Stimulating Healthy Food Choices in an Online Supermarket

Research into the influence of a priming nudge and a salience nudge on stimulating healthy food choices in an online supermarket environment.

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Abstract

Aim. This study aimed to investigate the effectiveness of a salience nudge, a priming nudge, or a combination of the salience nudge and the priming nudge on stimulating participants to make healthier food choices in an online supermarket environment. Additionally, to explore the moderation effect of general health interest on the relationship between the single nudges and the healthiness of participants' food choices.

Method. The study had a 2 *(salience nudge: absent/present)* x 2 *(priming nudge: absent/present)* between-subjects experimental study design. Participants (n = 225) were randomly assigned to one of the four conditions and filled out a questionnaire in which four mobile supermarket product pages were presented to them. On each of the product pages they needed to pick one product to purchase, which was either healthy or unhealthy. Furthermore, they were asked additional questions such as their general health interest.

Results. No significant effects were found of the salience nudge, the priming nudge, or the combination of the salience nudge and the priming nudge on the healthy food selection. Additionally, no significant moderating effect was found for general health interest.

Conclusion. The salience nudge, the priming nudge, or the combination of the two nudges do not stimulate participants to make healthier food choices in an online supermarket environment. This can possibly be explained by the presentation of the nudges in the current study, or by low-level processing, reduced attentional scope, and concentrated focus that were found to be associated with online information processing.

Keywords: Nudging, health behavior, food choice, salience, priming, online grocery shopping

Table of Contents

Stimulating Healthy Food Choices in an Online Supermarket

The global pandemic of obesity is one society has been fighting for years (Meldrum et al., 2017; Roth et al., 2004). In 2016, about 44% of adults worldwide were overweight or obese (BMI over 30), with most cases in Europe and the USA (Shekar & Popkin, 2020). Not to mention, by the year 2030, about 40% of the world's population is expected to be overweight, and another 20% is expected to be obese (Kelly et al., 2008). Reducing obesity rates is important since obesity has large consequences on the health of the people in our society since research shows that many diseases and medical conditions are directly related to obesity. A few examples of this are type 2 diabetes, cardiovascular diseases, and various types of cancer, such as esophageal cancer, breast cancer, and kidney cancer. However, this is merely part of the long list of possible consequences resulting from obesity (Meldrum et al., 2017).

This expected rise in the number of people that are overweight or obese raises the question of how society can contribute to stopping this growth and reducing the number of obesity cases. One of the main predictors of obesity was found to be eating behavior and, more specifically, the consumption of energy-dense food products was found to be significantly associated with obesity (Mendoza et al., 2007). The energy density of food products is the amount of ‘energy’ a specific food product contains. On food packaging in the supermarket, this amount of ‘energy’ is presented as kilocalories (Drewnowski, 2004). Two factors that were found to be associated with this increased intake of energy-dense foods, and therefore with the population’s weight gain, are the increased availability of high-processed, sugar-containing, and energy-dense food products (Meldrum et al., 2017; Swinburn et al., 2011), and increased exposure to persuasive food marketing expressions (Swinburn et al., 2011). To reduce the

number of overweight and obesity cases it is, therefore, required to stimulate healthy eating habits that contain mostly low-energy-dense foods and other nutritious foods.

The consumption behavior of humans is based on the decisions that people make, and research shows that around 200 food decisions per day are made by unconscious information processing (Marchiori et al., 2017). Kahneman (2013) describes this unconscious processing as System 1 in our brain, which can be defined as quick, automatic, and unconscious information processing. Furthermore, there is also system 2 in our brain which is slow, conscious, and rational information processing. Most daily behavior of people is driven by system 1 (Kahneman, 2013), and this, as mentioned above, also applies to most food decisions (Marchiori et al., 2017).

These system 1 decisions are influenced by the choice environment and how this environment is presented to the consumer (Marchiori et al., 2017; Thaler & Sunstein, 2009). Manipulating the choice environment by the use of nudges can, therefore, influence a person's decision-making process since nudges anticipate system 1 processing to guide someone unconsciously to a specific option (Mirsch et al., 2017). Nudging can be defined as changing an aspect of the choice environment to guide the consumer to one of the options without excluding any alternative options (Mirsch et al., 2017; Thaler & Sunstein, 2009). Previous research found that nudging was already effective in changing people’s food choices in the physical environment to more healthier options. An example is a study by Kroese et al. (2015) in which they repositioned healthy foods next to the cash register of a station store to make them more accessible and salient, and this resulted in a significant increase in the sales of these food

products. Another study examined the opposite by placing unhealthy foods further away and hard to reach, and found that sales of these products were decreasing (Maas et al., 2012).

Furthermore, a meta-analysis by Broers et al. (2017) reviewed the effectiveness of healthy food nudging for fourteen studies. Almost all reviewed studies were conducted in the physical environment and contained one of the following three nudging options; altered properties (such as product labels and product size), altered placement, a combination of both. They found that sales of fruits and vegetables significantly increased due to the nudges, with most of the effect being generated by repositioning and using combined nudges.

In addition to this, a systematic review study by Wilson et al. (2016) on nudging healthy food choices reviewed twenty-six studies. The studies specifically contained a priming nudge, salience nudge, or both the priming nudge and salience nudge. Priming nudges were defined as "subconscious cues which may be physical, verbal or sensational, and are changed to nudge a particular choice" (Wilson et al., 2016, p. 49). Moreover, salience nudges were defined as "Novel, personally relevant or vivid examples and explanations are used to increase attention to a particular choice. Reactions will be elicited primarily through emotional associations in response to the nudge" (Wilson et al., 2016, p. 49). In this review study by Wilson et al. (2016), they describe multiple studies that found positive results on healthy food choices for the usage of priming nudges, as well as multiple studies that found positive results for the usage of salience nudges. Finally, the review also showed positive results for the combination of these two nudges for all 3 studies that used both a salience nudge and a priming nudge (Wilson et al., 2016).

Furthermore, based on the review study by Wilson et al. (2016) it is expected that the effect of the salience nudge and the priming nudge combined is stronger than that of the single

nudges by themselves. The reason for this is that the studies described in the review study by Wilson et al. (2016) only showed positive results on stimulating healthy eating behavior for some of the studies in which only a priming nudge was applied as well as for the studies that contained only a salience nudge. However, for the studies that researched both the salience nudge and the priming nudge combined, all studies found positive results on stimulating healthy eating behavior. This suggests that the nudges possibly reinforce each other when combined.

Above mentioned studies (Broers et al., 2017; Wilson et al., 2016) already showed the potential of using a priming nudge, a salience nudge, or both nudges to change eating behavior. However, nudges are highly context-dependent which means that the effects of the nudges found in a specific context may not be generalizable to other contexts (Marchiori et al., 2017). From a research viewpoint it is, therefore, interesting to further explore the potential of these nudges in another context, and more specifically in a digital context. The reason for researching this in a digital context is that the possibilities for nudging in online environments have increased, and nowadays people make more and more product decisions online (Mirsch et al., 2017). Also, recently there was a large increase in people doing online grocery shopping due to the corona pandemic. For instance, in Finland, they observed an increase of 800% in online grocery shopping sales (Eriksson & Stenius, 2020).

Besides the fact that consumers increasingly make decisions online, there is also reason to believe that results may differ in a digital context compared to the physical context that was researched in the previously mentioned studies. This reason is the distinction that was found by researchers between physical environments and online environments. For example, it was found that information processing in an online environment reduces someone's attentional scope and

increased concentrated focus compared to an offline environment. Furthermore, it was found that information processing of internet information was associated with low-level processing (Peng et al., 2018). Narrowed attention scope can be beneficial for nudging since it was found that presenting goal-related primes under conditions with a narrow attentional scope elicits larger effects on decision-making than under conditions with broader attentional scope (Sadowski et al., 2020). These findings suggest that it cannot be assumed that the findings for nudges used in a physical context also automatically apply to a digital context. For the current study, this means that the previous positive results found for the salience nudge and the priming nudge (Wilson et al., 2016) on behavioral change may elicit other results when applied online.

An additional factor that possibly influences whether people make healthy food decisions is their general health interest. Many years ago, research already found that higher interest in eating healthy was associated with making healthier food choices. For example, the study by Roininen and Tuorila (1999) found that people with higher interest in healthy eating choose apples over chocolate bars and vice versa. General health interest can also be an important factor when it comes to nudges since it was found that the effect of priming nudges was larger when the primed concept was personally valued by a person (Weingarten et al., 2016). For the current research, this suggests that priming healthy food could be more effective in stimulating healthy food choices for people that already have high general health interest. Therefore, people's general health interest should be taken into account to see whether this possibly strengthens or weakens the relationship between the nudges and the healthiness of someone's food choices.

In sum, the research question guiding the current research is: "What are the effects of a priming nudge and salience nudge on stimulating healthier food choices in an online

supermarket, and do these nudges reinforce each other when deployed together? Additionally, are the effects of the single nudges moderated by a person's general health interest?".

Theoretical Framework

Dietary Decision Making

As mentioned before, do people make around 200 food-related decisions per day (Marchiori et al., 2017). Since a healthy diet is required to improve our health and reduce overweight it is important to understand what influences these decisions.

Influences. There are multiple factors that influence someone's food decisions. Research by Shepherd and Raats (2010) illustrates a model that contains five factors that have a large effect on people's food choices. These factors are based on previous findings from other researchers (Connors et al., 2001; Falk et al., 1996; Furst et al., 1996) and are, therefore, a reliable indicator of the most important influences. The influences that Shepherd and Raats (2010) mention are; *Ideals* which are norms that are taught by the parents, the family, or the culture of an individual (e.g. parents taught their children what a proper meal is), *Personal factors* which are the physiological, psychological and emotional characteristics of an individual (e.g. someone's interests in for example healthy eating behavior), *Social factors* which are the people with whom an individual is surrounded with (e.g. deciding together what to have for dinner), *Resources* which are the money, equipment, space an individual has access to, but also someone's time, skills and knowledge (e.g. low income shapes food decisions), and finally

Context which is the environment in which an individual makes the food choices (e.g. availability of food products or how they are presented) (Shepherd & Raats, 2010).

The influence 'personal factor' is one which will be elaborated on later on in the context of General Health Interest. The focus, for now, will be on the above-mentioned factor 'context' since this factor can be manipulated. Therefore, it is valuable to explore how this specific factor can be used to influence eating behavior. When it comes to studies that investigated food decision making in a specific context most studies referred to the term *choice environment* (Schneider et al., 2018; Vlaev et al., 2016), meaning the environment in which the consumer makes the decision on what product(s) to buy. An example of a choice environment in which consumers make food-related decisions can be a canteen, a restaurant, or a supermarket website.

In conclusion, this means that the food decisions that someone makes are influenced by the choice environment and how this environment is presented to them (Marchiori et al., 2017; Thaler & Sunstein, 2009). This choice environment can be manipulated by implementing adaptations in the physical or digital environment, which can be done using so-called nudges.

Nudging

A definition that is mainly used in the research literature to describe what a nudge is, is the one by Thaler & Sunstein (2009) which states as follows; "A nudge is any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives." (p. 6). However, multiple researchers have added additions to this definition such as that it should not add additional time, trouble or social consequences (Hausman & Welch, 2010), and that they are meant to affect

decisions and behavior in not only a predictable way, but also in an intentional way (Hansen & Jespersen, 2013).

The concept of nudging stems from behavioral economics and social psychology, and explains why people do not always make the most rational choices (Thaler & Sunstein, 2009), or in this case; the healthiest choices when it comes to food decisions. Furthermore, nudging corresponds to libertarian paternalism, which is a philosophy about how people are guided to help them make better decisions, but also give them the ability to behave differently or make other choices (Marteau et al., 2011).

Types of Nudges. There are multiple types of nudges to incorporate into a choice environment to guide someone's decision-making process (Wilson et al., 2016). For example, *Priming nudges* which are unconscious physical, verbal, sensational signals to point out a particular option, and *Salience nudges* which are cues that move the attention to a specific option which evokes reactions through emotional associations (Wilson et al., 2016). The current study will focus on the two above mentioned nudges, however, there are other nudges that can be effective in changing behavior, such as; *Default nudges* which preset choices to make it the easiest option, *Incentive nudges* which are providing something for positive choice options or take away something for negative choice options, *Commitments and ego nudges* which are options in line with someone's provided commitment or promise, and lastly, *norms and messenger nudges* which are setting a norm of what other people chose or using people with status to communicate an option (Wilson et al., 2016).

Information Processing of Nudges

What all of these types of nudges have in common is that they guide someone unconsciously to a specific option, and they do this by anticipating system 1 information processing (Mirsch et al., 2017). System 1 information processing is part of the dual-system theory by Kahneman (2013). This theory explains that there is a distinction between two information processing systems within human cognition. On the one hand, there is system 1 which can be defined as quick, automatic, and unconscious information processing, and on the other hand, there is system 2 which is slow, conscious, and rational information processing (Kahneman, 2013).

Type 1 Versus Type 2. The two systems are interacting and complementing each other. Both of them are active, however, system 1 is always active and does not require activation, and system 2 is only minimally active until more complex processing is required. System 1 generates responses, impressions, and intuitions for system 2 on which system 2 can further elaborate to turn these into beliefs and impulses. In most cases system 2 just accepts the suggestions given by system 1 (Kahneman, 2013). What this means is that most of the impressions and intuitions will guide a person's decisions and behavior, since system 2 does not have to be activated.

Overall, people themselves think that the decisions they make are voluntary, rational, and cannot be influenced by cues in the environment (Marchiori et al., 2017). However, due to unavailable time, motivation, or cognitive resources, most decisions people make are not actually conscious or rational. This leads to most decisions being made based on attention, emotion, familiarity, or popularity (Marchiori et al., 2017).

Nudging for Behavior Change

What nudging does is respecting and using the way of information processing done by system 1 and, therefore, it can elicit behavior change unconsciously. Nudging uses this unconscious relation between a person and its environment by implementing interventions in this environment that do not require complex or rational processing (Marchiori et al., 2017). This influences people's choices and behavior since people do not pay attention to all elements within a choice environment, and just accept the intervention and choose the path with the least resistance (Thaler & Sunstein, 2009). Nudging can, therefore, possibly control human behavior without people being aware of it.

The reason why nudges focus on system 1 processing instead of system 2 processing is that system 2 interventions, such as education, can change people's intentions but do not directly contribute to behavioral change (Broers et al., 2017). This gap between someone's intentions and behavior explains why system 2 interventions only lead to minor effects when it comes to behavior change (Broers et al., 2017). This intention-behavior gap also applies to food-related decisions. An example is the study by Mullan et al. (2014) in which intention only accounted for a small percentage of variance in increased fruit and vegetable consumption. Nudging can possibly solve this intention-behavior gap since it uses system 1 processing to not only change intentions but also behavior.

Despite the potential advantages of nudging, there is also an uncertainty that should be mentioned. Since nudges are tested in specific contexts it is unsure whether the effects of nudges would also apply to other situations and whether generalizations can be made (Marchiori et al., 2017).

Nudges to Guide Healthy Eating Behavior

Nudging already showed its ability for behavior change when it comes to encouraging healthier diets. A meta-analysis by Broers et al. (2017) reviewed the effectiveness of nudges for fruit and vegetable choices in food-related environments of fourteen studies. The studies were divided into three groups of nudges; altered properties (for example altered product labels or product sizes), altered placement, or a combination of both. Results showed a significant increase in sales for fruits and vegetables, with the largest effects in studies that used strategies of alternating the placement or using combined nudges.

Besides this meta-analysis, a systematic review was done by Wilson et al. (2016) within this study they reviewed twenty-six research studies on the effectiveness of nudges to increase healthy food selection. While selecting the articles they did not search for specific types of nudges within the studies. However, all studies found using their selected key terms contained either a priming nudge, a salience nudge, or both nudges. The priming nudges within these studies were captured as; visibility, accessibility, availability, a combination of these three, or visibility and accessibility combined. Furthermore, the salience nudges in these studies were captured as; calorie labels, color coding, descriptive labels, invitation to downsize meals, or descriptive label and taste-testing. Additionally, in the studies in which the priming nudge and the salience nudge were combined the salience nudge was captured as color-coding in all studies. Similar to the meta-analysis described above, also within this review almost all studies were conducted in a physical environment (Wilson et al., 2016). Based on their review, they found significant positive results for increasing healthy food choices for the priming nudges in 7 of the 12 studies. Furthermore, of these 12 studies, two studies showed mixed ability to influence

healthy food choices, two studies did not show an influence on healthy food choices, and one study showed a negative influence on healthy food choices. When it comes to the salience nudge studies, they found significant positive results for 5 out of 11 studies. Of these 11 studies, one study showed a mixed ability to influence healthy food choices, four studies showed no influence on healthy food choices, and one study found a negative influence on healthy food choices. The review study describes that the reason for not finding positive results for all salience nudge studies and priming nudges studies, is mostly due to the fact that they were conducted as a field experiment in which confounding variables that influence the results are hard to eliminate (Wilson et al., 2016). Therefore, the nudges are still expected to be effective when these confounding variables are avoided.

Furthermore, another study that describes how nudging can be effective to encourage eating behavior is one by Kroese et al. (2015) in which they repositioned healthy food products to make them more accessible and salient in a station store. They found that this intervention significantly increased the sales of these healthy products (Kroese et al., 2015). Additionally, a comparable study that researched the opposite by repositioning unhealthy food products to make them less accessible and salient was found to decrease the sales of unhealthy products (Maas et al., 2012).

Overall, the above-mentioned studies provide a reason to believe that using nudges could be an effective tool to improve people's eating behavior positively.

Digital Nudging

As above mentioned, are there already multiple studies that researched and found positive effects of salience nudges and priming nudges on stimulating healthy eating behavior. However,

it is mentioned before that one of the uncertainties of nudges is that nudges are tested in specific contexts and that it is hard to make generalizations since effects can differ between situations (Marchiori et al., 2017). Therefore, it could be valuable to research whether the positive effects found for the salience nudge, the priming nudge, or a combination of those two also apply to other contexts, such as an online environment.

The reason for testing these nudges in an online environment in the current study compared to previous studies conducted in the physical environment is because there is a distinction between these two. For example, a study by Peng et al. (2018) conducted an experiment in which participants either needed to execute an online task (shopping online), a physical task (reading magazines), or just have some relaxation time. They found that internet information processing was associated with low-level processing and that participants who performed the online task had reduced attentional scope and more concentrated focus compared to the other two tasks. This narrowed attentional scope could be beneficial for nudging since it increases the chance of the nudge being observed (conscious or unconscious) and it was found that presenting goal-related primes under conditions of narrow attentional scope elicited larger effects on decision-making compared to broader attentional scope (Sadowski et al., 2020).

Another example of this difference between online and physical environments is that it was found that people in an online environment show more loyalty with regard to brands and product sizes and are less sensitive to prices compared to offline environments (Chu et al., 2010). Though this study did not investigate the effect of nudges, this study explains that human information processing works differently in an online context compared to an offline context. The findings of these studies suggest that it cannot be assumed that results found for studies on

priming nudges and salience nudges that were conducted in a physical environment also automatically apply to an online environment.

Within the research field, nudging in online environments is called digital nudging which means “the use of user-interface design elements to guide people’s behavior in digital choice environments” (Weinmann et al., 2016, p. 433). Digital nudging can be done by altering what is presented and how this is presented in the choice environment by changing design elements in the user interface (Schneider et al., 2018).

Digital nudging can also be done using salience nudges and priming nudges. Two studies already investigated the effects of a salience nudge and a priming nudge in an online environment to stimulate healthy eating (Hoenink et al., 2020; van der Laan et al., 2017). Both studies were conducted in a realistic virtual supermarket simulation. The study by Hoenink et al. (2020) used salient pricing strategies and nudges which resulted in an increase in the sales of healthy food products. Furthermore, van der Laan et al. (2017) used a priming nudge to prime healthy products, which resulted in more people choosing these products and less choosing unhealthy food products.

These studies are conducted in an online environment, however, they are both conducted with a virtual supermarket simulation to mimic an experience in the physical environment. Therefore, it cannot be directly assumed that the positive effects found for these studies also apply to digital environments. Research on the effects of a salience nudge and a priming nudge on stimulating healthy food choices are primarily conducted in offline environments. More research should be conducted to determine whether these positive effects of the salience nudge

and the priming nudge on stimulating healthy eating behavior can be translated to digital environments such as a mobile supermarket website.

Cognitive Processes of Salience nudges and Priming nudges

To understand how the salience nudge and the priming nudge can influence human decision making, it is important to explain which cognitive processes underlie these nudges and explain how they can be effective.

Salience Nudge. The success of the salience nudge is mainly based on the concept of attention. As mentioned before, attention is a crucial component in decision making (Marchiori et al., 2017; Thaler & Sunstein, 2009). For good, or in this case healthy, decision making we want to capture what is most important to us, so our attention will be drawn to what seems to be most relevant within the choice environment. Since we only have limited cognitive resources, the decisions that we make are based on what we capture within our limited attention span (Kahneman & Thaler, 2006). Research shows that elements in the choice environment that are most visually salient will capture our attention (Wilson et al., 2016) and we will ignore information that is less salient but could be relevant to us (Vlaev et al., 2016). The human brain indicates that the salience of an element represents its importance, meaning that whenever something is more salient, it must be important to us and vice versa (Noggle, 2017). By manipulating the salience of a certain option, it increases the chances of that option being chosen (Wilson et al., 2016). For the current research study, this means that making healthy food products more salient could increase the chance of people choosing that product over the unhealthy food product.

Especially, since research already provides evidence to believe that the use of a salience nudge to make healthy food products more visible is an effective strategy to improve healthy eating behavior. For example, a study found that making healthy products more salient by taste labels increased the selection of these products (Grabenhorst et al., 2013). In line with these findings, a study by Levy et al. (2012) also saw an increase in healthy food purchases by making healthy options more salient with traffic light labels. Above, the study by Hoenink et al. (2020) was already mentioned. This study researched the effect of a salience nudge in a digital supermarket simulation and found that combined salient pricing strategies and salience increased the sales of healthy products.

Two of the above-mentioned studies were conducted in a physical environment (Grabenhorst et al., 2013; Levy et al., 2012) and only the one by Hoenink et al. (2020) was conducted in a digital environment. The reason for this is that not a lot of research has yet been conducted on the effects of a salience nudge on healthy eating behavior in a digital environment, probably due to the fact that research into digital nudges is still in its early stages. However, it is still expected that using a salience nudge in a digital environment can change eating behavior. Ground for this is online environments reduce attentional scope and increase concentrated focus (Peng et al., 2018) which could be beneficial for the salience nudge since their effectiveness relies mostly on attention.

These findings suggest the following hypothesis for the current research study: **H1:** *The presence of a salience nudge on healthy products increases the proportion of healthier food choices in an online supermarket compared to the absence of a salience nudge.*

Priming Nudge. As mentioned, can human behavior be influenced by unconscious interventions in the choice environment (Marchiori et al., 2017). Besides a salience nudge, this can also be done using a priming nudge. The effect of priming relies on the fact that human rationality while making decisions is limited due to the cognitive limitations of the person making the decision (Momsen & Stoerk, 2014), which was mentioned before as part of system 1 processing.

For example, Tversky and Kahneman (1974) found that people think that the likelihood of events occurring depends on how easily they can come up with examples of that event or a similar event. Moreover, research also shows that decision-makers rely on the information that comes directly to mind and do not evaluate all the information recorded by their brain (Gennaioli & Shleifer, 2010).

These cognitive limitations can be explained by spreaded activation, which describes that our memory is a semantic network of concepts that are connected with each other. Whenever external cues are presented to the information processing system, a specific set of concepts and related concepts will be activated (Ratcliff & McKoon, 1988). A phenomenon that uses this process of spreaded activation is priming. Priming can be defined as the pre-activation of concepts within our memory (Bermeitinger, 2015). This means that when a prime is presented before a test property it speeds up the activation spread between the prime and this test property. The reason for this is that it requires less time and effort to activate relevant concepts since these are already activated when exposed to the prime (Esmark, 2016; Ratcliff & McKoon, 1988).

A specific type of priming which is relevant for behavior change is goal priming. This refers to a priming situation in which the test property is a goal and where a prime is used to steer

the decision-maker in the direction of this established goal (Custers & Aarts, 2010). In this specific context, a goal refers to behavior that is perceived as rewarding by the decision-maker, which helps to motivate them to make decisions that are in line with the pursued goal and avoid decisions that are not (Papies, 2016). Furthermore, priming works mostly unconsciously and can, therefore, affect someone's behavior by anticipating existing motivations without them being aware of the trigger of this behavior (the prime) (Custers & Aarts, 2010; Papies, 2016).

That priming is a successful strategy for behavior change is already supported by multiple research studies. For example, it was found that priming people with healthy products at the start of a buffet would lead to people choosing healthier products (Wansink & Hanks, 2013). This means that recent exposure to a healthy product also increases the chance of those products being selected by someone. Furthermore, a meta-analysis by Weingarten et al. (2016) found that using goal-related words to prime people was an effective tool for behavior change. The analysis researched the effects of this strategy in multiple domains and found that the effects were larger for studies about health behavior and consumption behavior. Additionally, they also found that these priming effects were larger for participants that valued the primed concept more (Weingarten et al., 2016). In line with this research are the results found in the study by Wryobeck and Chen (2003) describing that health-related words such as 'active' and 'fit' was an effective prime for participants to take the stairs instead of the elevator.

A study by van der Laan et al. (2017) that was mentioned before used priming as a technique to influence healthy eating in an online environment, which was a supermarket simulation. Both priming words were used on recipe banners to prime the goal of healthy eating

which resulted in an increase in healthy food selection and a decrease in unhealthy food selection.

Similar to the salience nudge, not a lot of research on the effects of the priming nudge has yet been done on stimulating healthy eating behavior in a digital environment as the study by van der Laan et al. (2017) is one of the limited studies that researched this. However, using a priming nudge in a digital environment still has the potential to be effective. Reason for this is that information from online environments was associated with low-level processing (system 1) (Peng et al., 2018), which is beneficial for the priming nudge since system 2 processing is not activated meaning that the intervention will just be accepted by the brain (Kahneman, 2013).

The above-mentioned findings suggest that priming can be an effective method for stimulating healthy eating behavior, therefore, the following hypothesis will be added for this research study: **H2:** *The presence of a priming nudge increases the proportion of healthier food choices in an online supermarket compared to the absence of a priming nudge.*

Combined Nudges Versus Single Nudges

That the salience nudge and the priming nudge can be effective methods to changing people's health behavior positively was already discussed. However, research also shows that combining multiple nudges can even elicit more positive effects. The before mentioned meta-analysis by Broers et al. (2017) reviewed multiple studies that either contained one nudge or a combination of nudges found that combining nudges significantly increased fruit and vegetable sales compared to almost all single nudges. This meta-analysis did not specifically focus on combining a salience nudge and a priming nudge, but it does indicate that there is potential in the positive effects of combining nudges.

Research provides reason to believe that combining a salience nudge and a priming nudge could be very effective. This reason is based on the findings by Kahneman and Frederick (2005) that describe that what comes to our mind is mostly depending on stimulus salience and priming. For decision-making, people rely on information that comes directly to mind without evaluating alternative information that was captured in their brain (Gennaioli & Shleifer, 2010). This means that stimulus salience and priming directly influence decision-making. Furthermore, it was found that combining the salience nudge and the priming nudge stimulates healthy choices, because it can make healthy options both sensory (more visible through the salience nudge) and mentally (pre-activated concepts through the priming nudge) an easy choice. Since people naturally have a tendency to go for the easy option it provides support to the effectiveness of the two nudges combined (Kahneman, 2003; Tversky & Kahneman, 1974).

The effectiveness of the two nudges combined was also already shown in the systematic review study by Wilson et al. (2016) on nudging healthy food choices. The study reviewed twenty-six experimental studies conducted in a physical setting that contained either a priming nudge, salience nudge, or a combination of these two nudges. Of the twenty-six studies, three studies were conducted with the priming nudge and salience nudge combined. All three studies used traffic light labeling as a salience nudge and repositioning as a priming nudge. These three studies all found an increase in healthy food sales or a reduction in unhealthy consumption (Levy et al., 2012; Thorndike et al., 2012, 2014). Contrary to this, for the studies that only researched the effect of one of the nudges, so either the salience nudge or the priming nudge, not all studies found significant increases on healthy food selection. What this suggests is that the nudges possibly reinforce each other when combined compared to when they are used by themselves

since the results of the nudges combined are consistently positive on encouraging healthy eating behavior.

These findings led to the following hypothesis for this study: **H3:** *The effect of the salience nudge on increasing the proportion of healthier food choices in an online supermarket are stronger when the priming nudge is present compared to the absence of a priming nudge.*

General Health Interest

As mentioned before, one of the important factors that influences someone's food decisions is 'personal factor'. A personal factor that is relevant to the current research study is someone's interest in healthy eating. The reason for this is that when someone strives to eat healthy this can be perceived as a personal goal. That someone's personal goals can play an important role in the effectiveness of nudges is already supported by multiple research studies. An example of this is the painted food steps to stairs which significantly increased the number of people taking the stairs (Zimmerman, 2009). This worked because it was found to be an appreciated intervention by someone aiming to exercise more since the nudge was in line with their personal goals. However, for someone that preferred the elevator and did not have the exercise goal, it could elicit negative emotions when noticing the intervention (Marchiori et al., 2017).

This effect can be explained by human behavior since most human behavior was found to be goal-directed, meaning that someone's goals influence their motivation to start or continue goal pursuing behavior, or to avoid behavior that does not match their goal (Marchiori et al., 2017). For the current research this means that whenever someone already had the personal goal

to strive for healthy eating behavior, the chances are highly conceivable that a nudge will have more influence on them than a person who doesn't share this goal.

Priming and Goal-Directed Behavior. When it comes to the priming nudge specifically, it was found that priming effects are larger for participants when the primed concept was personally valued by them (Weingarten et al., 2016). This was also supported by a study by Papies (2016) which found that when a personally valued concept such as healthy eating was primed using a specific intervention, then this would draw that person's attention to this intervention and would pre-activate their goal-related cognitive processes which happen unconsciously by system 1 processing. Both are important requirements for the effectiveness of priming. Whenever these elements are not activated because someone does not value the primed goal, priming was found to be not effective (Papies, 2016) In summary, this means that a person's goal to eat healthy moderates the effect of a priming nudge.

Therefore, the following hypothesis was added for the current study: **H4a:** *The effects of the priming nudge on increasing the proportion of healthier food choices in an online supermarket are larger when a person has high general health interest compared to low general health interest.*

Salience and Goal-Directed Behavior. Above the importance of attention for the effectiveness of goal priming was already mentioned. However, it was found that other external cues can possibly also attract attention that is needed to activate goal-related cognitive processes. This means that the goal concept (healthy product) competes with other concepts (unhealthy products) for the attention of the decision-maker. What increases the chances that someone's

attention will be drawn to the goal concept is increasing the salience of it (Weingarten et al., 2016).

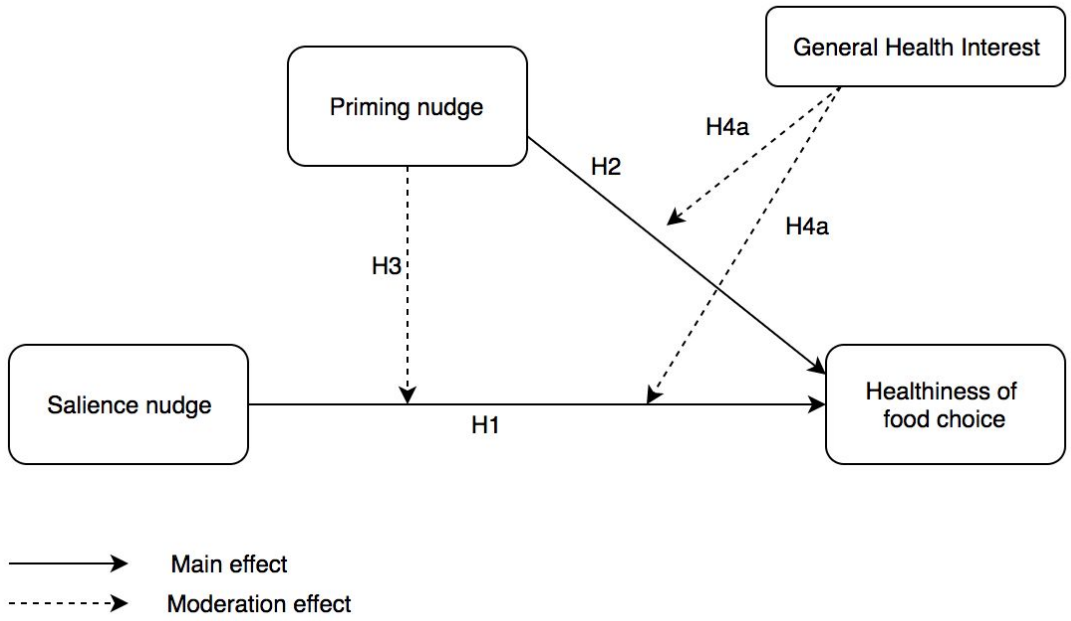
This suggests that a nudge that increases the salience of a goal concept also can be a relevant factor for goal pursuing behavior. For the current research, this means that the goal of stimulating healthy food choices can possibly be reached by increasing the salience of healthy products compared to unhealthy food products. For someone that already personally values healthy eating, the effects of a salience nudge are expected to be larger since this intervention is in line with their personal goal. However, for someone that does not share this goal, it possibly has negative effects since the increased salience of a nudge makes it more noticeable which was found to possibly elicit negative emotions (Marchiori et al., 2017). This led to the following hypothesis:

H4b: *The effects of the salience nudge on increasing the proportion of healthier food choices in an online supermarket are larger when a person has high general health interest compared to low general health interest.*

In summary, Figure 1 represents the conceptual model and the associated hypotheses.

Figure 1

Visual representation of the research model.



Method

Design

The study had a 2 x 2 between-subjects experimental study design in which participants were divided over the four conditions. Within the experiment, the salience nudge (*absent/present*) and the priming nudge (*absent/present*) were the independent variables, and the healthiness of the chosen food product (*healthy/unhealthy*) was the dependent variable. Furthermore, general health interest was the moderating variable. Participants were randomly assigned to one of the four conditions and were equally divided over the conditions.

Participants

The required number of participants was based on a prior nudging field study with four conditions (van Kleef et al., 2012). The goal was to recruit 158 participants through convenience sampling, but eventually 225 people participated within this study. Participants were invited through social media to complete the questionnaire in exchange for a chance to win a gift certificate of twenty-five euros. To participate in the experiment, participants needed to meet the criteria that they were above the age of 18 years old, had a sufficient level of English, had access to a smartphone device, and did not have any food allergies or intolerances since this could possibly affect their responses. The gathered data was collected in the period of 16 - 25 November 2020.

Of the participants in this study, 64% were women (n = 144) and 36% were men (n = 81). The mean age of the participants was 28.8 (SD = 10.7) with the youngest participant being 18 years old and the oldest being 73 years old. The BMI of the participants ranged from 17.3 to 39.0 with the mean being 23.9 (SD = 3.67). Overall, 2.7% (n = 6) of the participants fell within the underweight range (BMI below 18.5), 67.1% (n = 151) fell within the healthy weight range (BMI between 18,5 and 25), 23.1% (n = 52) fell within the overweight range (BMI between 25 and 30), and 7.1% (n = 16) fell within the obese range (BMI above 30). Additionally, when it comes nationality, most participants were Dutch (n = 212, 94.2%) and a small number of participants had another nationality (n = 13, 5.8%) such as German (n = 4, 1.8%), Portuguese (n = 3, 1.3%), Greek (n = 2, 0.9%), Bulgarian (n = 1, 0.4%), Luxembourgish (n = 1, 0.4%), Peruvian (n = 1, 0.4%) and South African (n = 1, 0.4%). Furthermore, when it comes to participants' education level, half of the participants attained the education level of HBO (n = 116, 51.6%), followed by

WO Master (*n* = 50, 22.2%), WO Bachelor (*n* = 22, 9.8%), MBO (*n* = 20, 8.9%), HAVO/VWO (*n* = 13, 5.8%), and VMBO (*n* = 4, 1.8%).

When it comes to familiarity with online supermarkets, the average participant in this experiment uses half the time/sometimes (1= always, 5 = never) the website to view the assortment before going grocery shopping (*M* = 3.85, *SD* = 0.97), and does sometimes/never (1= always, 5 = never) grocery shopping online (*M* = 4.55, *SD* = 0.82).

Manipulations

Participants were either exposed to a control condition without any nudges, a condition with a salience nudge, a condition with a priming nudge, or a condition in which both a salience nudge and a priming nudge. The manipulations of the salience nudge (*present/absent)* and the priming nudge (*present/absent)* are described below.

Salience Nudge. In the current study, the salience nudge was presented as an orange frame with the text ‘favorite’ on it. This frame was placed around the healthy products on the mobile supermarket product pages. The color orange was chosen since this color was in line with the brand colors of the supermarket of which the visuals were used (Albert Heijn) to make the interface representable for a realistic online grocery shopping experience. Furthermore, the text ‘favorite’ was used within the frame to attract attention, but without suggesting a health-related goal. A similar presentation of the salience nudge was used in a previous study by Hoenink et al. (2020). This study already found positive results on stimulating healthy eating behavior in an online environment. This lends support to the choice of presentation of the salience nudge used in the current experiment.

Not to mention, in the control condition in which the salience nudge was perceived as absent no colored frame with text was presented.

Priming Nudge. The priming nudge in this research study is presented as a recipe banner with a blue background, a picture of a dish, the title of the recipe, and words related to health. Both the color and the health-related words are used to prime the goal of healthy eating. The color blue was chosen for the priming banner since literature found that this color was associated with health (Gelici-Zeko et al., 2012). Furthermore, the priming text 'healthy recipe' was used to prime the goal of healthy food selection. A similar presentation of this priming nudge was used in a previous study by van der Laan et al. (2017) on goal priming nudges in an online environment in which they found positive results on healthy food selection. This provides ground that this method of presenting the priming nudge can be effective in an online environment to encourage healthy eating behavior.

Furthermore, in the condition in which the priming nudge was absent, an orange recipe banner with the text 'new recipe' on it was presented instead of the blue recipe banner with the words 'healthy recipe'.

Materials

The questionnaire that was used to conduct this experiment was created with the program Qualtrics. Within the questionnaire, participants in each condition were exposed to four images that would represent an online mobile supermarket webpage with each image representing another product category; pasta, cheese, bread, and nuts. Four product pages were used instead of only one because then it is possible to see whether healthy food selection is based on coincidence or whether there is a consistent pattern in participants' product selection. Furthermore, these

specific products were used since these are represented in the ‘schijf van 5’ which serves as a guideline in this study for determining which products are healthy and which products are unhealthy. More information on this will be provided later on.

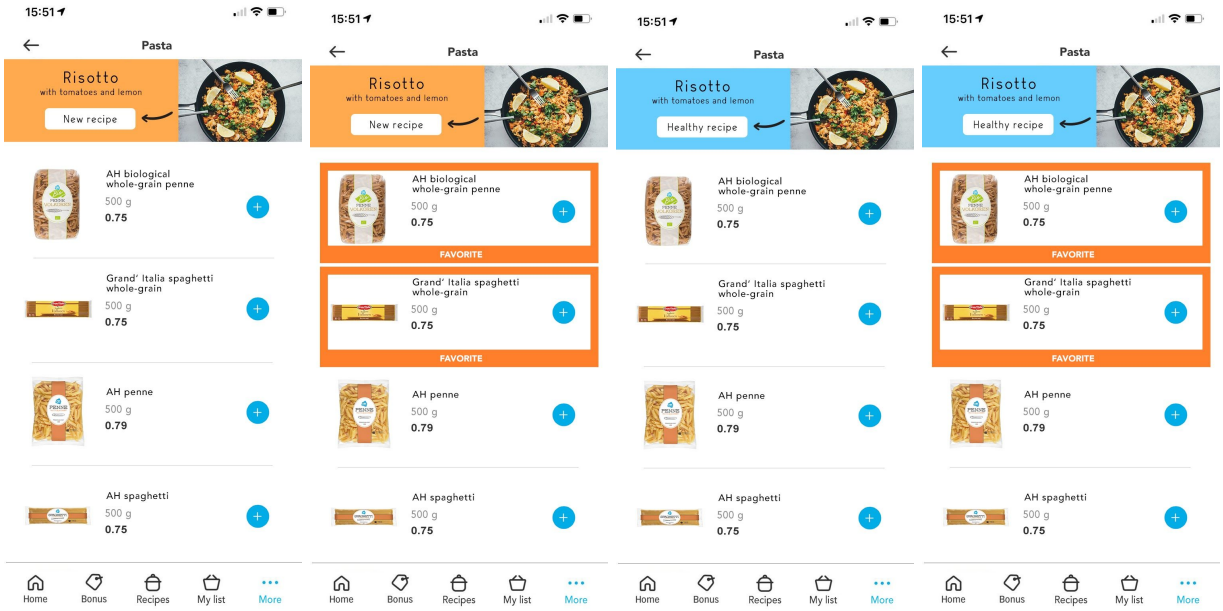
The mobile product category pages and products used for this experiment were from Albert Heijn, which currently is the largest supermarket chain in the Netherlands (Spanke, 2020). The decision was made to present images of the mobile webpages within Qualtrics instead of an external interactive supermarket simulation as this could possibly interrupt participants’ attention from the questionnaire or, in the worst case, even lead to the survey participants dropping out.

Overall, the basis of mobile webpages for the four conditions was similar, with on each of the webpages four products displayed of which two were healthy and two were unhealthy. These images of the mobile webpages including the nudge interventions were created using Adobe Photoshop software. The number of products presented on the webpages was based on the number of products that are presented on the actual mobile webpage of Albert Heijn to make it a realistic online grocery shopping experience. These products had the same package size (one unit or in grams) and had a maximum of €0.05 price difference to reduce the impact of confounding variables. On each webpage, all products were selectable by clicking on the product, but only one product could be selected as a final purchase choice before going to the next page.

A visual representation of the stimuli used for the four conditions for the product category ‘pasta’ is presented below in Figure 2. The visual representations of the stimuli for the other product categories can be found in Appendix A.

Figure 2

Visualization of stimuli for (from left to right) control condition, salience condition, priming condition, combined condition.



Measures

All measures used in the current study are described below. The full questionnaire containing these measures can be found in Appendix C.

The Healthiness of the Food Choices. To determine whether a product was healthy or unhealthy the healthy dietary guidelines called ‘de schijf van 5’ were used which are provided by Het Voedingscentrum, which is an organization financed by the Dutch government (Voedingscentrum, n.d.). This organization has published a list of products that are not supported by these guidelines since they contain too much sugar, salt, or saturated fat. Moreover, they provide alternatives to these products that are supported by these guidelines (Voedingscentrum,

n.d.). In the current study, the products supported by the guidelines were perceived as “healthy”, and products not supported by the guidelines were perceived as “unhealthy”.

The healthiness of a participant’s food choices was calculated as a percentage based on how many times (out of four) they selected a healthy product instead of an unhealthy product on the four product pages. The more healthy products selected by a participant, the higher the healthiness of their food choices was perceived. For example, when a participant selected one healthy product, the healthiness of their food choices was considered 25% and when a participant selected four healthy products, it was considered 100%.

General Health Interest. To determine participants' general health interest an existing scale by Roininen and Tuorila (1999) was used. The scale contained eight items with a 7-point Likert scale that ranged from *strongly disagree* until *strongly agree*. General Health Interest was measured with eight items on a 7-point Likert scale, which had good reliability, Cronbach's α = .81. The eight statements that determined a person's general health interest (Roininen & Tuorila, 1999) can be found in Appendix B.

Manipulation Check: Salience Nudge. To check whether participants were aware of the orange frame with the text ‘favorite’ in the salience nudge condition, participants were asked the question whether they had seen a frame on the product webpages that made products stand out from the other products (*yes/no/not sure)*. Whenever participants answered ‘yes’ they were asked what color the frame had (*blue/orange*). This question was only presented to the participants that were exposed to the salience nudge, so both the salience nudge condition and the combined condition.

Manipulation Check: Priming Nudge. To indicate whether participants were aware of the banner and the associated text on the product webpages they were exposed to, participants were asked whether they had seen a banner on top of the page (*yes/no/not sure*). Whenever participants answered 'yes' they were asked what text was presented in the banner to describe the recipe (*new recipe/healthy recipe*). This question was only presented to the participants that were exposed to the priming nudge, so both the priming nudge condition and the combined condition.

Health Knowledge. To check whether participants knew the difference between a healthy and unhealthy product, a manipulation check was done. The reason for this is that participants possibly do not have enough knowledge about the difference between a healthy and an unhealthy product, which might make them think that they are choosing a healthy product while they are actually clicking on an unhealthy product. This may be especially relevant for the priming nudge because participants are then primed to choose healthy products, but when they do not know which products are healthy, their choices may bias the results. For the salience nudge, health knowledge of the foods is less important because the healthy products are already visually marked.

To determine their knowledge about healthy and unhealthy food products participants were asked four questions concerning their knowledge of the products for the four presented product categories; pasta, cheese, bread, and nuts. They were asked to choose the healthier option between two given options. These options were also based on the same healthy dietary guidelines as mentioned before (Voedingscentrum, n.d.). Participants needed to choose between

white pasta or whole-grain pasta, 48+ cheese or 30+ cheese, white bread or whole-grain bread, and salted nuts or unsalted nuts. The two options for each question were randomly ordered.

The health knowledge of a participant was calculated as a percentage based on the number of times (out of four) they answered correctly. The more correct answers, the higher their knowledge was perceived. For example, participants with one correct answer were considered to have 25% correct knowledge about healthy food, and participants with four correct answers were considered to have 100% correct knowledge.

Perceived Influence Salience Nudge and Priming Nudge. To gain a better understanding of the effect of nudges when actively observed, so when participants are aware of the visual presentation of the nudge, additional questions were asked. Participants that indicated that in the manipulation check of both nudges that they observed a frame or banner were also asked to what extent that intervention affected their decision for the products (*1 = strongly disagree, 7 = strongly agree*).

Self-Evaluation of the Healthiness of the Food Choices. To gain insights in whether participants can evaluate the healthiness of the products that they chose, an additional question was asked in which participants were asked to rate the healthiness of the products that they chose on a scale of 1 (*unhealthy*) to 10 (*healthy*). This variable was used to explore whether participants' self-evaluation matches their choices, so whether they are aware of the fact that they are choosing healthy or unhealthy products.

Influence of the Healthiness of the Food Product. To obtain a better understanding of the health consciousness of the participants during the selection of the products, participants were asked to what extent the healthiness of the food products contributed to their choices (*1 =*

strongly disagree, 7 = strongly agree). This variable was used to examine whether, in addition to measuring general health interest, people also valued the health aspect of the products at the specific time of food selection compared to a more general interest in healthy eating that was tested using the general health interest scale.

Procedure

After participants gave their informed consent, they were first asked some demographic questions (gender, age, nationality, education level, height in cm, and weight in kg). Furthermore, they would answer two questions concerning their familiarity with online grocery shopping. Afterwards, participants would read some instructions explaining that they were going to do online grocery shopping to buy products for the next day and that they needed to buy four products from their grocery list; pasta, cheese, bread, and nuts. They were then presented four mobile webpages containing either four pasta, cheese, bread, or nut products of which they needed to choose one to purchase on each webpage. Whether these webpages contained a blue or orange recipe banner, and orange frames or no frames depended on the condition to which the participant was assigned.

After choosing a product on each of the four webpages the participants were asked about their agreement on eight statements with regard to their general health interest. Followed by four questions to determine their knowledge level when it comes to the difference between healthy and unhealthy food products. Additionally, participants were asked to evaluate the healthiness of their choices and to what extent the healthiness of the food products influenced their decisions. Furthermore, depending on to which condition the participant was assigned, they were asked whether they had seen a frame around some products and if so, which color this frame had and to

what extent this frame affected their choices and/or whether they had seen a banner on top of the page and if so, which text was presented to describe the recipe and to what extent this banner affected their choices.

Lastly, participants were asked to provide an email address if they wanted a chance to win the gift certificate, were thanked for their participation, and debriefed about the purpose of the research study.

Analysis

Before analyzing the data, the data was checked for missing data, and outliers were removed. The statistical analysis was conducted using SPSS statistical software. A one-way ANOVA test was performed to test the main effects. Furthermore, an additional Hayes moderation analysis was conducted to test the moderation effect of general health interest.

Results

Randomization Checks

Before starting the analyses to test the hypotheses, multiple randomization checks were performed to make sure that the participants divided over the four conditions had comparable characteristics. Firstly, chi-square tests were performed to test whether there were associations between condition and gender, condition and nationality, condition and BMI category, and condition and educational level. No association was found between the assigned condition and gender ($\chi2(3) = 1.02$, $p = .797$), as well as for condition and nationality (Fisher's Exact Test = 1.19, $p = .788$), condition and BMI category ($\chi2(9) = 3.33$, $p = .950$),and condition and education

level ($\chi 2(15) = 23.00$, $p = .084$). Secondly, one-way ANOVA tests were performed to test whether there were significant mean differences between conditions for characteristics such as age, familiarity with pre-viewing the assortment online before grocery shopping, and familiarity with ordering groceries online. No significant mean differences were found between the conditions for age ($F(3, 221) = 0.29$, $p = .831$, $\eta 2 < .01$), $\eta 2 = .01$), familiarity with pre-viewing the assortment ($F(3, 221) = 0.70$, $p = .552$, $\eta 2 = .01$), and familiarity with ordering groceries online ($F(3, 221) = 0.48$, $p = .694$, $\eta 2 = .01$).

These analyses show that there are no significant differences between the four conditions when it comes to all characteristics of the participants. This means that randomization of participants over the four conditions was achieved.

Confounding Variables

To check whether there were any confounding variables within the dataset that needed to be taken into account while executing the main analyses. These checks were done using Pearson's Correlation. It was found that there was a significant correlation between the healthiness of the chosen food products and the variable education ($r = 0.19$, $p = .005$). The other variables did not show any significant correlation with the healthiness of the chosen food products. An overview of all the variables and their correlation analysis with regard to the healthiness of the chosen food products can be found in Table 1.

Since Pearson's Correlation found that there was a significant correlation between the healthiness of the chosen food products and education it can be used as a covariate in the main analyses. However, since the randomization of education did not show a significant difference

between the four conditions it was decided to not include this variable as a covariate for the main analyses.

Table 1

Pearson's correlation tests between control variables and the dependent variable.

	r	p
Gender	-0.11	.087
Age	0.07	.285
Nationality	0.07	.283
Education	0.19	.005
BMI	0.06	.357
Assortment viewing on website	-0.09	.163
Grocery shopping online	-0.01	.832

Manipulation Checks

Besides the randomization checks, some manipulation checks were done to make sure that the manipulations were successfully implemented.

To check whether participants were aware of the nudge manipulations, additional questions were asked. Of the participants that were exposed to the salience nudge (n = 109), which were participants assigned to either the salience condition or the combined condition, 90.3% (n = 103) indicated that they had seen a frame around one of the products on each product page and 9.7% (n = 6) indicated not seeing a frame. Participants that said that they saw a frame were asked whether the frame was orange or blue of which 90.3% (n = 93) answered orange (correct) and 9.7% (n = 10) answered blue (incorrect). It can be concluded that of the 109 participants that were exposed to the salience nudge, 93 participants were fully aware of the manipulation, 10 participants were partly aware of the manipulation, and 6 participants were not aware of the manipulation. Since the vast majority of the participants observed the manipulation, it can be concluded that the manipulation with the salience nudge was successful.

Secondly, similar questions were asked for participants that were exposed to the priming nudge condition (n = 112), which were participants assigned to either the priming condition or the combined condition. To the question about whether they saw a banner on top of the page, 66.1% (n = 74) of the participants that were exposed to the priming nudge said they saw the banner and 33.9% (n = 38) indicated they did not see a banner. Participants indicating that they saw the banner were then asked about the text on the banner. 68.9% (n = 51) said that the text ‘healthy recipe’ was displayed (correct) and 31.1% (n = 23) said that ‘new recipe’ was displayed (incorrect). Based on this manipulation check, of the 112 participants that were exposed to the priming nudge, 51 participants were fully aware of the manipulation, 23 participants were partly aware, and 38 participants were not aware of the manipulation. Since there were quite some

participants that did not observe the manipulation, or only could partly remember the presentation of the manipulation, it is questionable whether the manipulation was successful.

However, research found that nudges work by anticipating unconscious processing (Marchiori et al., 2017) which means that the manipulation by nudges does not necessarily have to be observed consciously for them to be effective. Therefore, it is impossible to conclude that participants that indicated not seeing the manipulations or answered incorrectly about the appearance of the nudge did not actually get influenced by the nudges.

In sum, both results of the manipulation tests provided no reason to exclude participants for the main analyses.

Main Analyses

Effect of Condition on Chosen Healthy Food Products. To test whether there are mean differences between the conditions (control condition, salience nudge condition, priming nudge condition, and combined condition) to which participants on whether participants would make healthier food choices in online supermarkets (H1, H2, H3), a one-way ANOVA was performed with the condition as an independent variable and healthiness of the chosen food product as a dependent variable.

On average, the percentage of products chosen by the participants that were healthy were for participants in the control condition (n = 59) on average 68% (M = 0.68, SD = 0.27). For participants in the salience nudge condition (n = 54) this were on average 62% healthy food products (M = 0.62, SD = 0.25), for participants in the priming nudge condition (n = 57) this were on average 72% healthy food products (M = 0.72, SD = 0.24), and for participants in the combined condition (n = 55) this were on average 61% healthy food products (M = 0.61, SD =

0.28). The overall ANOVA was not significant, indicating that there are no differences in the mean scores of the healthiness of the chosen food choices between the four conditions, $F(3, 221) = 2.34$, $p = .074$, $\eta 2 = 0.03$.

Post hoc test revealed that the control condition and the salience nudge condition did not significantly differ from each other, *Mdiff* = 0.07, $p = .528$, 95% CI [-0.06, 0.19]. Based on this result, it can be concluded that hypothesis 1 is not supported by the data. This means that the presence of the salience nudge placed on healthy food products does not lead to participants making healthier food choices in online supermarkets compared to when the salience nudge is absent.

The same post hoc test also revealed that the control condition and the priming nudge condition did also not significantly differ from each other, *Mdiff* = -0.03, $p = .903$, 95% CI [-0.16, 0.09]. Therefore, it can be concluded that hypothesis 2 is as well not supported by the data, meaning that the presence of a priming nudge does not lead to participants making healthier food choices in online supermarkets compared to the absence of the priming nudge.

Furthermore, as mentioned before did the overall ANOVA not find significant differences between the mean scores. Post hoc test revealed no significant difference between the combined condition and the salience nudge condition (*Mdiff* = -0.01, $p = .996$, 95% CI [-0.14, 0.12]). This means that the effect of the salience nudge is not stronger when the priming nudge is present compared to the absence of the priming nudge. Therefore, hypothesis 3 is not supported by the data.

Influence of General Health Interest. To test whether the effects of a salience nudge or priming nudge on healthier food choices in an online supermarket are larger when a person has

high general health interest compared to low general health interest (H4a, H4b), a moderation analysis using the PROCESS macro by Andrew F. Hayes was performed.

Before executing the analysis, all relevant assumptions were tested within a linear regression analysis. Only one of the assumptions was not met, which was the assumption of absence of strong multicollinearity. The VIF score for the variable conditions was 14.12 and for the interaction variable of conditions and general health interest was 19.50. Therefore, the model could possibly not be reliable since it could cause false positives and results should be interpreted with caution.

In the first Hayes analysis, the variable conditions (only control condition and priming nudge condition) was the predictor, the healthiness of the chosen food products was the outcome, and general health interest the moderator. The Hayes moderation analysis showed a significant effect of the overall model, $R^2 = 0.13$, $SE = 0.06$, $F(3, 112) = 5.38$, $p = .002$. No significant main effect was found of the condition (control condition versus priming nudge condition) on participants' healthiness of their food choices, $b = 0.11$, $SE = 0.17$, $p = .502$.

To check whether general health interest possibly strengthens or weakens the relationship between the priming nudge and the healthiness of the food choices, the interaction effect was interpreted. The analysis showed that there was no significant interaction effect between the presence of the priming nudge and general health interest on the healthiness of food choices, $b = -0.02$, $SE = 0.04$, $p = .578$. Therefore, it can be stated that hypothesis 4a is not supported by the data.

Furthermore, in the second Hayes analysis, the variable conditions (only control condition and salience nudge condition) was the predictor, the healthiness of the chosen food

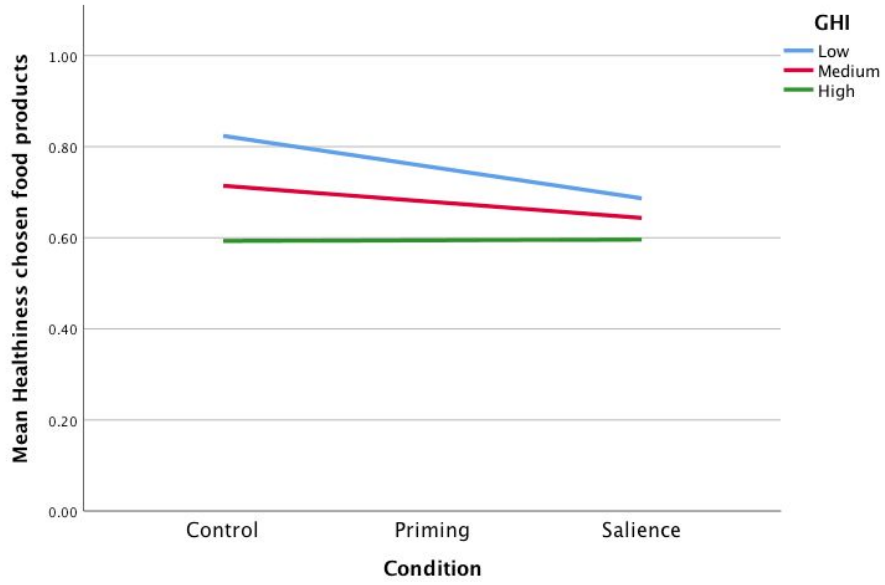
products was the outcome, and general health interest the moderator. The Hayes moderation analysis showed no significant effect of the overall model, $R^2 = 0.06$, $SE = 0.07$, $F(3, 109) = 2.36$, $p = .075$. Additionally, no significant main effect was found of the condition (control condition versus salience nudge condition) on participants' healthiness of their food choices, $b = -0.27$, $SE = 0.18$, $p = .134$.

The interaction effect was observed to check whether general health interest possibly strengthens or weakens the relationship between the salience nudge and the healthiness of the food choices. The analysis showed that there was no significant interaction effect between the presence of the priming nudge and general health interest on the healthiness of food choices, $b = 0.05$, $SE = 0.05$, $p = .241$. Therefore, it can be stated that hypothesis 4b is as well not supported by the data.

A visual representation of the mean scores of the healthiness of the chosen food products by the conditions divided by general health interest can be found in Figure 3.

Figure 3

Mean healthiness of chosen food products by GHI divided by condition.



Additional Analyses

Some additional analyses were done to investigate the effects of other factors on participants' healthiness of their food choices.

Health Knowledge. To investigate whether there is a relation between the health knowledge of a participant and the healthiness of their food choices, a Pearson's correlation test was performed. Participants in the control condition had on average 91% ($M = 0.91$, $SD = 0.15$) correct knowledge about healthy foods, for participants in the salience nudge condition this was 90% ($M = 0.90$, $SD = 0.14$), and for participants in the priming nudge condition this was 92% ($M = 0.92$, $SD = 0.13$).

The analysis showed that a participant's health knowledge is not related to the healthiness of their food choices for participants in the control condition ($r = 0.12$, $p = .100$). Also, for participants in the salience nudge condition no correlation was found ($r = 0.07$, $p = .606$), as well as for the priming nudge condition ($r = 0.32$, $p = .015$). In sum, this means that a participants' health knowledge level does not relate to the healthiness of their food choices.

Perceived Influence Salience Nudge. As mentioned before were 109 participants that were exposed to the salience nudge of which 103 indicated that they had observed frames around the products. Participants furthermore indicated to what extent the frames had influenced their choices. To test whether there is a relation between participants' indication of the influence of the frames and the healthiness of their food choices, a Pearson's correlation test was performed. Participants' agreement with the statement 'The frames have influenced my choices for the products' (1 = strongly disagree, 7 = strongly agree) was on average 2.97 ($SD = 1.74$). The correlation analysis showed no significant relation between the two variables, $r = 0.19$, $p = .060$.

Perceived Influence Priming Nudge. Of the 112 participants that were exposed to the priming nudge, 74 participants indicated that they were aware of the banner on top of the page. Participants indicated to what extent the banner influenced their choices for the products. Pearson's correlation test was performed to test whether there is a relationship between participants' indication of the influence of the banner and the healthiness of their food choices. Participants' agreement with the statement 'The banner has influenced my choices for the products' (1 = strongly disagree, 7 = strongly agree) was on average 2.22 ($SD = 1.42$). Pearson's correlation test showed no significant relation between the two variables, $r = 0.04$, $p = .680$.

Self-Evaluation of the Healthiness of Their Choices. A Pearson's correlation test was performed to test whether there was a relation between participants' self-evaluation of the healthiness of their food choices and the actual healthiness of their food choices. Participants' self-evaluation of the healthiness of their choices (1 = unhealthy, 10 = healthy) was on average 6.38 (*SD* = 1.53). The analysis showed a significant weak positive correlation between participants' self-evaluation of the healthiness of their choices and the healthiness of their food choices, $r = 0.52$, $p < .001$. In conclusion, 26.7% of the variance in healthiness of the chosen food products is accounted for by a participants' self-evaluation of the healthiness of their food choices.

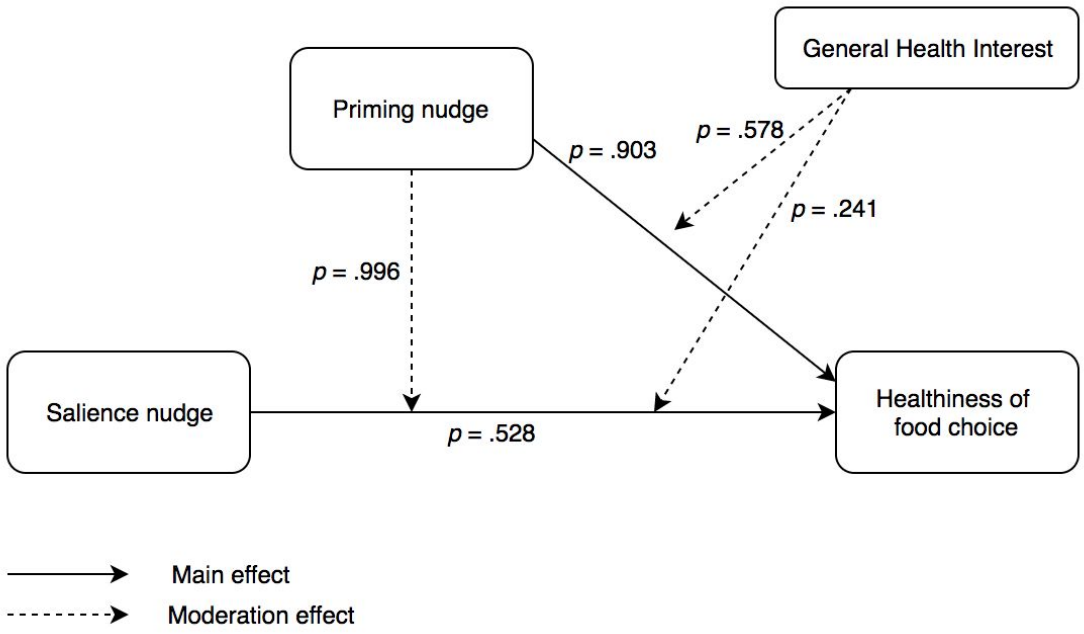
Influence of the Healthiness of the Food Products. To test whether there is a relation between the perceived influence of the healthiness of the food products and the healthiness of the food products chosen by the participants, a Pearson's correlation test was performed. Participants' agreement to the statement 'The healthiness of the products has influenced my choices' (1 = strongly disagree, 7 = strongly agree) was on average 3.22 (*SD* = 1.46). The analysis showed a significant weak positive correlation between the perceived influence of the healthiness of the food product and the actual healthiness of their food choices, $r = 0.53$, $p < .001$. It can be concluded that 27.5% of the variance in healthiness of the chosen food products is accounted for by participants' self-evaluation of the healthiness of their food choices.

Summary of the Findings

The results found with the main analysis and the moderation analysis presented within the research model can be found below in Figure 4.

Figure 4

Visual representation of results of the main analysis and moderation analysis.



Discussion

The aim of this study was to research the effectiveness of a salience nudge, a priming nudge, or a combination of these nudges on stimulating participants to make healthier food choices in an online supermarket environment. In addition to this, the moderation effect of general health interest on the relationship between the single nudges and the healthiness of participants' food choices was investigated.

The effects of the Salience Nudge and the Priming Nudge

The results of the analysis showed that the implementation of a salience nudge did not significantly influence the healthiness of participants' food choices. Therefore, it can be

concluded that hypothesis 1 is not supported by the data. Furthermore, results also showed no significant influence on the healthiness of participants' food choices when a priming nudge was implemented. This means that hypothesis 2 is as well not supported by the data. Lastly, no significant effects were found for the condition in which both the salience nudge and priming nudge were present on the healthiness of participants' food choices. This illustrates that hypothesis 3 is also not supported.

Effect of the Salience Nudge. The results from the current research study contradict with most findings from previous research studies since these previous research studies suggested that making healthy options more salient compared to unhealthy options increases the selection of healthy food options (Grabenhorst et al., 2013; Hoenink et al., 2020; Levy et al., 2012). However, in the systematic review by Wilson et al. (2016), they mentioned four experimental studies that did not find an influence of only a salience nudge on stimulating healthy food selection. Therefore, the results from the current study are more in line with the findings of these four studies (Jue et al., 2012; Olstad et al., 2014) since in the current study no positive effect on healthy eating behavior was found.

A possible explanation of these insignificant findings is the context in which the current study was conducted compared to the previous studies. Two out of three above mentioned studies were conducted in a physical environment (Grabenhorst et al., 2013; Levy et al., 2012) compared to the digital environment of the current study. The study by Grabenhorst et al. (2013) was conducted in a laboratory setting. Furthermore, the study by Levy et al. (2012) was conducted in a hospital cafeteria. Possibly the significant effects found for the salience nudge in these studies do not apply to a digital environment because the processing of information differs

between online and offline environments. The narrowed attentional scope and increased concentrated focus that were associated with internet information processing (Peng et al., 2018) possibly negatively influenced the effectiveness of the salience nudge even though it was expected that this could enhance the effect of the salience nudge.

However, one of the above-mentioned studies was conducted in a digital context and the setting is, therefore, more comparable to the current study (Hoenink et al., 2020). The reason that Hoenink et al. (2020) did find positive results for the salience nudge increasing healthy food selection compared to the insignificant findings in the current study, could be due to the fact that the digital context of that study consisted of a realistic virtual supermarket simulation that should mimic a physical supermarket. The digital context was, therefore, not similar to the current study since in the current study the digital context was a mobile supermarket webpage. As mentioned before does the specific context in which the nudge is tested matter because it is possible that results only apply to that specific context and generalizations for other contexts cannot be made (Marchiori et al., 2017). Context, therefore, possibly explains the insignificant results found for effect of the salience nudge on healthy food selection.

Another possible explanation of the insignificant results is the presentation of the salience nudge. The study by Grabenhorst et al. (2013) used taste labels to increase the salience of healthy products, and the study by Levy et al. (2012) used traffic light labeling as a salience nudge. In the current study a simple frame was used to increase the salience of the healthy products. A different method possibly elicits other effects because some methods can be perceived as more salient than others. This could explain why the positive results that were previously found, were not found in the current study.

However, the presentation of the salience nudge in the study by Hoenink et al. (2012) was very similar to the one used in the current study. This raises the question how the current study did not find the significant results that were found in their study even though the study seems very similar to the current study. Besides the difference in digital context that was mentioned above, the study by Hoenink et al. (2012) also differed on some other aspects. For example, the most important difference is the number of products participants could choose from. The online supermarket simulation contained 1175 products and the current study only contained 4 products to choose from. Because of these limited product choices, the current research study may be less representative for a realistic grocery shopping experience compared to the study conducted by Hoenink et al. (2012) which possibly explains the difference in results between the studies. When participants have more choice options, they can make choices that are based on their daily life purchase behavior. With limited choice options of four products it could be that participants normally would not buy the presented products, which therefore could have biased the results.

Effect of the Priming Nudge. As well as for the salience nudge, the results from the current study for the effectiveness of the priming nudge were also not in line with most results found by previous studies. No increase in healthy food selection was found in the current study compared to previous studies in which a positive effect actually was observed for the effect of a priming nudge on healthy food selection (van der Laan et al., 2017; Wansink & Hanks, 2013; Weingarten et al., 2016). However, in the review study by Wilson et al. (2016), there were two studies that also showed no influence of only the priming nudge on encouraging healthy food

selection. The results of the current study therefore seem to be similar to these results (van Kleef et al., 2012; (Rozin et al., 2011).

The studies that supported the hypothesis for the priming nudge were conducted in different contexts compared to the current study. The study by Wansink and Hanks (2013) was conducted in a physical environment in which people made food choices at a buffet at a conference. They were primed with healthy products at the start of the buffet which led to an increase of healthy food purchases. Furthermore, the studies from the meta-analysis by Weingarten et al. (2016) were also all conducted in physical environments. The implementation of the priming nudge in a physical environment may elicit different effects compared to the implementation in a digital environment since information processing works differently for online environments. Even though it was expected that the low-level processing that was found to be associated with internet information processing (Peng et al., 2018) could enhance the effectiveness of the priming nudge, results did not show positive results. This means that this difference in information processing possibly influenced the effectiveness of the nudge.

One study that investigated the priming nudge in an online context was the study by van der Laan et al. (2017). This study used a priming nudge in an online supermarket simulation to stimulate people to choose healthy products and found significant positive results. However, as mentioned above is an online supermarket simulation possibly not comparable to a mobile supermarket webpage since it was used to mimic a physical shopping experience.

Also, the presentation of the priming nudge differed between the above-mentioned study by Wansink and Hanks (2013) and the current study. In the study by Wansink and Hanks (2013) the used altered placement as a priming method. Whereas in the current study a priming banner

was used. This difference in priming method may also explain the difference in results since some priming methods are possibly perceived as more effective than others.

Not to mention, the study by van der Laan et al. (2017) used a highly comparable priming method to the one used in the current study. However, there are some differences between that study and the current study that possibly explains the different results. For example, the study by van der Laan et al. (2017) was conducted in a lab compared to the current study in which participants could fill out the questionnaire from any location, which could yield different results since external factors such as noise or visual distractions are limited in lab studies compared to real life settings. Lastly, participants were presented 24 choice screens compared to only 4 in the current study. This possibly could explain why that study found significant results and the current study did not, since more choice screens means more data to analyze and more possibilities to find consistent patterns in healthy food selection.

Effect of the Nudges Combined. When it comes to the results of the combined nudges in the current study, then it can be concluded that these results do not match the results that were found in previous studies. These studies found that using a salience nudge and a priming nudge combined would stimulate healthy food selection (Levy et al., 2012; Thorndike et al., 2012, 2014), whereas the current study did not find a significant increase in healthy food selection.

There are some possible reasons that can explain the inconsistent results between these studies and the current study. First of all, the context in which the nudges were used was not in an online environment. All three studies were conducted in a physical environment of a hospital cafeteria (Levy et al., 2012; Thorndike et al., 2012, 2014) compared to the mobile supermarket webpage that was used in the current study. As mentioned before, can the difference in

information processing between online and offline environments possibly explain why no significant results were found.

Secondly, was the presentation of the nudges used in this study different compared to the other studies in which the two nudges were combined. As mentioned before did these studies use traffic light labeling to increase the salience and replacement to prime participants. In the current study, no traffic light labels were used for the salience nudge but a colored frame with the text 'favorite' on it to increase the salience of healthy products, and the priming nudge that was implemented in this study was a goal-primed recipe banner. It is possible that other presentations of the salience nudge and the priming nudge are more effective than others.

Besides this difference in context and presentation, also the sample size differed between these studies and the current study. For example, the study by Levy et al. (2012) was conducted with 4642 customers and the study by Thorndike et al. (2014) with 2285. Furthermore, was the mean age of the participants in these studies much higher (41 years old and 43 years old) than the mean age of the participants in the current study (29 years old). With a larger sample size, it is easier to make generalizations, and with higher mean age may elicit other results since participants may have different needs and knowledge. This possibly explains why the results between those studies and the current study differed.

The Moderation Effect of General Health Interest. In the current study, no significant results were found of a moderation effect of general health interest on the relationship between the single nudge and healthy food selection. This contradicts with previous research studies since research by Weingarten et al. (2016) and Papies (2016) found that priming a health-related goal would actually increase the selection of these healthy products whenever someone was already

interested in healthy eating. Furthermore, the same study by Weingarten et al. (2016) also found that increasing the salience of a healthy concept would also increase the selection of these products when healthy eating was a personal goal of the participant. These results for both goal priming as increasing the salience of the goal product were not found in the current research study.

A possible reason for not finding significant results for the moderation effect of general health interest is that the presentation of the nudges to prime the goal may not activate the required cognitive processes enough for participants' to actually pursue the primed goal. Therefore, more research is needed to further explore the moderating effect of health-related goal primes for nudging. This could possibly be done by exploring whether the effects of general health interest may be stronger for other salience nudge and priming nudge methods.

Additional Limitations of the Study

The reason for not finding significant results in this study could also possibly be due to one of the other limitations of this study. Firstly, the images that were presented to the participants within the experiment were possibly not comparable to a real online grocery shopping experience since participants could not interact with the image. In a realistic experience, participants can scroll through the products, click on products, and read additional information before choosing a product. This possibly could have led to other results since participants could then read more information about the products, compare the products, and possibly change their mind before they make a decision on what to purchase. Therefore, the non-interactivity of the shopping experience could possibly have led to other results compared to when the shopping experience was more interactive.

Another limitation of this study is the manipulation check that was conducted for this experiment. The question of whether participants had seen a frame, in other words, whether they had observed the salience nudge manipulation, was only asked when participants were actually exposed to this manipulation. Because the question was not asked when participants were not exposed to the frame, it was not possible to statistically test whether the manipulation had been successfully implemented. The same situation applies to participants who were exposed to the priming nudge. Only those participants were asked whether they had seen a banner, thus whether they had observed the priming nudge. This possibly lowers the quality of the current study since it remains unsure whether the manipulations were actually successfully implemented. If it turned out that these were not implemented successfully, this could possibly have explained the insignificant results found within this study.

A last limitation of the study is the lack of scientific studies that researched the effects of the salience nudge and the priming nudge on stimulating healthy food selection in a digital context, and more specifically for mobile webpages. Currently, research on nudging in a digital context is still in its early stages, making it difficult to establish well-founded scientific hypotheses. More research is needed to further explore the effects of nudging in a digital context and to be able to make generalizations about this topic.

Implications

Even though no significant results were found in the current research, it still contributes to the existing knowledge on digital nudging. Actually, not finding significant results provides reason to believe that the positive effects of the salience nudge and priming nudge that were found in previous studies conducted in the physical environment or supermarket simulations may

not apply to digital environments such as a mobile webpage. This result can possibly be explained by how the salience nudge and the priming nudge were presented in the current study, or by the difference in information processing in an online environment compared to an offline environment since it was found that these differ in required level of processing, attentional scope, and concentrated focus.

A suggestion for future research is, therefore, to explore the effects of different salience nudge and priming nudge methods in a similar context as in the current study. Another suggestion is to conduct a study similar to this one in which participants are either exposed to stimuli with the salience nudge and the priming nudge in a physical context or in a digital context. Then it could be tested whether the level of processing, attentional scope, and concentrated focus possibly moderate the effect of the nudges in the digital context compared to the physical context.

A last suggestion would be to conduct the same study but within a different digital context. So instead of implementing the nudges on a mobile web page, it could be done, for example, in a normal computer web page. This may yield different results, as nudges have been found to be highly context-dependent (Marchiori et al., 2017). Testing the nudges in different digital contexts will contribute to the existing knowledge on digital nudging. In the future, this will help to make generalizations about the effectiveness of the salience nudge and the priming nudge for encouraging healthy food choices in multiple digital contexts.

Conclusion

This study aimed to research the effects of a salience nudge, a priming nudge, and a combination of these two nudges on stimulating people to choose healthier food options in an

online supermarket environment. Additionally, the moderating effect of general health interest on these effects was investigated.

Results do not provide evidence that implementing a salience nudge, a priming nudge, or the combined nudges significantly increases healthy food selection. Additionally, no significant moderating effect of general health interest was found that could possibly affect the relationship between these nudges and healthy food selection.

References

Bermeitinger, C. (2015). Priming. *Advances in Psychology, Mental Health, and Behavioral Studies*, 16–60. https://doi.org/10.4018/978-1-4666-6599-6.ch002

Broers, V. J. V., De Breucker, C., Van den Broucke, S., & Luminet, O. (2017). A systematic review and meta-analysis of the effectiveness of nudging to increase fruit and vegetable choice. *European Journal of Public Health*, *27*(5), 912–920. https://doi.org/10.1093/eurpub/ckx085

Chu, J., Arce-Urriza, M., Cebollada-Calvo, J.-J., & Chintagunta, P. K. (2010). An Empirical Analysis of Shopping Behavior Across Online and Offline Channels for Grocery Products: The Moderating Effects of Household and Product Characteristics. *Journal of Interactive Marketing*, *24*(4), 251–268. https://doi.org/10.1016/j.intmar.2010.07.004

Connors, M., Bisogni, C. A., Sobal, J., & Devine, C. M. (2001). Managing values in personal food systems. *Appetite*, *36*(3), 189–200. https://doi.org/10.1006/appe.2001.0400

Custers, R., & Aarts, H. (2010). The Unconscious Will: How the Pursuit of Goals Operates Outside of Conscious Awareness. *Science*, *329*(5987), 47–50. https://doi.org/10.1126/science.1188595

Drewnowski, A. (2004). Obesity and the food environment. *American Journal of Preventive Medicine*, *27*(3), 154–162. https://doi.org/10.1016/j.amepre.2004.06.011

Eriksson, N., & Stenius, M. (2020). Changing Behavioral Patterns in Grocery Shopping in the Initial Phase of the Covid-19 Crisis—A Qualitative Study of News Articles. *Open Journal of Business and Management*, *08*(05), 1946–1961. https://doi.org/10.4236/ojbm.2020.85119

Esmark, A. (2016). The informational logics of liberal democracy. Making sense of the nudging agenda. *Information Polity*, *21*(2), 123–137. https://doi.org/10.3233/ip-160382

Falk, L., Bisogni, C. A., & Sobal, J. (1996). Food Choice Processes of Older Adults: A Qualitative Investigation. *Journal of Nutrition Education*, *28*(5), 257–265. https://doi.org/10.1016/s0022-3182(96)70098-5

Furst, T., Connors, M., Bisogni, C., Sobal, J., & Falk, L. (1996). Food Choice: A Conceptual Model of the Process. *Appetite*, *26*(3), 247–266. https://doi.org/10.1006/appe.1996.0019

Gelici-Zeko, M. M., Lutters, D., ten Klooster, R., & Weijzen, P. L. G. (2012). Studying the Influence of Packaging Design on Consumer Perceptions (of Dairy Products) Using Categorizing and Perceptual Mapping. *Packaging Technology and Science*, *26*(4), 215–228. https://doi.org/10.1002/pts.1977

Gennaioli, N., & Shleifer, A. (2010). What Comes to Mind. *The Quarterly Journal of Economics*, *125*(4), 1399–1433. https://doi.org/10.1162/qjec.2010.125.4.1399

Grabenhorst, F., Schulte, F. P., Maderwald, S., & Brand, M. (2013). Food labels promote healthy choices by a decision bias in the amygdala. *NeuroImage*, *74*, 152–163. https://doi.org/10.1016/j.neuroimage.2013.02.012

Hansen, P. G., & Jespersen, A. M. (2013). Nudge and the Manipulation of Choice. *European Journal of Risk Regulation*, *4*(1), 3–28. https://doi.org/10.1017/s1867299x00002762

Hausman, D. M., & Welch, B. (2010). Debate: To Nudge or Not to Nudge. *Journal of Political Philosophy*, *18*(1), 123–136. https://doi.org/10.1111/j.1467-9760.2009.00351.x

Hoenink, J. C., Mackenbach, J. D., Waterlander, W., Lakerveld, J., van der Laan, N., & Beulens, J. W. J. (2020). The effects of nudging and pricing on healthy food purchasing behavior

in a virtual supermarket setting: a randomized experiment. *International Journal of Behavioral Nutrition and Physical Activity*, *17*(1), 1–12. https://doi.org/10.1186/s12966-020-01005-7

Jue, J. J. S., Press, M. J., McDonald, D., Volpp, K. G., Asch, D. A., Mitra, N., Stanowski, A. C., & Loewenstein, G. (2012). The impact of price discounts and calorie messaging on beverage consumption: A multi-site field study. *Preventive Medicine*, *55*(6), 629–633. https://doi.org/10.1016/j.ypmed.2012.10.009

Kahneman, D. (2003). Maps of Bounded Rationality: Psychology for Behavioral Economics. *American Economic Review*, *93*(5), 1449–1475. https://doi.org/10.1257/000282803322655392

Kahneman, D. (2013). *Thinking, Fast and Slow* (1st ed.). Amsterdam, Netherlands: Farrar, Straus and Giroux.

Kahneman, D., & Frederick, S. (2005). A model of heuristic judgement. *The Cambridge Handbook of Thinking and Reasoning* (pp. 267–293). Cambridge University Press.

Kahneman, D., & Thaler, R. H. (2006). Anomalies: Utility Maximization and Experienced Utility. *Journal of Economic Perspectives*, *20*(1), 221–234. https://doi.org/10.1257/089533006776526076

Kelly, T., Yang, W., Chen, C.-S., Reynolds, K., & He, J. (2008). Global burden of obesity in 2005 and projections to 2030. *International Journal of Obesity*, *32*(9), 1431–1437. https://doi.org/10.1038/ijo.2008.102

van Kleef, E., Otten, K., & van Trijp, H. C. M. (2012). Healthy snacks at the checkout counter: A lab and field study on the impact of shelf arrangement and assortment structure on

consumer choices. *BMC Public Health*, *12*(1), 1–10. https://doi.org/10.1186/1471-2458-12-1072

Kroese, F. M., Marchiori, D. R., & de Ridder, D. T. D. (2015). Nudging healthy food choices: a field experiment at the train station. *Journal of Public Health*, *38*(2), e133–e137. https://doi.org/10.1093/pubmed/fdv096

van der Laan, L. N., Papies, E. K., Hooge, I. T. C., & Smeets, P. A. M. (2017). Goal-directed visual attention drives health goal priming: An eye-tracking experiment. *Health Psychology*, *36*(1), 82–90. https://doi.org/10.1037/hea0000410

Levy, D. E., Riis, J., Sonnenberg, L. M., Barraclough, S. J., & Thorndike, A. N. (2012). Food Choices of Minority and Low-Income Employees. *American Journal of Preventive Medicine*, *43*(3), 240–248. https://doi.org/10.1016/j.amepre.2012.05.004

Maas, J., de Ridder, D. T. D., de Vet, E., & de Wit, J. B. F. (2012). Do distant foods decrease intake? The effect of food accessibility on consumption. *Psychology & Health*, *27*(sup2), 59–73. https://doi.org/10.1080/08870446.2011.565341

Marchiori, D. R., Adriaanse, M. A., & De Ridder, D. T. D. (2017). Unresolved questions in nudging research: Putting the psychology back in nudging. *Social and Personality Psychology Compass*, *11*(1), e12297. https://doi.org/10.1111/spc3.12297

Marteau, T. M., Ogilvie, D., Roland, M., Suhrcke, M., & Kelly, M. P. (2011). Judging nudging: can nudging improve population health? *BMJ*, *342*(jan25 3), d228. https://doi.org/10.1136/bmj.d228

Meldrum, D. R., Morris, M. A., & Gambone, J. C. (2017). Obesity pandemic: causes, consequences, and solutions—but do we have the will? *Fertility and Sterility*, *107*(4), 833–839. https://doi.org/10.1016/j.fertnstert.2017.02.104

Mendoza, J. A., Drewnowski, A., & Christakis, D. A. (2007). Dietary Energy Density Is Associated with Obesity and the Metabolic Syndrome in U.S. Adults. *Diabetes Care*, *30*(4), 974–979. https://doi.org/10.2337/dc06-2188

Mirsch, T., Lehrer, C., & Jung, R. (2017). Digital nudging: Altering user behavior in digital environments. *Proceedings der 13. Internationalen Tagung Wirtschaftsinformatik (WI 2017)*, 634-648.

Momsen, K., & Stoerk, T. (2014). From intention to action: Can nudges help consumers to choose renewable energy? *Energy Policy*, *74*, 376–382. https://doi.org/10.1016/j.enpol.2014.07.008

Mullan, B., Allom, V., Brogan, A., Kothe, E., & Todd, J. (2014). Self-regulation and the intention behaviour gap. Exploring dietary behaviours in university students. *Appetite*, *73*, 7–14. https://doi.org/10.1016/j.appet.2013.10.010

Noggle, R. (2017). Manipulation, salience, and nudges. *Bioethics*, *32*(3), 164–170. https://doi.org/10.1111/bioe.12421

Olstad, D., Goonewardene, L. A., McCargar, L. J., & Raine, K. D. (2014). Choosing healthier foods in recreational sports settings: a mixed methods investigation of the impact of nudging and an economic incentive. *International Journal of Behavioral Nutrition and Physical Activity*, *11*(1), 6. https://doi.org/10.1186/1479-5868-11-6

Papies, E. K. (2016). Health goal priming as a situated intervention tool: how to benefit from nonconscious motivational routes to health behaviour. *Health Psychology Review*, *10*(4), 408–424. https://doi.org/10.1080/17437199.2016.1183506

Peng, M., Chen, X., Zhao, Q., & Zhou, Z. (2018). Attentional scope is reduced by Internet use: A behavior and ERP study. *PLOS ONE*, *13*(6), e0198543. https://doi.org/10.1371/journal.pone.0198543

Ratcliff, R., & McKoon, G. (1988). A retrieval theory of priming in memory. *Psychological Review*, *95*(3), 385–408. https://doi.org/10.1037/0033-295x.95.3.385

Roininen, K., & Tuorila, H. (1999). Health and taste attitudes in the prediction of use frequency and choice between less healthy and more healthy snacks. *Food Quality and Preference*, *10*(4–5), 357–365. https://doi.org/10.1016/s0950-3293(98)00057-3

Roth, J., Qiang, X., Marbán, S. L., Redelt, H., & Lowell, B. C. (2004). The Obesity Pandemic: Where Have We Been and Where Are We Going? *Obesity Research*, *12*(S11), 88S-101S. https://doi.org/10.1038/oby.2004.273

Rozin, P., Scott, S., Dingley, M., Urbanek, J. K., Jiang, H., & Kaltenbach, M. (2011). Nudge to Nobesity I: Minor Changes in Accessibility Decrease Food Intake. *Judgement and Decision Making*, *6*(4), 323–332. https://repository.upenn.edu/marketing_papers/410

Sadowski, S., Fennis, B. M., & van Ittersum, K. (2020). Losses tune differently than gains: how gains and losses shape attentional scope and influence goal pursuit. *Cognition and Emotion*, *34*(7), 1439–1456. https://doi.org/10.1080/02699931.2020.1760214

Schneider, C., Weinmann, M., & vom Brocke, J. (2018). Digital nudging. *Communications of the ACM*, *61*(7), 67–73. https://doi.org/10.1145/3213765

Shekar, M., & Popkin, B. (Eds.). (2020). Obesity: Health and Economic Consequences of an Impending Global Challenge. *World Bank Publications*, 1–199. https://doi.org/10.1596/978-1-4648-1491-4

Shepherd, R., & Raats, M. (2010). The Psychology of Food Choice (Public Health). CABI.

Spanke, M. (2020). *Retail Isn't Dead: Innovative Strategies for Brick and Mortar Retail Success* (1st ed. 2020 ed.). Springer. https://doi.org/10.1007/978-3-030-36650-6_11

Swinburn, B. A., Sacks, G., Hall, K. D., McPherson, K., Finegood, D. T., Moodie, M. L., & Gortmaker, S. L. (2011). The global obesity pandemic: shaped by global drivers and local environments. *The Lancet*, *378*(9793), 804–814. https://doi.org/10.1016/s0140-6736(11)60813-1

Thaler, R. H., & Sunstein, C. R. (2009). *Nudge: Improving Decisions About Health, Wealth, and Happiness* (Revised & Expanded ed.). London, United Kingdom: Penguin Putnam inc.

Thorndike, A. N., Riis, J., Sonnenberg, L. M., & Levy, D. E. (2014). Traffic-Light Labels and Choice Architecture. *American Journal of Preventive Medicine*, *46*(2), 143–149. https://doi.org/10.1016/j.amepre.2013.10.002

Thorndike, A. N., Sonnenberg, L., Riis, J., Barraclough, S., & Levy, D. E. (2012). A 2-Phase Labeling and Choice Architecture Intervention to Improve Healthy Food and Beverage Choices. *American Journal of Public Health*, *102*(3), 527–533. https://doi.org/10.2105/ajph.2011.300391

Tversky, A., & Kahneman, D. (1974). Judgment under Uncertainty: Heuristics and Biases. *Science*, *185*(4157), 1124–1131. https://doi.org/10.1126/science.185.4157.1124

Vlaev, I., King, D., Dolan, P., & Darzi, A. (2016). The Theory and Practice of "Nudging": Changing Health Behaviors. *Public Administration Review*, *76*(4), 550–561. https://doi.org/10.1111/puar.12564

Voedingscentrum. (n.d.). *Lijst van producten die niet in de Schijf van Vijf staan*. Retrieved October 25, 2020, from https://www.voedingscentrum.nl/nl/gezond-eten-met-de-schijf-van-vijf/hoeveel-en-wat-kan-ik-per-dag-eten-/wat-staat-niet-in-de-schijf-van-vijf-.aspx

Wansink, B., & Hanks, A. S. (2013). Slim by Design: Serving Healthy Foods First in Buffet Lines Improves Overall Meal Selection. *PLoS ONE*, *8*(10), e77055. https://doi.org/10.1371/journal.pone.0077055

Weingarten, E., Chen, Q., McAdams, M., Yi, J., Hepler, J., & Albarracín, D. (2016). From primed concepts to action: A meta-analysis of the behavioral effects of incidentally presented words. *Psychological Bulletin*, *142*(5), 472–497. https://doi.org/10.1037/bul0000030

Weinmann, M., Schneider, C., & Brocke, J. (2016). Digital Nudging. *Business & Information Systems Engineering*, *58*(6), 433–436. https://doi.org/10.1007/s12599-016-0453-1

Wilson, A. L., Buckley, E., Buckley, J. D., & Bogomolova, S. (2016). Nudging healthier food and beverage choices through salience and priming. Evidence from a systematic review. *Food Quality and Preference*, *51*, 47–64. https://doi.org/10.1016/j.foodqual.2016.02.009

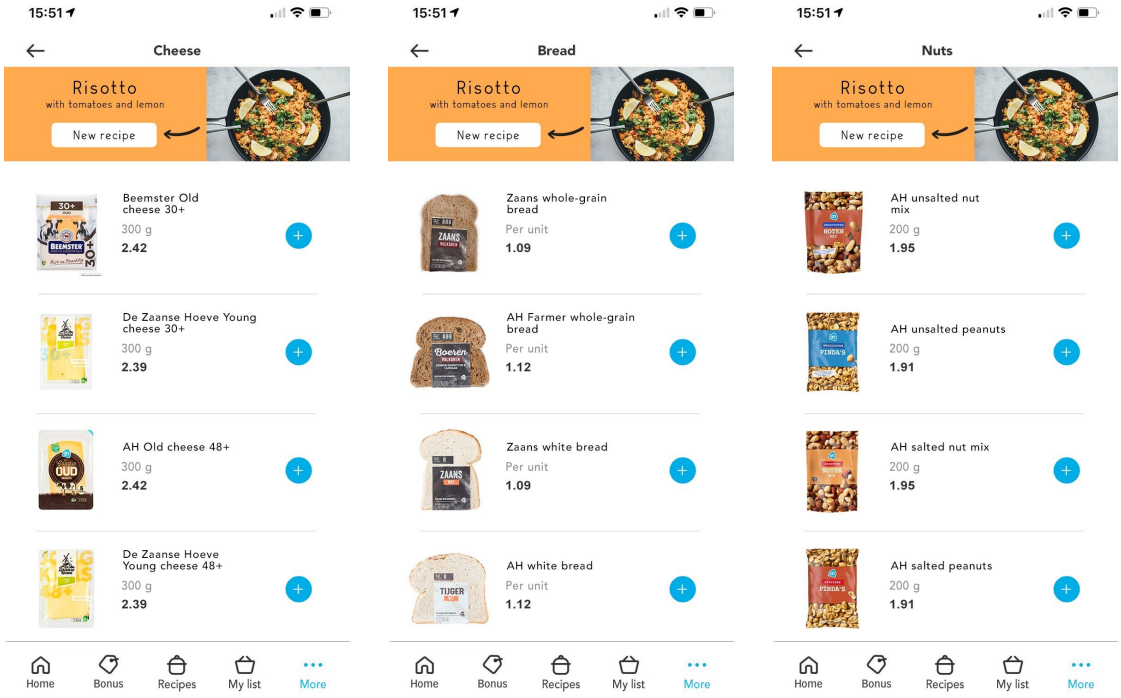
Wryobeck, J., & Chen, Y. (2003). Using Priming Techniques to Facilitate Health Behaviours. *Clinical Psychologist*, *7*(2), 105–108. https://doi.org/10.1080/13284200410001707553

Zimmerman, F. J. (2009). Using behavioral economics to promote physical activity. *Preventive Medicine*, *49*(4), 289–291. https://doi.org/10.1016/j.ypmed.2009.07.008

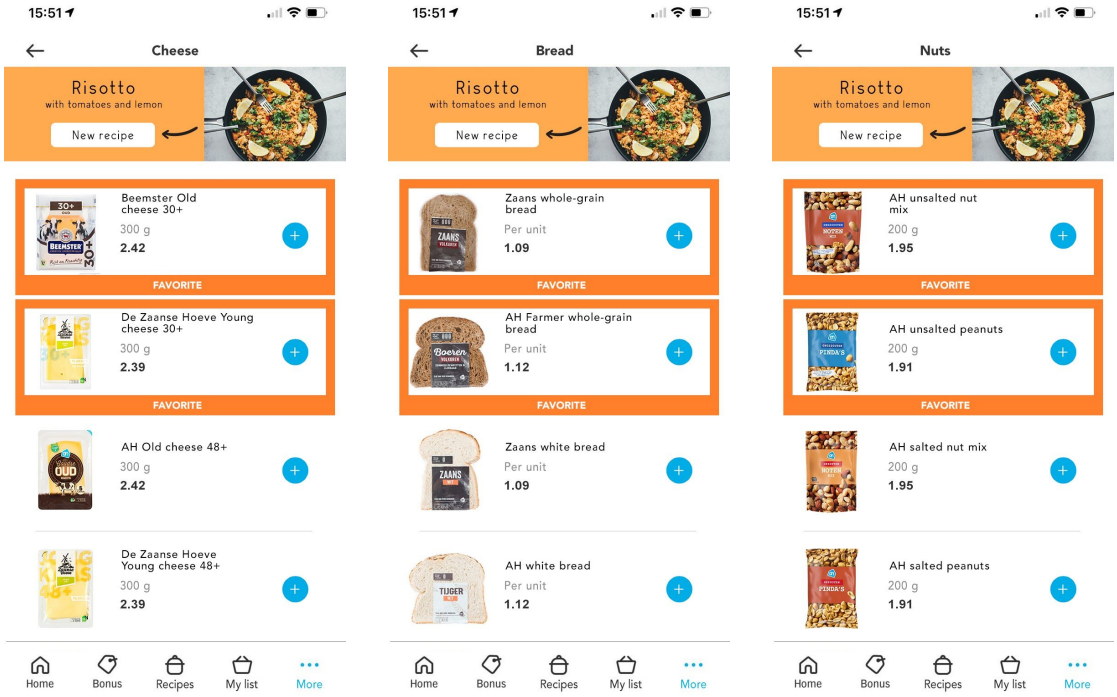
Appendix A

Stimuli

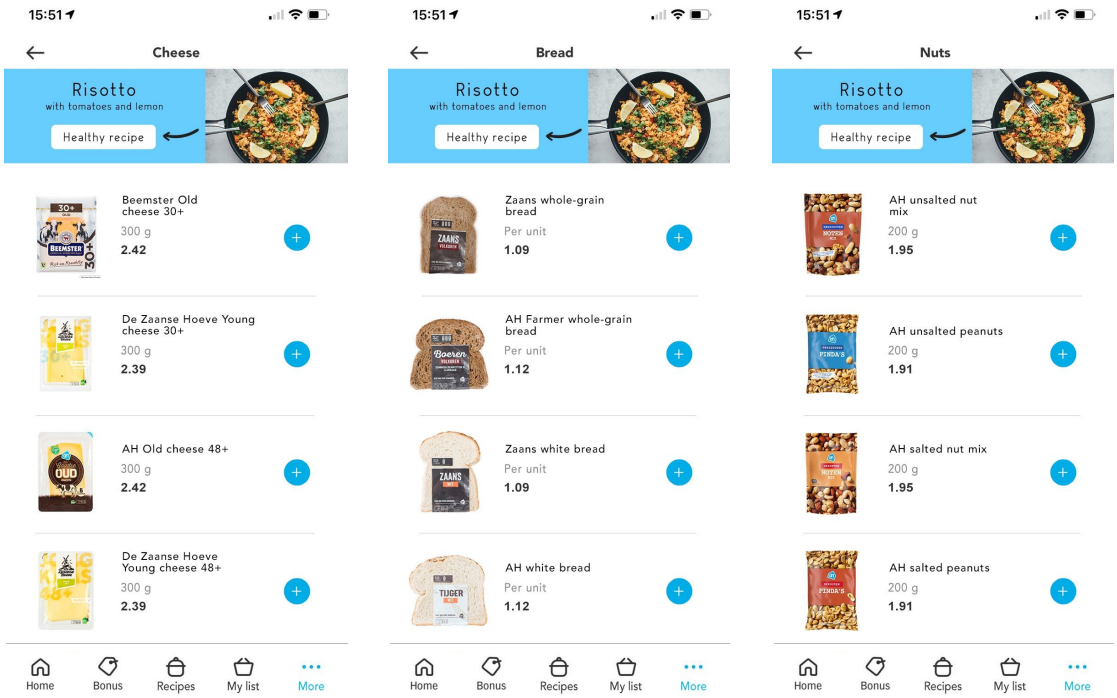
Control condition



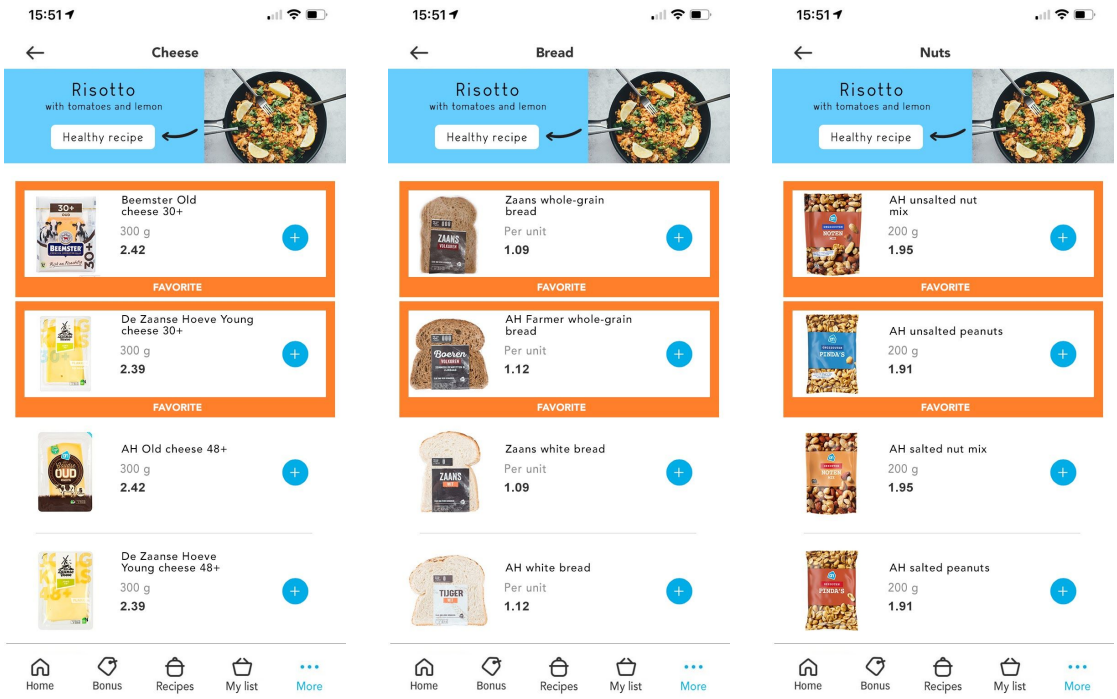
Salience nudge condition



Priming nudge condition



Combined condition



Appendix B

Statements of the General Health Interest Scale

1. The healthiness of food has little impact on my food choices.
2. I am very particular about the healthiness of food I eat.
3. I eat what I like, and I do not worry much about the healthiness of food.
4. It is important for me that my diet is low in fat.
5. I always follow a healthy and balanced diet.
6. It is important for me that my daily diet contains a lot of vitamins and minerals.
7. The healthiness of snacks makes no difference to me.
8. I do not avoid foods, even if they may raise my cholesterol.

Appendix C

Questionnaire

Informed consent

Principal investigator
Kim Paulissen
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Institution Tilburg University
Department Tilburg School of Humanities and Digital Sciences

The study: research into the online shopping behavior in an online supermarket
You are invited to participate in this research study. If you have any questions or comments with regard to this research study, do not hesitate to contact the principal investigator through email. If you have any remarks or complaints regarding this research, you may also contact the "Research Ethics and Data Management Committee" Tilburg School of Humanities and Digital Sciences via tshd.redc@tilburguniversity.edu.

The purpose
The purpose of this research is to gain more knowledge about the shopping behavior of consumers in an online supermarket environment.

Participation
Participation in this research study is completely voluntary. You have the right to decline to participate and withdraw from the research at any point in the experiment, without giving an explanation and without any negative consequences. Participation in this study will take no longer than 5 to 10 minutes. You will be asked to answer a number of demographic questions, then you will be guided to online supermarket web pages to do fictitious shopping and finally you will be asked a number of additional questions.

Benefits and risks
A potential benefit for participating in the study is that you have the ability to have a chance to win a gift certificate of twenty-five euros from Bol.com. You will be asked to provide an email address at the end of the survey if you want to have a chance to win this gift certificate. Furthermore, there are no potential risks associated with participating in this research study.

Confidentiality
The data collected will be stored confidentially. However, whenever you decide to provide your email address for the gift certificate, then this will be the only personal information stored. These

email addresses will be deleted immediately after the draw that will take place after the required number of participants has been reached.

Data analysis and storage
The data collected will be used and analyzed for research purposes. Furthermore, the data will be stored for a maximum of 5 years on the servers of Tilburg University.

To participate in this research study, I agree to the following conditions:
- I confirm that I am 18 years or older.
- I confirm that I have no food allergies or intolerances.
- I confirm that I answer this survey on a mobile phone.
- I confirm that I have read all the parts of the informed consent and I have a good understanding of the purpose of this research study.
- I confirm that my participation in this study is voluntary and that I am allowed to quit the study at any given time without giving any reason.
- I am aware of the fact that I can ask for the removal of my data at any given time.
- I am aware of the fact that the survey is anonymous and my data cannot be accessed by third parties.
- I am aware of the fact that my data will be used for analytical purposes.
- I am aware of the fact that I need to provide an email address to have a chance of winning the gift certificate.
- I am aware of the fact that demographical data such as gender, age, nationality, education level, height and weight will be documented.
- I give permission to document the information I provide with this questionnaire.

Consent
In order to start the questionnaire, please accept the terms of consent below:

- ○ I consent (1)
- ○ I do not consent (2)

What is your gender?

- ○ Female (1)
- ○ Male (2)

○ I rather not tell (3)

What is your age?

_____

Where are you from?

▼ Afghanistan (1) ... Zimbabwe (1357)

What is the highest level of education that you have attained?

○ No education (1)

○ Primary school (2)

○ VMBO (3)

○ HAVO / VWO (4)

○ MBO (5)

○ HBO (6)

○ WO Bachelor (7)

○ WO Master (8)

○ PhD (9)

What is your height in centimeters?

_____

What is your weight in kilograms?

_____

Do you ever use the website of a supermarket to see what products they offer before you go grocery shopping?

- ○ Always (1)
- ○ Most of the time (2)
- ○ About half the time (3)
- ○ Sometimes (4)
- ○ Never (5)

Do you ever do grocery shopping online?

- ○ Always (1)
- ○ Most of the time (2)
- ○ About half the time (3)
- ○ Sometimes (4)
- ○ Never (5)

Welcome to our online supermarket! You are going to do grocery shopping online to buy some products that will be delivered to your place tomorrow.

Your grocery list:

- Pasta
- Cheese
- Bread
- Nuts

You will be presented the webpages to buy the products. Please choose one product on each page. Take all the time needed to make a decision.

Choose 1 pasta product

	Off (1)	On (2)
Region #1		
Region #2		
Region #3		
Region #4		

Choose 1 cheese product

	Off (1)	On (2)
Regio #1		
Regio #2		

Regio #3	
Regio #4	

Choose 1 bread product

	Off (1)	On (2)
Regio #1		
Regio #2		
Regio #3		
Regio #4		

Choose 1 nut product

	Off (1)	On (2)
Regio #1		
Regio #2		
Regio #3		
Regio #4		

According to you, how healthy were the by you chosen pasta, cheese, bread and nut products?

- ○ (Unhealthy) 1 (1)
- ○ 2 (2)
- ○ 3 (3)
- ○ 4 (4)

- ○ 5 (5)
- ○ 6 (6)
- ○ 7 (7)
- ○ 8 (8)
- ○ 9 (9)
- ○ (Healthy) 10 (10)

Based on your knowledge, what is the healthier product?

	1 (1)	2 (2)	
White pasta	○	○	Whole-grain pasta
30+ cheese	○	○	48+ cheese
Whole-grain bread	○	○	White bread
Salted nuts	○	○	Unsalted nuts

To what extent did the healthiness of the products influenced your choice for the pasta, cheese, bread, and nut product?

	Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree (5)	Disagree (6)	Strongly disagree (7)
The healthiness of the products has influenced my choices (1)	○	○	○	○	○	○	○

Did you see a banner on top of the page representing a recipe?

- ○ Yes (1)
- ○ No (2)
- ○ Unsure (3)

What text was presented in the banner to describe the recipe?

- ○ "New recipe" (1)
- ○ "Healthy recipe" (2)

To what extent has the presence of the banner influenced your choice of the pasta, cheese, bread and nut product?

	Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree (5)	Disagree (6)	Strongly disagree (7)
The banner has influenced my choices for the products (1)	○	○	○	○	○	○	○

Did you see a frame around some products on each of the product pages that were shown before?

- ○ Yes (1)
- ○ No (2)
- ○ Unsure (3)

What color did the frames have?

- ○ Blue (1)
- ○ Orange (2)

To what extent has the presence of frames influenced your choice of the pasta, cheese, bread and nut product?

	Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree (5)	Disagree (6)	Strongly disagree (7)
The frames have influenced my choices for the products (1)	○	○	○	○	○	○	○

GHI Please indicate to what extent the statements below apply to you.

	Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree (5)	Disagree (6)	Strongly disagree (7)
I am very selective when it comes to the healthiness of food I eat. (1)	○	○	○	○	○	○	○

I always follow a healthy and balanced diet. (2)	○	○	○	○	○	○	○
It is important for me that my diet is low in fat. (3)	○	○	○	○	○	○	○
It is important for me that my daily diet contains a lot of vitamins and minerals. (4)	○	○	○	○	○	○	○
I eat what I like and I do not worry about healthiness of food. (5)	○	○	○	○	○	○	○
I do not avoid any foods, even if they may raise my cholesterol. (6)	○	○	○	○	○	○	○

The healthiness of food has little impact on my food choices. (7)	○	○	○	○	○	○	○
The healthiness of snacks is not important to me. (8)	○	○	○	○	○	○	○

If you want a chance to win the 25 euro gift certificate (Bol.com), please leave your e-mail address below:

_____