention for healthy eating as an individual difference that might have influenced food choices.

5. General discussion

Through two studies our present research aimed to extend on the recent work by Salmon et al. (2014) by demonstrating that heuristics could be used to promote consumers' decision competence in making choices that favour long-term interests not only when they are in a state of ego-depletion, but also when they are experiencing hunger. As mentioned earlier, dual-process models posit that behaviours result from two different, but interacting modes of processing: a fast, low-effort and automatic mode (System I), and a slow, effortful, and deliberative mode (System II; Evans, 2008).

Conventionally both ego-depletion and hunger are assumed to predispose consumers to predominant System I processing, which is typically regarded as an 'impulsive' way of decision-making that leaves people vulnerable to self-control failure – giving in to a short-term craving at the expense of long-term goals (Kahneman, 2011; Loewenstein, 1996). However, in the current research we reasoned that an increased use of System I thinking does not necessarily lead to choices that compromise long-term goals because the decision outcome of such processing could be influenced by contextual cues, – for example, a social proof heuristic

(Cialdini, 2009). Specifically, we predicted that consumers using 'impulsive' processing due to hunger would become more responsive to a social proof heuristic that promoted healthy food products.

Based on the collective findings from the two studies of the present research we inferred that hunger was associated with System I processing that is fast, low-effort and automatic. Importantly, in line with predictions our results demonstrated that hungry consumers who were assumedly reliant on System I processing were not invariably bound to self-control failure (e.g., making unhealthy food choices), but would prefer healthy food products given that there was a social proof heuristic in the choice-setting to promote these choices. Moreover, our findings allow us to extend on Salmon et al.'s (2014) research in showing that the social proof heuristic to promote healthy choices is not only effective for individuals experiencing ego-depletion but also for those who are hungry. Nonetheless, as compared to Salmon and colleagues' study the unhealthy food options presented in the self-control conflicts in the current study might even be stronger temptations because participants were experiencing hunger. Nonetheless, the social proof heuristic was still robust and effective in helping hungry participants transcend the strong temptations of unhealthy food in favour of the healthier, but less tasty options.

Generally, our current research has portrayed the impulsivity triggered by a visceral state of hunger in a more favourable light, while demonstrating the strength of environmental factors to influence the decisional outcome of 'impulsive' processing. Rather than reducing impulsivity to circumvent self-control failure, we took an innovative approach by installing social proof heuristics in the environment to work with impulsivity to facilitate self-control success. This approach aligns with the call for implementing nudges, which are subtle physical changes in the choice architecture that works with automatic decision-making processing (e.g., System I thinking) to promote positive choices and behaviours without forbidding any option or substantially changing economic incentives (Thaler & Sunstein, 2008). Moreover, considering that consumers' food choices often occur (outside their awareness) as the result of environmental influences as opposed to careful deliberation (Cohen & Babey, 2012), the use of nudges as an intervention to promote healthy eating is particularly suitable (Johnson et al., 2012). For instance, research has demonstrated that relocating fresh fruits next to the cashier register (Kroese et al., 2016), and placing large, salient green arrows accompanied by

the message “Follow green arrow for health” on the grocery floor to direct consumers to the fresh produce section (Payne, Niculescu, Just, & Kelly, 2016) were successful in nudging consumers to purchase more fruits and vegetables. Meanwhile, our current findings showcased the social proof heuristic as a suitable nudge that could also be easily installed in everyday environments to promote healthy food choices.

5.1. Limitations and directions for future research

First, we acknowledge that these are novel findings that would benefit from future studies to replicate the effects found in the current research. Second, we also encourage future studies to improve on the limitations inherent to the current research. For example, in both studies participants made hypothetical choices that were presented as single trade-off choices between a healthy vs. an unhealthy food. This dichotomized view, especially with food, has been criticized as perhaps being too artificial and simplistic in understanding self-control and consumption choices (Askegaard et al., 2014). As such, future studies could examine the effects of heuristics in influencing actual product choices that have real life consequences for diets and consumption behaviour. Correspondingly, field studies could test the influence of heuristics installed in the cafeteria, supermarket, convenience stores or other settings where hunger would be naturally experienced and where real consumption choices and actual eating behaviour would occur more naturally outside the context of dichotomous trade-offs. Moreover, considering the effect sizes of the current findings are rather modest, testing the robustness of social proof heuristics is important. It would be beneficial to replicate the current findings in both controlled and experimental setting as well as real-life contexts. Research that has used the social proof heuristic presented in more naturalistic formats as interventions in real-life settings have also demonstrated promising results in promoting healthy food choices. For instance, the field study by Salmon and colleagues (2014) has shown that a social proof heuristic presented as a conventional marketing slogan, “Most sold in this supermarket”, was effective in promoting the sale of a low-fat cheese, especially for ego-depleted consumers, in a supermarket. Besides presenting the social proof heuristic with explicit information, research by Prinsen et al. (2013) has also found the social proof heuristic implicitly installed in the physical environment, such as leftover food wrappers, could influence people's food choice behaviours – participants were more likely to choose a healthy snack when empty wrappers of a healthy snack were present (assumedly left behind by previous participants).

Fourth, in the current studies we provided the social proof heuristic by displaying descriptive norms in the form of graphical information (i.e., bar graph in Study 1, pie chart in Study 2) that depicted majority preference for healthy food choices, with the cover story that we were presenting the preliminary results (i.e., the choices made by previous participants) of an ongoing marketing study. A shortcoming of this approach is that the cover story used in the social proof condition might have potentially led participants to believe their choices would also be displayed to others, thereby motivating them to make more healthy choices as means of positive self-representation. To rule out this alternative explanation, future studies could introduce an intermediate control condition where participants would be given additional information indicating that other people have *equally* chosen healthy and unhealthy choices, and assess whether this condition would also lead participants to make more healthy food choices as currently observed. Moreover, in the current studies we provided a social proof heuristic based on fabricated information regarding the choice behaviour of ‘previous participants’, but it would be worthy

to examine the effects of disclosing real-life descriptive norms based on factual statistics (e.g., Mollen, Rimal, Ruiter, & Kok, 2013). Besides using the social proof heuristic, future studies could also consider using different heuristic cues (e.g., price, logos, appearance of packages) to influence people's food decisions for more healthy choices (Cohen & Babey, 2012). Finally, future studies should also look into factors such as individual differences (e.g., habits, personal involvement, dieting status) or other external factors (e.g., disclosure of the influence attempt) that could potentially influence the impact of heuristics targeting behavioural change. More generally, future studies would benefit from having larger samples that are inclusive of a broader diversity of participants in terms of gender and socio-economic status.

6. Conclusion

Hunger, a visceral state commonly encountered as a daily experience, is typically assumed to compromise self-control by leading consumers to default to fast and automatic processing that typically result in suboptimal choices that favour short-term interests at the expense of long-term goals. Contrasting this view, our research showed that hunger does not necessarily leave individuals vulnerable to making decisions that compromise long-term goals, given that there are suitable heuristics in the environment to direct their choices towards more optimal outcomes. More specifically, our findings showcased the social proof heuristic as a low-cost and easy to implement intervention to promote choices in line with long-term goals. Together, current findings posit that the same factors (e.g., visceral states) that dispose consumers to self-control failure could be reversed to help them achieve self-control success.

Appendix

Menu A

~ A la carte 3 course menu ~

On the next few pages, you will be presented with the options for a three-course meal. Please proceed to make a choice of **starter, main and dessert**.

Starter

Please make your choice of starter from the selection below.

Quesadilla - Baked flour tortilla layered with Cajun chicken, cheddar cheese, salsa sauce, green onions and diced tomatoes. Served with sour cream, salsa and shredded lettuce.

House Salad - Mixed greens with fresh lemon, olive oil, new potatoes, chickpeas, yellow and green beans, and tomatoes, then sprinkled with sesame seeds and our sweet & spicy Thai vinaigrette.

Main Course

Please make your choice of starter from the selection below.

Chicken Parmigiana - Fried Parmesan-crusted chicken breast topped with tomato sauce and mozzarella cheese. Served with a generous side of our fettuccine Alfredo.

California Flatbread - Roasted red peppers, Kalamata olives, sun-dried tomatoes, mushrooms, roasted garlic, pesto sauce and goat cheese.

Dessert

Please make your choice of dessert from the selection below.

Fruit sorbet - with red fruit compote, whipped cream and

sugared almonds.

Cheesecake - with rhubarb, lemon ice cream and crunch of Amaretti cookies.

Menu B

~ *A la carte 3 course menu* ~

On the next few pages, you will be presented with the options for a three-course meal. Please proceed to make a choice of **starter**, **main** and **dessert**.

Starter

Please make your choice of starter from the selection below.

Roasted Garlic & Tomato Soup - Smooth tomato puree in a light vegetarian broth, with hints of garlic, basil, fennel and sweet cream.

Calamari - Lightly dusted in flour and spices, fried golden brown, served with lemon & seafood sauce.

Main Course

Please make your choice of starter from the selection below.

Chicken Fingers - Tender strips of chicken, seasoned and breaded, then fried golden brown. Served with plum sauce and our fries.

Tuscan Turkey Club Wrap - Turkey, diced tomatoes, fresh lettuce, cheddar cheese and homemade pesto-mayo.

Dessert

Please make your choice of dessert from the selection below.

Chocolate Fudge Brownie - Chocolate brownie served warm with a scoop of creamy vanilla ice cream.

Mixed Fruit Tart - A flaky pastry cup filled with light cream, topped with a mix of seasonal berries and fresh fruit.

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