

# **Can nature help save nature?**

**Investigating the possibilities of awe-inspiring  
biophilic design for motivating sustainable  
consumption behaviour.**

*Thesis study submitted in partial fulfilment of the requirements for the  
master's degree in Communication Science*

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## Abstract

People who feel awe are more likely to engage in pro-social behaviour. However, it is still unclear how awe influences sustainable consumption behaviour while engagement in sustainable consumption behaviour is important to help preserve the nature environment. This study investigates via an experiment if awe evoked in a service environment can be used to directly influence consumers sustainable product choices. A positive relation has already been found between awe and engagement in sustainable behaviour, but evidence suggests that feeling nature connectedness and self-transcendent emotions is key for this relation to exist. To further investigate this expectation, this experimental study tested the effects of an awe-inspiring and a non-awe-inspiring nature design on sustainable behaviour. During this study, the following research question was investigated: *Does the integration of an awe-inspiring biophilic design in a service environment affect consumers in such a manner that it increases their consumption behaviour of sustainable foods?*

The relation between awe-inspiring biophilic design and sustainable consumption behaviour is investigated via a single subject experimental design [high awe-inspiring biophilic design versus low awe-inspiring biophilic design] with nature identity tested as a moderator and nature connectedness tested as a mediator. The experiment was performed online by exposing participants to a simulation of a restaurant's online delivery service and data was gathered via a questionnaire. The results of the experiment show that none of the designs are related to feeling awe, nature connectedness or sustainable behaviour, but a link was found between self-transcendent emotions and nature connectedness. The results of this study give a better understanding about how feelings of awe and nature connectedness are instigated and whether these feelings can be used in a commercial setting. While this study did not find a correlation between awe-inspiring design and sustainable behaviour, it is still expected that this correlation exists and can be found by following the recommendations for future research in this study.

*Keywords: Awe-inspiring design, biophilic design, self-transcendent emotions, nature connectedness, nature identity, sustainable behaviour*

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## Introduction

The United Nations (n.d.) have taken action and created development goals to restore, protect and preserve the world's nature environment. In order to save the nature environment, people need to change their way of living to a more sustainable alternative before damage to the nature environment is irreversible. To save the world's nature environment, people need to be motivated to engage in sustainable behaviour. More specifically, people need to engage in sustainable consumption behaviour, which can be described as "the purchase, use, and disposal of goods and services with the goal of minimizing negative impacts on nature while still achieving personal gains" (Kunchambo et al., 2017, p. 127). One way of engaging in sustainable consumption behaviour is by buying sustainably produced foods. The Dutch government already takes a role in this matter by stimulating manufactures to consider the environmental impact of their food produce and by helping businesses in their abilities to produce food sustainably (Rijksoverheid, n.d.). Nonetheless, there is still much room for improvement as the market share of sustainable foods in the Netherlands was only 14% of all food purchases in 2019 (Rijksoverheid, 2020). Therefore, the proposed research focuses on investigating if consumers can be motivated to buy more sustainably produced foods in their everyday life. The corona crisis has led to a relatively high growth of delivery services and it is likely that this growth will only proceed in the future (FoodService Instituut Nederland, 2021), therefore, it is worth focusing on a food delivery service in this study.

Nature is assumed to be a motivating factor in encouraging people for sustainable behaviour. Certain nature experiences (e.g., the wilderness) evoke feelings of "perceived vastness and need for accommodation" (Allen, 2018, p. 7). This combination of perceived vastness and need for accommodation is often referred to as awe. Perceived vastness refers to the moment when people feel "as if they are part of something much larger than themselves" (Allen, 2018, p.8) and people feel a need for accommodation when their "conception of the world needs to shift or expand in order to make sense of this new experience" (Allen, 2018, p. 8). Feeling awe can increase a person's willingness to do something good for others (Piff et al., 2015). Awe caused by nature also strengthens a person's connectedness with nature (Yang et al., 2018) and a positive relation exists between a person's connectedness with nature and their pro-environmental behaviour (Cleary et al., 2020; Mackay &

Schmitt, 2019; Whitburn et al., 2020). It is also worth noting that non-awe-inspiring nature can also have the effect to strengthen one's connectedness with nature (Cleary et al., 2020).

Literature about the link between awe, nature connectedness and pro-environmental behaviour gives reason to belief that this link might be useful for motivating consumers to buy more sustainable foods and help protect the nature environment. As awe and nature connectedness are most likely triggered by nature experiences, most direct effects are expected to occur when nature is used in a consumer environment. Using nature to affect consumers is nothing new as nature is already being used in consumer environments. Research shows that service environments with biophilic design, which is design that includes nature elements, have positive effects on consumers' shopping experience as the biophilic design tend to make them feel less stressed, more relaxed and more focused (Rosenbaum et al., 2018, 2019). However, it has not yet been studied if and how biophilic design influences consumers' (sustainable) shopping choices.

While biophilic design is argued to improve consumers' experience and awe-inspiring nature is argued to motivate pro-environmental intentions, it has not yet been studied whether awe-inspiring biophilic design plays a role in consumers' sustainable consumption behaviour. Therefore, the aim of this study is to investigate via an experimental design if a service environment with an awe-inspiring biophilic design influences the sustainable consumption behaviour of consumers. To find out if this is true, this study will test the effects of an awe-inspiring biophilic design and a non-awe-inspiring biophilic design. This led to the following overall research question: *Does the integration of an awe-inspiring biophilic design in a service environment affect consumers in such a manner that it increases their consumption behaviour of sustainable foods?* The research question will be investigated via a one-factor experimental design in which participants will be randomly exposed to a simulated environment of a restaurant's online delivery service which includes either an awe-inspiring biophilic design or a non- awe-inspiring biophilic design.

## Theoretical framework

In this chapter the relevant literature findings will be discussed and it will be explained how the Hypotheses were formed. A visualization of the research model is included in the final section of the chapter in which all hypotheses are integrated.

### Self-transcendent emotions and sustainable behaviour

As mentioned before, certain nature experiences (e.g., the wilderness) evoke feelings of “perceived vastness and need for accommodation” (Allen, 2018, p. 7). This combination of perceived vastness and need for accommodation is often referred to as awe. Perceived vastness refers to the moment when people feel “as if they are part of something much larger than themselves” (Allen, 2018, p.8) and people feel a need for accommodation when their “conception of the world needs to shift or expand in order to make sense of this new experience” (Allen, 2018, p. 8). Feelings of awe positively influence people’s motivation for pro-social behaviour (Piff et al., 2015) and green consumption behaviour (Wang et al., 2019). Therefore, it can be argued that presenting sustainable products in an awe-inspiring nature-inspired service environment can make the difference in motivating consumers to buy more sustainable products. The inclusion of nature in a service environment is called biophilic design, as was mentioned in the introduction. Unfortunately, it is still uncertain which specific designs elicit awe within humans but it is key that the design includes elements that are known to trigger a feeling of vastness and a need for accommodation within the observer (Ke & Yoon, 2020). Awe is most likely elicited by immersive nature experiences and not just by nature elements (e.g., trees) in the built environment (Ballew & Omoto, 2018). Shiota et al. (2007) state in a study among undergraduate students that awe is mostly evoked by experiencing nature scenes but that art and music are also mentioned as elicitors of awe. Luke (2021) found in her study that art museum visitors sometimes experience awe because they see an art piece that surprises them. In an experiment about awe, Yang et al. (2018) show that it also possible to evoke awe by letting individuals think about great persons who cause large-scale change.

Besides awe, other emotions are likely to play a role in motivating people for sustainable behaviour. Research shows that having contact with nature, even for a brief moment, can positively influence a person’s self-transcendent and hedonic emotions (Neill et al., 2019). This is similar to the findings of Castelo et al. (2021), who experimentally found that nature experiences can increase a person’s sense

of self-transcendence and that this sense of self-transcendence is related to pro-social behaviour. Other literature even suggests that self-transcendent emotions are evidently related to pro-environmental values and behaviour (Zelenski & Desrochers, 2021). Jacobs and McConnell (2022) found that the self-transcendent emotions awe, compassion and love are associated with sustainable behaviour. However, they argue that it is uncertain if self-transcendent emotions as a state have the same effect and argue that future research should further investigate the effects of self-transcendent emotions as a state. Jacobs and McConnell did not investigate the effects of the self-transcendent emotion gratitude but argued that it can be expected that the emotion gratitude will have similar effects.

While influencing self-transcendent emotions seems to be useful for improving people's sustainable behaviour, the mechanism of self-transcendent emotions can be quite complex. To get a better understanding of the dynamics of self-transcendent emotions, Stellar et al. (2017) reviewed scientific documentation of the self-transcendent emotions awe, gratitude and compassion. Stellar et al. describe awe as perceived vastness and need for accommodation. Gratitude is then explained as the feeling that you benefited from a voluntary, costly, intentional action of someone else. Compassion is described as being both concerned for other people's suffering and being motivated to help. Stellar et al. (2017) argue that self-transcendent emotions are different from other positive emotions and state that "self-transcendent emotions are other-oriented, diminishing one's focus on the self and encouraging greater sensitivity and attunement to others" (p. 201). Zelenski and Desrochers (2021) state in their literature review that there is enough academic evidence to assume that a positive relation between the self-transcendent emotions awe, gratitude and compassion and pro-environmental behaviour exists and that the strongest evidence relates to the effects of awe. Via a series of experiments, Piff et al. (2015) tested how awe-like experiences influence individuals' perception and behaviour. Based on the experiments' results it can be stated that feeling awe tends to make people consider that there is something greater than themselves and that this change in perspective relates to more pro-social behaviours. Moreover, Wang et al. (2019) tested if recalling awe-inspiring experiences would trigger different feelings than recalling moments of happiness and if this difference would result into different pro-environmental behaviour. The results show that the manipulations indeed mostly trigger the feelings that fit the manipulation and that the people with triggered feelings of awe had a higher intent for green consumption behaviour than the people with triggered feelings of happiness. Based on these findings it

can be expected that people who are confronted with a high vastness (awe-inspiring) design will experience more feelings of awe and show more sustainable consumption behaviour.

To come back to the influence of the self-transcendent emotions compassion and gratitude on pro-environmental behaviour, it can be argued that certain literature findings give reason to further study this relation. Compassion means that one has concerns for other people's suffering and Pfattheicher et al. (2016) found out that having compassion for other individuals is positively related to having pro-environmental tendencies. Lu and Schuldt (2016) found that feeling compassion for individuals who directly suffer from climate change positively influences peoples' support for a governmental pro-environmental policy; which suggests that this type of compassion is not limited to an increase in support for short-term aid actions according to Lu and Schuldt. Furthermore, the connection between gratitude and pro-environmental behaviour has not been widely studied yet but a few interesting findings have been found. Naito et al. (2010) found that people who feel gratitude for nature also had a higher pro-environmental intent to support nature and care with resources. Additionally, Syropoulos et al. (2020) found a positive relation between feeling gratitude and having concerns about climate change for future generations. Even more relevant for this study is how Liang and Guo (2021) found that gratitude can act as a predictor for the consumption of sustainable products.

Literature shows that people will be more likely to choose pro-environmental products, when they are triggered to feel self-transcendent emotions. As nature can increase a person's self-transcendent emotions (Castelo et al., 2021; Neill et al., 2019) and most awe-inspiring experiences are caused by nature (Shiota et al., 2007), it can be assumed that a high vastness design is most likely awe-inspiring when the design is also biophilic and that such a design will trigger emotions of awe, gratitude and compassion. The current knowledge about self-transcendent emotions and pro-environmental behaviour led to Hypothesis 1.

**H1.** A service environment with an awe-inspiring biophilic design leads to higher self-transcendent emotions and higher sustainable food consumption as opposed to a service environment with a non-awe-inspiring design.



## Nature connectedness and sustainable behaviour

Yang et al. (2018) investigated how awe influences environmental behaviour and found that nature connectedness plays a mediating role between awe experiences and environmental behaviour. Nature connectedness is mostly described as a person's affective, cognitive and behavioural relationship with nature that can be stable or change over time (Whitburn et al., 2020). In a study about nature connectedness, Cleary et al. (2020) found a positive relation between nature experiences and nature connectedness and state that nature experiences can foster people's connection with nature. Additionally, Cleary et al. state that the strength of the connection is not dependent of childhood nature experiences. Mayer et al. (2009) found that a fifteen minute walk through a nature environment results in significantly higher nature connectedness as opposed to a walk through an urban environment, and, albeit less strong, nature videos also have this effect. Furthermore, Yang et al. (2018) investigated the effects of an awe-evoking nature video in comparison to a non-awe-evoking nature video and found that the awe-evoking nature video led to a higher increase of nature connectedness and ecological behaviour than the non-awe-evoking nature video. The studies of Mayer et al. (2009) and Yang et al. (2018) suggest that nature connectedness indeed acts as a mental state that can be temporarily increased by awe and nature experiences. In this study, nature connectedness will be approached as a mental state to investigate its mediating role between awe-inspiring biophilic design and sustainable consumption behaviour. It is expected that the combination of a high vastness and biophilic design will result in a stronger increase of nature connectedness and sustainable consumption behaviour as opposed to a low vastness biophilic design. To investigate if this difference is significant, Hypotheses 2 was formulated.

**H2.** A service environment with an awe-inspiring biophilic design leads to a higher person's connectedness as opposed to a service environment with a non- awe-inspiring biophilic design.

While contact with nature is associated with sustainable behaviour, it is still unclear how this relation exists (Martin et al., 2020). Academics are trying to map out the process of human's relation with nature and sustainable behaviour but the field still lacks true understanding. Most promising results are related to how people connect themselves with nature and how people identify with nature. Whitburn et al. (2020) investigated how academic research supports the association between feeling connected to nature and engaging in pro-environmental behaviour. In a meta-analysis, Whitburn et al. concluded that

there is a positive relation between connectedness to nature and pro-environmental behaviour. Mackay & Schmitt (2019) argue in a meta-analysis that there is a positive causal effect between nature connectedness and sustainable behaviour. Yang et al. (2018) found via an experiment that participants with an increased state of nature connectedness were more likely to engage in environmental behaviour. Sustainable behaviour can be described as all behavioural acts that help protect the nature environment (Whitburn et al., 2020) or minimize the negative effects of human actions on nature (Yang et al., 2018). Based on research it can be hypothesized that nature experiences positively influence a person's sustainable consumption behaviour through the person's state of nature connectedness. This led to Hypothesis 3.

**H3.** A person with a strong state of nature connectedness engages more in sustainable consumption behaviour as opposed to a person with a weak state of nature connectedness.

### Nature identity

Clayton et al. (2021) state that a person's identity with nature is a stronger predictor for people's behaviour towards nature than a person's connection with nature as identity includes values, attitudes and behaviour, while nature connectedness can also be measured as a temporal state. This is similar to how Kunchamboo et al. (2017) argue how people see nature as an extended-self and how these feelings can influence consumption behaviour, which is explained as "the purchase, use, and disposal of goods and services with the goal of minimizing negative impacts on nature while still achieving personal gains" (p. 127). Therefore, it can be argued that nature connectedness is sensitive to external stimuli like awe-inspiring nature experiences and a person's nature identity determines how strong the influence of the external stimuli is. This led to Hypothesis 4.

**H4.** The positive influence of an awe inspiring biophilic design on a person's state of nature connectedness is stronger for people with a strong nature identity than for people with a weak nature identity.

### Self-transcendent emotions and nature connectedness

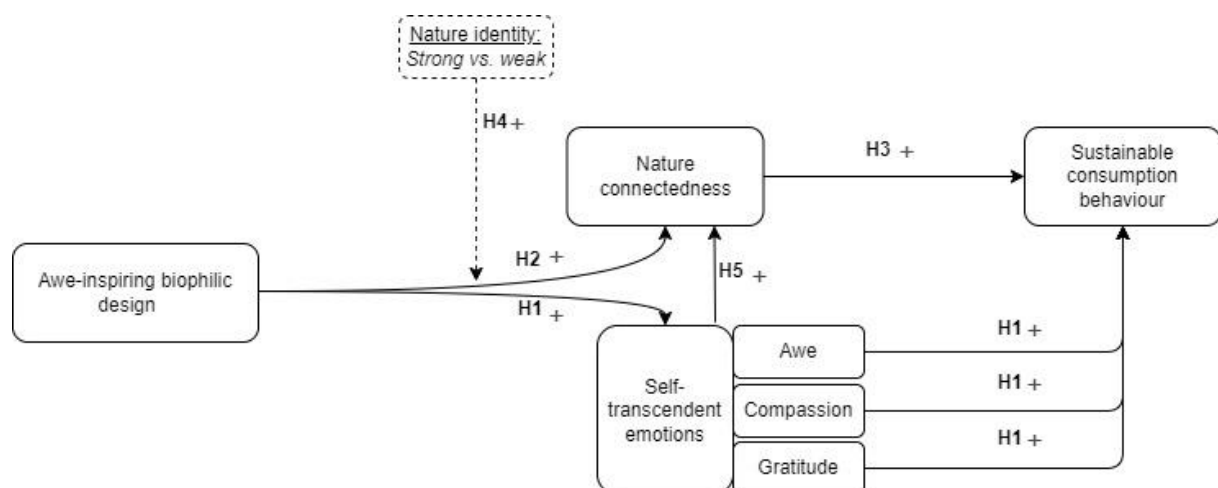
While awe is mostly evoked by nature experiences, awe can also be evoked by art (Shiota et al., 2007) and great people who cause great change (Yang et al., 2018). Both nature connectedness and self-transcendent emotions play a role in the link between experiencing awe and engagement in sustainable

behaviour. Yang et al. (2018) argue that this link is mediated by nature connectedness, however, Jacobs and McConnell (Jacobs & McConnell, 2022) argue that self-transcendent emotions predict nature connectedness and concerns about environmental problems. This raises questions about the link between feeling awe and feeling connected with nature as it might just be that awe-inspiring experiences trigger self-transcendent emotions and that these triggered self-transcendent emotions raise nature connectedness and sustainable behaviour. Yang et al. (2018) did not investigate how a temporarily increase in the self-transcendent emotions compassion and gratitude play a role in increasing people's nature connectedness after an awe-inspiring experience. Therefore, it will be investigated if a correlation exists between self-transcendent emotions and nature connectedness after seeing a high vastness design. This led to Hypothesis 5.

**H5.** The effect of awe inspiring biophilic design on sustainable food choices will be mediated by self-transcendent emotions and nature connectedness.

## Research model

The argued hypotheses have been visualized in Figure 1.



*Figure 1.* Research model with awe-inspiring biophilic design as the independent variables, nature connectedness, self-transcendent emotions and sustainable consumption behaviour as the dependent variables and nature identity as the moderating variable.

## Method

The hypotheses of this study about how the presence versus the absence of awe-inspiring design in a service environment affects consumers' consumption behaviour of sustainable foods were investigated via a single-factor experimental design. The setting of the experiment consisted of a simulated environment of a restaurant's online delivery service. This chapter will further elaborate on the pre-test, the participants of the main test, the experiment procedure, the manipulation designs, the used measures and the validity and reliability of the measures.

### Pre-test for determining experiment designs

A pre-test was conducted via an online questionnaire prior to the main study to determine which experimental manipulations of the experimental materials are useful for inspiring awe and which designs are viewed as realistic and biophilic website designs. Some non-biophilic designs were also tested via the pre-test, as people can also experience awe from non-biophilic settings or experiences. It is expected that biophilic designs are better for triggering awe in general but some studies show that non-biophilic designs or experiences can also be used. For example, Luke (2021) found in her study that art museum visitors sometimes experience awe because they see an art piece that surprises them and Yang et al. (2018) found via an experiment that awe can also be evoked by letting participants think about great persons who have caused large-scale change. To test if awe is best evoked by biophilic designs, eight website designs were created including four biophilic designs and four non-biophilic designs. The nature related images consisted of two images of a forest (website 1 and 2) and two images of a field (website 3 and 4). The forest image that is expected to be high awe-inspiring shows a picture of a forest in which depth is suggested by the different levels of image sharpness and the inclusion of a path into the forest (website 2). The field image that is expected to be high awe-evoking shows a picture of a large field during sunset with mountains in the background (website 4). These nature images are expected to be high awe-inspiring as these images show a form of depth within a nature view which might trigger people to experience some form of vastness. The non-nature designs consisted of four images of which two images show a white space with either a large or a small black circle (website 7 and 8) and two images show a white space with either a large or a small silhouette of a walking person (website 5 and 6). The differences in size will be used to test if scale will influence the perception of awe, as it is expected that the larger images, thus website 5 and 7, will be more surprising and thus

create a feeling of vastness. See Appendix A for the pre-tested images. Additionally, the pre-test was used to develop a fitting food menu for the main study. During the pre-test, participants had to explain to what extent they think that certain food items can be produced sustainably, to prevent confusion during the main study, and if they think that the menu items are logical options for a delivery restaurant.

During the pre-test, nine participants rated eight different website designs on how awe-inspiring they are based on items from the Awe Experience Scale (AES) from Yaden et al. (2019) and on how nature-related they are. The pre-test results showed that out of the biophilic designs websites 3 and 4 had the highest and lowest mean score for the AES and websites 7 and 8 had the highest and lowest mean score out of the non-biophilic designs (see Table 1 for the mean scores). As the results for the non-biophilic designs were opposite of what was expected, studies about awe-inspiring non-biophilic design are scarce and the designs were reviewed as not realistic, it was decided to not use non-biophilic designs for the main study. For the biophilic designs the highest AES mean scores are relatively low, but it was decided to still use the designs from websites 3 and 4 because it was expected that the difference in high and low awe scores would be measurable on a larger scale. For the final experiment, websites 3 and 4 were slightly adjusted with text and subtle abstract graphics to make the websites more interesting. See Figure 1 to 4 for the final designs.

**Table 1**

*Means and standard deviations of the pre-tested manipulation designs in which a score 1 is the lowest awe score and score 5 the highest*

|                           |                  | Mean awe score | Standard deviation |
|---------------------------|------------------|----------------|--------------------|
| <i>Forest set</i>         | <i>Website 1</i> | 2.54           | 0.53               |
|                           | <i>Website 2</i> | 2.61           | 0.87               |
| <i>Field set</i>          | <i>Website 3</i> | 2.41           | 1.01               |
|                           | <i>Website 4</i> | 2.78           | 1.06               |
| <i>Walking person set</i> | <i>Website 5</i> | 2.20           | 0.71               |
|                           | <i>Website 6</i> | 1.98           | 0.82               |
| <i>Dot set</i>            | <i>Website 7</i> | 2.31           | 1.02               |
|                           | <i>Website 8</i> | 1.96           | 0.48               |

## Participants main test

The target group of this study consists of adults living in the Netherlands who either speak Dutch or English and use a restaurant online delivery service at least once a year to make sure that participants are familiar with the platform type; people who did not meet these requirements were excluded from the study by filter questions. A non-probability sampling method was conducted by placing announcements on social media with a hyperlink that led to the study. People who follow a vegetarian or vegan diet were excluded from the study as vegetarian and vegan diets are considered to be most sustainable (Chai et al., 2019), which makes it more interesting to focus on people who still include meat in their diets.

After removing the respondents who did not correspond with the target group, a total of 74 participants remained (50% female, 48.6% male, 1.4% non-binary). 71 (95.9%) participants answered the Dutch version of the questionnaire and 3 (4.1%) participants answered the English version. The mean age of participants was  $M=27.46$  ( $SD=10.20$ ). Participants' age ranged from 18 to 71, but 85.1% of the participants belonged to the age group 18 to 35. The participants were randomly assigned to one of the experimental conditions and the number of participants per condition which resulted in 38 (51.4%) respondents for condition 1 (non-awe-inspiring) and 36 (48.6%) for condition 2 (awe-inspiring). An independent T-test showed that the two condition groups did not significantly differ in age ( $t(72) = -0.991$ ;  $p=0.325$ ) and a Likelihood ratio showed that the two condition groups did not significantly differ in gender ( $\chi^2(2)=3.67$  ;  $p=0.16$ )

## Procedure main test

The experiment took place in an online environment and data was gathered via an online questionnaire on Qualtrics. During the questionnaire, respondents were randomly confronted with one out of four simulated online environments of a restaurant's food delivery service. Each environment was visualized as a website with a homepage, a menu-page, a contact page and an about us page and the manipulations were incorporated as the websites' background image. Environment one contained a low awe-inspiring biophilic design and environment two contained a high awe-inspiring biophilic design. Each environment consisted of a sperate menu page so that the textual menu did not distract participants from absorbing the manipulated designs.

The simulated environments were randomly assigned to the participants and the participants got the task to order an ordinary meal for themselves existing of a side dish, main dish and dessert.

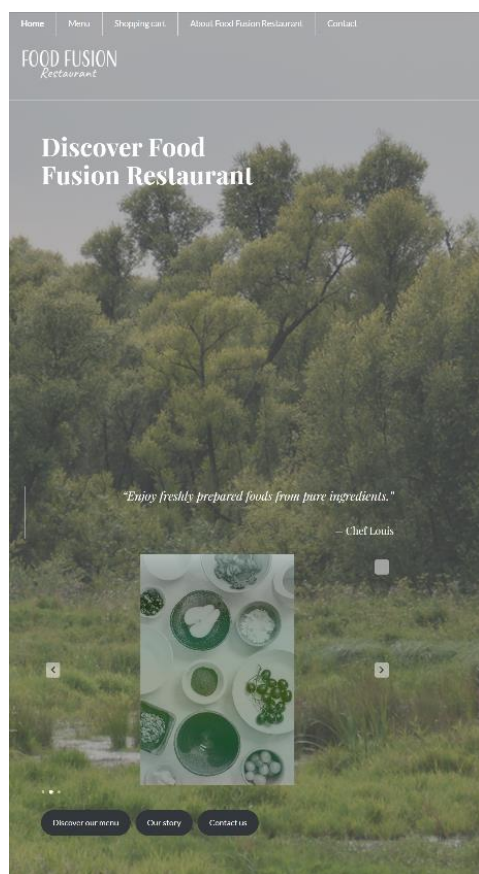
Participants also had to answer questions that were related to feeling Nature Connectedness and Transcendent Emotions. Additionally, questions about the website information were added to encourage participants to pay more attention to the website design and to distract them from the true purpose of the study. All the simulations consisted of the same menus and information; but some food items were marked as sustainably produced while others were not. In this experiment, sustainability is not directly related to healthiness.

## Manipulation designs

The pre-test results let to the manipulation designs visible in Figure 1 to 4.

**Figure 1**

*Manipulation design homepage website 3 that is presumed biophilic and low awe-inspiring*



**Figure 2**

*Manipulation design homepage website 4 that is presumed biophilic and awe-inspiring*





Figure 3

Manipulation design menu page website 3 that is presumed biophilic and low awe-inspiring



Figure 4

Manipulation design homepage website 4 that is presumed biophilic and awe-inspiring





## Measures

To measure the effects of the different manipulations, a range of measurements scales will be used throughout the experiment. The measures that were used are mostly based on validated scales and can be found in Appendix B. Some measurement scales were somewhat rewritten or shortened to better fit the experiment as can be seen in the final questionnaire in Appendix C.

The moderating variable nature identity was tested through survey questions based on the revised Environmental Identity Scale by Clayton et al. (2021) to determine how nature is integrated in the participants' identity. This is a measurement that uses 14 statements on a 5-point Likert scale as can be seen in Table B in Appendix B.

To be able to measure participants' state of awe, Yaden et al. (2019) developed and validated the Awe Experience Scale (see Appendix B, Table C). This scale includes 30 statements that measure the awe-related items: time, self-loss, connectedness, vastness, physiological and accommodation. The Awe Experience Scale in combination with a 5-point Likert scale was used to measure awe. For this study, the scale was shortened to 10 statements that were somewhat rewritten to better fit the experiment as can be seen in Appendix C.

To measure the self-transcendent emotion compassion, nine statements in combination with a 5-point Likert scale were used. Those statements were based the Compassion Scale that is used in the study of Keller and Pfattheicher (2013) which can be found in Table D in Appendix B.

The self-transcendent emotion gratitude was measured via the Gratitude Questionnaire-6 developed by McCullough et al. (2002) that uses six statements on a 5-point Likert scale. The Gratitude Questionnaire-6 is included in Table E in Appendix B.

For measuring nature connectedness the AIMES scale of Meis-Harris et al. (2021) was used. The AIMES scale values nature connectedness as a multidimensional construct that consists of the concepts attachment, identity, materialism, experiential and spiritual and can be found in Table F in Appendix B. The concepts are each measured by two items on a 5-point Likert scale.

Sustainable behaviour was measured via the number of sustainable food options participants picked. Participants had to choose three food options (one per course) and could pick between zero to three sustainable options. This resulted into a scale ranging from least sustainable behaviour to most sustainable behaviour.

## Validity and reliability

A factor analysis with a varimax-rotation was executed for the constructs nature identity, compassion, gratitude, awe and nature Connectedness to measure the validity of the items that were used to measure the constructs. The analysis showed that certain items from each construct did not load into the construct they were intended to measure. This led to the removal of six items of the nature identity construct, the removal of two items of the gratitude construct, the removal of four items of the compassion construct, the removal of five items of the awe construct and the removal of six items of the nature connectedness construct. After the removal of the invalid items, 26 statements distributed over five constructs remained with an Eigenvalue above 1 and an explained variance of 68.4%. A reliability analyses showed that each of the constructs had a Cronbach's Alpha value of 0.82 or higher. See Table 2 for the validity and reliability of the measurement constructs.

**Table 2***Factor Analysis (rotated component matrix)*

| Construct       | Statements                                                                                                                                                    | 1     | 2     | 3     | 4     | 5 |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------|-------|-------|---|
| Nature Identity | REIS_Q1 - I like to spend time outdoors in natural settings (such as woods, mountains, rivers, fields, local parks, lake or beach, or a leafy yard or garden) | 0.840 |       |       |       |   |
|                 | REIS_Q4 - When I am upset or stressed, I can feel better by spending some time outdoors surrounded by nature.                                                 | 0.740 |       |       |       |   |
|                 | REIS_Q7 - Learning about the natural world should be part of everyone's upbringing.                                                                           | 0.699 |       |       |       |   |
|                 | REIS_Q8 - If I could choose, I would prefer to live where I can have a view of the natural environment, such as trees or fields.                              | 0.609 |       |       |       |   |
|                 | REIS_Q9 - An important part of my life would be missing if I was not able to get outside and enjoy nature from time to time.                                  | 0.750 |       |       |       |   |
|                 | REIS_Q11 - I feel refreshed when I spend time in nature.                                                                                                      | 0.856 |       |       |       |   |
|                 | REIS_Q13 - I feel comfortable out in nature.                                                                                                                  | 0.790 |       |       |       |   |
| Gratitude       | REIS_Q14 - I enjoy encountering elements of nature, like trees or grass, even when I am in a city setting.                                                    | 0.794 |       |       |       |   |
|                 | GRATITUDE_Q1 - I have so much in life to be thankful for.                                                                                                     |       | 0.862 |       |       |   |
|                 | GRATITUDE_Q2 - If I had to list everything that I felt grateful for, it would be a very long list.                                                            |       | 0.861 |       |       |   |
|                 | GRATITUDE_Q4 - I am grateful to a wide variety of people.                                                                                                     |       | 0.736 |       |       |   |
| Compassion      | GRATITUDE_Q5 - As I get older, I find myself more able to appreciate the people, events, and situations that have been part of my life history.               |       | 0.812 |       |       |   |
|                 | COMPASSION_Q2 - I cannot continue to feel OK if people around me are depressed.                                                                               |       |       | 0.717 |       |   |
|                 | COMPASSION_Q3 - I get very angry when I see someone being ill-treated.                                                                                        |       |       | 0.788 |       |   |
|                 | COMPASSION_Q4 - I tend to get emotionally involved with a friend's problems.                                                                                  |       |       | 0.793 |       |   |
|                 | COMPASSION_Q5 - I am very upset when I see an animal in pain.                                                                                                 |       |       | 0.671 |       |   |
| Awe             | COMPASSION_Q6 - It makes me sad to see a lonely stranger in a group.                                                                                          |       |       | 0.672 |       |   |
|                 | AWE_Q1 - Makes you forget about yourself.                                                                                                                     |       |       |       | 0.797 |   |
|                 | AWE_Q3 - Makes you feel in the presence of something grand.                                                                                                   |       |       |       | 0.710 |   |
|                 | AWE_Q4 - Makes you experience something greater than yourself.                                                                                                |       |       |       | 0.774 |   |
|                 | AWE_Q7 - Changes your sense of time.                                                                                                                          |       |       |       | 0.781 |   |

|                         |                                                                                            |       |       |      |       |       |
|-------------------------|--------------------------------------------------------------------------------------------|-------|-------|------|-------|-------|
| Nature<br>Connectedness | AWE_Q8 - Makes you experience the passage of time differently.                             |       |       |      | 0.656 |       |
|                         | AIMES_Q1 - Feeling connected to nature helps me deal with everyday stress.                 |       |       |      |       | 0.653 |
|                         | AIMES_Q2 - I feel a strong emotional connection to nature.                                 |       |       |      |       | 0.715 |
|                         | AIMES_Q3 - I think of myself as someone who is very concerned about taking care of nature. |       |       |      |       | 0.786 |
|                         | AIMES_Q4 - Protecting nature is an important part of who I am.                             |       |       |      |       | 0.829 |
| Cronbach's Alpha:       |                                                                                            | 0.91  | 0.90  | 0.85 | 0.82  | 0.87  |
| Explained variance %:   |                                                                                            | 32.99 | 13.34 | 8.59 | 6.74  | 6.43  |
| Eigenvalue:             |                                                                                            | 8.58  | 3.47  | 2.23 | 1.75  | 1.67  |

## Results

A Multivariate Analysis of Variance (MANOVA) was executed to investigate the effect of awe-inspiring design on the combined dependent variables (awe, compassion, gratitude, nature connectedness and sustainable consumption behaviour). As can be seen in Table 3 the MANOVA analysis did not reveal a significant effect of awe-inspiring design on the combined dependent variables. An ANOVA analysis was executed to investigate if an awe-inspiring design affects the dependent variables individually (awe, compassion, gratitude, nature connectedness and sustainable consumption behaviour). The test did not show any significant effect of awe-inspiring design on the dependent variables as can be seen in Table 3. Therefore, Hypotheses 1 and 2 need to be rejected. See Table 4 for the means and standard deviations of the dependent variables for the manipulation designs.

**Table 3**

*Results of the MANOVA and ANOVA of the independent variable awe-inspiring design*

| Manipulation  | Manova        |    |         |      | Anova                 |                              |                             |                                        |                                         |
|---------------|---------------|----|---------|------|-----------------------|------------------------------|-----------------------------|----------------------------------------|-----------------------------------------|
|               | Wilks' Lambda | df | F-value | Sig. | Awe<br>F-value / Sig. | Compassion<br>F-value / Sig. | Gratitude<br>F-value / Sig. | Nature Connectedness<br>F-value / Sig. | Sustainable behaviour<br>F-value / Sig. |
| Awe-inspiring | 0.96          | 67 | 0.49    | 0.81 | 0.17 / 0.68           | 0.28 / 0.60                  | 0.04 / 0.85                 | 0.27 / 0.61                            | 0.56 / 0.46                             |

**Table 4**

*Mean and standard deviation values for the main effects of awe-inspiring design and non-awe-inspiring design*

|                                    | Awe-inspiring |      | Non-awe-inspiring |      |
|------------------------------------|---------------|------|-------------------|------|
|                                    | Mean          | SD   | Mean              | SD   |
| Nature connectedness <sup>a)</sup> | 3.05          | 0.93 | 2.93              | 0.97 |
| Awe <sup>a)</sup>                  | 2.84          | 0.99 | 2.93              | 0.81 |
| Compassion <sup>a)</sup>           | 3.60          | 0.89 | 3.49              | 0.83 |
| Gratitude <sup>a)</sup>            | 3.67          | 1.05 | 3.71              | 1.00 |
| Nature identity                    | 4.12          | 0.62 | 3.86              | 0.85 |
| Sustainability level <sup>b)</sup> | 0.25          | 0.24 | 0.21              | 0.21 |

<sup>a)</sup> 5-point Likert-scale (1= strongly disagree / 5= strongly agree)

<sup>b)</sup> Menu choices (0= least sustainable / 3= most sustainable)

### Moderating effect of Nature identity

The PROCESS Model 1 by Hayes (2017) was used to test if nature identity has a moderating effect on the relation between awe-inspiring design and nature connectedness. No moderating effect of the variable nature identity was found ( $b=-0.710$ ,  $t=-0.904$ ,  $p=0.369$ ). The results of the test for moderation can be found in Table 5.

**Table 5**

*Results of the test for moderation*

| Variable on Nature connectedness                     | $\beta$ | t-value | $p$   | 95% CI<br>Low / Up |
|------------------------------------------------------|---------|---------|-------|--------------------|
| (Constant)                                           | 3.017   | 26.415  | 0.000 | 2.790 / 3.245      |
| Awe-inspiring design                                 | 0.073   | 0.321   | 0.749 | -0.383 / 0.530     |
| Nature identity                                      | 0.284   | 0.733   | 0.466 | -0.488 / 1.056     |
| Interaction (Awe-inspiring design * Nature identity) | -0.710  | -0.904  | 0.369 | -2.277 / 0.857     |

### Mediation effect of Nature connectedness and Self-transcendent emotions

A Pearson correlation was computed to determine the relation between awe and nature connectedness, between compassion and nature connectedness and between gratitude and nature connectedness. As can be seen in Table 6, the results showed a positive significant relation between awe and nature connectedness ( $r=0.30$ ,  $p=0.009$ ), a positive significant relation between compassion and nature connectedness ( $r=0.49$ ,  $p<0.001$ ) and a positive significant relation between gratitude and nature connectedness ( $r=0.44$ ,  $p<0.001$ ).

**Table 6**

Pearson correlation test between awe, compassion and gratitude and nature connectedness

| Variable   | Pearson Correlation                |
|------------|------------------------------------|
|            | Nature Connectedness<br>$r$ / Sig. |
| Awe        | 0.30 / 0.009                       |
| Compassion | 0.49 / <0.001                      |
| Gratitude  | 0.44 / <0.001                      |

To test if participants nature connectedness and self-transcendent emotions (gratitude, compassion, awe and nature connectedness) mediate the relation between awe-inspiring design and sustainable consumption behaviour, the SPSS PROCESS Model 4 by Hayes (2017) was used. The results did not reveal an indirect effect of awe-inspiring design on sustainable behaviour through gratitude ( $b=0.002$ ,  $CI=-0.030$  ,  $0.028$ ), compassion ( $b=0.002$ ,  $CI=-0.014$  ,  $0.026$ ), awe ( $b=0.001$ ,  $CI=-0.012$  ,  $0.018$ ) or nature connectedness ( $b=0.006$ ,  $CI=-0.018$  ,  $0.041$ ).

**Table 7**

*Results of the test for mediation*

|                                                                         | effect | t-value | p     | 95% CI<br>Low / Up |
|-------------------------------------------------------------------------|--------|---------|-------|--------------------|
| <i>Total effect of awe-inspiring design on sustainable behaviour</i>    |        |         |       |                    |
|                                                                         | 0.0395 | 0.745   | 0.458 | -0.066 / 0.145     |
| <i>Direct effect of awe-inspiring design on sustainable behaviour</i>   |        |         |       |                    |
|                                                                         | 0.028  | 0.528   | 0.599 | -0.078 / 0.134     |
| <i>Indirect effect of awe-inspiring design on sustainable behaviour</i> |        |         |       |                    |
| Gratitude                                                               | 0.002  |         |       | -0.030 / 0.028     |
| Compassion                                                              | 0.002  |         |       | -0.014 / 0.026     |
| Awe                                                                     | 0.001  |         |       | -0.012 / 0.018     |
| Nature connectedness                                                    | 0.006  |         |       | -0.018 / 0.041     |

## Overview hypotheses

The results of the statistical analyses for the hypothesized effects showed that none of the hypothesized effects could be supported by the data. Therefore, all of the hypotheses need to be rejected. See Table 8 for an overview of all the hypotheses.

**Table 8**

*Overview hypotheses*

| <b>Hypotheses</b>                                                                                                                                                                                                               | <b>Accepted / Rejected</b> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| <b>H1.</b> A service environment with an awe-inspiring biophilic design leads to higher self-transcendent emotions and higher sustainable food consumption as opposed to a service environment with a non-awe-inspiring design. | Rejected                   |
| <b>H2.</b> A service environment with an awe-inspiring biophilic design leads to a higher person's connectedness as opposed to a service environment with a non- awe-inspiring biophilic design.                                | Rejected                   |
| <b>H3.</b> A person with a strong state of nature connectedness engages more in sustainable consumption behaviour as opposed to a person with a weak state of nature connectedness.                                             | Rejected                   |
| <b>H4.</b> The positive influence of an awe-inspiring biophilic design on a person's state of nature connectedness is stronger for people with a strong nature identity than for people with a weak nature identity.            | Rejected                   |
| <b>H5.</b> The effect of awe-inspiring biophilic design on sustainable food choices will be mediated by self-transcendent emotions and nature connectedness.                                                                    | Rejected                   |



## Discussion

The main objective of this study was to investigate the potential relation between awe-inspiring biophilic design and more sustainable consumption behaviour and how people's state of nature connectedness and self-transcendent emotions might play a role in this relation.

### General discussion

Previous studies found that certain nature views result in feeling awe (Ballew & Omoto, 2018) and that feeling awe is related to having more willingness to do something good for the world (Piff et al., 2015; L. Wang et al., 2019). The results of this study show that an awe-inspiring biophilic design does not significantly affect sustainable consumption behaviour. However, it must be noted that even for the group of respondents who saw a biophilic design that was intended to be awe-inspiring, the measured mean of awe was still on the negative side. Thus on average, respondents did not actually feel awe and were therefore likely not triggered to feel the need to do something good for the world. Additionally, sustainable behaviour was measured in this study by making respondents choose between a set of food options of which certain fixed options were marked as sustainable with a leaf symbol and text. Therefore, personal preference might have played a role for respondents in making their food choices. More likely is that the majority of the respondents did not realise that the leaf symbol on the menu card was used to indicate the sustainable food options and therefore they did not consider sustainability in their decision. A check question was used to see if people understood the leaf symbol and it turned out that 7 respondents (9.5%) thought that the leaf stood for the healthy food option, 33 respondents (44.6%) thought it stood for the vegetarian option and 34 respondents (45.9%) correctly thought that it stood for the sustainable option. As a result, it cannot be concluded that awe-inspiring biophilic design has no effect on sustainable behaviour.

Furthermore, it was expected that exposure to an awe-inspiring biophilic design would lead to a positive effect on nature connectedness because research shows that both low awe-inspiring and awe-inspiring nature videos lead to higher feelings of nature connectedness (Mayer et al., 2009; Yang et al., 2018). The results of this study did not show any effect of the manipulated designs on participants' nature connectedness. When participants' nature identity was considered in the measurements as a moderating variable, still no effect was found of the manipulation designs on participants' nature

connectedness. The results of this study showed that none of the experimental groups had an overall mean score for nature connectedness that would suggest a strong connection with nature. This was unexpected for the participants in the awe-inspiring design condition but might have happened because the participants had not been instructed to take their time to focus on the nature elements when visiting the tested websites. This corresponds to how Richardson et al. (2020) point out in their study that simple contact with nature does not always result in an increase of nature connectedness because simple contact with nature might be too passive. Sheffield et al. (2022) state in their meta-analysis about increasing nature connectedness that people who feel a stronger nature connection are people that pay more attention and react more emotionally towards nature. Lumber et al. (2017) argue that nature connectedness is formed via nature activities in which a person focusses on (digital) nature through certain pathways that are categorized as contact (sensory engagement with nature), beauty (perceiving aesthetic qualities of nature), meaning (using nature symbolism to communicate), emotion (feeling an emotional attachment to nature) or compassion (seeing yourself as part of nature and therefore wanting to protect it). This underlines that it is possible to purposely raise peoples' state of nature connectedness, but that this more likely to happen when people are consciously watching or engaging with nature or a nature design. In this study, participants were not instructed to pay extra attention to website design, which may explain why no effect was measured on participants' nature connectedness. This suggests that it is important to encourage people to consciously pay attention to the nature elements when using nature connectedness as a motivator for sustainable behaviour through nature designs.

It was also hypothesized that nature connectedness would mediate the relation between awe-inspiring design and sustainable behaviour. As there was no correlation between awe-inspiring design and participants' nature connectedness, the relation between awe-inspiring design and sustainable behaviour could not be mediated by nature connectedness. In addition, no correlation was found between participants' nature connectedness and sustainable behaviour. This might be explained by the fact that only 45.9% of the participants understood that certain items on the menu were sustainable.

Furthermore, it was hypothesized that awe-inspiring design would increase the self-transcendent emotions awe, gratitude and compassion and that this increase would motivate people to choose sustainable products. The results in this study did not show a correlation between awe-inspiring designs and self-transcendent emotions. As mentioned earlier, this is likely explained by the lack of focus for the

experimental designs by the participants. Above that, no relation was found between the emotions awe, compassion and gratitude and sustainable behaviour. This is not unexpected as there was no difference in participants' self-transcendent emotions of the experiment groups. As there was no difference in self-transcendent emotions of the participant groups, it cannot be concluded whether self-transcendent emotions have an effect on people's sustainable behaviour. Additional research is required to find out if self-transcendent emotions can be induced by a digital awe-inspiring design and how this relates to sustainable behaviour.

Lastly, it was hypothesized that an awe-inspiring design would result in sustainable behaviour and that this relation would be mediated by people's state of self-transcendent emotions in combination with people's nature connectedness. As mentioned before, no relation was found between the awe-inspiring design and participants' sustainable behaviour. The results of this study do show that the emotions awe, gratitude and compassion indeed correlate with nature connectedness, which is in line with the findings of Jacobs and McConnell (2022) about the self-transcendent emotions awe and compassion. However, in this study no correlation was found between the experimental designs and participants' self-transcendent emotions or nature connectedness, suggesting that participants' measured self-transcendent emotions and nature connectedness are their baseline emotions. The found correlation between self-transcendent emotions and nature connectedness seems promising for encouraging sustainable behaviour as other studies show that nature connectedness correlates with pro-environmental behaviour (Miles Richardson et al., 2022; J. Wang & Huo, 2022; Yang et al., 2018). This suggests that sustainable behaviour can be encouraged via nature connectedness when self-transcendent feelings are instigated. However, the lack of correlation with the experimental designs and participants' sustainable behaviour suggests that an online food delivery restaurant is not a useful design for instigating self-transcendent emotions, nature connectedness and sustainable behaviour.

This study used a setting of an online restaurant delivery service for investigating the effects of an awe-inspiring design on participants' sustainable consumption behaviour. Overall, no correlation was found between the experimental designs and sustainable behaviour. While previous studies did show a relation between awe-inspiring environments and pro-environmental beliefs, it cannot be said whether this relation can be exploited in an online shopping environment due to the lack of correlation results in

this study. This raises questions about the usefulness of awe-inspiring design in an online service environment and whether an online service environment can even be experienced as awe-inspiring. As mentioned earlier, Sheffield et al. (2022) and Lumber et al. (2017) have stated that nature connectedness and self-transcendent emotions towards nature primarily happen when people pay attention to a nature environment. In addition, Ballew and Omoto (2018) have stated that awe is most likely elicited by immersive nature experiences and not just by nature elements (e.g., trees) in the built environment. These statements suggest that nature connectedness is mostly elicited when people mindfully observe a nature design and that feeling awe is mostly elicited when people feel immersed by a nature design. This study did not incorporate a mindful perception and immersive experience of the experimental designs as participants in this study had the fictitious task to order their dinner via a computer or portable device. Therefore, it remains unclear if this is key for instigating self-transcendent emotions, nature connectedness and sustainable behaviour within people.

## **Managerial implications**

The United Nations (n.d.) have taken action and created development goals to restore, protect and preserve the world's nature environment. In order to save the nature environment, people need to change their way of living to a more sustainable alternative before damage to the nature environment is irreversible. Finding ways to encourage people to engage in sustainable behaviour seems necessary to achieve the United Nations' goals. This study therefore examined how communication professionals can use their messages to motivate sustainable behaviour.

Existing literature gives reason to belief that awe-inspiring design can be useful in making people want to do good for others and perhaps take better care of the world (Piff et al., 2015). Academic knowledge about using awe-inspiring biophilic design in a service environment to motivate people for sustainable behaviour is scarce and no studies could be found about using awe-inspiring design to sell sustainable products instead of non-sustainable products. Literature suggests that nature experiences (Ballew & Omoto, 2018) and observing art (Shiota et al., 2007) can lead to stronger self-transcendent emotions and nature connectedness. While self-transcendent emotions and feelings of nature connectedness are linked to pro-environmental behaviour (Yang et al., 2018), communication professionals should be reluctant with trying to instigate these emotions and feelings through digital design as this study could not find a relation between awe-inspiring design and self-transcendent

emotions or feelings of nature connectedness. Awe-inspiring design is difficult to make as it needs to be immersive and needs to get strong engagement by the viewer. Therefore, simple online biophilic designs that are viewed via a phone screen are unlikely to be useful in eliciting self-transcendent emotions and feelings of nature connectedness. Additionally, the costs and efforts for making an immersive awe-inspiring design with a strong engagement by the viewer are likely to be higher than the achieved revenue for sustainable everyday products.

Although communication professionals are unlikely to be able to encourage sustainable behaviour with online designs, this does not mean that using awe is useless for this purpose. Literature still suggests a link between feeling awe, nature connectedness and pro-environmental behaviour (Yang et al., 2018). Therefore, it is likely that sustainable behaviour can be encouraged in situations where people feel awe due to the environment instead of a manufactured digital design. Environmental advocates and marketers should therefore target people who for example have just watched a beach sunset or a large waterfall, as awe is most likely elicited by panoramic nature experiences (Shiota et al., 2007) and this feeling of awe might influence their sustainable behaviour when they are encouraged to do so. Thus the effects of awe on sustainable behaviour should not yet be dismissed.

## **Limitations and future research**

Studies that investigate the effect of awe-inspiring biophilic design on sustainable consumer behaviour in a service environment are scarce. This study differs from previous studies by testing webshop designs and measuring sustainable behaviour through product choice instead of an environmental intention scale. Because of this, this study contains several limitations that need to be discussed and led to multiple recommendations for future research.

A literature search about key points for triggering awe already made it clear that no one-fits-for-all nature view exists for triggering awe. Therefore, a pre-test was conducted to find out which designs are most likely perceived as awe-inspiring. The pre-test indeed showed that none of the designs were awe-inspiring for everyone but one of the designs was expected to stick out in triggering awe during the main test. As the literature and the pre-test results did not contain any suggestions for improving the designs, the pre-tested designs were used in the definitive study. Not knowing if the awe-inspiring designs were

significant in triggering awe was a limitation in this study as it was hypothesised that feeling awe would lead to stronger effects on the dependent variables. The lack of repeatedly pre-testing and improving the designs leaves it in the middle whether awe-inspiring design does not affect the dependent variables or whether website design cannot be truly awe-inspiring. Future research should, therefore, first extensively investigate if non-biophilic website design can be significantly awe-inspiring and if different levels of awe can be triggered by different biophilic designs.

Additionally, it is recommended for future research to study if the effects of awe-inspiring designs are stronger when people are motivated to specifically pay attention to the design, as Sheffield et al. (2022) concluded in their meta-analysis that the people who feel a stronger nature connection are the people that pay more attention and react more emotionally towards nature. To further study whether an online service environment can be used for encouraging sustainable behaviour through self-transcendent emotions and nature connectedness, future research should investigate if mindfully experiencing an immersive awe-inspiring biophilic digital design is more effective for raising people's self-transcendent emotions and nature connectedness as the design that was used in this study was not immersive or mindfully experienced.

Furthermore, another limitation in this study was that nature connectedness was only measured once in this study after the participants had viewed the experimental designs. As both designs contained a nature view and none of the designs instigated awe, it cannot be said if participants' nature connectedness had risen after viewing the designs. Future studies should measure participants' nature connectedness before they view the manipulation and after they view the manipulation to better understand if and how the different biophilic manipulation designs affect participants' nature connectedness.

Above that, Lumber et al. (2017) argue that nature connectedness is formed through certain pathways when having contact with nature. Future research should investigate if integrating these pathways into the contact with the biophilic design leads to stronger and more consequent effects on nature connectedness and sustainable behaviour.

Lastly, the method that was used in this study to measure sustainable behaviour turned out to be a limitation. Sustainable behaviour was measured through the food choices participants made of the given menu and some food choices were marked as sustainable while most were not. During the study, a

symbol of a leaf in combination with text was used to point out which food options were sustainable. However, 54.1% of the participants could not recall that the leaf was used to symbolize the sustainable food options. Therefore, it is recommended for future research to explore the options to make it more clear to people what the sustainable options are when testing the effects of awe-inspiring design on sustainable consumption choices.

While this study contains some big limitations that make drawing firm conclusions somewhat difficult, the literature results and the learned limitations of this study do show some interesting findings that are useful for further research. While the experiment results of this study suggest that using digital awe-inspiring design is not useful in a commercial setting for motivating sustainable behaviour, the literature and results of this study do suggest some improvements for future research that are promising for finding the expected results for motivating sustainable behaviour through awe-inspiring design. This means that studying the effects of awe-inspiring design on sustainable behaviour should not yet be dismissed and be further explored.

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## Appendices







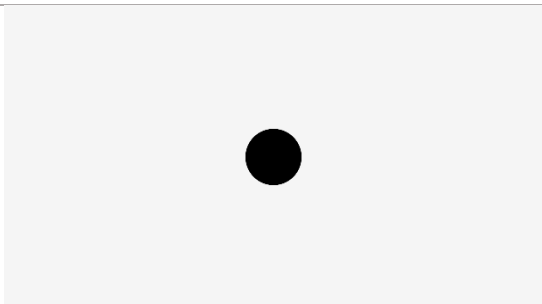
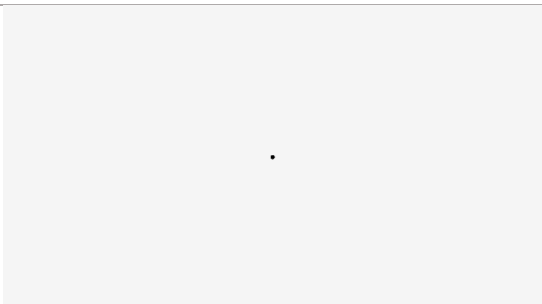
The appendices exist of the pre-tested manipulation designs in Appendix A, the used measurement scales for the main study in Appendix B and the used questionnaire for the main test in Appendix C.

## Appendix A: Pre-test images

This appendix contains the manipulation designs for the pre-test.

**Table A**

*Pre-tested manipulation designs*

| Website 1                                                                           | Website 2                                                                            |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|    |    |
| Website 3                                                                           | Website 4                                                                            |
|   |   |
| Website 5                                                                           | Website 6                                                                            |
|  |  |
| Website 7                                                                           | Website 8                                                                            |
|  |  |

## Appendix B: Measurement scales

This Appendix contains an overview of the used measurement scales.

### Identity Scale

**Table B**

*Revised environmental Identity Scale by Clayton et al.*

| Revised Environmental Identity Scale (EID-R)                                                                                                                 |   |   |                            |   |   |                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|----------------------------|---|---|--------------------------|
| Please indicate the extent to which each of the following statements describes you by using the appropriate number from the scale below.                     |   |   |                            |   |   |                          |
| 1                                                                                                                                                            | 2 | 3 | 4                          | 5 | 6 | 7                        |
| Not at all<br>true of me                                                                                                                                     |   |   | Neither true<br>nor untrue |   |   | Completely<br>true of me |
| _____ 1. I like to spend time outdoors in natural settings (such as woods, mountains, rivers, fields, local parks, lake or beach, or a leafy yard or garden) |   |   |                            |   |   |                          |
| _____ 2. I think of myself as a part of nature, not separate from it.                                                                                        |   |   |                            |   |   |                          |
| _____ 3. If I had enough resources such as time or money, I would spend some of them to protect the natural environment.                                     |   |   |                            |   |   |                          |
| _____ 4. When I am upset or stressed, I can feel better by spending some time outdoors surrounded by nature.                                                 |   |   |                            |   |   |                          |
| _____ 5. I feel that I have a lot in common with wild animals.                                                                                               |   |   |                            |   |   |                          |
| _____ 6. Behaving responsibly toward nature – living a sustainable lifestyle – is important to who I am.                                                     |   |   |                            |   |   |                          |
| _____ 7. Learning about the natural world should be part of everyone's upbringing.                                                                           |   |   |                            |   |   |                          |
| _____ 8. If I could choose, I would prefer to live where I can have a view of the natural environment, such as trees or fields.                              |   |   |                            |   |   |                          |
| _____ 9. An important part of my life would be missing if I was not able to get outside and enjoy nature from time to time.                                  |   |   |                            |   |   |                          |
| _____ 10. I think elements of the natural world are more beautiful than any work of art.                                                                     |   |   |                            |   |   |                          |
| _____ 11. I feel refreshed when I spend time in nature.                                                                                                      |   |   |                            |   |   |                          |
| _____ 12. I consider myself a steward of our natural resources.                                                                                              |   |   |                            |   |   |                          |
| _____ 13. I feel comfortable out in nature.                                                                                                                  |   |   |                            |   |   |                          |
| _____ 14. I enjoy encountering elements of nature, like trees or grass, even when I am in a city setting.                                                    |   |   |                            |   |   |                          |

*Note.* Reprinted from "Cross-Cultural Validation of A Revised Environmental Identity Scale" by S.

Clayton, S. Czellar, S. Nartova-Bochaver, J.C. Skibins, G. Salazar, Y.C. Tseng, B. Irkhin and

## Awe Experience Scale

**Table C**

*Awe Experience Scale*

| <b>Awe Experience Scale</b> |                                                         |
|-----------------------------|---------------------------------------------------------|
| <b>Time</b>                 | I sensed things momentarily slow down.                  |
|                             | I noticed time slowing.                                 |
|                             | I felt my sense of time change.                         |
|                             | I experienced the passage of time differently.          |
|                             | I had the sense that a moment lasted longer than usual. |
| <b>Self-loss</b>            | I felt that my sense of self was diminished.            |
|                             | I felt my sense of self shrink.                         |
|                             | I experienced a reduced sense of self.                  |
|                             | I felt my sense of self become somehow smaller.         |
|                             | I felt small compared to everything else.               |
| <b>Connectedness</b>        | I had the sense of being connected to everything.       |
|                             | I felt a sense of communion with all living things.     |
|                             | I experienced a sense of oneness with all things.       |
|                             | I felt closely connected to humanity.                   |
|                             | I had a sense of complete connectedness.                |
| <b>Vastness</b>             | I felt that I was in the presence of something grand.   |
|                             | I experienced something greater than myself.            |
|                             | I felt in the presence of greatness.                    |
|                             | I perceived something that was much larger than me.     |
|                             | I perceived vastness.                                   |
| <b>Physiological</b>        | I felt my jaw drop.                                     |
|                             | I had goosebumps.                                       |
|                             | I gasped.                                               |
|                             | I had chills.                                           |



|                      |                                                                 |
|----------------------|-----------------------------------------------------------------|
|                      | I felt my eyes widen.                                           |
| <b>Accommodation</b> | I felt challenged to mentally process what I was experiencing   |
|                      | I found it hard to comprehend the experience in full.           |
|                      | I felt challenged to understand the experience.                 |
|                      | I struggled to take in all that I was experiencing at once      |
|                      | I tried to understand the magnitude of what I was experiencing. |

*Note.* Reprinted from “The development of the Awe Experience Scale (AWE-S): A multifactorial measure for a complex emotion” by D.B. Yaden, S.B. Kaufman, E. Hyde, A. Chirico, A. Gaggioli, J.W. Zhang & D. Keltner, 2019, *The Journal of Positive Psychology*, 14(4). Copyright 2019 by the authors.

## Compassion scale

**Table D**  
*Compassion Scale*

| Compassion Scale                                                                                                                                                                                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. It upsets me to see helpless old people.                                                                                                                                                     |
| 2. I cannot continue to feel OK if people around me are depressed.                                                                                                                              |
| 3. I get very angry when I see someone being ill-treated.                                                                                                                                       |
| 4. I tend to get emotionally involved with a friend's problems.                                                                                                                                 |
| 5. I am very upset when I see an animal in pain.                                                                                                                                                |
| 6. It makes me sad to see a lonely stranger in a group.                                                                                                                                         |
| 7. I become nervous if others around me seem to be nervous.                                                                                                                                     |
| 8. Seeing people cry upsets me.                                                                                                                                                                 |
| 9. I feel compassion when I observe a child being mistreated by its parents                                                                                                                     |
| <i>Note.</i> Reprinted from "The Compassion–Hostility Paradox" by J. Keller & S. Pfattheicher, 2013, <i>Personality and Social Psychology Bulletin</i> , 39(11). Copyright 2013 by the authors. |

## Gratitude Scale

**Table E**

*Gratitude Scale*

### **Gratitude Scale**

---

\_\_\_\_ 1. I have so much in life to be thankful for.

---

\_\_\_\_ 2. If I had to list everything that I felt grateful for, it would be a very long list.

---

\_\_\_\_ 3. When I look at the world, I don't see much to be grateful for.

---

\_\_\_\_ 4. I am grateful to a wide variety of people.

---

\_\_\_\_ 5. As I get older I find myself more able to appreciate the people, events, and situations that have been part of my life history.

---

\_\_\_\_ 6. Long amounts of time can go by before I feel grateful to something or someone.

---

*\*Items 3 and 6 are reverse scored*

---

*Note.* Reprinted from "The grateful disposition: A conceptual and empirical topography" by M.E.

McCullough, R.A. Emmons & J.-A. Tsang, 2002, *Journal of Personality and Social Psychology*, 82(1), p. 127. Copyright 2002 by the authors.

## AIMES Scale

**Table F**

*Short format-version AIMES Scale*

### **AIMES Scale**

|                     |                                                                                                      |
|---------------------|------------------------------------------------------------------------------------------------------|
| <b>Attachment</b>   | 3. Feeling connected to nature helps me deal with everyday stress                                    |
|                     | 4. I feel a strong emotional connection to nature                                                    |
| <b>Identity</b>     | 6. I think of myself as someone who is very concerned about taking care of nature                    |
|                     | 7. Protecting nature is an important part of who I am                                                |
| <b>Materialism</b>  | 10. Meeting the needs of people requires sacrificing some natural areas                              |
|                     | 11. In order to provide us with the goods and services we need we can't avoid nature being degraded. |
| <b>Experiential</b> | 13. I enjoy spending time in nature                                                                  |
|                     | 14. I like to get outdoors whenever I get the chance                                                 |
| <b>Spiritual</b>    | 18. Everything in nature is connected (e.g. animals, plants, humans, water, air, land, fire, etc.)   |
|                     | 20. Human wellbeing depends upon living in harmony with nature                                       |

*Note.* Reprinted from “The construct validity of the multidimensional AIMES connection to nature scale: Measuring human relationships with nature” by J. Meis-Harris, K. Borg & B.S. Jorgensen, 2021, *Journal of Environmental Management*. Copyright 2021 by the authors.

## Appendix C: Main test questionnaire

This appendix contains the written version of the main questionnaire.

Dear participant,

Thank you for your interest in this study. This questionnaire is part of my graduation research for the master's programme in Communication Science. This study is about a new type of delivery restaurant and how the restaurant's website design matters for consumer impressions. Website designs can sometimes trigger certain feelings. This research investigates if certain designs may trigger different feelings within people and how this might influence peoples' impressions.

The results of the questionnaire are confidential and intended for research purposes only. Completion of the questionnaire is anonymous and voluntary. You can withdraw from the survey at any time and without explanation. For comments and questions, please contact me at [i.n.hootsen@student.utwente.nl](mailto:i.n.hootsen@student.utwente.nl).

This questionnaire is only intended for participants over 18 years of age who currently live in the Netherlands and use an online food delivery service at least once a year. Due to the nature of this study, you cannot participate if you follow a vegan or vegetarian diet. Please note, you can only complete the questionnaire using a mobile phone. By clicking on next, you indicate that you understand and agree with the conditions of the study.\* Thank you again for your participation.

Indigo Hootsen

*Master's programme in Communication Science, University of Twente*

*\*You are only able to participate in this questionnaire if you can answer the four following statements with "yes".*

|                                                                                                                                                            |        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 1. I am at least 18 years old and I currently live in The Netherlands.                                                                                     | Yes/No |
| 2. I use a restaurant's online delivery service at least once a year (for example ordering a meal via Uber Eats, TakeAway.com, or a restaurant's website). | Yes/No |
| 3. I follow a vegan or vegetarian diet.                                                                                                                    | Yes/No |
| 4. I fill in the questionnaire using a mobile phone.                                                                                                       | Yes/No |

During this questionnaire you will be asked several questions about a new type of restaurant. This restaurant is called Food Fusion Restaurant and uses an online food delivery service. The following questions are about the homepage of the Food Fusion Restaurant\* website only. You can view the homepage in a new tab by clicking on the link below. While looking at the homepage, pay particular attention to its design. You may view the page by scrolling, but it is important to stay on the homepage. Once you have viewed the homepage thoroughly, you can close the tab and answer the questions on the next page.

[EXPOSURE TO EXPERIMENT DESIGN]

You have just viewed the website of Food Fusion Restaurant. This website has a certain design and sometimes these kinds of designs trigger certain feelings. Therefore, the following questions are about the feelings you might experience while viewing the Food Fusion Restaurant website.

**1. Based on this website, I have the impression that Food Fusion Restaurant considers the consumption / dining experience as something that..**

| <b>Awe Experience Scale</b> |   | <b>Strongly disagree –<br/>Strongly agree<br/>1 – 5</b>                      |
|-----------------------------|---|------------------------------------------------------------------------------|
| <b>Self-loss</b>            | 1 | makes you forget about yourself.                                             |
|                             | 2 | makes you feel small.                                                        |
| <b>Vastness</b>             | 3 | makes you feel in the presence of                                            |
|                             | 4 | something grand.<br>makes you experience something greater<br>than yourself. |
| <b>Accommodation</b>        | 5 | makes you struggle to fully understand.                                      |
|                             | 6 | is difficult to mentally process.                                            |
| <b>Time</b>                 | 7 | changes your sense of time.                                                  |
|                             | 8 | makes you experience the passage of<br>time differently.                     |

**2. Besides the fact that website images can trigger certain feelings, website design also affects the user experience. What do you think about the statements below?**

| Strongly disagree – Strongly agree<br>1 – 5 |
|---------------------------------------------|
| 1. The website has a logical layout.        |
| 2. I appreciate the design of the homepage. |
| 3. I like the background image.             |

Take a look at the Contact page of Food Fusion Restaurant. While viewing the Contact page, pay particular attention to the page design and what information is provided. You may view the page by scrolling, but it is important to stay on the Contact page. Once you have viewed the Contact page, you can close the tab and answer the questions on the next page. You can visit the Contact page by clicking on the link below.

[EXPOSURE TO EXPERIMENT DESIGN]

You have just viewed the Contact page of Food Fusion Restaurant. You will be asked some questions about the content of this page in a moment, but first you will be asked some questions about your personal characteristics.

**3. To what extent do the statements below describe you at this moment after viewing the website?**

| Gratitude scale                                                                                                                    | Strongly disagree –<br>Strongly agree<br>1 – 5 |
|------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| 1. I have so much in life to be thankful for.                                                                                      |                                                |
| 2. If I had to list everything that I felt grateful for, it would be a very long list.                                             |                                                |
| 3. When I look at the world, I don't see much to be grateful for.                                                                  |                                                |
| 4. I am grateful to a wide variety of people.                                                                                      |                                                |
| 5. As I get older I find myself more able to appreciate the people, events, and situations that have been part of my life history. |                                                |
| 6. Long amounts of time can go by before I feel grateful to something or someone.                                                  |                                                |
| <i>*Items 3 and 6 are reverse scored</i>                                                                                           |                                                |

A few questions about the restaurant will now follow.

**4. Thinking back on the content of the Contact page, to what extent do you agree with the statements below?**

|                                                                          | <b>Strongly disagree – Strongly agree<br/>1 – 5</b> |
|--------------------------------------------------------------------------|-----------------------------------------------------|
| 1. Food Fusion Restaurant has appropriate opening hours.                 |                                                     |
| 2. Food Fusion Restaurant should be closed on Mondays.                   |                                                     |
| 3. Food Fusion Restaurant does not need to be opened during lunch hours. |                                                     |

Take a look at the About us page of Food Fusion Restaurant. While viewing the About us page, pay particular attention to the page design and what information is provided. You may view the page by scrolling, but it is important to stay on the About us page. Once you have viewed the About us page, you can close the tab and answer the questions on the next page. You can visit the About us page by clicking on the link below.

[EXPOSURE TO EXPERIMENT DESIGN]

You have just viewed the About Us page of Food Fusion Restaurant. You will be asked some questions about the content of this page in a moment, but first you will be asked some questions about your personal characteristics.

**5. To what extent do the statements below describe you at this moment after viewing the website?**

| <b>Compassion Scale</b>                                            | <b>Strongly disagree – Strongly agree<br/>1 – 5</b> |
|--------------------------------------------------------------------|-----------------------------------------------------|
| 1. It upsets me to see helpless old people.                        |                                                     |
| 2. I cannot continue to feel OK if people around me are depressed. |                                                     |
| 3. I get very angry when I see someone being ill-treated.          |                                                     |
| 4. I tend to get emotionally involved with a friend's problems.    |                                                     |
| 5. I am very upset when I see an animal in pain.                   |                                                     |
| 6. It makes me sad to see a lonely stranger in a group.            |                                                     |
| 7. I become nervous if others around me seem to be nervous.        |                                                     |
| 8. Seeing people cry upsets me.                                    |                                                     |



---

9. I feel compassion when I observe a child being mistreated by its parents.

---

**6. To what extent do the statements below describe you at this moment after viewing the website?**

---

**AIMES**

**Strongly disagree –**

**Scale**

**Strongly agree**

**1 – 5**

---

**Attachment** 3. Feeling connected to nature helps me deal with everyday stress

---

4. I feel a strong emotional connection to nature

---

**Identity** 6. I think of myself as someone who is very concerned about taking care of nature

---

7. Protecting nature is an important part of who I am

---

**Materialism** 10. Meeting the needs of people requires sacrificing some natural areas

---

11. In order to provide us with the goods and services we need we can't avoid nature being degraded.

---

**Experiential** 13. I enjoy spending time in nature.

---

14. I like to get outdoors whenever I get the chance.

---

**Spiritual** 18. Everything in nature is connected (e.g. animals, plants, humans, water, air, land, fire, etc.).

---

20. Human wellbeing depends upon living in harmony with nature.

---

A few questions about the restaurant will now follow.

**7. Thinking back on the content of the About Us page, to what extent do you agree with the statements below?**

|                                                                                             | Strongly disagree – Strongly agree<br>1 – 5 |
|---------------------------------------------------------------------------------------------|---------------------------------------------|
| 1. I think it is important to know about the restaurant's history before I place an order.  |                                             |
| 2. I want to know about the personnel before I place an order.                              |                                             |
| 3. I am less likely to place an order if I know that a restaurant is part of a large chain. |                                             |

For the following questions you will visit the restaurant website again. You will start from the homepage and navigate yourself to the Menu page. Once on the Menu page, it is important that you investigate the different menu options as the next questions will relate to the restaurant's food options.

**8. Imagine that you had a long day. You are hungry and not in the mood to cook yourself dinner, so you decide to order a three-course meal from Food Fusion Restaurant.**

|                                         |                                   |
|-----------------------------------------|-----------------------------------|
| <b>What side dish would you choose?</b> | <i>Spring rolls</i>               |
|                                         | <i>Grilled veggie salad</i>       |
|                                         | <i>Sweet potato fries</i>         |
|                                         | <i>Rustic Cajun fries</i>         |
| <b>What main dish would you choose?</b> | <i>Poké bowl chicken</i>          |
|                                         | <i>Crispy chicken burger</i>      |
|                                         | <i>Vegetable teriyaki noodles</i> |
|                                         | <i>Pizza caprese</i>              |
| <b>What dessert would you choose?</b>   | <i>Lemon cheesecake</i>           |
|                                         | <i>Blondie &amp; brownie</i>      |
|                                         | <i>Red velvet cake</i>            |
|                                         | <i>Raspberry swirl cheesecake</i> |

**9. It can be difficult to create a menu that fits with most people's preferences. What is your opinion about the menu?**

|                                                                                                  | Strongly disagree – Strongly agree<br>1 – 5 |
|--------------------------------------------------------------------------------------------------|---------------------------------------------|
| 1. The menu of Food Fusion Restaurant includes meals that fit in with a healthy lifestyle.       |                                             |
| 2. The menu of Food Fusion Restaurant includes meals that are made with sustainable ingredients. |                                             |
| 3. The menu of Food Fusion Restaurant is suitable for most people.                               |                                             |

**10. On the menu, a symbol in the form of a leaf was used to clarify a certain characteristic of some meals. What characteristic did the leaf symbolise?**

- ☐ *That the meal is a healthy option.*
- ☐ *That the meal is a vegetarian option.*
- ☐ *That the meal is a sustainable option.*

You are almost finished with the questionnaire. The final questions are about your demographics and character traits. Please answer the questions on the next page.

**11. What is your age in numbers?**

**12. What is your gender?**

- ☐ *Male*
- ☐ *Female*
- ☐ *Non-binary / third gender*
- ☐ *Prefer not to say*

**13. To what extent do the statements below describe you?**

| <b>Revised Environmental Identity Scale</b>                                                                                                            | <b>Strongly disagree –<br/>Strongly agree<br/>1 – 5</b> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| 1. I like to spend time outdoors in natural settings (such as woods, mountains, rivers, fields, local parks, lake or beach, or a leafy yard or garden) |                                                         |
| 2. I think of myself as a part of nature, not separate from it.                                                                                        |                                                         |
| 3. If I had enough resources such as time or money, I would spend some of them to protect the natural environment.                                     |                                                         |
| 4. When I am upset or stressed, I can feel better by spending some time outdoors surrounded by nature.                                                 |                                                         |
| 5. I feel that I have a lot in common with wild animals.                                                                                               |                                                         |
| 6. Behaving responsibly toward nature – living a sustainable lifestyle – is important to who I am.                                                     |                                                         |
| 7. Learning about the natural world should be part of everyone's upbringing.                                                                           |                                                         |
| 8. If I could choose, I would prefer to live where I can have a view of the natural environment, such as trees or fields.                              |                                                         |
| 9. An important part of my life would be missing if I was not able to get outside and enjoy nature from time to time.                                  |                                                         |
| 10. I think elements of the natural world are more beautiful than any work of art.                                                                     |                                                         |
| 11. I feel refreshed when I spend time in nature.                                                                                                      |                                                         |
| 12. I consider myself a steward of our natural resources.                                                                                              |                                                         |
| 13. I feel comfortable out in nature.                                                                                                                  |                                                         |
| 14. I enjoy encountering elements of nature, like trees or grass, even when I am in a city setting.                                                    |                                                         |

**End of questionnaire**

This is the end of the questionnaire. Thank you very much for your cooperation. At the start of this questionnaire, it was explained that this questionnaire is being used to investigate whether certain restaurant website designs are better suited to certain types of people. The actual purpose of this research is to study if people who feel the emotion awe will make different choices than people who do not feel awe. The emotion awe can be described as feeling part of something much larger than yourself and feeling the need to better understand the experience. Seeing extraordinary nature images such as a sunset or a big waterfall are experiences that tend to trigger awe. People who experience awe tend to feel the need to do something good for the world. Therefore, this study tries to investigate whether an awe-inspiring website background has an impact on making sustainable food choices. By clicking on finish you agree with the answers you have given and that the results will be saved. If you have any questions or comments, please contact me at [i.n.hootsen@student.utwente.nl](mailto:i.n.hootsen@student.utwente.nl).

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