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Overcoming Naturalness Bias: The role of Nudges in the Acceptance of Cultured Meat

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Executive summary

Cultured meat is a novel food technology that is a promising solution for environmental and ethical issues regarding traditional meat production. Acceptance of this novel food relies on several factors. Past research shows that the naturalness bias plays a key role. This bias may cause cultured meat to be perceived as unnatural, thereby hindering potential acceptance. This study focuses on overcoming this naturalness bias by making use of nudges. Nudges are a well know tool for influencing people attitudes and behavior. The present study aims to investigate how nudges can influence the perception of naturalness and thereby the acceptance of cultured meat in the Netherlands.

To investigate the effect is of the nudges, an online experiment was performed using a 2x2 research design. The respondents were assessed to one of four experimental conditions, combining either a neutral or informational nudge with varied message sourcing (from a researcher or no source mentioned). The moderating role of past dietary patterns on nudges was also examined.

Participants for the experiment were obtained via a convenience sampling method. Most of the respondents were recruited through researcher's personal network (via WhatsApp and social media). A substantial part of the respondents was gathered through directly approaching students on the University of Rotterdam. Out of 158 initial respondents, 131 individuals could be used for analysis. The survey took on average a couple minutes to complete and was administered online.

The data was analyzed using SPSS software. Randomization checks showed that none of the control variables had a significant relationship with the dependent variable. This means the process of randomization was successful in creating groups that could be compared. Having established that, the analysis was followed by using a binominal logistic regression model to examine the main effect. The assumptions of logistic regression were tested to ensure reliable and valid results. The assumptions were successfully met. The analysis didn't show a significant main effect of nudges on willingness to try.

Subsequently the moderation effects of source (from a researcher vs not mentioned) and past behavior (vegan/vegetarian) were investigated. To test for these moderation effects, the PROCESS model by Heyes (2017) was used. The analysis showed no significant moderation effects. PROCESS was also used to investigate the mediational role of perceived naturalness. There was no significant evidence found either. However, a marginal negative effect of perceived naturalness on willingness was found. This finding challenges the traditional view that greater perceived naturalness fosters acceptance.

This research contributes to existing literature by clarifying the limited impact of nudges in altering people perception towards naturalness of cultured meat and consequently increasing the acceptance. Marketeers and policy makers in the food industry could benefit from these findings. They could create more effective strategies to enhance acceptance of this novel food.

Despite most of the result were non-significant, future research is recommended. New research may employ a lager sample size, a refined experimental design and ensuring better control over external factors to enhance the reliability and validity of the findings. Moreover, addressing potential biases (as many younger people in the sample) is important to avoid skewing the results and accurately measure participants true attitudes and intentions.

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1. Introduction

Cultured meat has a big potential as sustainable solution that could replace traditional or substitute meats. In many countries there are legal constraints for eating cultured meat, but this may change soon. Cultured meat is more environmental and animal friendly than traditional meat. Also, it's a good substitute because it has the same characteristics as normal meat. The properties are the same because it is made from real animal cells. The Netherlands is the first country in Europe that allowed limited tasting of in vitro meat. This means scientist have now the green light to test the products amongst consumers. From an economic perspective, allowing people to try these new meats could foster the Dutch leading position in commercializing this technology.

Although cultured meat is a promising technology and solution, the adaptation of it will be challenging. Past research has shown that the naturalness bias is a major barrier for acceptance (Wilks et al., 2019). Naturalness bias refers to a tendency to favor products that are perceived as natural over synthetic or industrial goods (Gagliardi, 2024). People perceive cultured meat as unnatural, preventing this new technology form being accepted. Future research is needed because we want to overcome this barrier to accept the new technology. Providing proper information and alter peoples attitude towards sustainable meat could be a solution. While there are some primary studies about this "informational nudge", decisive findings hold off. Future research is needed to address what kind of information works. The findings of this research will have implications for marketing and branding teams, as they are looking for optimized communication strategies to promote products.

1.1 Research Problem and motivation

Although cultivated meat is a relatively new technology, some research had already been conducted. As mentioned before, in many countries consumption is prohibited but conducting theoretical research isn't. The promising future of cultivated meats moves scientist in the direction of understanding what if consumption is allowed.

One study investigated how social norms and dietary identity affects the willingness to try cultivated meat (Lewisch & Riefler, 2023). That study finds support for both variables.
Other studies have discovered that perceived naturalness and disgust evoked by cultivated meat are major barriers for accepting. A study by Bryant et al. (2019) tried to control this bias by experimenting with different messages. From 4 different messages only the message that conventional meat is unhealthy, had a significant impact on some measures on acceptance. On the other hand, the statements that cultivated meat is natural was not a persuasive strategy. These findings are inconsistent with findings from other studies, where positive messages lead to more acceptance of clean meat (Verbeke et al. 2015) (Bekker et al. 2017).

Researchers recommend conducting research about what aspects of messaging are most effective. These aspects could be taste, texture, and nutritional profile, or the health, environmental, or animal welfare benefits (Bryant et al., 2019). Exploring this gap is important to understand how messages could be used to adopt this new technology quicker. My study will investigate aspects of messages that are effective for overcoming the naturalness barrier in accepting cultivated meat.

1.2 Research Objective

According Román et al (2017) for the majority of consumers, food naturalness is crucial for acceptance. What we see now is that naturalness is a hurdle for accepting this new technology. If we want that people are willing to try this new technology, we must overcome this hurdle. This study aims to understand how we could overcome this. The study of Román et al. (2017) shows that naturalness can be defined into three categories: the way the food has been grown (food origin), how the food has been produced (what technology and ingredients have been used), and the properties of the final product.

The study of Verbeke (2015) shows that a positive information made the participants try cultured meat more. In this current study, we want to know whether this relation is also present for a more specific set of factors that contribute to naturalness. By that way we can possibly overcome this naturalness hurdle, resulting in more acceptance of this new technology.

1.3 Research Question

How do informational nudges influence the relationship between naturalness and acceptance of cultured meat amongst Dutch consumers?

This study is going to investigate whether a positive approach to the 3 factors contributing to naturalness, could be an effective strategy to increase the willingness to try cultured meat. That way we can say this type of messages works and could be used by marketeers and brand managers to communicate toward their audience. From an academic perspective, this research is going to contribute to the existing knowledge. We don't know the exact effect of different messages on the naturalness bias. This study will approach the subject form a different angle, to get a better understanding.

1.4 Research Methodology

Firstly, a comprehensive literature will be conducted for this study. Many readings will be covered to gather a better understanding of the topic. After this, a survey will be developed to gather data about participants' attitudes, perceptions, and willingness to try cultivated meat. In this survey demographic information of the participants will also be collected.

Then the participants will be exposed to manipulations in order to give an answer to the research question. The experimental conditions will manipulate the content material of messages associated to 3 factors contributing to naturalness as outlined by Román (2017): meals origin, production techniques, and food properties. The participants will be exposed to this manipulation and the data will be gathered if their willingness to try changes. There will also be a control group that receives an unrelated or neutral message, to see to what extent the manipulation works.

Participants will be gathered mostly through social media channels (Facebook, LinkedIn, Instagram, WhatsApp). The survey tool will be administered online the use of a survey platform, making sure the anonymity and confidentiality of participants' responses. Experimental manipulation will occur by turning in written or visible messages through the survey platform. The gathered data will be analyzed with SPSS to see whether there's a causal relation between the variables.

2. Literature review

This chapter presents some key concepts and relevant background information regarding the research topic. This review will also motivate this present research by identifying literature gaps. It will also provide some testable hypotheses derived from past research.

Cultured meat is a relatively new technology and a promising sustainable alternative for conventional meat. We know that conventional meat is not sustainable and has environmental externalities (Vissers, 2021). In recent years we have seen rise of alternative protein sources, like plant based "meats". These meats are good, but way different than conventional meat. People still want to eat conventional meats, so this plant-based alternatives are a good addition but are not for everyone.

In contrast, cultivated meat resembles traditional meat closely in the way it looks and tastes. Moreover, it is more animal friendly than traditional meat. On paper it is a promising alternative, but this will probably not be the case in practice. There are some hurdles that appear for embracing and commercializing this new technology. The most important one is the acceptance of cultured meat (Bryant & Barnett, 2018).

It seems that in some cases consumers don't want to try cultured meat. We see from a study in Belgium that two-thirds of the people asked, were hesitant about trying cultured meat (Verbeke, 2015). Nine percent of the respondents rejected the idea of trying this novel food, while a quarter was willing to try it. Rather these findings are preliminary and not conclusive, they show that many people are hesitant about trying in vitro meat when it becomes available.

However, a study conducted amongst U.S. citizens shows different results. Most people from this sample had a positive attitude toward trying cultured meat (Wilks & Phillips, 2017). Two-thirds of them was willing to try in vitro meat, while one third was definitely or probably wanting to try it. Gender and political ideology were important moderators in this study. The effect of willing to try was stronger for men and liberal respondents. This study and the previous one give a different perspective on the attitude towards cultured meat. It remains unclear whether people are going to accept this new technology.

2.1 Hypothesis Development: Acceptance and perceived naturalness

According to past research, key determinants for accepting cultured meat are (1) having food allergies, (2) being a locavore (consumes locally grown food) and (3) having concerns about the new food technology (Rombach et al., 2022). These factors inhibit the acceptance. On the other hand, food curiosity, meat importance, and a consumer's perception of cultured meat are important motivators to try this novel food.

Another important factor influencing acceptance is perceived naturalness (Bryant et al., 2019); (Román et al., 2017); (Pakseresht et al., 2022). From these studies we see that naturalness is an important factor for acceptance of cultured meat. Bryant shows that telling consumers cultured meat is natural, resulted in lower acceptance compared to not mentioning naturalness at all. On the other hand, a focus on the unnaturalness of conventional meat seems to be more effective. The researchers advise to not change the perceived naturalness directly, but rather providing people with informative and educational messaging about the characteristics of cultured meat. Future research will show what aspects will be the most effective.

The importance of naturalness for acceptance is confirmed in the study of Román et al (2017). For majority of the consumers, naturalness is crucial. This is also one of the findings from the systematic review of Pakseresht et al. (2022). It showed that acceptance of cultured meat depends on perceived naturalness. As research suggests the following can be expected:

H1: *Perceived naturalness positively affects acceptance of cultured meat.*

People perceive cultured meat as unnatural and therefore as bad. Past literature calls this the *appeal to nature*, where people perceive natural things as good and unnatural things as bad (Moore, 1903). However, this is not always true. Earthquakes are natural but have disastrous consequences. On the other hand, modern medicine is ‘unnatural’ but commonly applied to support people. These irrational (mis)believes led to certain behavior. In case of cultured meat, it leads to avoidance of the new technology. Researchers advocate for strategies to overcome these barriers otherwise the new technology cannot be applied, resulting in missing out on its potential benefits (Bryant et al., 2019).

2.2 Hypothesis Development: moderating role of past behavior

Nudges are low-cost interventions that influence decision- making without limiting freedom of choice and have been tested in the environmental realm of electricity and water saving, reduced meat consumption, recycling, and decreasing private car transportation (Kollmuss & Agyeman, 2002); (Cheng et al., 2011); (Osbaldiston & Schott, 2011). An example of effective informational nudges is shown in the study of Nelson et al. (2021), where messages were shown to the respondents to encourage pro environmental behavior. They found a significant and positive difference between subjects that were exposed to an intervention compared to those in the control conditions. However, the researchers did not find significant differences in observed environmental behavior between negative and positive information.

The effect of informational nudge becomes also clear from the study of Bekker et al. (2017). They observed that informational nudges can influence people's perceptions. In one of the experiments, positive or negative information about cultured meat changed the explicit attitude in the direction of the information. This effect was smaller for participants who were more familiar with cultured meat. Therefore, it is plausible that informational nudges can influence people's perception of naturalness.

The provision of information about cultured meat can change the willingness to this novel food, as shown in the study of (Verbeke, 2015). The respondents received positive information about cultured meat, and this changed the willingness to try it. About half of the participants who claimed now not to be willing to try cultured meat changed their opinion after receiving the information into 'maybe willing' to try it, but none of them switched to 'surely wanting to'. Additionally, 29% of those to begin with 'maybe wanting' to try cultured meat switched from 'maybe' to 'surely' wanting to try. Furthermore, a study from Netherlands shows that positive information has the power to change people's explicit attitude towards cultured meat (Bekker et al., 2017). From these findings we see the significance of informational nudges in changing people's behavior.

We see from past research that past behavior could be a moderator for nudges that promote sustainable behavior. The study of Garnett et al. (2019) shows that past behavior significantly

moderates the effectiveness of nudges on food choices. They found that nudges had a stronger effect on individuals who did not eat vegetarian options in the past. This indicates that nudges might be effective for people that are not in the target group of the food already.

The study of Bacon and Krpan (2018) confirms the moderating role of past behavior. This study shows that the "Chef's Recommendation" nudge was more effective for infrequent vegetarians. This suggest that nudges can encourage new behavior or break current habits for individuals that are less familiar with the behavior. The findings suggests that past behavior is a crucial factor in determining the impact of nudges and therefore it will be included in this present study as a moderator as well. Derived from the studies the following is hypothesized:

H2: *The effect of nudges will be stronger among participants who do not frequently choose plant-based or vegetarian options compared to those who do.*

2.3 Hypothesis Development: different aspects of naturalness

Consumer objections about unnaturalness falls normally out in two categories: (1) people that find cultured meat is unnatural and therefore bad for their health. And, (2) people perceive cultured meat as inherently bad because of the unnaturalness (Laestadius & Caldwell, 2015). According to the researchers, the first objection could be overcome through providing evidence to the contrary. On the other hand, the second object might be harder to overcome with reasoning because the ideas about unnaturalness appear to be deeply rooted and therefore more resistant to reasoning.

A study by Etale and Siegrist (2021) showed that food processing influences the perception of its naturalness. Results show that the perception depends on whether the technique used for production is considered old (traditional) or new. People don't seem to care whether the food has undergone physical of chemical changes. This study also shows that product type and production scale have a significant effect on perceived naturalness. People found food significantly more natural when organic food was used (instead of conventional) and the food was grown on small scale (vs large). This experiment was about sauerkraut (fermented cabbage). We don't know if we can apply these findings to cultivated meat.

Factors that determine naturalness of food are studied by (Román et al., 2017). He found that naturalness can be classified into three categories: (1) food origin, (2) production, and (3) final product. The first factor is about how the food is grown. It emphasizes how the food if farmed (organic) and produced locally. The second factor is about the ingredients and production process. People tend to perceive food more natural when there is an absence of some negative elements (preservatives, artificial colors and flavors, chemicals, hormones, pesticides, and genetically modified organisms), than to the presence of certain positive elements (natural ingredients). Also, people perceive the food more natural when it's processed minimally and traditionally. The last factor is about the result. If there are attributes of healthiness, freshness, tastiness and eco-friendliness, people perceive it as more natural.

Looking at the systematic review of Román et al. (2017), the majority of studies focus on the production category. Specially, most of the studies are about the absence of specific additives. It would be interesting to investigate whether this emphasis on the absence also applies to cultured meat. From prior findings we can hypothesize that:

H2a: *Emphasizing the absence of negative perceived ingredients, will improve perceived naturalness compared to not mentioning it.*

H2b: *The effect of the nudges on acceptance is mediated through perceived naturalness.*

Support for H2c can be found in the framework Theory of Planned Behavior (TPB). This framework suggests that attitudes, subjective norms and perceived behavioral control collectively shape intentions and subsequent behavior (Ajzen, 1991). When we apply this framework for the present study, nudges serve as stimuli that influence consumers perceptions subsequently their behavior. The perception in this case is the perceived naturalness and this acts as a mediator between nudges and acceptance. According to TPB, may influence consumers perception of naturalness which enhance their acceptance. This hypothesis will help understand how nudges affect consumers decisions. This gives us important insights about what nudges are effective in promoting sustainable behavior.

2.4 Hypothesis development: moderating role of source

In a study Boenke et al. (2022) the researchers investigated the intentions of consumers to reduce their meat consumption after seeing norm messages from different sources (researcher, vegan activist and company representative). In line with the predictions, dynamic norm messages from a researcher led to more sustainable consumption choices than identical messages communicated by a vegan activist or company representative while controlling for gender. In line with findings from this study the following is hypothesized:

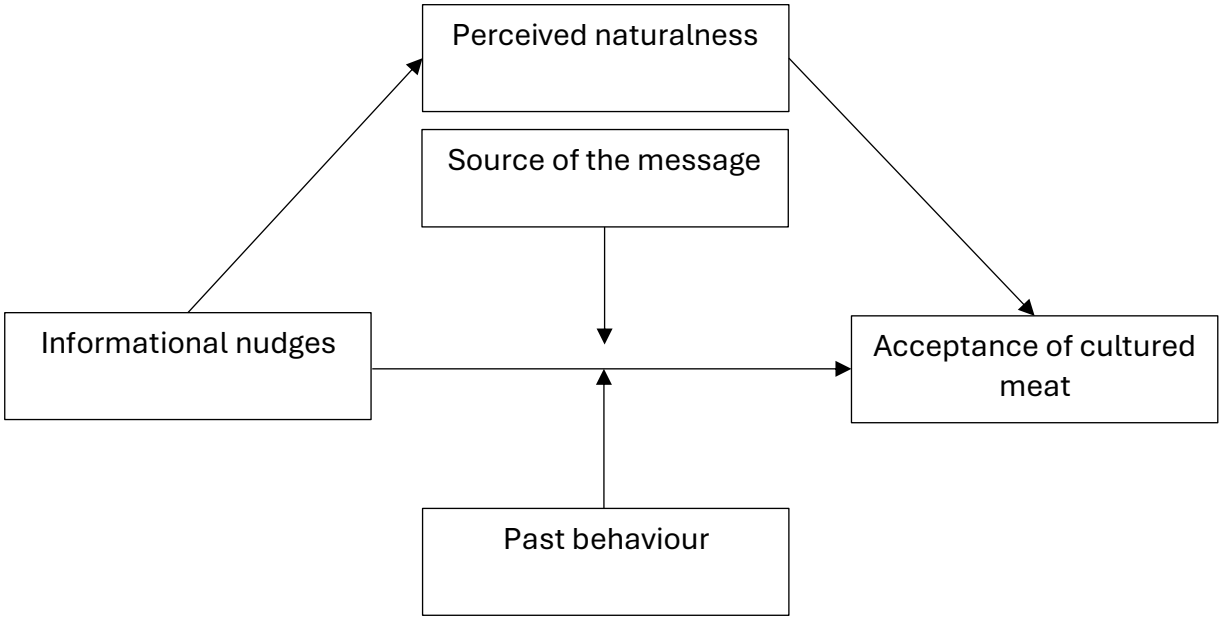
H3: *The delivery of informational nudges about cultured meat from a researcher will result in higher acceptance compared to when the source is not mentioned.*

The idea behind this hypothesis is that consumers may perceive messages from a researcher as more trustworthy. This might lead to a greater acceptance of cultured meat. This hypothesis is essential to explore given the growing interest in sustainable protein sources and the potential role of researchers in shaping public opinion and behavior.

2.5 Closing the gap and implications

In countries where cultured meat is gaining traction (like Singapore and Netherlands), it's important to know whether people are going to accept it. As stated earlier, acceptance is an important factor for commercial success of cultured meat. As current information about the Dutch market is missing, more research about cultured meat is needed. We know from past research that acceptance levels varied amongst consumers, with perceived naturalness as important barrier. Having more information about perceived naturalness could contribute to the acceptance and therefore to its commercial success. At this moment, literature lacks on this topic in the Netherlands. This present study is going to contribute by making this gap smaller.
If this will be a successful strategy for altering acceptance, it will be relevant for food managers in food retail and gastronomy (Rombach et al., 2022). They could use this information for making their marketing campaigns more effective and making more consumers satisfied with cultured meat.

2.6 Conceptual framework



2.7 Hypothesis overview

H1: *Perceived naturalness positively affects acceptance of cultured meat.*

H2: *The effect of nudges will be stronger among participants who do not frequently choose plant-based or vegetarian options compared to those who do.*

H2a: *Emphasizing the absence of negative perceived ingredients, will improve perceived naturalness compared to not mentioning it.*

H2b: *The effect of the nudges on acceptance is mediated through perceived naturalness.*

H3: *The delivery of informational nudges about cultured meat from a researcher will result in higher acceptance compared to when the source is not mentioned.*

3. Data and Methodology

This chapter explains how the proposed hypotheses are going to be examined. First, the research design is going to be explained followed by the review structure. The following section is divided to explain how the variables are going to be measured in the measurement section. Subsequently, the sampling approach and sample size will be explained. Finally, the method of data collection and analysis will be outlined.

3.1 Research design

The present research aims to investigate the influence of different factors on the acceptance of cultured meat. From the literature review, we see that naturalness is a major factor that affects acceptance. This study aims to understand the effect of this variable on acceptance. Besides this, other variables such as exposure to informational nudges and different aspects of naturalness impact consumers, are also being examined in this study. To achieve this goal, an experimental research design in the form of a survey will be conducted.

The nature of this research is explanatory, aiming to understand relationships between variables, including causality. In this study we want to know how the different independent variables, affect the dependent variable which is the acceptance of cultured meat. By testing the provided hypotheses that are formed in the literature review, this study is going provide insights into the factors influencing the acceptance of in vitro meat.

An experimental approach is the most appropriate one for this study. This method consists of measuring, collecting, and analyzing numerical data from the respondents. This enables to understand the relationship between the variables and to test the hypotheses (Creswell & Creswell, 2017). A survey is chosen as a method to gather data, because the efficiency of gathering data form a large and diverse sample. A survey also enables quantification of the variables, making measurement simple. The survey will be held online, as this is an efficient and cost-effective wat of gathering data.

For this experiment a between subject design will be used. Each participant will be exposed to one treatment condition, while different groups will be exposed to different conditions. This

design is more appropriate for this research because it reduces the risk of carry over effects. Carry over effects occur when participants are exposed to different conditions, and they can learn procedures during the survey. This leads to transfer of knowledge and changing their behavior, resulting is biased outcomes (Allen, 2017). A downside from this approach, is that more respondents and time is needed.

3.2 Research structure

The hypotheses will be tested via an online experiment. The participants will be divided into two groups: a treatment group and a control group. They will be randomly assigned to reduce selection bias. This helps to create comparable groups and minimizes the risk of any pre-existing differences amongst participants that could disrupt the results (Creswell & Creswell, 2017). One group is the treatment group that gets the informational nudge (message) about the absence of ingredients and the other, the control group, does get a neutral message about cultured meat. Both groups also get some questions to establish the mediation role of perceived naturalness. To establish the moderator role of "past behavior" some questions to identify previous sustainable behavior of the participants. More specific outline of the survey is presented later.

3.3 Measurement

3.3.1 Dependent variable: Acceptance

Previous studies have researched the acceptance of novel foods. In these studies, the variable used here to measure acceptance was called "willingness to try", as in recent studies of Rombach et al (2022), Mancini and Antonioli (2019). The scale they used there was from 1 to 3 (1=No, 2=Possible, 3=Yes). This scale will also be used in the present study.

3.3.2 Independent variable: Informational nudge

The respondents are going to see an informational nudge that emphasizes the absence of some negative perceived ingredients. This is what the study of Roman (2017) says of negative perceived ingredients:

"As for the ingredients, consumers seem to give more importance to the absence of certain negative elements (mainly additives but also preservatives, artificial colors and flavors, chemicals, hormones, pesticides, and genetically modified organisms) than to the presence of certain positive elements (natural ingredients)."

In this present study the responders are going to see this information presented in a message (nudge). Both messages are generated with AI, to ensure consistency and maintaining a standardized approach in experimental design.

Message for treatment group:

Cultivated with Care, Crafted for You!

Have you ever wondered about the future of food? Cultured meat offers a new horizon in sustainable dining. Free from additives, preservatives, and artificial enhancers, it represents a cleaner, greener alternative to traditional livestock farming. By omitting antibiotics, hormones, and the ethical concerns of animal welfare, cultured meat provides a guilt-free option for conscious consumers.

Embrace the future of food with every delicious, environmentally friendly bite.

Neutral message for control group:

Introducing Cultured Meat

Ever curious about the next wave of culinary innovation? Cultured meat represents a fascinating advancement in food technology. Through a meticulous process, meat is grown from animal cells in a controlled environment. This method offers exciting possibilities for sustainable food production without compromising taste or texture.

Join us in exploring the future of food with cultured meat – a blend of innovation and culinary delight.

3.3.3 Mediating variable: perceived naturalness

Román (2017) conducted a study (systematic review) about how naturalness is defined and measured. In past studies we see that authors defined naturalness in different ways. The most

recent study that defined naturalness (partially based on previous studies) was from Rozin et al. (2012). They defined natural (including food) "principally by the absence of certain 'negative' features (e.g., additives, pollution, human intervention), rather than the presence of certain positive features."

In terms of measurement of perceived naturalness, the sale developed by Steptoe and Wardle (1999) has been used in 36 studies, showing good reliability (Cronbach's a ranged from 0.60 to 0.91) (Román et al., 2017). This method will also be used in the present research. The statements are shown below:

1. *"It is important to me that the food I eat on a typical day contains no additives."*
2. *"It is important to me that the food I eat on a typical day contains natural ingredients."*
3. *"It is important to me that the food I eat on a typical day contains no artificial ingredients."*

These statements are going to be presented to participants using a Likert scale (1= Strongly Disagree, 5= strongly agree).

3.3.4 Moderating variable: past behavior

To assess if the respondents ate vegetarian food, they will be asked the following question: "During the previous seven days, on how many days did you eat neither meat nor fish?" This will a similar methodology as in the study of Bacon and Krpan (2018). The scale that they used was from 0 to 7, corresponding with the number of days that no fish or meat was consumed (0 = zero days during the previous seven days, 1= eating vegetarian on only one day, and so on).

3.3.5 Moderating variable: source of the message

Participants will be randomly assigned to one of two conditions: (1) informational nudges about cultured meat delivered from a researcher ("researcher condition"), and (2) informational nudges about cultured meat with no mention of the source ("no source condition").

The participants will be exposed to either the researcher condition, where the informational nudges will explicitly state the source as a researcher from Erasmus University Rotterdam, or

the no source condition, where the source will not be mentioned. This will be a similar setup as in the study of Boenke et al. (2022).
Following exposure to the informational nudges, participants will complete measures assessing their acceptance of cultured meat.

3.4 Control variables

To establish internal validity of the experiment, the survey will contain control variables such as age, gender, educational background, and home residency. This information will be collected to ensure that respondents are equally distributed amongst the groups (Creswell & Creswell, 2017).

3.5 Sample size

In experimental economics a rule of thumb can be used to determine the number of respondents needed. As List, Sadoff & Wagner (2011) use n=25 per treatment as a rule of thumb, others use n=30 per treatment (Cooke et al., 2002). This present study aims for a sample size of n=40 per treatment. As the experiment in the present study consists of 4 groups (treatment and control), there are two treatments. This means that the minimum number of respondents is 160 (4x40).

4. Results

The research design that was described in the previous chapter was transformed into a questionnaire (Appendix A). This survey was launched on Monday 3rd of June and ended on Monday 10th of June. It was distributed online trough through WhatsApp, Instagram, LinkedIn and by directly approaching people at the University of Rotterdam. During the period the survey was online, 158 respondents accessed the survey. Only 132 respondents completed the questionnaire fully.

4.1 Survey setup

First the respondents were presented an introduction of the questionnaire. This consisted of an introductory statement and explaining the purpose, anonymity and voluntary nature of the survey. To proceed, the participants needed to confirm they read the introduction. All respondents confirmed.

After the introduction, the respondents were divided in one of the four groups (see table 1): informational nudge from a researcher (Group 1), informational nudge with no specified sender (Group 2), neutral message from a researcher (Group 3), and neutral message with no specified sender (Group 4).

It was the intention to randomize the respondents evenly over these groups. However, during the survey distribution the participants were distributed randomly but not evenly because the box “Evenly Present Elements” was unchecked. The issue was recognized in an early stage, and it was possible to correct this. As a result, this clarifies the slightly higher participant count in one group (3).

		From who was the message you just saw?			
		Not specified	A researcher for the Erasmus University of Rotterdam	I don't know	total
Group	1.	9	16	5	30
	2.	16	9	5	30
	3.	5	27	8	40
	4.	12	7	13	32
	total	42	59	31	132

Table 1: frequencies of experimental conditions

After the respondents were divided to one of the groups, the nudge was shown (in combination with the source of the message). Subsequently, the respondents were exposed to questions representing the variables that needed to be measured. The questions were shown in a random order to the participants, to minimize order effects. One of these questions was a manipulation check. More about this in the subsequent section.

4.2 Preparing the data

In order to optimize data quality, outliers in terms of completions time were checked. Descriptive statistics of completion time were consulted in this case. Then, the lower and upper bounds for outliers were calculated using the following formulas:

$$lower\ bound = \mu - k * \sigma$$

$$upper\ bound = \mu + k * \sigma$$

These formals were used in previous statistical practices for outlier detection, as in the work of Pincus (1995). For the present study, k=2 is used to define the bounds. This is a common practice that identifies true outliers, ensures data reliability and maintains a robust sample size.

When this method was applied, one respondent was excluded from the sample size. Consequently, the sample size for this analysis decreased to n=131.

4.3 Factor Analysis and Reliability

To further optimize the data for testing the hypotheses, correlations of variables were examined (see appendix B). This analysis showed that the questions regarding perceived naturalness, correlated significantly. This indicated that the questions may measure the same construct.

4.3.1 Factor Analysis

A Principal Axis Factoring method was used for the factor analysis. Communalities of the item varied from 0.415 to 0.612 after extraction. This suggested a moderate to high level of common variance among the items.

The factor analysis resulted in the extraction of one factor with an eigenvalue of 1.951, accounting for 65.024% of the variance. After extraction, the factor explained 48.105% of the variance. Finally, the factor loadings showed that all items were significantly loaded onto one factor (see appendix B).

4.3.2 Reliability Analysis

After the factor analysis, a reliability analysis was conducted. This resulted in a Cronbach's Alpha coefficient of 0.73 for the variables the measured perceived naturalness. This indicated a high level of internal consistency and reliability (see appendix B).

To mitigate multicollinearity, these variables were condensed into one single variable (Percieved_Naturalness), while maintaining the same scale.

4.4 Manipulation check

A manipulation check was also incorporated into the questionnaire to make sure the respondents understood the manipulation and to make the data more accurate. In this study, the manipulated variable was the source of the message. In this case this could mean (1) the message was send by a researcher form the University of Rotterdam or (2) the source of message had no sender.

To verify that participants had seen this manipulation, they were asked to identify the source of the message, after the message was shown. They could respond in three ways: (1) the researcher, (2) not specified or (3) I don't know.

To see whether the manipulation is understood by the respondents and had the intended effect, an analysis of the responses was conducted. Results showed a significant association between group assignment and the manipulation check, as indicated by the Pearson Chi-Square test, $\chi^2(6, N=131) = 25.142$, $p < .001$. This result confirms that participants were able to identify the source of the message, thus affirming that the manipulation was effective.

4.5 Descriptive statistics and randomization checks

The sample used for this study consisted of 131 respondents. The respondents were randomly distributed across the different groups. In this study, the number of respondents per group varied between 30 and 40 (see Appendix C). This is a bit lower than intended (n=40). Time constrains led to this slightly smaller sample size. However, the sample size of n=30 per condition is sufficient according to previous studies by Cooke et al. (2002) and List, Sadoff, & Wagner (2011).

Overall, the majority of the respondents (55%) showed they are willing to try cultured meat in the future. A smaller group (37%) responded with "perhaps", suggesting they are not sure of willing to try it. Finally, a minority segment (8%) expressed unwillingness to try cultured meat. Males were more willing to try cultured meat (56%) compared to woman (44%) (Appendix C).

The sample of this study consisted of 65 males (50%) and 66 females (50%). Among the four groups, gender had an even distribution. This is based on the Pearson's chi-squared test ($\chi^2(3) = 0{,}649$, $p = 0.885$) (see Appendix C). Most of the respondents were between 18 and 25 years old (71%), followed by the second group that had the age of 26-35 (10%).

Based on the Pearson's chi-squared test, age was initially equally distributed among the groups ($\chi^2(15) = 11{,}721$, $p = 0.7$). However, the assumption that at most 20% of the cells have expected count less than 5, was violated. In this case it was 83%, which exceeds the acceptable limit.

Subsequently, looking at the likelihood ratio shows that the null hypothesis cannot be rejected ($p=0,695 > \alpha = 0,05$). This means that there is no association between group and age.

Finally, the highest level of education was measured. Most of the respondents had a bachelor's or master's degree form a university (57%). The second highest level among the respondents was higher professional education (24%). Looking at the Pearson's chi-squared test ($\chi^2(18) = 27,825$, $p = .065$), no significant association between education and group arrangement is indicated. However, an important assumption of the chi-squared test was violated. 71,4% of the cells had an expected count less than five, which exceeds the limit of 20%. To address this issue, the likelihood ratio was examined. It showed that there is no evidence to suggest an association between group and education ($p = 0,057 > \alpha = 0,05$). The distribution of education level appears to be random across the groups. For detailed statistical output, see Appendix C.

In conclusion, none of the control variables had a significant relationship with the dependent variable. This means that these variables do not need to be analyzed further. Moreover, the process of randomization was successful in creating groups that could be compared. In other words, it can be stated that the observed outcomes are more confidently due to the experimental condition rather than due to any pre-existing differences in the groups. This enhances the internal validity of the study. It can therefore be said that the results and outcomes are more reliable.

4.5.1 Model Specification

To analyze the main effect, a multinominal logistic regression model was initially considered. The dependent variable (willingness to try) has three categories and the independent (nudges) is binary. However, the model did not show a significant improvement in fit. Consequently, another model was considered. The dependent variable was recoded into a binary variable, allowing to make use of a binary logistic regression model.

Recoding the dependent variable was done by reducing the three levels (no, possible and yes) into two levels. Levels "no" and "possible" were merged, resulting in a binary variable. This approach was chosen because the aim of the study was to assess the influence of nudges on acceptance. The influence of nudges is likely to be more on consumers that are negative or

unsure about the new technology compared to those who have already a positive attitude toward cultured meat.

The new model showed a significant improvement in fit ($\chi^2 = 30.625$, $p = 0.002$). The overall model fit improved, with 69% of cases correctly classified, compared to 55% in the null model (see Appendix E).

4.6 Robustness of the logistic regression model

Before running the logistic regression analysis, it is necessary to test the corresponding assumptions to ensure validity and reliability. Testing the hypotheses helps to understand better the relation between the dependent and independent variable and assesses whether the model fits the data accurately. Hereafter the assumption will be tested and discussed.

4.6.1 Binary dependent variable and independence

As mentioned earlier, the dependent variable is binary, which meets the assumption. Additionally, it is important to test for independence of observations. In this study, each respondent is independent of the other, thereby meeting the independence assumption.

4.6.2 Multicollinearity

Multicollinearity occurs when two variables are highly correlated. This can affect the validity and ratability of the results. The assumption of multicollinearity was tested using a correlation matrix as shown in table 2. Table 2 shows that no significant coefficients of 0,7 or higher are present among the variables in this study. The highest observed correlation was between gender and past behavior (0.205). This indicates that the variables do not have strong linear relationships with each other. Therefore, the assumption of multicollinearity is met.

	Correlations							
		1	2	3	4	5	6	7	8
1	Past Behevior	1							
2	Age	.158	1						
3	Education	.054	-.122	1					
4	Gender	.205*	.041	.032	1				
5	Percieved Naturalness	.128	.204*	.012	.003	1			
6	nudge	-.046	-.167	-.134	-.007	.000	1		
7	source	.046	-.122	-.023	-.008	-.090	-.063	1	
8	Willingness to Try	.046	-.191*	.198*	-.131	-.168	-.153	-.138	1
	* Correlation is significant at the 0.05 level (2-tailed).								

Table 2: Correlations matrix

4.6.3 Linearity

To ensure the robustness of the model it is important to test the assumption of the independent variables and the log odds of the dependent variable. To test this, the Box-Tidwell transformation and test was performed. This transformation involves creating interaction terms between each predictor and its natural logarithm. The formula used for this transformation was: variable * ln(variable).

This approach aims to linearize the relationship between predictors and the log odds of the dependent variable. The new variables were renamed into this format: auto_[old variable name] to clearly distinguish the variables from the original ones. Subsequently, these variables were integrated into a logistic regression model and the Box-Tidwell test was conducted.

The significance of these terms in the logistic regression model was evaluated to see if further adjustments were needed. As seen in the model output (appendix D), none of the variables was statistically significant. This indicates there is no evidence for non-linearity between the predictors log odds of the dependent variable. Given these results, the linearity assumption of logistic regression has been met.

4.6.4 A large sample size

To conduct a logistic regression analysis, the sample size needs to be sufficiently large. A common guideline for logistic regression is to have at least of 10 cases for each parameter in the model. This guideline is supported by various sources like Harrell (2001). This researcher

emphasizes the importance of having at least 10 events per predictor variable to minimize the risk of type I and type II errors and to stabilize parameter estimates. In this study, this minimum was met. The smallest sample size per predictor was n=30. Therefore, the assumption of a large sample size has been met.

4.7 Testing of the conceptual framework – Hypothesis testing

4.7.1 Main Effect of Nudges on Dependent Variable

A binary logistic regression was performed to assess the main effect of nudges on acceptance of cultured meat. Control variables such as gender, age and education were also incorporated into the model. This was done to ensure that the analysis is accounted for potential confounding factors. By incorporating the control variables, their effect could be isolated. This approach makes interpretation of the main effect more accurate.

This regression model has a Negelkerke R Square of 0.279, meaning that the model explains 27.9% of the variance of willingness to try cultured meat. By looking at the Omnibus Tests of Model Coefficients, the model is found to be significant ($\chi^2 = 30.625$, $p = 0.002$). This implies that the model with predictors significantly fits the data better, than the null model (see Appendix E).

Results of the binary logistic regression are shown in Table 3. Findings indicate that nudges have an odds ratio of 0.530. This means that respondents are 47% less likely to show willingness to try cultured meat when they are exposed to the informational nudge (absence of additives) compared to the neutral nudge (ceteris paribus). This is contrary to what was expected. However, the effect is not significant ($p = 0.131$).

Variables in the Equation					
	Beta	**S.E.**	**Wald**	**p -value**	**Odds ratio**
Past Behavior	.149	.103	2.076	.150	1.160
Age	-.324	.209	2.403	.121	.723
Edu | Primary (reference)			2.486	.870	
Edu | MBO	-41.146	4,39E+07	.000	.999	.000
Edu | HAVO	-20.186	4,02E+07	.000	1.000	.000
Edu | VWO	-20.955	4,02E+07	.000	1.000	.000
Edu | HBO	-20.623	4,02E+07	.000	1.000	.000
Edu | University	-20.021	4,02E+07	.000	1.000	.000
Edu | PhD	.250	5,68E+07	.000	1.000	1.284
Gender (1)	-.623	.407	2.335	.126	.537
Percieved Naturalness	-.443	.254	3.053	.081	.642
Nudge (1)	-.635	.420	2.285	.131	.530
Source (1)	-.962	.423	5.184	**.023**	.382
Constant	23.374	40.193.135	.000	1.000	1,42E+13

Table 3: Binominal Logistic Regression Model

4.7.2Mediating role of perceived naturalness

To test hypotheses H1, H2a, and H2b, the PROCESS model (Hayes, 2017) was used. Model number 10 was used for this analysis because this best suited the conceptual model of this study. This model takes two moderators in account, and this aligns with the requirements of the research. Overall, it is found that the mediational role of perceived naturalness, estimated with 5000 bootstrap samples (with the 95% confidence interval including zero), was not significant. Therefore, no evidence is found that support the mediational role of perceived naturalness. Hypothesis H2b is not supported.

Hypotheses:

H1: *Perceived naturalness positively affects acceptance of cultured meat.*

H2a: *Emphasizing the absence of negative perceived ingredients (nudge), will improve perceived naturalness compared to not mentioning it.*

H2b: *The effect of the nudges on acceptance is mediated through perceived naturalness.*

In order to test hypothesis H1 and H2a, two different models were utilized. The results are as follow (see Appendix F):

The first regression model, predicting perceived naturalness from nudges, source, past behavior and their interaction, along with covariates, was not significant (R^2 = 0.1398, F(13, 117) = 1.4624, p = 0.1421). Specifically, nudges did not have a significant effect on perceived naturalness (a = -0.0533, t(117) = -0.1718, p = 0.8639). Hypothesis H2a is not supported by the data.

The second regression model, predicting acceptance of cultured meat from perceived naturalness, nudges, source, past behavior and their interaction, along with covariates, was significant (Nagelkerke R^2 = 0.2867, p = 0.0046). However, perceived naturalness did not have a significant direct effect on acceptance (b = -0.4549, Z = -1.7667, p = 0.0773), nor did nudges (c = -1.0027, Z = -1.2048, p = 0.2283). Although perceived naturalness is marginally significant, a negative effect was observed where a positive was expected. Thus, there is no evidence found to support Hypothesis H1.

4.7.3 Source as a moderator

To test hypothesis H3, the moderating role of source on relation between nudges and willingness to try is. This hypothesis posited that nudges from a researcher would result in a higher acceptance, compared to when the source in not mentioned. Again, PROCESS by Heyes (2017) is used to examine this relationship. The variable “source” is coded as 0 for no source mentioned and 1 as source is mentioned (from a researcher).

Results from the analysis (see Appendix F) show that interaction between nudge and source on influencing willingness to try was not significant (β = -0.3237, Z = -0.3846, p = 0.7005). Therefore, hypothesis H3 is not supported.

While there is no moderation effect, findings show a significant direct effect of source on willingness (β=−0.911, Z=−4.772, p=0.029). Contrary to what expected, this result shows a negative relation. This indicates when the source of the message is mentioned (from a researcher) it reduces the willingness to try among consumers.

4.7.4 Past behavior as a moderator

In analyzing the moderating role of past behavior on the influence of nudges on willingness to try cultured meat, the interaction between nudges and past behavior is examined to test hypothesis H2: The effect of nudges will be stronger among participants who do not frequently choose plant-based or vegetarian options compared to those who do. For this analyze PROCESS model 10 was used. Results (in Appendix F) show non-significant results ($\beta = 0.1967$, $Z = 0.9371$, $p = 0.3487$). Thus, hypothesis h2 is not supported by the findings.

5. Discussion and conclusion

5.1 Summary of main findings

The main objective of this study was to investigate the influence of informational nudges on acceptance of cultured meat. More specifically, this study focused on the mediating role of perceived naturalness and the moderating role of past behavior and source of the messages. In this study a between-subject design was utilized, where participants were assigned to one of four different experimental conditions. The data was analyzed using tools like SPSS and R to evaluate the impact of the variables and to test the hypotheses. During the analysis, a binominal logistic regression was performed. Also, the PROCESS tool by Heyes (2017) was utilized for the moderation and mediation analysis.

Results from the study did not show a positive or significant main effect of nudges on willingness to try. Moreover, the study revealed that perceived naturalness did not significantly influence willingness to try cultured meat. Contrary to what was expected, results show a negative and marginally significant effect of perceived naturalness on willingness to try. Consequently, this led to the rejection of hypothesis H1. Enhancing perceived naturalness might not be sufficient to increase willingness to try among future consumers.

Additionally, the influence of nudges based on past behavior of the participants was researched. In this study it was hypothesized that the effect of the nudges will be stronger for people who do not frequently choose vegetarian options compared to those who do. The analysis showed no significant result for past behavior, thereby rejecting hypothesis H2.

Further analysis examined the mediation effect of perceived naturalness on willingness to try cultured meat. Results showed no significant relationships and therefore hypothesis H2b was rejected. Moreover, the data showed no significant results to support hypothesis H2a. This hypothesis posited that the informational nudge emphasizing the absence of some negatively perceived ingredients, will improve perceived naturalness compared to not mentioning it.

Lastly, the results indicate that no significant evidence was found to support hypothesis H3. This hypothesis proposed that nudges (the message) from a researcher will lead to a higher acceptance, compared to a nudge where that source is not mentioned. Contrary to what was expected, analysis showed a significant negative effect for source. This suggest that when the source is mentioned (from a researcher) it leads to a less willingness to try, compared to not mentioning the source.

5.2 Overview of Hypotheses Outcomes

Hypothesis	**Description**	**Outcome**
H1	Perceived naturalness positively affects acceptance of cultured meat.	Not supported
H2	The effect of nudges will be stronger among participants who do not frequently choose plant-based or vegetarian options compared to those who do.	Not supported
H2a	Emphasizing the absence of negative perceived ingredients will improve perceived naturalness compared to not mentioning it.	Not supported
H2b	The effect of the nudges on acceptance is mediated through perceived naturalness.	Not supported
H3	The delivery of informational nudges about cultured meat from a researcher will result in higher acceptance compared to when the source is not mentioned.	Not supported

In conclusion, none of the hypotheses was supported in this study. Form past literature we know that informational nudges are a popular way to influence consumer behavior. From this study we see that the effectiveness of nudges to alter acceptance seems to be limited. The outcome shows that consumer attitudes toward cultured meat are complex. Consequently, more strategies are needed to change the acceptance of cultured meat.

5.3 Theoretical implications

While most of the results are not significant, this research contributed to existing knowledge on acceptance of cultured meat. Nudges are normally an effective way to influence consumers behavior. However, from this study we see that nudges in this context appear limited. In this study nudges indicated a counterproductive effect when the absence of negative perceived ingredients was emphasized. Although it was not a significant effect in the model, it was a remarkable finding in the descriptive analysis.

Additionally, the mediational role of perceived naturalness, that is an important factor in accepting cultured meat, seemed to have a different effect from what was expected. Instead of a positive effect of perceived naturalness on acceptance, we a negative effect was observed which was marginally significant. These findings suggest that altering the perceived naturalness to increase acceptance by nudging consumers might not be the best approach.

In conclusion, these results underscore the need to rethink strategies for increasing consumer acceptance of cultured meat. Traditional approaches, such as nudging, may have varying impacts on the acceptance of novel foods, indicating the necessity for more nuanced methods. Future research could focus on general psychological and social factors shaping consumer attitudes toward novel foods.

5.4 Managerial implications

Although the majority of the hypotheses was not significant, some findings offer valuable insights for managers, marketers, and policymakers in the food industry. The insight are valuable for those involved in the industry of alternative proteins like cultured meat. Moreover, these finding could be helpful for governmental bodies that are focused on the promotion of sustainable food choices.

Firstly, the observed negative effect of nudges on the acceptance, which was not significant, may provide valuable insight for managers, marketeers and product developers in the industry.

More comprehensive educational campaigns could be considered that tackle alter acceptance of cultured meat.

Further, the source credibility results show that it was the source - whether from a researcher or not - that did affect acceptance. Different from what was expected, source showed to have a significant negative effect. This indicates that mentioning the source of the message (a researcher) may not be an effective strategy to increase acceptance of cultured meat. Managers could use this information to optimize their future communication strategies.

Additionally, the fact that nudges did not have a differential impact based on past dietary behavior (consuming less meat or fish) means that cultured meat should be targeted broadly, instead of focusing on specific past dietary habits.

The surprising negative effect of perceived naturalness on acceptance could be interesting for managers and marketers. Result show that when the food is perceived more natural, it lowers the acceptance. This is not in line with previous research, where a positive relationship is observed. Thus, this result needs to be taken with a grain of salt. Marketeers should reconsider how they emphasize naturalness in their campaigns.

In conclusion, although the direct effects found in this research are relatively small, the insights are valuable for marketeers and policy makers in the food industry. They know what may not work when promoting cultured meat. These findings guide them to develop more effective strategies.

5.5 Limitations and suggestions for future research

While this study was conducted with care, there are some limitations that should be acknowledged.

Firstly, the sample size used for this study is not fully representative of the broader population. The respondents were predominantly young adults (18-25 years), which doesn’t represent the whole potential market of cultured meat. Perspectives of older people may be underrepresented in this sample. Moreover, the recruitment methods (social media and university networks), may

have led to selection bias. It could be that the selected respondents were already more tech-savvy and possible more open to novel foods like cultured meat. A suggestion for future research is to use a more representative sample, where wider age range are is included and diverse distribution channels are used.

Secondly, the sample size of this study (n=132) is relatively small. While is meets the minimum requirement for statistical analysis, increasing the size would improve the generalizability and validly of the results. Larger sample size could provide more reliable estimates of the population and reduces the margin of error.

Thirdly, binary recoding of the dependent variable has several limitations. Data might be oversimplified which means that important information is lost. During merging the categories together, it might lead to bias, especially if there are different reasons for the categories to exist. Also, a binary classification gives a very primitive view of consumer behavior, which could obscure important insights. This approach also has implications in terms of generalizability. The binary outcome might not meet the real word scenarios. Although theoretically justified, these limitations should be recognized to ensure transparency and reporting accuracy.

Another notable limitation of the present study is lack of specificity in the question regarding perceived naturalness. While the questions were aimed to capture perceptions of the respondents about naturalness of food, it was not specifically pointed towards cultured meat. This lack of direct association may have led that respondent shared their general perception of naturalness, rather than their perspective regarding cultured meat. This may have resulted in not accurate findings. Future research should ensure that the questions regarding perceived naturalness tap on cultured meat to provide more precise and relevant insights.

The online distribution method forms the next limitation. This method lacks controllability over respondent's environment which could mean that external factors, such as distractions, may have influenced their responses. Also, the online format may not fully capture the complexity of social influences in real life settings. Future studies could focus on more controlled experimental design, to control for these factors.

Furthermore, the reliance of self-reported data could lead to several issues regarding validity and reliability of the findings. One of them is response bias. Participants may gave socially desirable responses, because sustainability is a sensitive and socially pressured topic. Although the survey was anonymous, the possibility that the respondents' perceptions are not fully reflected in their responses. Implementing behavioral experiments or longitudinal follow-ups could help to overcome this issue.

Lastly, the scale used in this research to capture willingness to try, may not fully capture the nuances of participants' perceptions. While the scale is used is prior studies, it may oversimplify the concept. In this study the data needed to be restructured, leading to potential reduced reliability. Making use of a Likert scale could be better understanding and improve the robustness of the analysis.

Lastly, the scale used in this research to capture willingness to try may not fully capture the nuances of participants' views. While this scale has been utilized in prior studies, it may oversimplify complex attitudes. In this study, the data needed to be restructured, leading to reduced reliability. Employing a Likert scale could provide a more nuanced understanding and improve the robustness of the analysis.

Future studies should address these limitations for more comprehensive insights and improve the overall findings related to acceptance of cultured meat.

5.6 Conclusion

The purpose of this study was to answer the following research question:

RQ: How do informational nudges influence the relationship between naturalness and acceptance of cultured meat amongst Dutch consumers?

Based on an extensive literature review and empirical analysis, this research study aimed to provide conclusive answers by formulating several hypotheses. The findings reveal that none of the expected relationships were supported by the findings.

Firstly, the results show that informational nudges emphasizing the absence of negative perceived ingredients did not significantly influence the acceptance of cultured meat. Secondly, the impact of perceived naturalness is limited in the results of this study. Both a direct and a mediation effect of perceived naturalness is found not to be significant. Surprisingly, a marginal significant but negative direct effect of perceived naturalness on willingness is found.

Thirdly, the results show no significant evidence to support the moderating role of source in the relationship between nudges and willingness to try. However, results show a not expected direct negative effect of source on acceptance. This indicates that respondents are less likely to try cultured meat when the source is mentioned (from a researcher), compared to when the source is not mentioned.

Moreover, analysis showed that no significant results were found that support the hypothesis that past dietary behavior influences the relationship between nudges and willingness. This suggests that previous dietary habits do not significant influence how consumer react to nudges that promote cultured meat.

Taken the previous together, these findings show that consumer acceptance of cultured meat is a highly complex. Future research should test for more variables to identify which of them best addresses consumer concerns and improve acceptance. Moreover, taking the limitations of this study into account would increase the reliability of future research. This study offers valuable insights into possible drivers that influence the acceptance of cultured meat. It points toward the need of future research to gain a better understanding of the elements that influence acceptance of this new technology.

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-t

Allen, M. (2017). The SAGE Encyclopedia of Communication Research Methods. In *SAGE Publications, Inc. eBooks*. https://doi.org/10.4135/9781483381411

Bacon, L., & Krpan, D. (2018). (Not) Eating for the environment: The impact of restaurant menu design on vegetarian food choice. *Appetite*, *125*, 190–200. https://doi.org/10.1016/j.appet.2018.02.006

Bekker, G. A., Fischer, A. R., Tobi, H., & Van Trijp, J. (2017). Explicit and implicit attitude toward an emerging food technology: The case of cultured meat. *Appetite*, *108*, 245–254. https://doi.org/10.1016/j.appet.2016.10.002

Boenke, L., Panning, M., Thurow, A., Hörisch, J., & Loschelder, D. D. (2022). Who can nudge for sustainable development? How nudge source renders dynamic norms (in-)effective in eliciting sustainable behavior. *Journal of Cleaner Production*, *368*, 133246. https://doi.org/10.1016/j.jclepro.2022.133246

Bryant, C., Anderson, J. E., Asher, K., Green, C., & Gasteratos, K. (2019). Strategies for overcoming aversion to unnaturalness: The case of clean meat. *Meat Science*, *154*, 37–45. https://doi.org/10.1016/j.meatsci.2019.04.004

Bryant, C., & Barnett, J. (2018). Consumer acceptance of cultured meat: A systematic review. *Meat Science*, *143*, 8–17. https://doi.org/10.1016/j.meatsci.2018.04.008

Cheng, T., Woon, D. K., & Lynes, J. (2011). The use of message framing in the promotion of environmentally sustainable behaviors. *Social Marketing Quarterly*, *17*(2), 48–62. https://doi.org/10.1080/15245004.2011.570859

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, Quantitative, and Mixed Method Approaches*.

Etale, A., & Siegrist, M. (2021). Food processing and perceived naturalness: Is it more natural or just more traditional? *Food Quality and Preference*, *94*, 104323. https://doi.org/10.1016/j.foodqual.2021.104323

Gagliardi, L. (2024). Naturalness Seeking Minds: The cognitive foundations of naturalness Bias in consumer food choice. *Social Science Research Network*. https://doi.org/10.2139/ssrn.4761160

Garnett, E. E., Balmford, A., Sandbrook, C., Pilling, M. A., & Marteau, T. M. (2019). Impact of increasing vegetarian availability on meal selection and sales in cafeterias. *Proceedings of the National Academy of Sciences of the United States of America*, *116*(42), 20923–20929. https://doi.org/10.1073/pnas.1907207116

Harrell, F. E. (2001). Regression modeling strategies. In *Springer series in statistics*. https://doi.org/10.1007/978-1-4757-3462-1

Kollmuss, A., & Agyeman, J. (2002). Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, *8*(3), 239–260. https://doi.org/10.1080/13504620220145401

Laestadius, L., & Caldwell, M. A. (2015). Is the future of meat palatable? Perceptions ofin vitromeat as evidenced by online news comments. *Public Health Nutrition*, *18*(13), 2457–2467. https://doi.org/10.1017/s1368980015000622

Lewisch, L., & Riefler, P. (2023). How social norms and dietary identity affect willingness to try cultured meat. *British Food Journal*. https://doi.org/10.1108/bfj-11-2022-1016

Mancini, M. C., & Antonioli, F. (2019). Exploring consumers' attitude towards cultured meat in Italy. *Meat Science*, *150*, 101–110. https://doi.org/10.1016/j.meatsci.2018.12.014

Nelson, K., Bauer, M. K., & Partelow, S. (2021). Informational nudges to encourage pro-environmental behavior: examining differences in message framing and human interaction. *Frontiers in Communication, 5*. https://doi.org/10.3389/fcomm.2020.610186

Osbaldiston, R., & Schott, J. P. (2011). Environmental sustainability and behavioral science. *Environment and Behavior*, *44*(2), 257–299. https://doi.org/10.1177/0013916511402673

Pakseresht, A., Kaliji, S. A., & Canavari, M. (2022). Review of factors affecting consumer acceptance of cultured meat. *Appetite, 170*, 105829. https://doi.org/10.1016/j.appet.2021.105829

Pincus, R. (1995). Barnett, V., and Lewis T.: Outliers in Statistical Data. 3rd edition. J. Wiley & Sons 1994, XVII. 582 pp., £49.95. *Biometrical Journal, 37*(2), 256. https://doi.org/10.1002/bimj.4710370219

Román, S., Sánchez-Siles, L. M., & Siegrist, M. (2017). The importance of food naturalness for consumers: Results of a systematic review. *Trends in Food Science & Technology (Regular Ed.)*, *67*, 44–57. https://doi.org/10.1016/j.tifs.2017.06.010

Rombach, M., Dean, D. L., Vriesekoop, F., De Koning, W., Aguiar, L., Anderson, M., Mongondry, P., Oppong-Gyamfi, M., Urbano, B., Luciano, C. a. G., Hao, W., Eastwick, E., Jiang, Z., & Boereboom, A. (2022). Is cultured meat a promising consumer alternative? Exploring key factors determining consumer's willingness to try, buy and pay a premium for cultured meat. *Appetite, 179*, 106307. https://doi.org/10.1016/j.appet.2022.106307

Rozin, P., Fischler, C., & Shields-Argelès, C. (2012). European and American perspectives on the meaning of natural. *Appetite*, *59*(2), 448–455. https://doi.org/10.1016/j.appet.2012.06.001

Siegrist, M., Sütterlin, B., & Hartmann, C. (2018). Perceived naturalness and evoked disgust influence acceptance of cultured meat. *Meat Science*, *139*, 213–219. https://doi.org/10.1016/j.meatsci.2018.02.007

Steptoe, A., & Wardle, J. (1999). Motivational factors as mediators of socioeconomic variations in dietary intake patterns. *Psychology & Health*, *14*(3), 391–402. https://doi.org/10.1080/08870449908407336

Verbeke, W., Sans, P., & Van Loo, E. J. (2015). Challenges and prospects for consumer acceptance of cultured meat. *Journal of Integrative Agriculture*, *14*(2), 285–294. https://doi.org/10.1016/s2095-3119(14)60884-4

Vissers, L., Jongeneel, R., Saatkamp, H., & Lansink, A. O. (2021). A multiple-standards framework to address externalities resulting from meat production. *Applied Economic Perspectives and Policy*, *44*(2), 946–959. https://doi.org/10.1002/aepp.13152

Wilks, M., & Phillips, C. J. C. (2017). Attitudes to in vitro meat: A survey of potential consumers in the United States. *PloS One*, *12*(2), e0171904. https://doi.org/10.1371/journal.pone.0171904

Wilks, M., Phillips, C. J. C., Fielding, K. S., & Hornsey, M. J. (2019). Testing potential psychological predictors of attitudes towards cultured meat. *Appetite*, *136*, 137–145. https://doi.org/10.1016/j.appet.2019.01.027

Appendix A: Questionnaire

Experiment

Start of Block: Introduction

Dear participant,

Thank you for participating in this survey about cultured meat (kweekvlees). This questionnaire is part of my Master's thesis in Marketing at EUR. The insights gained will help us better understand the acceptance of cultured meat in the Netherlands.

Your participation is crucial and highly valued. The survey will take approximately 5 minutes to complete. All responses are confidential and will be used solely for academic research purposes. By proceeding, you consent to participate in this study voluntarily.

Thank you for your time and valuable input!

Best,
Marek

Q1 Please check the box if this applies to you:

○ I confirm that I have read the information provided above and consent to participate voluntarily. (1)

End of Block: Introduction

Start of Block: **Group 1: Informational nudge (TG) x Researcher**

Q2 Read the following message about cultured meat from a researcher at the Erasmus University Rotterdam:

Cultivated with Care, Crafted for You!

Have you ever wondered about the future of food? Cultured meat offers a new horizon in sustainable dining. Free from additives, preservatives, and artificial enhancers, it represents a cleaner, greener alternative to traditional livestock farming. By omitting antibiotics,

hormones, and the ethical concerns of animal welfare, cultured meat provides a guilt-free option for conscious consumers.

Embrace the future of food with every delicious, environmentally friendly bite!

End of Block: Group 1: Informational nudge (TG) x Researcher

Start of Block: **Group 2: Informational nudge (TG) x No Researcher**

Q3 Read the following message about cultured meat:

Cultivated with Care, Crafted for You!

Have you ever wondered about the future of food? Cultured meat offers a new horizon in sustainable dining. Free from additives, preservatives, and artificial enhancers, it represents a cleaner, greener alternative to traditional livestock farming. By omitting antibiotics, hormones, and the ethical concerns of animal welfare, cultured meat provides a guilt-free option for conscious consumers.

Embrace the future of food with every delicious, environmentally friendly bite!

End of Block: Group 2: Informational nudge (TG) x No Researcher

Start of Block: **Group 3: Neutral message (CG) x Researcher**

Q4 Read the following message about cultured meat from a researcher at the Erasmus University Rotterdam:

Introducing Cultured Meat

Ever curious about the next wave of culinary innovation? Cultured meat represents a fascinating advancement in food technology. Through a meticulous process, meat is grown from animal cells in a controlled environment. This method offers exciting possibilities for sustainable food production without compromising taste or texture.

Join us in exploring the future of food with cultured meat – a blend of innovation and culinary delight.

End of Block: Group 3: Neutral message (CG) x Researcher

Start of Block: **Group 4: Neutral message (CG) x No Researcher**

Q5 Read the following message about cultured meat:

Introducing Cultured Meat

Ever curious about the next wave of culinary innovation? Cultured meat represents a fascinating advancement in food technology. Through a meticulous process, meat is grown from animal cells in a controlled environment. This method offers exciting possibilities for sustainable food production without compromising taste or texture.

Join us in exploring the future of food with cultured meat – a blend of innovation and culinary delight!

End of Block: **Group 4: Neutral message (CG) x No Researcher**

Start of Block: Manipulation check

Q(m) From who was the message you just saw?

- ○ Not specified (1)
- ○ A researcher from the Erasmus University of Rotterdam (2)
- ○ I don't know (3)

End of Block: Manipulation check

Start of Block: Mediation

Q6 Read the following 3 statements and choose to what extent this applies to you

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
It is important to me that the food I eat on a typical day contains no additives. (1)	○	○	○	○	○
It is important to me that the food I eat on a typical day contains natural ingredients. (2)	○	○	○	○	○
It is important to me that the food I eat on a typical day contains no artificial ingredients. (3)	○	○	○	○	○

End of Block: Mediation

Start of Block: Willingness to try

Q7 Would you be willing to try cultured meat in the future?

○ No (1)

○ Possible (2)

○ Yes (3)

End of Block: Willingness to try

Start of Block: Moderation: past behavior

Q8 During the previous seven days, on how many days did you eat neither meat nor fish?

- 0 (1)
- 1 (2)
- 2 (3)
- 3 (4)
- 4 (5)
- 5 (6)
- 6 (7)
- 7 (8)

End of Block: Moderation: past behavior

Start of Block: Control variables

Q9 What is your age?

- 18-25 (1)
- 26-35 (2)
- 36-45 (3)
- 46-55 (4)
- 56-65 (5)
- 66 and older (6)

Q10 What is your highest level of education?

- ○ Primary school (1)
- ○ Lower / intermediate secondary education (VMBO / MAVO) (2)
- ○ intermediate professional education (MBO) (3)
- ○ higher secondary education (HAVO) (4)
- ○ pre-university secondary education (VWO) (5)
- ○ higher professional education (HBO) (6)
- ○ University (bachelor's degree / Master's degree) (7)
- ○ Doctorate (PhD) (8)

Q11 What is your gender?

- ○ Male (1)
- ○ Female (2)
- ○ Non-binary / third gender (3)
- ○ Prefer not to say (4)

End of Block: Control variables

Appendix B: Factor Analysis and Reliability

Pearson Correlations

		1	2	3	4	5	6	7	8	9
1	From who was the message you just saw?	1								
2	It is important to me that the food I eat on a typical day co	-.130	1							
3	It is important to me that the food I eat on a typical day co	-.144	.505**	1						
4	It is important to me that the food I eat on a typical day cor	.004	.505**	.415**	1					
5	Willingness to try cultured meat	-.006	-.149	-.111	-.208*	1				
6	During the previous seven days, on how many days did yo	-.023	.195*	.004	.106	.070	1			
7	What is your age?	-.074	.154	.233**	.110	-.195*	.158	1		
8	What is your highest level of education?	.087	.011	.015	.003	.266**	.054	-.122	1	
9	What is your gender?	.125	.047	-.113	.068	-.112	.205*	.041	.032	1
	** Correlation is significant at the 0.01 level (2-tailed).									
	* Correlation is significant at the 0.05 level (2-tailed).									

Factor Analysis

Communalities

	Initial	Extraction
Read the following 3 statements and choose to what extent this applies to you - It is important to me that the food I eat on a typical day contains no additives.	.360	.612
Read the following 3 statements and choose to what extent this applies to you - It is important to me that the food I eat on a typical day contains natural ingredients.	.289	.415
Read the following 3 statements and choose to what extent this applies to you - It is important to me that the food I eat on a typical day contains no artificial ingredients.	.289	.416

Extraction Method: Principal Axis Factoring.

Reliability Analysis

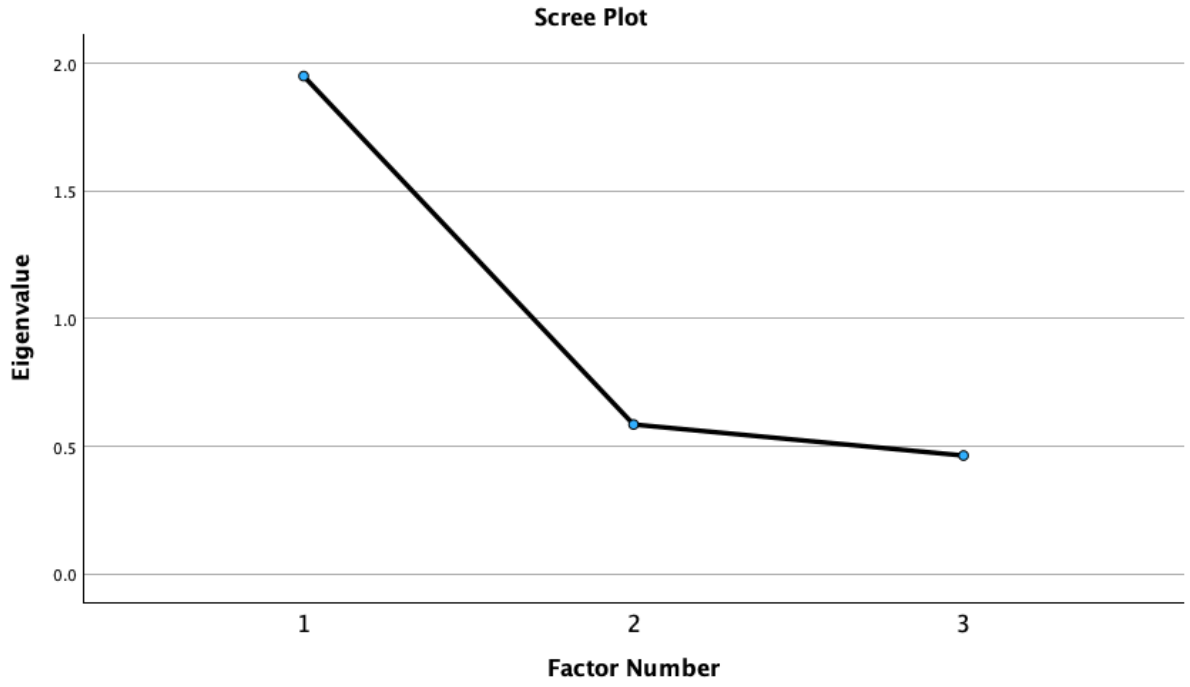
Reliability Statistics

Cronbach's Alpha	N of Items
.730	3

Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.951	65.024	65.024	1.443	48.105	48.105
2	.585	19.515	84.539			
3	.464	15.461	100.000			

Extraction Method: Principal Axis Factoring.



Manipulation check

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	25.142[a]	6	<.001
Likelihood Ratio	25.622	6	<.001
Linear-by-Linear Association	2.671	1	.102
N of Valid Cases	131		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.05.

Appendix C: Descriptive statistics

Willingness to try cultured meat

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	11	8.4	8.4	8.4
	Possible	48	36.6	36.6	45.0
	Yes	72	55.0	55.0	100.0
	Total	131	100.0	100.0	

Willingness to try cultured meat * What is your gender? Crosstabulation

			What is your gender?		
			Male	Female	Total
Willingness to try cultured meat	No	Count	5	6	11
		% within Willingness to try cultured meat	45.5%	54.5%	100.0%
		% within What is your gender?	7.7%	9.1%	8.4%
		% of Total	3.8%	4.6%	8.4%
	Possible	Count	20	28	48
		% within Willingness to try cultured meat	41.7%	58.3%	100.0%
		% within What is your gender?	30.8%	42.4%	36.6%
		% of Total	15.3%	21.4%	36.6%
	Yes	Count	40	32	72
		% within Willingness to try cultured meat	55.6%	44.4%	100.0%
		% within What is your gender?	61.5%	48.5%	55.0%
		% of Total	30.5%	24.4%	55.0%
Total		Count	65	66	131
		% within Willingness to try cultured meat	49.6%	50.4%	100.0%

	% within What is your gender?	100.0%	100.0%	100.0%
	% of Total	49.6%	50.4%	100.0%

What is your age?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-25	93	71.0	71.0	71.0
	26-35	13	9.9	9.9	80.9
	36-45	10	7.6	7.6	88.5
	46-55	9	6.9	6.9	95.4
	56-65	5	3.8	3.8	99.2
	66 and older	1	.8	.8	100.0
	Total	131	100.0	100.0	

Please check the box if this applies to you:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I confirm that I have read the information provided above and consent to participate voluntarily.	131	100.0	100.0	100.0

From who was the message you just saw?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not specified	41	31.3	31.3	31.3
	A researcher from the Erasmus University of Rotterdam	59	45.0	45.0	76.3
	I don't know	31	23.7	23.7	100.0
	Total	131	100.0	100.0	

Willingness to try cultured meat

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	11	8.4	8.4	8.4
	Possible	48	36.6	36.6	45.0
	Yes	72	55.0	55.0	100.0
	Total	131	100.0	100.0	

During the previous seven days, on how many days did you eat neither meat nor fish?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	44	33.6	33.6	33.6
	1	22	16.8	16.8	50.4
	2	21	16.0	16.0	66.4
	3	16	12.2	12.2	78.6
	4	7	5.3	5.3	84.0
	5	10	7.6	7.6	91.6
	6	2	1.5	1.5	93.1
	7	9	6.9	6.9	100.0
	Total	131	100.0	100.0	

What is your highest level of education?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Primary school	1	.8	.8	.8
	intermediate professional education (MBO)	5	3.8	3.8	4.6
	higher secondary education (HAVO)	5	3.8	3.8	8.4
	pre-university secondary education (VWO)	12	9.2	9.2	17.6
	higher professional education (HBO)	32	24.4	24.4	42.0

	University (bachelor's degree / Master's degree)	75	57.3	57.3	99.2
	Doctorate (PhD)	1	.8	.8	100.0
	Total	131	100.0	100.0	

What is your gender?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	65	49.6	49.6	49.6
	Female	66	50.4	50.4	100.0
	Total	131	100.0	100.0	

Group

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Group1: Informational nudge (TG) x Researcher	30	22.9	22.9	22.9
	Group2: Informational nudge (TG) x No Researcher	30	22.9	22.9	45.8
	Group3: Neutral message (CG) x Researcher	40	30.5	30.5	76.3
	Group4: Neutralmessage (CG) x No Researcher	31	23.7	23.7	100.0
	Total	131	100.0	100.0	

Percieved_Naturalness

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	1	.8	.8	.8
	1.67	3	2.3	2.3	3.1
	2.00	6	4.6	4.6	7.6
	2.33	5	3.8	3.8	11.5

	2.67	11	8.4	8.4	19.8
	3.00	6	4.6	4.6	24.4
	3.33	14	10.7	10.7	35.1
	3.67	25	19.1	19.1	54.2
	4.00	22	16.8	16.8	71.0
	4.33	23	17.6	17.6	88.5
	4.67	6	4.6	4.6	93.1
	5.00	9	6.9	6.9	100.0
	Total	131	100.0	100.0	

Crosstabs

Group * What is your gender? Crosstabulation

			What is your gender?		
			Male	Female	Total
Group	Group1: Informational nudge (TG) x Researcher	Count	14	16	30
		Expected Count	14.9	15.1	30.0
	Group2: Informational nudge (TG) x No Researcher	Count	16	14	30
		Expected Count	14.9	15.1	30.0
	Group3: Neutral message (CG) x Researcher	Count	21	19	40
		Expected Count	19.8	20.2	40.0
	Group4: Neutralmessage (CG) x No Researcher	Count	14	17	31
		Expected Count	15.4	15.6	31.0
Total		Count	65	66	131
		Expected Count	65.0	66.0	131.0

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.649[a]	3	.885
Likelihood Ratio	.650	3	.885

Linear-by-Linear Association	.014	1	.907
N of Valid Cases	131		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 14.89.

Group * What is your highest level of education? Crosstabulation

Count

		What is your highest level of education?							
		Primary school	intermediate professional education (MBO)	higher secondary education (HAVO)	pre-university secondary education (VWO)	higher professional education (HBO)	University (bachelor's degree / Master's degree)	Doctorate (PhD)	Total
Group	Group1: Informational nudge (TG) x Researcher	0	1	0	7	6	16	0	30
	Group2: Informational nudge (TG) x No Researcher	0	3	2	1	10	14	0	30
	Group3: Neutral message (CG) x Researcher	1	1	3	2	6	27	0	40
	Group4: Neutralmessage (CG) x No Researcher	0	0	0	2	10	18	1	31
Total		1	5	5	12	32	75	1	131

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	27.825[a]	18	.065
Likelihood Ratio	28.378	18	.057
Linear-by-Linear Association	2.323	1	.127
N of Valid Cases	131		

a. 20 cells (71.4%) have expected count less than 5. The minimum expected count is .23.

Group * What is your age? Crosstabulation

			What is your age?						
			18-25	26-35	36-45	46-55	56-65	66 and older	Total
Group	Group1: Informational nudge (TG) x Researcher	Count	24	3	2	1	0	0	30
		Expected Count	21.3	3.0	2.3	2.1	1.1	.2	30.0
	Group2: Informational nudge (TG) x No Researcher	Count	22	4	1	2	1	0	30
		Expected Count	21.3	3.0	2.3	2.1	1.1	.2	30.0
	Group3: Neutral message (CG) x Researcher	Count	28	3	5	3	1	0	40
		Expected Count	28.4	4.0	3.1	2.7	1.5	.3	40.0
	Group4: Neutralmessage (CG) x No Researcher	Count	19	3	2	3	3	1	31
		Expected Count	22.0	3.1	2.4	2.1	1.2	.2	31.0
Total		Count	93	13	10	9	5	1	131
		Expected Count	93.0	13.0	10.0	9.0	5.0	1.0	131.0

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11.721[a]	15	.700
Likelihood Ratio	11.789	15	.695
Linear-by-Linear Association	5.700	1	.017
N of Valid Cases	131		

a. 20 cells (83.3%) have expected count less than 5. The minimum expected count is .23.

Appendix D: assumptions testing

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Step 1[a]	auto_vega	.167	.137	1.474	1	.225	1.181	.903	1.547
	auto_age	-.334	.182	3.369	1	.066	.716	.501	1.023
	auto_edu	.617	.389	2.523	1	.112	1.854	.866	3.970
	auto_gender	-.515	.278	3.444	1	.063	.597	.346	1.029
	auto_PN	-.502	.358	1.965	1	.161	.605	.300	1.221
	Constant	-.473	1.641	.083	1	.773	.623		

a. Variable(s) entered on step 1: auto_vega, auto_age, auto_edu, auto_gender, auto_PN.

Appendix E: binomial logistic regression model

Block 0: Beginning Block

Classification Table[a,b]

			Predicted		
			WTT		
	Observed		.00	1.00	Percentage Correct
Step 0	WTT	.00	0	59	.0
		1.00	0	72	100.0
	Overall Percentage				55.0

a. Constant is included in the model.

b. The cut value is ,500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	.199	.176	1.286	1	.257	1.220

Variables not in the Equation

			Score	df	Sig.
Step 0	Variables	Vega	.277	1	.599
		What is your age?	4.760	1	.029
		What is your highest level of education?	12.749	6	.047
		What is your highest level of education?(1)	6.344	1	.012
		What is your highest level of education?(2)	.053	1	.817
		What is your highest level of education?(3)	.943	1	.331
		What is your highest level of education?(4)	2.150	1	.143
		What is your highest level of education?(5)	5.790	1	.016
		What is your highest level of education?(6)	.826	1	.364
		What is your gender?(1)	2.254	1	.133
		PN	3.689	1	.055
		nudge(1)	3.077	1	.079
		source(1)	2.480	1	.115
	Overall Statistics		26.347	12	.010

Block 1: Method = Enter

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	30.625	12	.002
	Block	30.625	12	.002
	Model	30.625	12	.002

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	149.688[a]	.208	.279

a. Estimation terminated at iteration number 20 because maximum iterations has been reached. Final solution cannot be found.

Classification Table[a]

			Predicted		
			WTT		
	Observed		.00	1.00	Percentage Correct
Step 1	WTT	.00	34	25	57.6
		1.00	16	56	77.8
	Overall Percentage				68.7

a. The cut value is ,500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Past Behavior	.149	.103	2.076	1	.150	1.160
	Age	-.324	.209	2.403	1	.121	.723
	Edu | Primary (reference)			2.486	6	.870	
	Edu | MBO	-41.146	43895.838	.000	1	.999	.000
	Edu | HAVO	-20.186	40193.135	.000	1	1.000	.000
	Edu | VWO	-20.955	40193.135	.000	1	1.000	.000
	Edu | HBO	-20.623	40193.135	.000	1	1.000	.000
	Edu | University	-20.021	40193.135	.000	1	1.000	.000
	Edu | PhD	.250	56841.559	.000	1	1.000	1.284
	Gender (1)	-.623	.407	2.335	1	.126	.537
	Percieved Naturalness	-.443	.254	3.053	1	.081	.642
	Nudge(1)	-.635	.420	2.285	1	.131	.530
	Source(1)	-.962	.423	5.184	1	.023	.382
	Constant	23.374	40193.135	.000	1	1.000	1.416E+10

a. Variable(s) entered on step 1: Vega, What is your age?, What is your highest level of education?, What is your gender?, PN, nudge, source.

Appendix F: Process analysis

Note: The variable “vega” represents past behavior

```
Run MATRIX procedure:

***************** PROCESS Procedure for SPSS Version 4.2 *****************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
    Documentation available in Hayes (2022). www.guilford.com/p/hayes3

**************************************************************************
Model  : 10
    Y  : WTT
    X  : nudge
    M  : PN
    W  : source
    Z  : Vega

Covariates:
 Age      Gender   Edu_HAVO Edu_VWO  Edu_HBO  Edu_Uni  Edu_PhD  Edu_MBO

Sample
Size:  131
**************************************************************************
OUTCOME VARIABLE:
 WTT

Coding of binary Y for logistic regression analysis:
       WTT  Analysis
       .00       .00
      1.00      1.00

Model Summary
       -2LL    ModelLL         df          p   McFadden   CoxSnell   Nagelkrk
   148.7111    31.6012    14.0000      .0046      .1753      .2143      .2867

Model
              coeff         se          Z          p       LLCI       ULCI
constant    18.0553  2001.0905      .0090      .9928 -3904.0101  3940.1207
nudge       -1.0027      .8323    -1.2048      .2283    -2.6340      .6286
PN           -.4549      .2575    -1.7667      .0773     -.9595      .0498
source       -.8279      .5761    -1.4370      .1507    -1.9571      .3013
Int_1        -.3237      .8417     -.3846      .7005    -1.9734     1.3259
Vega          .0722      .1272      .5673      .5705     -.1772      .3215
Int_2         .1967      .2099      .9371      .3487     -.2147      .6081
Age          -.2944      .2096    -1.4042      .1603     -.7052      .1165
Gender       -.6614      .4163    -1.5889      .1121    -1.4773      .1545
Edu_HAVO   -13.9767  2001.0905     -.0070      .9944 -3936.0421  3908.0887
Edu_VWO    -14.7796  2001.0904     -.0074      .9941 -3936.8448  3907.2855
Edu_HBO    -14.5803  2001.0904     -.0073      .9942 -3936.6454  3907.4847
Edu_Uni    -13.8446  2001.0903     -.0069      .9945 -3935.9096  3908.2204
Edu_PhD       .2968  2829.9691      .0001      .9999 -5546.3407  5546.9342
Edu_MBO    -29.2190  2179.5974     -.0134      .9893 -4301.1515  4242.7135

These results are expressed in a log-odds metric.

Product terms key:
 Int_1    :        nudge    x        source
 Int_2    :        nudge    x        Vega

Likelihood ratio test(s) of highest order
unconditional interactions(s):
           Chi-sq         df          p
X*W         .1479     1.0000      .7006
X*Z         .8860     1.0000      .3466
BOTH(X)     .9764     2.0000      .6137
```

```
**************************************************************************
OUTCOME VARIABLE:
 PN

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .3739      .1398      .6942     1.4624    13.0000   117.0000      .1421

Model
              coeff         se          t          p       LLCI       ULCI
constant     2.6697      .8803     3.0326      .0030      .9262     4.4131
nudge        -.0533      .3103     -.1718      .8639     -.6678      .5612
source       -.1595      .2079     -.7671      .4446     -.5713      .2523
Int_1         .1793      .3095      .5793      .5635     -.4336      .7922
Vega          .0315      .0464      .6799      .4979     -.0603      .1233
Int_2         .0182      .0729      .2489      .8039     -.1263      .1626
Age           .1573      .0746     2.1091      .0371      .0096      .3051
Gender       -.0639      .1523     -.4194      .6757     -.3655      .2378
Edu_HAVO     1.2236      .9223     1.3267      .1872     -.6030     3.0501
Edu_VWO       .2407      .8835      .2725      .7857    -1.5090     1.9905
Edu_HBO       .5745      .8702      .6603      .5104    -1.1488     2.2979
Edu_Uni       .8385      .8508      .9855      .3264     -.8465     2.5236
Edu_PhD      1.3813     1.1988     1.1523      .2516     -.9928     3.7555
Edu_MBO      1.3072      .9380     1.3935      .1661     -.5506     3.1649

Product terms key:
 Int_1    :        nudge    x        source
 Int_2    :        nudge    x        Vega

Test(s) of highest order unconditional interaction(s):
           R2-chng          F        df1        df2          p
X*W          .0025      .3356     1.0000   117.0000      .5635
X*Z          .0005      .0619     1.0000   117.0000      .8039
BOTH(X)      .0029      .1999     2.0000   117.0000      .8191



****************** DIRECT AND INDIRECT EFFECTS OF X ON Y *****************

Conditional direct effects of X on Y
     source       Vega     Effect         se          Z          p       LLCI       ULCI
      .0000     1.0000     -.8060      .7136    -1.1296      .2587    -2.2046      .5925
      .0000     2.0000     -.6093      .6432     -.9473      .3435    -1.8701      .6514
      .0000     5.8800      .1539      .9369      .1642      .8695    -1.6825     1.9903
     1.0000     1.0000    -1.1297      .6978    -1.6191      .1054    -2.4973      .2378
     1.0000     2.0000     -.9330      .5966    -1.5640      .1178    -2.1023      .2362
     1.0000     5.8800     -.1698      .8259     -.2056      .8371    -1.7886     1.4489

Conditional indirect effects of X on Y:

INDIRECT EFFECT:
 nudge       ->    PN          ->    WTT

     source       Vega     Effect
      .0000     1.0000      .0160
      .0000     2.0000      .0077
      .0000     5.8800     -.0243
     1.0000     1.0000     -.0656
     1.0000     2.0000     -.0738
     1.0000     5.8800     -.1059

      Indices of partial moderated mediation:
            Index
source     -.0816
Vega       -.0083
```

```
************************ ANALYSIS NOTES AND ERRORS ************************

Level of confidence for all confidence intervals in output:
  95.0000

Z values in conditional tables are the 16th, 50th, and 84th percentiles.

NOTE: Direct and indirect effects of X on Y are on a log-odds metric.

NOTE: The bootstrapping was not completed due to problematic bootstrap samples.
      Bootstrap confidence intervals are therefore suppressed.

NOTE: Due to estimation problems, some bootstrap samples had to be replaced.
      The number of times this happened was:
     6027

------ END MATRIX -----
```