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DOI
10.1080/17524032.2021.1943700

Publication date
2022

Document Version
Final published version

Published in
Environmental Communication

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ENVIRONMENTAL COMMUNICATION
2022, VOL. 16, NO. 1, 1–22
https://doi.org/10.1080/17524032.2021.1943700

Routledge
Taylor & Francis Group

RESEARCH ARTICLE

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Stimulating Sustainable Food Choices Using Virtual Reality: Taking an Environmental vs Health Communication Perspective on Enhancing Response Efficacy Beliefs

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ABSTRACT

Personal response efficacy beliefs are vital in instigating, maintaining, and catalyzing environmental behavior change. In this experimental study (N = 249), we investigated whether such efficacy beliefs could be stimulated using Virtual Reality. In a VR-supermarket, participants would see interactive pop-ups displaying *impact messages* when they picked up products, these are messages that display the (environmental or health) impact of a product. Our results show that these impact messages are effective in stimulating personal response efficacy beliefs and subsequently pro-environmental food choices. The heightened personal response efficacy beliefs positively affected maintaining and catalyzing behavior change (i.e. positive spill-over) up to two weeks after the VR-experience. The effectiveness of the impact messages did not depend on appeal type (health vs environmental appeal) or modality (text + visual vs text only) of the message. Theoretical and practical implications are discussed.

ARTICLE HISTORY
Received 28 January 2021
Accepted 10 June 2021

KEYWORDS
Virtual reality; experiment; behavior change; environment; health

1. Introduction

Environmental problems, like climate change, deforestation, and pollution are largely rooted in human behavior. Food consumption plays a particularly large role in this (Poore & Nemecek, 2018). For example, the consumption of palm oil leads to deforestation and biodiversity loss; pesticide use for growing crops has detrimental effects on ecosystems; air freight vegetables contribute more to climate change than local, in-season vegetables, and food packaging contributes to the plastic pollution (Jungbluth et al., 2000; Vijay et al., 2016). The influence of food consumption on the environment is illustrated by estimations that about 26% of the global greenhouse gas emissions is due to food consumption (e.g. life stock, crop production, supply chains; Poore & Nemecek, 2018). Changing people's food choices may, therefore, have a large positive effect on the environment and fighting climate change.

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Supplemental data for this article can be accessed at https://doi.org/10.1080/17524032.2021.1943700.
This article has been corrected with minor changes. These changes do not impact the academic content of the article.

Instigating environmental behavioral change so to limit environmental problems has, however, proven to be challenging. One particular important barrier is low personal response efficacy beliefs (i.e. the belief that one is able to contribute to the solution of a problem; Bandura, 1977). That is, environmental problems are not always directly observable due to the psychological distance between oneself and (the solution of) environmental problems; there might be physical distance involved (e.g. observing Australian fires in the news in Europe), the environmental problems might not be easily visible (e.g. microplastics in the ocean; CO_2 in the atmosphere), the consequences might not emerge until a later point in time (e.g. climate change), or it is unclear how people's individual behavior affects environmental problems altogether (Fauville et al., 2020; Van der Linden et al., 2015). These barriers often lead to low personal response efficacy beliefs, therefore hindering the engagement in pro-environmental behavior (Van der Linden et al., 2015; Weber, 2006). Since scholars suggest that personal response efficacy beliefs are an important predictor of both behavior change and maintenance of behavior change (Koletsou & Mancy, 2011), we aim to increase personal response efficacy beliefs by using Virtual Reality (VR).

Specifically, we investigate how personal response efficacy beliefs can be enhanced by providing people with information on the environmental impact of their product choices in a VR-supermarket. By providing this information in an interactive pop-up at the point of purchase and at the moment that people make a purchase decision, the link between people's food purchases and their environmental impact will be clearer. Consequently, we expect that this increases personal response efficacy beliefs and, as a result, pro-environmental food choices (Ahn et al., 2014; Ahn et al., 2015; Bandura, 1977; Meijers, Remmelswaal, et al., 2019). Additionally, we investigate what message characteristics make impact messages especially effective in (1) influencing specific pro-environmental food choices (i.e. palm oil free, locally produced products) within the VR-supermarket (*instigating* behavior change), (2) influencing specific pro-environmental food choices (i.e. palm oil free, locally produced products) while grocery shopping in the subsequent weeks in regular supermarkets (*maintaining* behavior change), and (3) environmentally friendly food shopping in general (e.g. purchasing eco-labelled food) in the subsequent weeks in regular supermarkets (spill-over or *catalyzing* behavior change).

2. Theoretical framework

2.1. Providing impact messages in VR

Although most people care about the environment, they do not always act accordingly, which can be partially explained by low response efficacy beliefs (Cojuharenco et al., 2016; Doherty & Webler, 2016; Ellen et al., 1991; Lam, 2006; Rogers, 1975). People often believe that their pro-environmental behavior is like a drop in the ocean because it typically has no immediate, noticeable consequences. Behavioral change theories like Social Cognitive Theory, the Extended Parallel Process Model, and Protection Motivation Theory and numerous empirical studies emphasize that personal response efficacy beliefs are vital for instigating pro-environmental behavior (Bandura, 1977; Bockarjova & Steg, 2014; Rogers, 1975; Witte, 1992). So, in order to stimulate pro-environmental behaviors, it is important to heighten people's response efficacy beliefs.

We posit here that observing how one's own behavior affects the environment ("if I engage in this behavior, this will have positive effects on the environment") enhances personal response efficacy beliefs as it lessens the psychological distance between the cause (someone's behavior) and the effect (environmental problems). To achieve this, we use *impact messages*, which we define as messages that make the consequences of one's actions observable in the here and now. Examples of impact messages are using VR to fast-forward how an avatar gains weight over the course of the years when drinking sugar-sweetened beverages daily (Ahn, 2015), illustrating the impact of one's car driving style on the environment by seeing either a tree flourishing when one drives slowly or a tree dying when one speeds up (Dahlinger et al., 2018), or making the

heat loss visible in one's house in the here and now with thermal messages – something that would be otherwise be unobservable (Goodhew et al., 2015). Such impact messages thus provide the possibility to envision and visualize possible future or physical distant events and unobservable events in the here and now.

Previous research shows that using impact messages to visualize the concrete, future consequences of people's behaviors increases people's response efficacy beliefs (Ahn, 2015; Ahn et al., 2015; Meijers, Remmelswaal, et al., 2019). For example, research shows that when people experience how they can nurture a seedling into a grown-up tree in VR (while hearing birds chirp as an enhancement of how trees add to biodiversity), they have stronger personal response efficacy beliefs and show more pro-environmental behavior than when not having such a VR-experience (Ahn et al., 2015). Another study shows that when people see visuals of how recycling clothes could help dress other people on a clothing recycling bin, they have stronger personal response efficacy beliefs and report more recycling intentions than when seeing a regular clothing recycling bin (Meijers, Remmelswaal, et al., 2019). Thus, seeing in real time how their behaviors impact the environment shows people that their behavior *can* make a difference, as such increasing personal response efficacy beliefs (Ahn, 2015; Ahn et al., 2015; Meijers, Remmelswaal, et al., 2019). To achieve such a real time experience of how people's food consumption affects the environment, we will incorporate impact messages in a highly realistic VR setting.

In a VR-supermarket we will test whether observing the consequences of one's food choices via impact messages instigates personal response efficacy beliefs and consequently more pro-environmental behavior than not seeing these consequences. By having such impact messages pop up at the moment people are making a product choice, the decision process can be intervened by having people directly observe the environmental impact of their behaviors, making the cause–effect link clearer. We therefore hypothesize that seeing the behavioral impact of one's food choices in VR via impact messages will lead to more environmentally friendly food choices (Hypothesis 1). Since impact messages will likely increase personal response efficacy beliefs, we hypothesize that the positive effect of impact messages on environmentally friendly (i.e. palm oil free, locally produced) food choices is mediated by personal response efficacy beliefs (Hypothesis 2).

2.2. Environmental versus health appeals

Since environmental problems constitute a collective problem, not only personal response efficacy beliefs might be of importance, but also collective response efficacy might be a necessary pre-requisite for instigating pro-environmental behavior (Homburg & Stolberg, 2006). Pro-environmental behavior constitutes a social dilemma: while the costs are for the individual, the benefits will be reaped by the collective (van Dam & Fischer, 2015). This is even further complicated by the fact that the actions of one individual are unlikely to make a change, but that the impact rather depends on the behavior of the collective and governments (Feldman & Hart, 2016; Fritsche et al., 2018; Jugert et al., 2016). Thus, foregoing one's favorite biscuits because they contain palm oil puts the individual at a disadvantage, but may benefit the collective in the long run – yet, only when many other people make similar pro-environmental choices. So, even when observing the positive consequences of one's pro-environmental food choices on the environment, people may feel reluctant to engage in pro-environmental behavior because the positive effects are contingent on the behaviors of others and constitute collective rather than personal benefits (Doran et al., 2015; Jugert et al., 2016). To conclude: when it comes to stimulating pro-environmental behavior, personal response efficacy is important, but it might not be enough (Chen, 2015; Doran et al., 2015; Reese & Junge, 2017).

In contrast to environmental problems, health problems are mostly seen as personal problems (e.g. eating saturated fat is bad for one's arteries, exercising too little may lead to weight increase, and smoking may lead to lung diseases). Personal response efficacy beliefs might therefore play a larger role in the health rather than the environmental domain. As such, it may be beneficial to

try to tackle environmental problems caused by food choices by using messages with a health rather than environmental appeal, in this case showing the effect of specific food purchases on one's health rather than on the environment. This is possible, as recent research shows that food choices that are environmentally friendly are generally also healthy (Clark et al., 2019). For example, palm oil is detrimental to the environment because of deforestation and the accompanying effects on biodiversity loss and climate change, but it is also unhealthy as it contains rather high amounts of saturated fats (Corciolani et al., 2019; Guadalupe et al., 2019; Koh & Wilcove, 2007; Reijnders & Huijbregts, 2008; USDA, 2020).

In line with this idea to focus on health rather than environmental benefits, a recent meta-analysis showed that while environmental considerations play a role in organic food consumption, health is people's main motivation to opt for organic food (Rana & Paul, 2020). Cross-sectional research also indicates that health motivations play a large role in food consumption patterns that might additionally benefit the environment, like eating less meat (Zur & Klöckner, 2014) and reducing the use of palm oil (Verneau et al., 2019). Nonetheless, there is little research comparing the impact of health vs. environmental messages on food consumption. The few studies looking into the effects of health vs. environmental messages find rather mixed effects, with some showing that health messages might be more effective in stimulating environmentally friendly food choices (Palomo-Vélez et al., 2018), while others show that both types of messages are equally effective (Carfora, Catellani, et al., 2019; Carrico et al., 2018; Kareklas et al., 2014; Vainio et al., 2018). So far, it is unclear why these mixed findings arise. We will, therefore, investigate to what extent environmental vs. health messages influence environmentally friendly food choices and how response efficacy plays a role in this. We expect that both environmental and health impact messages may stimulate personal response efficacy beliefs and consequently lead to more environmentally friendly food choices than a control message. However, we expect that health impact messages may lead to more environmentally friendly food choices than environmental impact messages through a stronger relationship between personal response efficacy beliefs and food choices in the health vs the environmental domain (Hypothesis 3). Furthermore, we expect that collective response efficacy beliefs are more important than personal response efficacy beliefs in the environmental realm, but not in the health realm (Hypothesis 4).

2.3. The role of vividness

Next to the influence of the message appeal (environment vs. health), we will study the influence of the vividness of the message, as research shows that it is not only of importance what message is delivered, but also how it is delivered (McQuarrie & Mick, 1996). Vivid messages are described as messages that provide concrete information, provoke imagery, and/or are emotionally interesting (Nisbett & Ross, 1980 in Bailey et al., 2015). Research shows that vivid messages grab attention, stimulate elaboration, and may be processed more easily, therefore, being more persuasive and effective than non-vivid messages (Dillard & Main, 2013; Guadagno et al., 2011; McQuarrie & Mick, 1996; Petty & Cacioppo, 1986). Furthermore, research suggests that vivid messages may make abstract concepts more concrete and proximate than non-vivid messages (Bailey et al., 2015; Nisbett & Ross, 1980), which might be especially useful for an abstract concept as environmental problems.

One way to achieve vividness is by including visuals (vs. text only) in a message (Bailey et al., 2015). The effectiveness of visual messages has been shown in a number of studies and visualization has been posited as a powerful tool by scholars for raising awareness for environmental problems and addressing such problems (O'Neill et al., 2013; Sheppard, 2005). For example, a VR study showed that when linking taking showers with coal use (for the transportation and heating of the water) the participants used cooler water when asked to wash their hands during the experiment when they were exposed to a vivid, visual message than when exposed to a non-vivid, textual message – although the same amount of water was used (Bailey et al., 2015). Based on previous research

on the influence of vividness, we expect that vivid messages lead to more environmentally friendly food choices than non-vivid messages (Hypothesis 5).

2.4. Maintaining behavioural change: longevity

Instigating environmentally friendly food choices is a good start, but to really make a sustainable environmental contribution, it is of great importance that people continue to make environmentally friendly food choices in daily life and might even take up a range of pro-environmental behaviors. As response efficacy beliefs play an important role in both instigating and maintaining behavioral change (Koletsou & Mancy, 2011), we investigate whether the VR-experience will also affect daily grocery shopping behavior during the subsequent weeks in the regular supermarket. Previous research has shown that VR-experiences might affect behavior also in daily life (Ahn et al., 2015). For example, reading a pamphlet on the effect of sugar sweetened beverages on gaining weight coupled with seeing in VR how sugar sweetened beverages affect one's weight over time led to drinking less sugar sweetened beverages a week later compared to reading a pamphlet only (Ahn, 2015). In the current study, we will investigate whether observing behavioral impact messages in VR will stimulate environmentally friendly (i.e. palm oil free, locally produced) food choices in the two weeks after the experiment (Research Question 1).

2.5. Catalyzing behavioural change: spill-over

Lastly, we will investigate spill-over effects, that is whether the VR-experience affects pro-environmental food choices in general in the subsequent weeks (e.g. such that people not only purchase more palm oil free products, but also purchase less meat). Previous research has shown that the engagement in one pro-environmental behavior, might affect the engagement in other pro-environmental behavior (Capstick et al., 2019; Nilsson et al., 2017; Truelove et al., 2014). For example, purchasing green products may increase the support for wind power policies (Thøgersen & Noblet, 2012; Willis & Schor, 2012). These so-called positive spill-over effects might, however, also have negative equivalents (e.g. moral licensing), such that up taking a pro-environmental behavior, negatively affects other pro-environmental behaviors (Alcock et al., 2017). For example, consuming less water might actually increase electricity consumption (Tiefenbeck et al., 2013) and purchasing organic clothes might decrease environmental behavioral intentions (Meijers, Noordewier, et al., 2019). Next to research finding positive and negative spill-over effects, however, there has also been research finding no evidence for spill-over effects, such that bringing one's own bag to the supermarket, does not lead to recycling more (or less) household waste (Poortinga et al., 2013). Recent qualitative research suggests that low response efficacy beliefs may partially account for negative spill-over effects (Hope et al., 2018). By explicitly stimulating people's personal response efficacy beliefs via impact messages in VR, we may also provide quantitative evidence for personal response efficacy beliefs being able to explain current mixed findings. Therefore, we investigate whether and how the impact messages in the VR-experience affect more environmentally friendly grocery shopping (e.g. eco-labelled food) in the two subsequent weeks and how personal response efficacy beliefs play a role in this (Research Question 2).

2.6. The current study

The current study will investigate if people can be stimulated to make more environmentally friendly food choices by providing them with impact messages in VR. By doing so, this study will add to the literature in a number of ways. First, the current study uses a novel approach by providing people with impact messages that pop up at the time of decision making, as such intervening the decision-making process *just in time* to stimulate more environmentally friendly food choices.

Furthermore, the study adds to the behavioral change literature by looking at specific message characteristics that may be especially effective in facilitating behavior change. That is, the study adds to the limited research that experimentally compares the effectiveness of environmental versus health messages (Bertolotti et al., 2016; Carfora, Bertolotti, et al., 2019; Palomo-Vélez et al., 2018; Vainio et al., 2018), as most studies so far are of cross-sectional nature and investigated participants' motivation for engaging in food purchasing behavior related to the environment rather than testing the effectiveness of messages on actual behavior. Additionally, the knowledge on impact messages will be enhanced by investigating whether encompassing visualizations is a prerequisite for the effectiveness of impact messages, or whether less vivid messages with text only could be just as effective (Bailey et al., 2015). Furthermore, it will provide more insights in the role of communication in generating spill-over effects in the environmental domain and the processes underlying these spill-over effects, thereby extending the few previous studies on this subject (Lauren et al., 2019).

Importantly, the study stands out among the limited number of existing environmental VR studies as most environmental VR studies so far focused on fostering environmental awareness (e.g. awareness of environmental problems effecting the ocean; for a review see Fauville et al., 2020). Moving beyond fostering awareness and focusing on changing behavior and its underlying mechanisms of behavior change will greatly add to the field. In addition, the few studies that focused on behavioral change mostly measured behavioral intentions, which usually only shows moderate correlations with actual behavior (Klöckner, 2013). So, the fact that behavior will be measured over time will further develop our understanding of the effectiveness of environmental VR – especially since the same review by Fauville et al. (2020) indicated that it is unclear how long VR-induced behavioral changes will last. Also, the environmental VR behavior change studies published so far mostly focused on environments that people are unlikely to encounter in daily life or on behaviors that people are unlikely to execute regularly. For example, one environmental VR study was set in a forest where people either water or cut down a tree to make a link with paper consumption (Ahn et al., 2015). In contrast, the current study links the VR-experience (i.e. in a supermarket) to everyday, real-life behavior (i.e. grocery shopping). Therefore, it is expected that desirable behavior adopted within the VR-supermarket more easily translates into actual everyday behavior, as it has been shown in earlier studies that purchasing behavior in VR-supermarkets is rather similar to purchases in real supermarkets (van Herpen et al., 2016; Waterlander et al., 2015). Lastly, by providing information in interactive pop-ups before the decision is made, rather than showing the impact after the behavior has been executed (as is often the case in the current VR studies), chances are higher that people can adapt their choices in time for make more environmentally friendly choices.

3. Method

We tested our hypotheses in a VR-supermarket (Figure 1), as virtual reality can provide an interactive, immersive, and personally relevant experience of how people's food choices influence the environment (Ahn, 2015; Ahn et al., 2015; Bailey et al., 2015; Fauville et al., 2020). Furthermore, in contrast to a real-life supermarket, a VR-supermarket provides more experimental control as possible confounding variables (e.g. other people purchasing a certain product, pricing, in-store communication/advertising, etc) can be kept constant. Please see OSF for the data, questionnaires, and a short movie of the experimental set-up.

3.1. Participants and design

Participants were recruited via the university's subject pool of a Dutch university and were randomly assigned to the conditions of a $2 \times 2 \times 3$ mixed factorial design with a control condition. Impact message appeal type (health vs. environment) and vividness (low vs. high) were between-subject factors and assessment time was a within-subject factor (questionnaires were administered at three time

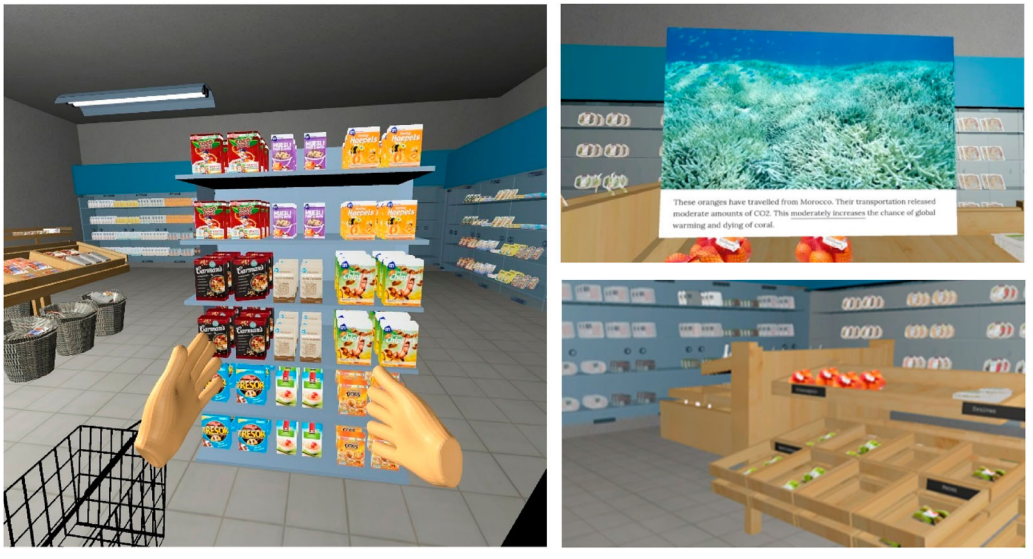

Figure 1. Impressions of the virtual supermarket the *Virtumart*, copyright Nynke van der Laan and a pop-up in the VR-supermarket, copyright iStock.

points spaced one week apart). We also included a hanging control condition (*factual product information*). Participants thus shopped in one of the five versions of the VR-supermarket and received two follow-up questionnaires. Using G*Power (Faul et al., 2007), we calculated the desired sample size of $N = 200$ for five conditions (based on a medium effect size $f = 0.25$, alpha = .05, power = .80). Given the longitudinal design, we accounted for 20% of attrition and thus aimed at sampling 250 participants. In total, 249 participants ($M_{age} = 21.56$, $SD = 3.48$; 77.1% female, 22.5% male, 0.4% other) participated in the study in exchange for either course credits or a monetary compensation of ten euros. Most participants had completed upper secondary education (needed to be able to enter at Bachelor level; 66.3%) and 22.9% of the participants had finished their Bachelor. Most participants lived with one or two roommates (45.8%) or alone (37.3%). Participants provided informed consent and the study was approved by the university's Ethical Review Board.

3.2. VR-Apparatus

An HTC Vive set was used, which consists of one VR-headset, two controllers, and two base stations. The controllers simulated the participants' hands in order to make the VR-experience feel as realistic as possible. Furthermore, the controllers enabled the participants to pick up products, and teleport through the VR-supermarket. The base stations enabled the participants to walk through the supermarket – as long as the participants stayed within the dedicated area, which was indicated with a grid that appeared when participants approached the edges of the area. Next, the participants could practice how to handle the controllers during a test round in the VR-supermarket. In this study, Unity (version 5.6.0f3) was used to run the VR-application, the immersive VirtuMart. The VirtuMart was developed in Blender/Unity3D, has been previously used in research (Hoenink et al., 2020; Van der Laan et al., 2018), and was adapted for the current study.

3.3. Procedure

Participants came into the lab for participating in the experiment. The participants were provided with a short instruction on the VR-equipment, how to use the controllers, and were informed that

during the VR-experience they could walk freely within the market, a dedicated area in the lab room. All participants were then assisted with putting the VR-headset on and took a practice round, in which they were asked to walk through the supermarket, choose a test product, and place it into a shopping basket.

After completing this practice round, participants were first instructed (while being in the VR-supermarket) to find the shopping list located on the wall of the supermarket, which included the following four product categories: *fruit, vegetables, fruit biscuits,* and *sauces*. Participants were informed that in this supermarket each product category always had six product options to choose from, and for each category they had to pick one option. Before participants could make their final selection, they first had to pick up each option in that category. By picking up a product, a pop-up with the impact message would automatically appear. Participants were instructed to carefully look at each pop-up and impact message, before making their final decision. Next, they had to put their product of choice in one of the shopping baskets. They had to repeat this process for each of the four product categories. To mimic real-life supermarkets and make the VR-experience feel as realistic as possible, relaxing, low-tempo music was played while the participants were performing the tasks. Immediately after completing the tasks in the VR-supermarket, the participants were instructed to fill out the first questionnaire, which assessed personal and collective response efficacy beliefs, the manipulation check and demographic variables.[1] After completion of this questionnaire, they were reminded that they would receive a second and third questionnaire via email one and two weeks later. These follow-up questionnaires assessed the extent to which behavior change was maintained and catalyzed, after these follow-up assessments, participants were debriefed. All materials were in English.

3.4. Stimuli

Once participants picked up a product in the supermarket, a pop-up with information would appear (see Figure 2). This was either information on the country of origin (fruits and vegetables) or on the presence of palm oil in the product (sauces and fruit biscuits). We opted for palm oil as the production of palm oil leads to deforestation and the accompanying effects on biodiversity loss and climate change, therefore posing a great environmental threat, whereas at the same time it is regarded as unhealthy as it contains rather high amounts of saturated fats (Corciolani et al., 2019; Guadalupe et al., 2019; Koh & Wilcove, 2007; Reijnders & Huijbregts, 2008; USDA, 2020). Furthermore, we opted for local fruits and vegetables as a shorter food miles distance can have positive environmental effects by decreasing the amount of greenhouse gas emissions, especially when a product is in-season, and that such lower amounts of greenhouse gas emissions have a positive effects on air quality and public health (Hoolohan et al., 2013; West et al., 2013). The information was either given textual (low vividness conditions) or as text with an accompanying image (high vividness conditions, cf. Bailey et al., 2015).

Figure 2. Example of the low, medium, and high environmental, vivid impact pop-ups. Copyright Mark Bowler/naturepl.com; Mighty Earth; Greenpeace/Ulet Ifansasti.

For the environmental appeals, a pop-up would appear with information on how palm oil leads to deforestation or how food miles add to CO_2 emissions and thus negative climate change consequences illustrated by coral bleaching. For the health appeals, a pop-up would appear with information on how palm oil is bad for one's health due to saturated fat and may pose a risk for arteries and heart diseases and how transportation of food might add to air pollution and may pose a risk for lung diseases. In total, there were six products within a category, two with a low, two with a medium, and two with a high environmental/health impact. Information in the control condition would show information that can be normally seen on the product. For fruits and vegetables this was country of origin, for sauces and fruit biscuits this was the ingredient list.

3.5. Measurements T1, T2, and T3

3.5.1. Personal and collective response efficacy

Participants were asked about their personal and collective response efficacy beliefs concerning palm oil and locally produced food on a scale from (1) *strongly disagree* to (7) *strongly agree* (T1). For personal response efficacy, participants were asked to what extent they thought they could personally contribute to a better environment and health by purchasing palm oil free or locally produced products (3 items each), for example: *When I purchase palm oil free products, I can contribute to solving environmental issues* and *Choosing locally produced products has a positive impact on my health.* For collective response efficacy, participants were asked to what extent they thought "we" could contribute to a better environment and health by purchasing palm oil free or locally produced products (3 items each), for example: *It helps if everyone chooses palm oil free products, because together we are able to protect the environment* and *It has a positive impact on my health, if everyone chooses locally produced products* (cf. Jugert et al., 2016; Reese & Junge, 2017). For both personal and collective response efficacy, we created an index concerning the environmental [health] response efficacy for the environmental [health] conditions, for the control condition we created an index of health as well as environmental response efficacy. To be able to compare the personal and collective response efficacy regarding the environment, health, and both, we standardized the indices. For an overview of the items, Cronbach's alfa's, Means, and Standard Deviations, see Table A1 in Appendix 1.

3.5.2. Instigating behaviour change

In the VR-supermarket (T1), participants chose four (two regarding palm oil, two regarding food miles) products with either a low (2), a medium (1), or a high negative impact (0) for the environment or their health. We summed participants' choices leading to a 0–8 scale reflecting environmentally unfriendly – environmentally friendly product choices.

3.5.3. Maintaining behaviour change

In the follow-up surveys (T2, T3), we asked participants how often they went shopping for groceries during the past week. Then we asked how often their purchasing decisions were influenced by whether the product contained palm oil or was locally produced, of the number of times they previously indicated that they went shopping, with participants answering on a scale from 1 (*Never*) to 5 (*Always*). The correlation between the purchasing decision regarding palm oil and local production were sufficiently high to create an index score ($r = .51$ at T2 and $r = .53$ at T3).

3.5.4. Catalyzing behaviour change

Furthermore, we asked how often their purchasing decisions during grocery shopping were influenced by environmental information on the product packaging (*1 = Never, 5 = Always*), to exploratively investigate whether impact messages would influence general environmental product choices while grocery shopping (i.e. not limited to palm oil free product and food mileages, thus spill-over).

3.5.5. Manipulation check

To check whether the manipulation was successful, participants were asked to what extent they thought that the impact of purchasing certain products on their health and on the environment was communicated and whether they thought that the information presented in the pop-ups was vivid (*1 = Strongly disagree, 7 = Strongly agree*).[2]

3.5.6. Perceived realism

Lastly, to check whether the participants perceived the VR-supermarket as realistic and bought similar products as they would normally do, we asked them *How real did the virtual world seem to you?* (*1 = Not real at all, 7 = Completely real, M* = 4.77, *SD* = 1.27) and *To what extent did you buy products in the VR-supermarket that you would normally buy?* (*1 = Not at all, 7 = A great deal, M* = 5.20, *SD* = 1.25). As the means illustrate, the VR-supermarket seemed rather realistic to the participants and they bought similar products as in the regular supermarket.

4. Results

4.1. Randomization check

To test whether the randomization was successful, we investigated whether the participants in the five conditions differed pertaining age and gender. The results showed that the participants did not differ regarding age across conditions $F(4, 248) = 0.32$, $p = .865$, $\eta_p^2 < .01$, nor with regard to gender $\chi^2\ (8) = 9.47$, $p = .304$. The randomization thus succeeded.

4.2. Manipulation check

To test whether the participants in the environmental [health] conditions reported seeing environmental [health] information on the pop-ups, we ran two ANOVA's. The ANOVA's showed that participants in the health conditions indeed reported that the pop-ups contain more health related information, $F(4, 249) = 35.07$, $p < .001$, $\eta_p^2 = .37$ and those in the environmental conditions, more environmental information, $F(4, 244) = 24.43$, $p < .001$, $\eta_p^2 = .29$ (a post-hoc Tukey test showed that the conditions all differed significantly as intended, with all *p-values* $\leq .020$; please see Supplemental Materials for Means and SDs). Another ANOVA tested whether the textual-visual pop-ups was seen as more vivid than the textual and control pop-ups. The ANOVA showed unexpectedly no differences between conditions, $F(4, 249) = 1.63$, $p = .166$, $\eta_p^2 = .03$ (see Supplemental Materials for Means and SDs). The manipulation regarding impact appeal thus was successful but the vividness manipulation was not.

4.3. Instigating behavior change

First we tested whether seeing impact messages leads to more environmentally friendly food choices in the VR-supermarket (i.e. locally produced, palm oil free) than not seeing such messages (H1), and whether this effect is mediated by personal response efficacy beliefs (H2), using PROCESS mediation Model 4 (5000 bootstraps, Hayes, 2013). The results confirmed that impact messages popping up at the moment of decision making, led to more environmentally friendly food choices in the VR-supermarket, $F(4, 241) = 16.80$ $p < .001$, $r^2 = .20$, where the control condition significantly differed from all other conditions ($p < .001$, see Figure 3).

As expected, the mediation models showed that the positive effect of the impact messages was mediated by an increase in personal response efficacy for all four conditions (health textual indirect effect = $B_{boot} = 0.18$; $se_{boot} = 0.09$; $CI_{boot} = 0.03–0.37$; health textual + visual indirect effect = $B_{boot} = 0.21$; $se_{boot} = 0.09$; $CI_{boot} = 0.05–0.38$; environmental textual indirect effect = $B_{boot} = 0.15$; $se_{boot} = 0.08$; $CI_{boot} = 0.02–0.32$; environmental textual + visual indirect effect = $B_{boot} = 0.16$; $se_{boot} = 0.08$;

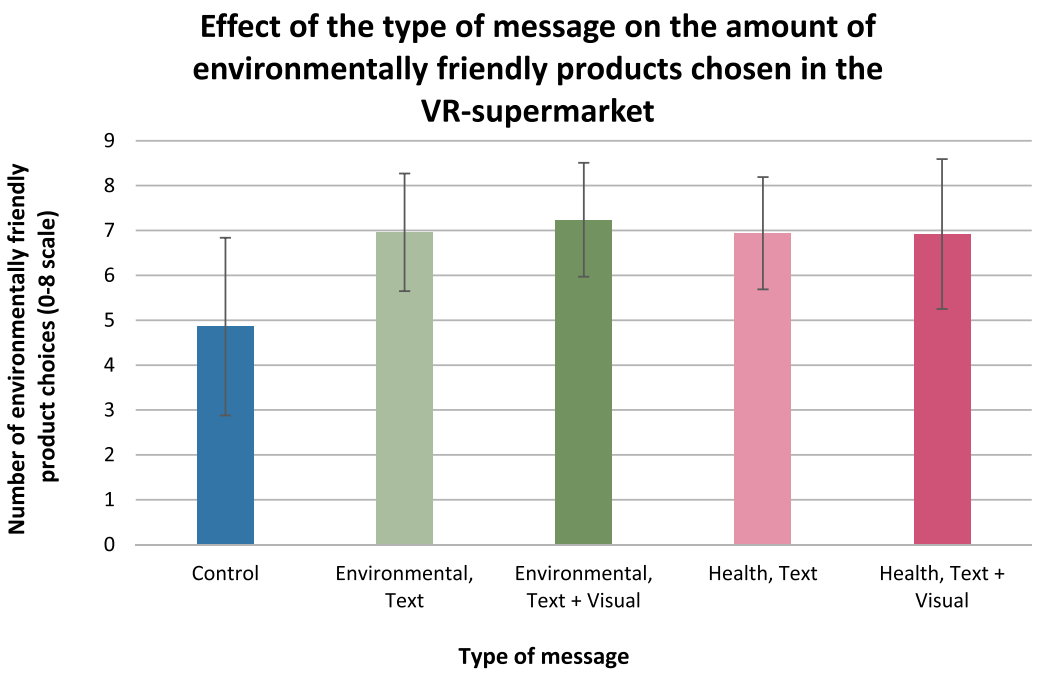

Figure 3. Figure demonstrates the mean amount of environmentally friendly products chosen in the VR-supermarket (0 indicates least environmentally friendly, 8 indicates most), for each of the five experimental conditions. Error bars represent standard deviations.

CI_{boot} = 0.03–0.34; see Supplemental Materials for full analyses). That is, all four impact message conditions led to an increase in personal response efficacy, which consequently led to an increase in more environmentally friendly (palm oil free and locally produced) food choices in the VR-supermarket (see also Supplemental Materials).

4.3.1 The role of personal vs. collective response efficacy in the health vs. environmental realm in behavior change

When it comes to H3 (health impact messages being more effective than environmental impact messages as the relation between personal response efficacy and behavior change in the health realm is stronger than in the environmental realm), there seems to be no evidence for this, as all four impact message conditions are equally effective. To formally test this, we conducted a moderation analysis, using PROCESS Model 1 (5000 bootstraps, Hayes, 2013), with the four experimental conditions. Personal response efficacy (standardized) was used as the independent variable, domain (health vs. environment) as the moderator and product choices in the VR-supermarket as the dependent variable. The results show that the relationship between personal response efficacy and product choices is not dependent on whether the impact was framed as a health vs environmental impact (interaction effect B = -.31, se = .21, $t = -1.46$, $p = .147$, CI = -.72 to .11), thereby rejecting H3, please see the Supplemental Materials for more details.

To test H4 (collective response efficacy beliefs are more important than personal response efficacy beliefs, but only in the environmental and not in the health domain) we ran two OLS regressions. The first OLS regression compared the influence of personal and collective response efficacy on products choices in the VR-supermarket in the environmental realm, by using the control and environmental appeal conditions. The results showed that collective response efficacy beliefs indeed were a larger predictor for product choices ($\beta = .25$, $p = .037$) than personal response efficacy beliefs in the environmental realm ($\beta = .06$, $p = .640$, Model: $F(2, 147) = 6.78$, $p = .002$, R^2

= .08, Cohen's f^2 = .09). The second OLS, when using the control and health appeal conditions, showed the reverse was true for the health realm: then personal response efficacy beliefs were a larger predictor for product choices in the VR-supermarket (β = .30, p = .002) than collective response efficacy beliefs (β = .08, p = .460, Model: $F(2, 146) = 10.19$, $p < .001$, $R^2 = .12$, Cohen's $f^2 = .14$). In sum, collective response efficacy beliefs play an important role in food choices when framed in an environmental rather than a health context, thereby supporting H4, please see the Supplemental Materials for more details.

4.4. Maintaining behavior change: longevity

To see whether the positive effect of seeing impact messages in the VR-supermarket on making more environmentally friendly product choices (i.e. palm oil free, locally produced) would sustain in daily life grocery shopping (RQ1), we ran mediation Model 4 (5000 bootstraps, Hayes, 2013) with self-reported behavior at T2 and T3 (only looking at those participants who shopped one time or more that week) and personal response efficacy beliefs (standardized) as mediator. The analysis showed that there were no direct effects of the impact messages on product choices at T2 ($F(4, 231) = 0.30$, p = .877, R_{change} = .004) or T3 ($F(4, 221) = 0.56$, p = .691, R_{change} = .009). Seeing impact messages in the VR-supermarket, did thus not directly lead to more environmentally friendly product choices while doing groceries in daily life (see Supplemental Materials for Means and SDs and full analyses) (Table 1).

The analysis did reveal significant indirect effects of the impact messages on product choices assessed at T2, mediated by an increase in personal response efficacy. That is, all four impact message conditions led to an increase in personal response efficacy, which consequently led to an increase in

Table 1. Means and standard deviations of the mediator and dependent variables differentiated by condition.

	Personal (T1)		Collective (T1)	
Response efficacy beliefs	*M*	(*SD*)	*M*	(*SD*)
Control	−0.31	0.80	−0.14	0.87
Health, text	0.28	0.90	0.16	1.04
Health, text + visual	0.35	1.00	0.14	0.99
Environment, text	0.19	0.85	0.24	0.71
Environment, text + visual	0.21	0.94	0.12	0.87
Instigating behavioral change	(T1)			
	M	(*SD*)		
Control	4.86	1.98		
Health, text	6.94	1.25		
Health, text + visual	6.92	1.67		
Environment, text	6.96	1.31		
Environment, text + visual	7.24	1.27		
Maintaining behavioral change: Longevity	(T2)		(T3)	
	M	(*SD*)	*M*	(*SD*)
Control	1.89	1.01	2.26	1.08
Health, text	1.93	1.17	2.28	1.10
Health, text + visual	1.90	1.06	2.13	1.05
Environment, text	1.87	0.88	2.19	0.94
Environment, text + visual	1.97	1.05	2.31	1.13
Catalyzing behavioral change: Spill-over	(T2)		(T3)	
	M	(*SD*)	*M*	(*SD*)
Control	2.53	1.16	3.04	1.22
Health, text	2.37	1.14	3.35	1.27
Health, text + visual	2.58	1.15	3.56	1.13
Environment, text	2.78	1.28	3.22	1.14
Environment, text + visual	2.73	1.29	3.49	1.10

Table 2. Indirect effects PROCESS Model 4 (Hayes, 2013) – Maintaining and Catalyzing behavior change in the regular supermarket mediated by personal response efficacy (standardized) at T2 and T3.

Maintaining behavior change: longevity				
Relative indirect effect (T2)	B_{boot}	se_{boot}	$LLCI_{boot}$	$HLCI_{boot}$
Health, text	0.18	0.07	0.06	0.32
Health, text + visual	0.20	0.07	0.07	0.36
Environment, text	0.17	0.06	0.06	0.30
Environment, text + visual	0.17	0.07	0.04	0.33
Relative indirect effect (T3)	B_{boot}	se_{boot}	$LLCI_{boot}$	$HLCI_{boot}$
Health, text	0.15	0.06	0.05	0.28
Health, text + visual	0.17	0.07	0.04	0.33
Environment, text	0.15	0.06	0.04	0.27
Environment, text + visual	0.15	0.07	0.03	0.32
Catalyzing behavior change: Spill-over				
Relative indirect effect (T2)	B_{boot}	se_{boot}	$LLCI_{boot}$	$HLCI_{boot}$
Health, text	0.14	0.07	0.03	0.29
Health, text + visual	0.16	0.07	0.04	0.31
Environment, tekst	0.13	0.06	0.03	0.28
Environment, text + visual	0.13	0.07	0.02	0.29
Relative indirect effect (T3)	B_{boot}	se_{boot}	$LLCI_{boot}$	$HLCI_{boot}$
Health, text	0.11	0.06	0.01	0.23
Health, text + visual	0.12	0.06	0.01	0.26
Environment, text	0.10	0.05	0.01	0.22
Environment, text + visual	0.10	0.06	0.01	0.24

more environmentally friendly (palm oil free and locally produced) food choices in the subsequent weeks. The same pattern of indirect effects emerged at T3 (see Table 2 and Supplemental Materials). In sum, whereas there are no direct effects of seeing the impact messages at T1 on choosing more environmentally friendly groceries at T2 and T3, there are significant indirect effects showing that seeing the impact messages in the VR-supermarket at T1 leads to more personal response efficacy (either pertaining to health or to the environment at T1) and subsequently to choosing more environmentally friendly (palm oil free and locally produced) products at T2 and T3.

4.5. Catalyzing behavior change: spill-over

To investigate whether seeing the impact messages in the VR-supermarket might positively influence environmental product choices in general (RQ2), we ran Model 4 (5000 bootstraps, Hayes, 2013) with self-reported general environmental grocery shopping behavior at T2 and T3 (i.e. not limited to palm free and locally produced food) as dependent variable (again only looking at those participants who shopped one time or more that week) and personal response efficacy beliefs (standardized) as mediator. The analysis showed that there were no direct effects of the impact messages on product choices at T2 ($F(4, 231) = 0.90$, $p = .462$, $R_{change} = .014$) or T3 ($F(4, 221) = 0.51$, $p = .731$, $R_{change} = .009$). Seeing impact messages in the VR-supermarket, did thus not directly lead to making more environmentally friendly product choices while doing grocery shopping (i.e. spill-over; see Supplemental Materials for Means and SDs and full analyses).

The analysis did show that the impact messages in the VR-supermarket could indirectly catalyze more general environmentally friendly grocery shopping at T2 and T3 (i.e. spill-over). The results showed that seeing environmental impact messages increased personal environmental response efficacy at T1 and subsequently led to more general environmentally friendly grocery shopping at T2 and T3 (see Table 2 and Supplemental Materials). Whereas the impact messages (both regarding the environment and regarding health) in the VR-supermarket thus do not directly lead to positive spill-over, they can indirectly catalyze behavior change, leading to more general environmentally friendly behavior in general (i.e. spill-over).

4.6. Vividness

Lastly, we hypothesized that vivid messages would lead to more environmentally friendly food choices than non-vivid messages. As the text + visual conditions were unexpectedly not perceived as more vivid than the text only and control condition, $F(4, 249) = 1.63$, $p = .166$, $\eta_p^2 = .03$ (see Supplemental Materials for means and SDs), it is not possible to either support or reject H5. Please note that bivariate correlations showed no significant relationship between perceived vividness and any of our dependent variables (product choice at T1, T2, and T3, and spill-over at T2 and T3), however, there was a positive correlation between vividness and personal response efficacy $r = .187$, $p = .003$.

5. General discussion

We investigated whether seeing the impact of food choices on the environment or one's health when grocery shopping in a VR-supermarket could stimulate more environmentally friendly food choices within this VR-supermarket (instigating behavior change) and during grocery shopping in the weeks after (maintaining behavior change). Additionally, we investigated whether making more environmentally friendly food choices in the VR-supermarket (i.e. palm oil free or locally produced products) might spill-over into making more environmentally friendly food choices in general (catalyzing behavior change). Furthermore, we investigated the role of personal response efficacy beliefs as an underlying mechanism and how message characteristics like appeal type (environment vs health) and vividness affected the effectiveness of the message.

The results showed that impact messages in the VR-supermarket instigated behavior change, leading to more environmentally friendly food choices in the VR-supermarket and that this effect was mediated by personal response efficacy beliefs. This positive effect of impact messages did not depend on appeal type (i.e. environmental vs. health appeal). When it came to maintaining and catalyzing behavior change, the results showed that the impact messages only indirectly stimulated specific (i.e. palm oil free, locally produced) and general (e.g. eco-labelled) environmentally friendly food choices in the real-life supermarket. That is, seeing the impact messages in the VR-experience strengthened participants' personal response efficacy beliefs, which subsequently continued to influence participants' food choices in the two weeks following the VR-experience.

5.1. Theoretical implications

The current paper adds to the literature in a number of ways. First of all, the results presented add to the impact messages literature, showing that communicating the impact of one's behavior on either the environment or one's own health may be fruitful in stimulating environmentally friendly behavior (Ahn et al., 2015; Dahlinger et al., 2018; Meijers, Remmelswaal, et al., 2019). Furthermore, it adds to the literature looking into the potentially differences in effectiveness of environmental vs. health appeals in stimulating desired behavior. There are few experimental studies which showed mixed evidence; while some showed that health messages might be more effective in stimulating environmentally friendly food choices (Palomo-Vélez et al., 2018), others showed that both appeal types may be being equally effective (Carfora, Catellani, et al., 2019; Vainio et al., 2018). The current study showed that when it came to instigating environmentally friendly food choices, the health and environmental appeal were equally effective.

Whereas this is in line with some of the previous findings mentioned (Carfora, Catellani, et al., 2019; Vainio et al., 2018), we initially expected that impact messages with a health (vs. an environmental) appeal would be more effective in instigating behavioral change. We expected this given that (1) personal response efficacy beliefs are more important in the health rather than environmental realm and (2) previous research in the environmental domain found that strong personal efficacy beliefs might not be enough to stimulate pro-environmental behavior. That is, in the

case of environmental behavior, collective response efficacy beliefs are also important due to the collective nature of environmental problems (Chen, 2015; Homburg & Stolberg, 2006) – while personal efficacy beliefs might be sufficient when it comes to one's health. Our results show that the effects of personal response efficacy beliefs on product choices within the VR-supermarket were similar for the environmental and health conditions. Yet, in line with previous research, the findings indicated that collective response efficacy beliefs are a larger predictor than personal response efficacy beliefs in the environmental (but not the health) realm.

Our finding that both appeal types (health and environmental) were similarly effective despite this larger importance of collective, rather than personal response efficacy beliefs for the environmental domain can be explained by research suggesting that when personal response efficacy beliefs increase, this might subsequently increase collective response efficacy beliefs (Fernández-Ballesteros et al., 2002; but see Jugert et al., 2016; Reese & Junge, 2017). To test this possible explanation (i.e. the impact messages increased collective response efficacy beliefs too as a result of increasing personal response efficacy beliefs), we ran an explorative sequential mediation. This indeed showed that exposure to the environmental impact messages increased personal and subsequently collective response efficacy beliefs, which in turn influenced product choices. Future research could focus in more detail on the causal relationship between personal and collective response efficacy beliefs and aim to disentangle their respective importance in this field.

The results additionally add to the literature on the longevity of behavior change instigated by VR-experiences (Ahn et al., 2015; Fauville et al., 2020). At T2 and T3, there were no longer direct effects of our manipulation of food choices, only indirect effects. This indicates that whereas short-term beliefs and behavior might be successfully affected by VR-experiences, it is more difficult to influence actual behavior – on the long-run and outside of the lab setting in which VR-experiences tend to take place. Therefore, future research might want to test whether actual and long-term behavior change might be more successfully achieved when people are exposed to impact messages in the regular supermarket.

5.2. Limitations and future research

Earlier research showed that more vivid messages might be more effective in stimulating pro-environmental behavior (Bailey et al., 2015). We manipulated vividness by modality (text vs. text + visual) as previous research did. However, in contrast to earlier research findings, the text + visual messages were not perceived as more vivid than the text only messages (see the manipulation check). This is a limitation of the current study as it was now not possible to draw a conclusion on the effectiveness of low vs. high vivid messages. When looking at the relationship between perceived vividness and personal response efficacy, the results do however show a significant positive relationship. For future research it could thus be interesting to see how vividness can be more effectively manipulated, for example, by using 360°-videos vs. text. While doing so, it could be interesting to use a 360°-video in which the changes in the environment are highlighted by showing gradually how consuming such a product affects the environment, as done in other previous VR-research (e.g. Ahn et al., 2015). Despite the limitation of the vividness manipulation not being successful, we can derive from the results that the modality of the message (text vs. text + visual) does not influence their effectiveness. This might be due to the pop-ups that appeared when participants took products from the shelf. This interactive feature of the pop-up and the fact that the messages were prominently in sight of the participants, might have reduced the hypothesized benefit of text + visual messages over the text only messages.

Furthermore, when focusing on the environmental and health benefits of food choices, there are many aspects to be considered. That is, there might be a gap between the perceptions of consumers regarding food impact and the actual impact. This is, for example, the case with organic beef, which is seen as healthier and more environmentally friendly than non-organic beef, but might actually have a larger carbon footprint (Buratti et al., 2017; Rana & Paul, 2020). Similarly, local foods

may be perceived as more environmentally friendly and healthier than imported food, but food mileages is only a part of the life cycle assessment and other factors (e.g. whether the product is in season) may have a larger impact (Feldmann & Hamm, 2015; Hoolohan et al., 2013). Therefore, when choosing the type of fruits and vegetables we used in the current study, we relied on a fruit and vegetable calendar of a Dutch NGO in which seasonality, food miles, and other parts of the life cycle were considered and we thoroughly debriefed the participants regarding the limitation of food miles. For future VR-research, it might be interesting to focus on behaviors that are unequivocally better for the environment, like eating less meat (Poore & Nemecek, 2018).

Furthermore, to assess effects of the impact messages on instigating behavior change, we looked into behavior in the VR-supermarket. As such, the behavior studied in our research may differ from behavior in the actual supermarket, even though our control variables suggest that purchasing behavior in the VR-supermarket was rather similar to purchasing in the real supermarket (see 3.5.6. Perceived Realism). In the current study we opted for not including prices in the supermarket to have the most experimental control, although this is, of course, less ecologically valid as prices differ for products and are an important criterion when purchasing food (Kalnikaitė et al., 2013). Nonetheless, many of the other extrinsic cues that people base their decisions on while grocery shopping, like the packaging and brand information (Behe et al., 2014), were present in the VR-supermarket. So, to enhance ecological validity in future studies even further, it could be good to include prices within the supermarket. To assess maintain and catalyzing behavior change, we relied on self-reported purchasing behavior rather than actual purchasing behavior, this might have influenced the results. For future research it could be interesting to combine the study with scanner data, have participants take pictures of their groceries, or use an app to track their food choices (Poelman et al., 2020).

5.3. Practical implications

When it comes to stimulating more environmentally friendly food choices so to combat environmental problems, the results presented have several practical implications. Using a VR-experience where impact messages pop up in the moment when people make purchase decisions seem a promising way forward, as they can stimulate response efficacy beliefs and environmentally friendly food choices. The VR-experience could, therefore, be used as an educational tool at schools. The VR-experience can not only educate children and adolescents and make them aware of the impact of their food choices, but it can also empower them as personal response efficacy beliefs are likely to increase, which may ultimately affect their environmental behavior. Results of a qualitative follow-up study using a similar set-up as the current study suggests that children also like such an educational tool (Smit et al., 2021).

For communication professionals the results indicate that when stimulating pro-environmental food choices via messages, the appeal type (health vs. environment) does not influence the effectiveness of the intervention. When trying to stimulate more environmentally friendly food choices such as eating palm oil free products or eating less meat, both health and environmental appeals can thus be used. For future research it might be interesting to investigate whether tailoring the type of appeal (depending on people's preference and interest for either health or the environment), might be extra effective.

Lastly, the results indicate that impact messages are especially effective at the moment when people make decisions. Our results showed positive direct effects of impact messages within the VR-supermarket. On the longer term, there were only indirect effects via personal response efficacy beliefs. So future research could investigate whether it might be beneficial to provide the information on the environmental impact of products within the supermarket. This could be done by introducing an (augmented reality) app that provides more interactive information while shopping. Such an augmented reality app could then show interactive pop-ups, like the ones that were used in the current study, which display the environmental impact of products

while shopping in the supermarket in an interactive fashion, for example, when scanning the product's barcode. This might then not only increase people response efficacy beliefs, but also make the impact of their food choices more salient, as such leading to more sustainable food choices and ultimately a healthier environment.

Notes

1. We also measured other variables at T1, T2, and T3 such as attitudes and intentions for another purpose. In this paper we focus on behavior. The full data sets can be obtained from the authors. For an overview of the full questionnaires and the data for the current paper, please see OSF.
2. We also asked participants other questions like environmental and health identification, the presence they experienced during the VR-experiment, and the emotions they experienced (in retrospect) when seeing the information. These items were measured for a different project and can be found on OSF. Please note that due to a programming error, the scale for the manipulation check concerning the environment ran from 1 to 6 instead of 1-7, we therefore, standardized the manipulation check.

Acknowledgements

The authors would like to thank Eline Jansen for her help in conducting the study and two anonymous reviewers for their helpful and constructive feedback.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The research was supported by a Netherlands Organisation for Scientific Research grant awarded to the first [grant number Veni.201S.075] and second author [grant number 451-15-028] and an ASCoR (Amsterdam School of Communication Research) grant.

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Appendix

Table A1. Items, Cronbach's alpha's and (unstandardized) Mean scores (SD) of the response efficacy scales used.

	α	Means (SD)	
Personal response efficacy	.86	4.91	(0.83)
Personal response efficacy – environment	.84	5.49	(0.91)
Palm oil	.90	5.30	(1.16)
(1) When I purchase palm oil free products, I can contribute to solving environmental issues			
(2) I can have a positive impact on the environment, when I purchase palm oil free products			
(3) By choosing palm oil free products, I can prevent environmental issues from getting worse			
Locally produced	.80	5.58	(0.98)
(1) When I purchase locally produced products, I can contribute to solving environmental issues			
(2) I can have a positive impact on the environment, when I purchase locally produced products			
(3) By choosing locally produced products, I can prevent environmental issues from getting worse			
Personal response efficacy – health	.86	4.34	(1.09)
Palm oil	.94	4.09	(1.29)
(1) When I purchase palm oil free products, this will improve my health			
(2) Choosing palm oil free products has a positive impact on my health			
(3) By choosing palm oil free products, I can prevent personal health issues			
Locally produced	.93	4.59	(1.36)
(1) When I purchase locally produced products, this will improve my health			
(2) Choosing locally produced products has a positive impact on my health			
(3) By choosing locally produced products, I can prevent personal health issues			
Collective response efficacy	.88	4.81	(0.90)
Collective response efficacy – environment	.86	5.56	(1.03)
Palm oil	.92	5.48	(1.18)
(1) We can protect the environment, if we all choose palm oil free products			
(2) If we would all purchase palm oil free products, this would help in solving environmental issues			
(3) It helps if everyone chooses palm oil free products, because together we are able to protect the environment			
Locally produced	.92	5.63	(1.20)
(1) We can protect the environment, if we all choose locally produced products			
(2) If we would all purchase locally produced products, this would help in solving environmental issues			
(3) It helps if everyone chooses locally produced products, because together we are able to protect the environment			
Collective response efficacy – health	.88	4.06	(1.16)
Palm oil	.91	4.06	(1.36)
(1) My health will improve, if we all choose palm oil free products			
(2) If everybody would purchase palm oil free products, this would help in preventing personal health issues			
(3) It has a positive impact on my health, if everyone chooses palm oil free products			
Locally produced	.89	4.07	(1.33)
(1) My health will improve, if we all choose locally produced products			
(2) If everybody would purchase locally produced products, this would help in preventing personal health issues			
(3) It has a positive impact on my health, if everyone chooses locally produced products			

Note. α is the Cronbach's α.