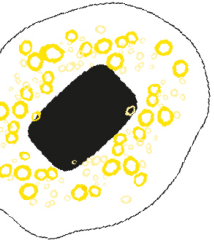


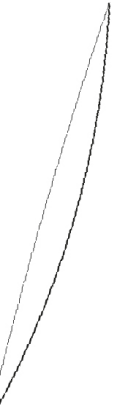
UNIVERSITY OF TWENTE.



Bringing Nature's Touch to the Digital Context:

Exploring the Impact of Biophilic Design on Sustainability

Perceptions in Social Media Advertisements



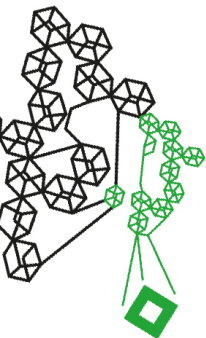
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Abstract

Bringing Biophilic Design (BD) elements into urban environments has gained significant attention from scientific literature and marketers seeking to create more sustainable and appealing spaces. However, as social media (SM) marketing continues to grow exponentially, it becomes critical to explore whether the benefits associated with incorporating natural elements into physical environments can be extended to the digital context. This research investigates the individual and synergistic effects of BD elements (water and natural daylight) on sustainability perceptions in SM advertising within the skincare industry. It aims to illuminate how digital representations of BD elements can enhance the appeal of perceived sustainability regarding skincare products, offering insights into effective digital marketing strategies in a competitive market landscape. A total of 208 participants were engaged in a 2x2x2 factorial experiment, which utilised a survey to investigate the effects of natural daylight and water imagery on sustainability perceptions of the advertised skincare product. Individual's pro-environmental beliefs were serving as the moderating variable. The results indicated that while individual BD elements (presented separately) positively influenced sustainability perceptions, their combination did not increase this effect. Participants with pro-environmental beliefs consistently induced higher sustainability perceptions, but these beliefs did not interact significantly with the presence of the biophilic elements in altering sustainability perceptions. The study's findings provide practical advice for marketers and designers, revealing that biophilic advertising in a digital context enhances sustainability perceptions of organic skincare products. It highlights the necessity of tailoring BD elements to resonate with consumer environmental values for enhanced marketing success.

Keywords: Biophilic Design, Social Media Advertising, Sustainable Marketing, Digital Marketing Strategies, Digital environment, Sustainability Perceptions

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1. Introduction

Consider the average individual today, dedicating roughly 90% of time indoors while simultaneously having a common desire for a greater connection to the natural world¹. This paradox presents a unique chance to rethink digital environments. It is about exploring ways to bring the outdoors into individuals' highly digital world, making their time spent inside feel more connected to nature. Bridging this divide, Biophilic Design (BD) emerges as a response to this challenge. It is deeply rooted in the Biophilia hypothesis and claims that humans tend to have an intrinsic affinity toward the natural world (Gillis & Gatersleben, 2015; Kellert & Wilson, 1993). This idea has shifted its ecological and architectural roots, affecting sectors such as marketing, health studies, and environmental psychology (Liberalesso et al., 2020; Wijesooriya & Brambilla, 2021). The main goal of BD is to incorporate natural elements into urban settings, establishing a vital connection with nature. Scholars have explored the impact of BD, examining how direct elements (light, water, and plants) and indirect elements (natural materials, shapes, and patterns) contribute to a variety of outcomes. These range from restoration and well-being to physiological responses, enhanced customer experiences, and sustainability (Gillis & Gatersleben, 2015; Jaggard, 2014; Kumar et al., 2020, Lee et al., 2022; Liberalesso et al., 2020; Wijesooriya & Brambilla, 2021; Zhong et al., 2021).

The efficacy of BD in fostering psychological restoration is fundamentally connected to a process described by Ulrich's (1983) Psycho-evolutionary Theory (PET). This theory implies that exposure to natural elements elicits a positive emotional reaction that is deeply embedded in human evolution. Such a reaction is critical in reassuring stress and fostering emotional stability (Joye & Van Den Berg, 2011; Ulrich, 1983; Ulrich et al., 1991). These innate responses support the restorative effects of BD, driving a shift towards a positive emotional state and triggering advantageous psychological changes. Consequently, this shift enhances how

¹ <https://shorturl.at/cnDY3>

individuals perceive and interact with their environment, eventually leading to more sustainability behaviours (Kaplan, 1972; Wohlwill, 1983; Wijesooriya & Brambilla, 2021).

The presence of tangible natural elements has been widely recognized as crucial in healing environments. However, findings suggest that even their visual representations can evoke comparable well-being and emotional benefits, highlighting the innate potential of natural imagery (Moslehian et al., 2023; Tanja-Dijkstra & Pieterse, 2011). Despite this, the effects of BD elements beyond greenery remain underexplored (Lee, 2019). This broader impact, affirmed by research highlighting the benefits of greenery for well-being (Brenngman et al., 2012), suggests that other natural elements may offer similar restorative advantages. While individual elements have been the focus of much research, the synergistic impact of combining these elements seeks further exploration (Gillis & Gatersleben, 2015).

Respectively, this study aims to delve into the confluence of multiple biophilic elements with an emphasis on water and natural daylight. Both elements possess distinctive qualities associated with positive psychological outcomes and are integral to impressions of natural beauty and tranquillity (Gatersleben & Gillis, 2015). Recent research highlights the combined impact of water and natural daylight in BD, mentioning that their joint presence can improve aesthetic appeal and evoke stronger psychological and behavioural responses (Lee et al., 2022; Song et al., 2022). The reflective nature of water, along with the changing qualities of natural daylight, can create an even greater sensory experience (Gillis & Gatersleben, 2015). This interaction promotes feelings of peace and a stronger connection with the natural world, potentially strengthening the restorative effects observed with BD. By examining their combined effects, this research seeks to contribute to a better understanding of BD's efficacy. Further, it demonstrates how digital representations of water and natural daylight can complement or even replace for the presence of greenery in physical spaces.

Research has been mainly focusing on the Biophilia aspects in urban environments, such as service landscapes and retail. Yet, no research has been done on exploring whether its

encountered effects can also be applied to the digital context. Social Media (SM), particularly Instagram, plays an essential role in brand-consumer engagement through targeted content (Appel et al., 2019; Dwivedi et al., 2021). Brands across industries are incorporating nature elements, like water or natural daylight, into their digital marketing strategies. This is done to enhance advertisements and fostering consumer connections via tailored content marketing (Du Plessis, 2017; Figure 1). The effectiveness of social media marketing in promoting well-being and eco-friendly products is especially notable in the beauty business². The trend towards organic skincare aligns with consumers' environmental values and their desire for self-care routines, promoting self-esteem and emotional well-being (Binwani & Ho, 2019; Chin et al., 2018). With sustainability's importance ever-growing, companies can better understand consumer preferences, values, and expectations regarding sustainable products when integrating BD principles into their digital presence (Camilleri et al., 2023). Featuring these elements in product promotions can link products to nature's restorative benefits by fostering aesthetic appeal and stimulating emotional responses. This can potentially guide consumers towards increased sustainability perceptions. In this study, sustainability perceptions of skincare products are examined in terms of customers' awareness and judgments of the promoted product's sustainability practices (Camilleri et al., 2023). Understanding and addressing these perceptions is essential for brands to stay connected with customer values and encourage environmental responsibility, hence defining their market success³.

Responding to the findings in the scientific literature and its suggestions for future research, this study contributes to the academic discourse by investigating whether integrating BD into SM advertising can enhance consumers' sustainability perceptions of the advertised product. This expands on previous studies indicating that humans natural affinity for biophilic elements can evoke positive emotions with restorative effects, potentially influencing attitudes

² <https://www.linkedin.com/pulse/social-media-beauty-industry-annabelle-brown/>

³ <https://shorturl.at/dEJRY>

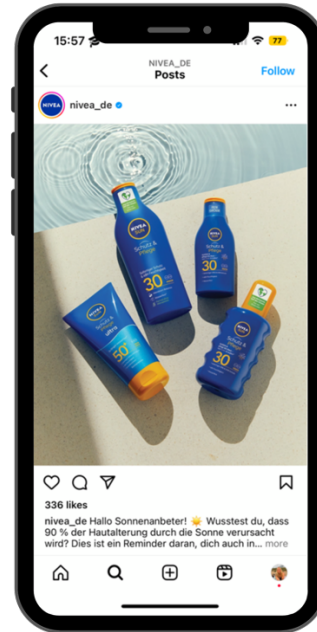
towards sustainability. While the benefits of BD in physical environments are well-documented, their digital use in SM advertising remains unexplored. Additionally, the study investigates how a synergistic display of water and natural daylight can uplift sustainability perceptions. As a result, this study provides novel insights about extending BD benefits from physical to digital contexts, adding an additional dimension to environmental psychology and marketing research. It also presents a strategic guide for practitioners using biophilic imagery in SM advertising to improve customers' impressions of the sustainability of skincare products. Thus, incorporating natural elements in digital narratives is essential to reinforce product sustainability in the SM landscape. Respectively, the following research question is introduced:

RQ: “What is the impact of incorporating the visualization of multiple biophilic design elements (water and natural daylight) in social media advertising on consumer sustainability perceptions regarding skincare products?”.

To explore the research question, a scenario-based between-subjects design was employed, utilising a survey method. This approach investigated the effects of BD elements, specifically natural daylight and water, across organic and non-organic product categories on consumer sustainability perceptions of skincare products. Subsequent sections of this paper will delve into the experiments' findings, discussing practical and theoretical implications, limitations, and suggesting potential pathways for future research.

Figure 1

Instagram advertising of skincare products containing BD elements.



2. Theoretical Framework

In today's digital age, the increasing urbanization and individuals' reliance on technology often intensify the feeling of disconnection from nature. Modern environments, with their urban landscapes and digital interfaces, have, in many ways, overshadowed direct interactions with the natural world. Applying BD principles to SM reveals a significant potential. Even on digital platforms, depictions of nature can stir strong feelings, enhancing humans' real-life connections with the environment. These feelings are critical, as they can influence how sustainability is perceived. For industries like skincare, where the value of being organic and sustainable is a key selling point nowadays, channelling these nature-inspired emotions on SM platforms can enhance the perceived sustainability of the products. A brief definition of all key concepts of this research can be found at the end of the theoretical framework (Table 1).

2.1 Biophilic design

In modern society, humans often had rather little contact with nature due to various factors, such as demanding work schedules, or increased reliance on technological advancements. However, individuals always had a natural need to connect with nature as part of their genetic history and biological nature (Kellert & Wilson, 1993). The concept of BD is based on this notion, as it serves to satisfy the human desire for exposure to nature. Green environments in physical surroundings have lately been identified as a promising strategy for boosting consumers' favourable behaviours and positive experiences (Lee et al., 2022). Empirical studies show that integrating natural features into built environments not only triggers positive behavioural reactions in terms of spending longer amounts of time or expressing a higher liking for the environment but also enhances mental and physical health. Lee (2019) specifically highlights the impact of biophilic elements in hospitality settings, such as hotels. The introduction of these elements can fulfil guests' innate need for natural connection, stimulating positive emotional states, quality perceptions, and favourable attitudes, associated

with their stay. These results align with previous studies indicating that biophilic stimuli in built environments significantly influence consumers' emotional states, perceived quality, attitude, and behaviour (Gillis & Gatersleben 2015, Rosenbaum et al., 2016). Furthermore, the study by Purani and Kumar (2018) conducted research that further supported the impact of biophilic elements on consumer behaviour. Their findings reveal that these elements have the potential to improve visual comfort, reduce emotional stress and anxiety, and enhance overall health and subjective well-being.

Central to this exploration is the concept of emotive processes induced by the restorative effects of BD. According to Ulrich et al. (1991) and Valtchanov (2010), the structural properties of an environment, such as the presence of natural elements, elicit an innate affective response that is crucial for the restorative process. This theory, deeply rooted in Ulrich's (1983) Psycho-evolutionary hypothesis, contends that humans' initial relationship with an environment is fundamentally effective. It implies that, because of evolution, humans respond affectively to natural stimuli, a response that precedes cognitive awareness. This suggests that positive affective responses to nature are critical in shaping positive changes in psychological and physiological states and behaviours. Such a process of restoration is replicated even in virtual environments that simulate natural settings, highlighting once more the profound impact that natural elements have on human well-being (Valtchanov & Ellard, 2015).

2.1.1 Sustainability Perceptions and Biophilic Design

The concept of sustainability becomes more present in people's heads as the world is currently facing dramatic environmental challenges. This is evident as consumers and brands increasingly prioritise sustainable processes, recognising their role in fostering support for sustainable development and shaping future behaviours (Ferguson et al., 2017; Ferreira et al., 2023; Lin et al., 2021). Vincenzi et al. (2018) offer a definition of sustainability perceptions, describing them as an individual's awareness of their environmental surroundings.

This awareness is not just about facts or information, it also involves how people feel emotionally about the environment. The researchers describe this awareness as part of both thinking (cognitive) and feeling (affective) that help people form their understanding of the environment. Building upon theoretical definitions of sustainability perceptions, this study specifically investigates how consumers perceive the environmental sustainability of skincare products. These perceptions are shaped not only by factual assessments but also by consumers' emotional responses to a brand's environmental responsibility. For instance, consumers' evaluations may consider how a skincare product and its brand manage environmental sustainability through practices like sourcing of ingredients, choice of packaging materials, and the overall environmental footprint throughout the product's lifecycle (Camilleri et al., 2023). These perceptions influence consumer behaviour and purchasing decisions, particularly in sectors where environmental concerns and eco-consciousness are prominent, such as in the skincare landscape (Suphasomboon & Vassanadumrongdee, 2022).

Several studies have highlighted that connection to nature and exposure to biophilic elements can be positively related to individuals' sustainability perceptions (Ljung, 2021; Rosa & Collado, 2019; Sheffield et al., 2022; Whitburn et al., 2020). For example, Zhong et al. (2022) uncovered that there is a clear connection between a positive attitude towards BD elements and sustainability perceptions. This connection can be attributed to the perceived benefits of spending time in nature, which have a positive influence on overall well-being (Rosa & Collado, 2019). Further research has deepened the understanding of how BD contributes to sustainability, also in the context of skincare products. Specifically, Zhong et al. (2021) demonstrate how BD improve buildings to become more resilient to climate change, possibly through greater energy efficiency and better adaptation to environmental changes. Further, Sharifi and Sabernejad (2016) highlighted BD's significance in accomplishing sustainable development objectives, which may be utilised to promoting eco-friendly packaging and formulas in skincare products. Similarly, Lin et al. (2018) as well as Wijesooriya and Brambilla

(2021) emphasized BD's significance in raising awareness about environmental issues, which can influence consumer perceptions towards the sustainability of skincare products.

Emotions are an essential part of human perception and interaction with the environment (Zhang, 2013). According to research, affective responses play a critical role in expanding our understanding of human relationships with the natural world (Ulrich, 1983). Such responses, including liking or disliking products made from recycled materials, play a crucial role in shaping consumer perceptions towards the sustainability of products (Polyportis et al., 2022). These reactions elicit positive emotions like pride, which play an important role in shaping sustainability perceptions towards products (Adigüzel & Donato, 2021; Krah et al., 2019). Highlighting the link between the human-nature connection and sustainable behaviours, research underscores the relevance of BD's restorative advantages in enhancing sustainability perceptions of products (Bratman et al., 2021; Nisbet et al., 2009; Tam, 2013; Wijesooriya & Brambilla, 2021).

2.1.2 Natural Daylight

In psychological literature, only a few studies have researched the advantages of natural daylight from a BD perspective. Gatersleben and Gillis (2015) uncovered that specifically natural daylight conditions are most beneficial in building settings. This is supported by Morales-Bravo and Navarrete-Hernández (2022) who ascertained that natural daylight not only elevates individual comfort and health but also addresses deeper emotional necessities. It stimulates feelings of connection with nature and evokes sentiments of security, which are frequently associated with eco-conscious lifestyles. According to research, natural daylight has a critical function in shaping our mood. Regular exposure to natural daylight, such as through the window, can help to synchronise the body's circadian rhythms, improving mood and overall well-being (McAuliffe, 2022). Morales-Bravo and Navarrete-Hernández (2022) emphasised this point by showing an actual connection between natural daylight in houses and

emotional well-being, highlighting the significant emotional implications associated with feelings of happiness or sadness.

Moreover, Kaplan (1995) suggests that environments offering opportunities for restoration from mental fatigue are particularly beneficial for well-being. This form of affective response could lead to positive perceptions and associations, especially when the light is seen as a symbol of naturalness and purity (Ulrich, 1984). Within the realm of advertising, Hartmann et al. (2013) specified that visual cues associated with nature, like natural daylight, can enhance product perceptions. Hence, in the skincare realm, imagery rich in natural daylight can conjure feelings and emotions of purity, naturalness, vitality, and holistic well-being, eventually leading to sustainability perceptions of the beauty product.

However, with digital platforms limiting genuine exposure to natural daylight, the question arises: Can mere visualisation of natural daylight evoke similar effects? Tanja-Dijkstra and Pieterse (2011), through their research on healing environments, proposed that visual representations indeed trigger similar benefits. From a biophilic perspective, humans evolved under natural daylight conditions, thus highlighting a deep-rooted association between natural daylight and human physiological and psychological well-being (Gatersleben & Gillis, 2015).

Exposure to natural daylight elicits powerful affective responses that connect individuals to nature. Harnessing natural daylight in advertising, especially in sectors like skincare, can evoke feelings of well-being and underscore sustainability principles. Thus, by tapping into the emotional power of the BD element natural daylight in SM advertising, there is potential to influence and enhance consumers' sustainability perceptions towards skincare products. Thus, it is hypothesised that the presence of natural daylight elements in SM advertising can lead to more favourable sustainability perceptions of the promoted skincare product compared to advertising without the presence of natural daylight. Previous research has identified the central role of emotions in shaping consumer reactions to different natural stimuli (Lee et al., 2019; Nanu & Rahman, 2023). In the skincare domain, natural daylight can amplify

these emotional responses, influencing perceptions of product sustainability (Liao, 2020; Yang et al., 2020). Building upon this evidence, the subsequent hypothesis is introduced:

H1: Visualisation of natural daylight in social media advertising will enhance consumers' sustainability perceptions of the promoted skincare product compared to advertising without the presence of natural daylight.

2.1.3 Water

The presence of water patterns was found to foster positive emotional responses to natural environments while simultaneously enhancing environmental perceptions (Gatersleben & Gillis, 2015). In the context of hotels, the study by Song et al. (2022) expanded on these findings by using pictures of real hotel lobbies as experimental conditions. They emphasised that visuals of water in hotel environments can enhance feelings of tranquillity, overall well-being, and other psychological reactivity, by watching water patterns. Adding upon that, Kelly (2018) explored how landscape preferences are deeply influenced by real water setting exposure (coastal setting), underscoring the profound relationship between human emotions and their connection to water. Expanding on that, White et al. (2010) highlighted the distinction between natural and urban spaces, illustrating that scenes containing water were often preferred, eliciting stronger positive emotions. Further, the researchers identified that water represents a unifying element and interacts well with various natural materials (such as natural daylight or greenery) by enhancing the experience of visual contact, which consequently enhances the dimension of biophilic appeal.

Applying this understanding to the context of skincare, water is commonly associated with natural beauty and is crucial in organic skincare products to achieve healthy skin (Palma et al., 2015). This implies that leveraging water visuals in SM advertising may provoke emotional responses like those evoked by actual natural surroundings. The emotional resonance

of water visuals, particularly feelings of pleasure and arousal, could serve as essential means of connecting the presence of these visuals to consumers' sustainability perceptions towards products. Given the illustrated emotional and behavioural implications of water in real-world contexts, it is reasonable to expect comparable outcomes when these water visuals are merged into the digital context of SM.

Thus, the following hypotheses seek to investigate how consumers' sustainability perceptions are affected when water is incorporated into an SM setting. Drawing on the profound impact of water in BD and its consistent association with positive emotional responses, which eventually lead to increased sustainability perceptions of a skincare product, the following hypotheses are posited:

H2: Visualisation of water in social media advertising will enhance consumers' sustainability perceptions of the promoted skincare product compared to advertising without the presence of water.

2.1.4 Synergy of Natural Daylight and Water

Furthermore, considering the combined potential advantages of both water and natural daylight components in enhancing the perceived sustainability of skincare products, their combination in a digital setting is expected to create even more positive impressions. This synergy between water and natural daylight elements could potentially enhance digital experiences by evoking stronger emotional connections and environmental awareness. Previous research has indicated that BDs' combined presentation can yield more pronounced effects. Lee et al. (2019) found out that the combination of greenery, water, and natural daylight was associated with amplified positive emotional responses among participants in hotel environments. Further supporting this in a hotel setting, Song et al. (2022) identified a trend towards environments incorporating both water and natural daylight correlating with increased

customer delight and overall subjective well-being. Such findings, as also highlighted by Morales-Bravo and Navarrete-Hernández (2022), emphasise the importance of considering the connected effects of BD elements rather than only evaluating them individually and separately. Visualising natural daylight and water imagery in digital environments may increase emotional engagement and improve perceptions of a product's sustainability.

Given these findings, there is scientific evidence to suggest that the digital advertising sector can benefit from these synergistic effects. It is feasible to predict an increased perception of the sustainability of a promoted skincare product among consumers by incorporating both natural daylight and water patterns in SM advertising. This leads to the following hypothesis:

H3: Visualisation of natural daylight and water combined in social media will enhance consumers' sustainability perceptions of the promoted skincare product compared to advertising without the presence of both elements.

2.2 Product Category

Focusing on organic skincare vs. non-organic skincare as the product category of interest is driven by the increasing demand for sustainable and eco-friendly beauty solutions. Natural skincare products are currently experiencing a growth in popularity as formulations resolve consumer concerns about synthetic ingredients (Emerald et al., 2016). Additionally, customers are increasingly seeking products that align with their environmental and personal well-being goals. In general, as healthier lifestyles, environmental awareness, and overall health consciousness become more popular in society, the sale of organic beauty products is expected to increase significantly (Narang & Sharma, 2022; Suphasomboon & Vassanadumrongdee, 2022).

In accordance with previous literature, organic skincare products comprise ingredients cultivated without chemicals, ensuring minimal harm to the environment (Annis, 2011). These

products are made from plant components, and the ingredients are botanically sourced and processed in a way that preserves the substances' natural properties (Hsu et al., 2017). Moreover, Hsu et al. (2017) note that organic skincare products are made from recycled materials and prioritize life expectancy and non-toxicity. Compared to their conventional counterparts, they strive for a lower environmental impact while providing higher health advantages (Dangelico & Pontrandolfo, 2010).

Considering the insights from previous research, it is reasonable to hypothesise that consumers' exposure to SM advertising incorporating the visualisation of natural daylight and water elements will influence their perceptions regarding the sustainability of the advertised skincare product. Hereby, product category is acting as the key factor. The choice between organic and non-organic skincare products has become relevant due to the growing demand for sustainable and eco-friendly beauty solutions (Emerald et al., 2016). Consumers are now seeking products that correspond with their environmental and personal well-being ideals, reflecting a broader trend of adopting healthier lifestyles and raising environmental consciousness. (Narang & Sharma, 2022). Given this context, it is feasible to hypothesise that the impact of the visualisation of BD elements on sustainability perceptions will be more pronounced for organic products compared to non-organic products. Therefore, the study hypothesises:

H4: The visualisation of natural daylight and water in social media advertising will enhance consumers' sustainability perceptions of organic skincare products more than non-organic ones.

2.3 Individual Pro-environmental Beliefs.

Individuals react differently to nature since their own values and environmental consciousness are important drivers in shaping their experiences, attitudes, and perceptions

towards sustainable behaviours. As explained by Macovei (2015), pro-environmental beliefs in consumers appear when they become conscious “*of the consequences of their decisions and actions on the environment and when they accept a responsibility to do their share for the benefit of the entire humanity*” (p. 3).

According to literature, consumers pro-environmental beliefs can be described through the value-belief-norm theory, which helps illuminate the underlying psychological processes driving sustainable perceptions and behaviours. Clarified by Li et al. (2021), the theory best describes that people build a distinctive worldview based on their personal values, which leads to views about environmental awareness and responsibilities. These ideas then shape their norms, which in turn drive environmental protection behaviours. Previous research has indicated that individuals with high pro-environmental values and beliefs engage more in green atmospherics, because of greater concerns about environmentalism, resulting in more favourable responses and perceptions regarding sustainability (Kreidler & Joseph-Mathews, 2009). Lee (2019) conducted a study in a hotel services landscape and confirmed that customers' sense of well-being, contentment, and intention to behave sustainably were higher when they preferred a greener physical environment when adding experiences of BD. This finding is supported by a recent study arguing that consumers' environmental beliefs about green behaviour showed significant effects on their personal values. Accordingly, individuals with greater pro-environmental values reported higher economic value and sustainability evaluations of BD elements than those with weaker beliefs (Lee et al., 2022).

Therefore, considering the effects of nature and biophilic elements in physical environments, customers who hold such pro-environmental views are probably going to spend more time in natural settings and provide more positive feedback on their overall experience. These findings raise intriguing possibilities for translating the positive outcomes of pro-environmental behaviour elicited by BD elements in physical environments to the digital realm, particularly within the realm of SM platforms.

Recognising the crucial role of BD in encouraging pro-environmental beliefs, it becomes essential to explore how the digital visualisation of natural daylight and water influences perceptions of sustainability. This matter is particularly relevant in the context of skincare, where consumer interest in sustainability is obvious. Therefore, investigating the differential impact of visualising biophilic elements on consumers with and without pre-existing pro-environmental beliefs, including those specific to skincare, can provide valuable insights into enhancing sustainability perceptions through digital channels. The inclusion of skincare-specific pro-environmental beliefs as an additional focus area is central to the study's objectives. Thus, the following is proposed:

H5: Visualisation of natural daylight and water will enhance sustainability perceptions in consumers with a) pre-existing pro-environmental beliefs and b) such beliefs regarding skincare products, more compared to those without such beliefs.

Table 1

Definition of the key concepts

Key concept	Definition
<i>Biophilic design</i>	Biophilic design integrates elements from nature into the architectural environment, drawing inspiration from natural features and processes. This approach stems from the belief that connecting with nature has beneficial impacts on human health and well-being (e.g., Gillis & Gatersleben, 2015; Kellert & Wilson, 1993).
<i>Sustainability Perceptions</i>	Sustainability perceptions of skincare products refer to consumers' awareness and evaluations of a product's environmental sustainability practices. This includes for example consumers' judgments regarding how environmentally responsible a skincare

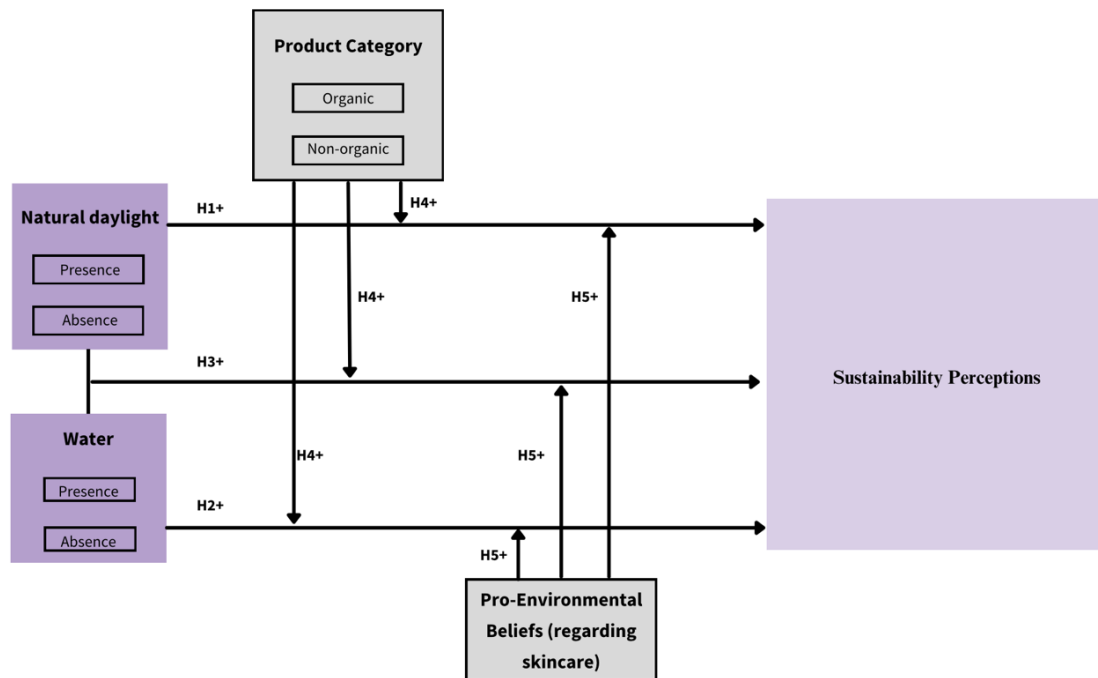
product is perceived to be. Sustainability perceptions encompass considerations such as the sourcing of ingredients, packaging materials, and overall environmental impact throughout the product's lifecycle (Camilleri et al., 2023).

Product Category

Within the realm of skincare, it differentiates between products based on their ingredients and environmental impact, such as organic skincare, which uses natural and chemical-free ingredients, and non-organic skincare. This classification is influenced by growing consumer demand for sustainable and eco-friendly beauty solutions (Emerald et al., 2016; Harper, 2015).

Pro-Environmental Beliefs

An individual's conscious awareness of the impact of their decisions and actions on the environment, coupled with a sense of responsibility to contribute positively for the broader benefit of humanity. This belief system, rooted in personal values, drives attitudes, perceptions, and behaviours towards sustainability and environmental protection (Macovei, 2015; Li et al., 2021).

Figure 2*Research Model***3. Method****3.1 Research Design**

This study seeks to understand the impact of BD elements on perceptions of sustainability regarding skincare products, specifically focusing on the interplay between natural daylight, water, and product category. A 2 (natural daylight: presence vs. absence) x 2 (water: presence vs. absence) x 2 (product category: organic vs. non-organic) scenario-based between-subjects design was employed. Pro-environmental beliefs acted as a moderating variable. The primary measures included consumers' sustainability perceptions of the skincare product and pro-environmental beliefs. A visual representation of this research model is depicted in Figure 2.

The integration of different conditions for BD serves to explore the nuanced impact of its elements on perceptions of sustainability. The conditions consider scenarios with and

without the BD elements, and each of these is further delineated based on the product category – organic vs. non-organic. A central aspect of this exploration will be to understand how BD elements can enhance consumers sustainability perceptions. As illustrated in Table 2, the study encompasses eight distinct conditions stemming from the combinations of the independent variables and the moderating variable.

Sunscreen is chosen as the skincare product of interest for testing the effectiveness of BD elements (Guan et al., 2021). It is widely recognised and used for protecting the skin from harmful UV radiation. Participants from diverse demographics, independently of skin colour, age, and gender, can relate to sunscreen, ensuring a broader understanding of sustainability perceptions (Guan et al., 2021).

Table 2

Stimuli conditions

		Biophilic Design			
		No Natural Light		Natural Light	
		No Water	Water	No water	Water
Product					
Category					
	<i>Organic</i>	Control Condition	Organic Water	Organic Natural Light	Organic Water & Natural Light
	<i>Non-organic</i>	Control Condition	Non-organic Water	Non-organic Natural Light	Non-organic Water & Natural Light

3.2 Pre-Test

To ensure the efficacy and clarity, and thus the validity of the study's materials, a pre-test was conducted. This was done via a focus group session to explore the knowledge, beliefs, and practises of the targeted audiences. The session was conducted with eight participants, a

size that optimises the balance between individual contributions and group dynamics (Krueger, 1994). The participants were a balanced combination of male and female, falling within the age range of 23 to 25 years. The group comprised individuals of German, Dutch, and Portuguese. Moreover, the discussion was held in an offline environment, ensuring a conducive setting for in-depth face-to-face interactions. Such a setting promotes open dialogue, encourages spontaneous feedback, and facilitates immediate clarifications on any ambiguities pertaining to the materials presented (Acocella & Cataldi, 2021)

The given collaborative environment ensured a comprehensive review and validation of study materials (Onwuegbuzie et al., 2009). For example, BD images, product labels, and other tangible elements of the study were dissected and evaluated for clarity, relevance, and efficacy in conveying the intended messages. Focus groups provide a platform in which participants can openly discuss and provide feedback, making them a valuable method in this phase (Needleman et al., 2023). Thus, engaging participants in an interactive discussion helped to discover how they interpret and respond to materials and questions, ensuring that they align with the research's intent.

3.2.1 Manipulation Check

An essential aspect of the pre-test involved the manipulation check. This part of the focus group session ensured that the materials not only communicated the intended concepts effectively but also functioned cohesively within the research design. The use of Miro as a digital collaborative platform was integral in the context of the manipulation test. Participants were engaged in an interactive card sorting activity, allowing them to categorise images and elements related to the study's focus. The platform enabled participants to make sticky notes, capturing their feelings, perceptions, and experiences in real-time. The intuitive interface of Miro assured that participants could focus on the content of the study materials rather than the mechanics of the tool, thereby preserving the ecological validity of the pre-test.

To explore participants' perceptions of the BD element natural daylight, they were presented with a variety of images capturing diverse light conditions. Hereby, participants were asked to engage in a card-sorting activity to further elucidate their perceptions. According to Conrad and Tucker (2019), card sorting is a visually appealing technique designed to demonstrate how participants comprehend and arrange ideas. In this research, participants categorised images containing light sources based on their perceived degree of naturalness (high level of naturalness vs. low level of naturalness). Observing how participants grouped these images provided insights into the visual conditions most associated with natural daylight. Similarly, to address perceptions of water within the BD framework, participants were exposed to various water representations. They again took part in a card sorting task, organizing these water images based on which water patterns best match the BD principle and participants' natural understanding of water (high level of naturalness vs. low level of naturalness). Furthermore, participants were asked to indicate which visual of both elements was perceived as most attractive in terms of being visually appealing.

The incorporation of real images complies with prior research on ecological validity. It is confirmed that positive responses to actual views of nature do not differ considerably from those to images of nature (Castro et al., 2021). Thus, real images of BD elements are presented to participants in the pre-test. External influences, such as people or animals, are omitted from these images. Such non-design components can confuse respondents' design-specific impressions (Lee et al., 2022).

Furthermore, simplified scenarios involving organic and non-organic skincare products were designed to validate the efficiency of the experimental condition of the product category. In such scenarios, participants were encouraged to imagine themselves scrolling through their Instagram "For You" page and recognising a brand promoting an organic sunscreen product vs. a non-organic one. The actual scenario may give participants the option to assess their sustainability perceptions of each product, which enables evaluation of individual reactions and

assurance that sustainability perceptions are changed as intended. In addition, a fictional organic brand was created to correspond with sustainable values and natural ingredient principles, including ethically sourced ingredients and applicable certifications. On the contrary, the same brand acted as non-organic to reflect a less sustainable and chemical-oriented strategy. To delve deeper into participants' interpretations of sustainability, they were shown to further sustainability indicators. These included logos, labels, and symbols. Hereby, participants were engaged once more in a card sorting exercise, urging them to organise these products based on perceived sustainability or organic attributes. Through this method, it was possible to gain insights into the specific logos, symbols, or ingredient lists those participants perceived as defining a product as organic or non-organic. For the next step of the pre-test procedure, the products were presented within a SM context on Instagram. For this, Instagram posts containing the different products were created, including a real brand name, its own brand page, and the actual organic/non-organic product description corresponding to real-life interactions to maintain high ecological validity. This reflected the prevalent mode of interaction many consumers have with brands and products today, but it also capitalises on the familiarity and comfort many users feel with these platforms. Hence, this resulted in overall attractiveness and authenticity of the research as it taps into existing habits, expectations, and comfort levels of many participants.

Incorporating these pretesting strategies not only elevated the research's quality and validity but also its attractiveness, credibility, and realism. Ensuring the manipulations authentically reflect participants' real-world experiences during testing makes the research more engaging and reliable, optimising the final stimulus design. A procedure for the pre-test can be found in Appendix A.

3.2.2 Pre-test Results

Through the card sorting method, it became obvious that participants preferred pictures with natural lighting generated naturally by sources like the sun while creating an interplay of light and shadow. This preference implies a tendency toward images with more natural features, suggesting that certain lighting settings are considered more aesthetically pleasing and harmonious. For example, one participant articulated this preference by stating, *“For me, natural daylight truly comes alive when it's showcased through the interaction between light and shadow”*. This observation is in line with the findings of Kellert (2015), who highlights that the aesthetic appeal of natural daylight is shaped through the creative interplay of light and shadow. Moreover, during the card sorting exercise, insights on the BD element water were uncovered. Participants demonstrated a clear preference for images where water was depicted in motion, such as flowing streams, bubbling brooks, or the undulating surface of the sea. One participant highlighted, *“I am particularly drawn to water when it exhibits motion, like the serene flow of bubbles”*. This insight underlines that incorporating water features that are perceived in motion is often most appealing (Kellert, 2015).

When reflecting on participants opinions regarding the product scenarios, the group showed a distinct preference for the scenario about the beach vacation, finding it more resonant and broadly appealing. This scenario's ability to attract a larger audience was attributed to its simplicity and relatability, particularly in the organic scenario. Participants emphasised the importance of using accessible language, avoiding complex terms, and focusing on relatable elements every day to enhance its appeal.

The product design feedback was equally telling, with participants agreeing on bottle colours in cream or white. Through the card sorting method, by ensuring feedback loops in between, there was a clear preference for a harmonious design with a larger font and a clearer display of the product ingredients. Furthermore, the group stressed the importance of

maintaining identical appearances for both organic and non-organic products, with the primary distinction between the two being the ingredients and logo.

Lastly, the insights regarding the SM context were particularly insightful. The group highlighted the necessity for more engaging and interactive content. While having an open discussion, they suggested replacing certain emojis with more appealing smileys and incorporating engaging questions or prompts.

3.3 Design Stimuli

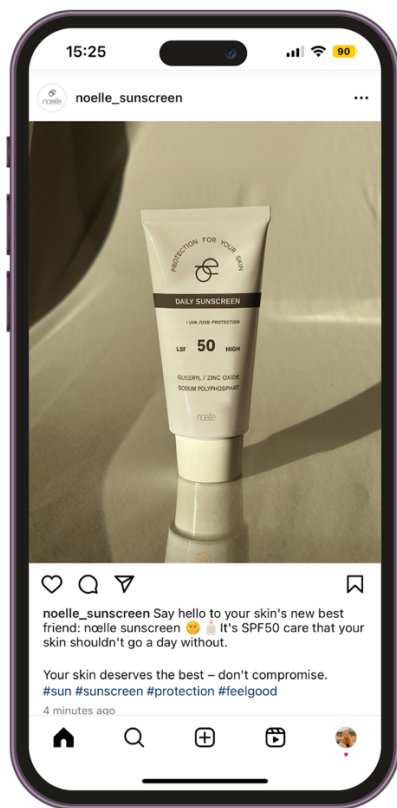
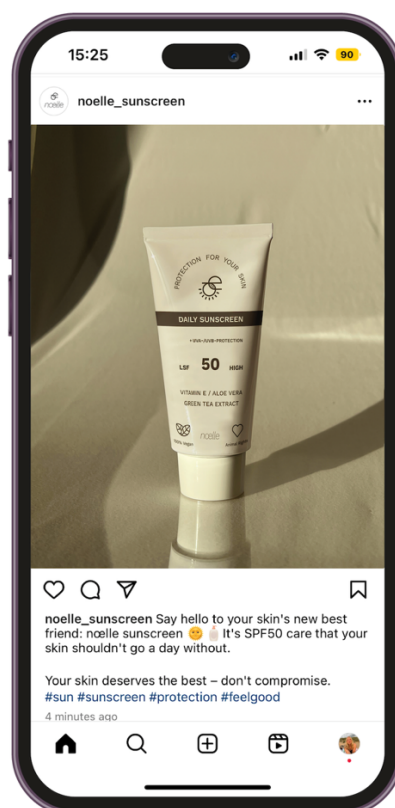
A scenario-based experiment was designed to investigate participants' perceptions of skincare products, specifically organic and non-organic sunscreen, in the context of BD elements. Two scenarios were presented: one promoting organic sunscreen, and the other promoting non-organic sunscreen. Each scenario was allocated to participants at random, and each participant was exposed to only one of the two scenarios, with *nælle* as the brand's name. Respondents were instructed to imagine themselves scrolling through their Instagram "For You" page fitting the research context (Appendix B).

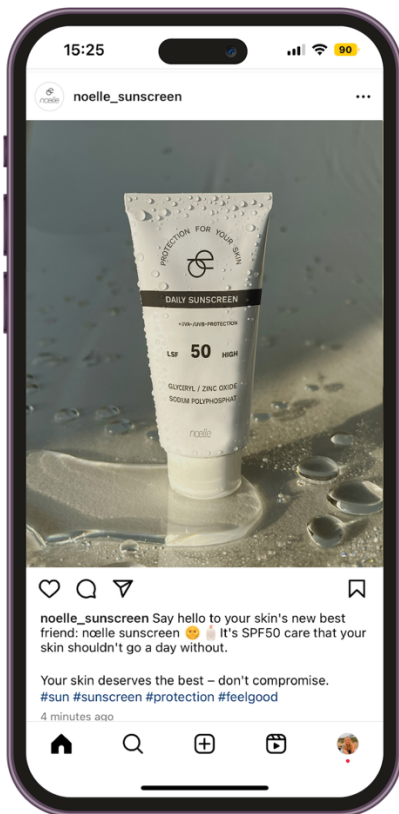
To provide participants with a realistic and immersive experience, an SM advertising post on Instagram was replicated, showing the actual products, each with variations in BD aspects. These variables included the presence or absence of natural daylight as well of water, and its combination. Such re-created advertising postings were presented in the context of Instagram for the corresponding organic and non-organic brands. Each post was accompanied by a caption aimed at engaging participants in a real-life setting, ensuring that their responses were as authentic and valid as possible. Participants were either able to see the poster with the organic skincare product and scenario or with the non-organic skincare products and scenario. However, the BD elements in its appearance were held constant across all conditions.

Adobe InDesign and Adobe Illustrator were used to develop and model the skincare product itself. The distinction between organic and non-organic was achieved through specific

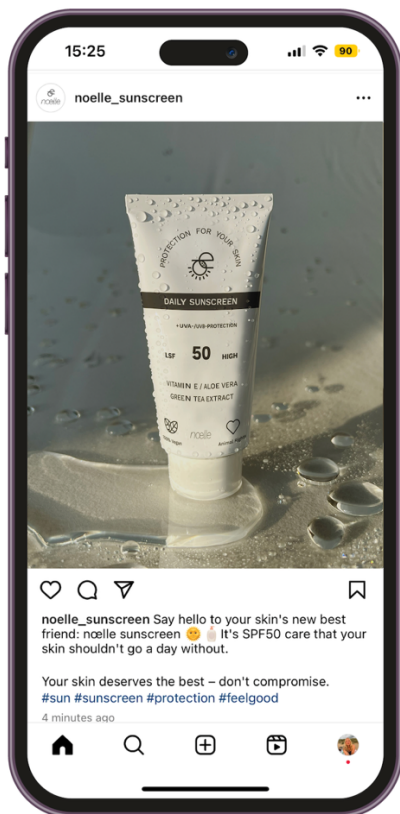
branding elements such as logos, icons, and ingredient listings. For the organic skincare products, logos and icons were designed to convey naturalness and eco-friendliness, incorporating elements like leaves or earth symbols to visually signal their organic status. In contrast, the non-organic skincare products were designed without natural imagery, to distinguish them from their organic counterparts. Additionally, the ingredient listings played a crucial role. The organic skincare products' advertisements emphasised natural or certified organic ingredients to reinforce their organic claim, while the non-organic skincare products listed standard or chemical ingredients without highlighting organic certification.

For the mock-up photographs, a detailed and controlled environment was set up to capture the essence of the product authentically. A white bedsheet was used as a backdrop to ensure a neutral background, complemented by a Plexiglas sheet for a clean and professional appearance. The photography session was conducted indoors, leveraging natural daylight as the primary and only light source. Water was introduced to the scene using a water spray, applied gently over the top of the setup. The final images were then used to craft the final posters, effectively showcasing the skincare product in a realistic and appealing manner (Figure 3).

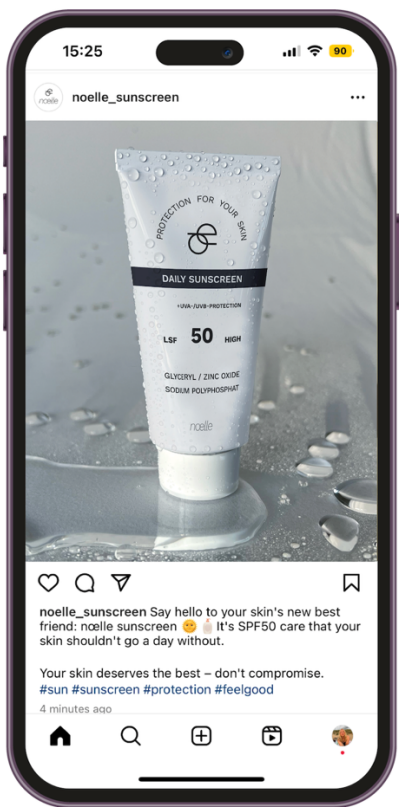
Figure 3*Final Design Stimuli**a) Non-Organic Natural light**b) Organic Natural Light*



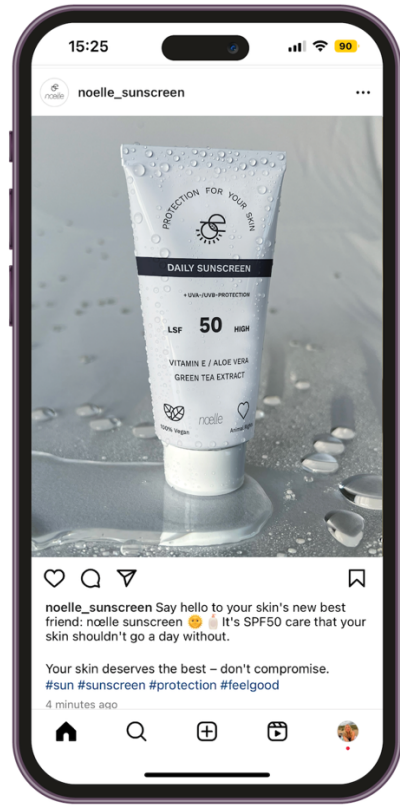
c) Non-Organic Natural Light & Water



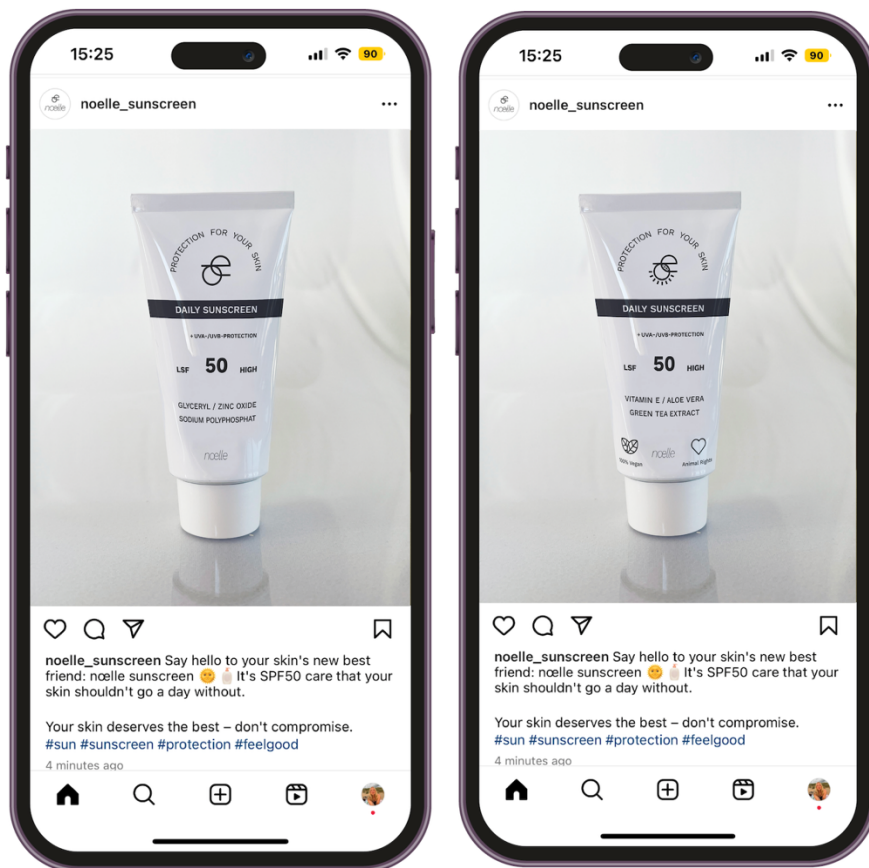
d) Organic Natural Light & Water



e) Non-Organic Water



f) Organic Water



g) Non-Organic Control

h) Organic Control

3.4 Experimental Procedure

Ethical approval for this study was granted by the Ethics Committee at the University of Twente. The primary data collection method used in this study was an online quantitative self-reported questionnaire. This explored participants' sustainability perceptions after being exposed to the Instagram posters related to the BD element and the skincare products. Before initiating data collection, participants were given a summary of the study's objective and its procedure. They were then asked to provide consent to participate in the study. This form featured a checkbox for consent. If respondents did not agree with the experiment or the data management, they were thanked for their time and appointed to the survey's conclusion. If agreed upon, they were led to the remainder of the survey (Appendix C).

After submitting consent, participants approached the demographics part, which consisted of questions, asking for gender, age, nationality, highest degree, or level of education completed, as well as employment status. Subsequently, participants were introduced to the scenario based on the skincare products (organic vs. nonorganic). At the outset of this survey page, participants were presented with full-sized Instagram advertising posters displayed on a simulated phone. Moving from this exposure, participants were asked to evaluate their environmental sustainability perceptions regarding the poster. After that, statements regarding their general eco-consciousness as well as skincare-specific pro-environmental beliefs were provided.

Toward the end of the survey, manipulation check questions were introduced, ensuring participants accurately identified and understood the various BD elements embedded in the scenarios. Such a manipulation check was placed directly after presenting the statements regarding the posters to affirm the intended engagement with the material, thereby substantiating the internal validity of the experimental conditions. In the questionnaire's concluding segment, participants had the chance to indicate their email address to win a voucher. To round off the survey experience, a warm closing statement acknowledged their completion of the survey and expressed gratitude for their time and participation.

3.4.1 Sampling Procedure

To reach the participants, convenient sampling was used by spreading the survey via the researcher's SM accounts (e.g., WhatsApp, Instagram) and through word-of-mouth. That ensured that it reaches those who were interested in and relevant to the product category. Moreover, the survey was requested to be shared and distributed by followers and friends to any like-minded individuals who would be interested in participating in the study. This process is called snowball sampling.

3.4.2. Participants

The sample for the main study consisted of 289 participants who agreed to take part. After a thorough review, the number of valid responses for the analysis was narrowed down to 208. This reduction was due to the exclusion of two respondents who withdrew their consent and 79 (27.3%) responses that were incomplete. This was because they did not fully answer the questions about the dependent variable's sustainability perceptions. Excluding these responses was essential to maintaining the integrity and validity of the study's analysis, as the missing information on dependent variables is critical for the analysis.

Within the pool of valid respondents, the mean age was 30.02 years ($SD = 12.856$) indicating a broad age range among the participants. An ANOVA analysis was performed to see if there were any noteworthy variations in age between the conditions. Accordingly, there was no apparent age difference between the conditions $F(7,221) = 0.94, p = .475$. A detailed division of characteristics of gender, nationality, educational level, and employment status can be found in Table 3.

To check for statistically significant differences in the experimental conditions between genders, a chi-square test of independence was carried out: $\chi^2(14, N = 208) = 78.075, p = .201$. There was no statistically significant difference in the distribution of genders across the eight experimental conditions. Additionally, a chi-square test of independence was applied to examine any significant differences in the experimental conditions amongst the different nationalities: $\chi^2(14, N = 208) = 3.599, p = 0.991$. This indicated that there was no significant relationship between the nationality of respondents across the conditions. In terms of educational attainment, a chi-square test of independence was performed to test for significant differences in the experimental conditions between professions: $\chi^2(35, N = 208) = 44.228, p = 0.141$. There was no obvious association between the respondents' profession and the provided responses. Finally, a Chi-squared test was performed to examine the relationship between

employment status and experimental conditions. The results indicated that there was no significant association between these variables: $\chi^2 (56, N = 208) = 62.093, p = 0.271$.

Table 3

Demographics of Gender, Nationality, Educational Level and Employment Status

Demographic	Percentage	Count (N)
Variable		
Gender		
Female	71.6%	149
Male	28.4%	59
Nationality		
German	47.1%	98
Dutch	27.9%	58
Other	25%	52
Educational Level		
Bachelor's degree	31.7%	66
High School Graduate	24.5%	51
Apprenticeship	18.8%	39
Master's Degree	16.3%	34
Others	6.7%	14
Employment Status		
Employment full-time	36.1%	75
Student	33.7%	70
Employment part-time	14.9%	31
Pupil	4.8%	10
Self-employed	4.3%	9
Retired	2.9%	6
Others	1.9%	4

Unable to work	1.4%	3
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3.5 Measures

In this study, all constructs were assessed using 7-point Likert scales ranging from *completely disagree* (1) to *completely agree* (7). Reliability and validity analyses of the constructs were conducted to confirm the sufficient quality of the results. In this study, Principal Component Analysis (PCA) was applied to each construct to distil the data into principal factors. This method identified a dominant factor for each construct, which significantly explained the variance in responses, summarising the core theme with clarity.

3.5.1. Sustainability Perceptions (Dependent Variable)

To measure consumers' sustainability perceptions towards the advertised product, existing scales and items were used and slightly adapted (Harmon et al., 2009; Kong et al., 2014; Lin et al., 2021; Nahar et al., 2022; Taufique et al., 2014; Vilkaite-Vaitone et al., 2022). The scale consisted of 12 items, such as, *I believe the sunscreen from nælle has a positive impact on the environment* or *For me when purchasing the advertised sunscreen from nælle, I can contribute to protect the environment*, were asked.

The reliability analysis for this construct indicated excellent reliability (Cronbach's $\alpha = .964$), and an exploratory factor analysis showed that *sustainability perceptions* accounted for 69.4% of the variance within the sample.

3.5.2. Pro-environmental beliefs (Moderating Variable)

Existing items by Lavelle et al. (2015) are used for this study in a slightly adapted way. The modified scale consisted of seven items, such as *I am concerned about the environment*, or *I think that my actions impact the environment*. Moreover, in total, four tailored items from

Quoquab et al. (2019) were incorporated to specifically address pro environmental beliefs in the context of skincare products.

The reliability analysis for this construct revealed good reliability (Cronbach's alpha = .855), with an initial factor analysis indicating that the items accounted for 46.9% of the variance. After removing two items with lower factor loadings, the explained variance improved to 52.3%, with a slight decrease in Cronbach's alpha to 0.843. Despite this minor decrease, the alpha value remained well above the commonly accepted threshold for reliability, suggesting that the revised scale was more efficient without compromising its robustness. In the specific context of skincare, the *Pro-environmental Beliefs Regarding Skincare* construct demonstrated excellent reliability, with a Cronbach's alpha of .906. The factor analysis for this construct revealed it accounted for 71.4% of the variance. A detailed version of all items and their scores can be found below in Table 4.

Table 4

Factor Analysis

Construct	Items	Factor Loading	Cronbach's Alpha	Explained Variance	Eigen-value
Sustainability	I believe the sunscreen from nœlle is environmentally friendly.	0.82	.96	69.4%	8.34
	I believe the sunscreen from nœlle is made of sustainable materials.	0.82			
	I believe the sunscreen from nœlle has a positive impact on the environment.	0.84			
	I believe the sunscreen from nœlle is safe for the environment.	0.83			
	I believe the sunscreen from nœlle offers a lot of environmental benefits.	0.84			
	I believe the sunscreen from nœlle supports sustainable sourcing and production practices.	0.83			
	I believe the sunscreen from nœlle helps to reduce my environmental impact.	0.86			
Perceptions	For me the advertised sunscreen from nœlle promotes the conservation of natural resources.	0.87			

	For me the advertised sunscreen from nœlle minimizes waste generation.	0.81			
	For me the advertised sunscreen from nœlle is free from harmful chemicals and toxins.	0.8			
	For me the advertised sunscreen from nœlle encourages sustainable consumption patterns and lifestyles.	0.83			
	For me when purchasing the advertised sunscreen from nœlle, I can contribute to protect the environment.	0.87			
	I am willing to accept cuts in my standard of living if it helped to protect the environment.	0.71			
	I am willing to pay higher prices for goods and services if it helped to protect the environment.	0.73			
Pro Environmental Beliefs	I am willing to sacrifice some personal comforts to protect the environment.	0.8	.86	52.3%	3.28
	I feel my own personal behaviour can bring positive environmental change.	0.65			
	I think that my actions impact the environment.	0.68			
	I actively seek out skincare products that are environmentally friendly.	0.92			
Pro Environmental Beliefs regarding Skincare	I make efforts to reduce my environmental impact through my skincare choices.	0.89			
	I prefer skincare brands that are committed to sustainability and eco-friendliness.	0.77	.91	71.4%	2.86
	I educate myself about the environmental impact of skincare products and make informed choices.	0.79			

3.6 Data Analysis Plan

In this research, a data analysis plan was outlined to assess the impact of BD elements on individuals' sustainability perceptions. The analysis was done with R Studios. During the initial phase of the analysis, manipulation checks were conducted to evaluate participant engagement with the given advertisements. Frequency tests measured recall accuracy, analysing the extent to which participants remembered the product categories and the presence of BD elements such as natural daylight or water.

Additionally, descriptive statistics were computed for the dependent variable, *sustainability perceptions*. This involved calculating means and standard deviations to articulate the central tendency and dispersion of perceptions among the study participants.

Following this, a multifactorial Analysis of Variance (ANOVA) was conducted to test the study's hypotheses (H1-H4). This analysis was crucial in determining the individual and interactive effects of natural daylight and water, as well as the product category (organic versus non-organic), on sustainability perceptions. In the presentation of the results for the interaction effects, interaction graphs were utilised to graphically represent the mean scores of sustainability perceptions. This visual aid provided an immediate and clear comparison between the conditions, elucidating the significant variances that emerged across different scenarios. Another subsequent phase of the analysis involved moderation analysis (H5) to investigate whether pro-environmental beliefs influenced the relationship between BD elements and sustainability perceptions.

4. Results

4.1 Manipulation Check

Manipulation checks were performed to evaluate the efficacy of the stimuli before analysing the main and interaction effects of the BD elements. Frequencies were reported for this.

4.1.1 Participants Recognition of Product Category

To assess participants' accurate recall of the product category, they were asked the following question: *How would you best describe the sunscreen product advertised in the poster you viewed?*. This question aimed to verify their memory regarding the attributes of the advertised product, specifically whether it was organic or non-organic. Thus, it is evident that 22.12% of participants were unable to recall the product category. When considering the actual

distribution of products, the recognition rate for non-organic products was 39.05%. Conversely, the recognition rate for organic products was notably higher at 116.35%, exceeding the proportion of organic items present in the stimuli.

4.1.2 Participants Recognition of Biophilic Elements

Next, participants' observation of natural elements within the sunscreen advertisement's background was examined by asking which nature elements did the participants noticed in the background of the sunscreen advertisement. This varied, with '*Both natural daylight and water*' being recognised at a rate of 23.56%, '*Natural daylight (sunlight)*' at 22.60% and '*Water*' at 13.46%. The condition '*No natural elements*' was recognised in 20.67% of the instances.

4.1.3 Control Check of Biophilic Elements

Additionally, a control check of the BD elements was conducted. Hereby, participants were asked to confirm whether they noticed any display of BD elements in the advertisement's background, to ensure once again the consistency and accuracy of their observations. The results revealed the following range of observations: 23.56% of participants were unable to recall if natural elements were mentioned or displayed. More than half of the participants (53.37%) confirmed the presence of natural elements, while 23.08% did not recognise them.

4.1.4 Message

In assessing the recognition of the message conveyed in the advertisements, participants most frequently identified '*The connection between nature and the product*' (31.85%) and '*The environmental friendliness of the product*' (29.30%). '*The health benefits of using the product*' was also well recognised by 23.57% of participants. There were several participants who identified combinations of these messages, suggesting that some advertisements may have

conveyed multiple messages simultaneously or that participants perceived them as such. Lastly, 15.29% of the participants were unsure or did not recall the message.

4.2 Descriptive Statistics of Sustainability Perceptions (Dependent Variable)

The following presents the descriptive statistics for the dependent variable, sustainability perceptions, across the various conditions tested. Overall, sustainability perceptions reflected in Table 5 range from moderate to high, with mean scores falling between 3.72 and 5.21. Detailed analysis in subsequent sections will further examine these variations.

Table 5

Descriptive Statistics of the Dependent Variable

Conditions	Sustainability Perception		
	Mean	SD	Totals (n)
Control organic	4.78	0.98	n=26
Control non-organic	3.72	1.27	n=26
Water organic	5.15	1.06	n=26
Water non-organic	4.33	1.04	n=26
Natural daylight organic	5.21	1.4	n=26
Natural daylight non-organic	4.28	1.49	n=26
Water & Natural daylight organic	5.17	1.17	n=26
Water & Natural daylight non-organic	4.76	1.19	n=26

Note: 7-point Likert Scale (1=completely disagree; 7=completely agree).

4.3 Main Effects

To test whether Hypotheses H1–H4 can be supported, a multifactorial analysis of variance (ANOVA) was executed to examine the effects of the BD elements, natural daylight, and water on the product category and on the dependent variable, sustainability perceptions.

The results from the ANOVA indicate a significant main effect of natural daylight on the sustainability perceptions, $F(1, 201) = 4.585, p = 0.034, \eta^2 = 0.019$. This conforms to Hypothesis 1, which posits that the visualisation of natural daylight in SM advertising will enhance consumers' sustainability perceptions of the promoted skincare product, as compared to advertising without its presence. Evidence of this effect is observable in Table 5, which shows higher mean sustainability perception scores in conditions featuring natural daylight.

The ANOVA analysis yielded a statistically significant main effect, demonstrating that the presence of water imagery in SM advertising impacts consumers' sustainability perceptions $F(1, 201) = 4.501, p = 0.035, \eta^2 = 0.019$, thereby supporting Hypothesis 2. As reflected in Table 5, advertisements that incorporate water imagery correspond to higher mean scores for sustainability perceptions, compared to those that do not include such visuals.

Additionally, the multifactorial ANOVA analysis revealed a significant main effect of product category, $F(1, 201) = 23.364, p < .001, \eta^2 = 0.104$. Products labelled as organic were perceived as more sustainable ($M = 4.78, SD = 0.99$) than non-organic products ($M = 3.72, SD = 1.27$). A detailed representation of these findings is specified in Table 5.

4.4 Interaction Effects

4.4.1 Natural Daylight x Water

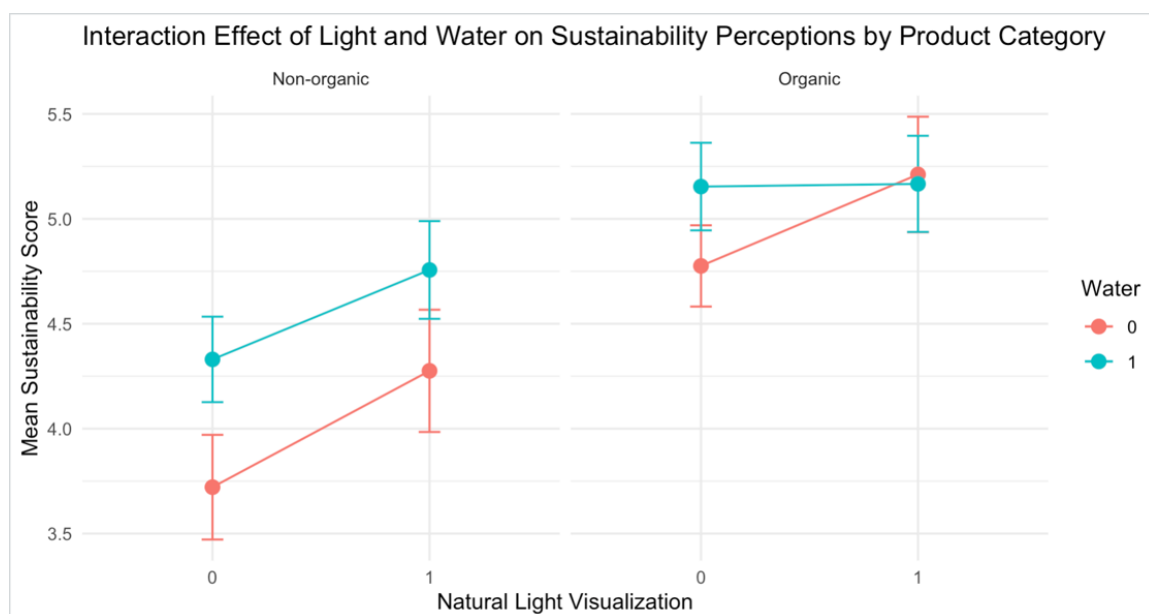
An ANOVA analysis was conducted, testing whether hypothesis 3 can be supported. H3 proposed that the visualisation of both natural daylight and water in SM advertising will enhance consumers' sustainability perceptions of the promoted skincare product compared to advertising without the presence of these elements. It was observed that the interaction effect between natural daylight and water on perceived sustainability is not significant, $F(1, 201) = 0.650, p = 0.4211, \eta^2 = 0.00286$. Thus, H3 is rejected.

4.4.2 Natural Daylight x Water x Product Category

The multifactorial ANOVA conducted to test hypothesis 4 revealed no significant interaction effect between product category, natural daylight, and water on sustainability perceptions, with $F(1, 201) = 0.30, p = 0.6489$. This statistical outcome suggests that the combined visualisation of natural daylight and water in social media advertising does not significantly enhance the sustainability perceptions of organic skincare products compared to non-organic ones (Figure 4). Therefore, Hypothesis 4 is not supported by the data.

Figure 4

Interaction Effect of natural daylight and water on sustainability perceptions by product category



4.5 Moderation Analysis

4.5.1 Pro-Environmental Beliefs

A moderation analysis was conducted to explore the influence of pro-environmental beliefs on the relationship between BD elements and sustainability perceptions (Hypothesis 5). The results from the ANOVA analysis revealed that pro-environmental beliefs had a significant

main effect on sustainability perceptions, with a coefficient estimate of $b = 0.465$, $t(201) = 2.61$, $p = .009$, indicating that higher pro-environmental beliefs are associated with higher perceived sustainability. However, neither the interaction of pro-environmental beliefs with natural daylight, $b = -0.028$, $t(201) = -0.11$, $p = .911$, nor with water, $b = 0.227$, $t(201) = -0.909$, $p = .365$, was significant. Additionally, the three-way interaction between pro-environmental beliefs, daylight, and water did not significantly predict sustainability scores $b = 0.016$, $t(201) = 0.046$, $p = .964$ (Table 6). Therefore, Hypothesis 5 is not supported.

Table 6

Moderated Regression Results on Sustainability Perceptions

Predictors	<i>b</i>	<i>S.E.</i>	<i>t</i>	<i>p</i>
Intercept	1.736	0.974	1.782	.076
Pro-Environmental Beliefs	0.465	0.178	2.613	.009
Pro-Environmental Beliefs X Natural light	-0.028	0.245	-0.112	0.912
Pro-Environmental Beliefs X Water	-0.227	0.249	-0.909	0.365
Pro-Environmental Beliefs X Natural light x water	0.016	0.357	0.046	0.964

4.5.2 Pro-Environmental Beliefs Regarding Skincare

A moderation analysis was conducted to evaluate the effect of pro-environmental beliefs specifically about skincare on the relationship between the presence of BD elements and sustainability perceptions of skincare products. The ANOVA revealed that pro-environmental beliefs about skincare significantly predicted sustainability scores ($b = 0.18294$, $t(201) = 2.613$, $p = .00965$). The interaction terms of pro-environmental beliefs with natural daylight ($b = 0.07427$, $t(201) = -0.112$, $p = .91084$) and with water ($b = 0.01708$, $t(201) = -0.909$, $p = .36470$) were not significant. Furthermore, the three-way interaction between pro-environmental beliefs, natural daylight, and water was also not significant ($b = -0.01565$, $t(201) = 0.046$, $p = .96365$).

4.6 Hypotheses Conclusion

Considering the main and interaction effects, inferences regarding the hypotheses can be made. Two of the five hypotheses can be supported, as Table 5 demonstrates. These results will be discussed in the section that follows.

Table 5

Hypotheses overview & outcome

Hypothesis and Question	Outcome
H1 <i>Visualisation of natural daylight in social media advertising will enhance consumers' sustainability perceptions of the promoted skincare product compared to advertising without the presence of natural daylight.</i>	Supported
H2 <i>Visualisation of water in social media advertising will enhance consumers' sustainability perceptions of the promoted skincare product compared to advertising without the presence of water.</i>	Supported
H3 <i>Visualisation of natural daylight and water in social media will enhance consumers' sustainability perceptions of the promoted skincare product compared to advertising without the presence of both elements.</i>	Not Supported
H4 <i>The visualisation of natural daylight and water in social media advertising will enhance consumers' sustainability perceptions of organic skincare products more than non-organic ones.</i>	Not Supported
H5 <i>Visualisation of natural daylight and water will enhance sustainability perceptions in consumers with pre-existing pro-environmental beliefs more compared to those without such beliefs.</i>	Not Supported

5. Discussion

5.1 Discussion of the Main Findings

The current study explores the impact of BD on consumer perceptions in digital environments. It addresses a gap in the existing literature by shifting the focus of BD's influence towards physical contexts, particularly its contributions to sustainability goals (Gillis & Gatersleben, 2015). Moreover, the study specifically investigates how the interplay between water and natural daylight influences consumer perceptions of sustainability, notably in the promotion of skincare products on SM. Prior research has highlighted the positive effects of greenery and single biophilic elements on consumer responses within physical environments (Rosenbaum et al., 2018; Sanchez et al., 2018). However, the nuanced effects of BD elements when applied in a digital context, both individually and in combination, remain largely unexplored. Building upon the groundwork of existing literature, several noteworthy findings of the current research contribute significantly to the yet limited knowledge of BD's role in marketing and advertising.

5.1.1 Biophilic Elements: Individual and Synergistic Effects on Sustainability Perceptions

In the present study, it was hypothesised that the visualisation of natural daylight and water presented separately in SM advertising will enhance consumers' sustainability perceptions of the promoted skincare product. Additionally, another expectation was that the interplay between natural daylight and water would increase sustainability perceptions, suggesting a synergistic effect when both elements are combined. The key finding of this study is that natural daylight and water, presented individually and separately in SM advertising, positively enhance consumers' sustainability perceptions. However, these elements do not strengthen one another when combined, failing to produce a synergistic effect on sustainability perceptions regarding skincare products.

These insights align with some prior research while diverging from other findings. Previous studies, like those by Lee (2019) and Niesbet et al. (2009) highlight the positive impacts of singular biophilic elements on environmental awareness and attitudes in physical contexts, aligning with the current study's findings on individual BD elements. Also, findings by Lee et al. (2022) suggest that the combination of BD elements did not lead to more favourable responses in terms of higher perceived quality or behavioural intentions in the context of hotel lobbies. This is congruent with the current study's insights regarding the synergy effect. However, Song et al. (2022) reported such findings the other way around, contradicting the results of the current study. The researchers noted a trend where the combination of water and natural light seemed to influence customer responses slightly more in hotel lobbies. Contrary to the findings of Lee (2019) and Niesbet et al. (2009), Song et al. (2022) did not observe any significant changes in consumer psychological responses to either water or natural daylight when these elements were presented separately.

The discrepancy in findings towards the effectiveness of BD elements across different research contexts underlines the importance of considering consumer responses and presentation environments (physical vs. digital spaces). The differences in presentation environments suggest that BD's impact varies by sector and the way individuals engage with it. In terms of combining BD elements, physical spaces enable a multisensory experience, such as the combination of natural daylight and water, which could enhance consumer reactions, as suggested by Song et al. (2022). On the other side, the visual presentation of these elements in digital advertising might be visually engaging but lacks the multisensory richness that physical settings provide. The rather immersive experience found in physical settings is less feasible in digital contexts suggesting that individual BD elements may be better presented separately and individually. In online environments, the sensory experience is mainly visual. If too many BD elements are present, it could lead to overstimulation in the already dynamic and crowded

digital space. (Bratman, 2012; Daugherty et al., 2008). Thus, when it comes to digital platforms, the strategic visual representation of BD elements is paramount.

Moreover, the inconsistency in the findings of different research could be attributed to the nuanced ways individuals react differently to biophilic elements. Gillis and Gatersleben (2015) pointed out that individual preferences, considering different levels of interest in nature, can possibly be considered within the concept of BD. These insights underscore the importance of recognising the varied range of human-nature relationships in effective BD, acknowledging that individuals engage with and perceive natural elements in different ways. For instance, while some may find a profound sense of calm in the presence of water, reflecting personal or cultural narratives, others may derive similar feelings from sunlight, associating it with vitality and transparency. This variability in individual preferences suggests that people have diverse affections for nature, which likely contributes to the inconsistent findings of this study. As for example, the inclusion of water imagery could be interpreted as BD, aiming to connect consumers with natural elements, or as a strategy to communicate the pureness and moisturising or hydrating effects of skincare products. This dual interpretation raises the question of whether the use of water visuals in skincare advertising is purely BD or a nuanced way to highlight product benefits, which may not align theoretically with BD principles.

Drawing on that, it is evident that BD's application, particularly in digital advertising contexts, requires a refined approach that goes beyond a general integration of natural elements. The study's inconsistent outcomes underscore the complexities of integrating BD principles into digital platforms. This complexity stems from the many ways individuals interpret and value biophilic elements, which are influenced by their individual experiences, cultural backgrounds, psychological traits, and connections to nature. Recognizing these individual differences is critical for gaining an in-depth understanding of how BD and sustainability perceptions are connected through physical settings.

5.1.1.1 Role of Greenery in Biophilic Design Effectiveness. Building on these findings, it is crucial to investigate how the incorporation of various BD elements affect sustainability perceptions. The current study found that natural daylight was associated with higher perceptions of the products sustainability than water patterns. These findings are consistent with Hartmann et al. (2013), who underscores the strong link between exposure to natural daylight and enhanced environmental consciousness. This relationship, as reinforced by McAuliffe (2022), suggests that sunlight not only improves mood but also promotes a greater understanding for sustainability.

However, the interplay between these elements and another BD element, like greenery, introduces a complex dynamic. Lee (2019) suggests a distinction in perceptions concerning the combination of different BD elements. The researcher notes that customers reported higher levels of pleasure when plants and water features were present. This implies that natural designs incorporating greenery and water have a synergistic effect, potentially enhancing an individual's well-being (Rosenbaum et al., 2018). Also, Lee's study showed stronger effects on arousal-related behaviours in biophilic settings when plants were combined with natural daylight. This synergy suggests that the psychological benefits of BD are maximised through the combination of elements, with plants playing a critical role. The primary focus of Lee's research on arousal and pleasure behaviours presents a different perspective from the sustainability perceptions central to the current study. This distinction demands a more in-depth investigation of how these psychological benefits may influence sustainability perceptions in different settings. The effectiveness of these combinations, particularly with the role of plants, might vary based on the intended use of the space and the specific outcomes desired, such as enhancing well-being, promoting sustainability, or encouraging certain behaviours.

Moreover, the critical role of plants in BD requires additional investigation. While water and natural daylight help create a minimalist aesthetic, adding plants to a BD enhances its visual appeal. This combination signifies that BD goes beyond the simple inclusion of natural

elements, such as water and natural daylight. As a result, it can be assumed that plants are necessary for transforming spaces into fully biophilic environments, perhaps leading to better psychological and behavioural effects. Thus, it might be claimed that BD aims to create environments that closely reflect the richness and vitality of natural ecosystems, with plants possibly acting as key components.

5.1.2 Pro-environmental Beliefs and their Impact on Biophilic Design Efficacy

Furthermore, the study aimed to investigate whether the visualisation of BD influences sustainability perceptions differently in consumers with pre-existing pro-environmental beliefs compared to those without such beliefs. The significant main effect of pro-environmental beliefs enhancing sustainability perceptions is consistent with the findings of Lee et al. (2022). It upholds the assumption that individuals with strong environmental consciousness are inclined to perceive products as more sustainable. However, when looking at the interaction between BD and sustainability perceptions moderated by pro-environmental beliefs, there is a lack of significant interaction. These insights are not congruent with the conclusions of Lee et al. (2022), who highlighted that customers' environmental beliefs about green behaviour significantly affect individuals' perceptions regarding BD. Hereby, individuals with stronger pro-environmental beliefs exhibited higher economic value and more favourable attitudes towards the biophilic context than those with weaker beliefs.

The lack of a significant interaction effect might be interpreted through the lens of the value-belief-norm theory. As explained by Li et al. (2021), the theory posits that people with strong environmental values and beliefs have developed a stable set of norms and behaviors, including their understanding and perception of sustainability. These individuals are less influenced by small, gradual environmental stimuli or changes because their environmental values are deeply established. This is supported by Kreidler & Joseph-Mathews (2009) who suggest that such individuals with high pro-environmental values are already engaged in green

atmospherics, indicating that their sustainability perceptions may have reached a saturation point.

5.1.3 Organic vs. Non-Organic Products: The Differential Impact on Biophilic Design

Finally, in this research, it was expected that the visualisation of natural daylight and water in SM advertising would enhance consumers' sustainability perceptions of organic skincare products more than non-organic ones. The findings revealed interesting patterns and emphasised that organic products tended to be perceived as more sustainable when paired with BD elements compared to their non-organic counterparts. Even though the differences in product category did not reach any statistical significance, a trend towards organic products being perceived as more sustainable with biophilic imagery was observed. This indicates a possibly nuanced relationship between the product categories and BD elements in shaping sustainability perceptions. Despite the absence of statistical significance, these observations imply a tendency that the visualisation of natural elements can enhance sustainability perceptions, particularly for organic products. Interestingly, non-organic products also experienced a slight increase in sustainability perceptions when presented with biophilic elements. This suggests that the design approach itself may convey sustainable attributes.

The products' minimalist design in this study, distinguished only by logo, slogan, and ingredients, underscores such an assumption. This observation is consistent with literature, which suggests that minimalism in product design, defined by attributes such as simplicity, practicality, and natural forms, could provoke sustainability perceptions (Kamal and Nasir, 2022; Zafarmand et al., 2003). The minimalistic design of non-organic products in this study may have unintentionally transmitted a sustainable image, potentially blurring the line between organic and non-organic products in the minds of customers. This supports the notion that phrases like *organic* inherently transmit a sense of sustainability, causing customers to immediately perceive items displaying these labels as more environmentally friendly. In turn,

consumers assign sustainability attributes to products even in the absence of direct environmental messaging (Beverland, 2005; Pancer et al., 2017).

5.2 Theoretical Implications

The theoretical implications of this study contribute to the existing body of literature, primarily by extending the application of BD principles from physical to digital environments. While recent scientific research has primarily focused on the effects of BD elements in physical settings, such as hotel lobbies or servicescapes, this study leads the exploration of how these principles translate into the realm of digital advertising (Kumar et al., 2020; Purani & Kumar, 2018). In addition, this study extended the understanding of the impacts of the synergy of different BD elements, particularly focusing on the interaction between water and natural daylight. This adds to the relatively sparse body of research examining the impacts of multiple biophilic elements simultaneously. By doing so, the current research addresses the gap in environmental psychology and consumer behaviour literature regarding BD, which has predominantly emphasized the role of greenery (Lee, 2019; Lee et al., 2022; Song et al., 2022) although it is just one of the biophilic stimuli (Purani & Kumar, 2018).

Furthermore, by examining sustainability through the lens of BD, this research uncovers a previously underexplored facet of BD's potential impacts, especially within digital contexts. Existing research has predominantly focused on the effects of BD on individuals' well-being, emotional reactions, and behavioural intentions or attitudes in general (Jaggard, 2014; Liberalesso et al., 2020; Wijesooriya & Brambilla, 2021; Zhong et al., 2021). Therefore, a gap in exploring its impact, specifically on sustainability, was noted. To the researcher's knowledge, most studies have not yet investigated how BD influences sustainability perceptions of products in digital environments. Thus, the current study provides a nuanced understanding of the interaction between BD, consumer attitudes, and sustainable behaviours in the digital age.

Responding to the observation that BD is primarily a practical design approach, this study acknowledges the need for a stronger theoretical underpinning. While BD is mainly a practice-oriented approach that aims to integrate natural elements into human environments for improved well-being and connectivity, its theoretical implications frequently stem from empirical research. The exploration into digital contexts raises questions about the suitability of traditional theories used in the current study, like the Attention Restoration Theory (ART), the Value-Belief-Norm (VBN) Theory, and the Psycho-Evolutionary Theory (PET) for explaining BD's impact in the digital realm. This investigation suggests that new or altered theories are required to adequately capture the complexities of digital biophilic experiences. However, the transition to digital settings presents multiple questions and concerns. One question is whether ART's principles, which focus on restoration through natural environment exposure, can be applied to virtual or digital representations of nature. Another concern is whether digital expressions of BD have a similar effect on environmental values and norms as in physical environments.

Addressing these concerns requires a comprehensive approach that considers both the adaptation of current theories and the development of new frameworks specifically designed for the digital application of BD. The need for a theoretical development is underscored, as scholars and practitioners are starting to navigate the complexities of BD inside digital environments. Traditional frameworks like ART provide valuable insights into the restorative effects of natural environments in physical settings. However, the digital realm introduces unique challenges and opportunities for biophilic engagement that are not fully encompassed by these existing theories. This gap emphasizes the significance of creating new theories or building on current ones in order to appropriately describe the dynamics of individual interactions with digital representations of nature. A potential avenue for investigation is the development of a *Digital Biophilic Interaction Theory*. This theory can specifically address

how digital platforms might enable a connection with nature, incorporating aspects such as interactive engagement, personalization, and the immediacy of content delivery.

More research will be essential for providing empirical support for these adapted or newly developed theories. Such studies should look at how digital biophilic experiences can influence psychological well-being, emotional states, and sustainable behaviours, adding to the theoretical knowledge of BD's applicability in the digital era.

5.3 Practical Implications

The study's findings provide valuable guidance for various stakeholders, particularly marketers and designers. The nuanced interplay between digital representations of natural elements and consumer perceptions highlights BD's potential in creating atmospheric digital environments. Despite some insignificant findings, the study demonstrates how BD may promote a greater connection to nature through digital marketing. This relationship not only provides a competitive advantage for beauty businesses, but it also improves the consumer experience, enhancing the notion of a product's sustainability.

With the findings presented in this study, marketers and designers in the skincare/beauty sector are encouraged to incorporate natural elements, like water features or natural daylight, into their product promotions, depending on the context. The choice and combination of these elements are crucial in shaping consumer perception, especially in conveying sustainability. It is advised that designers strike a balance between simplicity and informativeness. While minimalistic design can suggest sustainability, it is important to ensure that product attributes, particularly those related to sustainability claims, are clear and distinct to avoid misinterpretation. This is especially relevant when using digital channels, which provide less sensory engagement than physical places. In such scenarios, marketers may prioritize promoting a single biophilic element that corresponds with the product's sustainability narrative, rather of integrating multiple elements, which might cause cognitive overload and

diminish the overall effect. By embracing this approach, marketers may build atmospheric digital settings that strengthen customers' connection to nature. It helps customers feel happier and more connected, which improves their perception of the product's sustainability. This can be done by incorporating natural images and stories into advertising and branding, therefore resonating deeper with customers and engaging them on an emotional level. (Lee, 2022; Schmuck et al., 2018).

The study concludes that practitioners need to consider product category (organic vs. non-organic) and design complexity when incorporating biophilic elements into digital marketing strategies. For example, organic skincare products may benefit more from the inclusion of biophilic elements than non-organic skincare products. However, for non-organic products, there might be the risk of greenwashing, especially when minimalistic design is combined with biophilic elements. Non-organic products may be perceived as more sustainable when combined with biophilic elements such as daylight and water images. Thus, clear and distinct communication of sustainable characteristics, supported by reliable information (e.g., third-party certifications for organic products), can help to prevent greenwashing and foster consumer trust.

5.4 Limitations and Future Research

This study primarily investigated how BD in an SM environment influences customers' sustainability perceptions of skincare products. Yet the incorporation of personal factors such as individual preferences or cultural backgrounds as variables were not considered. This represents a limitation, given that empirical evidence has demonstrated that these factors could shape customer perceptions in various BD contexts (Lee, 2019; Nanu et al., 2020). To name one example, different cultural values, as seen in the reverence for water in Chinese culture, may result in stronger favourable behaviours from Chinese customers towards BD (Lee, 2019). Considering this, future research should include personal and cultural factors to examine the

influences on the effectiveness of BD in shaping sustainability perceptions. This approach promises not only to deepen the understanding of BD's impact across diverse populations but also to guide the creation of more tailored and effective biophilic interventions. Additionally, it is advised that future studies can make use of advanced technologies like eye-tracking, Virtual Reality (VR), or Augmented Reality (AR). These tools can simulate a range of biophilic elements in highly immersive and interactive ways in the digital sphere, potentially uncovering specific emotional and behavioural responses towards sustainability that traditional digital environments might not capture.

Moreover, while the study focuses on the short-term effects of BD, it might raise questions, whether the observed outcomes can be inferred from long-term sustainability behaviours. The current study primarily highlights the immediate sustainability perception elicited by BD stimuli. For future research, it could be interesting to delve into the progression of how individuals' feelings of BD evolve overtime (e.g., by using Diary Studies) and how this affects their long-term sustainable consumption behaviours. Examining the emotional pathways activated by BD and their role in fostering sustainable behaviours could provide a more comprehensive understanding.

Furthermore, the study revealed challenges in distinguishing between organic and non-organic products based on digital cues like logos and slogans, highlighted by a manipulation check that showed an over-recognition of organic products. This finding invites a broader discussion on conveying sustainability through minimalistic digital design by emphasising the need for clearer messaging and design strategies to enhance sustainability perceptions accurately. Additionally, to further enhance consumer engagement and sustainability perceptions, future research should explore the integration of multisensory biophilic elements in digital advertising. Integrating sensory elements such as nature sounds on social media (TikTok, Reels, Posts) emerges as a promising approach to deepen engagement and make experiences more lifelike. While the current study did not include sounds, previous research by

Diette et al. (2003) demonstrates that sounds can accompany images or videos, potentially enhancing the restorative effects of visual stimuli. Therefore, further exploring these immersive experiences in the digital sphere, offer interesting insights into optimising content marketing for sustainability communication.

5.5 Conclusion

This study illustrates how BD can extend beyond the physical to the digital sphere, specifically in the realm of SM marketing for skincare products. By using BD elements such as water and daylight, it taps into individuals innate connection to nature while promoting organic skincare products online. It demonstrates how BD can be applied effectively in digital environments in addition to physical settings. These findings are critical in developing marketing strategies that align with customers environmental values and provide a systematic approach to integrate nature-inspired elements into digital advertising. This is a unique attempt to bridge the digital and natural worlds, opening avenues for novel approaches to encourage sustainable practices in today's increasingly interconnected society.

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Appendix

In this paper, ChatGPT was especially used in the section about analysing the actual data, particularly in identifying and correcting potential errors in R coding due to the researcher's limited proficiency with RStudio. The tool was invaluable not only for error correction but also for enhancing the paper's vocabulary, especially when overcoming language barriers. Furthermore, ChatGPT offered clarity on any ambiguities encountered during the study. In preparing the research paper, it facilitated the rephrasing of sentences for better understanding and inspired new expressions. Following the application of ChatGPT, the researcher thoroughly reviewed and improved the content as necessary, fully taking the responsibility for the integrity of the work.

Appendix A: Procedure of the Pre-test

https://miro.com/app/board/uXjVNbty2Uk=?share_link_id=272173240613

Appendix B: Survey Scenarios

Organic Scenario:

Imagine you are scrolling through your **Instagram “For You”** page and recognizes a skincare brand called *nælle*, producing **sunscreen**. The product fits perfect to your next vacation destination. Spending two weeks at the beach with only sunny weather.

Nælle produces natural-based sunscreen for everyone. Crafted for the eco-conscious and the skin-conscious, this sunscreen is your vacation's best friend. With its natural-based formula, it boasts a blend of skin-nurturing organic minerals. Our commitment to your health and the planet is evident as it's free from synthetic UV filters, preservatives, and fragrances. As our premier certified organic and vegan offering, it's designed to reflect UV rays, creating a protective barrier that cares for your skin while you soak in the joy of sunny days. With *nælle*, immerse yourself in the purity of nature and safeguard your skin with an organic touch on your next beach vacation.

Non-Organic Scenario:

Imagine you are scrolling through your **Instagram “For You”** page and recognizes a skincare brand called *nælle*, producing **sunscreen**. The product fits perfect to your next vacation destination. Spending two weeks at the beach with only sunny weather.

Nælle brings you a straightforward **sunscreen** for practical sun care. This sunscreen is made for simplicity — just squeeze, apply, and you are all set for a day at the beach. Its formula is simple, delivering high UVA and UVB ray protection without the need for regular reapplication. The lotion is light, absorbs rapidly, and leaves no sticky residue, allowing you to enjoy your beach activities while feeling comfortable and protected. With *nælle's* sunscreen you will be ready to enjoy every sun-kissed moment on your next beach vacation.

Appendix C: Survey

Start of Block: Introduction

Q1 Dear participant,

I hereby cordially invite you to take part in the **research** for my Master Thesis.

Please read the following information carefully.

My **Master Thesis** examines the use of natural elements in skincare advertising on social media, focusing on how these visuals affect consumers' perceptions of sustainability.

This survey will take approximately 15 minutes. All **collected data** will be used exclusively for the Master Thesis of the Double Degree in Digital Marketing in Communication Sciences and Business Administration. In addition, your data will be treated with care and is subject to absolute confidentiality. Participation in this study is voluntary and you have the option to withdraw from the study at any time.

If you have any further questions, you can always contact me by e-mail:

m.n.wojtun@student.utwente.nl

You can switch between **English and German** during the survey for your convenience.

When you're completing the survey on your mobile phone, you might need to zoom in on the pictures for a clearer view of all the details. Please note that the poster and text in

the following slide are presented for one-time viewing only; you will not be able to go back to them once you advance.

I would like to take this opportunity to thank you in advance for your assistance with this research!

Warm regards,

Marie Noelle Wojtun

Please indicate your choice below:

- Yes, I voluntarily consent to participate in this study! I understand that I can refuse to answer questions and withdraw from the study at any time without providing a reason. (1)
- No, I do not consent! (2)

Skip To: End of Survey If Please indicate your choice below: = No, I do not consent!

Page Break

End of Block: Introduction

Start of Block: Demographics

Gender What is your gender?

- Male (1)
 - Female (2)
 - Non-binary/third gender (3)
 - Prefer not to say (4)
 - Prefer to self-describe: (5)
-

Age What is your age?

Nationality What is your Nationality?

- German (1)
- Dutch (2)
- Others: (3) _____

Education Level What is the highest level of education you have completed?

- High school graduate (1)
- Apprenticeship (2)
- Bachelor's degree (3)
- Master's Degree (4)
- Prefer not to say (5)
- Others: (6) _____
-

Employment Status What is your current employment status?

- Employed full-time (1)
- Employed part-time (2)
- Self-employed (3)
- Student (4)
- Pupil (5)
- Retired (6)
- Unable to work (7)
- Prefer not to say (8)
- Others: (9) _____

End of Block: Demographics

Start of Block: Control group = no elements +. Non-organic - non organic scenario

Q20 Please read the following text carefully:

Imagine you are scrolling through your **Instagram “For You”** page and recognizes a skincare brand called *nælle*, producing **sunscreen**. The product fits perfect to your next vacation destination. Spending two weeks at the beach with only sunny weather.

Nælle brings you a straightforward **sunscreen** for practical sun care. This sunscreen is made for simplicity — just squeeze, apply, and you are all set for a day at the beach. Its formula is simple, delivering high UVA and UVB ray protection without the need for regular reapplication. The lotion is light, absorbs rapidly, and leaves no sticky residue, allowing you to enjoy your beach activities while feeling comfortable and protected. With *nælle*'s sunscreen you will be ready to enjoy every sun-kissed moment on your next beach vacation.

End of Block: Control group = no elements +. Non-organic - non organic scenario

Start of Block: Control group = no elements + Organic - Organic scenario

Q51 *Please read the following text carefully:*

Imagine you are scrolling through your **Instagram “For You”** page and recognizes a skincare brand called *nælle*, producing **sunscreen**. The product fits perfect to your next vacation destination. Spending two weeks at the beach with only sunny weather.

Nælle produces natural-based sunscreen for everyone. Crafted for the eco-conscious and the skin-conscious, this sunscreen is your vacation's best friend. With its natural-based formula, it boasts a blend of skin-nurturing organic minerals. Our commitment to your health and the

planet is evident as it's free from synthetic UV filters, preservatives, and fragrances. As our premier certified organic and vegan offering, it's designed to reflect UV rays, creating a protective barrier that cares for your skin while you soak in the joy of sunny days. With *nælle*, immerse yourself in the purity of nature and safeguard your skin with an organic touch on your next beach vacation.

End of Block: Control group = no elements + Organic - Organic scenario

Start of Block: Natural light + organic - organic scenario

Q52 Please read the following text carefully:

Imagine you are scrolling through your **Instagram "For You"** page and recognizes a skincare brand called *nælle*, producing **sunscreen**. The product fits perfect to your next vacation destination. Spending two weeks at the beach with only sunny weather.

Nælle produces natural-based sunscreen for everyone. Crafted for the eco-conscious and the skin-conscious, this sunscreen is your vacation's best friend. With its natural-based formula, it boasts a blend of skin-nurturing organic minerals. Our commitment to your health and the planet is evident as it's free from synthetic UV filters, preservatives, and fragrances. As our premier certified organic and vegan offering, it's designed to reflect UV rays, creating a protective barrier that cares for your skin while you soak in the joy of sunny days. With *nælle*,

immerse yourself in the purity of nature and safeguard your skin with an organic touch on your next beach vacation.

End of Block: Natural light + organic - organic scenario

Start of Block: Water + organic - organic scenario

Q53 Please read the following text carefully:

Imagine you are scrolling through your **Instagram “For You”** page and recognizes a skincare brand called *nælle*, producing **sunscreen**. The product fits perfect to your next vacation destination. Spending two weeks at the beach with only sunny weather.

Nælle produces natural-based sunscreen for everyone. Crafted for the eco-conscious and the skin-conscious, this sunscreen is your vacation's best friend. With its natural-based formula, it boasts a blend of skin-nurturing organic minerals. Our commitment to your health and the planet is evident as it's free from synthetic UV filters, preservatives, and fragrances. As our premier certified organic and vegan offering, it's designed to reflect UV rays, creating a protective barrier that cares for your skin while you soak in the joy of sunny days. With *nælle*, immerse yourself in the purity of nature and safeguard your skin with an organic touch on your next beach vacation.

End of Block: Water + organic - organic scenario

Start of Block: Natural light + non-organic - non organic scenario

Q55 Please read the following text carefully:

Imagine you are scrolling through your **Instagram “For You”** page and recognizes a skincare brand called *nælle*, producing **sunscreen**. The product fits perfect to your next vacation destination. Spending two weeks on the beach with only sunny weather.

Nælle brings you a straightforward sunscreen for practical sun care. This sunscreen is made for simplicity — just squeeze, apply, and you're all set for a day at the beach. Its formula is simple, delivering high UVA and UVB ray protection without the need for regular reapplication. The lotion is light, absorbs rapidly, and leaves no sticky residue, allowing you to enjoy your beach activities while feeling comfortable and protected. With *nælle*'s sunscreen you will be ready to enjoy every sun-kissed moment on your next beach vacation.

End of Block: Natural light + non-organic - non organic scenario

Start of Block: Water + non organic - non organic scenario

Q56 Please read the following text carefully:

Imagine you are scrolling through your **Instagram “For You”** page and recognizes a skincare brand called *nælle*, producing **sunscreen**. The product fits perfect to your next vacation

destination. Spending two weeks on the beach with only sunny weather.

Nælle brings you a straightforward sunscreen for practical sun care. This sunscreen is made for simplicity — just squeeze, apply, and you're all set for a day at the beach. Its formula is simple, delivering high UVA and UVB ray protection without the need for regular reapplication. The lotion is light, absorbs rapidly, and leaves no sticky residue, allowing you to enjoy your beach activities while feeling comfortable and protected. With *nælle*'s sunscreen you will be ready to enjoy every sun-kissed moment on your next beach vacation.

End of Block: Water + non organic - non organic scenario

Start of Block: Natural light & water + organic - organic scenario

Q54 *Please read the following text carefully:*

Imagine you are scrolling through your **Instagram “For You”** page and recognizes a skincare brand called *nælle*, producing **sunscreen**. The product fits perfect to your next vacation destination. Spending two weeks at the beach with only sunny weather.

Nælle produces natural-based sunscreen for everyone. Crafted for the eco-conscious and the skin-conscious, this sunscreen is your vacation's best friend. With its natural-based formula, it boasts a blend of skin-nurturing organic minerals. Our commitment to your health and the planet is evident as it's free from synthetic UV filters, preservatives, and fragrances. As our premier certified organic and vegan offering, it's designed to reflect UV rays, creating a

protective barrier that cares for your skin while you soak in the joy of sunny days. With *nælle*, immerse yourself in the purity of nature and safeguard your skin with an organic touch on your next beach vacation.

End of Block: Natural light & water + organic - organic scenario

Start of Block: Natural light & water + non-organic - non organic scenario

Q57 Please read the following text carefully:

Imagine you are scrolling through your **Instagram “For You”** page and recognizes a skincare brand called *nælle*, producing sunscreen. The product fits perfect to your next vacation destination. Spending two weeks on the beach with only sunny weather.

Nælle brings you a straightforward sunscreen for practical sun care. This sunscreen is made for simplicity — just squeeze, apply, and you're all set for a day at the beach. Its formula is simple, delivering high UVA and UVB ray protection without the need for regular reapplication. The lotion is light, absorbs rapidly, and leaves no sticky residue, allowing you to enjoy your beach activities while feeling comfortable and protected. With *nælle*'s sunscreen you will be ready to enjoy every sun-kissed moment on your next beach vacation.

End of Block: Natural light & water + non-organic - non organic scenario

Start of Block: Sustainability Perceptions

Q3 I believe the sunscreen from *nælle* is environmentally friendly

- Strongly agree (1)
 - Somewhat agree (2)
 - Neither agree nor disagree (3)
 - Somewhat disagree (4)
 - Strongly disagree (5)
-

Q4 I believe the sunscreen from *nælle* is made of sustainable materials.

- Strongly agree (1)
 - Somewhat agree (2)
 - Neither agree nor disagree (3)
 - Somewhat disagree (4)
 - Strongly disagree (5)
-

Q5 I believe the sunscreen from *nælle* has a positive impact on the environment.

- Strongly agree (1)
 - Somewhat agree (2)
 - Neither agree nor disagree (3)
 - Somewhat disagree (4)
 - Strongly disagree (5)
-

Q6 I believe the sunscreen from *nælle* is safe for the environment.

- Strongly agree (1)
 - Somewhat agree (2)
 - Neither agree nor disagree (3)
 - Somewhat disagree (4)
 - Strongly disagree (5)
-

Q7 I believe the sunscreen from *nælle* offers a lot of environmental benefits.

- Strongly agree (1)
 - Somewhat agree (2)
 - Neither agree nor disagree (3)
 - Somewhat disagree (4)
 - Strongly disagree (5)
-

Q8 I believe the sunscreen from *nælle* supports sustainable sourcing and production practices.

- Strongly agree (1)
 - Somewhat agree (2)
 - Neither agree nor disagree (3)
 - Somewhat disagree (4)
 - Strongly disagree (5)
-

Q9 I believe the sunscreen from *nælle* helps to reduce my environmental impact.

- Strongly agree (1)
 - Somewhat agree (2)
 - Neither agree nor disagree (3)
 - Somewhat disagree (4)
 - Strongly disagree (5)
-

Q10 For me the advertised sunscreen from *nælle* promotes the conservation of natural resources.

- Strongly agree (1)
 - Somewhat agree (2)
 - Neither agree nor disagree (3)
 - Somewhat disagree (4)
 - Strongly disagree (5)
-

Q11 For me the advertised sunscreen from *nølle* minimizes waste generation.

- Strongly agree (1)
 - Somewhat agree (2)
 - Neither agree nor disagree (3)
 - Somewhat disagree (4)
 - Strongly disagree (5)
-

Q12 For me the advertised sunscreen from *nølle* is free from harmful chemicals and toxins.

- Strongly agree (1)
 - Somewhat agree (2)
 - Neither agree nor disagree (3)
 - Somewhat disagree (4)
 - Strongly disagree (5)
-

Q13 For me the advertised sunscreen from *nølle* encourages sustainable consumption patterns and lifestyles.

- Strongly agree (1)
 - Somewhat agree (2)
 - Neither agree nor disagree (3)
 - Somewhat disagree (4)
 - Strongly disagree (5)
-

Q14 For me when purchasing the advertised sunscreen from *nølle*, I can contribute to protect the environment.

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

End of Block: Sustainability Perceptions

Start of Block: Pro Environmental Beliefs

Q21 I am willing to accept cuts in my standard of living if it helped to protect the environment.

- Strongly agree (1)
 - Somewhat agree (2)
 - Neither agree nor disagree (3)
 - Somewhat disagree (4)
 - Strongly disagree (5)
-

Q22 I am willing to pay higher prices for goods and services if it helped to protect the environment.

- Strongly agree (1)
 - Somewhat agree (2)
 - Neither agree nor disagree (3)
 - Somewhat disagree (4)
 - Strongly disagree (5)
-

Q23 I am willing to sacrifice some personal comforts to protect the environment.

- Strongly agree (1)
 - Somewhat agree (2)
 - Neither agree nor disagree (3)
 - Somewhat disagree (4)
 - Strongly disagree (5)
-

Q24 I feel my own personal behavior can bring positive environmental change.

- Strongly agree (1)
 - Somewhat agree (2)
 - Neither agree nor disagree (3)
 - Somewhat disagree (4)
 - Strongly disagree (5)
-

Q25 I am concerned about the environment.

- Strongly agree (1)
 - Somewhat agree (2)
 - Neither agree nor disagree (3)
 - Somewhat disagree (4)
 - Strongly disagree (5)
-

Q26 The condition of the environment affects the quality of my life.

- Strongly agree (1)
 - Somewhat agree (2)
 - Neither agree nor disagree (3)
 - Somewhat disagree (4)
 - Strongly disagree (5)
-

Q27 I think that my actions impact the environment.

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

End of Block: Pro Environmental Beliefs

Start of Block: Pro Environmental Beliefs regarding Skincare products

Q28 I actively seek out skincare products that are environmentally friendly.

- Strongly agree (1)
 - Somewhat agree (2)
 - Neither agree nor disagree (3)
 - Somewhat disagree (4)
 - Strongly disagree (5)
-

Q29 I make efforts to reduce my environmental impact through my skincare choices.

- Strongly agree (1)
 - Somewhat agree (2)
 - Neither agree nor disagree (3)
 - Somewhat disagree (4)
 - Strongly disagree (5)
-

Q30 I prefer skincare brands that are committed to sustainability and eco-friendliness.

- Strongly agree (1)
 - Somewhat agree (2)
 - Neither agree nor disagree (3)
 - Somewhat disagree (4)
 - Strongly disagree (5)
-

Q31 I educate myself about the environmental impact of skincare products and make informed choices.

- Strongly agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Strongly disagree (5)

End of Block: Pro Environmental Beliefs regarding Skincare products

Start of Block: Manipulation Check

Recognition of BD The sunscreen product advertised in the image you saw can be best described as:

- Organic (1)
 - Non-Organic (2)
 - I do not recall (3)
-

Design elements Which of the following nature elements did you notice in the background of the sunscreen advertisement?

- Natural light (sunlight) (1)
 - Water (2)
 - Both natural light and water (3)
 - No natural elements (4)
 - I do not recall (5)
-

Control Check Was there any mention or display of natural elements such as natural light or water in the background of the advertisement?

- Yes (1)
- No (2)
- I do not recall (3)
-

Message What do you think was the primary message the advertisement was trying to convey?

- The health benefits of using the product (1)
- The environmental friendliness of the product (2)
- The connection between nature and the product (3)
- I am not sure/I do not recall (4)

End of Block: Manipulation Check

Start of Block: Block 14

Q66 To enter the draw and have a chance to win a 50€ Douglas voucher, please provide your email address.

End of Block: Block 14
