Expanded Nature – Nature-Related User Interfaces for Websites and Their Role on Human Behavior and Cognition

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Abstract

As online shopping has become an essential part of people's lives, organizations explore innovative design strategies to enhance customers' experience, satisfaction, and loyalty. Various organizations have taken on the trend of implementing nature-related designs into the user interfaces of their web applications. Despite the widespread use of nature-related user interfaces, academic research that covers their integration remains limited and focuses primarily on concrete representations of nature. This research paper aims to expand the literature on nature-related user interfaces, exploring innovative design methods of incorporating nature elements in subtle ways, using the totality of user interface elements available on a website, including colors, layouts, buttons, and animations. These design interventions were evaluated for their effectiveness in emitting feelings of nature presence and for their role in influencing participants' cognitive and behavioral responses in the context of a hypothetical e-commerce organization that has no link to nature. For this study, three websites were created, and participants' responses to various levels of nature presence were assessed using an experimental design with three conditions. Finally, their answers were linked to their self-reported levels of nature connectedness. On one hand, this research provided evidence that implementing subtle nature-related design elements positively influences the level of perceived nature of the website, increases the level of perceived aesthetics, and elicits similar mental health benefits as exposure to outdoor nature. On the other hand, this research fails to determine a significant effect of nature presence on green brand assessment and trust in the website. These findings shed light on the different roles subtle nature-related user intefaces can play in shaping user experience and suggest implications for website design and environmental branding strategies.

Keywords: virtual nature; user interface design; website design; e-commerce: perceived aesthetics; positive affect

Introduction

Since the early 1990s, online shopping has grown significantly in popularity. The widespread availability of the internet allows modern-day users to shop for a wide variety of products from the comfort of their own homes. While consumers are increasingly doing their shopping online, businesses are exploring innovative design methods to differentiate themselves from competitors and increase customer experience, satisfaction, and loyalty. Consequently, consumers are provided with many options when it comes to online retailers, mobile applications and digital products, resulting in increased cognitive demand due to large amounts of information processing and multitasking (Rendell et al., 2019).

Based on evidence that exposure to nature has a positive influence on human perception and behavior, it became a common practice among web designers to implement nature-related user interfaces (UI) and user experiences (UX), even in cases in which the products or services marketed are not linked to nature or environmental causes (Rendell et al., 2021). For instance, as seen in Figure 1, the UI of Google Maps mirrors the outside environment by turning dark once daylight goes down. To match their values of travel and exploration, Airbnb often uses nature-related imagery on their website. Patagonia, an outwear brand famous for supporting environmental causes, uses images and videos of outdoor nature on their website, which can be seen in Figure 2. Finally, Normal Phenomena of Life, an innovative clothing brand producing clothes out of bio fabrics, implemented biomorphic animations when interacting with the website.
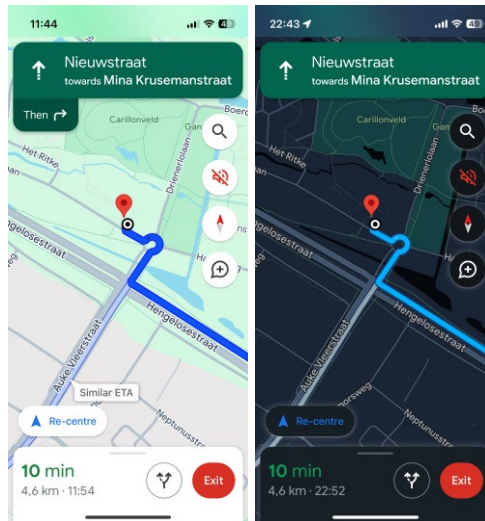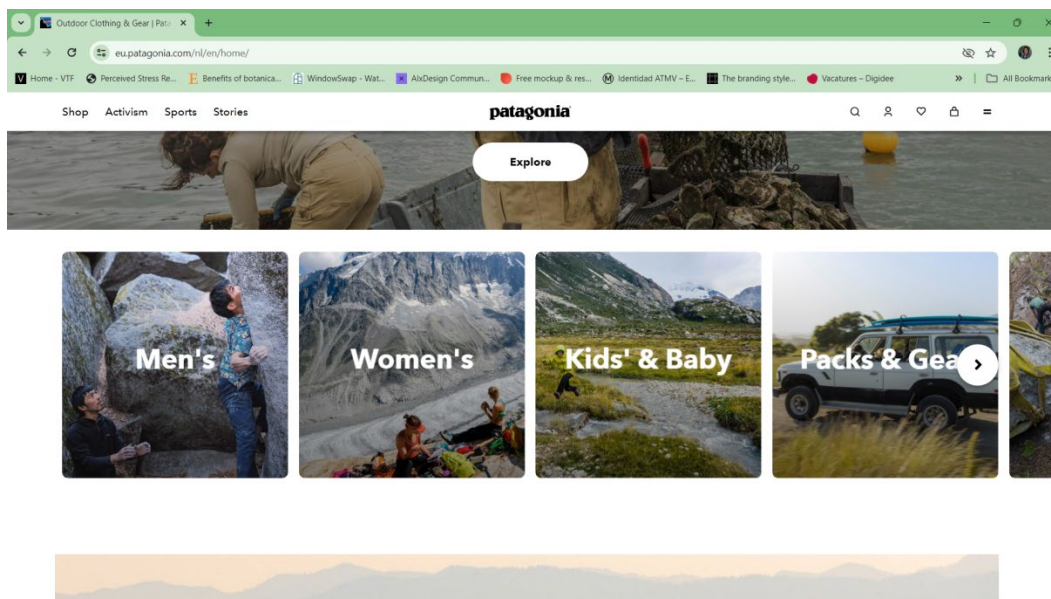
Figure 1

UI of Google Maps

Figure 2

UI of Patagonia

It is known that humans have an innate preference for natural environments (Wilson, 1984, as cited in Gullone, 2000) and that exposure to nature is associated with extensive benefits for mental and physical well-being, such as increased working memory (Berman et al., 2008; Bratman et al., 2015), a surge in creativity (Plambech & Konijnendijk Van Den Bosch, 2015; Williams et al., 2018), improved perception of quality of life (Stepansky et al., 2022), relaxation (Kim et al., 2023) and decreased anxiety and negative affect (Bratman et al., 2015). Furthermore, researchers have showed that exposure to virtual nature-related elements triggers similar positive and pleasurable experiences (Hartmann & Apaolaza-Ibáñez, 2012). Yet, academic research that covers the implementation of nature-related design elements in the field of human-computer interaction (HCI) is scarce. Previous research demonstrated that the use of nature-inspired UI elements on websites has a positive influence on trust and visual aesthetic (Rendell et al., 2021). These studies, however, limited the portrayal of natural elements to images only. As indicated by Rosen and Purinton (2004), there are many other graphic elements that can be used to display visual content on websites, examples including elements of space, use of animation, use of color, or character size.

Therefore, the present aims to address this research gap and respond to the call of Rendell et al. (2021) for exploring new ways of engaging users through innovative use and design of nature-related UI elements that could help organizations stay relevant in today's digital economy. Innovative abstract designs that evoke the feeling of nature presence on websites are suggested. The role of these subtle nature-related UI elements will be explored in the context of an e-vendor's website. Hence, this study will explore to what extent more subtle and creative means to integrate nature-inspired UI design can help organizations in promoting pleasurable consumer experiences and a desirable 'green' image. Therefore, the main research question of this paper is:

RQ: "What role do subtle nature-related UI elements play on online experiences, brand image and shopping behavior?"

To answer this question, an experiment was conducted employing three prototypes of a fictive e-vendor's website that differed in terms of naturalness. Insights from this study could contribute to establishing guidelines for designers to follow when implementing nature-related design elements into their work.

Theoretical Background

This section introduces relevant theories of environmental psychology that support the association between (digital) nature exposure and human well-being. Furthermore, findings of previous studies that evaluate the use of nature-related imagery and graphic elements in design are presented to explore how they might affect human perception and behavior, and to reveal any existing research gaps.

Foundations on the Benefits of Nature Exposure

The Cambridge Dictionary defines nature as "all the animals, plants, rocks, etc. in the world and all the features, forces, and processes that happen or exist independently of people, such as the weather, the sea, mountains, the production of young animals or plants, and growth" *(Nature,* 2024). The relationship between humans and nature varies across different societies around the world. In modern Western societies, humans distinguish themselves from the natural world, and nature is often viewed as an external resource that humans seek to control (Selin, 2003, p.2). Furthermore, urbanization is progressing rapidly all around the world, and, as a result, people spend less time in contact with nature (Bratman et al., 2015), and are in constant need to adapt to the manufactured environment (Gullone, 2000). Starting with the 1960s, public interest in environmental issues increased and led to efforts to protect and conserve the natural environment (Sills, 1975). As the environmental movement gained popularity, many academics explored alternative cultural, spiritual, philosophical, and practical views of nature in search of inspiration to reshape Western beliefs (Selin, 2003, p.2). Similarly, research on the benefits of nature on mental and physical health has begun to gain significant attention. Wilson's biophilia hypothesis claims that natural environments are central to human history and, as a consequence of evolution, humans tend to seek connections with nature and other living organisms (Gullone, 2000). The Biophilia hypothesis led to the conceptualization of other theories, such as Attention Restoration Theory (ART) (Kaplan, 1995) and Stress Recovery Theory (SRT) (Ulrich, 1991). ART suggests that humans are captivated by natural settings without having to devote conscious attention to processing them, consequently allowing fatigued directed attention resources to recover (Kaplan, 1995). In addition,

SRT suggests that natural environments trigger a sense of familiarity, provide a sense of spaciousness and freedom, capture human attention effortlessly, and exhibit patterns that have a calming effect on the mind.

Biophilia hypothesis also provided the foundation for biophilic design, known as the practice of incorporating elements of nature in the built environment (Kellert & Calabrese, 2015). In the practice of biophilic design, Kellert and Calabrese, (2015) distinguish between direct and indirect exposure to nature. They describe indirect nature as representations, patterns, and processes particular to the natural world, in the form of images of nature, natural materials, natural colors, natural light and space, naturalistic shapes and forms, information richness, the patina of time, natural geometries and biomimicry. Literature has previously explored the use nature-related design elements in marketing and communications, focusing mainly on the use of nature imagery. Hartmann and Apaolaza-Ibáñez (2012) use nature imagery in the advertising of a fictitious green energy brand, arguing that nature imagery and videos elicit similar affective responses as being in outdoor nature. Similarly, Schmuck et al. (2017) found that in an online advertisement for an environmentally friendly digital device, the use of nature imagery, together with an environmental textual claim, enhanced the level of perceived virtual nature experience reported by participants. Hartmann et al. (2016) evaluated the use of nature imagery also in the advertising of non-green products. They show that exposure to imagery depicting pleasant nature scenery in advertisements for a technological device activates autobiographical memories of nature experience.

Across the web, designers have implemented nature-related UI in different contexts and researchers have started to gain interest in exploring the cognitive and behavioral outcomes resulting from the use and exposure to these design elements. On one hand, companies with genuine environmental aims, such as Patagonia, use nature imagery on their websites to communicate and reinforce brand identity (Rendell et al., 2021). On the other hand, nature imagery is frequently used also by organizations whose products and services have no link to nature. For instance, Microsoft and Apple incorporate nature imagery in the UI of their technological applications aiming to evoke positive emotions and to create an appealing brand image (Rendell et al., 2019). However, literature on the inclusion of nature imagery and

other nature-related UI elements online is scarce. Rendell et al. (2019) linked multiple findings from advertising literature and argue that the use of nature imagery on websites and web applications could increase perceived aesthetics, attitude towards ads and brands, website loyalty and satisfaction, and purchase intention.

Despite the widespread use of nature imagery in the digital environment, Rendell et al. (2021) are the first to develop an experimental research design concerning the effects of nature imagery on user perceptions on an e-commerce website. In order to increase perceptions of nature online, they incorporated nature imagery into the website of a fictive insurance company and concluded that representations of water and vegetation are effective in evoking a feeling of nature presence. They defined nature presence as the extent to which the website enables a user to feel as though they are in a natural environment. However, as indicated by Rosen and Purinton (2004), besides nature imagery, other visual content, such as elements of space, use of animation, color, or character size, could be utilized to mimic nature. To this day, there is no research that explores whether subtle nature-related elements could evoke a sensation of nature presence. Therefore, inspired by Rendell et al. (2021), the first hypothesis of this study will explore whether subtle nature-related UI elements designed to mimic water and vegetation could also trigger the feeling of nature presence.

H1: The presence (as opposed to the absence) of subtle UI representations of water and vegetation enhance user perceptions of perceived naturalness on a website.

Affective Benefits of Virtual Nature Exposure

Nature presence in the online environment can trigger restorative responses. According to Chung et al. (2018), indirect contact with nature allows people to combat any spatial, temporal, or social constraints restricting them from accessing outdoor nature. There is a lot of research arguing that exposure to video, photography, and virtual reality representations of nature is an effective method for improving positive affect and reducing stress. In line with ART and SRT, adults who were immersed in short virtual reality representations of nature depicting seaside, grassland, and hilly scenes reported an

increase in positive affect and a decrease in stress levels (Chung et al., 2018). Similarly, Valtchanov et al. (2010) show that adults showed increased levels of positive affect and decreased levels of stress during a ten-minute active exploration of a virtual reality computer-generated forest setting. Furthermore, Van Houwelingen-Snippe et al. (2023) highlight the importance of using digital representations of nature to improve social well-being. They argue that exposure to videos of digital nature increased feelings of connectedness, peacefulness, serenity, and content among older adults. Finally, the use of nature imagery in non-green advertisements induces similar responses to those experienced through outdoor nature exposure (Hartmann et al., 2016). They argue that nature imagery depicting pleasant nature scenery can increase feelings of content, such as happiness, and decrease feelings of dissatisfaction, such as boredom. However, all these examples explore the use of concrete nature representations, while insights into the emotional responses that result from user exposure and interaction with subtle nature-related UI designs are lacking. The present research gap opens the opportunity to explore whether the integration of subtle nature-related UI elements on a website could evoke relaxation and stress-reduction benefits through feelings of serenity and inner peace.

H2: The presence (as opposed to the absence) of subtle nature-related UI elements on a website evokes similar positive emotional responses to those evoked by real nature exposure.

Aesthetic Response

Research in environmental psychology widely supports the idea that humans find nature content more visually appealing in comparison to urban views. However, research in the field of HCI does not cover the use of nature-related UI elements and their effect on the perceived aesthetics of a website. Rendell et al. (2021) are the only ones known to demonstrate a positive relationship between perceptions of nature presence and website aesthetics. They started from the idea that specific imagery affects user perceptions towards a UI, even in cases in which the content of the images is not directly linked to the site's purpose. In their study, they implemented nature imagery depicting water and vegetation in the UI

of a website that markets a non-green product and suggested that the overall aesthetic appreciation of the website was influenced by the photograph's color, balance, and symmetry.

Further research in this field is recommended because based on visual aesthetics, users form a lasting opinion within the first 500ms of seeing a website for the first time (Reinecke et al., 2013). Although the effect of nature-related UI elements on perceived aesthetics has not been explored in more depth, various researchers in the field of HCI propose UI design interventions that can enhance a website's aesthetic. For instance, Moshagen and Thielsch (2010) and Reinecke et al. (2013) argue that a website's aesthetic can be judged based on its complexity. They show that simple layouts can be processed more fluently and indicate an increase in aesthetic appreciation. Similarly, Zheng et al. (2009) argue that symmetrical, balanced, and less complex websites are evaluated as more appealing, professional, and captivating. However, these findings are clashing against the biophilic design principles proposed by Kellert and Calabrese, (2015). Natural environments are characterized by intermediate levels of visual complexity (Van Den Berg et al., 2016). They add that this visual quality evokes soft fascination, and consequently makes natural environments to be perceived as more pleasant compared to built scenes. A deeper dive into the literature reveals suggestions for design elements that can be linked to their visual appearance, such as diversity and colorfulness, which Moshagen and Thielsch (2010) argue to provoke high levels of arousal and consequently, aesthetic responses. Furthermore, website aesthetics is also linked to the amount of animation, interactive metaphors, and graphics (Hartmann et al., 2007).

The present research paper aims to use the findings listed above as design guidelines when creating novel subtle nature-related UI. To cover a gap in the literature, the proposed UI elements will be assessed for their effectiveness in enhancing the aesthetic appreciation of a website. Therefore, the third hypothesis of this study is suggested:

H3: High (as opposed to low) levels of nature presence on a website enhance its perceived visual aesthetics.

Perceptions of Trust

E-commerce organizations rely on people's trust when financial information is being submitted and when transactions are being performed (Wang & Emurian, 2005). The development of online trust has been widely associated with simulated human interaction, such as the presence of human imagery (Steinbrueck et al., 2002) or the replication of physical interactions (Cyr et al., 2007). However, across different bodies of literature, visual design elements were shown to also play a role in emulating trust. In their literature review, Wang & Emurian (2005) analyze online trust from an interface design perspective and note that the credibility of a website is reflected in its simplicity, consistency, and accessibility. Furthermore, Alsudani and Casey (2009) distinguish unity, balance, harmony, contrast, and dominance as aesthetic factors leading to credibility. Rendell et al. (2019) and Rendell et al. (2021) argue that, in line with Wilson's biophilia hypothesis, humans developed evolutionary instincts to trust nature. Contrary to Wang & Emurian (2005), Rendell et al. (2021) demonstrated that the use of nature-related UI elements, such as nature imagery, facilitates the development of online trust in an e-commerce setting in which the services marketed had no link to nature. Therefore, the fourth hypothesis of this study was formulated:

H4: High (as opposed to low) levels of nature presence on a website enhance the perceptions of trust in the e-vendor.

H5: High (as opposed to low) levels of nature presence on a website increase purchase intention.

Green Brand Assessment

Nature-related design elements have been widely used in advertising green products and services to highlight environmental features and influence the cognitive processes of consumers. Hartmann & Ibáñez (2006) and Xue (2013) argue that the use of nature imagery leads to the association of a brand's eco-friendliness. Xue (2013) argue that advertisements containing nature imagery generated more positive perceptions of the brand's eco-friendliness than those without visuals. They specify that the use of nature imagery was more effective in advertising low-involvement products (napkins, detergent, or towels) rather than high-involvement (laptop, computer, cell phone) in terms of their impact on consumers'

perception of the brand's eco-friendliness. Xue (2015) argue that the presence of nature imagery helps perceive the environmental efforts of a brand.

Other visual design elements also play a role in transmitting environmental messages. For example, green is universally associated with environmentalism (Sundar & Kellaris, 2015). In their research, Seo and Scammon (2017) found that students evaluated packaging that used green as more environmentally friendly than when the packaging was designed using other colors. Furthermore, brand logos featuring eco-friendly colors, such as green or blue, shape consumers' perception of the brand's eco-friendliness (Sundar & Kellaris, 2015). They demonstrate that students who were exposed to logos featuring an eco-friendly color rated ethically ambiguous practices as more ethical than those of a retailer represented by a logo featuring a less eco-friendly color.

The same studies argue that the presence of environmental messages generates positive green brand associations. In the case of undergraduate students from the U.S., Xue (2015) showed that textual environmental claims are effective in facilitating the perception of a brand's environmental efforts. The effect of textual environmental claims could be enhanced by nature-related design elements, as they found an interaction effect between textual environmental claims and nature imagery in consumers' perceptions of the brand's environmental effort. Similarly, Xue (2013) discovered an interaction effect between verbal claims and green visuals, arguing that green visuals were the determining factor in consumers' perception of a brands' eco-friendliness. When no nature imagery was presented, the use of verbal environmental claims could generate positive perceptions of the brand's eco-friendliness on their own. FInally, Seo and Scammon (2017) argue that the presence of textual environmental claims enhances the positive effect of the color green on packaging in generating green brand associations. Based on the findings listed above, the fifth hypothesis will test whether green brand associations could be linked to the presence of subtle nature-related UI. Furthermore, this study will introduce an exploratory environmental message to determine whether enforcing an environmental mission statement influences the role of the subtle nature-related UI elements.
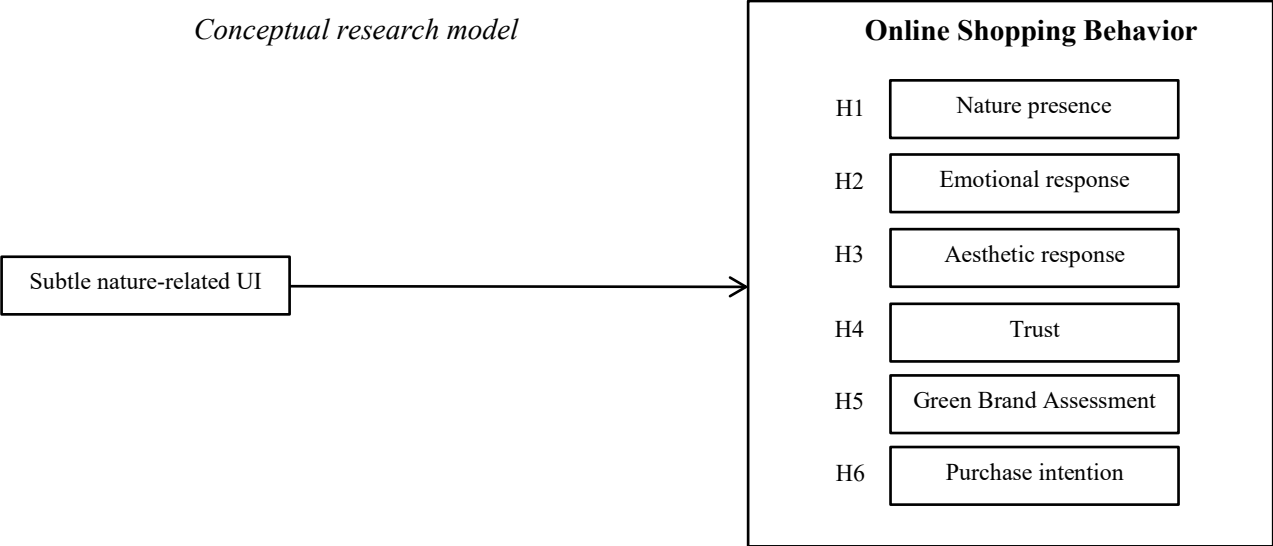
H5: The presence (as opposed to the absence) of subtle nature-related UI elements on a website leads to high levels of green brand associations.

Research Model

A visualization of the research model can be found in Figure 3.

Figure 3

Conceptual research model

	Online Shopping Behavior
H1	Nature presence
H2	Emotional response
H3	Aesthetic response
H4	Trust
H5	Green Brand Assessment
H6	Purchase intention

Subtle nature-related UI ⟶

Methodology

This study investigated to what extent subtle nature-related UI elements influence human cognition and behavior while navigating an online store. The subtle nature-related UI elements were created for the purpose of this study, and their design was rooted in the findings of the theoretical framework. Three realistic web stores were created using the prototyping application Figma, and two pretests were conducted to test the effectiveness of the design. Afterwards, an experimental design study was conducted to test the hypotheses derived from the literature review. Participants (N = 92) were randomly assigned to test one of the three websites, where they completed a pre-established shopping task. To assure the external validity of the study, participants performed the experiment on their personal desktop devices, in their own environment, at their own time. The study was conducted with the approval of the BMS ethics committee of the University of Twente (approval number 240169).

Experimental Procedure

The main experiment was conducted using Qualtrics and Figma. Participants were presented with a questionnaire consisting of multiple blocks. To facilitate the viewing of the prototypes, the experiment was required to be run on a desktop device. The first block included details about the survey, the researcher's contact information, as well as an informed consent button. These were followed by a block of questions concerning demographic variables regarding age, gender, and nationality.

Afterwards, participants were randomly allocated to one of the three different experimental conditions. A static screen showed the following instructions:

'Your task is to explore the website of the fictive online retailer, Miette. Imagine you are shopping for a new interior décor piece for a dear family member, a clothing item for yourself, a recreational item and an electronic device you wanted to get for a long time. There is no limited budget, so you're invited to take your time to explore the website and add these 4 different items in your shopping cart. Please keep in mind that the website prototype has some limitations and that, once added to the basket, items cannot be removed'.

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The three experimental conditions differed in terms of "naturalness". The Control Condition served as a benchmark, showing no nature components. Its design mirrored common features, content and product information found across major online e-commerce platforms such as "Amazon" and "Zalando". The websites of the Nature Condition and the Nature with a Mission Statement Condition featured the same content as the website of the Control Condition, with added subtle nature-related UI elements. Unlike the other two websites, the Nature with a Mission Statement condition also included a pop-up containing a written environmental mission statement that participants could read before navigating the website. The pop-up contained the following message:

'Welcome to Miette! A new store concept that promotes slowly acquiring what you need instead of rushing out to make impulse buys. Our mission is to make sustainable shopping easy and accessible to everyone, and to promote a healthy lifestyle. Browse our curated selection of timeless garments, eco-friendly electronics and artisan objects. Start your Slow Shopping journey!'. An overview of the three experimental conditions can be found in Table 1.

Finally, after completing the shopping task, participants were instructed to return to the Qualtrics environment to evaluate their experience based on the following seven components: Nature Presence, Green Brand Assessment, Emotional Response, Aesthetic Response, Trust, Purchase Intention, and Nature Connectedness.

Table 1

Breakdown of the characteristics of experimental conditions

Condition	Description
Control	No nature-related UI elements integrated on the website.
Nature	Subtle nature-related UI elements integrated on the website.
Nature with a Mission Statement	Subtle nature-related UI elements and an environmental textual claim integrated on the website.

Stimuli Design

Pretest 1

Before the experiment, a pretest was conducted to assess whether the subtle nature-related UI elements featured on the websites of the Nature Condition and Nature with a Mission Statement were suitable for the main experiment. Through a moderated in person explorative study, participants (N = 10) were asked to navigate the website while completing a shopping task in which they had to place three different items in their shopping cart. While doing so, participants were asked to brainstorm and share their opinions on the overall look and feel and functionality of the website. Afterwards, they were asked specific questions regarding the different subtle nature-related UI elements included on the website. The direct interaction between the researcher and test participants brought in-depth feedback and resulted in the discovery of different issues regarding functionality, accessibility and aesthetics. The overall feedback was directed towards similar issues and could be categorized based on layout, color palette and background, and graphic elements. While a document containing in-detail feedback can be found in Appendix A, the main findings are summarized below.

Layout. The prototype consisted of a landing page, as seen in Figure 4, four main product category pages, and a checkout. Participants were first shown the landing page, from which they could choose to navigate to any of the category pages. Each category page displayed a collection of either

twelve or eight products at the same time, in a random manner. Once a product was selected, participants were directed to individual product pages that displayed additional information about the selected product. The product page is depicted in Figure 5. From the header present on each page, users could navigate to the checkout page, which showed an overview of the products added to the basket. Participants appreciated the random layout and distribution of the products on each category page.

Figure 4

Nature Condition landing page during the preliminary study
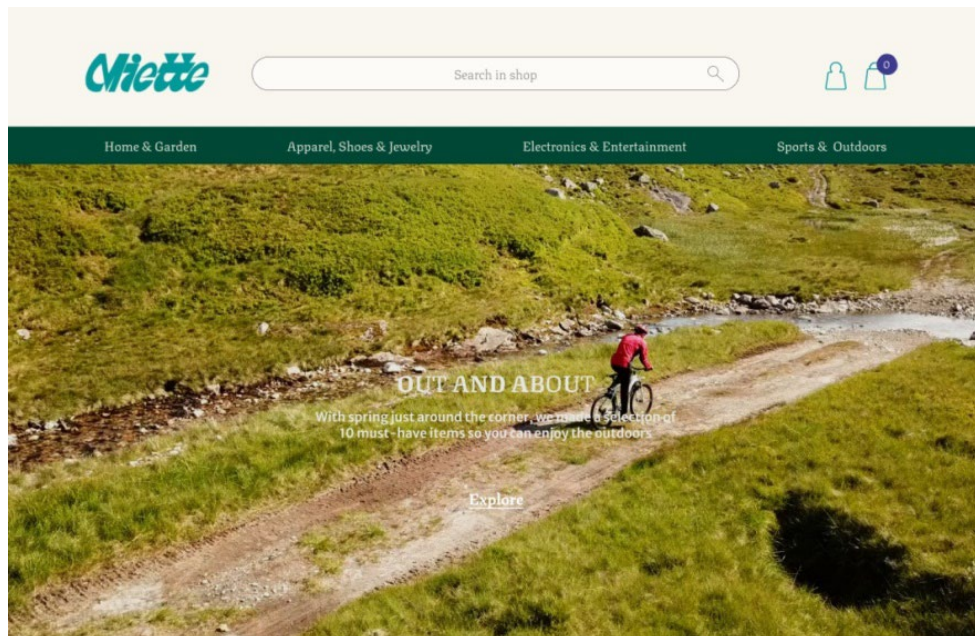
Figure 5

Nature Condition product category page example during the preliminary study
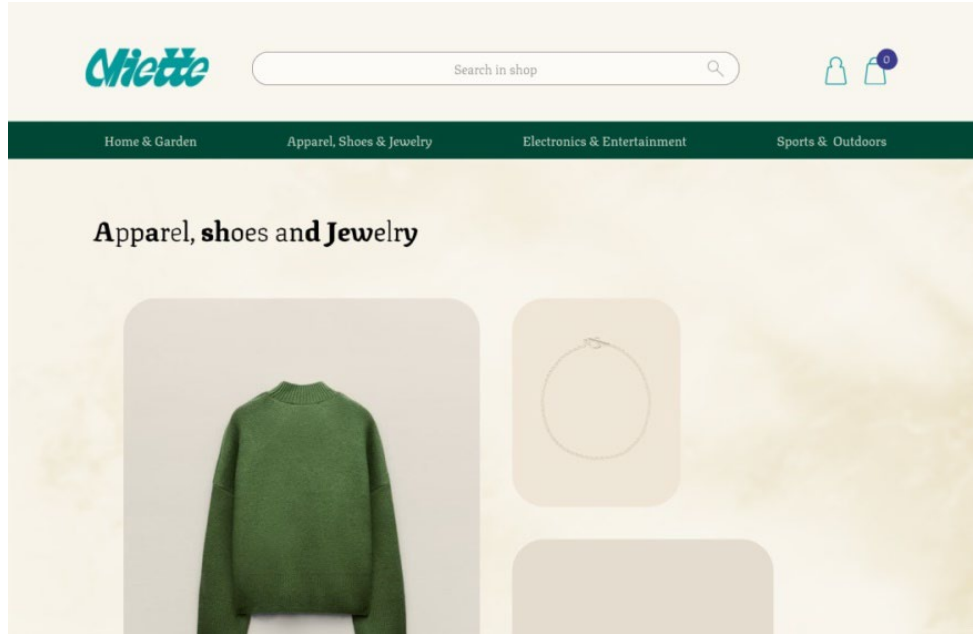
Color Palette and Background. As seen in Figure 6, the website's color scheme consisted of ivory white and a deep shade of gray, which are more neutral options to pure white or pure black. The color palette also featured green tones, which are perceived as natural (Sundar & Kellaris, 2015). As it can be observed in Figure 4, the background of the prototype was composed of a gentle, off-white color and a natural image overlay. During the preliminary study, participants were asked to evaluate whether they perceive the background as natural. The opinions were divided, and participants did not appreciate the background as natural until asked specifically. On the other hand, the colors were perceived as natural.

Figure 6

Nature Condition product page during the preliminary study
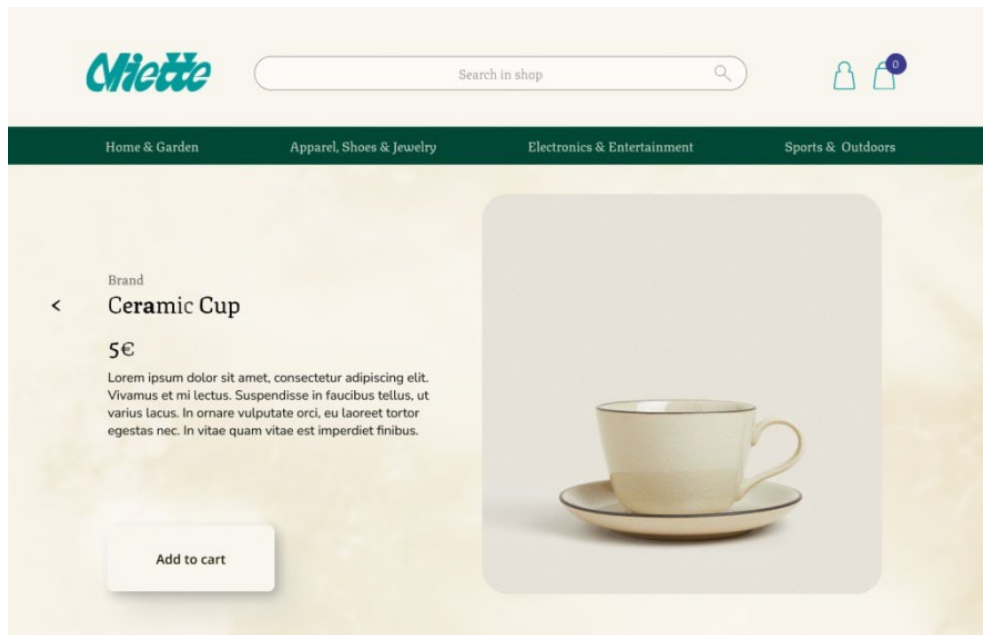
Graphic Elements. The products were randomly scattered throughout each category page, and displayed in boxes with soft rounded corners which were animated to turn angular and dark once they were hovered. Participants in the pre-test were not fond of the shift to angled corners, indicating that a shift in color on hover is enough, or that the angled corners disrupt from the feeling of nature. All participants indicated that adding more concrete natural elements to the website will improve the feeling of being in nature. Nevertheless, some participants mentioned that the website's header, which consisted of the logo, search bar and the icon leading to the shopping cart, is far too empty, suggesting to fill it up with natural graphic elements. When it comes to the type face chosen, participants rated it as natural and readable. However, many participants were confused by the random distribution of bold and narrow properties of the letters and suggested implementing the bionic reading method instead, which consists of highlighting the first letters of each word to facilitate reading.

Pretest 2

Further in the design process, the website corresponding to the Nature Condition and Nature with a Mission Statement was adjusted according to the feedback resulted from the preliminary study. A pre-test was then conducted to assess whether the subtle nature-related elements introduced are strong and distinguishable. Participants (N = 13) were recruited using the convenience sampling method. Each of the participants was asked to explore the three websites and rate them on a 7 point Likert scale based on the following statements: "Navigating the website makes me feel like I am in nature", "The graphic elements bring a sense of closeness to nature", "The products listed on this website are more sustainable than on other websites", "This website is linked to a green company". The test was conducted using the Qualtrics Experience Management platform and Figma. Each participant received the conditions in a randomized order. The definitive design of the website was based on the results of the pre-test, and can be seen in Figures 7, 8 and 9.

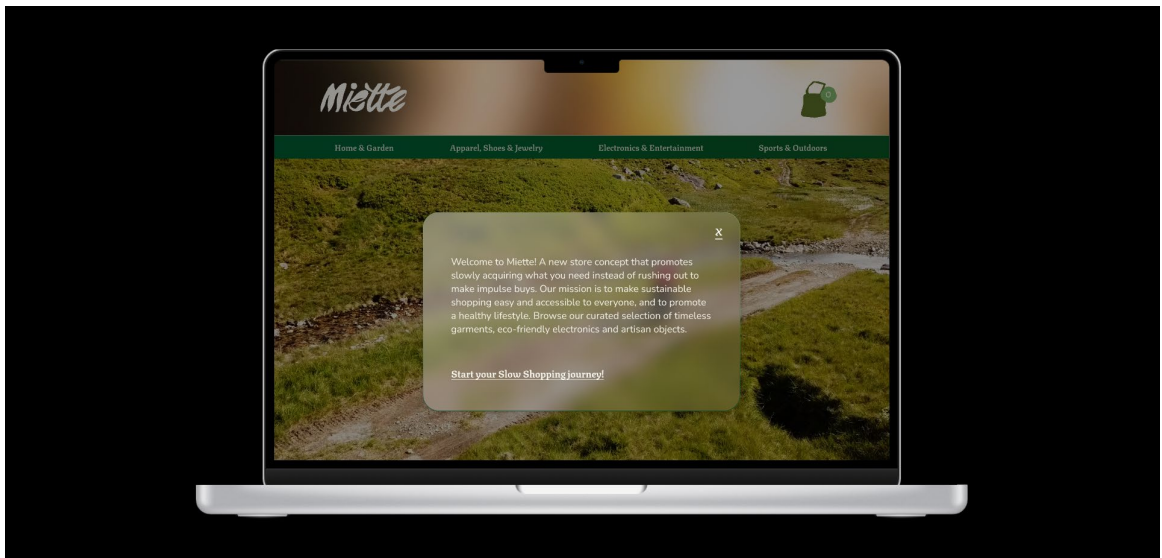**Figure 7**

Design of the Control Condition

Figure 8

Design of the Nature Condition

Figure 9

Design of the Nature with a Mission Statement condition

Measures

Each construct was measured using seven point Likert Scales, anchored by Strongly Disagree (1) and Strongly Agree (7). The statements were developed based on pre-existing scales or were created for the purpose of this research. Additionally to the six dependent variables, this study included Nature Connectedness as a covariate to avoid the possibility of biases during the experiment. On the following page, Table 2 presents an overview of the statements used in the main experiment, while the main experiment survey flow can be found in Appendix B.

Table 2

Measures

Measurement	Statement
Nature Presence (Rendell et al., 2021)	This website makes me think of nature There is a sense of closeness to nature in this website This website evokes the sensation of being in nature There is a sense of naturalness in navigating this website
Green Brand Assessment (Created for this research)	This online retailer respects the environment This online retailer helps protect the environment This online retailer tries to minimize their waste This online retailer is environmentally friendly
User Emotional Experience (Created for this research)	Visiting this website was relaxing Visiting this website was pleasurable While visiting the website, I experienced a sense of tranquility While visiting this website, I felt at peace
Aesthetic Response (Rendell et al., 2021)	The user interface (colors, boxes, menus etc.) of this website are attractive The user interface of this website is easy to understand This website looks professionally designed The overall look and feel of this website is visually appealing
Trust (Rendell et al., 2021)	This website is a trustworthy online store This website wants to be known as an online store that keeps promises and commitments I believe that this website keeps my best interests in mind I have trust in this website
Purchase Intention (Created for this research)	I am very likely to buy products from this website I would consider buying products from Miette instead of other competing websites I would check if a product I intend to buy is available on this website I would recommend this website to others
Nature Connectedness (Nisbet & Zelenski, 2013)	My ideal vacation spot would be a remote, wilderness area I always think about how my actions affect the environment My connection to nature and the environment is a part of my spirituality I take notice of wild life wherever I am My relationship to nature is an important part of who I am I feel very connected to all living things and the earth

Nature Presence

To measure perceived nature presence, four statements were derived from Rendell et al. (2021).

These are: "This website makes me think of nature", "There is a sense of closeness to nature in this

website", "This website evokes the sensation of being in nature" and "There is a sense of naturalness in

navigating this website". Measurements were performed to assess the internal consistency of all sets of

statements. For the statements measuring nature presence, the results reported a satisfactory internal consistency with a Cronbach's Alpha of $\alpha = 0.89$.

User Emotional Response

Similarly, the four statements measuring emotional response were created for this research. They were meant to assess feelings of positive affect consistent with ART and SRT. Participants rated the degree to which they agree with the following items: "Visiting this website was relaxing", "Visiting this website was pleasurable", "While visiting the website, I experienced a sense of tranquility", "While visiting this website, I felt at peace". Reliability tests showed a Cronbach alpha of $\alpha = 0.87$.

Aesthetic Response

"The user interface (colors, boxes, menus etc.) of this website are attractive", "The user interface of this website is easy to understand", "This website looks professionally designed" and "The overall look and feel of this website is visually appealing" were the four statements measuring aesthetic response. These were derived from Rendell et al. (2021) and slightly adjusted to fit the context of the study. A reliability analysis resulted in a Cronbach's Alpha of $\alpha = 0.83$.

Trust

Likewise, the statements measuring trust were adapted from Rendell et al. (2021). The four items were: "This website is a trustworthy online store", "This website wants to be known as an online store that keeps promises and commitments", "I believe that this website keeps my best interests in mind" and "I have trust in this website" The internal consistency analysis showed a satisfactory Cronbach's Alpha of $\alpha = 0.84$.

Purchase Intention

The statements measuring purchase intention were created for this research and consisted of the following four items: "I am very likely to buy products from this website", "I would consider buying

products from Miette instead of other competing websites", "I would check if a product I intend to buy is available on this website" and "I would recommend this website to others". The internal consistency analaysis resulted in a Cronbach's Alpha of α = 0.89.

Green Brand Assessment

Instruments for green brand assessment were created for the purpose of this research. Participants were asked to indicate to what extent they agree with the following statements: "This online retailer respects the environment ", "This online retailer helps protect the environment ", "This online retailer tries to minimize their waste" and "This online retailer is environmentally friendly". The statements received a Cronbach alpha coefficient of α = 0.92.

Nature Connectedness

Finally, nature connectedness was fully adapted from the Nature Connectedness Scale (Nisbet & Zelenski, 2013) and contained items such as "My ideal vacation spot would be a remote, wilderness area" and "I always think about how my actions affect the environment". Although the original scale was measured on a five point Likert scale, this was adjusted to a seven point Likert scale in order to maintain consistency throughout the questionnaire. A reliability analysis reported a satisfactory internal consistency with a Cronbach's Alpha of α = 0.81.

Sampling Procedure and Participants

Participants were selected using the convenience and snowball non-probability sampling methods, and were eligible to participate regardless of age, gender or nationality. They were recruited through social media channels and word of mouth, and did not receive any kind of reward or compensation for the completion of the study. In total, 92 valid responses were collected, from 48 males (52%), 42 females (46%), 1 non-binary (1%) and 1 who preferred not to say (1%). No significant differences were found in the gender (χ2(6, N = 92) = 4.94, p = 0.55) or age (F(3, 91) = 1.19, p = 0.31) distributions between the three conditions, strengthening the internal validity of the study.

<center>**Results**</center>

Nature Presence

Starting out with Nature Presence, an ANOVA with 'Experimental Condition' as independent variable and 'Nature Presence' as dependent variable yielded, as expected, a significant main effect of Experimental Condition on Nature Presence, $(F(2, 89) = 11.46, p < 0.001, \eta2 = 0.205)$. Across the three conditions, Nature Presence was more apparent in Nature with a Mission Statement ($M = 5.18$, SD = 1.25) and in the Nature Condition ($M = 4.65$, SD = 1.25) than in the Control Condition ($M = 3.61$, SD = 1.46). A post-hoc test revealed that there is a difference in perceived naturalness between the Control Condition and Nature Condition ($p = 0.009$) as well as between the Control Condition and Nature with a Mission Statement ($p = < 0.001$), confirming that the natural and non-natural experimental conditions differed significantly in terms of naturalness. However, the results show no significant difference in perceived Nature Presence between the Nature Condition and Nature with a Mission Statement ($p = 0.288$). Confirming H1, UI elements designed to visualize subtle representations of water and vegetation influence the perception of nature presence on a website. To get a clearer view of the relationship between Experimental Condition and Nature Presence, an ANCOVA was run to test the external influence of Nature Connectedness. The results still show a statistical significant effect of Experimental Condition $(F(2, 88) = 11.46, p < 0.001, \eta2 = 0.176)$, meaning that the recognition of subtle nature-related UI design as natural does not depend on the level of nature connectedness of an individual.

Emotional Response

For user Emotional Response, an ANOVA showed a significant main effect of Experimental Condition on Emotional Response $(F (2, 89) = 4.42, p = 0.015, \eta2 = 0.09)$. In line with H2, this result confirms that digital subtle representations of natural elements on websites could trigger similar restorative responses as real natural environments. Participants reported higher levels of Emotional

Response in Nature with a Mission Statement condition (M = 5.77, SD = 0.83) than in the Nature

Condition (M = 5.4911, SD = 0.84) and Control Condition (M = 5.00, SD = 1.32). When performing a

post-hoc test a significant difference was found only between the Control Condition and Nature with a

Mission Statement (p = 0.12), and not between the Control Condition and Nature Condition (p =

1.72). Similarly, no significant difference was found between the Nature Condition and Nature with a

Mission Statement (p = 0.558). After running an ANCOVA, a significant effect of Experimental

Condition ($F(2, 88)$ = 3.54, p = 0.033, η2 = 0.07) on Emotional Response was still detected.

Aesthetic Response

Similarly, an ANOVA showed a significant effect of Experimental Condition on Aesthetic

Response ($F (2, 89)$, p = .008, η2 = 0.01). A significant difference (p = 0.006) was found between Nature

with a Mission Statement group (M = 6.00, SD = 0.87) and Control Condition (M = 5.18, SD = 1.2).

However, the post-hoc test yielded no significant difference between Nature Condition (M = 5.7, SD

= 0.95) and Nature with a Mission Statement, based on the very high p = 5.26. Furthermore, when

running an ANCOVA, Nature Connectedness did not affect the effect of Experimental Condition on

Aesthetic Response ($F (2, 88)$, p = 0.017, η2 = 0.08). Confirming H3, it can be concluded that high levels

of perceived nature presence on a website result in high levels of perceived website aesthetics.

Perceived Trust

Similarly, Trust was not influenced by the Experimental Condition ($F (2, 89)$ = 1.62, p = 0.203,

η2 = 0.03). Trust was rated differently by participants in the three experimental conditions. No significant

difference was found between the Nature with a Mission Statement group (M = 5.12, SD = 1.01), Nature

Condition (M = 4.74, SD = .82) and Control Condition (M = 4.72, SD = 1.05). Hence, H5 cannot be

confirmed. Nature Connectedness did not affect the effect of Experimental Condition on Trust ($F (2, 88)$

= 1.02, p = 0.364, η2 = 0.02).

On the other hand, a main effect of Nature Connectedness was observed on Trust (F (1, 90) = 4.32, p = 0.04, η2 = 0.04). Although H4 cannot be confirmed, nature connectedness is associated with greater trust in a website that contains subtle nature-related UI elements.

Green Brand Assessment

An ANOVA showed a marginally significant effect of Experimental Condition on Green Brand Assessment (F (2, 89) = 3.05, p = 0.052, η2 = 0.06). Participants in the Nature with a Mission Statement group evaluated the website as the most environmentally friendly (M = 4.96, SD = 1.11), followed by the Nature Condition (M = 4.66, SD = 0.89) and Control Condition (M = 4.26, SD = 1.33). Yet, a post-hoc test yielded no significant difference between the three experimental conditions. Similarly, ANCOVA showed no significant effect of Experimental Condition on Green Brand Assessment after checking for the influence of Nature Connectedness as a covariate (F (2, 88) = 2.2, p = 0.116, η2 = 0.048). Therefore, H5 cannot be confirmed.

Purchase Intention

On one hand, a main effect of Nature Connectedness was found on Purchase Intention (F (1, 90) = 10.8, p = 0.001, η2 = 0.11). On the other hand, no main effect of Experimental Condition was found on Purchase Intention (F (2, 89) = 1.98, p = 0.144, η2 = 0.43). Likewise, no significant interaction effect was found between Nature Connectedness and Experimental Condition on Purchase Intention (F(2, 86) = 1.42, p = 0.247, η2 = 0.032) was found. H6 cannot be confirmed, but high levels of nature connectedness are associated with high levels of purchase intention in a website that contains subtle nature-related UI elements.

Overview of Hypotheses

An overview of the hypotheses and outcomes of the statistical analysis can be found in Table 3.

Table 3

Overview of the Tested Hypotheses

	Hypothesis	Result
H1	User perceptions of nature presence are influenced by subtle UI representations of water and vegetation.	Supported
H2	The presence of subtle nature-related UI elements on a website evokes similar emotional responses to those evoked by real nature exposure.	Supported
H3	High levels of nature presence are associated with high levels of perceived visual website aesthetics.	Supported
H4	High levels of nature presence lead to high levels of green brand associations.	Rejected
H5	High levels of nature presence are associated with high levels of trust in the e-vendor.	Rejected
H6	The presence (as opposed to the absence) of subtle nature-related UI elements increases purchase intention.	Rejected

Discussion

The present study sought to investigate what role does the presence of subtle nature-related UI elements on a shopping website play on human cognition, brand image and shopping behavior. It was inspired by research attesting the positive effects of virtual representations of nature on human cognition, emotions and behavior. The motivation for creating novel nature-related design elements came from research encouraging the implementation of different graphic elements in addition to the usage of imagery (Rosen & Purinton, 2004). The chosen research environment was the website of a fictive e-commerce organization, and the findings report that the use of organic animations, natural shapes, natural colors, fractal backgrounds and randomized layouts, successfully induce the feeling of nature presence on the website.

In addition to the findings of Rendell et al. (2021), who report positive associations of nature imagery and videos on feelings of naturalness, this study demonstrates that nature presence could be evoked even in the absence of concrete natural elements. Most importantly, the main effect of subtle nature-related UI elements alone was a powerful design intervention. The textual claim highlighting the environmentally friendly mission of the website had no added value to the degree of nature presence reported by participants.

These findings are particularly worthy of attention considering that the presence of subtle nature-related UI elements had a significant impact in evoking feelings of tranquility, calmness, joy and relaxation. Consistent with the principles of ART and SRT, this study confirms the fascination humans have for natural environments and contributes to the growing body of literature attesting that virtual nature exposure evokes similar benefits for human mental well-being as exposure to outdoor nature. Previously, researchers have been able to confirm this relationship using virtual reality (Chung et al., 2018, Valtchanov et al., 2010), video (Van Houwelingen-Snippe et al., 2023) and photographic (Hartmann et al., 2016) depictions of nature. This study adds that abstract representations of nature also

enhance positive affect and reduce stress. However, these effects were observed only when an environmental textual claim was present on the website simultaneously. The environmental message was the first element users interacted with. Its presence might have served as a primer, making users more aware of the subtle nature-related UI elements that they encountered on the rest of the website navigation. Additionally, the environmental textual claim might have strengthened the promotion of well-being by giving the subtle nature-related UI elements a sense of purpose.

Additionally, the presence of subtle nature-related UI elements enhanced the aesthetic appreciation of the website. In line with biophilia hypothesis, incorporating subtle nature-related UI elements into website design increases visual appeal. Contrary to previous research arguing that simplicity, symmetry and balance are elements that increase the perceived aesthetic of a website (Moshagen & Thielsch, 2010, Reinecke et al., 2013, Zheng et al., 2009), this study shows that intricate abstract natural patterns are also perceived as aesthetic. Just as in the case of emotional response, the effect was significant only when subtle nature-related UI elements were accompanied by an environmental textual claim. The environmental message might have helped users be aware of the subtle nature-related visual cues, framing the visuals more positively. The combination of environmental messages and subtle nature-related UI elements creates a sense of intentionality, coherence and reinforces brand identity which might have made users perceive the website as more thoughtfully crafted.

Yet, the implementation of subtle nature-related UI elements failed to show a significant impact on trust and green brand association. The subtle nature-related UI interventions had no significant impact on the perceived trust in the e-vendor. Rendell et al. (2021) were able to prove that the use of nature imagery induces feelings of trust in the e-vendor even when the services marketed have no link to nature. However, compared to nature imagery, the nature-related design elements proposed by this study were intricate and represented complex and non-symmetrical layouts, designed despite the findings of Wang & Emurian (2005). They argue that in order to emit feelings of trust, a website's layout should be simple and

coherent. Furthermore, other communication factors that were not taken into account in this study, such as labels and certifications (Taufique et al., 2016), also have an influence on the level of trust in an organization. In the context of an environmentally friendly organization, the presence of environmental textual claims next to subtle nature-related UI elements could strengthen brand image and convey sincerity. Therefore, further research addressing the use of subtle nature-related UI elements in the context of genuine green organizations is recommended.

Subsequently, despite the fact that the subtle nature-related UI elements had a marginally significant impact on green brand association, participants in the three different experimental conditions did not differentiate between the environmentally friendly nature of the websites. A possible explanation could be that individuals are more inclined to perceive an organization as environmentally conscious when it provides rich information about its environmental mission rather than vague claims (Alnıaçık & Yılmaz, 2012). In the case of this research, the environmental textual claim was present only in the beginning of the navigation on the website of the Nature with a Mission Statement condition. No further information about the environmental friendliness of the products or of the website was provided throughout the rest of the website interaction. Its content addressed a general, environmentally-conscious mission statement, and consequently, could also be interpreted as ambiguous. Moreover, manipulating consumers by misusing nature-related imagery to suggest false green associations is a frequent green washing practice (Akturan, 2018). Analyzing the results from the perspective of the elaboration likelihood model, the research participants were aware that they are participating in a study and might have processed the entirety of the website through the central route to persuasion. The central route involves extensive cognitive processing and it is activated when individuals are motivated to carefully assess the arguments and contents presented (Petty et al., 1983). Therefore, the weak persuasive message included on the website might not have been convincing enough in this context.

Finally, nature connectedness was associated with the feeling of nature presence, as well as with trust and purchase intention. On one hand, these results lead to the conclusion that interacting with websites that feature subtle nature-related UI elements have a positive impact on mental health even for individuals who do not have a strong affinity for nature. Similarly, an individual's perception of the website's aesthetics does not depend on their connectedness to nature. On the other hand, when an individual feels connected to nature, there is a higher chance that they have trust in the website of an e-vendor that uses subtle nature-related UI in their design. Furthermore, the extent to which individuals are willing to buy products from a website that uses subtle nature-related UI elements is also associated to their connectedness to nature. These findings could be linked to biophilia hypothesis, our innate tendency to affiliate with nature explaining the development of a sense of trust in the reliability and nurturing qualities of nature.

Theoretical Implications

This research paper contributes to the ever-growing body of literature that explores the effects of virtual nature representations on human cognition and behavior. However, the majority of studies miss out on the opportunity to explore the implementation of visual representations of nature on a generally available technology, the internet, in favor of exposing individuals to nature-related design interventions in media such as photography, video and virtual reality. Although nature-related UI elements are widely used in web design, they receive little attention in HCI literature. Furthermore, when studying the effects of nature-related UI, researchers have directed their attention to nature imagery, disregarding other UI elements that make up the majority of a website or application. One key conclusion of this study is that non-figurative design interventions are effective in eliciting nature presence, figurative elements not being the sole means of doing so. Buttons, headers, pagination, dropdown menus, and animations designed to mimic natural structures and mechanics not only successfully convey a sense of nature presence on a website, but are also positively associated with emotional and aesthetic responses. Contrary to research

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arguing that simple, symmetrical layouts are an indicator of a website's aesthetic appreciation (Moshagen & Thielsch, 2010; Reinecke et al., 2013; Zheng et al., 2009), this research paper demonstrates that complex non-symmetrical layouts based on natural patterns and structures, are also perceived as aesthetic. This result could be explained by the human innate affinity for nature and general preference for natural settings over urban environments.

Previous research argues that individuals who feel strongly connected to nature also have a deep appreciation and affinity for natural environments (Kaltenborn & Bjerke, 2002) and are more likely to be influenced by the effects of nature representations in non-green advertising than consumers with low environmental involvement (Hartmann et al., 2016).

Finally, the subtle nature-related UI elements proposed by this research serve as a source of inspiration for researchers who aim to further explore this topic, as well as for web designers who aim to evoke feelings of nature presence and well-being. This aspect covers a gap highlighted by Kim et al. (2022), who mention the absence of clear guidelines for designers to follow when creating virtual nature experiences that promote human well-being.

Practical Implications

First of all, the present research paper brings important practical implications for web designers. Implementing subtle nature-related UI elements is an efficient design solution to induce the feeling of nature presence on a website. Given that the use of subtle nature-related UI elements together with environmental written statements positively increased positive affect and aesthetic appreciation of a website, these findings could be especially valuable for organizations that are trying to spread environmental messages or already established an environmentally-friendly brand image. Based on the high levels of positive affect recorded by the Nature with a Mission Statement group, it is advised that the use of subtle nature-related UI elements is accompanied by clear environmental written statements to

trigger positive and pleasurable consumer experiences. In the context of e-commerce organizations, these elements could bring positive benefits for the mental and physical well-being of users, but also affect their decision making. Berry et al. (2015) argue that exposure to nature-related design may be related to lengthened time perception and consequently affect decision-making leading to less impulsive buys. Furthermore, websites that use subtle nature-related UI elements and environmental written claims will be perceived as more aesthetic compared to non-natural websites or websites showing no environmental information. While there is no evidence to show that subtle nature-related UI elements alone influence perceptions of trust in a website, green organizations could implement subtle nature-related UI elements together with transparent information about environmental initiatives and commitments to strengthen trust and credibility.

As the digital environment represents a space for designers to experiment and express a new aesthetic vision (Bollini, 2017), there is a lot of room for creative freedom when designing nature-related UI elements. Inspired by Rendell et al. (2021), the present research paper used water and vegetation as main sources of inspiration for the design of the UI interventions. These designs serve as an example and could be improved as well as tailored to the desired context of use. Given that this research paper found a positive relationship between the implementation of subtle nature-related UI elements and perceived nature presence in the context of an online store that had no link to nature, the results could be comparable if applied in an online environment other than e-commerce. For instance, integrating subtle nature-related UI elements on online educational platforms may improve students' concentration and reduce stress levels, creating a more enjoyable and stimulating learning environment. It is recommended to perform additional research on the integration of subtle nature-related UI elements across different digital platforms in order to compare variability and to generalize the effects observed in this study.

This paper also brings practical implications for enhancing internet users' well-being. While increased urbanization reduces daily nature exposure, subtle nature-related UI elements implemented in

the digital environment are beneficial to promote a sense of nature. Simulating the presence of nature on the internet with subtle nature-related UI elements could provide users with a mental refuge that will reduce the negative psychological effects of urban living. Nevertheless, implementing subtle nature-related UI elements could go beyond the scope of functionality and usability. By shifting focus on building online environments that keep users connected to the real world and in contact with nature, digital spaces will become more aesthetically pleasing, rewarding and restorative.

Limitations

It is important to consider that this research was conducted with some theoretical and practical limitations. From a research perspective, there was a lack of studies investigating the role of nature-related UI elements in the online environment. Consequently, this study relied on findings from related fields, such as environmental psychology, advertising, and HCI. Moreover, there were no existing studies exploring the implementation of subtle-nature related UI elements in web design. Although the scarcity of available research provided a lot of creative freedom in designing the subtle nature-related UI elements, it limited the possibility of performing comparisons with other cases of use. Identifying patterns and common findings could have provided validation of the results. In light of these limitations, future research is necessary in order to develop a more comprehensive understanding of the impact of subtle nature-related UI elements in the online environment.

Moving on to practical limitations, the small sample size of 92 participants may have reduced the chance to find a statistical effect. Conducting the same study with a larger sample size might provide different results. Additionally, the experiment was executed in the context of a fictive shopping environment. Similarly, the results might have been different if the same subtle nature-related design elements would have been implemented in the context of an existing online store. This leads to the recommendation to investigate whether the findings extend beyond the hypothetical online context. For instance, considering that transparent environmental claims are more effective in creating feelings of trust

and green brand association, implementing the subtle nature-related design elements on the online shop of a real environmentally friendly organization could be of practical relevance and demonstrate a positive relationship between nature presence and green brand assessment or trust.

Nevertheless, as a prototyping tool, Figma only allowed for limited types of website interactions, which reduced the credibility and fidelity of the three e-commerce websites. For example, the websites were missing the possibility to remove items from the shopping cart.

Finally, the effectiveness of subtle nature-related UI elements could vary depending on their design, implementation, context, and interaction with other design features not considered in the study. Although the subtle nature-related UI elements did not have an effect on green brand association and trust in the context of an online shop, they could potentially affect these variables in the context of a different website. For example, subtle nature-related UI elements could be implemented and tested in the context of websites of organizations with a well-established environmental mission, such as Patagonia. The effectiveness of the subtle nature-related UI elements could also be dependent on the amount of time of exposure. In this research, the variables were assessed during a single browsing session. Long-term exposure and repeated interactions with the websites might lead to different outcomes, as users' initial impressions could evolve over time. While the study highlights the potential benefits of incorporating subtle nature-related UI elements into website design, practical concerns such as technical feasibility and cost-effectiveness might prevent a widespread adoption by organizations and web designers.

Conclusion

This study shows that the UI of websites and digital applications could be specifically designed to be reminiscent of the natural world. Most importantly, a feeling of naturalness could be achieved without utilizing concrete nature images. Instead, natural color palettes, organic shapes, textures that resemble natural materials, organic typography and animations are effective in evoking the feeling of nature

presence. To build upon these findings, future research should investigate how organizations could enrich their online experiences by implementing subtle nature-related UI. Meanwhile, these findings attest the unexplored potential of using subtle nature-related UI elements, which could bring a new dimension to the connection between humans and the natural world.

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Appendices

A: Feedback received during the preliminary study

Subject	Colors and Backgrounds	Layout	Graphic Elements	Improvements
1 Interactive Technology	The background gives an organic feel. The color palette feels natural.	On the checkout page, the scroll function is not clear.	Logo is clashing with the rest of the website and feels modern. Use the trick of bionic reading to make the text more legible and still keep the element of randomness.	
2 M&C Traineeship	The background and color palette complement well each other.	The product page of each category does not feel natural enough. Add elements such as clouds, trees or leaves. On the checkout page, the scroll function is not clear. The header containing the search bar feels too empty. Add vines, leaves or other more concrete nature elements.	The color of the Logo clashes with the rest of the website. The Category Tab could be redesigned to fit with the rest of the website. Use warm toned colors.	
3 Industrial Design Eng.	Colors are natural. The website needs more contrast overall.	Rounded corners look nice, but at the same time, too perfect. The Search Bar could be redesigned – include plants or other playful elements. Add subcategories when clicking on the Category Tab and make them bouncy. The Checkout Page is nice, but the blob should be bigger to fit more items in the cart at once.	The Logo and Category Tab could be redesigned with different colors.	Consider having a day and night version. The idea of having the Header as a window to the outside world - show the current weather conditions. Consider adding sound.

4 Psychology	Use a lighter color for the Category Tab. Overall aesthetic look and feel. Background feels natural.	Make the search bar more compact. Consider allowing people to close/open it. The products on each product page should be grouped together and organized based on product type, the way it is now is frustrating. There should be an indication that you can scroll to see more images of a specific product. Unpleasant mix of geometric and organic elements on the Checkout Page.	The purpose of the initial pop-up is not clear. Also not clear how to close it. The logo is not very readable. The video on the Landing Page might be too distracting for some people. The text is readable. "Add to Cart" button is big which is nice. Overall, the website could use more organic elements. The icons can be more natural.	Add a filtering option to sort through the objects on each product page.
5 Industrial Design Eng.	The colors and background feel natural.	The overview in the shopping cart needs to be improved.	The explore and start buttons are not clear enough. The angled corners take away from the feeling of nature. The logo is not legible. Likes the blobs at the checkout page.	
6 Computer Science	The background doesn't necessarily feel natural, but it looks good.	On some pages, the layout looks better than on others. The fact that the corners become angular improves the effect of an item being clickable. Knew how to scroll to view the total price on the Checkout Page. The scrolling should be more noticeable. The start page and Checkout feel very natural.	Needs more concrete natural elements. The titles can be more natural.	Natural effect is more perceivable when there is a mix of big and small elements.
7 Communication Science	The background is too subtle and doesn't strike as natural at first glance. The colors on the header mismatch.	Likes the layout, it gives the feeling of randomness. The Checkout Page does not give a clear overview of what was purchased. The blob window should be bigger. The header feels very empty.	The rounded corners don't necessarily make me think of nature. The animated shift to angled corners feels like a design mistake. Category Bar is too geometric and straight. The font at first seemed like something went wrong when loading the website. Also mentions bionic reading. Add more concrete nature elements.	

8 Creative Technology	Background is neutral, resembles marble.	The products shouldn't shift to have angled edges. The animation in which they change color is enough. The Checkout Page is frustrating as it is, it doesn't give a good overview of the products and it should be more straight forward. Don't use too much randomness, because the website becomes too distracting and it becomes a game of figuring out patterns instead of shopping. There should be an indication that you can scroll to see more images of a specific product.	The purpose of the initial pop-up is not clear. The font feels random. Use bionic reading instead. Each product on its page should have rounded edges to keep continuity. Add the same blob effect as on the Checkout Page around the logo.	
9 Communication Science	The colors of the different products feel consistent in this environment. The colors work well together.	Clear and intuitive layout at the start. The layout feels clean and, because it is not all the same, it feels like an experience, evokes the feeling of being in an art gallery. The whole experience doesn't scream "Buy me". The layout of the checkout doesn't provide a good overview. The website feels airy and makes them enjoy the process of shopping.	Rounded edges evoke softness. Likes the different font sizes, think it's readable, fun and not noticeable until looking more closely. Add more concrete natural elements.	Unexpectedness is not what people want on a website. Items should move only when you want them to.
10 Interactive technology	The background does not necessarily give the feeling of nature. However, it resembles old, crinkled paper and almost evokes a smell.	The layout makes sense for this amount of products. However, once more products are added, it might become problematic and will need a sorting function. Scrolling not clear. Overall the website is calm and relaxing, and does not invoke the feeling of buying, make irresponsible purchases or spend too much money.	The animation following the mouse on the Category Tab is nice. Prefers the rounded corners over the sharp ones. The animation in which the product shifts color is enough. Logo should be more legible.	Add more videos throughout the website (i.e. on each category page)

B: Main experiment survey flow

Miette

Dear participant, Thank you for taking the time to participate in this research. This experiment should take approximately 10 minutes to finish and should be done on a computer. Within this experiment, you will firstly have to put products in the shopping basket of Miette, a fictive online retailer's website. Afterwards, you will have to answer questions about your experience. For questions about the study, please send an e-mail to m.c.ionas@student.utwente.nl.

Potential risks and confidentiality of data
There are no physical, legal, or economic risks associated with participating in this study.
Your participation is voluntary, and you can stop your participation at any time.
Your responses are completely anonymous. No personal identifying information or addresses will be collected. Data will be aggregated via the Qualtrics reporting function. Quantitative and qualitative results will be shared with the thesis supervisors.

I have read the information above and authorize the use of my records, observations, and findings found during the course of this research for education, publication and presentation.

○ Yes, I consent

○ No, I do not consent

Skip To: End of Survey If Dear participant, Thank you for taking the time to participate in this research. This experiment... = No, I do not consent

1. What gender do you identify as?

     ○ Male

     ○ Female

     ○ Non-binary

     ○ Prefer not to say

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2. What is your age?

     ○ Under 18 years old

     ○ 18-35 years old

     ○ 36-45 years old

     ○ 46-65 years old

     ○ 65+

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3. What is your nationality?

_____

Your task

Your task is to explore the website of the fictive online retailer, Miette. Imagine you are shopping for:

-   a new interior décor piece for a dear family member
-   a clothing item for yourself
-   a recreational item
-   an electronic device you wanted to get for a long time

There is no limited budget, so you're invited to take your time to explore the website and add **these 4 different items** in your shopping cart. Please keep in mind that the website prototype has some limitations and that, once added to the basket, items cannot be removed.

[Click here to go to the website](#)

X→

1. Indicate to what extent you agree with the following statements about the online retailer you just visited

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
This website makes me think of nature	○	○	○	○	○	○	○
There is a sense of closeness to nature in this website	○	○	○	○	○	○	○
This website evokes the sensation of being in nature	○	○	○	○	○	○	○
There is a sense of naturalness in navigating this website	○	○	○	○	○	○	○

End of Block: Nature Presence

Start of Block: Green Brand Assessment

X→

2. Indicate to what extent you agree with the following statements about the online retailer you just visited

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
This online retailer respects the environment	○	○	○	○	○	○	○
This online retailer helps protect the environment	○	○	○	○	○	○	○
This online retailer tries to minimize their waste	○	○	○	○	○	○	○
This online retailer is environmentally friendly	○	○	○	○	○	○	○

End of Block: Green Brand Assessment

Start of Block: User emotional experience evaluation

X→

4. Indicate to what extent you agree with the following statements about the online retailer you just visited

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Visiting this website was relaxing	○	○	○	○	○	○	○
Visiting this website was pleasurable	○	○	○	○	○	○	○
While visiting the website, I experienced a sense of tranquility	○	○	○	○	○	○	○
While visiting this website, I felt at peace	○	○	○	○	○	○	○

End of Block: User emotional experience evaluation

Start of Block: Aesthetic Response

X→

5. Indicate to what extent you agree with the following statements about the online retailer you just visited

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Disagree nor Agree	Somewhat Agree	Agree	Stronly Agree
The user interface (colors, boxes, menus etc.) of this website are attractive	○	○	○	○	○	○	○
The user interface of this website is easy to understand	○	○	○	○	○	○	○
This website looks professionally designed	○	○	○	○	○	○	○
The overall look and feel of this website is visually appealing	○	○	○	○	○	○	○

6. Indicate to what extent you agree with the following statements about the online retailer you just visited

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
This website is a trustworthy online store	○	○	○	○	○	○	○
This website wants to be known as an online store that keeps promises and commitments	○	○	○	○	○	○	○
I believe that this website keeps my best interests in mind	○	○	○	○	○	○	○
I have trust in this website	○	○	○	○	○	○	○

End of Block: Trust

Start of Block: Purchase Intention

X→

7. Indicate to what extent you agree with the following statements about the online retailer you just visited

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I am very likely to buy products from this website	○	○	○	○	○	○	○
I would consider buying products from Miette instead of other competing websites	○	○	○	○	○	○	○
I would check if a product I intend to buy is available on this website	○	○	○	○	○	○	○
I would recommend this website to others	○	○	○	○	○	○	○

End of Block: Purchase Intention

Start of Block: Nature connectedness

X→

8. Indicate to what extent you agree with the following statements

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
My ideal vacation spot would be a remote, wilderness area	○	○	○	○	○	○	○
I always think about how my actions affect the environment	○	○	○	○	○	○	○
My connection to nature and the environment is a part of my spirituality	○	○	○	○	○	○	○
I take notice of wild life wherever I am	○	○	○	○	○	○	○
My relationship to nature is an important part of who I am	○	○	○	○	○	○	○
I feel very connected to all living things and the earth	○	○	○	○	○	○	○

End of Block: Nature connectedness