A Nudge Too Much

Nudging healthy food choices in restaurants through its menu and eating environment

Stefano M. Di Matola

S1884026

Master Communication Studies

University of Twente

Dr. Mirjam Galetzka

Dr. Joris J. van Hoof

11 May, 2020

Abstract

Aim. This study investigates whether a combination of a traffic light nudge and a green-plant based environment can positively influence the healthiness of food choices in restaurants. The relevance of this study derives from the growth in overweight and obesity numbers in western societies.

Method. A 2 (menu: traffic light label versus no traffic light label) \times 2 (restaurant eating environment: green plant-based versus regular) between subjects experiment was performed in a restaurant in the city center of Enschede. Participants (N = 82) who were under the impression of aiding in a taste experiment, chose one of four dishes from the menu. The menu was composed of healthy and unhealthy dishes. After finishing their lunch, a questionnaire composed of questions about the lunch and questions to measure constructs was handed out. **Results.** Analyses showed that the traffic light nudge had a positive effect on healthiness of food choice. There was no main effect for the restaurant eating environment. However, data did show a marginally significant interaction effect between the menu and eating environment. In contrary to expectations, the traffic light nudge was more effective in the normal eating environment than in the green plant-based environment.

Conclusion. This study provides evidence that the healthiness of food choices can be increased by implementing a relatively simple and cost effective salience nudge (i.e., traffic light nudge) in restaurants. However, when combining two nudges (traffic light nudge and green plant-based eating environment) can create a "boomerang" effect and lower the healthiness of food choice compared to a single salience nudge. Therefore, more research is required to explore why certain nudges negate the effect of other nudges.

Keywords: nudge, healthy food, restaurants, food choice, eating environment, salience, priming, traffic light, plant based environment

Research by the National Center for Health Statistics (2018) found that in 2016, 39.8 percent of US adults were obese, while, more shockingly, 71.6 percent of the US adults are overweight. Obesity amongst children in the age categories 2-5 years, 6-11 years, and 12-19 years were respectively 13.9, 18.4, and 20.6 percent. The growth in childhood obesity has leveled off in the last decade and the rise in obesity among adults is slowing down. Obesity remains one of the biggest threats to the health of children and the US, putting millions of Americans at increased risk for chronic diseases, while not even mentioning the billions of dollars spent in preventable healthcare. Obesity and overweight is not just an issue in the US, but all western societies seem to struggle with it. For instance, amongst adults in The Netherlands in 2019, 50.1 percent had overweight, of which 14.7% were obese (CBS i.s.m. RIVM, 2019).

These numbers illustrate the importance to research into topics on enhancing healthier food habits in restaurants to tackle this societal issue. The numbers can be partially attributed to the fact that frequently eating out is linked to a higher caloric intake, weight gain and obesity (Steward, Blisard, & Jolliffe, 2006). The higher calorie intake can be attributed to the poor nutritional quality and calorie-dense servings at restaurants (Guthrie, Lin, & Frazao, 2002).

Many studies explore how to improve consumers' food choices by educating and informing them through nutrition labels or substitutes. For example, using traffic light colors indicating healthiness of food was found to be the best signal for suggesting healthiness in fast food restaurants (Montandon & Colli, 2016). Yet, it is still to be explored in what other contexts such strategy can be used.

In this research, a 2 (menu: traffic light label versus no traffic light label) \times 2 (restaurant eating environment: green plant-based versus regular) field experiment has been conducted. This study explored whether the eating environment and the menu could be

adjusted in such a way that it will improve the healthiness of choices made in a restaurant. The main research question is formulated as follows: "*How can the eating environment and menu of a restaurant be used to increase healthier food choices in favor of unhealthy food choices*?"

Theoretical framework

Consumer decision-making

Traditional consumer decision-making theories rely heavily on the notion of a rational process of decision-making, such as the Theory of Planned Behavior (Ajzen, 1991) or the Five Stage model (Solomon, 2014). These theories are broadly accepted and applicable to highly rational and conscious decision making. However, Köster (2009) argues that decision-making is not only a rational or conscious process, but that it can also be a process without conscious control. For food choices especially it is argued that habit and hedonic appreciation are often the better predictors than the traditional models (Köster, 2009).

The Dual Process Theory, in which specifically System 1, illustrates a better approach for the food decision-making process at a restaurant. Kahneman (2003) suggests that there are two ways people make decisions. The first is intuition (System 1), in which the process is characterized by operations that are "fast, automatic, effortless, associative, implicit and often emotionally charged; they are also governed by habit and therefore difficult to control or modify" (Kahneman, 2003, p. 698). The second is reasoning (System 2), and is basically a more rational process, Kahneman (2003) describes it as "slower, serial, effortful, more likely to be consciously monitored and deliberately controlled; they are also relatively flexible and potentially rule governed" (p. 698).

In System 1 decision-making, people use heuristics and biases as a "rule of thumb" to make decisions, because consciously and extensively reflecting on every possibility via

System 2 is too time-consuming (Broers, De Breucker, Van den Broucke, & Luminet, 2017). Heuristics often lead to unhealthy choices, however, nudges uses these heuristics that rely on System 1 decision-making to direct people in a beneficial and healthy behavior (Broers et al., 2017).

Nudges

Thaler and Sunstein (2008) first coined the term nudge in their book Nudge:

improving decision about health, wealth, and happiness. A nudge is, as described by Thaler and Sunstein (2008, p. 6), "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". In the food service domain this could mean altering the restaurant's eating environment or menu. Thaler and Sunstein (2008) argue that nudges are meant to support people in making the right choice, rather than banning other choices.

According to Wilson and colleagues (2016), nudges can be classified in six different categories, namely, priming, salience, default, incentive, commitment and ego, and norms and messenger nudges. A brief explanation of these nudges can be found in Table 1.

Table 1

Category	Explanation
Priming nudges	Subconscious cues which may be physical, verbal or sensational, and are changed to nudge a particular choice.
Salience nudges	Novel, personally relevant or vivid examples and explanations are used to increase attention to particular choice.
Default nudges	A particular choice is pre-set (default), which makes it the easiest option.
Incentive nudges	Incentives are used to either reinforce a positive choice, or to punish a negative choice
Commitment and ego nudges	Consumers make a commitment or promise public, and their desire to feel good about themselves will nudge them to make choices consistent with their commitment.
Norms and messenger nudges	Other people are used to establish a norm, as consumers are influenced by comparing themselves to others.

Categorization and Explanation of Nudges as Described by Wilson et al. (2016)

More recently, Cadario and Chandon (2019) categorized nudges in three main categories, namely, cognitively-oriented nudges (descriptive labeling, evaluative labeling, and visibility enhancement) are used to influence what consumers know, affectively-oriented nudges (healthy eating calls and hedonic enhancements) are used to influence how consumers feel, and behaviorally-oriented nudges (convenience enhancements and size enhancements) are used to influence what consumers do. Cadario and Chandon (2019) also found that cognitively-oriented nudges have a lower effect when compared to the other two categories, with effect sizes increasing by a factor of 3.2 between cognitively- and behaviorally-oriented nudges.

As described in Table 1, priming nudges, which could be classified as cognitivelyoriented nudges are subconscious cues to nudge a particular choice. Priming is described as the process of building connections in the associative network by activating one particular node in the network (Esmark, 2016). These cues may be physical, verbal or sensational (Wilson et al., 2016). These types of cues can be used strategically as primers to enhance healthy choices (Blumenthal-Barby & Burroughs, 2012). Blumenthal-Barby and Burroughs (2012) discuss a wide range of studies where priming nudges have shown success in promoting healthy behavior, including making healthier food choices.

Salience nudges, which could also be categorized as cognitively-oriented nudges, use novel, personally relevant or vivid examples, and explanations to increase attention to a particular choice (Wilson et al., 2016). Emotional associations derived from salient nudges remain readily available in memory and form decisions and behaviors (Blumenthal-Barby & Burroughs, 2012).

Eating environment

Sobal and Wansink (2007) distinguished eating environment and food environment. The eating environment refers to the ambient factors that are independent of food, for example, the atmosphere, the time of day, the social interactions that occur, and the effort of obtaining food. The components of an eating environment could be adjusted in such a way, that it nudges healthiness. Nudges are often relatively cheap and easy to implement (Hansen, Skov, & Skov, 2016), for instance, a simple modification of the environment could potentially increase intake of more healthy foods, or reduce the intake of unhealthy food.

When visual cues in the eating environment influence the eating behavior, they act as priming nudges. Primes subconsciously activate semantically associated mental content temporarily, which is then more likely integrated into ongoing mental processes, which is likely to influences behavior (Stämpfli, Stöckli, & Brunner, 2017). Therefore, visual exposure to green plants and herbs may also activate healthiness through the associative network.

Unhealthy food choices can also be attributed to depletion of cognitive capacity (Muraven & Baumeister, 2000). Kim & Magnini (2016) stated that cognitive resources are needed to resist unhealthy temptation, and visual exposure to indoor plants leads to the restoration of cognitive depletion. Therefore, visual exposure to indoor plants can influence healthier eating (Kim & Magnini, 2016).

It is expected that a green-plant based eating environment increases healthier food choices. It is hypothesized that a green plant-based eating environment will restore a person's cognitive depletion, while also, or either, activating semantic associations with healthiness, resulting in an healthier food choice over an unhealthy food choice.

H1: A green plant-based eating environment will positively influence the healthiness of food choice as opposed to an eating environment without green plants.

Menu

Research in menu design started in the early 1980s, with a focus on profitability and cost optimization. However, due to overweight numbers and obesity concerns in the last

decade, the focus has shifted to designing menus that improve responsible food choices (Filimonau & Krivcova, 2017).

Nudging healthier food choices in a restaurant can be done by adjusting the menu to show labels, symbols, icons, motivational messages or information (Kraak, Englund, Misyak, & Serrano, 2017). Each type of nudge may have different effects, and may be context bound.

It was found that when priming nudges and salience nudges are combined, healthier food options are easier to choose (Blumenthal-Barby & Burroughs, 2012). Research indicates that one of the most effective priming nudge for a menu is using descriptive names (Wansink, Painter, & Ittersum, 2001; Wansink & Love, 2014). Wansink, et al. (2001) illustrate that descriptive names can result in the halo-effect, to clarify, when a consumer scans the menu and reads the food option "Homemade Cheesecake", and associates the characteristic of homemade baking with "tasty or baked with love", it could influence their behavior. Concisely, descriptive words for healthy food options can influence the appeal and expectations about taste, which subsequently increase the likeliness the item will be chosen (Wansink & Love, 2014). A downside may be that a restaurant should avoid too many items with descriptive menu labels and descriptions that are too long in general (Wansink & Love, 2014).

Evidence supports that salience nudges at the point-of-purchase are effective interventions to promote healthier food choices (Gallicano, Blomme, & Rheede, 2012; Sonnenberg et al. 2013; Wansink & Love, 2014). Examples of effective salience nudges are the use of traffic lights (Sonnenberg et al. 2013), nutritional information (Vanderlee & Hammond, 2014), and logo's such as the "Healthy Choice®" label (Gallicano, Blomme, & Rheede, 2012). However, Burton, Howlett, and Tangari (2009) found that when a restaurant uses the nutritional information on its menu, it disconfirmed expectations, as certain foods were perceived to be healthy, but the nutritional information contradicted the expectations, resulting in decreased purchase intentions and consumptions.

In short, there are various studies affirming that a menu can be used to nudge healthier food choices. Since the eating environment is better suited for a priming nudge, a traffic light nudge is used as a salience nudge for the menu.

H2: A menu design with the traffic light nudge will positively influence the healthiness of food choice as opposed to a menu without the traffic light nudge.

The effects of priming and salience nudges combined, through simple education and physically rearranging the environment, has shown that healthier options are easier to choose (Blumenthal-Barby & Burroughs, 2012). However, the meta-analysis on nudging does not support the notion that combining two cognitive nudges increases the effect size (Cadario & Chandon, 2019). Yet, it seems logical that specifically a traffic light nudge in a green plant-based eating environment could positively influence the healthiness of food choices.

H3: The combined effect of a green plant-based eating environment (priming nudge) and the traffic light nudge (salience nudge) on the menu will positively influence healthier food choices as opposed to no or one of the conditions.

Health consciousness

As Hong (2009, p. 219) stated, "health consciousness refers to an individual's comprehensive mental orientation toward his or her health, being comprised of self-health awareness, personal responsibility, and health motivation, as opposed to being related to specific issues (e.g. smoking, exercise, healthy diet)". Hong (2009) divided health consciousness into five major dimensions from previous literature, namely, integration of health behavior, attention to one's health, health information seeking and usage, personal health responsibility, and health motivation. However, measuring health interest may be a more specific approach for restaurants and food, disregarding health topics such as exercise

and smoking. Chandon and Wansink (2007) measured nutrition involvement using a five-item scale in which respondents indicated their agreement to statements such as "I pay close attention to nutrition information" and "Calorie levels influence what I eat" on a nine-point scale.

The fourth and fifth hypothesis refer to the health consciousness of a person, and how it will influence their food choice. It is expected that people with a high level of health consciousness are more likely to be affected by the salience nudge. It is also expected that a person with a high level of health consciousness may be more susceptible to the priming nudge, thus resulting in healthier food choices.

H4: The menu nudge is expected to be more effective on people with a high level of health consciousness as opposed to a low level of health consciousness.

H5: The environment is expected to be more effective on people with a high level of health consciousness as opposed to a low level of health consciousness.

Lastly, there is an open research question regarding the eating environment. It is not known whether the hypothesized effect of the green plant-based eating environment can be attributed to semantic associations or rather the cognitive restorative capabilities. The Perceived Restorativeness Scale, which is based on the Attention Restoration Theory (Kaplan, 1995), will be used to investigate this research question.

Research model

A research model (Figure 1) has been drawn taking all of the literature and hypotheses discussed into account.



Figure 1. Research model with independent variables eating environment and menu, moderator variable health consciousness and dependent variable healthiness of food choice.

Method

This study investigated how consumers can be influenced into making healthier food choices in a restaurant by using its eating environment and menu card. Building upon the theory discussed in the theoretical framework, a 2 (menu: traffic light label versus no traffic light label) \times 2 (restaurant eating environment: green plant-based versus regular) field experiment has been designed and conducted.

Participants

A total of 82 participants were recruited, of which 49 male (59.8%) and 33 female (40.2%), no gender differences were found amongst the four conditions (X^2 (3, N = 82) = 4.84, p = .18). The participants ages ranged between 18 and 83 (M = 37, SD = 16.33). There were no significant differences found in age distributions between the four conditions (F(3, 78) = 1.43, p = .24. Finally, the condition groups did not differ by education level (X^2 (12, N = 82) = 12.57, p = .40). Table 2 shows basic demographics of the participants.

Table 2

Condition	Participants	Age	Gender		Educ	ation
	Ň	M (SD)	Male %	Female %	Low %	High %
Normal menu (no nudge)	42	40.24 (18.36)	64%	36%	41%	<u>59%</u>
Normal eating environment	22	38.14 (17.64)	50%	50%	46%	54%
Green plant-based eating environment	20	42.55 (19.30	80%	20%	35%	65%
Nudge menu (Traffic lights)	<u>40</u>	<u>33.75 (13.32)</u>	<u>55%</u>	<u>45%</u>	<u>43%</u>	<u>57%</u>
Normal eating environment	17	35.12 (10.74)	59%	41%	59%	41%
Green plant-based eating environment	23	32.74 (15.10)	52%	48%	39%	61%
Total	82	37.07 (16.33)	59.80%	40.20%	43.90%	56.10%

Participants Characteristics per Condition

Procedure

A non-probability sampling strategy was applied. Specifically, participants were recruited via three ways, namely, people were asked to participate in the experiment in the city center and the University of Applied Sciences Saxion in Enschede in the city center of Enschede, and through Facebook. Furthermore, people who agreed to participate were allowed to bring friends and family to also participate in the research.

The experiment was held over the course of two days in a real restaurant in the city center of Enschede. The first day of the experiment the restaurant's eating environment was without any manipulation, while the second day was used for the manipulated green plant-based eating environment, in which the restaurant room was transformed to an eating environment filled with green plants and herbs. On both days two different groups participated in the experiment, from 12:00 to 13:00 the participants were given the normal menu, and from 13:00 to 14:00 participants were given the manipulated menu with traffic lights indicating healthiness.

Participants were recruited by offering free lunch and drinks, and were told they would be participating in a tasting experiment for a new lunch restaurant opening soon in the city center. They were told that the restaurant wanted to find out which of the dishes they should add to their menu. Participants also agreed to fill in a survey, which was handed out after the participant was done with their meal.

A waiter and three cooks aided in the experiment, given clear instructions on what to do. The cooks were instructed how the dishes had to be plated, trying to make each dish as identical as its preceding dish, while the waiter was instructed what they should and should not say or do, to ensure that every participants had a similar experience leading up to their food choice.

Stimuli

Pretest. Prior to the main study, a pretest was conducted. The aim of the pretest was to select appropriate materials for the main study, namely, which dishes to use for the menu condition, and how to arrange the green plant-based eating environment. Through an online survey participants were asked to rate food items on healthiness and tastiness. Furthermore, pictures were shown of either a normal eating environment or the same environment with green plants and herbs installed, in order to measure the perceived healthiness and relaxation of the restaurant, in order to find whether the perception of the two environments differed. This was not the case, therefore, adjustments were made for the main experiment. The full report on the pretest can be found in Appendix I.

Four of the ten dishes were selected from the pretest as the food options in the menu (Table 3). These food items were selected as they had the highest perceived tastiness score in their corresponding category, while having a significant difference in healthiness score.

Table 3

Dish	Healthiness of food choice	Mean health score (SD)	Mean taste score (SD)
Hamburger	Unhealthiest	2.16 (1.00)	4.11 (0.65)
Grilled Cheese	Unhealthy	2.66 (0.78)	4.00 (1.01)
Tuna Salad	Healthy	3.45 (1.35)	3.45 (0.86)
Vegetables Soup	Healthiest	4.11 (1.00)	3.37 (0.65)

Healthiness and Tastiness Scores from Pretest (N = 38)

Main study. For this experiment, the restaurant menu was manipulated with a salience nudges. The salience nudge used was a traffic light indication. Each food option was given either a green, yellow, or orange sign, respectively indicating healthy, neutral, and unhealthy, which was also written at the bottom of the menu. The color orange was prioritized over red, as one could argue that a restaurant would not want to actively make their dishes look bad. The used menus for the experiment can are shown in Figure 2.

The eating environment was also manipulated. A green plant-based environment was set up (Figure 3). Five big green indoor plants were placed throughout the eating environment, two small plants were placed at the entrance of the eating environment, two big plants in the middle of the restaurant room (Figure 4), and two artificial hanging plants were placed in the eating environment. Finally, basil, mint, and parsley plants were placed on each single table in the eating environment.

Lunchmenu

Tosti Kaas

Ook mogelijk met ham, saus naar keuze

Hamburger Broodje hamburger met kaas, sla, tomaat en hamburgersaus

Groentesoep Goed gevulde groentesoep met vermicelli

Tonijnsalade

Salade met tonijn, tomaatjes, ei, zwarte olijven met citroendressing

Dranken

Koffie Thee Cola / Cola zero Fanta / Fanta zero Sprite Water / bruisend water

Lunchmenu



Dranken

Koffie	
Thee	
Cola / Cola zero	
Fanta / Fanta zero	
Sprite	
Water / bruisend water	

•	Laagst in kcal
•	Gemiddeld in kcal
•	Hoogst in kcal

Figure 2. Menu without traffic light nudge and menu with traffic light nudge.



Figure 3. Normal eating environment and green plant-based eating environment showing usage of green herbs on the tables.



Figure 4. Green indoor plant used for the green plant-based eating environment.

Measures

To measure health consciousness, a five-item scale by Chandon and Wansink (2007) was used. Participants were asked to indicate their agreement with the statements, "Calorie levels influence what I eat", "I actively seek out nutrition information", "I pay close attention to nutrition information", "It is important to me that nutrition information is available", and (reverse coded) "I ignore nutrition information", measured on a seven-point scale from 1 = strongly disagree to 7 = strongly agree. The latter question showed little correlation to the other questions, and was therefore not included in the construct for health consciousness.

To measure the restorative capabilities of the eating environment, a five-item scale, based on the Attention Restoration Theory (Kaplan, 1995) was used. The Perceived Restorativeness Scale (Negrín et al., 2017; Ruiz, Pérez & Hernández, 2013) is composed of the following questions: "This place lets me forget my everyday responsibilities, feel relaxed, and lose myself in my own thoughts"; "This is a fascinating place that keeps my curiosity alive and stops me from getting bored"; "This is a place where activities and things are orderly and well organized"; "This place is like another world, where I can move around at ease"; and "I feel comfortable here because it's easy to find your way around this place". A ten-point scale was used, ranging from 1 = Not at all to 10 = Totally.

To measure to what extent participants perceived the restaurant as healthy, a threeitem scale was composed of the questions: "I expect that they serve healthy dishes here", "This restaurant looks attractive", and "I would rather order a healthy dish in this restaurant". A seven-point scale ranging from 1 = Totally disagree to 7 = Totally agree was used.

Table 4

Constructs Used for Data Analyses with Corresponding Reliability Scores

Construct	Cronbach's α	Number of items	Source
Health consciousness	.86	4	Chandon and Wansink (2007)
Perceived Restorativeness Scale	.90	5	Ruiz and Hernández (2014)
Perceived Restaurant Healthiness	.71	3	

Results

Analyses of the relationship between the independent variables environment and menu, and the dependent variables healthiness of food choices, perceived restorativeness of the eating environment, and perceived restaurant healthiness were conducted using a MANOVA. Results of the MANOVA are shown in Table 5. The results show a significant main effect of the environment (F(3,76) = 4.20, p = .008, Wilks' Lambda = .86, partial $\eta^2 =$.14), and the menu (F(3,76) = 4.28, p = .008, Wilks' Lambda = .86, partial $\eta^2 =$.15). There was also a significant interaction effect between the environment and menu (F(3,76) = 3.61, p= .017, Wilks' Lambda = .88, partial $\eta^2 = .13$).

Table 5

Results of the MANOVA

Effect		Value	F	df	Error <i>df</i>	р	Partial η^2
Environment	Wilks' Lambda	.86	4.20	3	76	.008	.14
Menu	Wilks' Lambda	.86	4.28	3	76	.008	.15
Environment * Menu	Wilks' Lambda	.88	3.61	3	76	.017	.13

Follow up analyses were conducted using a factorial ANOVA to assess the effect of the two independent variables, the menu and environment, on the outcome variable healthiness of food choices.

Menu

It was found that guests of the restaurant who were given the menu with traffic lights indicating healthiness of dishes chose significantly more healthier dishes (M = 1.95; SD = .99) than those who were given the menu without traffic light indications (M = 1.52; SD = .94), F(1, 78) = 5.17, p = .03. Hypothesis 1 "a menu with the traffic lights nudge will positively influence the healthiness of food choice as opposed to a menu without nudges" can be accepted.

Eating environment

It was found that there was a non significant difference in healthiness of food choices between the normal eating environment (M = 1.87; SD = 1.06) and the green plant-based eating environment (M = 1.60; SD = .90), F(1, 78) = 2.40, p = .13. Therefore, hypothesis 2, "a green plant-based environment will positively influence the healthiness of food choice as opposed to an eating environment without green plants", has to be rejected. More so, the data illustrates a lower mean score of healthiness of food choice in the green plant-based eating environment than in the normal eating environment.

Interaction effect: menu and eating environment

It was also found that there was a marginally significant interaction effect between the variables menu and eating environment on healthiness of food choices, F(1, 78) = 3.20, p = .08. Figure 5 suggests that the traffic light nudge is more effective when it is presented in a normal eating environment as opposed to a green plant-based eating environment. While the interaction effect was marginally significance, the third hypothesis "the combined effect of a green plant-based eating environment (priming nudge) and the traffic light nudge (salience nudge) on the menu will positively influence healthier food choices as opposed to no or one of the conditions" has to be rejected, as in a situation with the combination of the traffic lights nudge and the green plant-based environment, the healthiness of food choice did not increase.



Figure 5. Interaction between menu type and eating environment on healthiness of food choice.

Moderation: health consciousness

To investigate whether health consciousness moderates the relation between the menu and the healthiness of food choice, a hierarchical multiple regression analysis was conducted. In the first step, two variables were included: menu and health consciousness. These variables accounted for a significant amount of the variance in healthiness of food choice, $R^2 = .259$, F(2, 79) = 13.82, p = <.001. Next, the interaction term between menu type and health consciousness was added to the regression model, which accounted for an insignificant proportion of the variance in healthiness of food choice, $\Delta R^2 = .06$, $\Delta F(3, 78) = .58, p = .45$. Therefore, the fourth hypothesis "the menu nudge is expected to be more effective on people with a high level of health consciousness as opposed to a low level of health consciousness" can be rejected. The PROCESS macro was used to create an interaction plot of the variables (Figure 6).



Figure 6. Interaction plot of menu and health consciousness on healthiness of food choice.

The same analysis has been conducted to examine whether health consciousness moderates the relation between the environment and the healthiness of food choice. The two variables accounted for a significant proportion of the variance in healthiness of food choice, $R^2 = .232$, F(2, 79) = 11.90, p = < .001. With the interaction term added to the model, it was found that it accounted for an insignificant proportion of the variance ($\Delta R^2 = .00$, $\Delta F(3, 78) =$.01, p = 0.93). The fifth hypothesis "the menu nudge is expected to be more effective on people with a high level of health consciousness as opposed to a low level of health consciousness" can be rejected. Again, the PROCESS macro was used to create an interaction plot (Figure 7).



Figure 7. Interaction plot of environment and health consciousness on healthiness of food choice.

Additional analyses

Additional analyses were conducted to investigate the effect of the traffic light nudge and the green plant-based environment on perceived healthiness of the restaurant, perceived restorativeness of the restaurant, and health consciousness.

Perceived healthiness of the restaurant. An additional analysis was also conducted on perceived healthiness of the restaurant. An ANOVA was performed using the two independent variables menu and environment with perceived healthiness of the restaurant as dependent variable. There was no significant difference between the group with the nudge menu (M = 5.37; SD = 1.00), and the group with the normal menu (M = 5.29; SD = 0.92), F (1, 78) = 0.33, p = .86. It was also found that there was no significant difference between the normal environment (M = 5.43; SD = .96), and the green plant-based eating environment (M = 5.24; SD = 0.95), F(1, 78) = 0.91, p = .34. Finally, it was found that there was a significant interaction effect between menu and environment on the perceived healthiness of the restaurant, F(1, 78) = 7.57, p = 0.007. As can be seen in Figure 8, results indicate that while

given the normal menu, perceived healthiness of the restaurant is higher in the green plantbased environment as opposed to the normal environment. However, when given the menu with traffic light indications, the perceived healthiness of the restaurant decreases in the green plant-based environment.



Figure 8. Interaction between menu and eating environment on perceived healthiness of the restaurant.

Post hoc comparisons using the Bonferroni correction indicated that in the normal eating environment, the mean scores of perceived healthiness of the restaurant show a marginally significantly lower for the normal menu (M = 5.20; SD = .20) than the nudge menu (M = 5.73; SD = .22), F(1, 78) = 3.13, p = .08.

However, in the green plant-based eating environment, it resulted in a significantly higher mean score for the normal menu (M = 5.57; SD = .21) than the nudge menu (M = 4.96; SD = .19) when used in the green plant-based eating environment F(1, 78) = 4.55, p = 0.04.

Unexpectedly, there seems to be a boomerang effect. In the normal eating environment, those with a normal menu had a lower mean score than those with the nudge menu. While, in the green plant-based eating environment, those with a normal menu had a higher mean score on perceived healthiness of the restaurant than those with the nudge menu.

Perceived restorativeness of the restaurant. An additional analysis was also conducted on perceived restorativeness of the restaurant. An ANOVA was also used to assess the perceived restorativeness of the restaurant. Menu and environment were used as independent variables, and perceived restorativeness scale as the dependent variable. There was a marginally significant difference between the group with the nudge menu (M = 7.24; SD = 1.62), and the normal menu (M = 7.89; SD = 1.64), F(1, 78) = 3.68, p = .059. It was found that there was no significant difference in the scores between the normal environment (M = 7.31; SD = 1.92), and the green plant-based eating environment (M = 7.81; SD = 1.34), F(1, 78) = 2.47, p = .12. Furthermore, it was found that there was no significant interaction effect between menu and environment on the perceived restorativeness of the restaurant, F(1, 78) = 0.96, p = 0.33.

Again, the results indicate that when given the nudge menu, participants had a lower score in perceived restorativeness of the restaurant than when given the normal menu.



Figure 9. Interaction between menu and eating environment on perceived restorativeness of the eating environment.

Health consciousness. Finally, an additional analysis was also conducted on health consciousness. An ANOVA was performed using the menu and eating environment as independent variables and health consciousness as the dependent variable to find whether the nudges could have an effect on the self-reported health consciousness scores. There was no significant difference between the group with the nudge menu (M = 3.91; SD = 1.27), and the normal menu (M = 3.61; SD = 1.55), F(1, 78) = 1.31, p = .26. Yet, it was found that there was a significant difference in the scores between the normal environment (M = 4.08; SD = 1.50), and the green plant-based eating environment (M = 3.46; SD = 1.29), F(1, 78) = 4.48, p = .037. However, it was found that there was no significant interaction effect between menu and environment on health consciousness for the green plant-based eating environment as opposed to the normal eating environment (Figure 10).



Figure 10. Interaction between menu and eating environment on health consciousness.

Discussion

The main objective of this study was to explore how restaurants can enhance healthier food choices in their premises to tackle the current western health issues. Literature showed many factors in a restaurant that could influence consumer choices, such as atmosphere, time of day, and ambience (Sobal & Wansink, 2007). This study explored two relatively easy and cost-effective manipulations to implement for restaurants in a real life setting. Namely, altering the menu with a traffic light nudge (salience nudge), and adding green plants and herbs to the eating environment of a restaurant (priming nudge).

The results show that the manipulation of the menu with a traffic light nudge did influence the healthiness of food choices. Specifically, participants who were nudged with the traffic lights were more likely to choose a healthier dish over an unhealthy dish, which is in accordance with the results of Sonnenberg et al. (2013). Yet, according to a meta-analysis on nudging by Cadario and Chandon (2019), salience nudges categorized as cognitively-oriented nudges, were supposed to be amongst the least effective types of nudges. While affectivelyand behaviorally-oriented nudges may be more effective, current study was especially centered around the combination of the cognitively-oriented nudges.

The second nudge used in this study was a priming nudge, or more specifically, the adjustment of the restaurants' eating environment into a green plant-based eating environment. It was found that there was no significant difference in healthiness of food choice between the normal eating environment and the green plant-based eating environment. Two theories were discussed in the literature explaining why it was hypothesized that the green plant-based environment should result in healthier food choices.

Firstly, it was discussed that a green plant-based environment could act as a priming nudge, and that the plants, herbs, and color green would subconsciously activate healthiness in the associative network (Stämpfli, Stöckli, & Brunner, 2017). Secondly, it was discussed that unhealthy food choice could be attributed to cognitive depletion (Muraven & Baumeister, 2000), and that visual exposure to indoor plants would restore cognitive depletion, which is needed to resist unhealthy temptations (Kim & Magnini, 2016). However, the visual exposure to the plants did not result in healthier food choices, as suggested by Kim and Magnini (2016).

Perhaps the cognitive resources that are needed to resist unhealthy food are context bound. For instance, a dieter may be affected by the priming nudge, thus resisting the urge to order unhealthy food. But then imagine someone who goes to a restaurant for hedonic purposes and just wants to choose the tastiest dish. That person could have been nudged by the menu, but possibly had their cognitive resources restored in the green plant-based eating environment. And, in that state, they would have the resources to resist the traffic light nudge, and choose the tastiest option.

Further analyses were conducted to explore why the green plant-based environment did not show a significant effect. Surprisingly, it was found that there was no significant difference in perceived healthiness of the eating environment between the two eating environment conditions. While it was hypothesized that the green plant-based eating environment would increase the healthiness of food choices, it did not even increase the perception of the healthiness of the restaurant. This could mean that the entire manipulation went unnoticed. However, there could still be other explanations to these results.

The perceived restorativeness of the eating environment was also measured to analyse whether the eating environment would have any cognitive restorative effect. But yet again, there was no significant difference between the normal eating environment and the green plant-based eating environment.

An explanation for the ineffective priming nudge (green plant-based environment) could be the self-reported health consciousness levels. It was found that there was a significant difference in health consciousness scores between the normal eating environment and the green plant-based eating environment. Participants in the green plant-based eating environment had a significantly lower level of health consciousness than those in the eating environment without the manipulation. Which may imply that consumers with a lower level of health consciousness are not as susceptible to priming nudges than those with a higher level of health consciousness. However, it is debatable whether health consciousness is a trait or state, and what it would mean to the results of the current study. Previous studies assumed that it was more of a trait than a state, implying that health consciousness may be less susceptible to interventions, according to Bennet et al. (2018). Bennet et al. (2018) also state that there were no experimental studies to assess the impact of an intervention on changes in health consciousness, but suggest that health consciousness has processes and levels.

Back to current study, if it is assumed that health consciousness is a trait, and that people with a lower level of health consciousness generally eat unhealthier, it could imply that the reason for the priming nudge (green plant-based environment) being ineffective can be partially attributed to the lower level of health consciousness in the manipulation group. In this case, it could also imply that people with a lower level of health consciousness are not as susceptible to priming nudges as opposed to those with a higher level of health consciousness.

However, if health consciousness is considered a state, it could imply that any factor could influence a person's self-reported health consciousness. Which could suggest that the eating environment may have influenced health consciousness. But, if the eating environment did influence health conscious, it still remains questionable how it caused the health consciousness levels to be lower in an environment filled with green herbs and plants than in a normal eating environment. Concluding, various approaches to explaining why there was no effect found during the priming nudge condition have been analyzed, and it seems that health consciousness may hold the key to the answer.

Moving on to the most interesting finding of the this study, which is the marginally significant interaction effect between menu and eating environment on healthiness of food choice. It is now known that the traffic light nudge is effective, and the green plant-based eating environment did not have any effect. But, the interaction between the combination of the two variables suggest a "boomerang" effect. The theory of psychological reactance (Brehm, 1966) point out conditions in which persuasive actions are effective, and when it may boomerang. The boomerang effect is described as a phenomenon where under certain conditions a persuasive action may cause changes in the behavior or attitude away from the intended effect (Mann & Hill, 1984).

The current study had the intention to nudge participants to make healthier food choices, using nudges on the menu and in the eating environment. However, in the condition with both manipulations simultaneously active (traffic light nudge \times green plant-based eating environment), participants seemed to show a boomerang away from the advocated result. The

results suggest combination of the two nudges had a negative effect on the healthiness of food choice, compared to using the menu nudge in a normal eating environment.

In brief, the traffic light nudge was found to be an effective intervention to invoke healthier food choices, while the green plant-based eating environment was not found to have an effect. And, when both nudges are combined, participants seemed to eat at the same healthiness of food choice level as when no nudges were presented. Which means that the combination of the nudges also negated the effect of the traffic light nudge.

Implications

Current research adds to the wide variety of existing research on the field of enhancing healthy food intake that nudging is a useful tool, if used correctly. Our study provides evidence that salience nudges in the form of a traffic light indication positively increases the healthiness of food choices. However, the combination of the traffic light nudge and the green plant-based eating environment seemed to negate the primary effect.

Furthermore, the study shows no evidence that a priming nudge in the form of a green plant-based environment has an effect healthiness of food choices, regardless of the underlying process, whether there is either an activation of semantically associated content, or whether there were no cognitive restorative capabilities of the eating environment.

Using nudges may be an accessible approach to deal with health issues in western societies. Current results suggest that people are willing to eat healthier, but they just need that nudge in the right direction. A simple intervention such as a salience nudge would be relatively easy to implement in order to tackle obesity and overweight issues. Yet, introducing more than one nudge may not enhance the effect of a single salience nudge. More so, an additional nudge may even negate the effect of the primary nudge. The food service industry could use these results for both economic interest and social importance. Restaurants could implement the traffic light nudge to stimulate high-margin healthy food sales, and at the same time it would aid in the societal problems.

Finally, it may be self-explanatory, but subconscious priming with the intention to influence a person's health decision or behavior should be done with good intentions in mind, ethical responsibility is required (Blumenthal-Barby & Burroughs, 2012).

Limitations

In this study, a real restaurant was used in a semi experimental setting. For a quantitative study, 82 participants is rather low. A more ideal setting for this study would have taken place over the course of multiple weeks in which the manipulations were implemented during normal opening hours of a restaurant, which would also result in a much higher number of participants. However, such a research would have a number of concerns.

First, my personal motive is against it. Namely, experimenting with the eating environment or menu of a restaurant could harm its identity (i.e., a casual dining restaurant may lose customers who may get an impression that the restaurant is fixated on healthiness). Secondly, there would be ethical concerns when consumers at a restaurant are unaware of any observation or research. Besides, being observed without consent may also invoke a negative attitude towards the participating restaurant. And, it could also be trivial to collect data other than the food choice, as consumers may not be willing to participate in a survey. Thirdly, while the behaviors are measured in a real-life setting and will more likely reflect real life, such a field study would be hard to replicate due to less control over extraneous variables that might bias results (McLeod, 2012).

For our experiment we tried to control all variables to the fullest, however, there were two extraneous variables that took place which could have had an effect on the results. Firstly, on day one we had a different waiter than on the second day of experimenting, which has the potential of influencing behavior. Secondly, during three of the conditions the weather outside was very similar, clouded without sunshine. However, during the green plant-based environment × normal menu condition it was moderately cloudy with occasional sunshine, which also has the potential to affect the consumers decision-making.

The menu used for the study comprised of just four food options ranging from unhealthy to healthy. Restaurants usually have considerably more food options. It is uncertain what the effect of a green traffic light indication would be when it accounts for a smaller amount of the total dishes as opposed to the 25 percent in the current study.

Another limitation to this study is that it was allowed for participants to bring friends and family and lunch together. Choices may have been influenced by the party. However, in real life it is also common to go to a restaurant with more people.

Furthermore, the moderator health consciousness was also analyzed as a dependent variable. Arguably, the menu or eating environment could induce a person with the feeling of being health conscious. For instance, a person surrounded by herbs and green plants could get into a state of higher health consciousness. It may be ruled out that the variables in our experiment induce a health conscious state by measuring health consciousness before and after the experiment in future studies.

Finally, in hindsight, a major limitation of this research is that no measures were used to assess the level of cognitive depletion or restoration. Other than the assessments of the perceived restorativeness of the eating environment, no data was collected about the current state of the participants cognitive depletion. More insights in participants' current state of mind would have been beneficial to our results.

Future research

Mainly the interaction effect between a salience nudge and a priming nudge should be explored to a broader extent in order exclude suggestive results. With the current study it was not possible to decipher why the combination of the nudges showed a boomerang effect.

The current study found that the priming nudge (green plant-based environment) had no effect on the healthiness of food choice. Yet, it could partially be attributed to the significant difference in health consciousness scores between the two conditions. It may be essential to get a deeper comprehension of the importance of health consciousness when a nudging strategy is applied. Perhaps future research could conclude whether the self-reported health consciousness was influenced by the environment or not.

Through the course of this study, the green plant-based environment was hypothesized to be a priming nudge, but it cannot be excluded that the cognitive restorative abilities of the green plant-based eating environment had an effect or not. Further research could elaborate the contexts in which cognitive depletion plays a role in nudging strategies. As discussed, a person who prioritizes tasty food over healthy food may have been affected by the traffic light nudge when their cognitive resources are depleted. But if their cognitive resources are restored, they may have the cognitive ability to repel the primary nudge, and thus resulting in a choice which they have actually wanted (e.g., hedonic purposes). Therefore, more information on the context in which individuals make choices is needed to explain results in the current study and in future studies.

Finally, it may be valuable to research how citizens would perceive salience nudges on menus when they are mandatory for restaurants, like other regulations regarding health (e.g., the Food Information Regulation in Europe, which makes it mandatory to include nutrition labeling on pre-packaged food). Such a regulation could possibly help governments in tackling the weight problems in western societies, but research is required to affirm that a traffic light nudge, or nudges in general, are still effective if they are mandatory by law.

Conclusion

To conclude, this study explored how restaurants can enhance healthier food choices through a combination of a salience and priming nudge (traffic light nudge and green plantbased eating environment). This research provides evidence that restaurants can improve healthier food intake of its consumers by implementing simple traffic light nudge on their menus. However, when the traffic light nudge is combined with a green eating environment, the advocated position seemed to boomerang and negate the effect of the traffic light nudge. Further research is required to explore what causes this effect takes place.

Acknowledgement

Firstly, I wish to thank my supervisors Mirjam Galetzka and Iris van Ooijen whose assistance was highly valuable and appreciated during the course of this study. Without your feedback and efforts, this project would not have been realized. Our meetings motivated me to continue working on the project and to put in my best effort.

Also a special thanks to Joris van Hoof for his feedback and motivational words during the final meeting.

Without my father, Pino Di Matola, the experiment would not have been possible. Thank you for allowing the experiment to take place in your restaurant, and for helping with the organization of all operational aspects during the experiment.

Finally, a special thanks to all the people who assisted during the experiment in restaurant Sorrentino. They have done a splendid job cooking, serving, and aiding in the experiment. And, without them it would not have been possible to conduct the experiment.

Stefano Di Matola,

Enschede, May 2020

References

- Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, *50*(2), 179-211.
- Bargh, J. A., & Chartrand, T. L. (2000). The mind in the middle. *Handbook of Research Methods in Social and Personality Psychology*, *2*, 253-285.
- Bennett, J. B., Lucas, G. M., Linde, B. D., Neeper, M. A., Hudson, M., & Gatchel, R. J.
 (2018). A process model of health consciousness: Its application to the prevention of workplace prescription drug misuse. *Journal of Applied Biobehavioral Research*, 23(3), e12130.
- Blumenthal-Barby, J. S., & Burroughs, H. (2012). Seeking better health care outcomes: the ethics of using the "nudge". *The American Journal of Bioethics*, *12*(2), 1-10.
- Brehm, J. W. (1966). A theory of psychological reactance.
- Broers, V. J., 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. *The European Journal of Public Health*, 27(5), 912-920.
- Burton, S., Howlett, S., & Tangari A. H. (2009). Food for Thought: How Will the Nutrition
 Labeling of Quick Service Restaurant Menu Items Influence Consumers' Product
 Evaluations, Purchase Intentions, and Choices? *Journal of Retailing*, 85(3), 258–273.
- CBS i.s.m. RIVM. (2019). Overgewicht / De Staat van Volksgezondheid en Zorg. Retrieved 29 March, 2020, from https://www.staatvenz.nl/kerncijfers/overgewicht
- Cadario, R., & Chandon, P. (2019). Which healthy eating nudges work best? A meta-analysis of field experiments. *Marketing Science*.
- Chandon, P., & Wansink, B. (2007). The biasing health halos of fast-food restaurant health claims: lower calorie estimates and higher side-dish consumption intentions. *Journal of Consumer Research*, *34*(3), 301-314.

- Deliza, R., & MacFie, H. J. (1996). The generation of sensory expectation by external cues and its effect on sensory perception and hedonic ratings: a review. *Journal of Sensory Studies*, 11(2), 103-128.
- Esmark, A. (2016). The informational logics of liberal democracy. Making sense of the nudging agenda. *Information Polity*, *21*(2), 123-137.
- Filimonau, V., & Krivcova, M. (2017). Restaurant menu design and more responsible consumer food choice: An exploratory study of managerial perceptions. *Journal of Cleaner Production*, 143, 516-527.
- Gallicano, R., Blomme, R. J., & van Rheede, A. (2012). Consumer response to nutrition information menu labeling in full-service restaurants: making the healthy choice.*Advances in Hospitality and Leisure*, 109-125.
- Guthrie, J. F., Lin, B. H., & Frazao, E. (2002). Role of food prepared away from home in the American diet, 1977-78 versus 1994-96: changes and consequences. *Journal of Nutrition Education and Behavior*, 34(3), 140-150.
- Hansen, P. G., Skov, L. R., & Skov, K. L. (2016). Making healthy choices easier: Regulation vs, nudging. *Annual Review of Public Health*, 37, 237–251.
- Hong, H. (2009). Scale development for measuring health consciousness: Reconceptualization. In 12th Annual International Public Relations Research Conference, Holiday Inn University of Miami Coral Gables, Florida.
- Irmak, C., Vallen, B., & Robinson, S. R. (2011). The impact of product name on dieters' and nondieters' food evaluations and consumption. *Journal of Consumer Research*, 38(2), 390-405.
- Kahneman, D. (2003). A perspective on judgment and choice. *American Psychologist*, 58(9), 697–720

- Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of environmental psychology*, *15*(3), 169-182.
- Kim, S., & Magnini, V. P. (2016). Prompting restaurant diners to eat healthy: Atmospheric and menu-related factors. *Journal of Foodservice Business Research*, 1-19.
- Köster, E. P. (2009). Diversity in the determinants of food choice: A psychological perspective. *Food Quality and Preference*, *20*(2), 70-82.
- Kraak, V. I., Englund, T., Misyak, S., & Serrano, E. L. (2017). A novel marketing mix and choice architecture framework to nudge restaurant customers toward healthy food environments to reduce obesity in the United States. *Obesity Reviews*, *18*(8), 852-868.
- Laumann, K., Gärling, T., & Stormark, K. M. (2001). Rating scale measures of restorative components of environments. *Journal of Environmental Psychology*, *21*(1), 31-44.
- Mann, M. F., & Hill, T. (1984). Persuasive Communications and the Boomerang Effect:
 Some Limiting Conditions to the Effectiveness of Positive Influence
 Attempts. Advances in consumer research, 11(1).
- McLeod, S. A. (2012). Experimental Method. Retrieved from www.simplypsychology.org/experimental-method.html
- Montandon, A. C., & Colli, C. (2016). Effective nutrition labels for fast food consumers. *British Food Journal*, *118*(10), 2534-2549.
- Muraven, M., & Baumeister, R.F. (2000). Self-regulation and depletion of limited resources: Does self-control resemble a muscle? *Psychological Bulletin*, 126, 247-259
- National Center for Health Statistics. (2020). *FastStats*. Retrieved March 29, 2020, from https://www.cdc.gov/nchs/fastats/obesity-overweight.htm
- Negrín, F., Hernández-Fernaud, E., Hess, S., & Hernández, B. (2017). Discrimination of Urban Spaces with different level of restorativeness based on the original and on a

shorter version of Hartig et al.'s perceived restorativeness scale. *Frontiers in psychology*, *8*, 1735.

- Ruiz, C., Pérez, C., & Hernández, B. (2013). Apego al lugar, restauración percibida y calidad de vida: un modelo de relación. *Estudios de Psicología*, 34(3), 315-321.
- Sualakamala, S., & Huffman, L. (2010). Value Negotiation for healthy food selection in restaurants. *Journal of Culinary Science & Technology*, 8(4), 242-256.
- Sobal, J., & Wansink, B. (2007). Kitchenscapes, tablescapes, platescapes, and foodscapes influences of microscale built environments on food intake. *Environment and Behavior*, 39(1), 124-142.
- Solomon, M. R. (2014). *Consumer behavior: Buying, having, and being (Vol. 10)*. Engelwood Cliffs, NJ: Prentice Hall.
- Sonnenberg, L., Gelsomin, E., Levy, D. E., Riis, J., Barraclough, S., & Thorndike, A. N. (2013). A traffic light food labeling intervention increases consumer awareness of health and healthy choices at the point-of-purchase. *Preventive medicine*, 57(4), 253-257.
- Stämpfli, A. E., Stöckli, S., & Brunner, T. A. (2017). A nudge in a healthier direction: how environmental cues help restrained eaters pursue their weight-control goal.Appetite, 110, 94-102.
- Stewart, H., Blisard, N., & Jolliffe, D. (2006). Let's eat out: Americans weigh taste, convenience, and nutrition (No. 1476-2016-120933).
- Tangari, A. H., Burton, S., Howlett, E., CHO, Y. N., & Thyroff, A. (2010). Weighing in on fast food consumption: the effects of meal and calorie disclosures on consumer fast food evaluations. *Journal of Consumer Affairs*, 44(3), 431-462.
- Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. Penguin.

- Vanderlee, L., & Hammond, D. (2014). Does nutrition information on menus impact food choice? Comparisons across two hospital cafeterias. *Public health nutrition*, *17*(6), 1393-1402.
- Wansink, B., Painter, J., & Ittersum, K. V. (2001). Descriptive menu labels' effect on sales. Cornell Hotel and Restaurant Administration Quarterly, 42(6), 68-72.
- Wansink, B., & Love, K. (2014). Slim by design: menu strategies for promoting high-margin, healthy foods. *International Journal of Hospitality Management*, 42, 137-143.
- 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.

Appendix I Pretest documentation

The menu used in the experiment derives from a pretest which was carried out before the experiment. Ten dishes, of which five considerably healthy and five unhealthy, were selected through online searches using the keywords "healthy lunches", "unhealthy lunches", and "lunches". Various websites and restaurant menus were used as inspiration. It was also important to compile a list of dishes that were easy and quick to prepare and serve, while also bearing the costs in mind for the experiment. To measure the perceived tastiness and healthiness of each dish, a 5-point Likert scale was used ranging from *very tasty* (1) to *not tasty at all* (5), while the scale was reversed for healthiness, ranging it from *very unhealthy* (1) to *very healthy* (5).

The restaurant environment was also pretested. A picture of the restaurants manipulated environment was taken and used in the pretest. In the survey, participants were shown the picture and asked to what extent they expected to be able to order healthy or tasty dishes in this restaurant. Participants were also asked how much they would you like to be in this environment, and how relaxed they would you feel in this environment (Laumann, Gärling, & Stormark, 2001). All questions regarding the restaurant room were measured on a 5-point Likert scale ranging from totally (1) *disagree* to (5) *totally agree*. All questions with Likert's scale were asked in a randomized sequence. Finally, basic demographic questions were asked and a final question asking if the participants consider themselves health conscious, which could be answered with a yes or no.

Pretest Participants

A non-probability sampling strategy was applied. The survey was spread online through social media and forums. 38 participants, of which 22 male (57.9%) and 16 female (42.1%), were willing to participate in the survey. The participants were between 19 and 58 years old (M = 34.29, SD = 11.00). Furthermore, 89.5 percent of the participants considered themselves health conscious.

Pretest Data Analysis

All analyses were conducted in SPSS version 25. To test the tastiness and healthiness of each individual dish, mean scores were computed and converted into graphs. Furthermore, Pairwise Comparison tests were carried out to explore the dishes in detail, particularly to explore whether differences in taste and healthiness expectations were significant or not.

An independent samples t-test was conducted to compare the results regarding the restaurant environment for the normal and healthy environment conditions.

Pretest Results

In Figure 1 mean scores and standard errors of the expected tastiness of the dishes are shown in a graph. Likewise, in Figure 2 the same statistics are illustrated for the expected healthiness of the dishes. The grey highlighted dishes in both graphs represent the selected dishes for the main study.

The chosen dishes for the Dishes with a high score on healthiness and a lower score on tastiness are Vegetable soup (*M*health = 4.11, *SD* = 1.00; *M*taste = 3.37, *SD* = 0.65) and Tuna salad (*M*health = 3.45, *SD* = 1.35; *M*taste = 3.45, *SD* = 0.86).



Figure 1. Mean scores and standard error of expected tastiness



Figure 2. *Mean scores and standard error of expected healthiness* Reversely, Grilled cheese (*M*health = 2.66, SD = 0.78; *M*taste = 4.00, SD = 1.01) and Hamburger (*M*health = 2.16, SD = 1.00; *M*taste = 4.11, SD = 0.65) score high on tastiness, while ranking lower on healthiness.

The pairwise comparison test show that Hamburger is significantly different in healthiness in comparison with Grilled cheese (p = .002), Tuna salad (p < .001), and Vegetables soup (p < .001). The pairwise comparison test for tastiness shows that Hamburger is significantly different than the two healthy options, Tuna salad (p = .003) and Vegetable soup (p = .002), while it is not significantly different than Grilled cheese (p = .38). Grilled cheese is also significantly different in healthiness in comparison with Tuna salad (p < .001) and Vegetable soup (p < .001), while it is also significantly different in taste in comparison to Tuna salad (p = .01) and Vegetable soup (p = .002). Finally, Tuna salad is significantly different in healthiness in comparison to Vegetable soup (p = .001), while it is not significantly different in taste expectations in comparison to Vegetable soup (p = .72).

The first three questions asked regarding the restaurant environment were focused on the combination of the restaurant environment and food expectations. For the question whether respondents expected healthy dishes to be served in the restaurant there was no significant difference in the scores for normal environment (M = 3.16, SD = 1.07) and healthy environment (M = 3.42, SD = 0.69) conditions; t (36) = -.90, p = .37. The expectation of being able to have a nice dinner in the restaurant also resulted in no significant difference in the scores for normal environment (M = 3.68, SD = 0.75) and healthy environment (M = 3.42, SD = 1,07) conditions; t(36) = .88, p = .39. No significant difference was found in the mean scores for normal environment (M = 3.00, SD = 0.94) and healthy environment (M = 3.21, SD = 0.54) conditions for the question whether one would expect to be able to eat healthy in the restaurant; t(36) = .85, p = .40.

The next questions are were designed to test the environment attraction and restorative abilities. The question whether the respondents would like to be in that environment showed no significant difference in the scores for normal environment (M = 3.42, SD = 0.11) and healthy environment (M = 3.26, SD = 1.20) conditions; t (36) = .45, p = .66. The next question was whether the respondents would feel relaxed in that restaurant environment, which also showed no significant difference in the scores for normal environment (M = 3.53, SD = 1.07) and healthy environment (M = 3.37, SD = 1.01) conditions; t (36) = .47, p = .64.

Pretest Discussion

The chosen dishes for the main study are a good fit, since the dishes all have significant different healthiness scores, with Vegetable soup being the healthiest option, followed by the Tuna salad as second healthiest. While Hamburger scores as unhealthiest, followed up by Grilled cheese being just a bit healthier. This perfectly ramps up or down from healthiest to unhealthiest or reversed food choices. There is no significant difference in taste expectations between the two healthiest options, while both differing significantly in taste expectations with the unhealthy dishes, which is also the case the other way around.

The chicken sandwich scored high on taste while also scoring high on health. This and some other dishes were not chosen for the main test as they did not differ in taste with unhealthy items. It was of utmost importance that the unhealthy dishes have a significant higher mean score on tastiness than healthy dishes in order to see correctly measure and interpret the results of the main experiment. For example, customers choosing a chicken sandwich could be motivated by either taste expectation or perceived healthiness. Therefore, two healthy dishes and two unhealthy dishes were selected which significantly differed in taste from the other group, while they are not expected to taste different between the groups.

The restaurant environment manipulation did not show any significant differences. However, this can partially be explained by the method of research. There could still be a major difference between respondents filling in a survey on a personal computer or mobile device and respondents who actually eat at a restaurant during the experiment. While results are not significant, we do see that survey participants found it more likely for the healthy environment to serve healthy food with 3.42 versus 3.16 in the normal environment in mean scores. Respondents also felt more inclined to order a healthy dish in the healthy environment with 3.21 versus 3.00 in the normal environment in mean scores. The hypothesis that a healthy eating environment increases healthy food selection still stands and it is expected that a real world setting will have significant differences in the two eating environments.

Pretest Limitation

The final question regarding the attractiveness of the restaurant environment has been deleted from the pretest due to a discrepancy in questioning. The questionnaire was tested by three people for any mistake, however, due to the randomization they only got the see either one of the questions, thus unable for the testers to find this discrepancy in questioning.

Appendix II Experiment questionnaire

Wij zullen via deze vragenlijst proberen te begrijpen hoe u de lunch ervaren heeft. Het invullen van deze vragenlijst neemt ongeveer 5 minuten in beslag. Alle reacties zullen anoniem en vertrouwelijk verwerkt worden.

Bij vragen, opmerkingen of onduidelijkheden kunt u bij een van onze medewerkers terecht.

Wij stellen uw input zeer op prijs!

1. Welk gerecht heeft u gekozen?

- O Tosti
- O Hamburger
- O Groentesoep
- O Tonijnsalade

2. Beantwoord de volgende vragen.

De smaak van het gerecht:	O Zeer slecht	O Slecht	O Voldoende	O Goed	O Uitstekend
De presentatie van het gerecht:	O Zeer slecht	O Slecht	O Voldoende	O Goed	O Uitstekend
De hoeveelheid van het gerecht:	O Zeer slecht	O Slecht	O Voldoende	O Goed	O Uitstekend

3. Zou u het door u gekozen gerecht nog een keer bestellen?

- O Ja
- O Nee

4. Welk drankje heeft u gekozen?

- O Koffie of thee
- O Cola
- O Cola Zero
- O Fanta
- O Fanta Zero
- O Sprite
- O Water / bruisend water

De volgende vragen gaan over het menu en de zaal waarin u geluncht heeft.

5. In hoeverre beschouwt u de gerechten als gezond?

Zeer ongezond				Neutraal	Zeer gezond			
Tosti:	0	0	0	0	0	0	0	
Hamburger:	0	0	0	0	0	0	0	
Groentesoep:	0	0	0	0	0	0	0	
Tonijnsalade:	0	0	0	0	0	0	0	

6. In hoeverre beschouwt u de gerechten als lekker?

	Helemaal n	iet lekker		Neutraal	Heel erg lekker			
Tosti:	0	0	0	0	0	0	0	
Hamburger:	0	0	0	0	0	0	0	
Groentesoep:	0	0	0	0	0	0	0	
Tonijnsalade:	0	0	0	0	0	0	0	

7. In hoeverre bent u het eens met de volgende stellingen over de zaal waarin u uw lunch hebt gegeten.

	Helemaal niet mee eens			Neutraal	F	Helemaal mee eens		
Ik bevind mij graag in deze omgeving:	0	0	0	0	0	0	0	
In deze omgeving voel ik mij relaxed:	0	0	0	0	0	0	0	
Dit restaurant ziet er aantrekkelijk uit:	0	0	0	0	0	0	0	
Ik verwacht dat ze hier gezonde gerechten serveren:	0	0	0	0	0	0	0	
Ik zou in dit restaurant eerder een gezond gerecht bestellen:	0	0	0	0	0	0	0	
Ik verwacht dat ik hier in het algemeen lekker kan eten:	0	0	0	0	0	0	0	

Deze plek laat me mijn dagelijkse verantwoordelijkheden vergeten,												
ļ	me onts	pannen	voelen	en meze	elf verlie	zen in i	mijn eig	en geda	achten.			
Totaal niet	0	0	0	0	O wel	0	0	0	0	0	Totaal	
Dit is een fascinerende plek die mijn nieuwsgierigheid in leven houdt en voorkomt dat ik mij ga vervelen.												
Totaal niet	0	0	0	0	O wel	0	0	0	0	0	Totaal	
Dit is	een plek	k waar a	octiviteit	en en di	ingen o	rdelijk e	en goed	georga	niseerd	zijn.		
Totaal niet	0	0	0	0	O wel	0	0	0	0	0	Totaal	
Deze ple	k voelt a	lls een a	andere v	vereld, v	waar ik i	ne op n	nijn gen	nak in k	an verp	laats	en.	
Totaal niet	0	0	0	0	O wel	0	0	0	0	0	Totaal	
lk voel mij hier op mijn gemak, omdat het makkelijk is om je weg te vinden op deze plek.												
Totaal niet	0	0	0	0	O wel	0	0	0	0	0	Totaal	

8. In hoeverre kunt u zich vinden in de volgende uitspraken?

9. Beantwoord in hoeverre u het eens bent met de uitspraken.

	Helemaal niet mee eens			Neutraal	Helemaal mee eens		
Calorieën beïnvloeden wat ik eet:	0	0	0	0	0	0	0
lk zoek actief naar voedingswaarden:	0	0	0	0	0	0	0
lk spendeer veel aandacht aan voedingswaarden:	0	0	0	0	0	0	0
lk vind het belangrijk dat voedingswaarden aanwezig zijn:	0	0	0	0	0	0	0
lk negeer voedingswaarden:	0	0	0	0	0	0	0

10. Bent u gezondheidsbewust?

- O Ja
- O Nee

11. Hoeveel kcal denkt u dat er in uw lunchgerecht zat? Drank niet meerekenen.

Vul in: _____

Wat is uw leeftijd?

Vul hier uw leeftijd in: _____

Wat is uw geslacht?

- O Man
- O Vrouw
- O Anders, namelijk: _____

Wat is uw hoogst genoten opleiding? De opleiding hoeft niet afgerond te zijn.

- O Voortgezet onderwijs
- O MBO
- O HBO
- O WO
- O Anders, namelijk: _____

Wat is uw huidige arbeidssituatie?

- O Full-time (Voltijd)
- O Part-time (Deeltijd)
- O Werkloos
- O Student
- O Gepensioneerd
- O Zelfstandig
- O Arbeidsongeschikt
- O Anders, namelijk: _____

Heeft u allergieën?

- O Ja, namelijk: _____
- O Nee

Volgt u een bepaald dieet waardoor u bepaalde producten niet mag eten? Bijvoorbeeld

om medische, ideologische of religieuze redenen.

- O Ja, namelijk: _____
- O Nee

Heeft u ooit eerder in dit restaurant gegeten?

- O Ja
- O Nee