

Article

The Effect of Sustainable and Natural Looking on Perceived Aesthetics and Eco-Friendliness in Building Material Evaluation

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Abstract: With the development of material synthesis technology, many artificial materials imitating natural materials have emerged in the construction industry. The processing technology of these materials' surface imitating natural texture is becoming more and more realistic. Some materials are not made of sustainable material but use natural textures to imitate natural materials, attempting to bring users a sense of being close to nature and ecology to attract consumers to use it. However, the intention of use still depends on the user's other factors like health, aesthetics, and environmental friendliness of the material. Therefore, the challenge for material manufacturers and designers is to understand people's perceptions of these materials to increase their acceptance by users. This paper aims to investigate the user's perception of materials (sustainable-unsustainable) to evaluate their perception of naturalness, environmental friendliness, and aesthetics through the visual senses. A total of 112 participants participated in the experiment which was divided into two groups (professional architects and non-professionals). The judgment of non-professionals on the environmental protection of materials imitating natural skin is relatively accurate, which is almost consistent with the judgment of professionals. Results show the importance of maintaining the naturalness of the surface texture in the material, which can enhance the user's demand for a natural aesthetic feeling. Therefore, it is important to maintain the naturalness of surface texture in the process of material surface treatment. Users' natural perception of materials will affect their aesthetic perception of materials.

Keywords: building material; aesthetics; eco-friendliness

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1. Introduction

With the development of current material technology, more and more materials imitating natural textures appear on the market. The technology of simulating the natural texture of materials on the surface is becoming more and more realistic, making it difficult for people to distinguish the real material texture, and easy to confuse people's judgment of the material's properties [1,2]. These materials that simulate natural materials (patterns, textures) on the surface can easily make consumers think that they are environmentally friendly and healthy materials, but some are not what they look like [3]. They can easily cheat people's eyes. It makes it more difficult for non-professionals to make the right judgment. Therefore, this research aims to understand how people perceive the sustainability, health, and aesthetics of these materials [4].

In architectural design and interior design projects, material selection largely determines the sustainability of a building. Material selection for a building project is often

determined by multiple stakeholders, not only relying on professional architects but also on non-professional clients [5]. Both professional and laypeople's perception of the material becomes key to the decision [6]. Therefore, it becomes important to understand the difference between professional and non-professional cognition for better promoting the adoption of healthy and environmentally friendly materials and contributing to sustainable development [7].

Designers evaluate material products through professional knowledge like raw materials and processing technology, etc. However, non-professional users often evaluate materials through visual perception, so they hardly distinguish the true properties of materials [5]. Therefore, there may be a perception difference between professional architects and non-professional users in the perceived naturalness, eco-friendliness, and aesthetics of materials [8–10].

The evaluation of these materials by non-professionals directly affects the acceptance and intention of material usage. The more aligned non-professionals and professionals are in their perceptions, the more likely they are to agree on the decisions [10]. In this study, we investigated the impact of the input of visual sensory information on material perception, including users' assessment of materials on perceived naturalness, perceived aesthetics, and perceived environmental friendliness [11].

Rozin [12] explained how users perceive naturalness. They identify the perceived naturalness as having two aspects: first is instrumental, relating to health, senses, and environment; second is emotional, referring to idealization or imaginative representation. Nature implicitly means better, more moral, more aesthetic, or just more real [12,13]. Therefore, it seems logical to associate the concept of nature with eco-friendliness and aesthetics. These perception factors can influence customer decisions [14].

Currently, there is much research on perceived nature that has focused on packaging and food, while little research has focused on the impact on user intentions in the area of materials. In making the decision on building materials, it is easy to be affected by the imitated natural texture. We propose to examine the effects of the perception of naturalness on material aesthetics, environmental friendliness, and sustainability.

2. Literature Review

2.1. Perceived Naturalness

The concept of naturalness is widely used. In this research, we define "natural" as something "having little or no processing". This definition was derived from the Oxford dictionary and adjusted for the purposes of this study based on this concept [15]. People are very fond of natural things, such as products made of natural materials, natural food, natural cosmetics, etc. [16,17]. People think that choosing nature means choosing health and ecology, because natural things are always related to harmlessness, health, environmental friendliness and beauty [18].

Many people show their preference for natural materials over synthetic replicas [19]. Their preferences for nature have been empirically demonstrated for food and medicine [13] as well as landscapes [20], and this preference exists across cultures [21]. This preference for natural things may strongly influence decision-making outcomes in everyday life when choosing what to eat or what items to use or buy [22].

Perception of the naturalness of a particular substance depends on knowledge of the history of transformations it has undergone from its original state: contagion, chemical change, processing and mixing [23,23]. Rozin et al. found that additives with negative or unnatural characteristics resulted in a substantial decrease in the perception of naturalness, even when the additive was later removed from the product [12]. It is obvious to notice that the preference for natural substances is beyond the objective qualities of the substances. In other words, although the physical properties of the two substances are identical, people still prefer the one that is subjectively judged to be more natural, based on knowledge of the processes by which these substances are produced. For example, untouched natural spring water is preferred over physically identical water [12,13,23].

Consumer research and consumer reports revealed consumer preference for natural products [24,25]. Naturalness is expressed by evoking nature and eliciting an emotional response or through ingredients; natural ingredients help reassure consumers [26]. Objects that are natural are often automatically perceived as more beautiful, healthier, and more environmentally friendly [27,28]. The preference for naturalness is found in many domains, especially food. Most people who like naturalness will continue to like it when it is specified that natural and artificial samples are chemically identical [13,27].

The environmental and health attributes of natural products have been extensively studied in food and daily necessities [29–32]. However, studies on the perception of the naturalness of building materials are scarce. The naturalness of building materials has been identified as a positive characteristic [32]. Natural elements, as well as their manifestations, can generate positive experiences in the built environment [12]. Over the past decade, a number of empirical studies have found that experiencing nature, both actively and passively, can reduce stress, increase well-being, and generate positive emotional experiences [33]. There is growing evidence that material choice can also have a strong influence on building occupants [34,35]. With a growing interest in green building paradigms, many users tend to prefer environmentally friendly buildings, and occupants have a higher awareness of whether or not materials are sustainable [36]. As the requirements for material selection gradually become higher, the requirements for environmental protection, health, and aesthetic properties of materials have become important factors affecting material selection [37,38].

Previous research has shown that consumers generally perceive “naturalness” as a desirable attribute and show a preference for natural alternatives [39]. We can assume that the presence of naturalness will have an impact on the perceived quality of the product. We thus infer that people use sustainability signals as a proxy for naturalness and that perceptions of product sustainability will positively affect the perceived naturalness of products.

2.2. Perceived Sustainability

Natural products are gradually added to artificial materials, resulting in changes in natural properties [1]. This results in mimicry of sustainable material, which is unsustainable, to confuse people to have a feeling of sustainability to influence users’ decision-making. Naik & Moriconi’s research found that the different degrees of processing of building materials will also affect users’ judgments on the sustainability of materials [40]. The attribute of sustainability of the material can be judged through reusability, recyclability, and biodegradability [41]. For example, Sun et al. studied the waste glass mortar of concrete. Their research makes it possible to recycle and reuse waste glass in buildings to achieve sustainable development. Existing studies have shown that consumers’ perceptions of products are significantly affected by sustainable signals [42]. Consumers tend to describe sustainable products as more environmentally friendly, ethical, and more aesthetically pleasing [43]. We, therefore, infer that perceptions of naturalness have an impact on perceived sustainability.

2.3. Perceived Aesthetics

Aesthetics refers to sensory perception and understanding or perceptual knowledge [44]. The 18th-century philosopher Baumgarten changed its meaning to sense gratification or sensory pleasure [45,46]. Why beautiful things are considered beautiful remains a mystery [47,48]. Aesthetic judgment, aesthetic attitude, aesthetic understanding, aesthetic emotion, and aesthetic value can all be used to help explain aesthetic experience [44]. The aesthetic experience profoundly affects our lives and influences our decisions about making important behaviors [49]. These experiences include sensory, captured perception, and cognitive and emotional responses [48,50,51]. Visual aesthetics influence consumer perception in many ways. Visual aesthetics also have a symbolic function that influences the way products are understood and evaluated [52]. Aesthetic

concepts are potentially important for understanding consumer decision-making processes [53]. In particular, aesthetic centrality can determine the way product aesthetics are evaluated and used when making purchasing decisions [54]. Previous studies have shown that providing aesthetic information plays a key role in consumers' decision-making when they are unable to try a product before purchasing it [55]. Amplifying the height of visual aesthetics can enhance the first impression [55,56] and induce different emotions. Therefore, it is believed that the product will be more attractive, with higher quality and performance [57,58], demonstrating the relationship between aesthetics and product value. Rokka and Uusitalo found that objects that are more respectful of the environment have a positive impact on consumer attitudes or preferences. In the context of architecture, the same is true [59]. Thus, we infer that aesthetics will be impacted by perceived naturalness and perceived sustainability.

2.4. Perceived Environmental Friendliness

The evaluation of architectural naturalness will be affected by the environmental protection of the building skin [60]. The use of natural materials in interior decoration can change the quality of the indoor environment and affect the overall quality of the environment. User impacts include both psychological and physical responses [61]. In particular, the natural perception of interior decoration will affect people's living quality, health, environmental friendliness, and happiness [62].

Binner's research shows that factors related to environmental friendliness can affect consumers' attitudes and behaviors [27]. Rokka and Uusitalo found that objects that are more respectful of the environment have a positive impact on consumer attitudes or preferences [59]. In the context of architecture, the situation is similar, and the evaluation of the naturalness of the building will be affected by the ecological degree of the building skin [60]. The use of natural materials in interior decoration can change the quality of the indoor environment; it will have an impact on users, including both psychological and physical responses [61]. In particular, the natural perception of interior decoration affects people's perceptions of living quality, health, sustainability, and well-being [62].

Users often use multiple senses to judge the properties of materials through vision, audition and touch [63,64]. Furthermore, users will relate the naturalness of the material to personal experience. For example, wood and wood products are associated with wood from forests where they have been or have fond memories of. Wood is more easily understood as a material related to natural, sustainable, and environmentally friendly materials [65]. The perception of wood may even carry over to the perception of environmentally friendly particle board. An interview study with users also showed that the user's perception of the environmental friendliness of a product is closely related to the ability of the material itself to degrade and return to nature [33]. Most natural materials will be in their raw natural state, with visible grain patterns. For processed products based on natural materials, such as engineered wood products, those without texture (e.g., Medium-density fibreboard) are often considered to no longer feel natural and environmentally friendly due to the degree of deformation and lack of apparent texture [66]. Therefore, we infer that the perception of the naturalness of the material will affect the judgment of the real environmental friendliness attribute of the material. Figure 1 is the research flowchart of this study.

Based on the theories mentioned above, we have the following hypotheses:

- H1.** *Building material with a sustainable look could enjoy a high level of perceived aesthetics.*
- H2.** *Building material with an eco-friendly look could enjoy a high level of perceived aesthetics.*
- H3.** *Building material with a sustainable look could enjoy a high level of perceived eco-friendliness.*
- H4.** *Building material with an eco-friendly look could enjoy a high level of perceived eco-friendliness.*

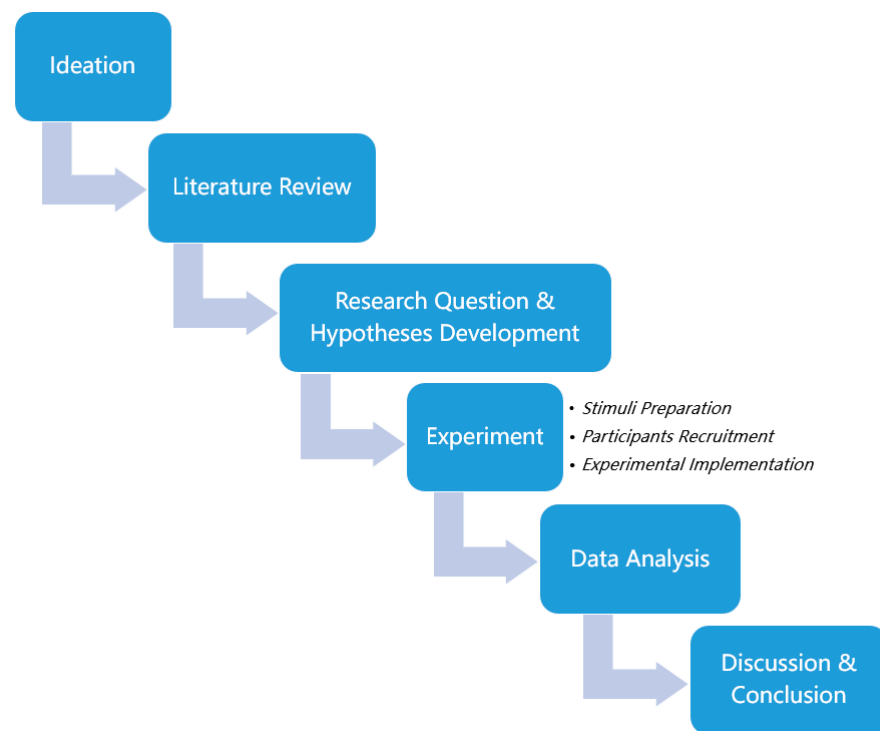


Figure 1. The Research Flowchart.

3. Methodology

In this study, the questionnaire research method was adopted to test participants using a five-level scale. This questionnaire is set to compare two groups (professional and non-professional) to determine whether professional knowledge influences users' factors on the naturalness of building materials. The participants were asked to give scores on perceived naturalness, perceived beauty, and perceived environmental protection. Two groups (construction professionals, and non-professionals) were invited to rate the pictures of eight categories representing natural and four non-natural kinds of materials for aesthetic perception and environmental protection perception. Picture samples of building materials were visually presented to subjects to measure perceptions of building materials in both professional and non-professional backgrounds. Eight samples were evaluated to reflect the different natural properties of materials such as wood, stone, brick, biological materials, particle boards, medium-density fiberboard, etc. (Table 1). The scale items related to the naturalness, aesthetics, and sustainability of materials in the questionnaire were derived from the measurement methods used in the literature by Overlivet and Soto-Faraco [31]. In addition, the last section is set to ask for demographic information. A total of 120 questionnaires were sent to participants for completion. Responses were received and eight incomplete responses were excluded. After removing these, 112 valid responses were received for around a 93 % response rate.

Table 1. Demographic information of the sample in this study.

Index	Frequency	Percentage	Index	Frequency	Percentage
Age			Educational Level		
–20	22	19.6%	High school graduate or lower	3	2.7%
21–25	57	50.9%	Bachelor	75	67.0%
26–30	10	8.90%	Master	31	27.7%
31+	23	20.6%	Doctor	3	2.7%
Gender			Eco-education Background		
Male	64	57.1%	Eco-related major	58	21.5%
Female	48	42.9%	Non-eco-related major	11	4.1%

3.1. Materials and Methods

3.1.1. Stimuli

In this study, common building materials were screened and classified into four categories with two dimensions (naturalness/sustainability). Specifically, these four groups are: naturalness while sustainable, non-naturalness while sustainable, naturalness while unsustainable, and non-naturalness while unsustainable (Figure 2).



Figure 2. Experimental Stimuli with two dimensions.

3.1.2. Experiment Design and Participants

An experiment was designed with the material and its sustainability as within-subject variables. Based on power analysis and sample calculation, a total of 112 participants with different backgrounds has shown sufficient power for statistical analysis (Song and Luximon, 2021), and thus they were enrolled to participate in this research via advertisement [67,68]. Specifically, the average age of this sample was 25.64 years (SD = 8.698). Table 1 presents detailed demographic information.

3.1.3. Measurements

Regarding the measurement items on perceived aesthetics and perceived eco-friendliness [27], participants were asked about the extent to which they agreed with five items on a five-point Likert scale: I think this material is an eco-friendly product; This product is one of those that really respect the environment; You can immediately see that this product is ecological; This material seems to be a nice solution to environmental issues; This product does not contain artificial elements.

3.1.4. Experimental Procedure

After consenting to participate, 112 individuals were recruited and briefly introduced to the current study. Then, they were asked to provide demographic information and assigned to all four scenarios with different materials in random order. For each stimulus, participants were asked to pay attention to the image of the building material and then complete the questionnaire. After finishing the questionnaire, they were told they had finished the experiment.

4. Results

To examine the hypotheses regarding the effect of naturalness and sustainability on perceived aesthetics and perceived eco-friendliness, SPSS was used to perform descriptive analysis and repeated measures of analysis of variance (ANOVA).

4.1. Descriptive Analysis

To examine the normality of univariate data, we performed the kurtosis and skewness test on five items. Results suggested the kurtosis and skewness of each item were within the threshold, suggesting a general normal distribution [69]. Additionally, QQ-plot showed the data was normally distributed. Accordingly, we conducted a descriptive analysis of different factors in the study (see Table 2).

Table 2. Summary of descriptive analysis of different factors.

	Factors	Levels	Mean	SD
Perceived Aesthetics	Naturalness	Sustainable	3.60	0.93
		Unsustainable	3.67	0.74
	Non-naturalness	Sustainable	3.04	0.84
		Unsustainable	3.17	1.01
Perceived Eco-friendliness	Naturalness	Sustainable	3.93	0.76
		Unsustainable	3.51	0.80
	Non-naturalness	Sustainable	3.31	0.76
		Unsustainable	2.84	0.90

4.2. Impact on Perceived Aesthetics

A two-way repeated analysis of covariance (ANCOVA; within-subjects variable: naturalness and sustainability; covariate variable: eco-education background) was then conducted. Table 3 presents the summarized ANCOVA results. We mainly focused on the main effects of naturalness and sustainability since they were theoretically relevant to the research questions at hand.

Table 3. Summary of the main effects and interactions of perceived aesthetics.

Factors	df	F-Statistic	p-Value	Effect Size
Naturalness (NL)	1	58.09	$p < 0.01$	0.35
Sustainability (SU)	1	2.86	$p = 0.09$	0.03
Background (BA)	1	1.05	$p = 0.31$	0.01
NL * BA	1	0.02	$p = 0.88$	0.00
SU * BA	1	6.91	$p < 0.01$	0.06
NL * SU	1	0.03	$p = 0.86$	0.00

Note: * refers to the interaction between different factors.

As for the main effect of naturalness, we found a significant impact of naturalness ($F(1, 110) = 58.09, p < 0.01, \eta^2 = 0.35$) and the marginal effect of sustainability ($F(1, 110) = 2.86, p = 0.09, \eta^2 = 0.03$), whereas the covariate, background, was nonsignificant ($F(1, 110) = 1.05, p = 0.31, \eta^2 = 0.01$). Specifically, (1) building materials with naturalness enjoyed a higher level of perceived aesthetics (Figure 3); (2) similarly, sustainable building material seems to increase perceived aesthetics; (3) however, the eco-education background did not have a significant effect on perceived aesthetics.

Regarding the interaction effect, the significant interaction of sustainability with background ($F(1, 110) = 6.91, p < 0.01, \eta^2 = 0.06$) demonstrated that although people with different educational background seem to have similar perceptions of aesthetics when encountering unsustainable building materials, their eco-education could help them have an increased level of perceived aesthetics when facing sustainable building materials.

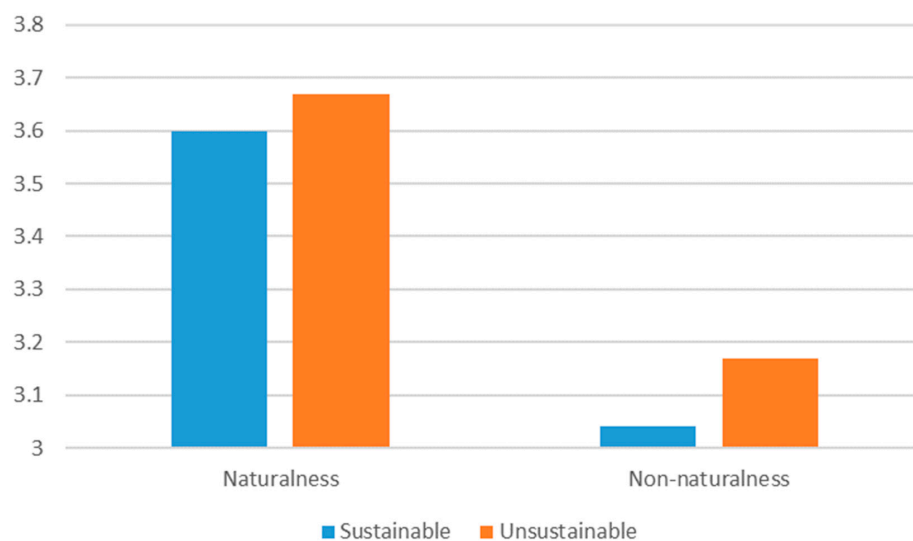


Figure 3. The effect of naturalness and sustainability on perceived aesthetics.

4.3. Impact on Perceived Eco-Friendliness

As depicted in Table 4, the ANCOVA results revealed strong main effects for naturalness ($F(1, 110) = 120.39, p < 0.01, \eta^2 = 0.52$), and sustainability ($F(1, 110) = 52.69, p < 0.01, \eta^2 = 0.31$) while the effect of background and all interactions are not significant. It showed that building materials with naturalness tend to have a higher level of perceived eco-friendliness, while sustainable building materials could also be regarded as eco-friendly (See Figure 4).

Table 4. Summary of the main effects and interactions of eco-friendliness.

Factors	df	F-Statistic	p-Value	Effect Size
Naturalness (NL)	1	120.39	$p < 0.01$	0.52
Sustainability (SU)	1	52.69	$p < 0.01$	0.32
Background (BA)	1	0.01	$p = 0.97$	0.00
NL * BA	1	0.01	$p = 0.93$	0.00
SU * BA	1	0.21	$p = 0.65$	0.01
NL * SU	1	0.48	$p = 0.65$	0.01

Note: * refers to the interaction between different factors.

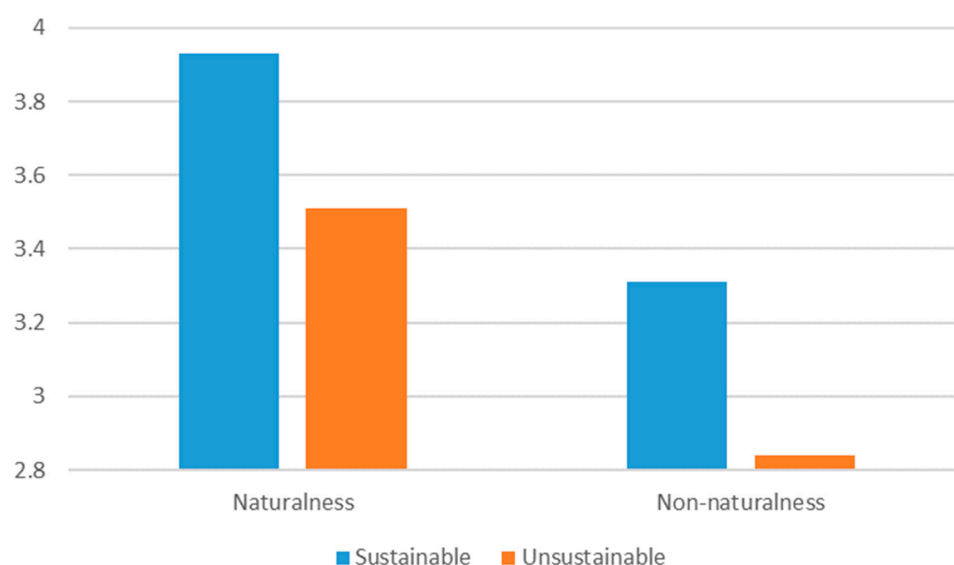


Figure 4. The effect of naturalness and sustainability on eco-friendliness.

5. Discussion

In this research, we tried to expose the perception of environmental friendliness and aesthetics from vision evaluation. The surface of the material can affect the judgment of material properties. According to Jonsson et al., the influence of material shape, texture, and integrity affects the judgment of material properties. These impressions can affect whether perception is natural or synthetic [1]. The closer to the original state, the more the origin of the material can be seen, and the easier it is to judge it as environmentally friendly and natural. The higher the degree of deformation, the easier it is to judge that it is not environmentally friendly. In addition, morphological integrity affects the extent to which visual features affect judgments of environmental attributes [60].

Results showed that sustainable and natural looking building materials could enjoy a high level of perceived aesthetics. It is consistent with previous literature which demonstrates that objects that are more respectful of the environment have a positive impact on consumer attitudes or preferences [59]. Thus, people might consider sustainable and natural looking building materials as more aesthetic.

In addition, results also indicated that sustainable and natural looking building material could enjoy a high level of perceived eco-friendliness. It is also in alignment with previous literature that the building skin might influence environmental consideration and architectural naturalness [60]. To specify, the natural perception of interior decoration will affect people's living quality, health and environmental friendliness, and happiness [62]. Thus, individuals might regard sustainable and natural looking building materials as more eco-friendly.

The current study also has practical implications. Although "aesthetics", and "environmental friendliness" have a very important impact on consumers' purchases, they do not necessarily have a relationship between purchases and consumption behavior [70]. Therefore, when consumers choose materials, they are also influenced by factors such as material aesthetics, craftsmanship, and price [71]. Thus, these factors may interfere with their chosen goals of maintaining health and promoting a clean environment. Therefore, the current research also helps us understand how consumers perceive materials, and how to use our findings to help people make healthy and environmentally friendly choices in building materials.

6. Conclusions

There are many materials that mimic natural textures which are being introduced to the market as a result of advances in contemporary material technology. It is becoming practically impossible for people to tell the difference between real material texture and the technology used to simulate it on a surface; it is simple to confuse people's perceptions of the material's inherent qualities. The acceptability and intention of material usage are directly affected by how these materials are assessed by non-professionals. Non-professionals and professionals are more likely to reach a consensus on decisions when their perspectives are more in line. In this study, we investigated how consumers' perceptions of materials' perceived naturalness, aesthetic, and environmental friendliness were affected by the intake of visual sensory information. There is much investigation on naturalness perception that has concentrated on food and packaging, but little research has emphasized how these factors affect user intentions in the field of building materials. Therefore, we conducted an empirical experiment to understand how material aesthetics, environmental friendliness, and sustainability are impacted by the idea of naturalness.

In this study, users' perceptions of the naturalness of building materials were investigated. A questionnaire was completed by two cohorts, one with a professional architect background and one with a non-professional background, to collect users' perceptions of the environmental friendliness and aesthetics of eight building materials with a five Likert scale rating. The eight types of building materials include solid wood, brick, particle board, medium-density fiberboard, stone, etc. The results showed that solid wood, stone, and brick are clearly considered more natural and more environmentally friendly than syn-

thesized material products. Similarly, processed wood-based composites were perceived to feel less eco-friendly than less processed materials. In addition, the study found that there were subtle differences in the perception of eco-friendliness of materials between the two cohorts.

The perception of the naturalness of the material may be influenced by the properties of the material ingredients itself. In the future, a better understanding of the psychological processes to perceive naturalness could become a basis for industries that produce or reproduce natural materials. In addition, this knowledge will also help create more desirable and environmentally friendly alternatives to rare, expensive, or hard-to-obtain natural materials such as animal fur and tropical wood, for archiving the preference for naturalness and aesthetics.

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References

- Jonsson, O.; Lindberg, S.; Roos, A.; Hugosson, M.; Lindström, M. Consumer Perceptions and Preferences on Solid Wood, Wood-Based Panels, and Composites: A Repertory Grid Study. *Wood Fiber Sci.* **2008**, *40*, 663–678.
- Rosenbaum, M.S.; McMillan, A.A.; Powell, J.; Cooper, A.; Culshaw, M.; Northmore, K. Classification of Artificial (Man-Made) Ground. *Eng. Geol.* **2003**, *69*, 399–409. [[CrossRef](#)]
- Meikle, J.L. Presenting a New Material: From Imitation to Innovation with Fabrikoid. *J. Decor. Arts Soc. 1850-Present* **1995**, *19*, 8–15.
- Bond, G.; Richman, R.; McNaughton, W. Mimicry of Natural Material Designs and Processes. *J. Mater. Eng. Perform.* **1995**, *4*, 334–345. [[CrossRef](#)]
- Ogunkah, I.; Yang, J. Investigating Factors Affecting Material Selection: The Impacts on Green Vernacular Building Materials in the Design-Decision Making Process. *Buildings* **2012**, *2*, 1–32. [[CrossRef](#)]
- Akadiri, P.O.; Chinyio, E.A.; Olomolaiye, P.O. Design of a Sustainable Building: A Conceptual Framework for Implementing Sustainability in the Building Sector. *Buildings* **2012**, *2*, 126–152. [[CrossRef](#)]
- McDonnell, J. Collaborative Negotiation in Design: A Study of Design Conversations between Architect and Building Users. *CoDesign* **2009**, *5*, 35–50. [[CrossRef](#)]
- Soliman, O. Perception of Building Materials in Architecture. *J. Eng. Appl. Sci.* **2013**, *60*, 1–23.
- Wastiels, L.; Wouters, I. Material Considerations in Architectural Design: A Study of the Aspects Identified by Architects for Selecting Materials. In Proceedings of the Undisciplined!—DRS International Conference, Sheffield, UK, 16–19 July 2008.
- Wastiels, L.; Wouters, I. Architects' Considerations While Selecting Materials. *Mater. Des.* **2012**, *34*, 584–593. [[CrossRef](#)]
- Florez, L.; Castro, D.; Irizarry, J. Impact of Sustainability Perceptions on Optimal Material Selection in Construction Projects. In Proceedings of the Second International Conference on Sustainable Construction Materials and Technologies, Ancona, Italy, 28 June 2010; pp. 719–727.
- Rozin, P. The Meaning of “Natural” Process More Important than Content. *Psychol. Sci.* **2005**, *16*, 652–658. [[CrossRef](#)]
- Rozin, P.; Spranca, M.; Krieger, Z.; Neuhaus, R.; Surillo, D.; Swerdlin, A.; Wood, K. Preference for Natural: Instrumental and Ideational/Moral Motivations, and the Contrast between Foods and Medicines. *Appetite* **2004**, *43*, 147–154. [[CrossRef](#)]
- Silayoi, P.; Speece, M. The Importance of Packaging Attributes: A Conjoint Analysis Approach. *Eur. J. Mark.* **2007**, *41*, 1495–1517. [[CrossRef](#)]
- Coffey, S. Oxford Learner's Dictionary Natural Definition from Oxford Dictionary. 2009. Available online: <https://www.oxfordlearnersdictionaries.com/> (accessed on 27 December 2022).

16. KARADUMAN, I. Factors Influencing Consumer Preferences on Natural and Non-Natural Cosmetics in Turkey. *Int. J. Bus. Manag. Stud.* **2014**, *6*, 141–153.
17. Lavuri, R.; Jabbour, C.J.C.; Grebinevych, O.; Roubaud, D. Green Factors Stimulating the Purchase Intention of Innovative Luxury Organic Beauty Products: Implications for Sustainable Development. *J. Environ. Manag.* **2022**, *301*, 113899. [[CrossRef](#)]
18. Hughner, R.S.; McDonagh, P.; Prothero, A.; Shultz, C.J.; Stanton, J. Who Are Organic Food Consumers? A Compilation and Review of Why People Purchase Organic Food. *J. Consum. Behav. Int. Res. Rev.* **2007**, *6*, 94–110. [[CrossRef](#)]
19. Schirmacher, H.; Elshiewy, O.; Boztug, Y. That’s Not Natural! Consumer Response to Disconfirmed Expectations about ‘Natural’ Food. *Appetite* **2023**, *180*, 106270. [[CrossRef](#)]
20. Purcell, A.T.; Lamb, R.J. Preference and Naturalness: An Ecological Approach. *Landsc. Urban Plan.* **1998**, *42*, 57–66. [[CrossRef](#)]
21. Kaplan, R.; Herbert, E.J. Cultural and Sub-Cultural Comparisons in Preferences for Natural Settings. *Landsc. Urban Plan.* **1987**, *14*, 281–293. [[CrossRef](#)]
22. De Magistris, T.; Gracia, A. The Decision to Buy Organic Food Products in Southern Italy. *Br. Food J.* **2008**, *110*, 929–947. [[CrossRef](#)]
23. Rozin, P. Naturalness Judgments by Lay Americans: Process Dominates Content in Judgments of Food or Water Acceptability and Naturalness. *Judgm. Decis. Mak.* **2006**, *1*, 91. [[CrossRef](#)]
24. Liu, R.; Hooker, N.H.; Parasidis, E.; Simons, C.T. A Natural Experiment: Using Immersive Technologies to Study the Impact of “All-Natural” Labeling on Perceived Food Quality, Nutritional Content, and Liking. *J. Food Sci.* **2017**, *82*, 825–833. [[CrossRef](#)] [[PubMed](#)]
25. Michel, F.; Sanchez-Siles, L.M.; Siegrist, M. Predicting How Consumers Perceive the Naturalness of Snacks: The Usefulness of a Simple Index. *Food Qual. Prefer.* **2021**, *94*, 104295. [[CrossRef](#)]
26. Evans, G.; de Challemaison, B.; Cox, D.N. Consumers’ Ratings of the Natural and Unnatural Qualities of Foods. *Appetite* **2010**, *54*, 557–563. [[CrossRef](#)] [[PubMed](#)]
27. Binninger, A.-S. Perception of Naturalness of Food Packaging and Its Role in Consumer Product Evaluation. *J. Food Prod. Mark.* **2017**, *23*, 251–266. [[CrossRef](#)]
28. Roman, S.; Sánchez-Siles, L.M.; Siegrist, M. The Importance of Food Naturalness for Consumers: Results of a Systematic Review. *Trends Food Sci. Technol.* **2017**, *67*, 44–57. [[CrossRef](#)]
29. Kaplan, R.; Kaplan, S. *The Experience of Nature: A Psychological Perspective*; Cambridge University Press: Cambridge, UK, 1989; ISBN 0-521-34939-7.
30. Kellert, S.R. *Building for Life: Designing and Understanding the Human-Nature Connection*; Island Press: Washington, DC, USA, 2012; ISBN 1-59726-591-8.
31. Overvliet, K.E.; Soto-Faraco, S. I Can’t Believe This Isn’t Wood! An Investigation in the Perception of Naturalness. *Acta Psychol.* **2011**, *136*, 95–111. [[CrossRef](#)] [[PubMed](#)]
32. Rozin, P.; Fischler, C.; Shields-Argelès, C. European and American Perspectives on the Meaning of Natural. *Appetite* **2012**, *59*, 448–455. [[CrossRef](#)] [[PubMed](#)]
33. Burnard, M.D.; Nyrud, A.Q.; Bysheim, K.; Kutnar, A.; Vahtikari, K.; Hughes, M. Building Material Naturalness: Perceptions from Finland, Norway and Slovenia. *Indoor Built Environ.* **2017**, *26*, 92–107. [[CrossRef](#)]
34. Ghodrati, N.; Samari, M.; Shafiei, M.W.M. Green Buildings Impacts on Occupants’ Health and Productivity. *J. Appl. Sci. Res.* **2012**, *8*, 4235–4241.
35. Spence, C. Senses of Place: Architectural Design for the Multisensory Mind. *Cogn. Res. Princ. Implic.* **2020**, *5*, 46. [[CrossRef](#)]
36. Smith, A.; Pitt, M. Sustainable Workplaces and Building User Comfort and Satisfaction. *J. Corp. Real Estate* **2011**, *13*, 144–156. [[CrossRef](#)]
37. Sakuragawa, S.; Miyazaki, Y.; Kaneko, T.; Makita, T. Influence of Wood Wall Panels on Physiological and Psychological Responses. *J. Wood Sci.* **2005**, *51*, 136–140. [[CrossRef](#)]
38. Tsunetsugu, Y.; Miyazaki, Y.; Sato, H. Physiological Effects in Humans Induced by the Visual Stimulation of Room Interiors with Different Wood Quantities. *J. Wood Sci.* **2007**, *53*, 11–16. [[CrossRef](#)]
39. Li, M.; Chapman, G.B. Why Do People Like Natural? Instrumental and Ideational Bases for the Naturalness Preference. *J. Appl. Soc. Psychol.* **2012**, *42*, 2859–2878. [[CrossRef](#)]
40. Naik, T.R.; Moriconi, G. Environmental-Friendly Durable Concrete Made with Recycled Materials for Sustainable Concrete Construction. In Proceedings of the International Symposium on Sustainable Development of Cement, Concrete and Concrete Structures, Toronto, ON, Canada, 5–7 October 2005; Volume 5.
41. Magnier, L.; Schoormans, J.; Mugge, R. Judging a Product by Its Cover: Packaging Sustainability and Perceptions of Quality in Food Products. *Food Qual. Prefer.* **2016**, *53*, 132–142. [[CrossRef](#)]
42. Sun, J.; Tang, Y.; Wang, J.; Wang, X.; Wang, J.; Yu, Z.; Cheng, Q.; Wang, Y. A Multi-Objective Optimisation Approach for Activity Excitation of Waste Glass Mortar. *J. Mater. Res. Technol.* **2022**, *17*, 2280–2304. [[CrossRef](#)]
43. Lunardo, R.; Saintives, C. The Effect of Naturalness Claims on Perceptions of Food Product Naturalness in the Point of Purchase. *J. Retail. Consum. Serv.* **2013**, *20*, 529–537. [[CrossRef](#)]
44. Hekkert, P. Design Aesthetics: Principles of Pleasure in Design. *Psychol. Sci.* **2006**, *48*, 157.
45. Gaut, B.N.; Lopes, D. *The Routledge Companion to Aesthetics*; Routledge: London, UK, 2005.
46. Gregor, M.J. Baumgarten’s “Aesthetica”. *Rev. Metaphys.* **1983**, *37*, 357–385.

47. Albers, A.M.; Gegenfurtner, K.R.; Nascimento, S.M.C. An Independent Contribution of Colour to the Aesthetic Preference for Paintings. *Vis. Res.* **2020**, *177*, 109–117. [[CrossRef](#)]
48. Nascimento, S.M.C.; Albers, A.M.; Gegenfurtner, K.R. Naturalness and Aesthetics of Colors—Preference for Color Compositions Perceived as Natural. *Vis. Res.* **2021**, *185*, 98–110. [[CrossRef](#)]
49. Briellmann, A.A.; Pelli, D.G. Aesthetics. *Curr. Biol.* **2018**, *28*, R859–R863. [[CrossRef](#)] [[PubMed](#)]
50. Chatterjee, A.; Vartanian, O. Neuroscience of Aesthetics. *Ann. N. Y. Acad. Sci.* **2016**, *1369*, 172–194. [[CrossRef](#)] [[PubMed](#)]
51. Conway, B.R.; Rehding, A. Neuroaesthetics and the Trouble with Beauty. *PLoS Biol.* **2013**, *11*, e1001504. [[CrossRef](#)]
52. Bloch, P.H.; Brunel, F.F.; Arnold, T.J. Individual Differences in the Centrality of Visual Product Aesthetics: Concept and Measurement. *J. Consum. Res.* **2003**, *29*, 551–565. [[CrossRef](#)]
53. Hoyer, W.D.; Stokburger-Sauer, N.E. The Role of Aesthetic Taste in Consumer Behavior. *J. Acad. Mark. Sci.* **2012**, *40*, 167–180. [[CrossRef](#)]
54. De Klerk, H.M.; Lubbe, S. Female Consumers' Evaluation of Apparel Quality: Exploring the Importance of Aesthetics. *J. Fashion Mark. Manag. Int. J.* **2008**, *16*, 13–18. [[CrossRef](#)]
55. Creusen, M.E.H.; Schoormans, J.P.L. The Different Roles of Product Appearance in Consumer Choice. *J. Prod. Innov. Manag.* **2005**, *22*, 63–81. [[CrossRef](#)]
56. Bloch, P.H. Seeking the Ideal Form: Product Design and Consumer Response. *J. Mark.* **1995**, *59*, 16. [[CrossRef](#)]
57. Batra, R. When Good Looks Kill: An Examination of Consumer Response to Visually Attractive Product Design. In *Asia-Pacific Advances in Consumer Research*; Association for Consumer Research: Chicago, IL, USA, 2009.
58. Orth, U.R.; Malkewitz, K. Holistic Package Design and Consumer Brand Impressions. *J. Mark.* **2008**, *72*, 64–81. [[CrossRef](#)]
59. Rokka, J.; Uusitalo, L. Preference for Green Packaging in Consumer Product Choices—Do Consumers Care? *Int. J. Consum. Stud.* **2008**, *32*, 516–525. [[CrossRef](#)]
60. Bysheim, K.; Nyruud, A.; Strobel, K. *Building Materials and Well-Being in Indoor Environments; A Focus Group Study*; Norsk Treteknisk Institutt: Oslo, Norway, 2016; Volume 88, pp. 3–65.
61. Jalilzadehazhari, E.; Johansson, J. Material Properties of Wooden Surfaces Used in Interiors and Sensory Stimulation. *Wood Mater. Sci. Eng.* **2019**, *14*, 192–200. [[CrossRef](#)]
62. Meral, A.; Başaran, N.; Yalçınalp, E.; Doğan, E.; Ak, M.K.; Eroğlu, E. A Comparative Approach to Artificial and Natural Green Walls According to Ecological Sustainability. *Sustainability* **2018**, *10*, 1995. [[CrossRef](#)]
63. Bhatta, S.R.; Tiippana, K.; Vahtikari, K.; Hughes, M.; Kytä, M. Sensory and Emotional Perception of Wooden Surfaces through Fingertip Touch. *Front. Psychol.* **2017**, *8*, 367. [[CrossRef](#)]
64. Fujisaki, W.; Tokita, M.; Kariya, K. Perception of the Material Properties of Wood Based on Vision, Audition, and Touch. *Vis. Res.* **2015**, *109*, 185–200. [[CrossRef](#)] [[PubMed](#)]
65. Marques, F.M.; Salgado, M.S. The Building Material Selection. Importance at the Building Design; Process for Its Sustainability. In *Proceedings of the CIB World Building Congress Construction for Development, Cape Town, South Africa, 14–17 May 2007*; pp. 14–17.
66. Wang, J.; Hsu, Y. Does Sustainable Perceived Value Play a Key Role in the Purchase Intention Driven by Product Aesthetics? Taking Smartwatch as an Example. *Sustainability* **2019**, *11*, 6806. [[CrossRef](#)]
67. Song, Y.; Luximon, Y.; Luo, J. A Moderated Mediation Analysis of the Effect of Lettering Case and Color Temperature on Trustworthiness Perceptions and Investment Decisions. *Int. J. Bank Mark.* **2020**, *16*, 124. [[CrossRef](#)]
68. Song, Y.; Luximon, Y. The Face of Trust: The Effect of Robot Face Ratio on Consumer Preference. *Comput. Hum. Behav.* **2021**, *116*, 106620. [[CrossRef](#)]
69. Groeneveld, R.A.; Meeden, G. Measuring Skewness and Kurtosis. *J. R. Stat. Soc. Ser. D* **1984**, *33*, 391–399. [[CrossRef](#)]
70. Strobel, K.; Nyruud, A.Q.; Bysheim, K. Interior Wood Use: Linking User Perceptions to Physical Properties. *Scand. J. For. Res.* **2017**, *32*, 798–806. [[CrossRef](#)]
71. Hoek, A.C.; Pearson, D.; James, S.W.; Lawrence, M.A.; Friel, S. Healthy and Environmentally Sustainable Food Choices: Consumer Responses to Point-of-Purchase Actions. *Food Qual. Prefer.* **2017**, *58*, 94–106. [[CrossRef](#)]

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