WAGENINGEN
UNIVERSITY & RESEARCH

'NudgeMe': the effects of personalized digital nudges on healthy food choice in a digital grocery shopping environment

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Masterthesis

Chairgroup: Consumption & Healthy Lifestyles

Date: 12-05-2023

Word count: 6521

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Abstract

In the current obesogenic environment, unhealthy nutritional habits are prevalent. An intervention that targets these habits is ‘Just-In-Time’-nudging. Because of the digitalization, more real-time behavioural data is available, which makes personalization of nudges possible. In this study, we tested whether digital (JIT) personalized nudges on nudge content (food-specific motivations, i.e. health versus price) and nudge type (based on cognitive style, i.e. visual versus verbal) were more effective than non-personalized nudges in promoting healthier food choices. It was also tested if there was a difference between the effect of nudge content and nudge type in promoting healthier food choices. A pseudo-randomized experiment was conducted, using an online grocery shopping application. Nudges, personalized on content and/or type, were shown to the participants depending on the assigned treatment arm. Data on perceived personalization and other control variables was collected through a questionnaire. Results showed no significant main or interaction effects of personalizing nudge content and nudge type on nudge effectiveness. No significant main or interaction effects of personalizing nudge content and nudge type were found on healthier food choice. There was also no difference between the effects of personalizing nudge content and nudge type on nudge effectiveness and healthier food choice. However, the results should be interpreted with caution, because manipulations failed. Suggestions for future research include investigating whether the absence of effects was due to actual missing effects or rather due to failed manipulations, a more nuanced investigation of personalizing nudge type and the effect of personalized nudging on long-term behaviour change.

Keywords: JIT-nudging, personalized nudging, nudge content, nudge type, healthy food choice, online grocery shopping application

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Introduction

A major threat to public health is the increasing prevalence of overweight and obesity (Bos et al., 2013). This is often the result of a systematic energy imbalance due to an excessive intake of unhealthy high-calorie (or energy-dense) foods (Drewnowski & Darmon, 2005; Hand et al., 2013). Although people may have good intentions to stick to a healthy diet, they continue to choose the unhealthy, energy-dense option instead of the healthy option, often mindlessly (Kroese et al., 2015). This finding is also captured in the intention-behaviour gap, which shows that explicit intentions get translated into action only approximately 50% of the time (Sheeran & Webb, 2016). In the domain of food choice, there is a growing positive attitude towards green, organic products (Aschemann-Witzel & Niebuhr Aagaard, 2014). However, the organic market share remains very small, in comparison with the overall food market. On the one hand, Aschemann-Witzel and Niebuhr Aagaard (2014) say that health motives and environmental protection reasons seem to be important drivers of organic product purchase. On the other hand, they say that price and availability are the main barriers to buying organic products (Aschemann-Witzel & Niebuhr Aagaard, 2014).

Food decision making incorporates cognitive processes based on both conscious reflection and cognitive processes that are more automatic or habitual in nature (Furst et al., 1996). Specific food choices repeatedly made in the same context lay the groundwork for long-term food habits, which is why rules-of-thumb have developed to simplify the food choice process and to minimize the time needed to make choices (Furst et al., 1996). As such, food choices do not only involve individual factors (e.g. taste, emotions, gender, state of hunger), but can also be influenced by external, contextual factors like the (food)environment (Bucher et al., 2016; Furst et al., 1996). This is especially problematic in the modern "obesogenic" food environment (the collective physical, economic, policy, social and cultural factors that promote obesity (Obesity Evidence Hub, 2020)), which is strongly driven by nutritional habits and the composition of nutritional models (Abbade & Dewes, 2015). Research shows that the world's nutritional patterns are dominated by a high consumption of high-caloric sweeteners, meat and cheap, unhealthy products which are rich in fat (Chan et al., 2017; Abbade & Dewes, 2015). A recent study in the Netherlands showed that the majority (70,7%) of promoted products, which are important in determining food purchasing decisions, in Dutch supermarkets do not contribute to a healthy diet (Hendriksen et al. (2021).

Cognitively oriented nudging

An intervention strategy that targets environmental influences on food choice to steer individuals towards healthier food choices, without forbidding any options or changing economic incentives, is called ‘nudging’ (Pechey & Marteau, 2018; Thaler & Sunstein, 2008). Healthy eating nudges include a variety of simple, inexpensive, freedom-preserving modifications to food choice environments (Cadario & Chandon, 2020). In their meta-analysis, Cadario and Chandon (2020) distinguish between three categories of healthy eating nudges: cognitively oriented nudges that seek to influence what people know, affectively oriented nudges that seek to influence what people feel, without changing what they know, and behaviourally oriented nudges that seek to influence what people do, without changing what they know or feel. Examples of cognitively oriented nudges that are relevant for the current study are descriptive and evaluative nutritional labeling and visibility enhancements (Cadario & Chandon, 2020; Vandenbroele et al., 2020). Descriptive nutritional labeling provides verbal nutritional information (e.g. “this alternative is healthier”), whereas evaluative nutritional labeling provides visual nutritional information (e.g. using traffic light colour coding). Moreover, visibility enhancement informs consumers of the availability of healthy options by increasing their visibility (e.g. showing a pop-up screen that suggests a healthier alternative) (Gribnau & Kamoen, 2022). Sunstein (2016) found that people usually prefer cognitively oriented nudges, or ‘System 2 nudges’, which provide decision-relevant information, because of the sense of autonomy and capacity to exercise their own agency, in comparison to system 1 nudges. Although there are strong indications that cognitively oriented nudges or system 2 nudges are perceived as effective for making good decisions and necessary for changing behaviour, inconsistent findings are evident (Ensaff, 2020; Jung & Mellers, 2016). Besides, studies investigating the combination of different types of nudges are limited, as well as the effect of cognitively oriented nudges on food choice in an online environment in contrast to the offline world (Berger et al., 2020; Ensaff, 2020).

Digital JIT nudging

Due to the proliferation of technology, food decisions are increasingly made within online contexts (Bergram et al., 2022; Weinmann et al., 2016). Digital nudging has therefore also evolved as a tool to promote health-related behaviour (Bergram et al., 2022). Digital nudging is defined as *‘the use of user-interface design elements to guide people’s behaviour in digital (food) choice environments’* (Weinmann et al., 2016). Though the domain is still growing, digital nudges show to have similar potential as ‘offline’ nudges in steering people towards healthier (food) decisions (Hummel & Maedche, 2019). Furthermore, due to the innovations in mobile technology, which makes the monitoring of real-time behaviour much easier, there are many opportunities to offer nudges using the Just-In-Time (JIT) delivery mechanism (Nahum-Shani et al., 2015). JIT nudges are defined as interventions at the moment close to or during the actual choice, that adapt to people's changing status and motivations and changing circumstances (Nahum-Shani et al., 2015; Van der Laan & Orcholska, 2022). The goal of a JIT nudge is to address the individual's need for support, whenever this need arises. JIT nudges function as 'cues to action' and can serve as a trigger to stimulate healthier food choices (Rosenstock, 1974). Compared to general nudging interventions, which are present during the complete decision process, JIT nudges are delivered directly in response to a choice, thus, at the exact time of need, but before an actual transaction is made (Van der Laan & Orcholska, 2022). It is relevant to investigate cognitively oriented nudges presented in a Just-In-Time manner, because there is a limited field of research that investigated the effect of cognitively oriented JIT nudges on food choice, although the few studies show promising results (Van der Laan & Orcholska, 2022).

Personalization of nudges

The high availability of personal real-time data in the digital sphere, also makes it possible to *personalize* the digital choice architecture of individuals (Bergram et al., 2022). Personalized nudging involves 'tailoring', which is a strategy that entails developing the content and type of nudges based on users' specific needs, goals and characteristics to improve nudge efficiency (Karlsen & Andersen, 2022; Lustria et al., 2013). A great advantage of personalized nudges compared to generic 'one-size-fits-all' nudges is the correspondence with people's preferences (Sunstein, 2012). De Ridder et al. (2022) show that preexisting preferences matter for nudge effectiveness, as nudges generally prove ineffective when they are not in line with goals and intentions. Besides, it is shown that nudges corresponding to personal (food)preferences or attitudes (i.e. where nudge content is manipulated) result in higher elaboration on a nudge and a higher nudge acceptability (De Ridder et al., 2022, Petty & Cacioppo, 1986; Tam & Ho, 2005). From the tailoring literature, there is also evidence that when health messages are tailored, they receive greater attention, are processed more intently, are better accepted and are perceived more positively (Lustria et al., 2013). Tailored messages also increase the personal relevance of healthy food messages (Lustria et al., 2013). Two important food motivations that have proved to influence food choice are health and price (Steptoe et al., 1995).

Moreover, it has been proven that different personal and psychological traits (e.g. preference for visual or verbal cognitive style) influence the effectiveness of a nudge (Bergram et al., 2022; Mills, 2022). Following the 'visualizer-verbalizer hypothesis', people have a certain preference for either visual or verbal cognitive information processing (Mayer & Massa, 2003). When people with a visual cognitive style are exposed to a visual nudge (e.g. a green traffic light) for example, this nudge (i.e. nudge type) is matched to their cognitive style and therefore more personally relevant, which makes people more likely to select the alternative shown in the nudge (Petty & Cacioppo, 1986; Tam & Ho, 2005). It is shown that when presented information is matched with someone's cognitive style, that it benefits the understanding of the information and task success (e.g. healthy food choice) (Willingham, 2018). The digital transition makes personalization of nudge type easier, because websites and app interfaces can be designed in a way that they match people's cognitive style to achieve (food) specific goals (Schöning et al., 2019). Taken together, personalized (user-matched) nudges, in contrast to generic (mismatched) nudges are more likely to result in healthier (food) choices. However, to date only a small body of research has assessed the effectiveness of digital nudging, especially in a personalization context (Ingendahl et al., 2020; Mills, 2022; Weinmann et al., 2016). The personalization of nudge content and nudge type can be used in conjunction, although this may not always give the best results (Mills, 2022). In some cases, only personalizing nudge content or nudge type may be more effective than when combining the two (Mills, 2022). It has been demonstrated in domains such as online security and retirement saving plans that personalizing nudge type was effective, but no comparison was made with personalizing nudge content (Peer et al., 2019; Mills, 2022). In their study into recipe recommendation systems, El Majjodi et al., (2022) found that a high level of personalization of recipes led to unhealthier recipe choices. The addition of nutritional labels (e.g. a nutri-score or multiple traffic-light) did not seem to mitigate the effect of personalizing the content of the recipes. However, research about the comparison between the separate effects of nudge type and nudge content is scarce in the domain of food decision making.

Therefore, the main aim of this research is two-fold: As a primary research objective, the present study will determine whether personalized digital nudges (using the JIT delivery mechanism) are more effective in promoting healthier food choices than non-personalized (generic) nudges. As a secondary research objective, this study will assess whether there is a difference between the effect of personalizing nudge content and nudge type on healthy food choice. We hypothesize that:

H1: Digital (JIT) Nudges personalized (user-matched) on content and/or type are more effective than non-personalized (user-mismatched) nudges in promoting healthier food choices. Specifically, personalized nudges will result in a higher nudge effectiveness and greater number of healthier foods purchased.

H2: There is a difference between the effect of personalizing nudge content and nudge type on healthy food choice. Specifically, personalizing nudge content will result in a higher effectiveness and a greater number of healthier foods purchased than personalizing nudge type.

Methods

Design

To answer the research questions, a between-subjects laboratory experiment has been conducted, with *nudge content* (personalized/user-matched versus non-personalized/user-mismatched, based on health- versus cost-specific food motivations) and *nudge type* (personalized/user-matched versus non-personalized/user-mismatched, based on one's preference for processing visual versus verbal information) as experimental factors. This design led to five treatment arms:

1. A control condition with no nudges implemented.
2. A content non-personalized and type non-personalized (CNTN) condition (e.g. when a participant was more health- and verbally-oriented, they received nudges that had a price-specific nudge content and a visual nudge type.)
3. A content personalized and type non-personalized (CPTN) condition (e.g. when a participant was more health- and verbally-oriented, they received nudges that had a health-specific nudge content and a visual nudge type.)
4. A content non-personalized and type personalized (CNTP) condition (e.g. when a participant was more health- and verbally-oriented, they received nudges that had a price-specific nudge content and a verbal nudge type.)
5. A content personalized and type personalized (CPTP) condition (e.g. when a participant was more health- and verbally-oriented, they received nudges that had a health-specific nudge content and a verbal nudge type.)

Participants

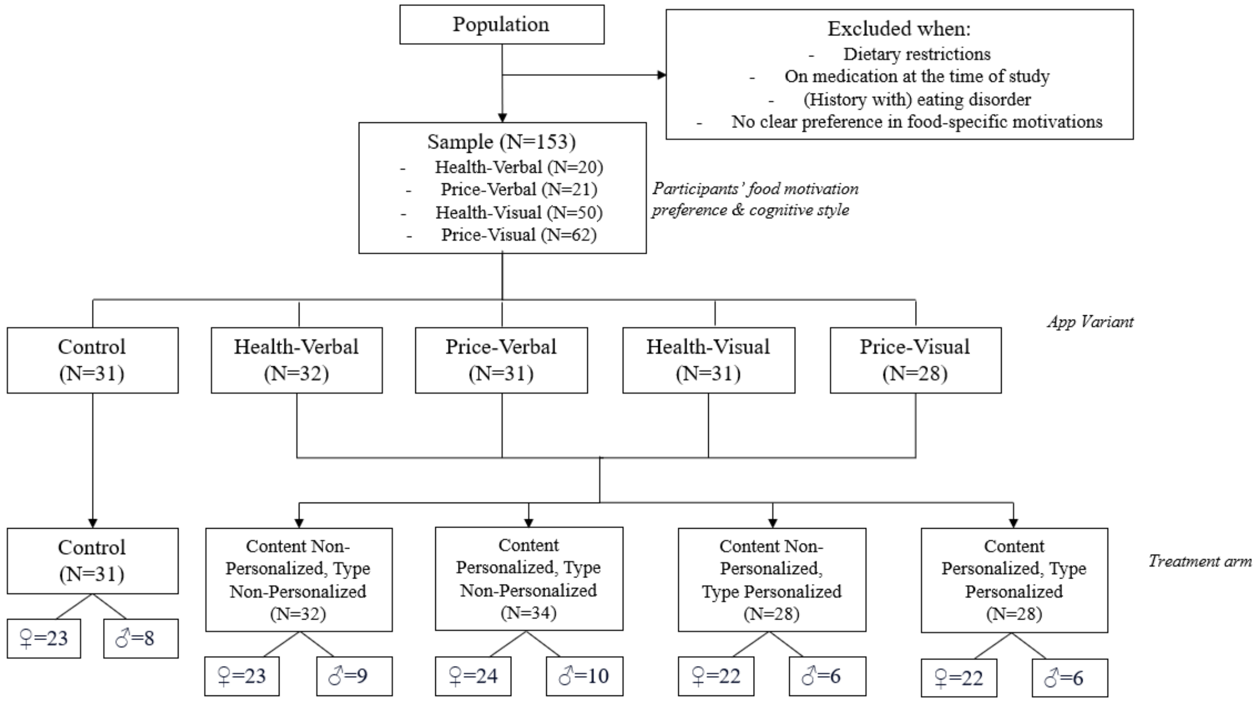
Participants represent Dutch-speaking male and female students (at least 18 years old) from Tilburg University and Wageningen University & Research (Bachelor to Master) from various educational backgrounds (N=153). From the entire sample, 114 participants were female and 39 were male, with a mean age of 21 (SD=2.24) and a mean BMI of 21.95 (SD=2.53). Individuals were included when healthy at the time of study (self-reported; i.e. not on medication except for oral contraceptives or paracetamol) and after providing written informed consent. Individuals were excluded when they reported dietary restrictions to (nudged/recommended) foods or the presence or history of eating disorder(s). To avoid floor effects on the research questions, individuals were also excluded when they did not have a clear preference in food-specific motivations (i.e. no variation in or distinction between rated food motivations).

Randomization process

Participants were pseudo-randomly assigned to the five different conditions, after their food-specific motivations and cognitive style were determined, to aim for participants to be equally divided across treatment conditions (i.e. personalized/user-matched vs non-personalized/user-mismatched). Participants received a variant of the app used in the experiment, which was either matched with their food-specific motivation and/or cognitive style or mismatched with their food-specific motivation and/or cognitive style. By doing this, participants were assigned to the different treatment arms. Otherwise, participants were assigned to the control condition. A visualization of the randomization process can be found in Figure 1.

Figure 1

Visualization of the randomization process



Materials

Food Stimuli

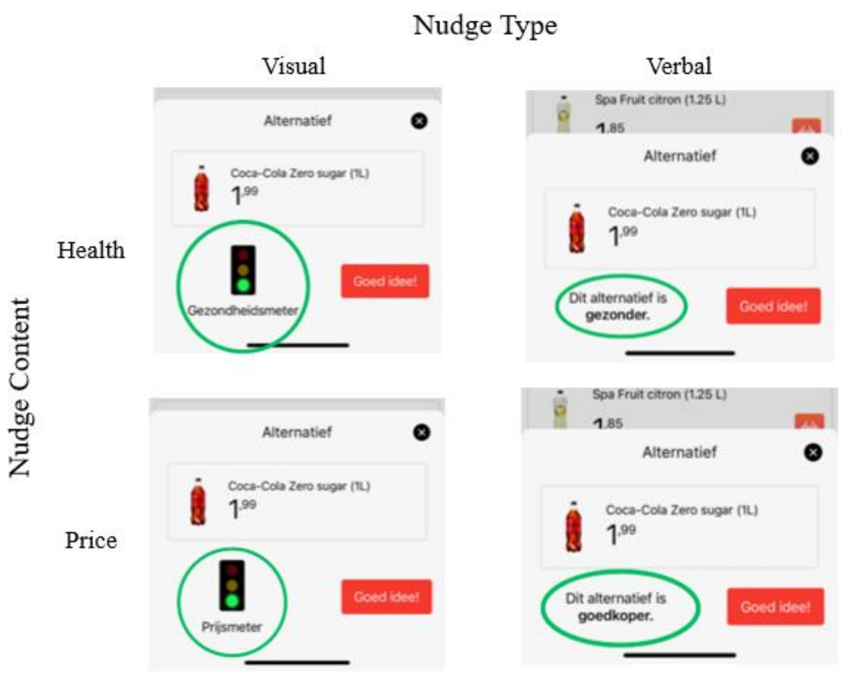
In the mock grocery shopping application, the 'MAND-app', a selection of 60 food products was included. These products represented 10 major product categories (N= 6 options per category; N= 42 unhealthy target products) that are commonly sold in Dutch supermarkets (i.e. dessert, noodles, bread, meat, dairy, soda, fruits, vegetables, in-between snacks and frozen products) (See Appendix 1). The digital nudges (N=39) consisted of matched healthier alternatives for the targeted unhealthy products (See Appendix 2). The categorization of a food as "unhealthy" or "healthier" was advised by Dutch dietary guidelines and the recommendations table of the Dutch Nutrition Centre (Kromhout et al., 2016; Voedingscentrum, 2016). The food stimuli were piloted in a separate sample to ensure that participants perceived the unhealthy products as significantly less healthy compared to (nudged) healthy product alternatives. The unhealthy and the healthy alternatives were standardized on hedonics (e.g. liking to eat), familiarity, presented amounts (e.g. grams) and price. The standardization on price is only applicable to healthier unnudged products (freely available in the app), as the healthier nudged products had to fulfill both health- and price-specific food motivations, to match product recommendations across the different treatment arms.

Digital (JIT) Nudges

In the control condition, no nudges were shown to participants and regular functioning of the MAND-app was preserved. In the four other treatment conditions, a pop-up recommendation highlighting a product alternative appeared when a participant had selected an unhealthy product. In the recommendations, visibility and either descriptive or evaluative nutritional or price label nudges were used. The pop-up consisted of either a visual or verbal label nudge (corresponding with nudge type) and either a nutritional or price label nudge (corresponding with nudge content). To effectively indicate whether the nudge communicated an either healthier or cheaper alternative, two variants (health- and price-specific) of the evaluative label (i.e. traffic light) were made and piloted in a separate sample. A visualization of the different nudges can be found in Figure 2. Which nudges were shown to the participant, depended on one's food motivations (i.e. health- or cost-specific) and one's preference for visual versus verbal cognitive style and the random assignment to the five different treatment arms (personalized/user-matched, non-personalized/user-mismatched/control).

Figure 2

Visualization of the different nudges used in the MAND-app.



In the Content non-personalized, Type non-personalized treatment arm (CNTN), fully non-personalized nudges (user-mismatched) were shown. This meant that when a participant had for example a preference for a health-specific food motivation and a verbal cognitive style, they received nudges highlighting a cheaper alternative (price-specific nudge content) and a visual nudge type (lower left picture in Figure 2). In the Content personalized, Type non-personalized treatment arm (CPTN), partially personalized nudges were shown; nudge content was personalized (user-matched) and nudge type was non-personalized (user-mismatched). This meant that when a participant had for example a preference for a health-specific food motivation and a verbal cognitive style, they received nudges highlighting a healthier alternative (health-specific nudge content) and a visual nudge type (upper left picture in Figure 2). In the Content non-personalized, Type personalized treatment arm (CNTP), it was the other way around; nudge content was non-personalized (user-mismatched) and nudge type was personalized (user-matched). This meant that when a participant had for example a preference for a health-specific food motivation and a verbal cognitive style, they received nudges highlighting a cheaper alternative (price-specific nudge content) and a verbal nudge type (lower right picture in Figure 2). In the Content personalized, Type personalized treatment arm (CPTP), fully personalized nudges were shown. This meant that when a participant had for example a preference for a health-specific food motivation and a verbal cognitive style, they received nudges highlighting a healthier alternative (health-specific nudge content) and a verbal nudge type (upper right picture in Figure 2).

Grocery Shopping Task

During the grocery shopping task, participants were asked to imagine that they were buying groceries using a new smartphone supermarket application, called the 'MAND-app'. They received a (pseudorandomized) grocery shopping list which consisted of the 10 product categories that must have been included in their shopping cart. Participants were instructed to search and select product categories in the app, and to choose one item from each product category. After they selected 10 products, participants had the opportunity to replace products prior to checking out of the online supermarket.

The task included a total of 10 choice trials (8 experimental trials and 2 filler trials). In four of the experimental trials (fixed nudge trials), only unhealthy, more expensive product options were shown, to ensure that participants were exposed to a sufficient number of (JIT) nudges in the experimental conditions. In the other four experimental trials (conditional nudge trials) and filler trials, participants were able to choose from 3 healthy and 3 unhealthy products, which were matched on price. In the conditional nudge trials, nudges were shown only if an unhealthy product was chosen. In the filler trials, nudges were paired with healthy options or were removed from unhealthy options, to distract participants from the real study aim. When participants received a nudge, they had to choose to either accept the nudged product or not by pressing the ‘Good Idea!’ button in the app. Clicking this button replaced the previously chosen product with the nudged product. When participants finished all choice trials, they were allowed to revise their final shopping cart just before checking out of the online supermarket. Only data from experimental trials was processed.

Procedure

Participants were recruited through advertisement of study posters and flyers in university buildings, on social media and the participant pool of the department of humanities and digital sciences and of the department of social and behavioural sciences of Tilburg University. Prior to the main lab session, participants were screened online to check if they were eligible for the experiment. Data on personalization parameters (verbal or visual cognitive style and health- or cost-specific food motivations) was also collected in the online screening questionnaire. After filling in the online screening questionnaire, eligible participants received a study information sheet via email and were invited to take part in the laboratory study.

After arriving at the laboratory and providing written informed consent, participants were directed to isolated testing booths with a laptop and smartphone equipped with the (mock) grocery shopping app. Preliminary information (i.e. hunger state) was collected on the laptop through a short questionnaire. Participants received a cover story that the aim of the study was to investigate consumer perceptions of a new grocery shopping application. To incentivize the grocery shopping task, participants were told they would receive a randomly chosen food product at the end of the experiment as part of the cover story as well. Then, participants performed the grocery shopping task on the smartphone where the experimental manipulations took place. After the grocery shopping task, participants completed online questionnaires on the laptop on relevant outcomes (e.g. perceived nudge effectiveness) and control variables (e.g. manipulation checks). These questionnaires were not conducted among participants in the control condition, since these participants did not receive any nudges.

The lab session took about 20-30 minutes. After full participation, participants were asked to fill in a debriefing form, were thanked and received a study credit or a monetary compensation (8 euros), as well as a randomly chosen food product (which was part of the cover story).

Measures

Outcome variables

The first outcome variable of the experiment was *nudge effectiveness.* This is operationalized as the percentage of recommended healthier alternatives accepted by individuals in experimental trials (i.e. the number of accepted nudge recommendations/total number of nudge recommendations in experimental trials). *Healthy food choice* is operationalized as the percentage of healthier foods purchased by an individual in the grocery shopping task (i.e. number of (nudged and unnudged) healthier food purchases/total number of food purchases in experimental trials).

Personalization Parameters

For personalizing/matching *nudge content*, food-specific motivations (health- vs cost-specific) rated highest on importance were used. Participants were asked to rate the statement: "It is important to me to purchase healthy products" on a 100 mm VAS anchored from "strongly disagree" to "strongly agree". Food motivations rated lowest on importance were used for constructing non-personalized/mismatched nudges.

For personalizing/matching *nudge type*, one's preference for processing visual versus verbal information (i.e. visual vs verbal cognitive style) was used. This was measured through the Verbal-Visual Learning Style Rating (Mayer & Massa, 2003). Participants were asked to rate the statement: "It is important to me to purchase cheaper products". A score between -3 and 0 was classified as preference for verbal information and a score between 1 and 3 was classified as preference for visual information.

Control measures and manipulation checks

As control variables, demographic information was collected across participants. This included gender, age and self-reported height and weight. With the self-reported height and weight, an individual's BMI was calculated. Another control variable was an individual's trait reactance proneness. This was recorded with an 11-item (5-point) trait reactance scale (Cronbach's alpha = .77, which implies that the scale had a relatively high reliability (Field, 2013)). The items were averaged per individual. Hunger state was also measured through a 100mm VAS anchored from 'not at all' to 'very much' at the start of the lab session.

To check if the manipulation of nudge content and nudge type was successful, participant's perceptions regarding to what extent the product recommendations matched their preferences (i.e. food-specific motivations and cognitive style) was measured. This was done through the perceived personalization questionnaire, a 4-item (7-point) questionnaire anchored from 'strongly disagree' to 'strongly agree' (Cronbach's alpha = .78, which implies that the scale had a relatively high reliability (Field, 2013)). The items were averaged per individual. Overall shopping time (the time participants needed for the grocery shopping task) was also recorded.

Statistical analysis

Randomization checks

To assess whether the randomization across different treatment arms was successful, separate general linear models (one-way ANOVA's) were conducted to check for differences in state and trait characteristics (i.e. Age, BMI, Hunger and Trait Reactance Proneness) between groups. A chi-square test of independence was conducted to check for the distribution of categorical control (i.e. Gender) and personalization measures (i.e. food-specific motivations and cognitive style) across groups.

Manipulation check

To assess whether *Perceived Personalization* (individually averaged) differed across personalized (user-matched) versus non-personalized (user-mismatched) nudges, a manipulation check was conducted using a two-way ANOVA with main and interaction effects of *Nudge Content* (Personalized vs Non-personalized) and *Nudge Type* (Personalized vs Non-personalized) as between-subjects variables. Overall shopping time (the time participants were using the MAND-app) was also compared between the different treatment arms using a one-way ANOVA.

Main analyses

A General Linear Model (i.e. ANCOVA) has been formulated to determine whether personalized (user-matched) digital nudges on content and/or type have a greater *nudge effectiveness* than non-personalized (user-mismatched) digital nudges (H1). *Nudge effectiveness* is the dependent variable with main and interaction effects of *Nudge Content* (personalized vs non-personalized) and *Nudge Type* (personalized vs non-personalized) as between-subjects variables. Variables *Age*, *Hunger* and *Trait Reactance Proneness* were added as covariates. It was also checked if the effect was stronger for *Nudge Content* than for *Nudge Type* (H2), by comparing effect sizes of the main effects in the ANCOVA.

Another General Linear Model (i.e. ANCOVA) has been formulated to determine whether personalized (user-matched) digital nudges on content and/or type result in *a greater number of healthier foods purchased* than non-personalized (user-mismatched) digital nudges (H1). *Healthy food choice* is the dependent variable with main and interaction effects of

Nudge Content (personalized vs non-personalized) and *Nudge Type* (personalized vs non-personalized) as between-subjects variables. Variables *Age*, *Hunger* and *Trait Reactance Proneness* were added as covariates. It was also checked if the effect was stronger for *Nudge Content* than for *Nudge Type* (H2), by comparing effect sizes of the main effects in the ANCOVA.

These analyses were executed in SPSS Statistics 29.

Results

Randomization checks

Descriptive statistics of all continuous control variables per treatment arm can be found in Table 1. Descriptive statistics of all categorical control variables and personalization measures per treatment arm can be found in Table 2.

Table 1

Descriptive statistics (Mean and Standard Deviation of continuous control variables per treatment arm

Treatment arm	**Age**		**BMI**		**Hunger**		**Trait Reactance Proneness**	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Content Non-Personalized, Type Non-Personalized (CNTN)	21.06	2.12	22.42	2.72	36.47	19.85	2.42	0.67
Content Personalized, Type Non-Personalized (CPTN)	21.85	2.35	21.78	2.38	49.82	21.48	2.45	0.54
Content Non-Personalized, Type Personalized (CNTP)	20.25	1.86	21.18	2.29	39.50	25.78	2.46	0.52
Content Personalized, Type Personalized (CPTP)	20.39	2.18	22.35	2.68	50.14	21.18	2.62	0.48
Control	20.81	2.34	22.00	2.53	42.06	21.04	2.76	0.33

Table 2

Descriptive statistics (Mean and Standard Deviation of categorical control variables and personalization measures per treatment arm

Treatment arm	Gender		Food preference		Learning preference	
	Male	**Female**	**Price**	**Health**	**Visual**	**Verbal**
Content Non-Personalized, Type Non-Personalized (CNTN)	9	23	16	16	24	8
Content Personalized, Type Non-Personalized (CPTN)	10	24	18	16	24	10
Content Non-Personalized, Type Personalized (CNTP)	6	22	17	11	21	7
Content Personalized, Type Personalized (CPTP)	6	22	14	14	20	8
Control	8	23	18	13	23	8

The one-way ANOVA showed no significant differences between the groups on the variable BMI ($F(4,148) = 1.16$, $p > 0.05$). The one-way ANOVA's for Age and Hunger showed significant p-values (Age: $F(4,148) = 2.66$, $p = 0.04$, partial $\eta^2 = .07$; Hunger: $F(4,148) = 2.45$, $p = 0.05$, partial $\eta^2 = .06$). For Trait Reactance Proneness, the assumption of equal variances was violated. Nonparametric tests showed that there were significant differences between the treatment arms on Trait Reactance Proneness ($p = 0.03$). Therefore, Age, Hunger and Trait Reactance Proneness were added as covariates to the General Linear Model in the main analysis (ANCOVA).

Furthermore, the results of the chi-square test of independence showed no significant differences between the groups on gender ($\chi^2 = 0.88$, $p > 0.05$), food-specific motivations ($\chi^2 = 1.11$, $p > 0.05$) and cognitive style (($\chi^2 = 0.28$, $p > 0.05$). This indicates that the randomization of categorical control and personalization measures was successful.

Manipulation check

Descriptive statistics of perceived personalization and overall shopping time per treatment arm can be found in Table 3.

Table 3

Descriptive statistics (Mean and Standard Deviation of perceived personalization and overall shopping time (in minutes) per treatment arm

Treatment arm	**Perceived personalization**		**Overall shopping time (minutes)**	
	Mean	**SD**	**Mean**	**SD**
Content Non-Personalized, Type Non-Personalized (CNTN)	3.66	1.18	4.90	0.29
Content Personalized, Type Non-Personalized (CPTN)	3.70	1.07	5.77	0.82
Content Non-Personalized, Type Personalized (CNTP)	3.97	1.28	5.07	0.38
Content Personalized, Type Personalized (CPTP)	3.85	1.01	5.50	0.78
Control	N.A.	N.A.	4.13	0.21

Results of the manipulation check indicated that there were no significant main effects of *Nudge Content* ($F(1,118) = 0.05$, $p > 0.05$) and *Nudge Type* ($F(1,118) = 0.27$, $p > 0.05$) and no significant interaction effect of *Nudge Content*Nudge Type* ($F(1,118) = 0.15$, $p > 0.05$). Therefore, the manipulation of *Nudge Content* and *Nudge Type* was not successful.

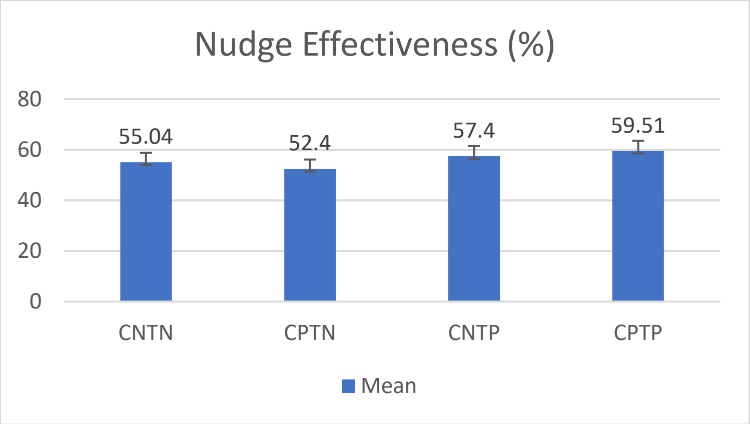
Results of the one-way ANOVA of overall shopping time showed that there were no significant differences between treatment arms on overall shopping times ($F(4,148) = 1.28$, $p > 0.05$), suggesting that differences in shopping time might not be due to the difference in treatment arms (whether nudge content and/or nudge type were personalized) and could be due to chance.

Personalized nudges, nudge effectiveness and healthier food choice

Across different treatment arms, the overall mean of the dependent variable *Nudge Effectiveness (%)* was 56.00 (SD=1.91). The means and standard deviations of *Nudge Effectiveness (%)*for all experimental conditions can be found in Figure 3.

Figure 3

Means and Standard Deviations of Nudge Effectiveness across treatment arms

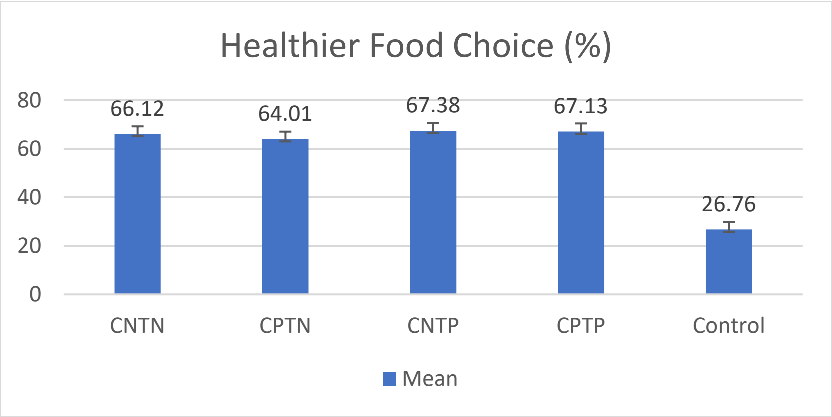


However, no significant main effects of *Nudge Content* (F(1,115) = 0.01, p > 0.05) and *Nudge Type* (F(1,115) = 1.54, p > 0.05) and no significant interaction effect between *Nudge Content* and *Nudge Type* (F(1,115) = 0.44, p > 0.05) were found on *Nudge Effectiveness.* The covariates added to the model did not show significant effects on *Nudge Effectiveness* either (Age: F(1,115) = 0.39, p > 0.05, Hunger: F(1,115) = 1.30, p > 0.05, Trait Reactance Proneness: F(1,115) = 0.43, p > 0.05).

Across different treatment arms, the overall mean of the dependent variable *Healthier Food Choice (%)* was 58.28 (SD=1.39). The means and standard deviations of *Healthier Food Choice (%)* for all experimental conditions can be found in Figure 4.

Figure 4

Means and Standard Deviations of Healthier Food Choice across treatment arms



However, no significant main effects of *Nudge Content* (F(1,145) = 0.13, p > 0.05) and *Nudge Type* (F(1,145) = 0.47, p > 0.05) and no significant interaction effect between

Nudge Content and *Nudge Type* ($F(1,145) = 0.09$, $p > 0.05$) were found on *Healthier Food Choice*. The covariates Hunger and Trait Reactance Proneness did not show significant effects on *Healthier Food Choice* either (Hunger: $F(1,145) = 0.25$, $p > 0.05$, Trait Reactance Proneness: $F(1,145) = 0.47$, $p > 0.05$). However, Age did show a significant effect on *Healthier Food Choice*, $F(1,145) = 8.66$, $p = 0.004$, partial $\eta^2 = .06$,

Difference between nudge content and nudge type

Descriptive statistics of Nudge Effectiveness and Healthier Food Choice for Nudge Content and Nudge Type can be found in Figure 5 and 6.

Figure 5

The means and standard deviations of Nudge Effectiveness across Content and Type personalized nudges

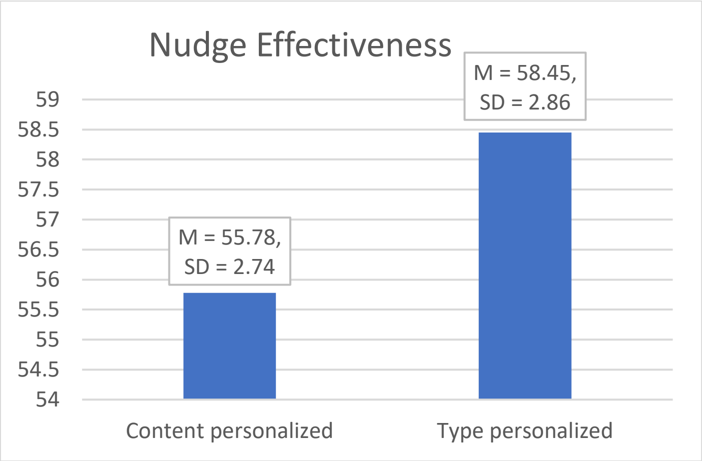
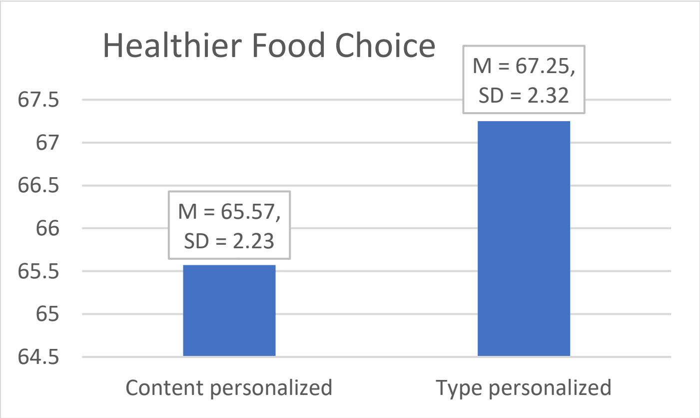


Figure 6

The means and standard deviations of Healthier Food Choice across Content and Type personalized nudges



No significant main effects and very small effect sizes of *Nudge Content* ($F(1,115) = 0.01$, $p > 0.05$, partial $\eta^2 = .00$) and *Nudge Type* ($F(1,115) = 1.54$, $p > 0.05$, partial $\eta^2 = .01$)

were found on *Nudge Effectiveness*. The covariates added to the model did not show significant effects on *Nudge Effectiveness* either (Age: $F(1,115) = 0.39$, $p > 0.05$, Hunger: $F(1,115) = 1.30$, $p > 0.05$, Trait Reactance Proneness: $F(1,115) = 0.43$, $p > 0.05$).

There were also no significant main effects and very small effect sizes of *Nudge Content* ($F(1,145) = 0.13$, $p > 0.05$, partial $\eta^2 = .00$) and *Nudge Type* ($F(1,145) = 0.47$, $p > 0.05$, partial $\eta^2 = .00$) were found on *Healthier Food Choice*. The covariates Hunger and Trait Reactance Proneness did not show significant effects on *Healthier Food Choice* either (Hunger: $F(1,145) = 0.25$, $p > 0.05$, Trait Reactance Proneness: $F(1,145) = 0.47$, $p > 0.05$). However, Age did show a significant effect on *Healthier Food Choice,* $F(1,145) = 8.66$, $p = 0.004$, partial $\eta^2 = .06$,

Discussion

The aim of this research was to investigate whether personalized digital nudges were more effective in promoting healthier food choices than non-personalized nudges and whether this effect was different for personalizing nudge content versus nudge type. Results showed that personalized nudges on content and/or type did not have a higher nudge effectiveness than generic, non-personalized nudges on content and/or type. It can also be concluded that personalized nudges on content and/or type did not lead to a greater number of healthier foods purchased compared to non-personalized nudges on content and/or type. When looking at effect sizes, there was also no difference between the effect of personalizing nudge content and nudge type on healthy food choice. However, when looking at the means of Nudge Content and Nudge Type, it seems that personalizing Nudge Type leads to a slightly higher Nudge Effectiveness than personalizing Nudge Content.

Regarding the first hypothesis, a possible explanation for the null effect of nudge personalization is that the manipulation check was not successful. This means that the manipulation of Nudge Content and Nudge Type did not have the intended effect on the perceived personalization of the nudges and the results found. The interpretation of the results should therefore be done with caution, because results might not be valid; it remains unclear whether the absence of effects was due to actual missing effects or rather due to failed manipulations. Another methodological explanation for the null effect is that the sample consisted of less participants than initially planned. Based on an *a priori* power calculation, the number of participants should have been 200. Because of time limitations, it was decided that data analysis was started with a sample of 153 participants. This could have implications for the internal validity of the study (Field, 2013).

Although the effects of *Nudge Content* and *Nudge Type* on *Nudge Effectiveness* were not significant, the means (Figure 3) show that it seems to be that nudge effectiveness is slightly higher for the condition where both nudge content and nudge type were personalized, compared to other conditions. Although mainly applied to research focusing on non-personalized nudging, research suggested that digital nudges might need to be combined to increase nudge effectiveness (Jesse & Jannach, 2021). The finding that it seems that nudge effectiveness is slightly higher for the combination of personalized nudge content and nudge type, is in line with this suggestion. Schöning et al. (2019) also found that when presentation format (i.e. nudge type in our research) is matched with cognitive style, this will increase the understanding of the content (of the nudge), as processing fluency is higher. This might imply that nudge type works in conjunction with nudge content.

Despite the fact that no significant effects of personalized nudge content and nudge type were found on healthier food choice, there seems to be a difference of healthier food choice between the four treatment arms and the control condition. This result seems to suggest that receiving any nudge leads to a healthier food choice than no nudge at all, which is in line with nudging literature regarding healthy food choice (Blom et al., 2021). Results also showed that the covariate Age explained a significant amount of variance in healthier food choice. While literature shows that age may impact how nutritional information is processed and what food choices are made (Steptoe et al., 1995), it is unlikely that that is what happened in the current study, since there are only minor age differences between treatment arms and all participants are in a range from 18 to 27 years old.

An explanation for the insignificant result of Nudge Type might be that people's preference for cognitive style is more nuanced than in the current study. According to the VARK learning styles inventory, people are not either more visually or verbally oriented, but people can also be more aurally or kinesthetically oriented or a combination of these styles (Leite et al., 2010).

Regarding the second hypothesis, the unsuccessful manipulation check and the lack of statistical power could be methodological explanations for the null effects as well. The lack of statistical power might have caused the very small effect sizes of the main effects of nudge content and nudge type. However, the means of nudge effectiveness and healthier food choice in content-personalized versus type-personalized nudges (Figure 5 and Figure 6), seem to indicate that both nudge effectiveness and healthier food choice are slightly higher for type-personalized nudges compared to content-personalized nudges, which was not in line with the hypothesis. This finding could be caused by the fact that a presentation format matched with someone's preferred cognitive style, leads to a better understanding of the content of a nudge (Schöning et al., 2019). In a study in which presentation format was matched with cognitive style, Thomas & McKay (2010) found that instructional materials in a learning environment, were better processed and understood when the material was matched to preferred cognitive style. For the current study, this could imply that the personalization of nudge type is an important moderator in the comprehension and processing of the content of nudges.

The result could possibly be also explained by the fact that digital nudging literature suggests that nudge effectiveness is higher when digital nudges are combined (Jesse & Jannach, 2021), as our results also seem to suggest that nudge effectiveness is higher for the combination of personalized nudge content and personalized nudge type. However, it is still interesting to investigate this hypothesis further in future research, because research on the difference between personalizing nudge content and nudge type is very limited in the domain of food choices (Peer et al., 2019; Mills, 2022).

This study contributes to the young field of personalized digital JIT nudging. Despite the fact that no effects were found of personalization of nudge content and nudge type on nudge effectiveness and healthier food choice, the study provides opportunities for follow-up research. Unsuccessful manipulation checks and a smaller sample than initially intended, might imply that the study lacks statistical power and results might not be valid. Therefore, future research is needed to investigate if the absence of results is due to the sample size, failed manipulations or if it is actually due to missing effects. Another limitation might be that the sample consisted of only Dutch-speaking students. It could be interesting for future research to investigate other age- or cultural groups to see if there are cultural or age differences in nudge effectiveness and healthier food choice.

In this study, the nudges were targeted at unhealthy food choices, which is a common pattern in the current obesogenic environment (Abbade & Dewes, 2015). As in the current study, the effect of (personalized) nudges is mostly investigated on one-time behaviour changes in the bigger nudging domain (Bergram et al., 2022). A suggestion for future research in the nudging domain is to investigate the effects of personalized nudging on longer-term behaviour change. Another interesting topic for future research is the personalization of nudge type, specifically if nudge type is personalized based on the VARK learning styles inventory. The means of nudge effectiveness and healthier food choice seem to suggest that the personalization of nudge type leads to a slightly higher nudge effectiveness and a slightly higher healthier food choice. When in future research, the personalization is more nuanced using the VARK learning styles inventory, this suggestion could be further and more deeply investigated. What is also interesting to investigate in follow-up research is the possibility that the personalization of nudge type is an important moderator in the comprehension and processing of the content of nudges.

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Appendix 1

In-app supermarket products

Product Category (N=10)	Trial Type	Product Type	Product Options (N=6 per category)
Dessert	Experimental - fixed choice	Unhealthy	Bros krakende mousse (4 x 57 g)
Dessert	Experimental - fixed choice	Unhealthy	Almhof Choco met echte slagroom wit-vanille (180 g)
Dessert	Experimental - fixed choice	Unhealthy	Mona Vanillepudding met aardbeiensaus (450 ml)
Dessert	Experimental - fixed choice	Unhealthy	Campina Vlaflip vanille (1L)
Dessert	Experimental - fixed choice	Unhealthy	De Zaanse Hoeve Tiramisu 2-pack (160 g)
Dessert	Experimental - fixed choice	Unhealthy	Solero exotic (3 stuks)
Frisdrank	Experimental - fixed choice	Unhealthy	Coca-Cola Regular (1L)
Frisdrank	Experimental - fixed choice	Unhealthy	Fanta Orange (1L)
Frisdrank	Experimental - fixed choice	Unhealthy	Lipton ice tea green (1.5 L)
Frisdrank	Experimental - fixed choice	Unhealthy	Royal Club Ginger ale (1L)
Frisdrank	Experimental - fixed choice	Unhealthy	Red Bull Energy drink 4-pack (1L)
Frisdrank	Experimental - fixed choice	Unhealthy	Spa Fruit citron (1.25 L)
Tussendoortje	Experimental - fixed choice	Unhealthy	Nakd. Pecan pie fruit- en notenrepen (4 stuks)
Tussendoortje	Experimental - fixed choice	Unhealthy	Nature Valley Fruit & nut cranberry noten mueslireep (4 stuks; 120 g)
Tussendoortje	Experimental - fixed choice	Unhealthy	Duyvis Pinda's Gezouten (235 G)
Tussendoortje	Experimental - fixed choice	Unhealthy	Kanjers Extra grote stroopwafels (320 g)
Tussendoortje	Experimental - fixed choice	Unhealthy	Bonne Maman Les Petits muffins vanille (235 g)
Tussendoortje	Experimental - fixed choice	Unhealthy	Pringles Original (165 g)
Zuivel	Experimental - fixed choice	Unhealthy	De Zaanse Hoeve Volle melk (1L)
Zuivel	Experimental - fixed choice	Unhealthy	Fage Total Griekse yoghurt 5% (500 g)
Zuivel	Experimental - fixed choice	Unhealthy	Campina Volle yoghurt (1L)
Zuivel	Experimental - fixed choice	Unhealthy	Campina Biologisch volle melk(1L)

Zuivel	Experimental - fixed choice	Unhealthy	Beemster Jong 48+ plakken (150 g)
Zuivel	Experimental - fixed choice	Unhealthy	Old Amsterdam Roomkaas original (125 g)
Brood	Experimental - free choice	Healthy	AH Bruin heel
Brood	Experimental - free choice	Healthy	AH Bakkersbol spelt (4 stuks)
Brood	Experimental - free choice	Healthy	AH Biologisch Volkoren broodjes met desem bereid (4 stuks)
Brood	Experimental - free choice	Unhealthy	AH Bakkersbol boter (4 stuks)
Brood	Experimental - free choice	Unhealthy	AH Extra lang lekker tijger wit heel
Brood	Experimental - free choice	Unhealthy	AH Witte pistolets (4 stuks)
Noedels	Experimental - free choice	Healthy	De Cecco Penne rigate integrali nr41 (500 g)
Noedels	Experimental - free choice	Healthy	Grand' Italia Salade pasta volkoren fusilli (500 g)
Noedels	Experimental - free choice	Healthy	Go-tan Whole wheat noodles bio-organic (250 g)
Noedels	Experimental - free choice	Unhealthy	Grand' Italia Spaghetti all'uovo (500 g)
Noedels	Experimental - free choice	Unhealthy	Samasaya Fijne Eiernoedels (250 g)
Noedels	Experimental - free choice	Unhealthy	Honig Macaroni Spelt (550 g)
Ontbijt	Experimental - free choice	Healthy	Milner Smeerkaas 20+ naturel (150 g)
Ontbijt	Experimental - free choice	Healthy	Quaker Oats express havermout naturel (324 g)
Ontbijt	Experimental - free choice	Healthy	Bolletje Lichte crackers volkoren (190 g)
Ontbijt	Experimental - free choice	Unhealthy	Meester & Zn. Runderrookvlees (100 G)
Ontbijt	Experimental - free choice	Unhealthy	Quaker Havermout crunchy muesli met noten (350 G)
Ontbijt	Experimental - free choice	Unhealthy	Vifit goedemorgen ardbei sinaasappel (1L)
Vlees	Experimental - free choice	Healthy	AH Kipgehakt naturel (300 g)
Vlees	Experimental - free choice	Healthy	AH Kalkoenfilet schnitzel (240 g)
Vlees	Experimental - free choice	Healthy	De vegetarische slager vegan kipstuckjes (160g)
Vlees	Experimental - free choice	Unhealthy	AH Greenfields Rundergehakt (300 g)

Vlees	Experimental - free choice	Unhealthy	Jumbo Grill Burgers (180 g; 2 stuks)
Vlees	Experimental - free choice	Unhealthy	AH Krokante kipfiletschnitzel 2 stuks (250 g)
Diepgevroren	Filler - no nudge	Healthy	Bonduelle diepvries Broccoli roosjes
Diepgevroren	Filler - no nudge	Healthy	Doosje Blauwe bes framboos (AH merk; 250 g)
Diepgevroren	Filler - no nudge	Unhealthy	Kwekkeboom oven bitterballen (12 stuks)
Diepgevroren	Filler - no nudge	Unhealthy	Mora oven kipnuggets (14 stuks)
Diepgevroren	Filler - no nudge	Unhealthy	Aviko SuperCrunch originals Franse frites (750 g)
Diepgevroren	Filler - no nudge	Healthy	Garnalen rauw en gepeld (AH merk; 225 g)
Groente	Filler - nudge attached to **healthy** product	Healthy	Vers spinazie (AH merk; 400g)
Groente	Filler - nudge attached to **healthy** product	Healthy	Vers worteltjes (AH merk; 300 g)
Groente	Filler - nudge attached to **healthy** product	Healthy	Vers maiskolven (AH merk; 2 stuks)
Groente	Filler - nudge attached to **healthy** product	Unhealthy	HAK gesneden bladspinazie (330 g)
Groente	Filler - nudge attached to **healthy** product	Unhealthy	Bonduelle crispy mais blik (300 g)
Groente	Filler - nudge attached to **healthy** product	Unhealthy	Bonduelle wortels blik (155 g)

Appendix 2

Healthy product recommendations (product nudges; separate from in-app products)

Product category	Trial Type	Unhealthy product counterpart	Healthy product nudge
Dessert	Experimental - fixed choice	Bros krakende mousse (4 x 57 g)	Melkunie protein pudding chocolate (200 g)
Dessert	Experimental - fixed choice	Almhof Choco met echte slagroom wit-vanille (180 g)	Melkunie protein pudding salted caramel (200 g)
Dessert	Experimental - fixed choice	Mona Vanillepudding met aardbeiensaus (450 ml)	Optimel magere kwark aardbei (500 g)
Dessert	Experimental - fixed choice	Campina Vlaflip vanille (1L)	Optimel magere vla vanille (1L)
Dessert	Experimental - fixed choice	De Zaanse Hoeve Tiramisu (160 g)	Melkunie protein pudding chocolate (200 g)
Dessert	Experimental - fixed choice	Solero exotic (3 stuks)	Coolbest mango fruitijs (400 ml)
Frisdrank	Experimental - fixed choice	Coca-Cola Regular (1L)	Coca-Cola Zero sugar (1L)
Frisdrank	Experimental - fixed choice	Red Bull Energy drink 4-pack (1L)	Red Bull Energy drink suikervrij 4-pack (1L)
Frisdrank	Experimental - fixed choice	Fanta Orange (1L)	Fanta Orange no sugar (1L)
Frisdrank	Experimental - fixed choice	Royal Club Ginger ale (1L)	Royal Club Ginger ale 0% suiker fles (1L)
Frisdrank	Experimental - fixed choice	Lipton ice tea green (1.5 L)	Lipton green zero (1.5 L)
Frisdrank	Experimental - fixed choice	Spa fruit citron (1.25 L)	Spa Touch Lemon (1 L)
Zuivel	Experimental - fixed choice	De Zaanse Hoeve Volle melk (1L)	De Zaanse Hoeve Halfvolle melk (1L)
Zuivel	Experimental - fixed choice	Fage Total Griekse yoghurt 5% (500 g)	Fage Total Griekse yoghurt 0% (500 g)
Zuivel	Experimental - fixed choice	Campina Volle yoghurt (1L)	Campina Magere yoghurt (1L)
Zuivel	Experimental - fixed choice	Campina Biologisch volle melk(1L)	Campina Karnemelk (1L)
Zuivel	Experimental - fixed choice	Beemster Jong 48+ plakken (150 g)	Milner Jong belegen 20+ plakken (175 g)
Zuivel	Experimental - fixed choice	Old Amsterdam Roomkaas original (125 g)	Philadelphia Light(200 g)
Tussendoortje	Experimental - fixed choice	Nakd. Pecan pie fruit- en notenrepen (4 stuks)	AH Vijgenbrood met amandelen (200 g)
Tussendoortje	Experimental - fixed choice	Nature Valley Fruit & nut cranberry noten mueslireep (4 stuks; 120 g)	AH Digestive 0% suiker (400 g)
Tussendoortje	Experimental - fixed choice	Duyvis Pinda's Gezouten (235 G)	Duyvis Pinda's ongezouten (235 g)

Tussendoortje	Experimental - fixed choice	Kanjers Extra grote stroopwafels (320 g)	LU Bastogne orginal (260 g)
Tussendoortje	Experimental - fixed choice	Bonne Maman Les Petits muffins vanille (235 g)	Peijnenburg Zero vanille smaak gesneden (280 g)
Tussendoortje	Experimental - fixed choice	Pringles Original (165 g)	Brouwer Studenten haver ongezouten (200 g)
Noedels	Experimental - free choice	Grand' Italia Spaghetti all'uovo (500 g)	Grand' Italia Spaghetti volkoren (500 g)
Noedels	Experimental - free choice	Honig Macaroni Spelt (550 g)	Honig Macaroni Vezelrijk (550 g)
Noedels	Experimental - free choice	Samasaya Fijne Eiernoedels (250 g)	Bio+ volkoren noodles (250 g)
Brood	Experimental - free choice	AH Bakkersbol boter (4 stuks)	AH Bakkersbol volkoren (4 stuks)
Brood	Experimental - free choice	AH Extra lang lekker tijger wit heel	AH Volkoren heel
Brood	Experimental - free choice	AH Witte pistolets (4 stuks)	AH Bruine pistolets (4 stuks)
Vlees	Experimental - free choice	AH Greenfields Rundergehakt (300 g)	AH Mager rundergehakt (300 g)
Vlees	Experimental - free choice	Jumbo Grill Burgers (180 g; 2 stuks)	Jumbo Lekker Veggie Hamburger Vegan (200g; 2 stuks)
Vlees	Experimental - free choice	AH Krokante kipfiletschnitzel 2 stuks (250 g)	AH Kipdijfilet (390 g)
Ontbijt	Experimental - free choice	Meester & Zn. Runderrookvlees (100 g)	Rosbief (AH merk; 60g)
Ontbijt	Experimental - free choice	Quaker Havermout crunchy muesli met noten (350 g)	Bolletje Krokante ontbijtgranen notenmix (375 g)
Ontbijt	Experimental - free choice	Vifit goedemorgen ardbei sinaasappel (1L)	Optimel magere yohurt aardbei (1L)
Groente	Filler - nudge attached to **healthy** product	Vers spinazie (400g)	Iglo spinazie fijn gehakt (500 g)
Groente	Filler - nudge attached to **healthy** product	Vers worteltjes (AH merk; 300 g)	AH Tuinerwten wortelen (450 g)
Groente	Filler - nudge attached to **healthy** product	Vers maiskolven (AH merk; 2 stuks)	AH Tuinerwten wortelen (450 g)