



Social proof in the supermarket: Promoting healthy choices under low self-control conditions



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ABSTRACT

Under low self-control conditions, people often favor tempting but unhealthy food products. Instead of fighting against low self-control to reduce unhealthy food choices, we aim to demonstrate in a field study that heuristic decision tendencies can be exploited under these conditions. To do so a healthy product was associated with a social proof heuristic, referring to the tendency to adopt the option preferred by others. A healthy low-fat cheese was promoted with banners stating it was the most sold cheese in that supermarket. A state of low self-control was experimentally induced in the supermarket, and compared to a high self-control condition. Participants low in self-control were more likely to buy the low-fat cheese, when this product was associated with the social proof heuristic, compared to when it was not. This suggests that under low self-control conditions, presenting social proof cues may benefit healthy purchases.

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1. Introduction

In today's Western obesogenic food environment, tempting food products are abundantly available (French, Story, & Jeffery, 2001). People are confronted with palatable but unhealthy foods, and persuasive food advertisements, at virtually every corner of the street (French et al., 2001). Despite the introduction of healthier alternatives (e.g., light or low-fat food products), many people purchase and consume unhealthy food products (Briefel & Johnson, 2004; Nielsen, Siega-Riz, & Popkin, 2002). This makes the question imperative of how food choices are actually made and what potential exists to change behavior in the direction of healthier alternatives at point-of-choice settings.

It is often suggested that people are more prone to succumbing to unhealthy food choices when they are low in self-control, for example when they are exposed to tempting snack foods at the canteen after doing tedious tasks at work. Consequently, it is assumed that in order to resist food temptations and act in line with long term health goals, people need a sufficient level of

self-control (e.g., Hofmann, Friese, & Wiers, 2008; Schwarzer, 2008). Interventions in healthy eating behavior are typically based on the assumption that people have a sufficient level of self-control at the moment they make a food choice (Herman & Polivy, 2011). However, most food choices are made mindlessly, when people are not able or willing to exert self-control (Bargh, 2002; Wansink & Sobal, 2007).

Instead of fighting against low self-control, we aim to exploit the low self-control conditions under which most food choices are made. More specifically, we previously demonstrated that by exploiting the impulsive decision tendencies that people show under low self-control conditions, the healthy option can become the automatic and impulsive one (Salmon, Fennis, de Ridder, Adriaanse, & de Vet, 2014). With the present study, we primarily aim to test our theory under more challenging conditions. Our previous work demonstrated the beneficial effect of the social proof heuristic on food choices under low self-control conditions in a restricted lab setting, which is a highly controlled environment. With the present research we aim to demonstrate that the effect holds under complex circumstances; a noisy supermarket environment with a representative community sample. In doing so, we provide a more critical test of our theory regarding the effectiveness of heuristics. Furthermore, we will, as far as we know, for the first time experimentally induce ego-depletion outside the

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lab, providing more insight into the strength and robustness of the ego-depletion effect. With this, our findings add to the recent controversies surrounding the replicability of the ego-depletion phenomenon (Carter & McCullough, 2014; Hagger, Wood, Stiff, & Chatzisarantis, 2010).

After an initial act of exerting self-control (e.g., such as doing tedious tasks at work, making a range of choices, or inhibiting impulses) people are less willing or able to exert self-control on a secondary task, a phenomenon labeled ego-depletion (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Inzlicht & Schmeichel, 2012; Muraven & Baumeister, 2000; Vohs et al., 2008; but see for a critical note on the strength and robustness of the ego-depletion effect Carter & McCullough, 2014; Dewitte, Bruyneel, & Geyskens, 2009; Job, Dweck, & Walton, 2010; and see for alternative mechanisms underlying the ego-depletion effect Dang, Xiao, & Dewitte, 2014; Inzlicht & Schmeichel, 2012; Kurzban, Duckworth, Kable, & Myers, 2013). Under conditions of ego-depletion, people do not have enough resources or lack the motivation to exert self-control over their behavior and decisions. Consequently, people are unwilling or unable to weigh the pros and cons of several options and make a deliberated decision. Instead, decision-making becomes more swift, automatic, and impulsive under these low self-control conditions (Fennis, Janssen, & Vohs, 2009; Hofmann, Friese, & Strack, 2009; Janssen, Fennis, Pruy, & Vohs, 2008). People frequently favor tempting but unhealthy food products under these conditions, as these are often more appealing in the short term (Bruyneel, Dewitte, Vohs, & Warlop, 2006; Vohs & Heatherton, 2000; Wang, Novemsky, Dhar, & Baumeister, 2010).

Nevertheless, people are not doomed to make unhealthy food choices. We suggest that people do not necessarily need to exert self-control to make a healthy food choice under specific conditions. The impulsive choice under low self-control conditions can become a healthy one, by associating the healthy option with a heuristic (Salmon et al., 2014). Heuristics are simple decision rules that simplify the decision making process, by excluding part of the information, and hence save self-control resources (Gigerenzer & Gaissmaier, 2011; Shah & Oppenheimer, 2008). A frequently used heuristic is the social proof heuristic, referring to the tendency to adopt the option preferred by others, which can be triggered by presenting majority information on food products, like calling a certain product the 'best-selling' product, suggesting that many people bought this product on previous occasions (Cialdini, 2009; Lun, Sinclair, Whitchurch, & Glenn, 2007). Importantly, heuristics are especially effective in influencing behavior under conditions of low self-control when people do not have the capacity or motivation to make a well-deliberated decision (Fennis et al., 2009; Jacobson, Mortensen, & Cialdini, 2011; Salmon et al., 2014). For instance, under low self-control conditions students chose to complete more extra surveys when a descriptive norm told them that other students allegedly also completed extra surveys, compared to under conditions of high self-control (inducing social proof; Jacobson et al., 2011).

In the current obesogenic food environment, heuristics often seem to favor unhealthy food choices. Whereas heuristics appear to be a well-known strategy for the promotion of palatable, unhealthy foods, they seem to be rarely associated with healthy food products. Up till now, healthy products are often promoted in conscious, deliberate ways, in which for instance the healthiness of a product is emphasized, thereby relying on deliberate decision making and self-control resources at the moment of making a food choice (e.g., Bandura, 2004; Conner, Norman, & Bell, 2002). In point-of-purchase settings, the healthiness and health benefits of products are often emphasized by the use of health and nutrition claims (Kozup, Creyer, & Burton, 2003; Sloan, 2008; Urala, Schutz, & Spinks, 2011). Yet, these conscious, deliberate attempts

at promoting healthy food choices have witnessed limited success or even counterproductive effects (Finkelstein & Fishbach, 2010; Herman & Polivy, 2011; Michie, Abraham, Whittington, McAteer, & Gupta, 2009). In the present study, we will promote healthy food choices by using heuristics. We aim to build on our previous finding (Salmon et al., 2014) that low self-control conditions can be beneficial for long term health goals when heuristics favor healthy food products.

To date, there is preliminary evidence for the effectiveness of heuristics in influencing health behavior under low self-control conditions (Fennis et al., 2009; Salmon et al., 2014). Inducing the heuristic of consistency, referring to the felt need to go through with something once feeling committed to it (Cialdini, 2009), has been found to promote behaviors relevant to one's health. People were more willing to keep a health and food diary when the heuristic of consistency was induced, by asking people questions about the foods they consume, compared to when it was not (Fennis et al., 2009). Furthermore, in a recent lab study we demonstrated the influence of social proof on food choices under low self-control conditions. Participants low in self-control made more healthy food choices in a hypothetical food choice task when the heuristic of social proof was associated with the healthy choice options by presenting majority information, compared to when it was not (Salmon et al., 2014). Importantly, participants in this study were more responsive to the heuristic information under low self-control conditions. Under conditions of high self-control, there was no effect of heuristic on food choice. In sum, these studies found initial evidence for the notion that heuristics can help making the impulsive choice a healthy one.

The aim of the present study is to demonstrate that social proof heuristics can help people to make healthier food choices under low self-control conditions in a supermarket where many food choices are made, and where actual temptations and influence techniques associated with other food products are assumed to play a big role in food choices. In doing so, we aim to demonstrate the social proof effect under low self-control conditions in an ecologically valid and challenging setting among a representative sample. The heuristic of social proof was associated with a healthy low-fat cheese at the cheese department of a supermarket. We selected low-fat cheese as the target product, because previous research showed that this type of cheese is perceived by Dutch consumers to be a healthier, yet less tasty option as compared to regular cheeses (Temminghoff & Paulussen, 2012). Importantly, self-control for choosing the healthy option is only required when food products are regarded as less tasty than the unhealthy option (Salmon et al., 2014). Therefore, choosing between a cheese that is perceived to be healthier but less tasty versus variants perceived to be more indulging but less healthy, represents a self-control dilemma between the goal to eat healthily and the goal to enjoy palatable foods. In sum, we hypothesize adding social proof cues to a healthy low-fat cheese increases healthy food choices, but only for participants low in self-control.

Cues that suggested that the low-fat cheese was the most frequently selected cheese by other customers at that supermarket were presented on banners at the point-of-sale. The sales of this cheese when the heuristic was present were compared to a control period when the heuristic was removed. Moreover, a state of low self-control was experimentally induced in the supermarket and compared to a high self-control condition. By for the first time manipulating ego-depletion outside the lab, in a representative community sample, we provide more insight into the generalizability and external validity of the ego-depletion effect.

The dependent variable was whether people bought the low-fat cheese or not. It is hypothesized that under conditions of low self-control, participants would more often buy the low-fat cheese when this cheese is associated with the social proof heuristic,

compared to when it is not. Under high self-control conditions we expect no effect of the heuristic.

2. Material and methods

2.1. Participants

All customers who visited the supermarket were potential participants. Participants who did not have the intention to buy cheese, who bought their groceries only for other people, or who did not get the target cheese from the shelves themselves, were excluded from the study. The final sample consisted of 127 participants¹ (28.2% men) with a mean age of 50.40 years ($SD = 10.97$; see [online Supplementary materials](#) for a flow diagram of participant inclusion).

2.2. Design

This study had a 2 (ego-depletion versus no depletion) \times 2 (social proof heuristic versus no heuristic) between-subjects design.

2.3. Procedure

The study took place at a Dutch supermarket. After passing the first shelves in the supermarket, participants were invited to take part in an experiment that was ostensibly about the influence of the time of the day on concentration levels. When they agreed to participate, participants first performed the ego-depletion task that was meant to induce a state of low self-control (or a control task; see ego-depletion manipulation) approximately 9 feet away from the cheese shelf, near the entrance of the supermarket. Participants then filled out a questionnaire that included a manipulation check of the ego-depletion task and some questions about their shopping behavior, including their intention to buy cheese. Participants were informed that after passing the cashiers their receipts would be requested. Thereafter, participants continued with the rest of their grocery shopping. About half of the respondents did their groceries in the supermarket when the social proof heuristic was associated with the low-fat cheese, suggesting that the particular low-fat cheese was the most sold brand of cheese in the supermarket. For the other half of the respondents, no heuristics were added to this cheese in the supermarket. After passing the cashiers, participants handed in their receipt, and completed a final questionnaire about the low-fat cheese, their healthy eating goal, and their demographic backgrounds. Finally, participants gave their email addresses, and were debriefed afterwards via email.

Participants were not randomized individually, because it was not feasible to expose participants to the heuristics in the supermarket on an individual basis. Instead, participants were cluster randomized by the time of day. Combinations of ego-depletion condition and heuristic condition (no depletion–no heuristic, $n = 41$, no depletion–heuristic, $n = 32$, depletion, no heuristic, $n = 26$ and depletion–heuristic, $n = 28$) were randomized over four days, such that each combination ran twice, once in the morning and once in the afternoon. Data were collected in a Dutch supermarket, in March 2013.

2.3.1. Ego-depletion manipulation

Self-control was manipulated by means of a speech control task. Participants were told that the task was about concentration, as

participants needed to focus to speak about themselves in a noisy supermarket environment. All participants were instructed to speak about themselves in a voice recorder for three minutes. In the ego-depletion condition, inducing a state of low self-control, participants were not allowed to say the words 'I' or 'uhm'. This task is expected to consume self-control resources, because people have to override their natural tendency to use these words. In the no depletion condition participants could speak freely about themselves, without any word restrictions (remaining high in self-control). Performance on a secondary self-control task has been shown to be impaired after completing the word restriction task in previous studies ([Janssen, Fennis, & Pruyn, 2010](#); [Muraven & Slessareva, 2003](#)).

2.3.2. Heuristic manipulation

In the heuristic condition, the social proof heuristic was associated with the low-fat cheese, using the following slogan: "Most sold in this supermarket", implying that most people who bought cheese in this supermarket bought this particular brand of cheese. This slogan was presented on a banner on the cheese shelf. Providing information about the majority of a reference group is an established way to manipulate social proof (e.g., [Goldstein, Cialdini, & Griskevicius, 2008](#)) and was used successfully before to study impulsive choices for health ([Salmon et al., 2014](#)). In the no heuristic condition, there was no heuristic presented next to the low-fat cheese.

2.4. Dependent measures

2.4.1. Manipulation check ego-depletion

As an indication of level of self-control after the ego-depletion manipulation, we asked participants 'How sharp/focused do you feel at this moment?', measured on a 7-point scale, ranging from 1 (*not at all*) to 7 (*very much*), adopted from the state self-control scale ([Ciarocco, Twenge, Muraven, & Tice, 2010](#)). We included only this question as manipulation check, because it would fit the cover story about concentration levels.

2.4.2. Ego-depletion task evaluation

The extent to which the ego-depletion task would be successful in reducing self-control, might be dependent upon the pleasantness of the task (e.g., a fun task might be less depleting than a boring task). In order to rule out that pleasantness of the task interfered with the ability of the ego-depletion task to induce a state of low self-control, such that the ego-depleting task was more fun and therefore less depleting, participants were asked to what extent they evaluated the task to be fun, boring and exciting. All questions were measured on a 7-point scale, ranging from 1 (*not at all*) to 7 (*very much*).

2.4.3. Purchase behavior

The dependent variable was whether participants bought the low-fat cheese or not, which was asked in the questionnaire that participants completed after the cashiers. This included standard sized prepackaged cheese as well as cheese from the fresh department for which people can choose the quantity of cheese themselves.

We aimed to conduct a second analysis with the quantity of low-fat cheese bought as dependent variable. After customers had passed the cashiers, we asked for their receipts, which specified the amount of money spent on the low-fat cheese. Ninety-one participants handed in their receipt, of which only 8 participants bought the low-fat cheese. Therefore, we did not have sufficient data to conduct a reliable analysis with the quantity of low-fat cheese bought as dependent variable.

¹ With an expected Odds ratio of at least 3 and a power of .80, a sample size of 127 is large enough to detect an effect ([Hsieh, 1989](#)).

Table 1
Descriptive statistics per condition.

	No heuristic–no depletion	No heuristic–depletion	Heuristic–no depletion	Heuristic–depletion
N	41	26	32	28
Gender	18.4% men (3 missings)	37.5% men (2 missings)	30% men (2 missings)	32% men (3 missings)
Age	49.24 (SD = 9.38) (4 missings)	46.33 (SD = 9.31) (2 missings)	52.7 (SD = 13.12) (2 missings)	53.26 (SD = 10.95) (3 missings)
Low education	10.50% (3 missings)	4.20% (2 missings)	10% (2 missings)	16% (3 missings)
Middle education	36.90%	20.80%	26.70%	40%
High education	52.60%	75%	63.30%	44%
Healthy eating goal	5.76 (SD = .75) (3 missings)	5.58 (SD = 1.10) (2 missings)	5.50 (SD = 1.17) (2 missings)	5.72 (SD = 1.06) (3 missings)
Habitual supermarket	95.10%	88.50%	96.90%	92.90%
Shopping list	73.20%	53.80%	62.50%	57.10%
Alone (versus with others)	75.60%	73.10%	71%	60.70%
Worked that day	26.30% (3 missings)	4.20% (2 missings)	13.30% (2 missings)	32% (3 missings)
Man. check: sharp/focused	4.07 (SD = 1.42)	3.69 (SD = 1.69)	4.34 (SD = 1.56)	3.68 (SD = 1.42)
Task evaluation: fun	4.20 (SD = 1.50)	4.62 (SD = 1.44)	4.22 (SD = 1.77)	5.00 (SD = 1.63)
Task evaluation: boring	3.22 (SD = 1.64)	2.64 (SD = 1.18) (4 missings)	3.25 (SD = 1.59)	2.57 (SD = 1.26)
Task evaluation: exciting	3.15 (SD = 1.71)	3.16 (SD = 1.95) (1 missing)	3.41 (SD = 1.41)	3.82 (SD = 1.61)
Other type of cheese bought	65% (1 missing)	66.70% (5 missings)	67.70% (1 missing)	66.70% (1 missing)
Low-fat cheese bought	19.50%	7.70%	12.50%	28.60%

2.5. Additional measures

2.5.1. Control variables

In order to control for possible confounding effects of participants' shopping habits and other behaviors prior to doing their grocery shopping, participants were asked in the questionnaire that was administered directly after the ego-depletion manipulation whether (a) this was their habitual supermarket or not, (b) whether they had a shopping list or not, and (c) whether participants did their grocery shopping alone or with others. Furthermore, in the final questionnaire after having passed the cashiers, participants were asked (d) whether they saw the banner with the social proof heuristic on it, and if they did, what text was on the banner, (e) whether they had worked that day or not, in order to control for possible upfront differences in levels of self-control, and (f) their healthy eating goal that was measured with one item, "To what extent do you have the goal to eat healthily?" on a 7-point scale ranging from 1 (*not at all*) to 7 (*very much*).

3. Results

3.1. Descriptives and randomization checks

Participants had a relatively strong goal to eat healthily ($M = 5.65$, $SD = 1.00$). Of the 127 participants, 10.3% completed lower education (primary school or lower levels of high school), 31.6% completed an average level of education (higher levels of high school, or lowest level of vocational education) and 58.1% completed higher education (highest level of vocational education or university). For 93.7% of the participants, the supermarket was their habitual supermarket, 70.6% did their groceries alone, 63% had a shopping list, and 19.7% of the participants had worked that day. Furthermore, 23.3% of the participants in the social proof heuristic condition reported to have seen a banner with the low-fat cheese, but only 3.3% of the participants in this condition correctly reported what was on it. Finally, 17.3% of the participants bought the low-fat cheese (of this 17.3%, 13.6% also bought another brand of cheese), 59.8% only bought another brand of cheese, and 16.5% did not buy any cheese, despite their intention to buy cheese

(6.3%, had missing data on whether they bought another type of cheese; see Table 1 for an overview of descriptive statistics per condition).

Two separate ANOVA's with age ($F(3,112) = 2.32$, $p = .079$, $\eta^2 = .06$) and education level ($F(3,113) = 2.15$, $p = .098$, $\eta^2 = .05$) as dependent variables revealed marginal significant differences between conditions.² Furthermore, a separate ANOVA with goal to eat healthily ($F < 1$, $p = .715$) as dependent variable did not reveal any significant differences between conditions. Moreover, three separate Chi-Square tests with condition as independent variable and gender ($\chi^2(3, N = 117) = 3.05$, $p = .385$), whether participants did their groceries alone or accompanied by others ($\chi^2(3, N = 126) = 1.89$, $p = .595$), and whether they had a shopping list or not ($\chi^2(3, N = 127) = 3.17$, $p = .366$) as dependent variables, did not reveal any differences between conditions. Furthermore, for participants in the social proof condition, a separate Chi-Square test with ego-depletion condition as independent variable and whether participants saw the banner or not ($\chi^2(1, N = 60) = .88$, $p = .348$) as dependent variable, did not reveal any differences between conditions. Due to a violation of assumptions in the Chi-Square tests of possible differences between conditions in habitual supermarket, and in whether participants worked that day, we separated the Chi-Square tests in order to measure possible differences between heuristic conditions and ego-depletion conditions in whether this was participants' habitual supermarket, and in whether participants worked that day, by four separate Chi-Square tests. Participants in the depletion versus the no depletion condition did not differ in whether this was their habitual supermarket ($\chi^2(1, N = 127) = 1.40$, $p = .238$), and whether they worked that day ($\chi^2(1, N = 117) = .09$, $p = .766$). Participants in the heuristic versus no heuristic condition also did not differ in whether this was their habitual supermarket ($\chi^2(1, N = 127) = .33$, $p = .568$), and whether they worked that day

² Since age and education level differed marginally significantly between conditions, we conducted the main logistic regression analysis with age and education level added as covariates. There were no significant effects of age ($p = .607$, 95% CI [.94, 1.04]), education level ($p = .759$, 95% CI [.73, 1.55]), depletion ($p = .338$, 95% CI [.08, 2.41]) and heuristic ($p = .758$, 95% CI [.20, 3.23]) on whether participants bought the low-fat cheese or not, and the interaction between ego-depletion and heuristic becomes insignificant (Odds ratio = 6.11, $p = .113$, 95% CI [.65, 57.21]).

($\chi^2(1, N = 117) = .31, p = .580$), indicating a successful randomization of participants.

None of the control variables were significantly associated with whether participants bought the low-fat cheese or not (all p 's > .129, N varying from 116 to 127).

3.2. Manipulation checks and task evaluation

An ANOVA with depletion condition as the independent variable, and level of state self-control as dependent variable showed a marginally significant difference between depletion conditions in state self-control after the depletion task. Participants in the ego-depletion condition reported a marginally significant lower level of self-control after the ego-depletion manipulation ($M = 3.69, SD = 1.54$) than participants in the no depletion condition ($M = 4.19, SD = 1.48; F(1,125) = 3.52, p = .063, \eta^2 = .03$), suggesting that the ego-depletion manipulation was relatively successful in inducing a state of low self-control.

Furthermore, a MANOVA showed a significant effect of ego-depletion condition on task engagement, $F(3,119) = 2.69, p = .049, \eta^2 = .06$, which was driven by two significant effects of ego-depletion condition on how much fun and how boring participants evaluated the task. Participants in the ego-depletion condition evaluated the task to be less boring ($M = 2.60, SD = 1.21$), than participants in the no depletion condition ($M = 3.23, SD = 1.60; F(1,121) = 5.60, p = .020, \eta^2 = .04$), and more fun ($M = 4.80, SD = 1.56$) than participants in the no depletion condition ($M = 4.21, SD = 1.62; F(1,121) = 4.12, p = .045, \eta^2 = .03$). There was no difference in how exciting participants evaluated the task to be ($p = .360$). So, even though the ego-depleting task was more fun and less boring compared to the non-depleting task, participants who performed this task were lower in self-control than participants who performed the non-depleting task.

3.3. Purchase behavior

A logistic regression analysis with ego-depletion, heuristic, and their interaction as predictors, revealed a (marginally) significant interaction between ego-depletion and heuristic (Odds ratio = 8.15, $p = .051, 95\% \text{ CI } [0.99, 67.11]$), on whether participants bought the low-fat cheese or not. Please notice the large confidence interval of the Odds ratio of the interaction parameter, as a consequence of the small subsample of the total sample that bought the low-fat cheese. The main effects of ego-depletion ($p = .201, 95\% \text{ CI } [0.07, 1.77]$) and heuristic ($p = .426, 95\% \text{ CI } [0.16, 2.17]$) were insignificant. As illustrated in Fig. 1, participants in the depletion condition (who were thus low in self-control) marginally significantly more often bought the low-fat cheese (28.6%) in the presence of the social proof heuristic, compared to when no heuristic was available (7.7%; Odds ratio = 4.80, $p = .064, 95\% \text{ CI } [0.91, 25.23]$). In the no depletion condition, there were no differences in whether participants bought the low-fat cheese between the social proof (12.5%) and the no heuristic condition (19.5%; $p = .426, 95\% \text{ CI } [0.16, 2.17]$).

Importantly, the majority of the participants who bought the low-fat cheese bought *only* this brand of cheese (86.4%; 3 participants who bought another cheese brand in addition were spread over three conditions). This suggests that the social proof heuristic did not persuade them to buy more cheese, but to buy a healthier low-fat cheese *instead* of a regular cheese brand.

4. Discussion

The present findings demonstrate that adding social proof cues to a healthy product in the supermarket facilitates healthy choices

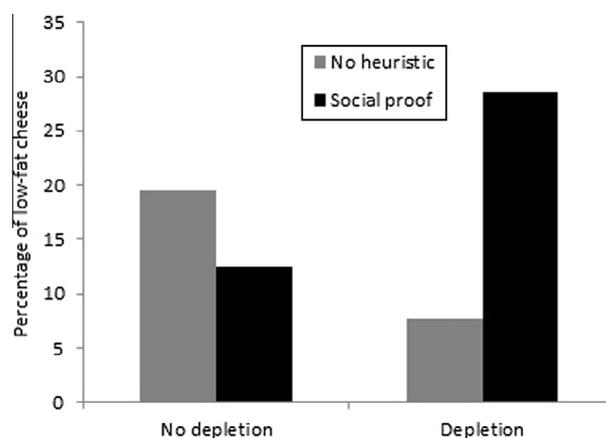


Fig. 1. The interaction of ego-depletion and heuristic on whether participants bought the low-fat cheese.

for those who are in a state of ego-depletion. Specifically, depleted individuals who rely on intuitive, impulsive and automatic decision making, seemed to follow the social proof cues that made the healthier choice (low-fat cheese in this study), the easy choice. They were more likely to buy a low-fat cheese when this cheese was associated with the heuristic of social proof. Thus, the results of this study demonstrate that under certain circumstances, a low level of self-control may actually be used to benefit choices for healthy products. Importantly, compared to other banners in the cheese shelf, it was unlikely that our banner attracted more attention. We can therefore be quite confident that the effect on food choice under low self-control conditions is caused by social proof instead of other factors such as salience.

The present results are in line with previous studies in laboratory settings among college samples (Fennis et al., 2009; Salmon et al., 2014). However, to our knowledge, this is the first study to demonstrate this principle in the challenging environment of a real supermarket, where people make real choices and where actual food temptations and influence techniques pointing towards other attractive (but often unhealthy) products are available. Moreover, it is the first study to demonstrate this principle in a representative community sample differing in age, health goals and education levels, underlining the generalizability and external validity of our findings.

Whereas we found an effect of the heuristic for depleted participants, such that they made more healthy choices when the social proof heuristic was available, compared to when it was not, in the present study we did not demonstrate a negative effect of low self-control on healthy food choices nor a positive effect of high self-control, when there was no heuristic present. When there was no heuristic available, participants who were high in self-control did not buy the low-fat cheese more often, and did not buy more of the low-fat cheese compared to participants who were low in self-control. Whereas in previous research that demonstrated effects of self-control on food choices participants could choose between one healthy and one unhealthy option (e.g., Wang et al., 2010), in the present research not choosing the healthier option does not necessarily imply making an unhealthy choice, as participants could choose any other healthy or unhealthy product instead of the low-fat cheese. Participants high in self-control may have deliberately decided not to buy any cheese at all, or buy another product instead (e.g., 16.5% of all participants did not buy cheese, despite their intention), which may explain why we did not demonstrate an effect of self-control on food choice in the no heuristic condition.

Importantly, the absence of a heuristic effect in the high self-control condition does not necessarily mean that people high

in self-control made more deliberate food choices, compared to people low in self-control. Rather, these findings only suggest that people with sufficient self-control resources did not follow the heuristic cue, whereas people with depleted self-control resources followed this cue. People high in self-control may as well habitually have chosen another type of cheese, without any cognitive elaboration involved.

Furthermore, we did not find a main effect of the social proof heuristic on whether participants bought the low-fat cheese or not, which is in contrast to previous research that demonstrated main effects of heuristics on actual behavior (e.g., [Cialdini, 2009](#); [Goldstein et al., 2008](#)). A possible explanation may be that in previous studies on the influence of heuristics, the investigated behavior did not immediately require the exertion of self-control. In research on the effects of social proof on towel reuse in hotels ([Goldstein et al., 2008](#)), the choice between having the towels refreshed or reusing them, seems to be less dependent on self-control as there is no immediate self-relevant conflict when someone considers to not reuse the towels. The option to have the towels refreshed, may not be as salient and attractive as the tempting food products available in the present study, and therefore it may not consume that much self-control resources to resist the more tempting option (refreshing the towels) and choose the long term beneficial option instead (reusing them). In the present study, participants high in self-control may have experienced a self-control conflict between the goal to eat healthily and the goal to eat palatable foods. These participants may have chosen the tempting option deliberately, for instance by making up reasons to indulge as a self-license to justify their food choice ([De Witt Huberts, Evers, & De Ridder, 2012](#)), which may explain the absence of a social proof effect in the high self-control condition.

The current findings contribute to several new lines of research suggesting that people do not necessarily need a high level of self-control in order to be able to make choices that are beneficial in the long run. Whereas previous research and interventions in health behavior typically aimed to increase level of self-control, several recent studies suggest that low self-control may be beneficial for healthy eating behavior. Low self-control may for instance lead to positive outcomes when people possess adaptive habits ([Neal, Wood, & Drolet, 2013](#)), as these can influence behavior automatically, by triggering behavior in reaction to a cue or situation. Furthermore, the concept of nudges also suggests that individuals do not need self-control in order to behave in a long term beneficial way. For instance, when good tasting snacks foods are made less accessible, by simply placing them at a further distance, people eat less of these foods, compared to when they are placed closer to people ([Maas, De Ridder, De Vet, & De Wit, 2012](#)). Finally, environmental cues making dieting goals salient may lead to healthy outcomes without cognitive elaboration. For instance, under cognitive load, people consumed less of a tasty milkshake when cues in the environment made their diet salient, by compared to when the food itself was made salient ([Mann & Ward, 2004](#)). Similarly, people do not need self-control resources when following heuristics, as these will direct people mindlessly to the desired outcome.

Albeit the speech task has been used successfully in previous lab experiments as an ego-depletion manipulation ([Janssen et al., 2010](#); [Muraven & Slessareva, 2003](#)), the supermarket environment may have distracted participants from the task, and may have reduced the ego-depletion effect. Nevertheless, regardless of participants reporting the ego-depleting task to be more engaging in the ego-depletion condition, the difference in reported state self-control was marginally significant, and ego-depleted participants were more sensitive to the social proof heuristic, compared to participants who were not depleted.

Besides consuming more self-control resources, ego-depleting tasks frequently also seem to be less engaging and less fun

compared to their corresponding non-depleting tasks. This may contribute to the ego-depletion effect, such that more annoying and boring tasks are also more depleting ([Laran & Janiszewski, 2011](#)). In the present study however, the ego-depleting task was perceived to be *more* engaging compared to the non-depleting task. This could suggest that the manipulation was still successful in depleting participants, as participants in the ego-depletion condition reported a marginally significant lower level of focus and concentration compared to participants in the no depletion condition, indicating a lower level of state self-control. This would contribute to the ecological validity of our ego-depletion task, as in real life ego-depleting tasks and situations do not seem to be less engaging per se.

On the other hand, the present manipulation check does not allow us to rule out possible alternative explanations for the reported lack of focus and concentration and the found effect of the ego-depletion manipulation on heuristic decision making. Instead of strictly having induced an actual ego-depletion effect, the speech task in the present experiment may have rather induced a state of reduced cognitive processing. Participants in the ego-depletion condition evaluated the speech task to be more fun and less boring compared to participants in the non-depletion condition. This may in turn have affected their level of positive affect, such that participants who completed the ego-depletion task experienced higher levels of positive affect, compared to participants who completed the non-depleting task. Similarly to conditions of ego-depletion, a state of positive affect is related to an increase in system 1 reasoning, and the reliance on heuristic forms of decision making ([Aspinwall, 1998](#)). Rather than an actual ego-depletion effect, an increase in heuristic processing as a consequence of experiencing positive affect, may explain the found effects on heuristic decision making and healthy food choices.

Related to this point, the manipulation check of the ego-depletion manipulation, existing of a single item, concerns a limitation of the present research. As this item nicely concurs with the cover story that was presented to participants stating that the experiment was about the influence of the time of the day on concentration levels, we chose to use this specific item. Whereas this item is one of the central items in the state self-control questionnaire developed by [Ciarocco et al.](#), which aims to assess a state of ego-depletion by self-report, future studies should include a manipulation check that measures multiple facets of ego-depletion to reliably measure a state of ego-depletion.

The distribution of gender was slightly skewed in the present study, such that more women than men participated. However, women more often do grocery shopping compared to men, so, regarding gender the present sample seems to be a representative sample of the grocery shopping population. Furthermore, we did not find any differences in gender between conditions ($p = .39$), indicating that gender probably does not influence the effects of depletion and heuristic on the amount of low-fat cheese bought.

Since age and education level differed marginally significantly between conditions, we controlled for these variables in our main analysis. When including these variables as covariates to the logistic regression, the interaction between depletion and heuristic on buying of the low-fat cheese becomes insignificant. This may be due to a lack of power, resulting from the inclusion of more predictor variables ([Cohen, 1992](#)). Logistic regression analyses are generally low powered when the distribution of the dichotomous variable is unequal (e.g., many more people did not buy low-fat cheese compared to those who did) and adding independent variables to the model lowers its power even further.

One may question to what extent the healthy choice option (i.e., cheese) in the present study constituted an actual healthy choice given the mixed messaging in popular media, emphasizing on the one hand the salt and fat content of the product, but it's rich

nutrient and protein content on the other. However, cheese is included in the nutritional recommendations in many countries in Europe, Africa, America and Asia (Muehlhoff, Bennett, & McMahon, 2013), indicating it fits within a healthy diet. Notwithstanding the discussion, the cheese used in the present study is a relatively healthier option within the product category. And even more important for the present study, low-fat cheese is indeed perceived by consumers to be healthier, yet less tasty than regular cheeses (Temminghoff & Paulussen, 2012).

An important practical implication of our findings is that heuristics can be implemented relatively easy in the supermarket environment, by showing information about other's behavior. This simple strategy stands in sharp contrast with more radical changes in the environment that are proposed by public health policy makers, such as taxes on unhealthy foods, or banning unhealthy foods from the environment (Faith, Fontaine, Baskin, & Allison, 2007). In the present research, social proof cues were displayed at the point-of-sale using a simple shelf banner, which use is already common practice in retail environments, emphasizing the relatively easy implementation of this technique.

Importantly, heuristics should be applied ethically. Information presented by social proof (or other) heuristics should be based on true facts. Since in many cases people seem to favor unhealthy products, marketers should be creative in communicating social proof while avoiding to deceive people. For example, social proof information could relate to a relative number of individuals buying the product. Instead of stating that 'most consumers in this supermarket bought this cheese', one could state that 'growing numbers of consumers chose low-fat cheese'. Social proof messages can also be framed differently, for instance by mentioning absolute (large) sales numbers, such as 'this week 3000 people bought [product A]'. Alternatively, social proof heuristics may also be more subtly embedded in the physical environment, by for instance leaving empty wrappers of a particular product (Prinsen, De Ridder, & De Vet, 2013) or varying in supply on shelves (Parker & Lehmann, 2011). Moreover, we can also think of other heuristics that can be manipulated, as there is no reason to believe the current effect is limited to the social proof heuristic. An example is the authority heuristic, which can be induced by promoting the product by an authority in the field of healthy foods.

4.1. Future research

Future research should point out *how* heuristics influence food choices under conditions of ego-depletion. According to recent insights ego-depletion may be driven by a temporary shift in motivation and attention (Inzlicht & Schmeichel, 2012). After exerting self-control on an initial task, one's motivation may shift from inhibiting impulses and deliberate control to approaching desires and instant gratification. Attention then becomes more focused on rewarding cues, instead of on restriction (Inzlicht & Schmeichel, 2012; Inzlicht, Schmeichel, & Macrae, 2014). However, a heuristic cue pointing towards a healthy product may reduce attention on gratifying cues and may induce a focus on the healthy product instead. This in turn may cause a decrease in desire for the attractive option, or an increase in desire for the healthy option, which may affect actual food choices.

The present study provides some indication of the extent to which the social proof heuristic influences people in a mindless way, without much cognitive elaboration. A minority of the participants in the social proof condition reported to have seen the banner (23.3%) and even fewer participants (3.3%) correctly remembered the text on the banner ('most sold in this supermarket'), suggesting that participants did not deliberately take this information into account. Indeed, heuristics are defined as simple decision rules that reduce the effort of making a decision by

strongly simplifying the decision making process (Gigerenzer & Gaissmaier, 2011; Shah & Oppenheimer, 2008), suggesting that heuristics can be followed without much cognitive elaboration. Exerting cognitive effort in making a decision may even disrupt the influence of a heuristic, as people may deliberately take the heuristic information into account in weighing the advantages and disadvantages of several options, instead of mindlessly following a simple decision rule. Future research should investigate to what extent cognitive elaboration disrupts the influence of a heuristic.

All in all, the present findings suggest that people can be subtly influenced towards making healthy food choices, by associating heuristics with healthy products in the supermarket. Since the majority of food choices are made under low self-control conditions, this seems to be a promising method to provoke impulsive healthy choices in the field.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.foodqual.2015.06.004>.

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