



PROMOTING HEALTHY FOOD CHOICES UNDER CONDITIONS OF LOW SELF-CONTROL

NUDDING THROUGH THE PERSUASIVE DESIGN OF THE ENVIRONMENT

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ABSTRACT

Food choices are often made mindlessly, when individuals are not able to exert self-control, for example when they have limited time, when they are in a hurry, are tired or when it is crowded. Under low self-control conditions, people often favor food products that are convenient to obtain, however, these products mostly are unhealthy. Instead of fighting against low self-control to reduce unhealthy food choices, this study tries to demonstrate that heuristic decision tendencies can be exploited under conditions of low self-control. In this study we use a food-ordering app to examine if the success of environmental cues that promote healthy food choices, also occurs in a technological device context. To do so healthy products are associated with a social proof heuristic, referring to the tendency to adopt the option preferred by the majority of the public. Besides the social proof heuristic, healthy food options are more convenient to select and to order in the food-ordering app and presented as the default and most straightforward option. This study uses a 2 (self-control: low vs. high) x 2 (social proof heuristic vs. no heuristic) x 2 (convenience heuristic vs. no heuristic) between-subjects design. A state of low self-control is experimentally induced by a cognitive busyness task. To examine the effect of heuristics on healthy food choices in a more technical situation, a usability research context offers background for the research and provides a "cover story" which falsely describes the purpose of the study. The food options are displayed by images of a food-ordering app. The assumption that heuristics can help individuals to choose the better option and that the level of self-control moderates this tendency, is not confirmed in this study, due to the lack of results and contradictory findings. Lack of results is partly due to the insufficiency of the cognitive busyness task and the convenience heuristic. Other factors were; the explicit cue used in the social proof heuristic that made participants reactant and the usability research context that made participants unwillingly critical, which influenced the decision-making processes in such way that this decision-making contains processes, which are more likely to be consciously monitored and deliberately controlled. Although this study does not verify the expected effects, it does provide a unique contribution to the understanding of self-control in combination with influence heuristics.

Keywords: self-control, ego-depletion, cognitive load, heuristics, social proof, food choice, convenience

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1 | INTRODUCTION

On the one hand, people are highly concerned about their weights, but on the other hand, people are getting heavier and heavier. Despite their good intentions to eat healthier, they choose tempting unhealthy food instead of healthy options without even thinking of it. It is the 'without thinking' aspect that makes this behavior particularly difficult to change: (unhealthy) food choices are often made mindlessly (Wansink, 2010). This typical mindless eating behavior means that many food choices are not based on rational considerations but are rather driven by impulsive tendencies (Kroese, Marchiori & De Ridder, 2015). An example of this impulsive behavior is that people tend to eat whatever is most salient. Recognizing the mindless nature of many food decisions, it has been suggested that attempts to increase healthy eating should not focus on convincing people what is the right food choice but rather aim to adjust the environment such that people are automatically directed toward healthy and better choices (Kroese et al., 2015). Due to growing empirical evidence for the strong environmental influence on overeating and excess weight gain, environmental approaches are increasingly being recommended as offering important potential for improving eating habits (Van Kleef, Otten & Van Trijp, 2012). This growing empirical evidence and the mindless nature of many food decisions make the question imperative of how food choices are actually made and what potential exists to change behavior in the direction of healthier options at point-of-choice settings, in order to support individuals in their choices.

Examples of typical settings in which people make quick and mindless decisions of food are public transport stations or canteens and lunchrooms in schools or at work. These used to be generally regarded as 'dangerous circumstances' in the sense that people would be easily tempted to discard their health goals and indulge in unhealthy food (Kroese et al., 2015). It is often suggested that people are more prone to succumbing to unhealthy food choices when they are low in self-control (Salmon et al., 2015), for example when they are exposed to tempting snack foods at the canteen after doing tedious tasks at work, or in the kiosk at the train station on their way home. The impulsive choice under low self-control conditions can become a healthy one, by associating the healthy option with a heuristic (Salmon, Fennis, De Ridder, Adriaanse & De Vet, 2014). These heuristics are simple decision rules that simplify the decision-making process.

Increasingly, efforts are made to reshape the environment in which consumers make their food decisions. Recently, the concept of nudging has become very popular in this respect (Van Kleef et al., 2012). Nudging as a strategy to influence behavior was first coined by Thaler and Sunstein. Thaler and Sunstein (2008) propose that efforts to change people's behavior for the better can improve if one recognizes the innate power of intuition with regards to decision-making. The concept 'nudging' consists of interventions in which a choice is presented and aims to make beneficial choices (from a consumers' perspective) more appealing (Van Kleef et al., 2012). These interventions can be seen as simple, easy to implement and inexpensive. A key characteristic of nudging is that individuals maintain their liberty of choice. Interventions are intended to support people in making a beneficial choice and do not ban other choices (e.g., junk food). Examples of

nudge-oriented interventions within the healthy eating domain are: putting fruit at eye level, traffic-light labels (green, yellow, red) to indicate the healthiness of food products, and making healthy options more attractive (for children Dinosaur Trees are more exciting and taste better than broccoli). Another way to influence the impulsive choice is by associating the healthy option as the 'default', the most salient and most straightforward option (Kroese et al., 2015). Examples of interventions, which are appropriate for this purpose are: making group norms salient (e.g., salient statistical information about the food choice of a relevant reference group), and making the healthy option the convenient choice (e.g., convenient to see, to find, to grab or select, and to eat).

Previous research of inter alia Kroese et al. (2015), Salmon et al. (2015), Van Kleef et al. (2012), Hanks, Just, Smith and Wansink (2012), confirmed a success when promoting healthy food choices by nudge-oriented interventions. These interventions were all related to repositioning of food products; shelf arrangement and assortment structure at cash register desks and supermarkets, and arrangement of lunch lines in cafeterias. In these researches physical settings were used to implement the intervention, such as kiosks at train stations, school canteens and supermarkets. This research uses a nudge-oriented intervention to promote healthy food choices, but approaches a different setting and uses apps on smartphones to implement the intervention. Due to growing role of information technology in people's daily decision-making (Lee, Kiesler & Forlizzi, 2011), environmental approaches (as important potential for improving eating habits) are not the only concern; innovations in the design of technological device-displays are more and more important. Therefore, the intervention in this study is translated into innovations of app displays.

Mobile phone technologies offer an innovative way for consumers to access all manner of information (Dunford et al., 2014). Since the growing role of information technology in people's daily decision-making, smartphone "apps" are a powerful tool for public health promotion (Gilliland et al., 2015). Smartphones present an excellent opportunity to advance the work of behavioral economics theory because of the sheer volume of users, and the frequency with which people use this technology (Gilliland et al., 2015). Smartphones, and food-ordering apps in particular, provide the opportunity to reshape consumer habits by making healthy decisions "easy" through a commonly used product (Gilliland et al., 2015). Besides that, this ubiquity provides a major opportunity to influence behavior, typically at a lower cost of implementation compared to other technologies (Gilliland et al., 2015). In this study we use a food-ordering app to examine if the success of influence tactics that promote healthy food choices (such as self arrangement or traffic-light labels), also occurs in a technological device context. To examine the effect of our intervention (in conditions of low and high self control) on healthy food choices in a more technical situation, a usability research context will create background for this research. This usability research context provides a "cover story" which falsely describes the purpose of the study, and makes it possible to examine the situation in a technological device context.

Instead of fighting against low self-control, this study aims to exploit the low self-control conditions under which most food choices are made. Chances for health promotion might be substantially

improved when the default state of reduced self-control is accepted and exploited rather than challenged and fought (Salmon et al., 2014). This asks for examining strategies that rely on the properties of decision-making under low self-control conditions for their effectiveness (Salmon et al., 2014). This is the key objective of the present research. More specifically, we argue that a low level of self-control does not by definition have to result in unfavorable choices. Rather, we propose that whether food decisions will be healthy or unhealthy under these conditions depends on external cues available in a situation. Low levels of self-control make individuals more impulsive and more prone to external, environmental cues (Salmon et al., 2014). This does not have to be disadvantageous; on the contrary external cues can be designed to help individuals in making healthier choices. When such cues prompt the individual to make more healthy decisions, low levels of self-control result in an impulsive adoption of healthy choices (Salmon et al., 2014). We attempt to make the healthy option the impulsive one by associating it with an external salient cue, in the form of an influence heuristic. In this study healthy food choices are promoted by the use of a social proof heuristic (that convey majority endorsement for certain food products) and by making the healthy food option, the convenience choice (e.g., convenient to see, to find, to select in the app, and to order). The present research aims to investigate the impact of social proof, with the use of a heuristic that promotes healthy food choices, and convenience in selecting and ordering healthy food options, in conditions of low self-control and high self-control. Instead of examining the effect of the heuristics in physical settings, this research examines the situation in a technological device context, whereby a usability research context will offer background and a cover story. This study will extend previous work (Kroese et al., 2015; Salmon et al., 2015; 2014; Van Kleef et al., 2012; Hanks et al., 2012; Wansink, 2010) by offering an innovative translation of the situation (the effect of heuristics on healthy food choices in conditions of low self-control and high self-control) into a modern technical context.

2| THEORETICAL FRAMEWORK

Nudging is a concept regarding behavioral change that takes into account the power of cues and (indirect) suggestion the influence of our subconscious upon decision-making. Thaler and Sunstein (2008) propose that efforts to change people's behavior for the better can improve if one recognizes the innate power of intuition with regards to decision-making. They define a *nudge* as: "Any aspect of choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives" (Thaler & Sunstein, 2008, p. 6). Nudges help people to make the right choice, for example throwing your trash into a trashcan, or taking the stairs instead of the elevator. Nudging can also help people making better and healthier decisions when it comes to food.

Worldwide, overweight and obesity have become a major public health problem, as they constitute a considerable risk for many chronic diseases (Berghöfer et al., 2008). One of the causes of overweight and obesity has to do with snacking. Over the past decades, the number of snacking occasions per day and the energy density of snacks have increased substantially (Piernas & Popkin, 2010). These kinds of food choices are often made mindlessly (Wansink, 2010). Standard approaches to overweight and obesity reduction assume that individuals' food-related behavior is carried out via the rational decision-making process (Just & Payne, 2009). This rational decision-making process ignores the fact that people often choose (almost) unconsciously (Dijksterhuis, Smith, Van Baaren & Wigboldus, 2005). Jeffery, Pirie, Rosenthal, Gerber and Murray (1982) stated in their research that shoppers failure to make healthy food choices might not be due to lack of knowledge, as shoppers already possess much of the information they are needed. Still when people have the knowledge to make healthier food choices, they do not behave towards this knowledge.

2.1 THE RATIONALITY OF PEOPLE

Behavior is not solely a rational, conscious process; decision-making is undertaken without conscious control (Köster, 2009). According to the dual process theory, a phenomenon can occur in two different ways, which is a result of two different processes. Kahneman (2003) states that decision-making could be split in two different processes: one site intuitive, the other rational. *Intuition* (or System 1) is characterized by operations that are "*fast, automatic, effortless, associative, implicit and often emotionally charged; they are also governed by habit and are therefore difficult to control or modify*" (Kahneman, 2003, p. 698). This system is also referred as our Automatic System. *Reasoning* (or System 2) contains decision-making processes, which are "*slower, serial, effortful, more likely to be consciously monitored and deliberately controlled; they are also relatively flexible and potentially rule governed*" (Kahneman, 2003, p. 698). This system is also called the Reflective System and monitors the quality of mental operations and overt individual behavior. This system is not able to monitor the quality of decision all the time; rather humans' ability to think rational is disrupted under conditions of multi-tasking, under time pressure, through emotions or even

according to what time of day it is. Under these conditions then the Automatic System will operate to make a decision, instead of the Reflective System (Kahneman, 2003).

2.2 MINDLESS EATING BEHAVIOR

Every day, environmental factors such as the visibility, size, and accessibility of food may be contributing to an ever-widening obesity problem in developed countries (Wansink, 2010). Recognizing the mindless nature of many food decisions, it has been suggested that attempts to increase healthy eating should not focus on convincing people what is 'right' but rather aim to adjust the environment such that people are automatically directed toward healthy and better choices (Kroese et al., 2015)

As Wansink (2010) illustrates in his research, people are largely unconscious of what influences our eating. Consumption can be unknowingly influenced by environmental cues (Wansink, 2010). For instance, the number of items in an assortment, the size of your plate, the music in the supermarket, the words on the label, or the eating behavior of a dinner companion may serve as a reference point that a person uses to gauge how much they should eat or drink, (Wansink, 2010). Similarly, large packages, serving bowls, and even pantry arrangements can all increase how much a person serves and consumes by 15–45% (Wansink, 2010). Mindless eating behavior is related to external eating, which is eating in response to external cues, not considering internal states of hunger and satiety (Alberts, Thewissen & Reas, 2012). External eating has to do with people's automatic system, which can be influenced by the level of self-control (Crescioni et al., 2011).

2.3 SELF-CONTROL

Another aspect that influences our eating behavior and has to do with mindless decisions is self-control (Crescioni et al., 2011). Self-control can be defined as "the exertion of control over the self by the self. That is, self-control occurs when a person (or other organism) attempts to change the way he or she would otherwise think, feel, or behave" (Muraven & Baumeister, 2000, p. 247). Self-control has been defined as the process of deliberately modifying or overriding one's prepotent responses (Baumeister, Muraven & Tice, 2000). It refers to human executive functioning and may be seen as one of the human beings' most useful abilities as it allows people to overcome unfavorable response tendencies that would hinder them from attaining a valuable goal (Bertrams, Baumeister, Englert & Furley, 2015). Evidence suggests that self-control is helpful in, *inter alia*, resisting unhealthy impulses to eat fattening food or drink alcohol (Crescioni et al., 2011). Self-control is related to motivational conflicts, such as resisting pleasurable temptations like unhealthy food or snacks (Crescioni et al., 2011). When individuals need to regulate their behavior, for instance when dieting, they are much more inclined to focus on healthy food. After an initial act of self-control, subsequent self-control is impaired (Bertrams et al., 2015). The implication of this work is that a limited resource akin to strength was depleted by exerting self-control in the first task, thereby leaving less resources for the second task. Self-control strength refers therefore to limited resource.

Food decisions are often made mindlessly in an impulsive way, when individuals have low self-control and consequently are unable to exert the effort to warrant a well-considered, balanced decision (Bertrams et al., 2015). It is often suggested that people are more prone to succumbing to unhealthy food choices when they are low in self-control (Salmon et al., 2015), for example when they are exposed to tempting snack foods at the canteen after doing tedious tasks at work, when feeling emotional or in the kiosk at the train station on their way home. According to Wang, Novemsky, Dhar and Baumeister (2010) low self-control only predicts unhealthy food decisions when the food choice represents a self-control conflict between a palatable option that is immediately gratifying and a healthy option that is beneficial in the long term.

Several studies demonstrated that behaviors and cognitions of people whose self-control strength had been depleted relied on their automatic and implicit response tendencies rather than on executive control (Bertrams et al., 2015). If self-control strength is relatively high, chances are good that the automatically activated responses from System 1 will be overridden by self-control and would bring little or no damage to cognitive performance. If self-control strength has previously been depleted, the responses will impair cognitive performance (Bertrams et al., 2015). The implication is that when self-control is at full strength, it can override the automatic impulse to make an unhealthy food decision, but ego-depletion reduces top-down control and allows the automatic preferences to guide behavior (Bertrams et al., 2015). Heuristics, such as social norms, thereby, provide an automatic and “easy way out” for individuals who are low in self-control.

The default interventionism framework (Evans & Stanovich, 2013) offers a basis for the hypothesis that self-control strength would moderate the effect of heuristics on healthy food decisions. As this theory suggests, a stimulus in the environment can trigger a response, which affects behavior in a largely automatic way. However, if the triggered response is unwanted or inappropriate, it can principally be overridden by cognitive control mechanisms. The automatic and mostly unconscious operations of associative memory, which is referred as System 1, generate response tendencies in a given situation (Bertrams et al., 2015).

Considering previous work (Bertrams et al., 2015; Wang et al., 2010) we assume that level of self-control moderates the effect of heuristics on the number of healthy food choices. Wang et al. (2010) assume that low self-control only predicts unhealthy food decisions when the food choice represents a self-control conflict between unhealthy but tasty/palatable looking food and healthy but less tasty looking food. We manipulated whether or not the food choice represents a self-control dilemma (thus, the choice between unhealthy but tasty looking food and healthy but less tasty looking food). Half of the decisions are trade off food choices representing a self-control conflict between healthy but less tasty looking options and tasty looking but unhealthy options, whereas the other half represents food choices between healthy and unhealthy food products that are equally tasty looking and, therefore, do not consume self-control resources (Salmon et al., 2014). Based on the

assumption of Wang et al. (2010), we expect that the proposed effects would only occur in case of trade-off choices that represent that self-control dilemma.

2.4 SOCIAL PROOF

Under conditions of low self-control, individuals are prone to use impulsive decision-making strategies, such as relying on salient cues or heuristics (Salmon et al., 2014). Heuristics are quick and simple decision-rules and can be seen as quick guides to action.

In his book Cialdini (1984) explains how automatic response patterns can be triggered, even with erroneous cues (heuristics). He came up with is a list of six principles for persuasion, what he calls, 'Weapons Of Influence'. Social proof is one these principles and is a phenomenon where people assume the actions of others in an attempt to reflect correct behavior for a given situation. People view a behavior as more correct in a given situation to the degree that we see others performing it (Cialdini, 1984).

Each of the principles can be translated into simple influence tactics. The social proof heuristic can be translated into a tactic making group norms salient. Social proof heuristics can be formed as social norms that represent normative cues that convey majority endorsement for certain food products. Examples of social proof heuristics are calling a certain product the 'best-selling' product or banners containing a message at the point-of-sale. Other ways of social proof heuristics are for example polls that show the outcome of a voting round or a statistical figure that shows the division of a certain opinion.

In his article Wansink (2015) states that the industry effectively can suggest norms. Whereas government's approach in suggesting norms has often been top-down and prescriptive, industry's approach of simply changing package sizes (the 100-calorie pack) or packaging (resealable bottles) led to new consumption norms and reduced intake (Wansink, 2015). Influencing normative behavior is the easiest, quickest, and most productive way to change consumer behavior (Wansink, 2015).

Social norms have been found to be positively associated with healthy and unhealthy food intake (Lally, Bartle, & Wardle, 2011), intentions to consume healthy foods (Smith-McLallen & Fishbein, 2008) and adopting a healthy diet (Yun & Silk, 2011). Social norms have been found to predict intentions to consume healthy foods and pursue a healthy way of eating (Smith-McLallen & Fishbein, 2008). The focus theory of normative conduct (Cialdini, Reno, & Kallgren, 1990) posits that norms affect human behavior systematically and significantly but only in situations where the norm is salient (focal) for the individual. De Kort, Mccally and Midden (2008) state that positive wording in social norms is preferred over negative wording, as this is reported to be an important determinant of prompt effectiveness.

Based on the preceding literature we assume to find a difference in consumers' food decisions in presence of a social norm compared to a situation without the presence of a social norm. It is

expected that in presence of social norms that convey majority endorsement for healthier food products, individuals more often choose healthy food products.

Not only do social norms influence our food decisions. As mentioned before, the level of self-control is an influencing factor for our food choices. Previously indicated; the default interventionism framework (Evans & Stanovich, 2013) offers a basis for the hypothesis that self-control strength would moderate the effect of the social norms on healthy food decisions. This theory suggests that a stimulus in the environment can trigger a response, which affects behavior. In this way it is expected that the level of self-control influences the effect of social norms. When individuals are low in self-control they rely on salient cues or heuristics (Salmon et al., 2014). That is why we think that in situations of low self-control individuals will rely more strongly (compared to situations of high self-control) on the social norm and make more healthy food decisions.

2.5 CONVENIENCE

Visual attention to unhealthy food may be harmful to successful resistance (Junghans, Hooge, Maas, Evers & De Ridder, 2015). In an attempt to prevent this cue-triggered urge to eat, people may self-regulate their visual attention to avoid the food, thereby resisting the temptation to eat and acting in consistence with long-term health goals. However, the required self-regulatory capacity is often insufficiently available, because it weakens during previous exertion of self-control, for example when coping with stress and regulating emotions (Baumeister et al., 2000).

One of the factors that affect visual attention is the positioning of food products. Marketing professionals have long known that cash registers are places where people make impulse purchases—a tendency that is typically exploited by placing unhealthy junk foods at this 'hot spot' (Kroeze et al., 2015). Both availability and easy accessibility of energy dense foods have been identified as risk factors for overeating (Van Kleef et al., 2012). Wansink (2010) states that making less healthy food options less salient and less accessible will decrease the intake of these food options. When healthier foods are more convenient to choose, people should be drawn to consume more of the healthier foods and fewer less healthy foods (Hanks et al., 2012).

The CAN approach (Wansink, 2015) addresses the same thought. CAN is an acronym for Convenient, Attractive, and Normal. This CAN approach tries to make healthy foods appear more *convenient*, *attractive*, and *normal* to choose. It has been shown to be much more effective than banning or eliminating favorite foods or from artificially restricting what someone can order (Wansink, 2015). Wansink (2015) states that the CAN approach has been shown to help guide parents, shoppers, restaurant goers, and students to select the healthier foods that are offered without having to necessarily change the foods themselves. Wansink (2015) describes in his article that healthy foods need to be made the easiest and most *convenient* choice – convenient to see, to order, to pick up, and to consume. He also states that the healthy choice needs to be made more *attractive* relative to what else is available. Last, many consumers often prefer what is popular – they prefer what they

think is normal to order, to purchase, to serve, and to eat. This is why Wansink (2015) explains that the industry can effectively suggest norms about what is *normal*.

As mentioned before, the required self-regulatory capacity is often insufficiently available, for example when coping with stress, regulating emotions and when people have limited time (Baumeister et al., 2000). Making healthy options the convenient choice can help facilitate making better choices. The principle of convenience states that the amount of food and what kind of foods individuals consume depends crucially on how convenient it is for them to obtain it – the easier it is to get the food, the more we will eat of it (Wansink, 2010). One often-cited technique to change behavior, which is related to convenience, is to change defaults (Wansink, 2015). This technique helps individuals to make the right choice in times of low-self control. When the required self-regulatory capacity is insufficiently individuals will choose the default option, because this choice saves cognitive effort. Convenience can take the form of saving physical effort, but it also takes the form of saving cognitive effort (Wansink, 2015). Convenience can relate to the way food is offered – such as whether it is convenient to see, select, and consume (Wansink, 2015). When the healthier food options are more convenient to select or more convenient to order, individuals will choose more often healthier food products, because it is presented as the most straightforward option.

This makes healthier food be perceived as an easier choice, both physically (when food is easier to grab or to order) and cognitively (when the healthier option is perceived as the normal/default choice) (Wansink, 2015). Technology – in the form of smart menu boards, personal menu profiles, food-ordering apps and websites, or simply more stylized information – could greatly alter or guide consumers to new choices by not only making healthier choices more cognitively convenient, but also by making healthy choices more conveniently visually salient, convenient to consider, and convenient to choose, order or select (Lowe, Souza-Monteiro & Fraser 2013).

There is reason to suspect that an environmental change that reverses the association—makes healthier foods more convenient—can lead individuals to select and eat healthier foods (Hanks et al., 2012). Within the healthy eating domain, this environmental change means for instance putting fruit at eye level (Kroese et al, 2015) or making the healthier option more attractive (Wansink, 2015). Convenience can reduce the cognitive effort, which is needed in making choices. In this case the healthier food options are the convenient choice; they appear to be the ‘default’ and are the most salient and most straightforward, since they are more easily to order in the food ordering app, than unhealthy food options.

According the information that convenience is a technique, which helps individuals to make the right choice in times of low-self control and that convenience can lead to saving cognitive effort, it is expected that making healthy food options the convenient choice, has a positive influence on healthy food decisions. When making healthier food options more convenient to choose, it is presumed they will be seen as default. In times of low self-control it is expected that individuals are more prone to select a convenient food option, but this does not have to be an unhealthy food option.

2.6 HYPOTHESES

In this study, we investigate whether we can promote healthy food choices under low self-control conditions in an innovative way by using a social proof heuristic and by using opportunities in making the healthy option the convenient choice. Social norms and convenience can affect individuals' automatic behavior. Where social norms are influence heuristics and trigger individuals to behave or eat in a certain way, convenience will help to make healthier foods more straightforward and seen as default. The influence tactics in this study are the presence of a social proof heuristic and the presence of convenience heuristic.

We assume that level of self-control moderates the effect of heuristics on the number of healthy food choices. We also assume that low self-control only predicts unhealthy food decisions when the food choice represents a self-control conflict between a palatable option that is immediately gratifying and a healthy option that is beneficial in the long term (*trade-off choice*), instead of the food choice between equally tasty looking food products (*control choice*). The following hypotheses are based on these findings.

H1a: Under conditions of low levels of self-control the social proof heuristic and convenience heuristic on healthy food options have stronger influence than under conditions of high levels of self-control.

H1b: The moderating effect of self-control on the effect of the social proof heuristic and convenience heuristic on healthy food decisions would only occur in case of trade-off choices as opposed to control choices.

Regarding social proof, it is expected that in presence of the social proof heuristic (that convey majority endorsement for healthier food products), individuals choose more often healthy food options. It is expected that the level of self-control influences the effect of social norms. When individuals are low in self-control they rely on salient cues or heuristics. That is why we think that in situations of low self-control individuals will rely more strongly (compared to situations of high self-control) on the social norm and make more healthy food decisions. The next hypothesis is formulated based on these findings.

H2a: The social proof heuristic has a positive effect on healthy food choices as opposed to no social proof heuristic.

H2b: Individuals under conditions of low self-control make more healthy food decisions, in the presence of the social proof heuristic than without the presence of the social proof heuristic.

H2c: Under conditions of high self-control the social proof heuristic will not have a significant effect.

Concerning the convenience heuristic (making the healthy option the convenient choice) it is

expected that making healthy food options the convenient choice, has a positive influence on healthy food decisions. When making healthier food options more convenient to choose, it is presumed they will be seen as default. In times of low self-control it is expected that individuals are more prone to select a convenient food option.

H3a: Making healthier food options more convenient to select will lead to more healthy food decisions as opposed to a less convenient option to select healthier food options.

H3b: Individuals under conditions of low self-control make more healthy food decisions when healthy food options are the convenient choice (more convenient to select and order), as opposed to a situation where healthy food options are not the convenient choice (and both healthy options as unhealthy options are equally convenient to select and order).

H3c: Under conditions of high self-control the convenience heuristic will not have a significant effect.

It is expected that when both influencing factors are designed to promote healthy food decisions, individuals will make the most healthy food decisions. When one of the factors is promoting healthy food decisions, it is presumed that this situation will create more healthy food decisions among individuals than absence of any influencing factor.

2.7 RESEARCH MODEL

This study examines whether social norms and convenience can influence individuals positively in making healthy food choices when self-control is low. The independent variables in this study are the presence of a social proof heuristic (normative cues that convey majority endorsement for certain food products) and convenience (making healthy food options the convenient choice by making them more convenient to select and order). The dependent variable is the number of healthy food choices participants make in the food-choice task. According to Wang et al. (2010) low self-control only predicts unhealthy food decisions when the food choice represents a self-control conflict. To examine this assumption, the dependent variable is divided into two different types of choices (trade-off and control). Half of the decisions are *trade-off choices* that represent a self-control conflict between healthy but less tasty looking options and tempting but unhealthy options, whereas the *control choices* represent food choices between healthy and unhealthy food products that are equally tasty looking and, therefore, do not consume self-control resources. The level of self-control is in this study the moderator. The different variables and hypotheses are shown in the figure below. As shown in this graphic representation, the level of self-control moderates the effect of the influencing factors on the number of healthy food decisions.

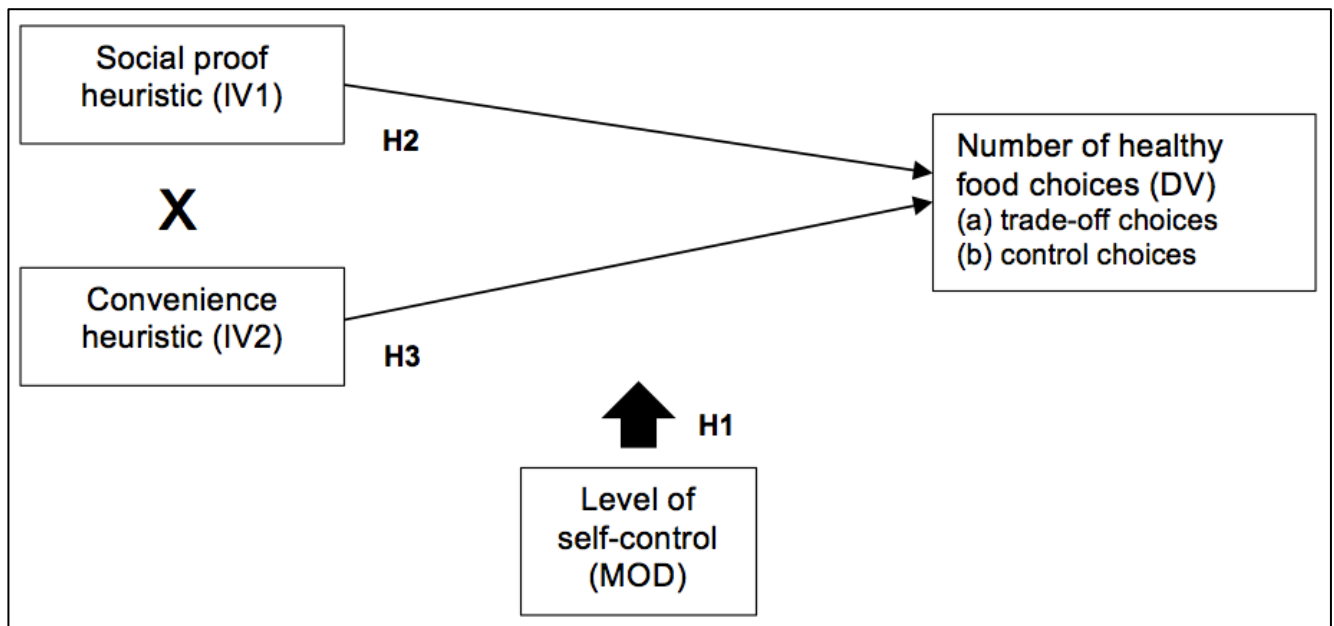


Figure 1. Research model

3 | RESEARCH DESIGN AND METHODOLOGY

The aim of this study was to examine individuals' automatic responses to heuristics with considerations for healthy food choices. The design of the research is a 2 (self-control: low vs. high) x 2 (social proof heuristic vs. no heuristic) x 2 (healthy food option convenient vs. unhealthy food option less convenient) between-subjects design.

In this study we have chosen to translate previous work (Kroese et al., 2015; Salmon et al., 2015; 2014; Van Kleef et al., 2012; Hanks et al., 2012; Wansink, 2010; 2015; Bertrams et al., 2015; Baumeister et al., 2000) into a more technological context: the design of smartphone apps. We investigated whether the intended effect of heuristics on healthy food decisions in conditions of low self-control, also occurs in a technological device context, by means of a food-ordering app. This food-ordering app offered images of food products that could be ordered in a canteen. In this study these food products were presented as six product pairs, each with a healthy and an unhealthy food option. Participants had to choose one of the two options in each product pair. The number of healthy food decisions was the dependent variable. Three of the six food decisions were trade-off food choices representing a self-control conflict between healthy but less tempting food products and tempting but unhealthy food products. The other three food product pairs were control food product pairs with healthy and unhealthy food products that looked equally tasty. This study was conducted by means of an online questionnaire. This online questionnaire was presented and designed as a usability research on the development of a food-ordering app for canteens. We used this usability research context as background and cover story that falsely describes the purpose of the study. By use of a usability research setting, we tested the effect of a social proof heuristic and convenience heuristic in conditions of low and high self-control on healthy food decisions.

3.1 PROCEDURE

In this study, we investigated whether we can promote healthy food choices under low self-control conditions in an innovative way by using influence heuristics in a canteen-app. We manipulated the influence heuristic of social proof by presenting salient statistical information about the food choice of a relevant reference group. The convenience heuristic was translated in the displays of the canteen-app. Each food product pair contained an option, which could be easily and directly ordered, and another option, which required more effort to purchase since participants had to follow several steps to order the product. In addition, level of self-control was manipulated by a frequently used cognitive busyness task, an established regulatory by Gilbert & Osborne (1989), which is adapted by Van den Bos, Peters, Bobocel & Ybema, (2006) and also used by Tuk (2008). By doing so, we could establish the effect of these influence heuristics on food choice under conditions of both low and high self-control. The dependent variable in our study was the number of healthy food choices participants made in the food-choice task. This food-choice task was part of an online questionnaire, which is translated into a usability research context.

3.1.1 INTRODUCTION OF THE STUDY AND COGNITIVE BUSYNESS TASK

The experiment was presented as a usability research for a new canteen-app. An online questionnaire is employed to ask participants to criticize the new app and choose between presented food options. Participants were recruited via convenience sampling on social networking sites, such as Facebook and LinkedIn. After a short introduction that explained the role of this study, the participants were randomly presented to one of the eight conditions. For each condition different a scenario text was used. These scenario texts explained the concept of the canteen-app and instructed participants how to fill in the questionnaire. In addition, these texts were used to implement the cognitive busyness task. This cognitive busyness task was presented as an element of the usability research. Participants were randomly assigned to the low or the high self-control condition, which affected the number of symbols they had to remember. In Figure 2 the text section that was used in the conditions of low levels of self-control to introduce the cognitive busyness task, is shown.

In the context of usability research and improvement of the canteen app, it is needed to gain insight in memory capacity so this app can be customized in order to provide the necessary support for memory and process orders as efficient as possible. We ask you to recall the following symbols in the same sequence at the end of the questionnaire:

@ * % # ? \$ ± §

When selecting your preferences you cannot go back to previous pages, so it is important to memorize the symbols. Please do not write down or copy the symbols.

Figure 2. Text section about cognitive busyness task in condition of low levels of self-control

In the conditions of high levels of self-control the cognitive busyness task was presented the same way, with the exception of the number of symbols participants were asked to remember. In conditions of high levels of self-control participants only had to remember one symbol: @. After reading the general introductory text and the scenario text participants filled in their gender and age. After completing these questions, participants once again were reminded of the symbols they had to remember.

3.1.2 CANTEEN-APP: SOCIAL PROOF HEURISTIC

Next, participants performed a food-choice task, which presented an ordering-process of a food-ordering app. This task consisted of six food product pairs, in which participants had to choose between healthy versus unhealthy food products (e.g., granola bar and chocolate bar). Participants were randomly assigned to either the social proof heuristic condition or to the no social proof heuristic condition. In the social proof heuristic condition, a poll with the opinion of other participants was shown before participants had to choose between the healthy or unhealthy option. In the condition without the social proof heuristic nothing was shown before participants had to make their choice.

3.1.3 CANTEEN-APP: CONVENIENCE HEURISTIC

As with the social proof heuristic participants were also randomly assigned to either the convenience heuristic condition or to the no convenience heuristic condition. In the conditions of the convenience heuristic, the healthy option was made the convenient choice, since participants could directly order this product instead of having to take further steps to order the product. In conditions of no convenience heuristic, both options were equally easy to order.

3.1.4 MANIPULATION CHECK

Next, participants were asked to fill in questions about how sharp/focused they felt by the use of six items, adopted from the state self-control scale (Ciarocco, Twenge, Muraven, & Tice, 2010). This could be associated with a manipulation check. After these six items participants' goal to eat healthy was measured and participants were asked to what extent they evaluated the task to be fun, because a fun task might be less depleting than a boring task (Salmon et al., 2015). The last question was to fill in the memorized symbols, after which participants were thanked.

3.2 FOOD-CHOICE TASK

The food-choice task consisted of six food product pairs, in which participants had to choose between healthy versus unhealthy food products. The task consisted of three trade-off and three control product pairs. Half of the decisions were *trade-off choices*. These product pairs consisted of healthy but less tasty looking options and tempting but unhealthy options. The other three decisions were *control choices*. These product pairs consisted of healthy and unhealthy food products that were equally tasty looking. The trade-off product pairs were: chocolate bar versus cereal bar, crisps versus rice crackers, and cupcakes versus dried fruit. The control product pairs were: Dutch caramel waffle versus banana, chocolate versus grapes, and almond pastry (in Dutch; gevulde koek) versus gingerbread (in Dutch; ontbijtkoek). These product pairs were determined in a pretest, whereby the products were evaluated by healthiness and attractiveness. In Table 1 the product pairs are shown.

Table 1

Product pairs

Type of product pair	Healthy option	Unhealthy option
Trade-off product pairs		
	Cereal bar	Chocolate bar
	Crisps	Rice crackers
	Cupcakes	Dried fruit
Control product pairs		
	Dutch caramel waffle	Banana
	Grapes	Chocolate
	Gingerbread	Almond pastry

During the food-choice task participants indicated which options of the product pairs they would prefer at that moment (e.g., chocolate bar or cereal bar). The dependent variable in this study was the number of healthy choices, ranging from zero to six healthy choices. The number of healthy food choices consisted of (healthy) choices for trade-off product pairs and for control product pairs. The food options were displayed in images derived from the 'canteen app'.

3.2.1 PRETEST: TRADE-OFF VERSUS CONTROL FOOD PRODUCT PAIRS

To pose a self-control dilemma, three food product pairs in the study should represent a trade-off between the goal to eat healthy and the goal to enjoy tempting but unhealthy foods. In order to select trade-off product pairs, a pretest is conducted. Ten participants evaluated the healthiness (e.g., "How healthy do you think this product is") and attractiveness (e.g., "How attractive do you find this product?") of 24 food products on 7-point scales ranging from 1 (*not at all*) to 7 (*very much*), in line with the pilot study of Salmon et al. (2014). This was done by an online questionnaire.

The study of Salmon et al. (2014) also contained three trade-off product pairs and three control product pairs. In this study the food products of the study of Salmon et al. (2014) are pretested together with fourteen other self-selected food products. The trade-off product pairs that are used in the study of Salmon et al. (2014) are; chocolate bar versus cereal cookie, crisps versus rice crackers with peanuts, and crisps versus mixed nuts and raisins. The control product pairs in the study of Salmon et al. (2014) are; chocolate cookie versus fruit biscuit, Dutch caramel waffle versus banana, and chocolate versus grapes. The self-selected food products are: popcorn, apples, muffin, raspberries, pretzels, dried fruit, almond pastry, gingerbread, fudge, grape tomatoes, cupcakes, nut bar, banana bread, muesli bar.

Based on the results of the pretest three trade-off product pairs were selected whereby the healthy option is evaluated to be healthier and less attractive than the unhealthy option; chocolate bar versus cereal bar, crisps versus rice crackers, and cupcakes versus dried fruit. In addition, three product pairs that do not represent a trade-off were selected out of the remaining 18 products. The control product pairs are; Dutch caramel waffle versus banana, chocolate versus grapes, and almond pastry (in Dutch; gevulde koek) versus gingerbread (in Dutch; ontbijtkoek).

Table 2

Evaluations of attractiveness and healthiness of products

Product	Attractiveness		Healthiness		Attractiveness	Healthiness
	M	SD	M	SD	t-test	t-test
Trade-off pairs						
Chocolate bar	6.40	0.70	1.30	0.48		
Cereal bar	2.90	0.99	3.80	1.03	$t(9) = 9.85$	$t(9) = -6.71$
Crisps	6.20	0.79	1.70	0.82		
Rice crackers	2.30	0.95	6.00	0.94	$t(9) = 11.21$	$t(9) = -8.31$
Cupcakes	6.40	0.70	1.20	0.42		
Dried fruit	2.10	0.99	4.90	1.37	$t(9) = 9.59$	$t(9) = -8.25$
Control pairs						
Caramel waffle	5.90	1.10	1.80	0.63		
Banana	4.50	0.85	6.90	0.32	$t(9) = 3.50$	$t(9) = -21.86$
Chocolate	6.20	0.79	2.40	0.97		
Grapes	3.80	0.79	6.20	0.79	$t(9) = 7.06$	$t(9) = -11.64$
Almond pastry	5.80	1.03	1.50	0.53		
Gingerbread	3.60	1.07	4.30	1.06	$t(9) = 4.49$	$t(9) = -6.73$

3.3 SOCIAL PROOF HEURISTIC

In the social proof heuristic condition, this heuristic was associated with the healthy options in the food-choice task. Statistical information about participants' choices was provided prior to the images of the product pairs on the canteen app. The statistical information in this study was formed as a poll, which allegedly represented the percentage of choices of students who previously participated in this experiment. This form of statistical information (poll) fits the usability research context. The percentages showed in the poll, indicated that the majority of these participants (varying from 65% to 85%) had chosen the healthy food product (for instance the banana), without explicitly stating that the specific product was the healthy option. Providing statistical information about the majority of a reference group is an established way to manipulate social proof (Goldstein, Cialdini & Griskevicius, 2008). In the condition without heuristic, no statistical information about the choices of the relevant reference group was provided. In Figure 3 an example of the social proof heuristic is shown.



Figure 3. Example social proof heuristic

3.3.1 PRETEST: SOCIAL PROOF HEURISTIC

A pretest was conducted to check if the created polls were clearly understandable. This pretest was carried out in order to develop and optimize the stimuli. Ten participants were asked to indicate what was the most chosen option and if the materials were clearly. Via face-to-face communication participants answered these questions. Based on these answers it could be concluded that the images were clearly understandable and participants recognized the cues that convey majority endorsement for certain food products.

3.4 CONVENIENCE HEURISTIC

One way to influence the impulsive choice is by associating the healthy option as the default, the most salient and most straightforward option (Kroese et al., 2015). This can be achieved by making the healthy option, the convenient choice. To create the convenient choice, the healthy option was made more convenient to select and order in the canteen-app. The healthy option was already 'selected' in the app-image by adding color to the order box. Information in the order box stated that individuals could directly order this product. This made it easier and more attractive to click the already selected box. The unhealthy option was made harder to choose. Participants could read that to order the unhealthy product they first had to go to another screen before they could order this product. Therefore participants had to make extra effort for choosing the unhealthy food option. It was easier and quicker to choose the healthy food option.

3.4.1 PRETEST: CONVENIENCE HEURISTIC

As well as the social proof heuristic, the convenience heuristic was also pretested by face-to-face communication. Different designs of app-images were shown on a laptop screen. Ten participants evaluated in four product pairs which option was the easiest one to choose (e.g., "Which product is the most convenient to choose?"), and to what extent they experienced this (e.g., "To what extent is this option more convenient to choose?", "When using this app, I would choose more often the convenient choice") on a 7-point scale, ranging from 1 (*not at all*) to 7 (*very much*). Each time the healthy option was designed as the easiest option to choose. Images of healthy food products were designed whereby participants directly could order the product and order boxes were already selected, in contrast to unhealthy food products. In cases of unhealthy food products participants could not directly order the product, they only could order the product by clicking the following screen. This pretest was carried out in order to develop and optimize the stimuli for the convenience heuristic. The first draft of the designed convenience heuristic did not explicitly mention that individuals were able to order the (unhealthy) product during the next step, but only mentioned that individuals could view the product. This first draft of the designed convenience heuristic is shown in Figure 4. In Table 3 the result of the pretest is shown, which indicates that the convenience heuristic helps participants to choose 'default' option.

Table 3

Evaluations of the convenience heuristic in pretest

Item	M	SD
Which product is the most convenient to choose?	10 out of 10 correct	
To what extent is this option more convenient to choose?	4.80	0.79
When using this app, I would choose more often the convenient choice.	3.40	0.52

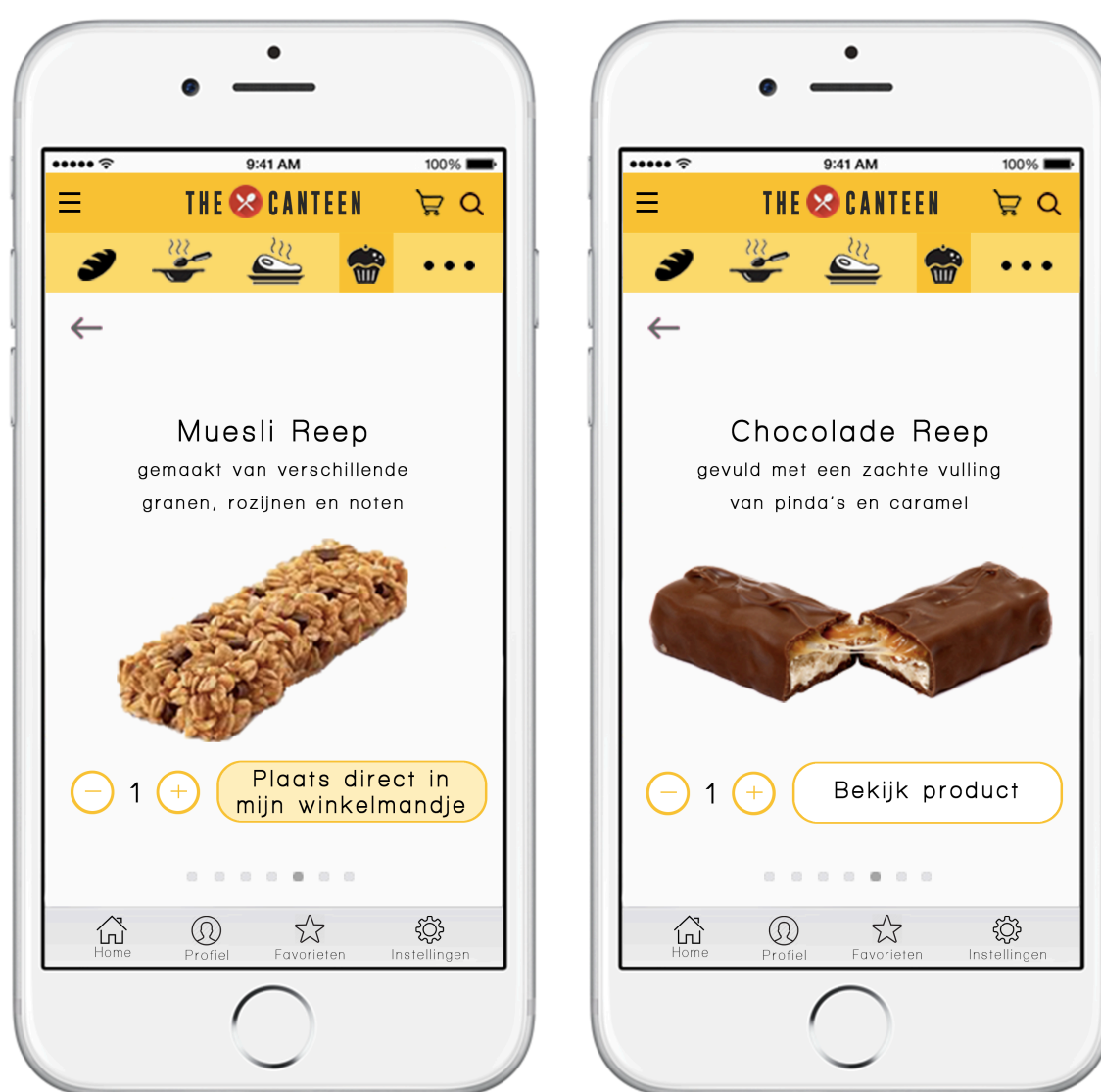


Figure 4. First draft of convenience heuristic

This design is improved and changed since participants suggested greater clarity about the ordering process of the unhealthy option. They indicated that they needed to read that individuals could order the (unhealthy) product during a next step, and thus this was not already the ordering page. In this way, it is clearer that ordering the particular product required more steps. These suggestions were added into a revised design.

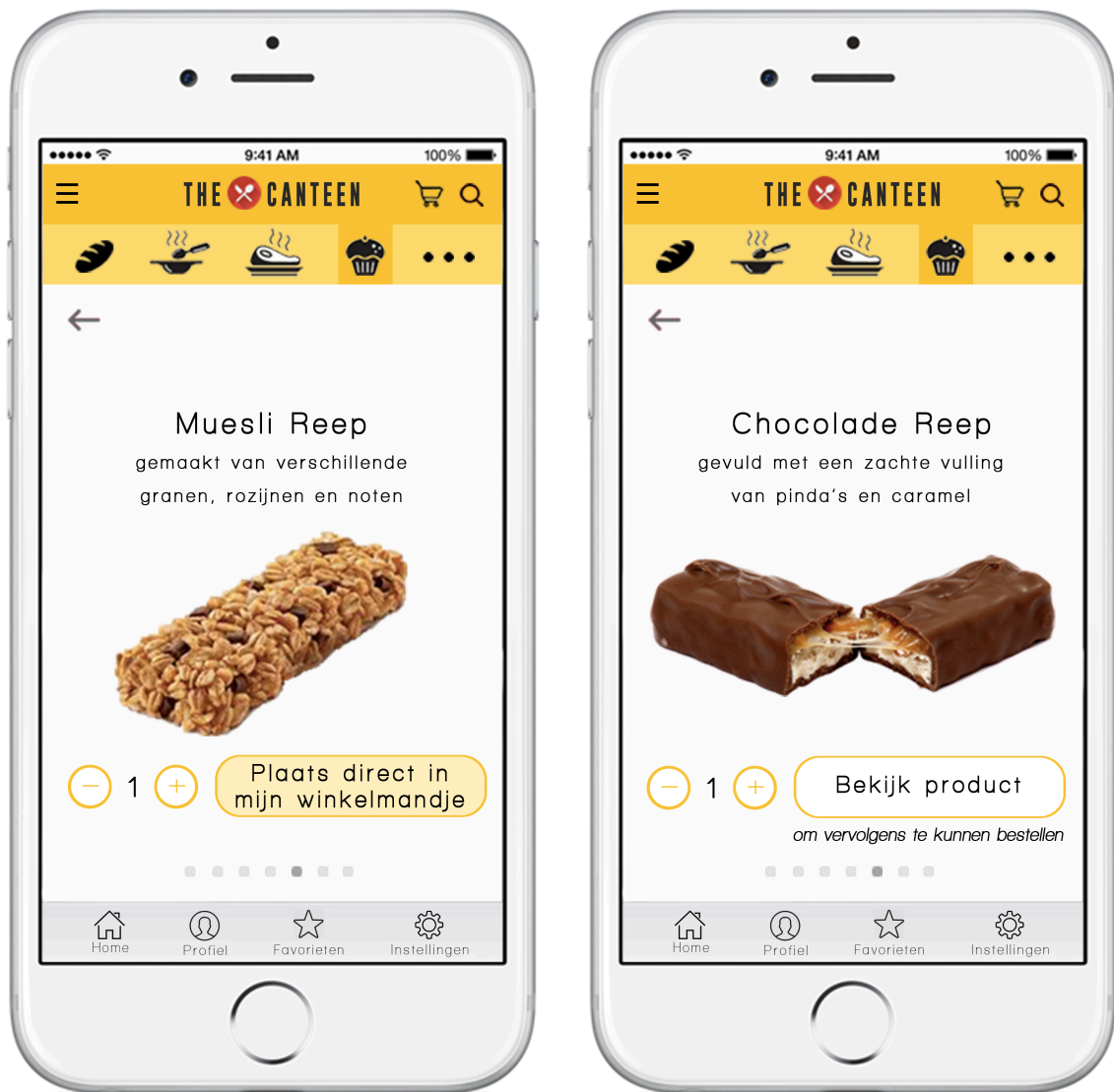


Figure 5. Revised design of convenience heuristic

In Figure 5 the revised design of the convenience heuristic is shown. In this design participants could read that to order the unhealthy product, they had to undergo an extra step. When participants chose the unhealthy option they were led to a next screen. This screen contained the image of the unhealthy option with a button that said 'view product' (in Dutch; *bekijk product*). The explanation below the button indicated that to order this product, participants first had to view the product before they could add this product to their shopping cart.

In the non-heuristic condition, both food products contained the same button: 'order product' (in Dutch: bestel product). In this case both options were equally easy to order. None of the buttons were already selected.

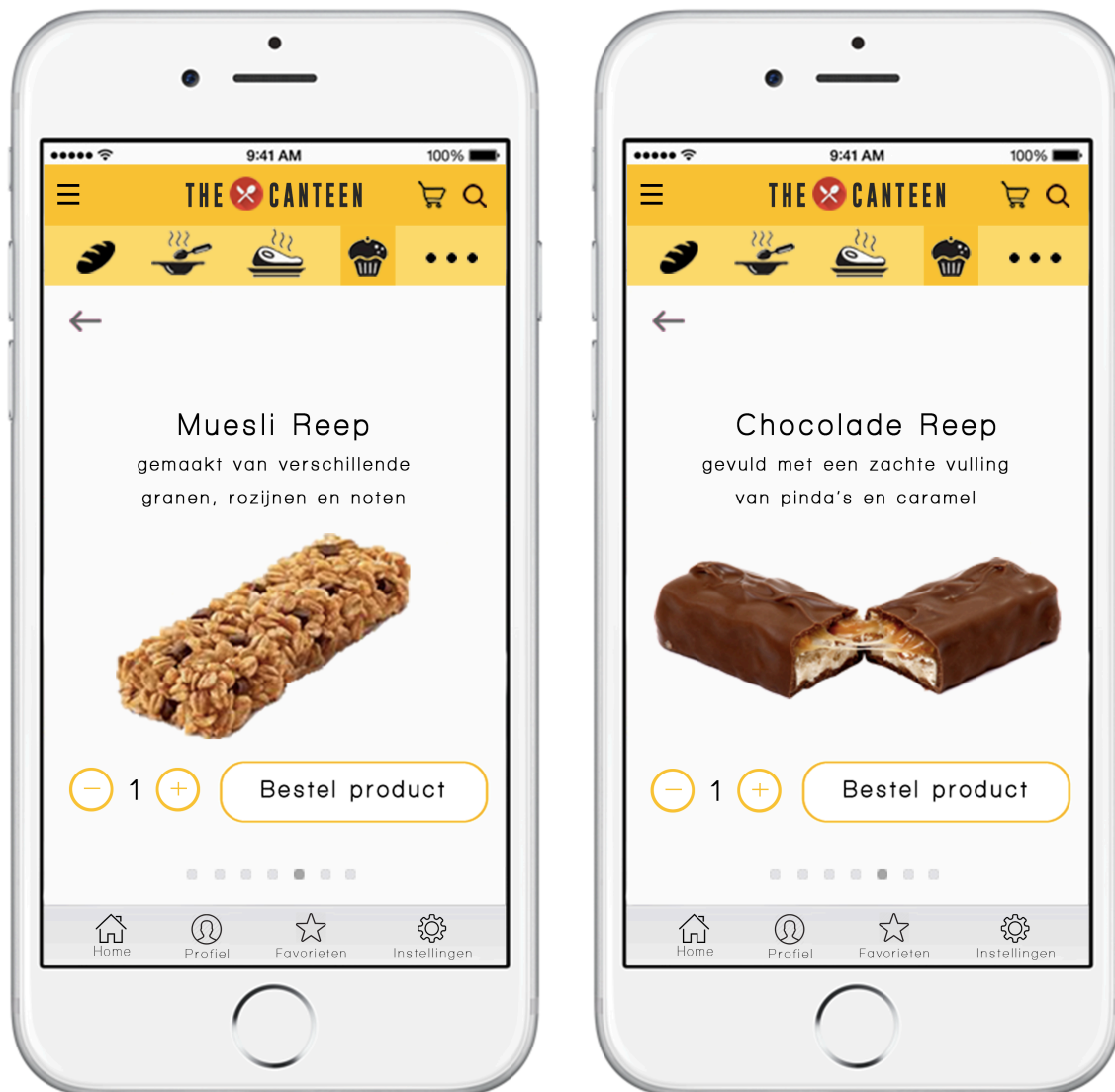


Figure 6. Example of images in the non-heuristic condition

3.5 SELF-CONTROL

Situations of people having a lower level of self-control are for example; when individuals are tired, when it's crowded, when people have limited time and when people are coping with stress or regulating emotions. Cognitive load can be defined as a multidimensional construct representing the load that performing a particular task imposes on the learner's cognitive system (Van Dillen, Papies & Hofmann, 2013). Cognitive load can lead to what we call a "blind eye" to temptation in that cognitive load may impact the hedonic appraisal of desirable targets and thus prevents the motivational "pull" of temptation that would otherwise ensue (Van Dillen et al., 2013). Previous research of Van Dillen et al. (2013) has shown that cognitive load can interfere with the down-regulation of one's impulses once these have been triggered by a tempting stimulus. To simulate the

effect of these situations a cognitive busyness task is used. Traditional models of impulse control have always stressed the negative impact of cognitive load on self-regulation success (Van Dillen et al., 2013). In this way, the cognitive load causes a lower level of self-control. The cognitive busyness task, a frequently used and established regulatory by Gilbert & Osborne (1989) that is adapted by Van den Bos et al. (2006), is used in this study. Participants in the high-busyness condition (low self-control condition) were asked to rehearse a string of eight symbols: @ * % # ? \$ ± §. Participants in the low-busyness condition (high self-control condition) were asked to rehearse one symbol: @. In both conditions, participants were asked to recall the symbols at the end of the questionnaire.

As an indication of level of self-control, as well as an manipulation check, participants had to indicate how sharp/focused they felt at that moment, at the end of the questionnaire, measured with six items on a 5-point scale, ranging from 1 (*not at all*) to 5 (*very much*), adopted from the state self-control scale (Ciarocco et al., 2010), with a Cronbach's Alpha of 0.87. At the end of the questionnaire participants also had to indicate to what extent they evaluated the task to be fun, because a fun task might be less depleting than a boring task (Salmon et al., 2015). This item about the pleasantness of the task is measured on a 5-point scale, ranging from 1 (*not at all*) to 5 (*very much*).

To withhold the aim of the cognitive busyness task participants were told that in the context of the usability research and improvement of the canteen app, it was needful to gain insight in memory capacity so this app could be customized in order to provide the necessary support for memory.

3.6 PRETEST: CREDIBILITY OF THE STIMULI AND 'USABILITY RESEARCH CONTEXT'

Considering a usability research context is used as cover story, any suspicious of participants could cause counteraction. Stimulus material and storytelling have to be believable and convincingly. To check if the materials and the story used in the online questionnaire to introduce participants to the subject produced the right effect, a pretest is conducted. In this pretest multiple materials are tested by face-to-face communication, using a laptop screen in order to present the materials: images of the app (both in the condition of convenience heuristic and the non-convenience heuristic condition), the introduction story and the polls that display the choices of the other participants. Ten participants criticized the app-images using items about credibility (e.g., "How believable do you find these images as photos of an app?") and improvement (e.g., "To what extent do you think these must be improved to make them more credible?") on 7-point scales ranging from 1 (*not at all*) to 7 (*very much*). The introduction story is assessed on credibility (e.g., "How believable do you find this story?") and clearness (e.g., "To what extent do you think this text is clear?"). The social proof heuristic is assessed on credibility (e.g., "How believable do you find this statistical information about the food choice of a relevant reference group?") and evidentiary (e.g., "To what extent do you conceive this poll as evidence of other opinions?"). These questions were asked face-to-face, but the stimuli were shown on a laptop screen. In this way materials were presented in the same way as in the online questionnaire and participants could easily give suggestions for improvement of the materials and report aspects that attracted attention unexpectedly.

Table 4

Evaluations credibility of the stimuli and 'usability research context'

Item	M	SD
How believable do you find these images as photos of an app?	6.20	0.63
To what extent do you think these must be improved to make them more credible?	1.80	0.63
How believable do you find this story?	5.90	0.88
To what extent do you think this text is clear?	6.00	0.82
How believable do you find this statistical information?	5.70	0.82
To what extent do you conceive this poll as evidence of other opinions?	5.00	0.67

3.7 POSSIBLE EXTRANEEOUS VARIABLE

In order to control for possible confounding effects of participants' habits in decision-making about food products, participants were asked about their goal to eat healthily. The goal to eat healthily is measured to determine whether there were any differences between conditions in this variable that might affect food choices. This variable is measured with one item, "To what extent do you have the goal to eat healthily?" on 5-point scales ranging from 1 (*not at all*) to 5 (*very much*). This variable is measured at the end of the online questionnaire.

3.8 PARTICIPANTS

Two hundred sixty-seven participants voluntarily participated in this online experiment. Of the 267 participants, 54 (20.2%) were male and 213 (79.8%) were female. Their ages ranged from 18 to 55 years, with an average age 28.81 year ($SD = 10.63$). The study used a 2 (self-control: low vs. high) x 2 (social proof heuristic vs. no heuristic) x 2 (convenience heuristic vs. no heuristic) between-subjects design. The participants were recruited via convenience sampling on social networking sites, such as Facebook and LinkedIn, via the network of the researcher.

Table 5

Demographic characteristics per condition

			Participants	Gender		Age
Condition of the study			N	Male %	Female %	Mean (SD)
low self-control						
social proof heuristic	x	convenient healthy choice	32	21.9	78.1	26.82 (11.92)
social proof heuristic	x	no convenient healthy choice	30	16.7	83.3	27.67 (6.89)
no social proof heuristic	x	convenient healthy choice	24	33.3	66.7	30.15 (11.23)
no social proof heuristic	x	no convenient healthy choice	38	26.3	73.7	28.39 (10.63)
high self-control						
social proof heuristic	x	convenient healthy choice	34	14.7	85.3	28.02 (9.65)
social proof heuristic	x	no convenient healthy choice	33	24.2	75.8	27.73 (7.60)
no social proof heuristic	x	convenient healthy choice	36	11.1	88.9	32.73 (10.45)
no social proof heuristic	x	no convenient healthy choice	40	21.2	78.8	28.97 (8.77)

3.9 DATA-ANALYSES

The goal of this research is test the prediction that self-regulatory resource depletion has an effect on the food consumption of individuals in a positive way when in presence of a social norm and convenience. Specifically, this research aimed to induce a state of self-regulatory resource depletion through a cognitive busyness task and tested the food choice of people under different conditions, with a social proof heuristic and convenience heuristic. To test the effect of both heuristics on the number of healthy food choices, ANOVA's with number of healthy food choices as the dependent variable and the conditions of self-control, social proof and convenience as the between subject factor, will be used. To check if self-control is the moderator of an effect, a hierarchical multiple regression analysis was conducted. Also a median split for level of ego-depletion was done and used to test the effect of ego-depletion on the number of healthy food choices.

4| RESULTS

To test the hypotheses that the number of healthy choices is positively affected by heuristics that are designed to promote the healthy option and more specifically whether level of self-control moderates the relationship between the heuristics and the number of healthy choices, ANOVA's were performed and a hierarchical multiple regression analyses was conducted. In these ANOVA's the heuristics and expected moderator were between-subject factors and number of healthy food choices, the dependent factor. Based on these ANOVA's, main effects and interaction effects were concluded. First, we checked if the manipulation of self-control produced the right effect.

4.1 MANIPULATION CHECK EGO-DEPLETION

To find out if the manipulation of level of self-control, by using a cognitive busyness task, produced the desired effect, a manipulation check was carried out first. This manipulation check was by means of a shortened state self-control scale (Ciarocco et al., 2010), with a Cronbach's Alpha of 0.87. An ANOVA was performed to check if the manipulation of the cognitive busyness task (high-busyness condition) had a significant effect on the level of self-control (state self-control scale). This ANOVA revealed no significant effect of level of cognitive busyness on level of self-control, $F(1,265) = 0.25$, $p = .617$.

Since Participants had an average score of 3.91 ($SD = 0.67$) on the state self-control scale (ranging from 1: ego depleted to 5: not depleted) and the ANOVA showed no significant effect of the cognitive busyness task on level of self-control, we conducted an extra test to figure out if the cognitive busyness task was not effective to use as a manipulation of self-control. This test was about the same as the online questionnaire, except this test did not contain any heuristics (social proof heuristic and convenience heuristic) and all the participants were assigned to the low self-control condition. Fifteen participants filled out this online questionnaire. To evaluate the results, the same state self-control scale was used as manipulation check. The results of this test did not show that this task is effective ($M = 3.94$, $SD = 0.55$). The cognitive busyness task did not show an (reducing) effect on self-control.

4.2 EFFECTS OF CONVENIENCE, SELF-CONTROL AND SOCIAL PROOF ON FOOD CHOICES

To test the effect of convenience, self-control and social proof on healthy food choices, an ANOVA was performed, with convenience, social proof and self-control as between-subject factors and number of healthy food choices as dependent factor. The ANOVA showed that there was no main effect of convenience on the number of healthy food choices, $F(1,265) = 0.55$, $p = .457$. As well as convenience, there was no main effect of self-control on the number of healthy food choices, $F(1,265) = 1.88$, $p = .172$. Another ANOVA was conducted with level of self-control, based on the state self-control scale (instead of the cognitive busyness task), as between subject factor. This ANOVA also showed no significant effect, $F(1,265) = 3.16$, $p = .077$, but it does suggests that

participants who reported a higher level of self-control, chose more often healthy food options ($M = 4.12$, $SD = 1.17$), than participants who reported a lower level of self-control ($M = 3.45$, $SD = 1.52$). It did not quite reach conventional levels of statistical significance but represented a suggestive trend.

In contrast to convenience and self-control the ANOVA revealed a main effect of the social proof heuristic on the number of healthy choices, $F(1,265) = 4.97$, $p = .027$. Participants made more healthy choices when social proof was absent ($M = 3.69$, $SD = 1.49$) than when social proof was present ($M = 3.28$, $SD = 1.52$). This effect also occurred in case of healthy trade-off choices, $F(1,265) = 4.16$, $p = .042$. Also in this case, participants made more healthy choices when there was no social proof ($M = 1.54$, $SD = 1.00$) then when there was social proof ($M = 1.29$, $SD = 1.00$).

In addition to the main effect of social proof on the number of healthy food choices, this independent variable also had an interaction effect with self-control on healthy food choices, $F(1,263) = 13.07$, $p < .001$. This means that the interaction between social proof and self-control accounted for significantly more variance in the number of healthy food choices than just social proof and self-control by themselves, $\Delta R^2 = .046$, $\Delta F(1, 263) = 13.07$, $p < .001$, $b = -.040$, $t(263) = -2.23$, $p = .027$. The ANOVA made clear that participants in conditions of low self-control (according to the cognitive busyness task) made more healthy choices when there was no social proof ($M = 3.90$, $SD = 1.35$) than when there was social proof ($M = 2.81$, $SD = 1.56$). In conditions of high self-control, participants made more healthy food choices when social proof was present ($M = 3.72$, $SD = 1.35$) than when social proof was absent ($M = 3.51$, $SD = 1.57$). This interaction effect also occurred in both types of choice conditions; the trade-off choices, $F(1,263) = 6.72$, $p = .010$, and the control choices $F(1,263) = 9.27$, $p = .003$. In all choice conditions the interaction showed the same effect; participants made more healthy food choices in low self-control conditions (based on the cognitive busyness task) when there is no social proof and in high self-control conditions when social proof is present. In conditions of low self-control, the number of healthy food choices in presence and in absence of the social proof heuristic differed more than in conditions of high self-control.

Table 6

Two-way interaction effect; social proof and self-control

Type of choice	Low Self-Control		High Self-Control	
	M	SD	M	SD
Present social proof heuristic				
All six product pairs together	2.81	1.56	3.72	1.35
Trade-off product pairs	1.06	0.96	1.51	1.00
Control product pairs	1.74	1.02	2.21	0.77
Absent social proof heuristic				
All six product pairs together	3.90	1.35	3.51	1.57
Trade-off product pairs	1.65	0.93	1.46	1.05
Control product pairs	2.26	0.87	2.05	0.92

Table 6 shows presence of social proof is most beneficial in conditions of high self-control and absence of social proof is most beneficial in conditions of low self-control. At the same time, this table also shows that in conditions of high self-control, the number of healthy food choices (when the social proof heuristic was present or absent) differed less than in conditions of low self-control.

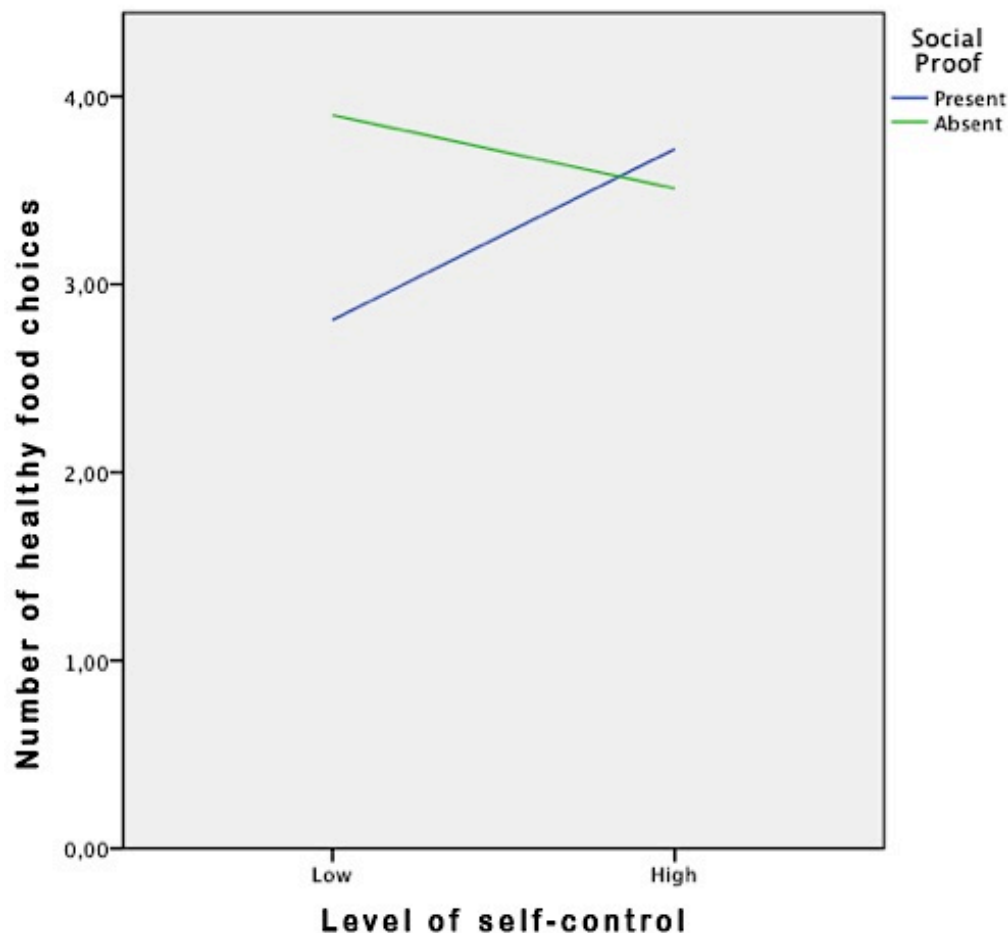


Figure 7. Interaction plot: social proof and self-control

Examination of the interaction plot showed that as level of self-control increased, the number of healthy food choices increased when social proof is present. In short: when level of self-control is low, individuals made more healthy food choices when social proof was absent and when level of self-control is high, individuals made more healthy food choices when social proof was present. Examination of the interaction plot also showed that difference in number of healthy food choices only occurs when self-control is low. This means that when self-control is high, the social proof heuristic did not cause a significant increasing or decreasing effect on number of healthy food choices. In conditions of high self-control the effect of the social proof heuristic is not really noticeable.

To check if participants in the control condition (high self-control, no social proof, no convenience) had a significantly different number of healthy food choices, an ANOVA was performed. The results of this ANOVA, with control condition as between subject factor and number of healthy food choices

as dependent factor, showed there was no significant effect of the control group on the number of healthy food choices, $F(1,265) = .09$, $p = .766$.

4.3 EFFECT OF CHOICE TYPE: TRADE-OFF CHOICES AND CONTROL CHOICES

The cognitive busyness task and the state self-control scale are not the only aspects referring to self-control. Since we assumed that low self-control only predicts unhealthy food decisions when the food choice represents a self-control conflict, we examined if there were any differences in the number of healthy food choices between trade-off choices and control choices. A Paired-Samples T Test revealed a significant effect of choice type (trade-off choices vs. control choices) on the number of healthy choices. The average number of healthy food choices for trade-off product pairs was 1.42 ($SD = 1.00$), and for control product pairs 2.07 ($SD = 0.92$) on a scale ranging from zero to three healthy choices (Table 7). The average number of healthy food choices for the six product pairs together was 3.49 ($SD = 1.51$) (on a scale ranging from zero to six). The number of healthy food choices for the control product pairs was significantly higher, $t(266) = -8.89$, $p < .001$), than for the trade-off product pairs.

This indicates that participants chose more often the healthy option if products looked equally tasty, than when the choice represented a trade-off between the goal to eat healthy and the goal to enjoy tempting foods. Participants found it less attractive to choose the healthy option in trade-off choices than in the control choices, because of this self-control dilemma. But regardless this result, we cannot state that this effect refers to the level of self-control, since subdivision by the cognitive busyness task and state self-control scale did not have any effect on the trade-off and control choices.

4.4 EFFECT OF EXTRANEOUS VARIABLE: THE GOAL TO EAT HEALTHILY

In order to control for possible confounding effects of participants' habits in decision-making about food products, participants were asked about their goal to eat healthily. On average, participants had the goal to eat healthily ($M = 2.18$, $SD = 0.76$) (on a scale ranging from 1: *high value* to 5: *low value*). The health goal of the participant had a significant effect on the number of healthy food choices, $F(1,265) = 37.92$, $p < .001$. In contrast to this effect, we have also examined the possibility that the images of the canteen app could affect participants' health goal. In this way, the images of the food products could produce, increase or decrease the goal to eat healthily. The ANOVA showed no main effects of convenience, social proof and self-control (according to the cognitive busyness task) on the goal to eat healthily. Social proof did not had a significant effect on the goal to eat healthily, $F(1,265) = 3.62$, $p < .058$, however, it did show a suggestive trend. When social proof was present, participants' goal to eat healthy was lower ($M = 2.09$, $SD = 0.70$) than when social proof was absent ($M = 2.26$, $SD = 0.80$).

5| DISCUSSION

5.1 MAIN FINDINGS OF THIS STUDY

In this study investigated whether we can promote healthy food choices under low self-control conditions by using a social proof heuristic and a convenience heuristic. This study tried to extend previous work (Kroese et al., 2015; Salmon et al., 2015; 2014; Van Kleef et al., 2012; Hanks et al., 2012; Wansink, 2010) by offering an innovative translation of the situation (the effect of heuristics on healthy food choices in conditions of low self-control and high self-control) into a modern technical context, by using a canteen-app.

Findings showed that the convenience heuristic did not have an effect on the number healthy food decisions, neither did self-control. Another ANOVA with level of self-control, based on the state self-control scale (instead of the cognitive busyness task), as between subject factor, showed a suggestive trend. This finding did not reach conventional levels of statistical significance but showed a suggestive trend; participants who reported a higher level of self-control, chose more often healthy food options than participants who reported a lower level of self-control. In contrast to convenience and self-control, the social proof heuristic did have an effect on the number of healthy choices. Participants made more healthy choices when social proof was absent than when social proof was present. An interaction effect of social proof and self-control on the number of healthy food choices showed that this effect of the social proof heuristic occurred when participants were low in self-control. When participants were low in self-control, they made more healthy food decisions when social proof was absent. In conditions of high self-control, participants made more healthy food choices when social proof was present. However, difference in the number of healthy food choices, regarding to social proof, only occurs when self-control is low. When self-control is high, the social proof heuristic did not cause a significant increasing or decreasing effect on number of healthy food choices. These findings correspondent with two of the eight hypotheses; *Under conditions of low levels of self-control the social proof has a stronger influence than under conditions of high levels of self-control & Under conditions of high self-control the social proof heuristic will not have a significant effect*. These hypotheses are the only ones that have not been rejected.

Results showed that participants chose more often the healthy option if products looked equally tasty, than when the choice represented a trade-off between the goal to eat healthy and the goal to enjoy palatable foods (self-control dilemma).

Findings showed that the number of healthy choices made, was significantly related to the participants' goal to eat healthy. Another finding was that social proof did not had a significant effect on the goal to eat healthily, however, it did show a suggestive trend that when social proof was present, participants' goal to eat healthy was lower than when social proof was absent.

5.2 EXPLANATIONS OF THE RESULTS

This study does not extent previous work that assume low levels of self-control can offer advantages in influencing individuals positively in making better choices (e.g. healthier food decisions) by influencing individuals by means of external cues. Although, the results of this study are unexpected and contradictory to the hypotheses, interpretation and explanation of the results are still important.

5.2.1 INSUFFICIENCY: THE CONVENIENCE HEURISTIC AND COGNITIVE BUSYNESS TASK

Findings showed that the convenience heuristic did not have an effect on the number of healthy food choices. We evaluated the convenience heuristic by using a pretest that asked participants to what extent the heuristic made the choice convenient. Perhaps these questions guided the participants in a certain direction, whereby we did not test the functioning of the heuristic. This lack of functioning also applies to the independent variable self-control. The manipulation check for level of self-control (using a cognitive busyness task) was by means of a shortened state self-control scale. This manipulation check showed that the cognitive busyness task had no significant effect on the level of self-control (state self-control scale). An extra test to check if the manipulation really did not had an effect on level of self-control confirmed that the cognitive busyness task did not show an (reducing) effect on self-control. In research of Van den Bos et al. (2006) and Tuk (2008) this cognitive busyness task produced the right effect. In these studies, they applied the cognitive busyness task along with written scenarios that demanded imagination and cognitive involvement. According to Wang et al. (2010), forming a preference does not resolve a conflict, may not require exertion of executive function, and therefore will not lead to depletion. In our study participants had to indicate which option they preferred at that moment (healthy or unhealthy food product), which did not requested enough cognitive effort and involvement. The cognitive busyness task did not cause enough impediments, since the food choice task did not require exertion of executive function and did not demand many cognitive effort, involvement and imagination. Wang et al. (2010) also state that the size of trade-offs is related to level of self-control. Larger trade-offs (e.g., choice between two apartments where one has a great view and the other offers a very short commute) will cause greater conflict and require greater executive resources to resolve than smaller trade-offs (e.g., choice between two very similar cell phones) (Wang et al., 2010). In our study we did not use large trade-offs, which allowed participants to weigh options and required less cognitive effort to make choices. Findings show that participants made less healthy food choices when the choice represented a trade-off. According Wang et al. (2010) this is due to the self-control dilemma, represented by the trade-off product pairs. However, self-control did not have an effect on the number of healthy choices and the trade-off had no large size, which is why we cannot be certain if difference in number of healthy food choices between trade-off and control choices is caused by the intended self-control dilemma. What we can conclude is that the appearance of food has effect on the number of healthy food choices. Since the control product pairs contained food products that were equally tasty looking, the effect of trade-off choices can also result from the attractiveness of a product. According the CAN-approach (Wansink, 2015), making the healthy choice more attractive will increase the intake of these food options.

5.2.2 REACTANCE

Another finding was the effect of social proof and its interaction effect with self-control on the number of healthy food choices. Both effects showed the opposite effect than what we expected. In conditions of low self-control the absence of the social proof heuristic was most beneficial for the number of healthy food choices. This is contradictory to the expectation that heuristics can help individuals in conditions of low self-control, in making better and healthier choices. It is possible, that drawing attention to various nudges might have differing effects depending on the person and the goal (Chance, Gorlin & Dhar, 2014). For example, most people might believe it would be a good idea for them to drink more water. But a sign on the same water bin reading "We stocked these bins with water to help you reduce your consumption of sugary beverages and lose weight" could spur reactance and might even lead some people to purchase sugary beverages out of spite for what they experience as paternalistic interference (Chance et al., 2014). A reason may be that interventions that are based on telling people what they should or should not do could cause reactance (Brehm, 1966). Reactance is a behavioural counter-response of someone who believes that someone or something is being restricted or taken away. Reactant individuals are annoyed or angry when someone else imposes goals on them (Brehm 1966). In this study we did not obligate the participants to make the healthy choice, but the used social proof heuristic (the poll) could have caused reactance, since this cue is pointing participants in a certain direction.

5.2.3 SOCIAL PROOF HEURISTIC: EXPLICIT CUE

The social proof heuristic in this study contained an explicit cue, which is more direct than an implicit cue. Explicit norm activation is more direct, because it is harder to miss, pointing individuals in a certain direction and eventually states clearly what is expected (De Kort et al., 2008). Several studies on littering behavior (e.g., Reich & Robertson, 1979) reveal that a negative or punitive message (e.g., "No littering!") actually increases littering compared to a polite message. In their study Reich and Robertson (1979) found out that messages making explicit commands against the act of littering actually generated more littering than messages making appeal to social normative standards concerning littering. Dillard and Pfau (2002) state that messages using explicit cues will elicit greater reactance than those with implicit cues. Results of the study of Hagen, Krishna and McFerran (2013) also showed that the indirect message led to healthier snack choices instead of the direct message. In this study the explicit message in the social proof heuristic could have created reactance, since this message was very direct and clear.

The intensity of reactance may vary individually. Hagen et al., (2013) state that people who have habitually experienced reactance while encountering similar persuasion messages will come to experience automatic resistance to performing the behaviour upon encountering the words often contained in such persuasion messages. For these people indirect messages can be more effective than direct messages at promoting the target behaviour because automatic resistance to performing the target behaviour has not developed for indirect messages, yet such indirect messages are still strong enough to activate the target behaviour. Seibel and Dowd (1999) stated that reactant people

inter alia tend to be autonomous, dominant, lacking in self-control. In our study, lack of self-control could have resulted in reactance. Individuals under conditions of low self-control did not have enough cognitive resources and self-efficacy, which made them more reactant towards the message, since the acceptance of the social proof message gave them the feeling of losing control.

5.2.4 USABILITY RESEARCH CONTEXT

Another aspect, which may be a possible cause for the contradictory results and strengthens reactance, is the usability research context, used in this study. One of the differences in this study in comparison with previous work regarding ego-depletion (Kroese et al., 2015; Salmon et al., 2014; 2015; Van Kleef et al., 2012; Hanks et al., 2012; Wansink, 2010; Baumeister et al., 2000), was the innovative translation of the situation (the effect of heuristics on healthy food choices in conditions of low self-control and high self-control) into a modern technical context, using a usability research context as background and cover story. Due to this context individuals could have made other decisions based on the task they thought they had to do. Studies regarding ego-depletion try to lower self-control, in such way that participants rely on their automatic system. Usability testing is a technique used in user-centered interaction design to evaluate a product by testing it on users. This means that participants of usability research are asked to evaluate and to think out all the options available, when completing tasks. A usability research is intended to see where participants encounter problems and experience confusion. As a result, participants try to cooperate in order to achieve the desired result. This usability research context, used in this study, had the effect that choices of participants are based on more critical judgments and are characterized by other operations than their automatic behavior. Since in the introduction text, the emphasis was on the opinion of the participant and participants were told that in the context of the usability research and improvement of the canteen app, it was needful to gain insight in memory capacity, this usability research context unwillingly asked participants to be critical and evaluate the options. Due to the information in the introductory text that it was needful to gain insight in memory capacity, participants were more alert. When evaluating, participants consider whether the game is worth the candle and participants make well-considered, balanced decisions. As mentioned earlier in this study decision-making could be split in two different processes: intuition and reasoning (Kahneman, 2003). This study tried to explore the automatic response by affecting individuals' level of self-control, since food decisions are often made mindlessly in an impulsive way, when individuals have low self-control and consequently are unable to exert the effort to warrant a well-considered, balanced decision (Bertrams et al., 2015). This usability research context could have made participants unasked critical that influences the decision-making processes in such way that this decision-making contains processes, which are more likely to be consciously monitored and deliberately controlled, that refers to the reflective system, instead of the automatic system. Potential differences in participants or testing environment (such as the online environment, or when using a usability research context) should be tested in future studies to establish whether ego-depletion is only observed under certain circumstances or for certain types of individuals (Lurquin et al., 2016).

5.2.5 QUESTIONING EGO-DEPLETION

Previous studies have assumed that high self-control is required to engage in healthy decision-making about foods, our findings show that there is no (main) effect of level of self-control on healthy food decisions. This result is inconsistent with previous research of inter alia Kroese et al. 2015, Salmon et al. 2015; 2014, Van Kleef et al. 2012, Hanks et al. 2012, Wansink, 2010 and Baumeister et al. 2000, regarding self-control and food decisions. However, since more researchers were not able to found the effect of ego-depletion, two Australian psychologists (Martin Hagger and Nikos Chatzisarantis) took the initiative in 2014 to let research teams from different universities all conduct the same, predetermined research (De Bruin, 2016). Twenty-three research groups from all over the world (including four Dutch) were able to complete the study as planned. A meta-analysis of the combined results shows no ego-depletion. The Australians Martin Hagger and Nikos Chatzisarantis state that if ego-depletion exists, it's a small effect, "close to zero" (De Bruin, 2016). It is possible that ego-depletion is not a reliable psychological phenomenon (Lurquin et al., 2016). After controlling for small-study effects and publication bias, Carter and McCullough (2014) also suggested that the true effect of ego-depletion was not significantly different from zero. There may be a large body of null findings and significant negative findings challenging ego-depletion that have never been published, and the published evidence consistent with ego-depletion is simply an artifact of publication bias, small-study effects, and potential p-hacking (Lurquin et al., 2016).

The idea that self-control is like a muscle—temporarily weakened following exertion, but strengthened with practice over time—is an elegant analogy that has grown increasingly popular (Lurquin et al., 2016). Although the ego-depletion effect is reported to be strong, reliable, and highly replicated (e.g., Hagger, Wood & Chatzisarantis, 2010), a few failed replication attempts have recently been published (Carter & McCullough, 2013; Xu et al., 2014) and have started to cast doubt on not only the magnitude and robustness of the effect but even the very existence of the ego-depletion effect. Additionally, a recent meta-analysis that used stricter inclusion criteria found little evidence for the ego-depletion effect (Carter, Kofler, Foster & McCullough, 2015). As a result, some researchers (e.g., Carter & McCullough, 2014) have recently issued a call for “determining whether truly convincing empirical support for the foundational finding of the model exists” (Carter & McCullough, 2014, p. 2) for the ego-depletion effect.

5.3 LIMITATIONS OF THIS STUDY AND SUGGESTIONS FOR FUTURE RESEARCH

Like other empirical research, the results of this study should be read within its limitations. The first limitation is the use of a convenience sample. When replicating the study, a more diverse sample that includes all ages, an equal distribution of both males and females and both low and high educated individuals should be used in order to increase the generalizability and external validity of these findings.

An additional limitation had to do with the cognitive busyness task that is used in this study. Since the manipulation check and an extra test did not show the effect of this task on the level of self-

control, we cannot assume that this manipulation had the desired effect. Van den Bos et al. (2006) and Tuk (2008) used this cognitive busyness task with success. In their studies, the cognitive busyness task was linked to a written scenario, which required cognitive involvement and imagination. In our study participants had to indicate what their preference was. The food choice task did not require exertion of executive function and did not demand many cognitive effort, involvement and imagination. Besides, in our study we did not use large trade-offs, which allowed participants to weigh options and required less cognitive effort to make choices. Future research should use the cognitive busyness task in context of a task, which requires cognitive involvement, such as identifying a scenario. When using trade-offs, these should be large, since large trade-offs demand cognitive effort and exert self-control. Another way to make sure that the desired effect of self-control is measured, is by using conditions wherein influencing self-control is obviously and natural instead of simulations and means to lower self-control. Individuals should already have lower self-control, to scrutinize this moderating effect. Furthermore, for a fuller understanding of the role of self-control in heuristic (food) decision-making, trait self-control should be taken into account. Prior research found some evidence for the relationship between trait self-control and eating behavior (De Ridder, Lensvelt-Mulders, Finkenauer, Stok, & Baumeister, 2012).

Concerning the social proof heuristic, we observed a pattern, which is the opposite of what we expected. Interventions that are based on telling people what they should or should not do could cause reactance. To avoid reactance, future research should use implicit cues. These implicit cues are more subtle and do not give participants the feeling that their freedom is being threatened, or that they might lose control. Future research should also focus on trait self-control and trait reactance and should examine interactions between experimental manipulations and individual differences (self-control, reactance), so that it can provide a nuanced understanding of how different consumers may respond to environmental cues, messages, and potential interventions.

This study used an online environment and technological device context to study the effect of heuristics and level of self-control on healthy food choices. Another important element is the usability context that offered background and was used as cover story that falsely described the purpose of the study. Contexts could affect the effectiveness of heuristics and trigger unwanted processes of decision-making. In this study the usability research context made participants more alert and encouraged rational decision-making processes instead of intuitive decision-making processes.

Although current research was not able to provide evidence supporting the idea that heuristics can help individuals in making better and healthier choices, previously mentioned studies indicate that it is a concept worth further investigation. Future research should further investigate how we can take advantage of people's tendency to act impulsively under conditions of low self-control and which types of heuristics are effective in guiding people toward the healthy option when they are open to suggestions due to their low levels of self-control. Future research should consider whether other types of heuristics could turn unhealthy choices into healthy ones and which combinations of heuristics and cues (explicit, implicit) are the most effective.

Prior to these suggested research, it is needed to determine if ego-depletion exists and whether truly convincing empirical support for the foundational finding of the model exists for this ego-depletion effect. Roy Baumeister is the author of the most famous study published in which ego-depletion was determined (De Bruin, 2016). Since more researchers are not able to determine ego-depletion, Baumeister received much criticism. Considering the burden of proof now lies with Baumeister, he will set up its own replication project (De Bruin, 2016). This replication project and other studies that are focusing on ego-depletion are necessary in order to avoid a lot of wasted time and energy.

5.4 PRACTICAL IMPLICATIONS

In this study we used app images to investigate if heuristics can help individuals in conditions of low self-control to make better and healthier food decisions. We cannot state if heuristics will have an enhancing effect on the number of healthy food orders in the context of a food-ordering app, due to the lack of- and contradictory results in this study. Although this study was not able to provide evidence supporting the theory that heuristics can help individuals to choose the better option in conditions of low self-control, previously mentioned studies indicate that heuristics have implications for promotion of and interventions on healthy eating behavior. Previously mentioned research showed that social proof heuristics and convenience heuristics could be effective tools to promote healthy food choices. Healthy eating begins with making healthy choices at point-of-purchase settings, such as cafeterias, kiosks, and supermarkets. In such settings, the social proof heuristic can be relatively easily implemented without requiring a radical change in the decision context (Salmon et al., 2014). An example of how the social proof heuristic can be implemented is, for instance, by advertising a certain product with a simple message presenting a healthy food option in a kiosk as “food product of the month,” thereby indirectly suggesting that the majority of the people who buy their lunch at this kiosk chose this healthy food product. An example of how the convenience heuristic can be implemented is, for instance, by placing the healthy food options at the counter or cash registers on eye level, so it will be easy for consumers to choose this option because it is within easy reach and does not need physical effort. This study examined the effect of heuristics in a technical device context. Implementation of the heuristics in this context could be done the same way as we did in this study. Small changes in the design of apps will offer individuals support in making healthy decisions. Since this study did not offer the expected results, future research is needed in order to have more certainty in the effectiveness of heuristics in the technical environment (smartphone apps).

Furthermore, because most food decisions are made without cognitive elaboration, subtle changes in the environment based on other influence heuristics, such as limited editions of healthy food products (scarcity principle) or suggesting that an authority approves a certain healthy food choice (authority heuristic), may mindlessly steer individuals toward healthy food choices (Salmon et al., 2014). All these examples can be translated into stimuli for smartphone apps. All in all, with this study, we tried to show that the healthy option could be the automatic one, by associating healthy food products with an influence heuristic. Due to lack of results and contradictory results this study

does not extend previous research. However, findings showed that explicit cues are not the right way to communicate to individuals, since these messages are direct and not subtle enough. Since automatic resistance to performing the target behaviour has not developed for indirect messages, these messages are more effective, yet such indirect messages are still strong enough to activate the target behaviour. An example of an implicit cue is traffic light labelling. These labels are easy to implement in an online environment, by giving food products certain colour-labels. For social proof this can be translated in to ranking-lists of most chosen products or subpages with 'popular products', without specifically stating that these products are the most popular among the app-users. A suggestion for a convenience heuristic is offering menus in the home page, so that the app-users do not have to search between food products and beverages, however, these suggestions need to be researched before implementation.

Since we translated previous research into a technical context, we employed an online environment to conduct this research, translated previous studies into a technological device context and used a usability research context as cover story. Both aspects were new elements regarding ego-depletion research that provide a unique contribution to the understanding of this phenomenon and its combination with nudges. Although this study does not verify the effect of the previously mentioned heuristics, based on previous research, we assume that applying heuristics to food products in everyday purchase settings may be a new and promising method to provoke more health on impulse.

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APPENDICES

APPENDIX A

TEXT SCENARIOS USED IN THE ONLINE QUESTIONNAIRE WRITTEN IN DUTCH

In this appendix the text scenarios that are used in the online questionnaire are shown. These text scenarios are written in Dutch because the target group is Dutch citizens. An English translation can be found after the scenarios written in Dutch.

General introductory text

Beste participant,

Fijn dat je wilt deelnemen aan dit onderzoek. Wij zijn benieuwd naar jouw mening over een nieuwe app. Aan de hand van jouw mening kunnen wij de app verbeteren in de gebruiksvriendelijkheid en vormgeving. Dit onderzoek wordt uitgevoerd vanuit de Universiteit Twente. Alle gegevens worden vertrouwelijk en anoniem behandeld.

Wanneer er naderhand vragen of opmerkingen zijn, dan kun je via onderstaande gegevens contact opnemen met de onderzoeker. Bij interesse kunnen resultaten gedeeld worden. Door hieronder op 'volgende' te klikken verklaar je vrijwillig deel te nemen aan dit onderzoek.

Jasmijn Demmer

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Scenario 1: low self-control and presence of social proof heuristic

De 'Canteen-app' maakt het mogelijk je voorkeur van voedsel (voor bijvoorbeeld de lunch) door te geven aan de kantine, zodat jij je bestelling op de gewenste tijd kunt komen ophalen en via de app kunt laten zien bij de kassa. Hierdoor is zowel de betaling aan de kassa als de productie van voedsel in de keuken efficiënter. Wij willen de gebruiksvriendelijkheid van de app meten door middel van een klein aantal vragen. Het is de bedoeling dat je bij elk tweetal voedselopties, de optie selecteert die jij zou kiezen wanneer je de app zou gebruiken. Naast de afbeeldingen van de app zijn de voorlopige resultaten van dit vooronderzoek weergegeven. In het kader van gebruiksvriendelijkheid en verbetering van de 'Canteen-app' is het noodzakelijk inzicht te krijgen in de effecten op het geheugen, zodat deze app eventueel kan worden aangepast. Om de nodige ondersteuning aan het geheugen te bieden en bestellingen zo efficiënt mogelijk te laten verlopen vragen we je de volgende symbolen te onthouden, en aan het eind van de vragenlijst in dezelfde volgorde in te vullen:

*@ * % # ? \$ ± §*

Bij het invullen van jouw voorkeur bij de afbeeldingen van de 'Canteen-app' kun je niet terug naar de

vorige pagina. Het daarom de bedoeling dat je aandachtig de symbolen in je gedachten houdt, en niet op een papiertje noteert of kopieert.

Scenario 2: low self-control and absence of social proof heuristic

De 'Canteen-app' maakt het mogelijk je voorkeur van voedsel (voor bijvoorbeeld de lunch) door te geven aan de kantine, zodat jij je bestelling op de gewenste tijd kunt komen ophalen en via de app kunt laten zien bij de kassa. Hierdoor is zowel de betaling aan de kassa als de productie van voedsel in de keuken efficiënter. Wij willen de gebruiksvriendelijkheid van de app meten door middel van een klein aantal vragen. Het is de bedoeling dat je bij elk tweetal voedselopties, de optie selecteert die jij zou kiezen wanneer je de app zou gebruiken. In het kader van gebruiksvriendelijkheid en verbetering van de 'Canteen-app' is het noodzakelijk inzicht te krijgen in de effecten op het geheugen, zodat deze app eventueel kan worden aangepast. Om de nodige ondersteuning aan het geheugen te bieden en bestellingen zo efficiënt mogelijk te laten verlopen vragen we je de volgende symbolen te onthouden, en aan het eind van de vragenlijst in dezelfde volgorde in te vullen:

@ * % # ? \$ ± §

Bij het invullen van jouw voorkeur bij de afbeeldingen van de 'Canteen-app' kun je niet terug naar de vorige pagina. Het daarom de bedoeling dat je aandachtig de symbolen in je gedachten houdt, en niet op een papiertje noteert of kopieert.

Scenario 3: high self-control and presence of social proof heuristic

De 'Canteen-app' maakt het mogelijk je voorkeur van voedsel (voor bijvoorbeeld de lunch) door te geven aan de kantine, zodat jij je bestelling op de gewenste tijd kunt komen ophalen en via de app kunt laten zien bij de kassa. Hierdoor is zowel de betaling aan de kassa als de productie van voedsel in de keuken efficiënter. Wij willen de gebruiksvriendelijkheid van de app meten door middel van een klein aantal vragen. Het is de bedoeling dat je bij elk tweetal voedselopties, de optie selecteert die jij zou kiezen wanneer je de app zou gebruiken. Naast de afbeeldingen van de app zijn de voorlopige resultaten van dit vooronderzoek weergegeven. In het kader van gebruiksvriendelijkheid en verbetering van de 'Canteen-app' is het noodzakelijk inzicht te krijgen in de effecten op het geheugen, zodat deze app eventueel kan worden aangepast om de nodige ondersteuning aan het geheugen te bieden en bestellingen zo efficiënt mogelijk te laten verlopen. We vragen je aan het eind van de vragenlijst een symbool in te vullen, dit symbool is een @.

Scenario 4: high self-control and absence of social proof heuristic

De 'Canteen-app' maakt het mogelijk je voorkeur van voedsel (voor bijvoorbeeld de lunch) door te geven aan de kantine, zodat jij je bestelling op de gewenste tijd kunt komen ophalen en via de app kunt laten zien bij de kassa. Hierdoor is zowel de betaling aan de kassa als de productie van voedsel in de keuken efficiënter. Wij willen de gebruiksvriendelijkheid van de app meten door middel van een klein aantal vragen. Het is de bedoeling dat je bij elk tweetal voedselopties, de optie selecteert die jij

zou kiezen wanneer je de app zou gebruiken. In het kader van gebruiksvriendelijkheid en verbetering van de 'Canteen-app' is het noodzakelijk inzicht te krijgen in de effecten op het geheugen, zodat deze app eventueel kan worden aangepast om de nodige ondersteuning aan het geheugen te bieden en bestellingen zo efficiënt mogelijk te laten verlopen. We vragen je aan het eind van de vragenlijst een symbool in te vullen, dit symbool is een @.

TEXT SCENARIOS TRANSLATED IN ENGLISH

General introductory text

Dear participant,

Thank you for participating in this usability research. We are curious to find out what your opinion is about a new app. With the help of your opinion we can improve the app in its usability and design. This research is executed from the University of Twente. All data is treated confidentially and anonymously.

When there are questions or remarks, you can contact the researcher, using the details below. In case of interest results can be shared. By clicking the 'next' button you agree to cooperate voluntarily.

Jasmijn Demmer

j.a.m.demmer@student.utwente.nl

Scenario 1: low self-control and presence of social proof heuristic

Using the 'Canteen-app' it is possible to send your preference in food (for example during lunchtime) to the canteen, so you can pick up your order at the desired time and show your order at the cash register. This makes payments at the cash registers and food productions in the kitchen more efficient. Via several questions, we want to measure the usability of this app. You will see different pairs of images of the 'Canteen-app'. You are supposed to select the option you would choose when using the app. Aside from the images you also find preliminary results of this research. In the context of usability research and improvement of the canteen app, it is needful to gain insight in memory capacity so this app can be customized in order to provide the necessary support for memory and process orders as efficient as possible. We ask you to recall the following symbols in the same sequence at the end of the questionnaire:

*@ * % # ? \$ ± §*

When selecting your preferences you cannot go back to previous pages, so it is important to memorize the symbols.

Scenario 2: low self-control and absence of social proof heuristic

Using the 'Canteen-app' it is possible to send your preference in food (for example during lunchtime) to the canteen, so you can pick up your order at the desired time and show your order at the cash

register. This makes payments at the cash registers and food productions in the kitchen more efficient. Via several questions, we want to measure the usability of this app. You will see different pairs of images of the 'Canteen-app'. You are supposed to select the option you would choose when using the app. In the context of usability research and improvement of the canteen app, it is needful to gain insight in memory capacity so this app can be customized in order to provide the necessary support for memory and process orders as efficient as possible. We ask you to recall the following symbols in the same sequence at the end of the questionnaire:

@ * % # ? \$ ± §

When selecting your preferences you cannot go back to previous pages, so it is important to memorize the symbols.

Scenario 3: high self-control and presence of social proof heuristic

Using the 'Canteen-app' it is possible to send your preference in food (for example during lunchtime) to the canteen, so you can pick up your order at the desired time and show your order at the cash register. This makes payments at the cash registers and food productions in the kitchen more efficient. Via several questions, we want to measure the usability of this app. You will see different pairs of images of the 'Canteen-app'. You are supposed to select the option you would choose when using the app. Aside from the images you also find preliminary results of this research. In the context of usability research and improvement of the canteen app, it is needful to gain insight in memory capacity so this app can be customized in order to provide the necessary support for memory and process orders as efficient as possible. We ask you to recall a symbol at the end of the questionnaire, this is the symbol @.

Scenario 4: high self-control and absence of social proof heuristic

Using the 'Canteen-app' it is possible to send your preference in food (for example during lunchtime) to the canteen, so you can pick up your order at the desired time and show your order at the cash register. This makes payments at the cash registers and food productions in the kitchen more efficient. Via several questions, we want to measure the usability of this app. You will see different pairs of images of the 'Canteen-app'. You are supposed to select the option you would choose when using the app. In the context of usability research and improvement of the canteen app, it is needful to gain insight in memory capacity so this app can be customized in order to provide the necessary support for memory and process orders as efficient as possible. We ask you to recall a symbol at the end of the questionnaire, this is the symbol @.

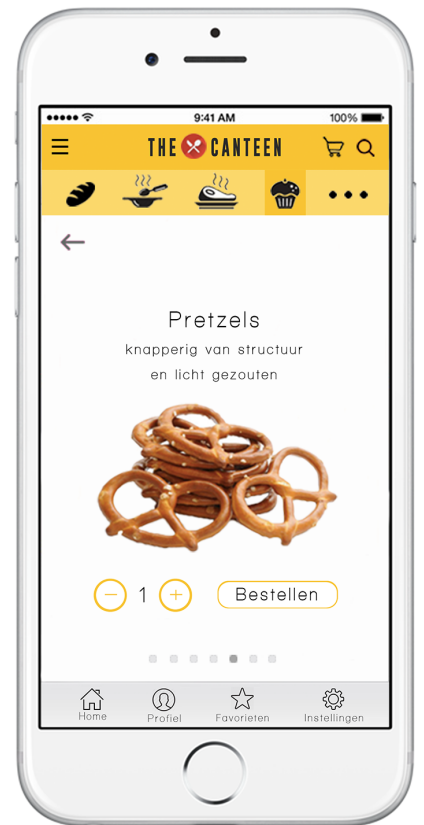
APPENDIX B

PRETEST MATERIALS PRODUCT PAIRS

These materials are used for product pairs pretest (trade-off versus control food product pairs). In the first two pages, the images are categorized according to the product pairs of Salmon et al. (2014). The other images are self-selected food options.

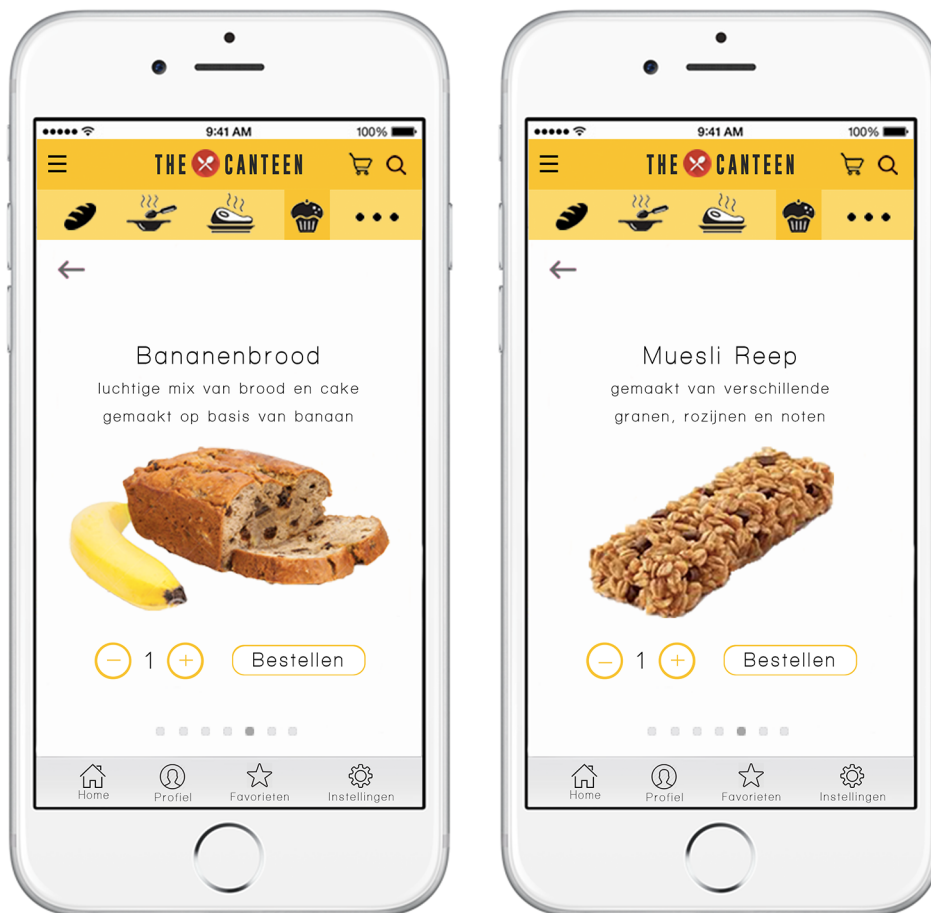








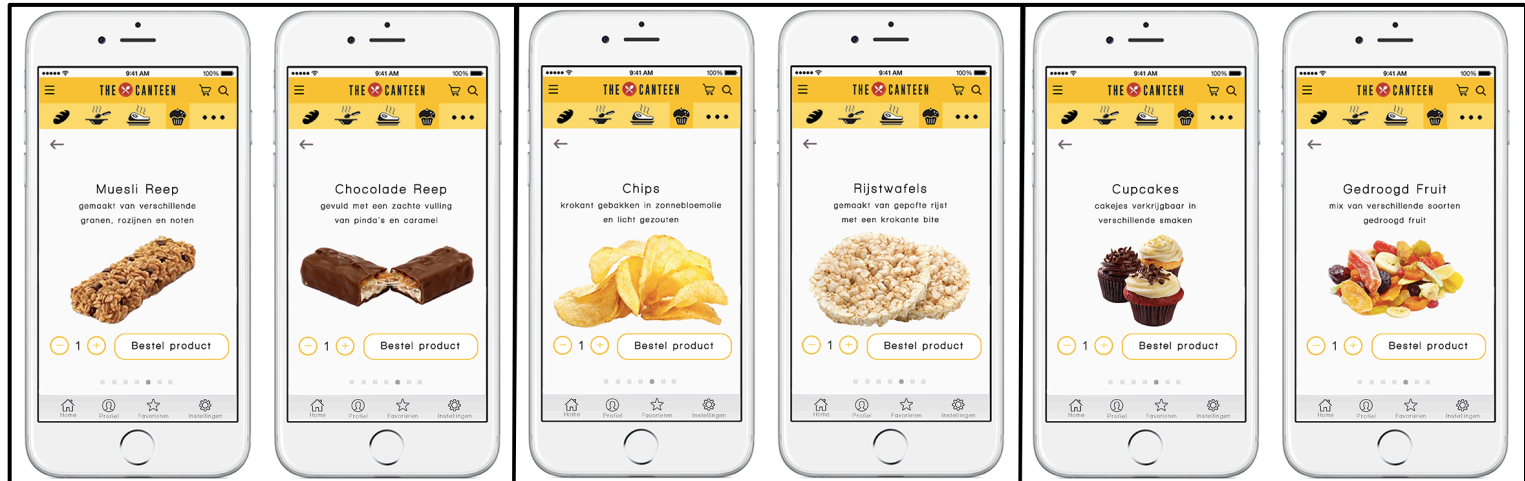
In total 24 single food products are pretested on healthiness and attractiveness. Based on the results of the pretest, the food pairs are made. In total three trade-off product pairs and three control pairs are created. The trade-off product pairs differ the most on the evaluations of healthiness and attractiveness. The control product pairs differ less on these evaluations, these product pairs do not represent as much a self-control dilemma as the trade-off product pairs do.



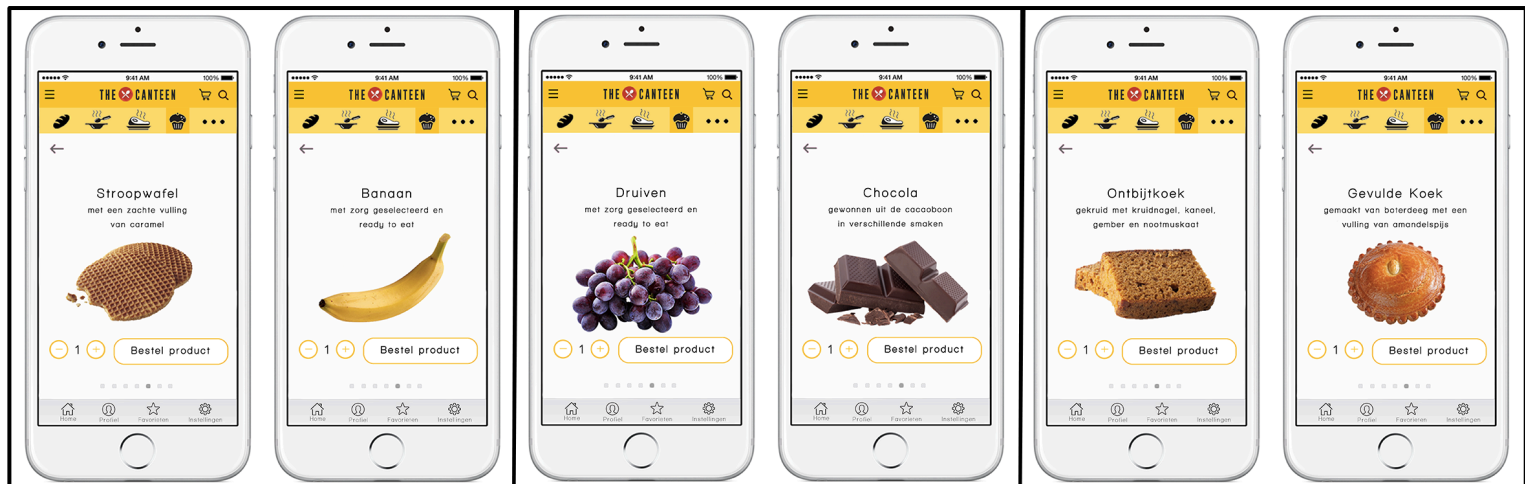
In this figure above, two remaining healthy food options are shown. Banana bread is not as well known as for example a rice cracker. This is why there were little doubts about this option. The pretest showed this product was not well known enough. The other remaining food option is the granola bar. The granola bar is already used, but in figure 6 another image is used to how the food product. The pretest showed that this granola bar is better to use for the food pairs, since participants rated this granola bar as less attractive.

APPENDIX C

IMAGES OF THE PRODUCT PAIRS



Images of the trade-off product pairs.

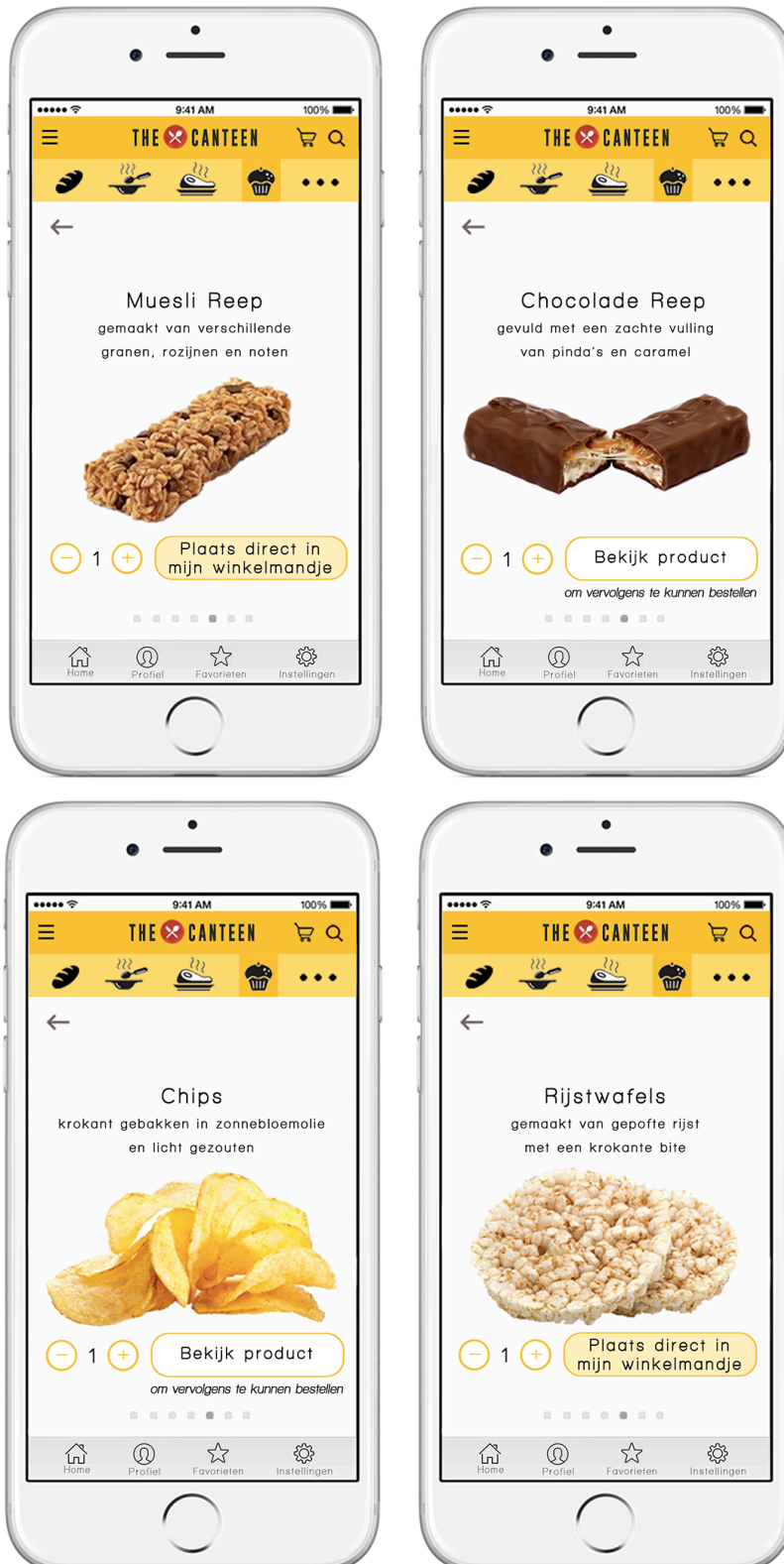


Images of the control product pairs.

APPENDIX D

IMAGES OF THE CONVENIENCE HEURISTIC

These images are also used in the pretest to test the credibility of the stimuli, the usability research context and the convenience heuristic. Each image represents a product pair. In every product pair, the healthy option is more convenient to select. The images below represent the product pairs in the convenience heuristic condition.







APPENDIX E

IMAGES OF THE SOCIAL PROOF HEURISTIC

These images represent the social proof heuristic. In the online questionnaire (in the social proof heuristic condition) the images of the social proof were shown preceding the food-choice task.



APPENDIX F

SHORTENED STATE SELF-CONTROL SCALE AND CONTROL VARIABLES

The items of the state self-control scale were:

1. Ik voel me mentaal uitgeput.

- ☐ Helemaal mee eens
- ☐ Mee eens
- ☐ Mee eens/Mee oneens
- ☐ Mee oneens
- ☐ Helemaal mee oneens

2. Als ik nu een moeilijke opdracht zou krijgen, zou ik makkelijk opgeven.

- ☐ Helemaal mee eens
- ☐ Mee eens
- ☐ Mee eens/Mee oneens
- ☐ Mee oneens
- ☐ Helemaal mee oneens

3. Ik voel me leeg.

- ☐ Helemaal mee eens
- ☐ Mee eens
- ☐ Mee eens/Mee oneens
- ☐ Mee oneens
- ☐ Helemaal mee oneens

4. Ik kan geen informatie meer opnemen.

- ☐ Helemaal mee eens
- ☐ Mee eens
- ☐ Mee eens/Mee oneens
- ☐ Mee oneens
- ☐ Helemaal mee oneens

5. Ik kan me op dit moment goed concentreren.

- ☐ Helemaal mee eens
- ☐ Mee eens
- ☐ Mee eens/Mee oneens
- ☐ Mee oneens
- ☐ Helemaal mee oneens

6. Ik heb bijna geen mentale energie meer.

- ☐ Helemaal mee eens
- ☐ Mee eens
- ☐ Mee eens/Mee oneens
- ☐ Mee oneens
- ☐ Helemaal mee oneens

The items that measured the control variables were:

1. In hoeverre heb je het doel om gezond te eten?

- ☐ Dit heb ik heel erg
- ☐ Dit heb ik wel
- ☐ Dit heb ik wel/Dit heb ik niet
- ☐ Dit heb ik niet
- ☐ Dit heb ik helemaal niet

2. Hoe leuk vond je het om deze vragenlijst in te vullen?

- ☐ Erg leuk
- ☐ Leuk
- ☐ Leuk/Niet leuk
- ☐ Niet leuk
- ☐ Helemaal niet leuk