Stimulating Vegan Food Choices With the Affordance Nudge: A One-Size Fits All Solution?

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Abstract

As a vegan diet has both health and environmental benefits, stimulating vegan food choices could help with both decreasing the prevalence of obesity, and decreasing greenhouse gas emission. We proposed the affordance nudge, in which a character is used to draw attention to the nudged product, as a way to guide people into making more vegan choices in their daily lives. We conducted an online study with two conditions (affordance nudge condition and control condition) in which participants had to choose between a vegan and a non-vegan product (n = 158). We analysed the data by doing a stepwise multiple regression analysis. We expected people in the affordance nudge condition to choose more vegan products than people in the control condition. We also expected the nudge to be more effective when people do not have a clear preference for vegan food, and less effective for people who have a low or high preference for vegan food. Results show that the affordance nudge does significantly increase the number of vegan products chosen, but only for people with a high preference for vegan food. For people with a low preference for vegan food, the affordance nudge appeared to have the opposite effect, where people chose fewer vegan products in the nudge condition compared to the control condition. These findings are promising for the effectiveness of the affordance nudge and for including moderating factors in nudging research, but more research needs to be done before implementing the nudge in a real supermarket environment.

Keywords: vegan, nudging, affordances, preferences, food choices

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Since climate change is a big topic all over the world (WWF, 2022), people are looking for ways to reduce greenhouse gas emission. One way is adopting a more sustainable, vegan diet (Garnet, 2016; Godfray et al., 2018). This reduces the amount of water used in food production, helps decrease deforestation and helps with lowering the amount of greenhouse gas emission (Mileucentraal, 2022).

Additionally, a sustainable diet can have a positive effect on people's health and wellbeing. According to the World Health Organization (2021a) overweight and obesity currently kills more people than underweight in most countries, with over 1.9 billion overweight adults worldwide. Studies show that adopting a vegan diet can help with weight-loss (Turner-Mcgrievy et al., 2015; Turner-Mcgrievey et al., 2017) and can decrease the risk of diabetes and cardiovascular disease (Rocha et al., 2019). Therefore, stimulating vegan food choices could help with both decreasing the prevalence of obesity, and decreasing greenhouse gas emission (World Health Organisation, 2021b).

However, changing people's food choices is deemed very difficult (Chen & Antonelli, 2020; De Ridder et al., 2017). In the last years, nudging has been presented as a way to help people make healthier (Arno & Thomas, 2016; Broers et al., 2017) and more sustainable food choices (Abrahamse, 2020; Vandenbroele et al., 2020). A nudge guides people into making a 'more desired' decision, without forbidding any options or significantly changing the economic incentives (Thaler & Sunstein, 2008). Nudging has shown to be a very easy-to-implement, cost-effective tool to change people's health behaviour (Bernartzi et al., 2017). Recent meta-analyses report small to medium effect sizes (d = 0.23-0.65) for nudging healthy food choices (Broers et al., 2017; Cadario & Chandon, 2020; Mertens et al., 2022). Therefore, nudging seems to be a promising strategy to help change the way people eat, and could thus be helpful in promoting vegan food choices.

Benefits of Adopting a Vegan Diet

A vegan diet is defined as a diet which excludes all animal products (e.g., dairy, meat and honey; as defined in World Health Organisation, 2021b). Eating a (mainly) vegan diet has many health benefits, such as decreasing the risk of diabetes and cardiovascular disease (Rocha et al., 2019). Vegan diets are associated with health benefits, because in general, they contain higher amounts of fibre, vitamins and minerals and more unsaturated fats than non-vegan diets (Craig, 2009). Adopting a vegan diet also appears to be effective for weight loss

(Turner-Mcgrievy et al., 2015; Turner-Mcgrievey et al., 2017), which is an important finding, given that being overweight is a serious and sometimes life-threatening condition (World Health Organization, 2021a).

As mentioned previously, consuming a vegan diet can also positively affect the environment. Livestock is one of the biggest contributors to global warming, as it contributes an estimated 18% to global greenhouse gas emissions (FAO, 2006). People that eat meat are responsible for almost 2.5 times as much greenhouse gas emission per day than people who eat a vegan diet (Scarborough et al., 2014). Currently, 40% of the global arable land is used to feed livestock (Mottet et al., 2017) and 8% of the global water supply is used for intensive, feed-based production of livestock (Schlink et al., 2010). Considering the growing population, food production is also expected to increase. Due to its impact on the environment, continuing with animal-based protein production will probably not be sustainable in the future (de Boer & Aiking, 2011). Stimulating vegan choices would therefore help reduce the environmental damage that comes with eating animal products.

Nudging

Given the different benefits of a vegan diet, promoting the consumption of more vegan food products can contribute positively to solving environmental and public health issues. Supermarkets are well on its way in providing more and more vegan options: one of the largest Dutch supermarket chains (i.e., Albert Heijn) has already over 1000 vegan products (from 28500 products in total) available to choose from (Albert Heijn, 2022).

As the food choice process is complex and based on different factors, such as food-related features (e.g., sensory features), individual differences (e.g., habits, preferences and biological features) and socio-cultural factors (Chen & Antonelli, 2020), it is considered very difficult to change (Chen & Antonelli, 2020; De Ridder et al., 2017). However, different meta-analyses have shown nudging to be effective in stimulating people to make more healthy food choices (Broers et al., 2017; Cadario & Chandon, 2020; Mertens et al., 2022), and there are also different studies that have specifically shown the effects of nudging vegan and vegetarian food options. For example, Hansen and colleagues (2021) showed that when making a vegetarian buffet the default option, there was an increase of 85% in vegetarian choices, compared to when the default option was a non-vegetarian buffet. A study in a butchery (Vandenbroele et al., 2021) found that the sale of meat-replacements was enhanced by placing meat-replacements next to their meat-based counterparts. A study by Perez-Cueto (2021) showed that in a restaurant setting, changing the menu design with a vegan ‘deal of the

day' resulted in 85% of people choosing this vegan meal compared to 9% in the control condition. We therefore suspect that nudging might be effective in stimulating more vegan food purchases in a supermarket environment.

Affordance Nudge

A recently developed nudge is the affordance nudge, designed by Blom and colleagues (2022). This nudge is developed based on the principle of affordances (Blom et al., 2022). Affordances are described as the opportunities for action that an object displays and indicate to a person how to interact with the object (Gibson, 1977). These affordances can invite people to interact with the object. The concept of affordances can be used to help nudge people toward interaction with the desired product rather than the undesired product, because objects that afford action have been shown to capture visual attention (Gomez et al., 2018; Handy et al., 2003), to be rated higher in attractiveness and preference (Eelen et al., 2013) and to increase purchase intentions (Elder & Krishna, 2012).

With the affordance nudge, the concept of affordances is deliberately linked to nudging. The nudge works by showing a character displayed on a monitor above products in the supermarket, which uses gaze-cueing – the direction of the gaze towards a stimulus - to draw attention to the nudged product (e.g. the vegan product). Gaze-cueing has been shown to increase attention to, preference for and desirability of the stimulus towards which the gaze is directed (Becchio et al., 2008; Tipper, 2010; Van der Weiden et al., 2010) and to elicit faster responses to the directed stimulus (Bobak & Langton, 2015). Therefore, gaze-cueing seems to be an effective approach to activate affordances.

This affordance nudge so far has only been studied in the context of healthy food choices in the supermarket (Blom et al., 2022), namely in promoting vegetable sales. When the affordance nudge was used, there was a 13% increase in sales of the nudged vegetables compared to when the nudge was not used. Additionally, customers in the supermarket seemed positive regarding the nudge, rating it as inviting, attractive, salient and accessible. In the present study, we will look into the effects of this affordance nudge on a different target behaviour, namely in promoting sustainable food choices in the supermarket.

Preferences

Since nudging is a relatively new research subject, many questions on the moderating factors of nudging remain unanswered (Marchiori et al., 2017). Most studies only indicate the effectiveness of a nudge without reporting on contextual or psychological factors involved.

However, in successfully implementing a nudge, moderating factors are important (Bryan et al., 2021), as they can give insight into for who and under what conditions nudges work. In the present study, we consider the effect of preferences for vegan food as a possible moderator.

Different studies suggest that preferences can influence the effectiveness of nudges. De Ridder and colleagues (2021) suggest that people are most nudgeable when they do not have a clear preference for the nudged behaviour. When uncertain about a decision, people generally rely more heavily on heuristics (Raue & Scholl, 2018), which could make them more susceptible to nudging. This implies two situations in which a nudge would be less effective: when preferences are not in line with the behaviour promoted by the nudge and when preferences are already in line with the promoted behaviour. In both situations, we would expect people to choose their preferred option, regardless of the nudge. Two recent studies (Venema et al., 2019; Venema et al., 2020) indeed suggest that nudges would be especially effective in influencing 'inconsistent choosers': people who do not have strong prior preferences. For example, Venema and colleagues (2020) studied the effect of a social proof nudge under conflicting preferences. The nudge was used to steer participants into choosing less meat products, in an online supermarket environment, by showing how many other people chose the meat product on the screen. They found that for people who felt more ambiguous about eating meat, seeing that others did not buy the meat product helped them choose less meat products, whereas they did not find this effect for people with strong nudge congruent and incongruent preferences.

Thus, as preferences do seem to influence the effectiveness of nudges in general, we will look at the influence of preferences for vegan food on the affordance nudge, so that we know for who and in what conditions the nudge will be effective.

Current study

Concluding, for both environment and public health, changing the way we eat and increasing the consumption of vegan products is important. We will therefore examine the effect of an affordance nudge on vegan product choices in an online supermarket environment, and the possible moderating effect of preferences for vegan food on the effectiveness of the affordance nudge. Based on the literature, we hypothesise that in the affordance nudge condition, people will choose more vegan products compared to the control condition. We also hypothesize that the affordance nudge will be more effective for people

who do not have a clear preference regarding vegan food, and less effective for people who have a low preference or a high preference for vegan food.

Method

Participants

For this study, we used convenience sampling to reach as many participants as possible. We approached participants via social media (i.e., Facebook, LinkedIn and Instagram), WhatsApp and through SONA systems (i.e., the University participant recruitment system where participants get rewarded with study points by participating in studies). A number of 434 people clicked on the link to participate. From these 434 participants, 89 did not provide informed consent and 172 participants dropped out at the start of the supermarket task. In total, 163 participants finished the questionnaire. After excluding participants due to their vegan diet (n = 4) and to being underage (n = 1), the final sample consisted of 158 participants, with 74 participants in the nudge condition and 84 participants in the control condition.

The mean age of the participants was 32.88 (SD = 16.30), ranging from 18 to 81. The sample consisted of 121 female (76.6%) and 37 male (23.4%) participants. The main levels of education attained were senior general secondary education/pre-university education (HAVO/VWO; n = 41, 25.9%), University Bachelor (n = 36, 22.8%) and University of Applied Sciences (HBO; n = 34, 21.5%). From all participants, 115 (72.8%) noted that they did not follow a specific diet, 21 (13.3%) participants followed a vegetarian diet, and 22 (13.9%) participants followed a different diet (amongst which a flexitarian diet, a gluten-free diet, a soy-free diet and a low sodium diet).

Design and Procedure

The study was approved by the Ethics Review Board of the Faculty of Social and Behavioural Sciences at Utrecht University (22-0443). The experiment was designed with the use of Gorilla Experiment Builder (www.gorilla.sc; Anwyl-Irvine et al., 2020), in which we tried to mimic an online supermarket environment. Data collection took place from March 17th until April 10th 2022. The language of the study was Dutch and participants were required to be 18 years or older. Additionally, they also needed to have access to a phone, laptop or tablet to participate in the experiment.

By doing a power analysis with G*Power (Faul et al., 2007), we estimated the required number of participants for a linear multiple regression analysis (F-test) at n = 489 (α

= 0.05, power = 80%, F^2 = 0.0225). However, due to time constraints we unfortunately did not expect to reach this number of participants. Therefore, we aimed at requiring a minimum of 50 participants per group (100 participants total). This number was based on a study by Blom and colleagues (2021) on nudging healthy food choices, which also used a nudge and control condition with the same number of participants. We expected this to be sufficient to study the effectivity of the nudge itself, but we take into consideration that we might not have enough power to detect the hypothesized interaction effect between condition and preference for vegan food.

When participants followed the link to participate in the experiment, they read an information letter explaining the task, the requirements to participate and data storage (Appendix A). After providing informed consent, participants answered several demographic questions. Then, the behavioural task started.

The behavioural task consisted of 20 trials. In each trial, participants were presented with two different products between which they had to choose. Participants were instructed to choose the product option they would choose when in the supermarket. In half of the trials (ten target trials) participants had to choose between vegan vs. non-vegan products. These ten trials consisted of food products from two different categories, namely meat and dairy products. In each of these ten trials, participants were shown a meat or dairy product and their vegan replacement (e.g., milk and a milk replacement). The other ten trials were filler trials to mask the real purpose of the study, which consisted of random supermarket products (e.g., toilet paper, cleaning products, fruits). The images of the products used in this experiment were retrieved from the Albert Heijn website (www.ah.nl) and consisted of both well-known brands as well as store-brand products (see Appendix C).

Participants were randomly assigned, using balanced randomization, to one of the two conditions: the affordance nudge condition or the no-nudge condition (Figure 1). In the nudge condition, the vegan product was nudged (with the filler trials, one of the two products was randomly chosen to be nudged). In this condition, people saw the two product options with a character above the two products that looked at the nudged product (Figure 2). When people chose the nudged product, the character smiled and raised its thumb. When people clicked on the other product, the character returned to a neutral position. In the control condition, there was no character above the two products.

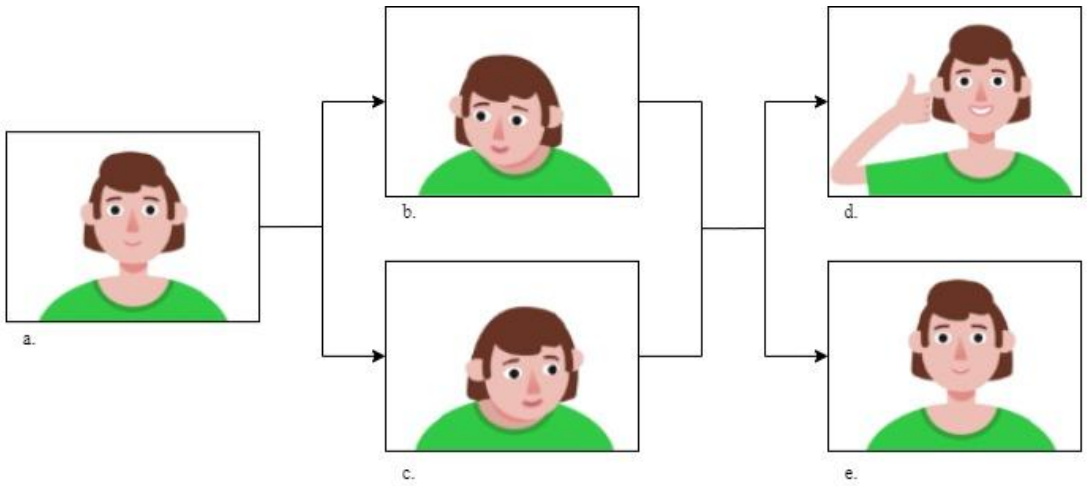
Figure 1

Difference Between the Nudge and Control Condition

Note. Affordance nudge condition on the left, Control Condition on the right. Text above the products states: 'make your choice by clicking on one of the products'.

Figure 2

Flowchart of the Displays in the Affordance Nudge Condition



Note. a: the default screen, b and c: the character gazing left or right, d: the character when choosing the nudged product, e: the character when choosing the other product.

Each trial started with a fixation screen (a white screen with a black plus sign in the middle) which was visible for 500 ms, followed by the screen where participants had to choose the product by clicking on the product. This screen remained visible until people made their choice. Then, depending on the condition people were in, they either got a response video from the character (nudge condition) and then a blank screen (300 ms), or the character returned to the neutral position and then they got a blank screen (300 ms) (control condition).

The two products were presented next to each other: half of the nudged products were presented on the left side, and half of the nudged products were presented on the right side. The trials were presented in a random order without replacement and there was no option to revisit the choices that were made.

After the trials, participants completed a questionnaire with questions about their preferred diet, their opinions and views on vegan food, how they perceived the products that were shown, and some additional demographical questions (Appendix B). After they completed this, they were debriefed shortly about the content of the study (Appendix A). People who participated through the recruitment system SONA were rewarded study points for their participation.

Measures

Number of vegan food choices

The total number of vegan food product choices served as the main outcome measure, with a minimum of zero and a maximum of ten vegan food product choices.

Food preferences

Food preferences towards vegan food were measured using a questionnaire (Povey, 2001) designed to measure preferences towards meat, vegetarian and vegan diets with four items for each type of diet. Participants were asked to respond to the statements 'A vegan diet is…', 'A vegetarian diet is…', and 'A diet that contains meat is…' on different 7-point dimensions, namely '*bad*' to '*good*', '*harmful*' to '*beneficial*' '*unpleasant*' to '*pleasant*', and '*unenjoyable*' to '*enjoyable*'. Cronbach's alpha values in the study by Povey (2001) show that the scales for each diet were reliable (meat eating $\alpha = 0.90$, vegetarian diet $\alpha = 0.80$, vegan diet $\alpha = 0.89$). In the current study, the alpha values were also reliable (meat eating $\alpha = 0.78$, vegetarian diet $\alpha = 0.84$, vegan diet $\alpha = 0.75$). Per diet, the mean score was calculated as a measure of preference, with one being the lowest score for preference and seven being the highest score.

We added a fifth question to this questionnaire[1], to touch on another aspect of attitude, namely how easy or difficult it seems to be to implement a specific diet, but decided to only use the original four questions as this was the validated questionnaire.

[1] Alpha's of the questionnaire with the fifth question were: meat eating $\alpha = 0.75$, vegetarian diet $\alpha = 0.86$, and vegan diet $\alpha = 0.74$.

Animation

Participants in the nudge condition were asked to respond to two statements (as used in: Blom et al., 2022)., the first being '*I liked the animation'* and the second being '*I identified with the animation*'. The answer options for both statements ranged from (1) '*completely disagree'* to (5) '*completely agree'.*

Demographic Variables

Before the start of the task, we asked about gender, age and highest attained level of education.

Control Measures

Participants were asked to answer some questions (as used in: Blom et al., 2022) on characteristics that are typically associated with affordances. They had to respond to the statement '*The presentation of the products was…'* and answer on three 7-point scales: (1) '*very unattractive'* to (7) '*very attractive',* (1) '*very uninviting'* to (7) '*very inviting',* and (1) '*not salient at all'* to (7) '*very salient'.* Participants also had to respond to the statement '*Selecting the products was…*' on two 7-point scales: (1) '*very difficult'* to (7) '*very easy'* and (1) *very unpleasant* to (7) *very pleasant*.

We measured ethical concerns regarding nudging (Schmidt & Engelen, 2020) with the statement '*How did you feel when selecting the products? I felt…*', followed by the words '*encouraged*', '*patronized*', '*directed*', '*like I was being watched*', and '*taken seriously*', which had to be answered on a 7-point scale ranging from '*strongly disagree'* (1) to '*strongly agree'* (7) (as used in: Blom et al., 2022).

Food choice satisfaction was measured with two questions (as in: Van Gestel et al., 2020) The first question was '*How satisfied are you with the items you chose in the supermarket task?*'. The answer scale ranged from (1) '*not satisfied at all'* to (7) '*very satisfied'*. The second question was '*To what extent did you come across products that you would buy in everyday life?*' with the answer scale ranging from (1) '*not at all'* to (7) '*a lot'*.

Hunger before the supermarket task was measured with a slider ranging from (1) '*not hungry at all'* to (100) '*very hungry'.*

We then asked the following question: '*Was there anything in the task that stood out to you?*', with the answer options being: '*No'* or *'Yes, namely … (text response)'*. The aim of this question was to measure nudge awareness.

We ended the questionnaire with the question: '*Do you follow a specific diet*' with the answer options being: '*No*', '*Vegetarian*', '*Vegan*', or '*Other, namely… (text response)*'.

Analysis

First, we conducted randomization checks for the variables age, gender, educational level, diet, hunger and the two questions on food satisfaction. We also tested the assumptions for the multiple linear regression analysis.

Then, we proceeded to perform a linear multiple regression analysis in order to examine if the affordance nudge was effective in promoting vegan food purchases and if preferences for vegan food had a moderating effect on the relation between condition and number of vegan food choices. We included the experimental conditions as a dummy variable, preferences for vegan food, and the interaction between preferences for vegan food and experimental condition as predictors, and the number of vegan food choices as the outcome variable. In case the interaction effect was significant, it was followed up by running a simple analysis with a two-way ANOVA.

We also performed an exploratory analysis to examine if people in the nudge condition felt more directed compared to people in the control condition. We did this by running a two-way ANOVA with the variables condition and preferences for vegan food (low, medium and high) as independent variables, and the variable feeling directed as dependent variable.

Results

Randomization checks

We performed a randomization check to see if participants were randomly distributed across the two conditions. For the dependent variables age (p = .266), hunger (p = .334) and the two questions on food satisfaction (p = .390 and p = .407), we performed separate independent sample t-tests with condition (nudge vs. control) as independent variable. For the dependent variables gender (p = .801), educational level (p = .501) and diet (p = .722), we ran Chi-squared analyses. The results showed that randomization was successful.

Descriptive Analyses

We found that participants on average chose 3.74 (SD = 3.06) vegan products. We found that a vegetarian diet had the highest average preference (M = 4.71, SD = 1.31), followed by a diet containing meat (M = 4.60, SD = 1.06), while a vegan diet had the lowest average preferences (M = 3.80, SD = 1.04). A full overview of the descriptives and correlation coefficients can be found in Table 1A and B, Appendix D.

Main Analysis

We tested the assumptions of linearity, multicollinearity, independence of the residuals, homoscedasticity, normality, and checked for influential cases. All assumptions were met.

To examine if the nudge condition stimulated participants to choose more vegan products compared to the control condition, and to see whether this effect was moderated by preferences for vegan food, we performed a stepwise multiple linear regression (Table 2). In the first step, we did not find a significant main effect for condition on number of vegan food choices. This is inconsistent with our first hypothesis, namely that people in the nudge condition would make more vegan food product choices. In the second step, we added preferences for vegan food to the model. No significant main effect of preference for vegan food on number of vegan food choices was found. In the third step, we added the interaction effect. We did find a significant interaction effect of condition X preferences for vegan food on number of vegan food choices. In this last step, the effect of condition also became significant, where people in the nudge condition chose less vegan products compared to the control condition, which was not in line with our hypothesis.

Table 1

Summary of the stepwise regression analysis for Condition and Preference for Vegan Food on Vegan Product Choice.

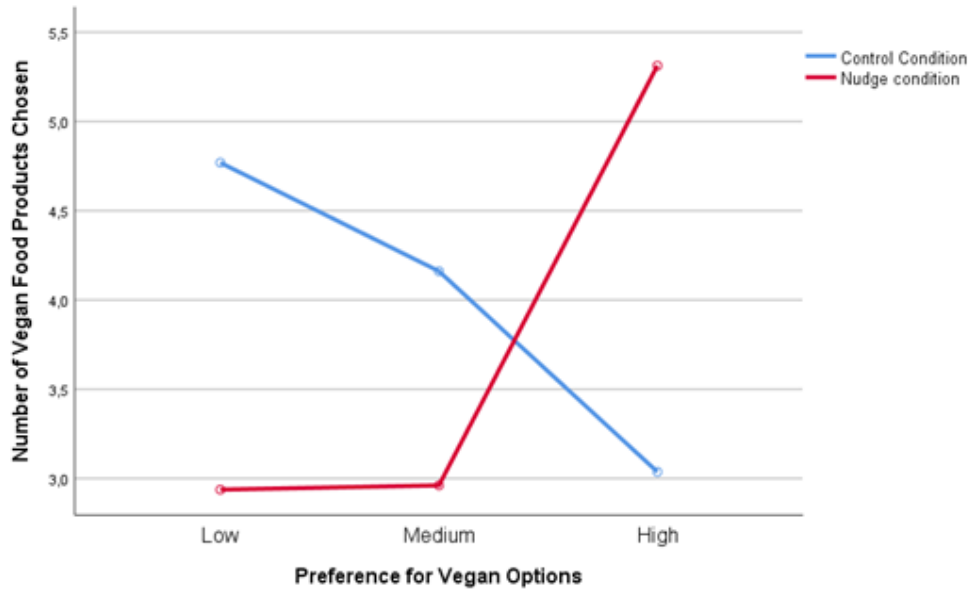
	R^2	ΔR^2	*F(df)*	*B (SE)*	β	*p*
Step 1	.007	.001	1.17 (1, 156)			
Constant				3.98 (.33)		<.001
Condition				-.53 (.49)	-.09	.281
Step 2	.014	.002	1.13 (2, 155)			
Constant				3.00 (1.00)		.003
Condition				-.44 (.50)	-.07	.376
Preference				.25 (.24)	.08	.298
Step 3	.065	.046	3.55 (3, 154)			
Constant				5.49 (1.31)		<.001
Condition				-5.52 (1.83)	-.90	.003
Preference				-.38 (.32)	-.13	.237
Condition x Preference				1.35 (.47)	.85	.005

Note. N = 158.

To further probe the interaction effect, we divided the participants in three even groups (low, medium and high preference for vegan food) and performed a simple effect analysis (Figure 3). We found a significant difference between the nudge condition (M = 2.94, SD = .53) and the control condition (M = 4.77, SD = .59) for people with low preference for vegan food (p = .021), where people with a low preference for vegan food buy more vegan products in the control condition compared to the nudge condition. The opposite pattern showed for people with high preference. We found that people with a high preference for vegan food chose significantly more vegan products in the nudge condition (M = 5.31, SD = .75) compared to the control condition (M = 3.04, SD = .57) (p = .017). There was no significant difference between the nudge condition (M = 2.96, SD = .59) and control condition (M = 4.16, SD = .54) for people with medium preference for vegan products (p = .132), which is inconsistent with our hypothesis, as we expected the nudge to be especially effective for people who did not have a clear preference.

Figure 3

Visual Representation of the Interaction Effect of Preference for Vegan Food and Condition on the Number of Vegan Products Chosen



Exploratory Analysis

Because of the outcome of the simple effects analysis, where we found that participants with a low preference for vegan food chose less vegan products in the nudge condition compared to the control condition, we wanted to look into why the nudge might have this effect for people with low preference for vegan food. Therefore, we looked at the control question in which we asked if people felt directed. We performed a two-way ANOVA with the variables condition and preferences for vegan food (low, medium and high) as independent variables, and the variable feeling directed as dependent variable. Conducting pairwise comparisons, we found a significant difference (p = .021) in the nudge condition between people with low (M = 3.50, SD = .34) and high (M = 4.88, SD = .48) preference for vegan food, where people with a low preference for vegan food felt significantly more directed by the nudge than people with a high preference for vegan food. For the other pairwise comparisons, we did not find any significant effects. We also checked if people with a low preference felt more directed in the nudge condition (M = 3.5, SD = .34) compared to the control condition (M = 4.15, SD = .38). This was not the case (p = .201), but this could be due to the small sample size (for low preference there were n = 26 participants in the control condition and n = 32 participants in the nudge condition).

Discussion

The purpose of this study was to gain a better understanding of nudging vegan products in supermarkets, specifically by use of the affordance nudge, where a character is used to draw attention to the nudged product. Because of the environmental benefits (Garnet, 2016; Godfray et al., 2018; Milieucentraal, 2022), as well as the health benefits that come with a vegan diet (Rocha et al., 2019; Turner-Mcgrievy et al., 2015; Turner-Mcgrievey et al., 2017), it is important to find ways to stimulate people to consume more vegan products.

To study the effectiveness of the affordance nudge on stimulating vegan product choices, we did an online supermarket experiment where participants had to choose between vegan and non-vegan products. In addition to examining the nudge's effectiveness, we also looked at the influence of preference for vegan food on this effectiveness, as literature shows that nudging is especially effective for people without a clear preference for the nudged behaviour, and less effective for people with a low of a high preference for the nudged behaviour (e.g., de Ridder et al., 2021). Looking at the effect of the nudge on its own would therefore not be sufficient when making a statement on its effectiveness (Bryen et al., 2021)

and increasing our understanding of the moderating factors of nudging will help in designing better targeted, more effective nudges (Venema et al., 2020).

We expected the affordance nudge to be effective in stimulating vegan choices for those without a clear preference for vegan food. Research suggests that when people are uncertain about a decision, they tend to rely more on heuristics, which could make them more susceptible to nudges (de Ridder et al., 2021). We expected that the nudge would not be effective for participants with a low preference or high preference for vegan food, as we expected them to choose their preferred option, regardless of the presence of the nudge (Venema et al., 2019; Venema et al., 2020).

However, our results showed that the nudge was effective, but only for people who had a high preference for vegan food, as they chose more vegan products in the nudge condition compared to the control condition. We also found that the nudge had the opposite effect for people with a low preference for vegan food, where the nudge caused them to choose fewer vegan products compared to the control group. For people without a clear preference, we did not find a difference in the number of vegan products chosen between the nudge and the control condition. This is inconsistent with our expectations and findings in the current literature, which state that nudges might be especially effective for those without a clear preference for the nudged behaviour (e.g. de Ridder et al., 2021).

The effectiveness of the nudge for people with a high preference for vegan food could be explained by the intention-behaviour gap. Researchers have found that what people think, what they intend to do, and what they actually do are not always aligned (Grimmer & Miles, 2017; Hassan et al., 2016). Therefore, it is possible that people with a higher preference for vegan food may intent to consume more vegan products, but do not necessarily act consistent with this intention. In that case, the nudge could remind them of their intentions, and ‘give them the final push’ towards the vegan option instead of the non-vegan option. Different studies show that environmental cues can remind people of their dietary goals, making them more likely to act consistent to those goals (Bittner & Kulesz, 2015; Papies & Hamstra, 2010). The nudge could therefore have reminded people with a higher preference for vegan food of their goal to choose more vegan products, which could have caused them to act more in line with their goal, and thus choose more vegan products.

For people with a low preference for vegan food, the nudge could also act as an environmental cue (Bittner & Kulesz, 2015; Papies & Hamstra, 2010), but instead of reminding them of the goal to buy more vegan products (as for people with a high preference for vegan food), it could actually remind them of their goal to not buy vegan products, and

thus the nudge could make them buy less vegan products compared to when there was no nudge. Another possible explanation is that, for people with a low preference for vegan food, the nudge elicited psychological reactance (Sustein, 2017), which can occur in situations where behavioural freedom is expected, and consequently threatened (Brehm & Brehm, 2013). There is some evidence that suggests that nudges can make people feel observed and limited in their freedom of choice (Hansen & Jespersen, 2013; Sunstein, 2018). It is possible that with this nudge, people with a lower preference for vegan food feel directed and steered towards choosing the vegan product. Our exploratory analysis indeed suggested that participants with a low preference for vegan food felt more directed compared to people with a high preference for vegan food. The feeling that they are being directed could cause them to react negatively to the nudge, especially when their personal preference does not align with the goal of the nudge (de Wijk et al., 2016; Sunstein, 2017). It thus seems that for people with a low preference for vegan food, the nudge actually works against the goal of encouraging more vegan product choices.

If the nudge indeed works as an environmental cue reminding participants of their goals (Bittner & Kulesz, 2015; Papies & Hamstra, 2010), this could also explain why the nudge was not effective for people without a clear preference. As they do not have a clear preference for vegan food, they also do not have a clear goal of which they are reminded when seeing the nudge.

There are several things to keep in mind when interpreting our current findings. The first thing is that our study focused only on meat and dairy replacements, but there is more to a vegan diet. There are a lot of food products that also play a big role in a healthy vegan diet, such as legumes, nuts, fruits and vegetables (Ostfeld, 2017). However, when wanting to stimulate people to eat less animal-based products, changing an animal-based product to a plant-based substitute is in general seen as the easiest way, as it allows consumers to keep their meal format relatively similar to what they are used to (Schösler et al., 2012). A study by Michel and colleagues (2021) also shows that meat alternatives that are similar to processed meats have the best chance in to replace meat.

Something that should also be taken into account is that after providing consent, and therefore intending to participate, 172 out of 335 participants dropped out when starting with the task. Unfortunately, it is not clear why they dropped out. It could be because they did not like the task, or because it did not work properly. This could be problematic if there is one specific group that dropped out, as this can impact the generalizability of the study. As we do not have any information on participants who dropped out, we cannot make any concluding

remarks on this. However, since the number of participants who dropped out was similar across conditions, it can be assumed that people did not drop out of the experiment due to the nudge.

A second limitation is the use of a convenience sampling method for recruiting participants. This could have a negative effect on the generalizability of the study. Furthermore, since the sample consisted of mostly female and highly educated participants, this could have had an influence on the outcome of the study, as women generally seem to have a higher preference for vegan diets (Modlinska et al., 2020). Research also shows that higher education is positively associated with higher preference for and more adherence to a vegan diet (Deliens et al., 2022). Both of these things could lead to an overestimation of the effectiveness of the nudge in this study compared to the general population. Next to that, the sample size was smaller than was actually required. The required estimate was not feasible on the time period available for this study. A small sample size could negatively influence the power of the study, which could in this study lead to an overestimation of the interaction effect (Scruggs, 2019).

Despite these limitations, these results suggest several theoretical and practical implications. Firstly, this study gives more insight into the conditions under which nudging works. We found nudging to be effective, but only for people with a high preference for vegan food. For these people, it could thus provide the extra push in making more vegan choices. However, we did also find that the nudge could have the opposite effect for a significant group of users, namely for people with a low preference for vegan food. If the nudge is implemented without knowing the effects of preferences, it could actually have the opposite effect for some people, making people choose more non-vegan products over vegan products. As our goal is to stimulate vegan choices to enhance positive effects on personal health and the environment, this would not be helpful. This finding emphasizes the importance of measuring moderating factors, not only for this nudge, but for nudging studies in general (Bryan et al., 2021), as this study shows that when you do not take into account the moderating factors of nudging, the nudge could actually have a different effect than expected.

In order to effectively implement the nudge, more research is needed. If, as the present study suggests, the nudge evokes reactance in people with low preference for vegan food, more research should be done to understand this reactance effect, as there is still not much known about reactance in nudging (Sunstein, 2017; de Jonge et al., 2018). This could be done by repeating this study, but with a questionnaire on reactance added at the end (e.g., Dillard et al., 200ba5).

Next to that, more research should be done to see if the nudge indeed works as an environmental cue, reminding participants of their goals. A suggestion to do this is to repeat this study, but adding a questionnaire to examine the goals participants have regarding their food choices, for example by using the Food Choice questionnaire (Steptoe et al., 1995) and the Sustainable Food Choice questionnaire (Verain et al., 2021).

Next to that, as a vegan diet does not only consists of meat and dairy replacements, but should be mostly based on legumes, fruits, and vegetables (World Health Organisation, 2021b), it would be useful to examine if the nudge would be effective in promoting that part of a vegan diet. The study by Blom and colleagues (2022) on the affordance nudge already showed the nudge to be effective in increasing vegetable sales, but more research should be done to strengthen this finding and to study the moderating factors that come into play, such as preferences for vegan food and food choice goals.

Conclusion

In summary, the results of this study suggest that the affordance nudge is effective in promoting vegan product choices in a supermarket environment, but only when people already have a high preference for vegan food. It seems like the nudge worked as an environmental cue, helping participants make decisions in line with their intentions and goals, which also helps explain why the nudge was not effective for people without a clear preference for vegan food and even had the opposite effect for participants with a low preference for vegan food. This study also suggests that the affordance nudge could have evoked a form of reactance in people with a low preference for vegan food. It is therefore questionable if this nudge, and nudging in general, will help stimulate vegan product choices in the supermarket, as the nudge does only seem to be effective when people already have an existing high preference for vegan food. The present study has enhanced our understanding of the effectiveness of the affordance nudge on vegan product choices, and has also shown that a one-size fits all nudge does not work for everyone, with moderating factors influencing the effectiveness of the nudge. This study has also shown the need for further research on this nudge and nudging vegan food choicces in general. Because of the beneficial effects of a vegan diet on public health (Rocha et al., 2019; Turner-Mcgrievy et al., 2015; Turner-Mcgrievey et al., 2017), as well as the environmental benefits of a vegan diet (Garnet, 2016; Godfray et al., 2018; Milieucentraal, 2022), we hope that the current research will stimulate further investigation of this important area.

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Appendix A

Information Letter and Informed Consent

Beste deelnemer,

Bedankt voor je interesse in ons onderzoek over productkeuzes in de supermarkt. Dit onderzoek is onderdeel van een thesisonderzoek van de master Social, Health and Organisational Psychology aan de Universiteit Utrecht. Met dit onderzoek willen wij meer te weten komen over productkeuzes in de supermarkt. Hieronder vind je kort wat informatie over dit onderzoek.

Het onderzoek zal beginnen met een korte supermarkt taak. Je zult telkens een aantal producten in beeld zien. We vragen je om het product te kiezen dat je het meeste aanspreekt. Na deze supermarkt taak wordt je gevraagd om nog een aantal vragen in te vullen. Het zal je ongeveer 15-20 minuten kosten om het onderzoek te voltooien. We vragen je om alles naar waarheid in te vullen.

Alvast bedankt voor je deelname!

Vriendelijke groet,

Maartje Fens, Masterstudente aan de Universiteit Utrecht

Voorwaarden

Om mee te kunnen doen aan dit onderzoek moet je minimaal 18 jaar oud zijn. Je maakt gebruik van een telefoon, computer of tablet om mee te doen aan dit onderzoek. Zorg ervoor dat je niet gestoord wordt en dat je een stabiele internetverbinding hebt wanneer je deelneemt aan het onderzoek.

Deelname

Je deelname aan dit onderzoek is vrijwillig. Je kunt op elk moment zonder opgave van een reden en zonder consequenties je deelname aan dit experiment stopzetten. Gegevens die al zijn verzameld tot het moment van stoppen, kunnen worden gebruikt voor onderzoek. Deelname aan dit onderzoek heeft geen nadelen voor de participant. Er zijn geen risico’s verbonden aan deelname aan dit onderzoek.

Vertrouwelijkheid

Alle verzamelde informatie zal anoniem en vertrouwelijk behandeld worden. Het zal niet mogelijk zijn om de verzamelde data terug te leiden naar je persoonlijke identiteit. De data zal maximaal 10 jaar bewaard worden op de beveiligde server van de Universiteit Utrecht voor onderzoeksdoeleinden.

Mocht je vragen of problemen hebben wat betreft dit onderzoek mag je mij altijd een email sturen (m.m.fens@students.uu.nl). Ik probeer zo snel mogelijk te reageren.

□ Door dit vakje aan te vinken verklaar ik dat ik 18 jaar of ouder ben.

□ Door dit vakje aan te vinken ga ik akkoord met het volgende:

- Ik ben geïnformeerd over het onderzoek
- Ik heb de schriftelijke informatie gelezen.
- Ik heb de mogelijkheid gekregen om vragen te stellen over het onderzoek.
- Ik heb gelegenheid gekregen om over mijn deelname aan het onderzoek na te denken en die is geheel vrijwillig.
- Ik heb het recht om te allen tijde de toestemming die ik geef weer in te trekken en mijn deelname aan het onderzoek stop te zetten zonder opgaaf van redenen.

Debriefing Letter

Bedankt voor je deelname!

Je bent nu aan het einde gekomen van dit onderzoek. Hieronder nog wat korte informatie over het doel van dit onderzoek.

Het doel van dit onderzoek is om meer te weten te komen over het kiezen voor veganistische producten en de rol van de supermarktomgeving hier in. In het onderzoek ben je ingedeeld in één van de twee condities: (1) één conditie waarbij er geen aanpassingen zijn gedaan (controleconditie) en (2) één conditie waarbij een van de producten opvallender gemaakt is door het vergroten van interactie met het product.

We hebben gekeken hoe deze verandering het koopgedrag en de evaluatie heeft beïnvloed ten opzichte van de controle conditie. Daarnaast hebben we ook gekeken naar de invloed van voorkeur op het koopgedrag. We verwachten dat de deelnemers door middel van deze kleine aanpassing in de supermarktomgeving wat vaker kiezen voor het veganistische product in de supermarkt.

Mochten er vragen zijn na afloop van dit onderzoek kun je altijd mailen naar m.m.fens@students.uu.nl

Appendix B

Questionnaire (Dutch)

Questions before the supermarket task

- Wat is je geslacht?
    1. Man
    2. Vrouw
    3. Anders, namelijk… (vul in)
- Wat is je leeftijd? (vul in)
- Wat is je hoogst behaalde opleidingsniveau?
    1. Lagere school
    2. LBS/vso
    3. VMBO/MAVO
    4. HAVO/VWO
    5. MBO
    6. HBO
    7. Universiteit (Bachelor)
    8. Universiteit (Master)
    9. PHD of hoger

Questions after the supermarket task

De eerste vragen gaan over jouw mening over verschillende soorten eetpatronen:

- Een veganistisch eetpatroon (bij een veganistisch eetpatroon eten mensen geen dierlijke producten zoals vlees, melk, kaas, honing, etc.) is...
    1. Heel erg slecht – Heel erg goed
    2. Heel erg schadelijk – Heel erg nuttig
    3. Heel erg onaangenaam – Heel erg aangenaam
    4. Heel erg onplezierig – Heel erg plezierig
    5. Heel erg moeilijk – Heel erg makkelijk
- Een vegetarisch eetpatroon (hierbij wordt geen vlees gegeten, maar wel andere dierlijke producten zoals melk, kaas en honing) is...

1. Heel erg slecht – Heel erg goed
2. Heel erg schadelijk – Heel erg nuttig
3. Heel erg onaangenaam – Heel erg aangenaam
4. Heel erg onplezierig – Heel erg plezierig
5. Heel erg moeilijk – Heel erg makkelijk

- Een eetpatroon dat vlees bevat is...
    1. Heel erg slecht – Heel erg goed
    2. Heel erg schadelijk – Heel erg nuttig
    3. Heel erg onaangenaam – Heel erg aangenaam
    4. Heel erg onplezierig – Heel erg plezierig
    5. Heel erg moeilijk – Heel erg makkelijk

Nu volgen er een aantal vragen over de supermarkt taak.

- Hoe tevreden ben je met de productkeuzes die je tijdens de supermarkt taak hebt gemaakt?
    1. Heel erg ontevreden – Heel erg tevreden
- In welke mate ben je producten tegen gekomen die je in het dagelijks leven ook zou kopen?
    1. Helemaal niet – Heel veel
- De presentatie van de producten was...
    1. Heel erg onaantrekkelijk – Heel erg aantrekkelijk
    2. Helemaal niet uitnodigend – Heel erg uitnodigend
    3. Helemaal niet opvallend – Heel erg opvallend
- Het kiezen van de producten was...
    1. Heel erg moeilijk – Heel erg makkelijk
    2. Heel erg onplezierig – Heel erg plezierig

Nu volgen er een paar stellingen, geef voor elke stelling aan in hoeverre je het hiermee eens of oneens bent.

Hoe voelde je je toen je de producten koos? Ik voelde me: (helemaal oneens – helemaal eens)

- Aangemoedigd
- Betutteld
- Gestuurd
- Bekeken
- Serieus genomen

Dat waren de stellingen. Er volgen nu nog een paar laatste vragen.

- Volg je een specifiek dieet?
    1. Nee
    2. Vegetarisch
    3. Veganistisch
    4. Anders, namelijk… (vul in)
- Hoeveel honger had je voordat je aan de supermarkt taak begon?
    1. Helemaal geen honger – Heel veel honger
- Is er iets in deze supermarkt taak dat je is opgevallen?
    1. Nee
    2. Ja, namelijk… (vul in)

Appendix C

Vegan and non-vegan products used in the food choice task

Meat and meat replacements		Dairy and dairy replacements	
			
Minced meat	*Vegan Minced Meat*	*Milk*	*Vegan Milk*
			
Sausage	*Vegan Sausage*	*Custard*	*Vegan Custard*
			
Liver Sausage	*Vegan Liver Sausage*	*Butter*	*Vegan Butter*
			
Chicken Schnitzel	*Vegan Chicken Schnitzel*	*Cream Cheese and Herbs Dip*	*Vegan Cream Cheese and Herbs Dip*
			
Fish Sticks	*Vegan Fish Sticks*	*Ice Cream*	*Vegan Ice Cream*

Filler products used in the food choice task

Potato Croquettes

Potato Rostis

Green Soap Dish Soap

Seepje Dish Soap

2-Layered Toilet Paper

4-Layered Toilet Paper

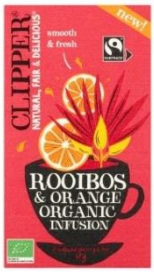
Red Grapes

White Grapes

Grapefruit Cleaner

Lavender Cleaner

Lemon and Ginger Tea



Rooibos Tea

Fuze Tea Ice Tea Green

Liptop Ice Tea Green

Natural Chips

Paprika chips

Laundry Detergent 'Pink Sensation'

Laundry Detergent original

Snack Tomatoes

Snack Cucumbers

Appendix D

Table 1A.

Descriptives and correlation coefficients for diet preferences, product presentation, product satisfaction, likely to buy again, product choice difficulty, product choice enjoyment and hunger.

	Mean (SD)	Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Condition	0.47 (0.50)	0-1														
2. Vegan diet preference	3.80 (1.04)	1-7	-.17	(.75)												
3. Vegetarian diet preference	4.71 (1.31)	1-7	-.06	.64*	(.84)											
4. 'Diet with meat' preference	4.60 (1.06)	1-7	.08	-.17	-.21*	(.78)										
5. Product satisfaction	5.01 (1.23)	2-7	.08	.06	.07	.23*										
6. Likely to buy again	4.91 (1.36)	2-7	-.07	.03	.02	.05	.40*									
7. Product presentation	4.72 (0.99)	2-7	.06	.09	.14	.12	.29*	.41*	(.83)							
8. Product choice difficulty	5.13 (1.36)	1-7	-.01	.02	.04	.16	.41*	.45*	.47*							
9. Product choice enjoyment	4.59 (1.30)	1-7	.07	.09	.13	.16	.40*	.39*	.64*	.49*						
10. Felt encouraged	4.16 (1.66)	1-7	.13	.04	-.03	.04	.22*	.22*	.38*	.11	.20					
11. Felt patronized	3.16 (1.61)	1-7	.01	.20*	.14	.01	-.04	-.26*	.03	-.12	-.01	.15				
12. Felt directed	4.22 (1.94)	1-7	-.08	.13	.07	-.07	-.18	-.25*	-.07	-.21	-.19	.09	.48*			
13. Felt like being watched	3.08 (1.90)	1-7	.14	.08	.03	.02	-.12	-.19	-.01	-.02	-.087	-.02	.36*	.26*		
14. Felt taken seriously	4.49 (1.38)	1-7	.08	-.08	-.09	.11	.18	.23*	.29*	.23	.30*	.31*	-.11	-.11	-.05	
15. Hunger	20.98 (24.12)	0-100	.03	-.00	-.02	.10	-.07	.03	.19	.06	.10	.15	-.02	-.10	-.04	.07

Note. Cronbach's alphas are shown in the diagonal. $n = 158$. * $p < .01$

Table 1B.

Descriptives and correlation coefficients for likeability of the nudge animation and recognition in nudge animation.

	Mean (SD)	Range	1	2
1. Likeability of the nudge animation	3.34 (1.36)	1-5		
2. Recognition in nudge animation	2.01 (1.01)	1-5	.51*	

Note. $n = 74$. * $p < .01$