

Article

The Impact of Sustainable Aesthetics: A Qualitative Analysis of the Influence of Visual Design and Materiality of Green Products on Consumer Purchase Intention

Ana-Maria Nicolau  and Petruța Petcu *

Department of Engineering Graphics and Industrial Design, Faculty of Aerospace Engineering, National University of Science and Technology Politehnica Bucharest, 060042 Bucharest, Romania; ana.avramescu@upb.ro

* Correspondence: petruta.toderasc@upb.ro

Abstract

The transition to a circular economy depends on the widespread adoption of sustainable products by consumers. However, the point-of-sale purchase decision is a complex process, influenced not only by ethical arguments but also by sensory cues. This study investigates how the aesthetics (visual design) and materiality (tactile sensation) of green products shape value perception and purchase intention. Using a qualitative methodology based on a focus group, the research directly compares consumer reactions to green products (e.g., a bamboo toothbrush) versus their conventional alternatives (e.g., plastic). Thematic analysis of the data reveals a fundamental dichotomy among consumers: while one segment associates high-tech aesthetics and perfect finishes with quality and hygiene, another segment values natural materials and their “imperfections” as signs of authenticity and responsibility. The results demonstrate that there is no single, universally accepted “sustainable aesthetic” and highlight the need for designers and marketers to align the visual and tactile language of products with the value system of the target consumer segment. The study provides a framework for understanding how design can act as either a barrier to or a catalyst for the adoption of sustainable products.



Academic Editor: Min-Young Lee

Received: 20 August 2025

Revised: 8 October 2025

Accepted: 11 October 2025

Published: 14 October 2025

Citation: Nicolau, A.-M.; Petcu, P. The Impact of Sustainable Aesthetics: A Qualitative Analysis of the Influence of Visual Design and Materiality of Green Products on Consumer Purchase Intention. *Sustainability* **2025**, *17*, 9082. <https://doi.org/10.3390/su17209082>

Copyright: © 2025 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

Keywords: sustainable design; consumer behavior; aesthetics; materiality; focus group; circular economy; purchase intention

1. Introduction

The acceleration of the climate crisis and plastic pollution has placed the circular economy at the center of sustainable development strategies globally [1]. A central pillar of this model is the substitution of conventional, single-use products with sustainable alternatives made from recycled, biodegradable, or renewable materials [2,3]. However, the success of this transition depends not only on the technological innovation of producers but also on the acceptance and adoption of these new products by consumers [4,5]. The final decision, in most cases, occurs at the point of sale, within a few seconds, where the product itself must convincingly communicate value and trust [6].

To navigate this critical moment of decision, consumers rely on a series of extrinsic cues to infer the intrinsic, often invisible, qualities of a product, such as its actual sustainability. According to Cue Utilization Theory, these cues can be verbal (e.g., labels, certifications) or non-verbal (e.g., design, material, color) [7]. While the literature has extensively explored the rational factors and verbal cues influencing sustainable consumption, such as ecological

knowledge, social norms, price, and the impact of eco-labels [5,6,8–10], a significant gap persists in understanding the role played by non-verbal sensory cues. A product's design functions as a silent language; its aesthetics and materiality convey messages about quality, value, and origin, often at a subconscious level [8,11].

How do the “look” (aesthetics) and “feel” (materiality) of a green product influence a consumer's decision to choose it over a familiar, conventional alternative? Can a product made of bamboo or bioplastic, with a minimalist aesthetic and a natural texture, compete on the shelf with a glossy plastic product featuring a complex design and vibrant colors [12–14]?

These questions are critical, as there is a risk of a perceptual gap between the designer's sustainability intent and the consumer's value interpretation. A design cue intended to communicate ecological responsibility can be decoded in a completely unexpected way. This gap can constitute a major barrier to the widespread adoption of green alternatives, undermining the transition to a circular economy [15,16].

This study aims to explore this issue through a qualitative approach. Unlike quantitative studies that measure market-level correlations, this research uses the focus group method to delve into the “black box” of the consumer's decision-making process [17]. The selection of a qualitative methodology, specifically focus groups, is crucial for this exploratory research. While quantitative approaches excel at measuring the prevalence and statistical relationships of attitudes or behaviors across large populations, they often fall short in uncovering the underlying motivations, subjective experiences, and nuanced interpretations that drive consumer choices. A qualitative lens allows us to gain a deep, rich understanding of the “why” and “how” behind consumers' perceptions, revealing the complex interplay of emotions, values, and sensory cues that shape their decisions. This in-depth perspective, derived from direct interaction and thematic analysis of discourse, is essential for addressing the intricate perceptual gaps in sustainable product adoption, which might remain obscure in a purely quantitative investigation. Through direct observation of participants' interactions with pairs of products (green vs. conventional) and the analysis of their discourse, the study seeks to answer the following research question: How do the attributes of the visual design (aesthetics) and material (tactile sensation) of a green product influence the consumer's value hierarchy and their final purchase decision?

The contribution of this paper is twofold: (1) it provides an in-depth understanding of how different consumer archetypes “read” and interpret the design cues of sustainable products, and (2) it offers a set of practical implications for designers and marketing strategists, helping them create products that are not only ecologically responsible but also commercially desirable [18]. The article is structured as follows: Section 2 presents the qualitative methodology, detailing participant selection, stimulus materials, and the data analysis process. Section 3 presents the results, organized around the central themes identified. Section 4 discusses the implications of these results for the theory and practice of sustainable design, and Section 5 offers final conclusions and directions for future research.

2. Materials and Methods

2.1. Methodological Approach and Rationale

To explore the subjective perceptions and complex decision-making processes of consumers, we adopted a qualitative, exploratory methodology grounded in the focus group method [19]. This approach was deemed optimal over quantitative methods, such as surveys, because the study's goal was not to measure the prevalence of attitudes but to gain an in-depth understanding of the reasoning, emotions, and language behind expressed preferences (“why do you choose this?”) [19,20]. Unlike quantitative studies that aim for statistical generalization across a larger population, our qualitative inquiry seeks to

uncover the underlying motivations, interpretations, and nuances of consumer behavior. The interactive dynamics of a focus group are particularly valuable for uncovering social norms, cognitive tensions, and contrasting viewpoints that might remain hidden in an individual interview [19]. This method allows for rich, detailed data collection through dialogue and observation, providing insights into the ‘how’ and ‘why’ of consumer choices, rather than just the ‘what’.

It is essential to emphasize that this study is phenomenological in nature; it is not an experimental investigation of the physical properties or technical performance of materials. The research focuses exclusively on the human perception of these materials and the forms in which they are presented. Therefore, the technical parameters of the stimulus products (e.g., chemical composition, tensile strength, biodegradation rates) are intentionally excluded from the analysis as they are irrelevant to the study’s objective, which is to understand subjective consumer interpretation of design and materiality cues.

2.2. Sampling and Participant Profile

A single focus group session, lasting 100 min, was conducted with 10 participants (N = 10) residing in an urban area (Bucharest, Romania). Inclusion criteria for participants included being over 18 years of age, being a regular consumer of personal care and household products, and residing in an urban environment to ensure relevance to the types of products discussed and typical consumer access. Exclusion criteria included individuals professionally involved in product design, marketing, or sustainability research to avoid expert bias. To ensure maximum variation in perspectives, a purposive sampling strategy was used [20]. Participants were recruited to cover a wide range of ages, genders, and socio-professional profiles. *This approach allowed us to gather diverse opinions and experiences relevant to the perceived aesthetics and materiality of both conventional and green products.* Although a sample of 10 individuals is typical for exploratory qualitative studies, special attention was given to achieving thematic saturation. Thematic saturation, a cornerstone of qualitative research, was rigorously assessed throughout the data analysis process. We continuously compared new data with existing categories and themes. By the latter half of the focus group session, and certainly during the final stages of transcription and coding, it was observed that no fundamentally new paradigms or arguments emerged. The central themes identified in the analysis—such as the “technical vs. natural” dichotomy and the perception of premium price—became recurrent and well-defined. This suggests that the diversity of primary perspectives was adequately captured within our sample, providing a rich and in-depth understanding of the phenomena under investigation without the need for additional participants.

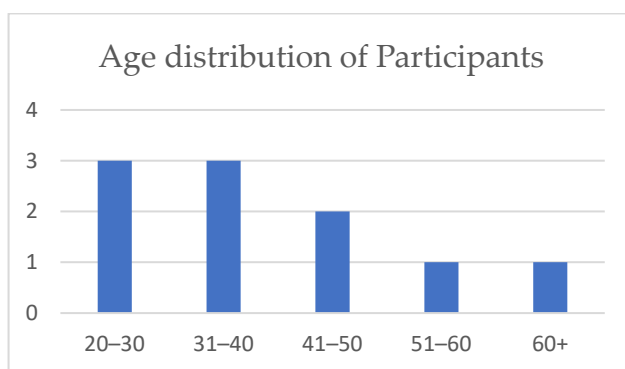
Table 1 presents the anonymized demographic profile of the participants. The assigned participant codes (P1–P10) are used throughout Section 3 to ensure data traceability.

This strategy was explicitly chosen to recruit individuals who could offer a diverse range of insights and experiences relevant to the perceived aesthetics and materiality of both conventional and green products, rather than to achieve statistical representativeness of a larger population. The primary objective was to elicit rich, in-depth qualitative data, ensuring that a broad spectrum of opinions, potential conflicts, and nuanced interpretations would emerge during the focus group discussion. The ethical protocol was strictly followed. Participation was voluntary and based on informed consent. Before the discussion began, each participant was informed of the study’s purpose, guaranteed anonymity and data confidentiality, and provided written consent for the audio-video recording of the session, in accordance with GDPR ethical standards. Full details of the ethical protocol and interview guide are available in Supplementary Material S1.

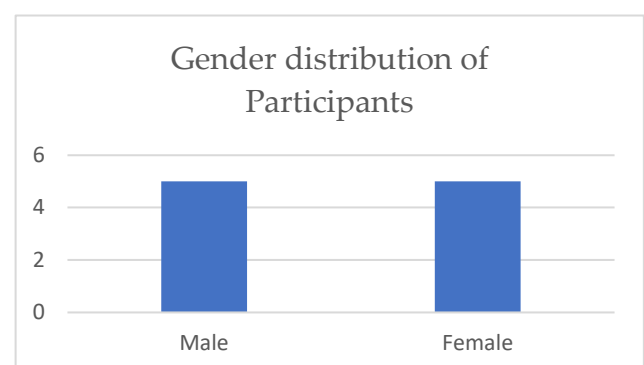
Table 1. Anonymized demographic profile of the focus group participants. Source: Own study, based on semi-structured interviews with participants (P1–P10). Detailed anonymized summaries are provided in Supplementary File S2.

Code	Gender	Age	Occupation
P1	Male	32	Software Engineer
P2	Female	28	Architect
P3	Male	45	Sales Manager
P4	Female	38	Teacher
P5	Male	22	Design Student
P6	Male	51	Accountant
P7	Female	30	Environmental Activist
P8	Female	68	Retired
P9	Male	41	Entrepreneur
P10	Female	44	Doctor

Figure 1: Demographic Distribution of Focus Group Participants: (a) Age Distribution of Participants: This bar chart illustrates the breakdown of participants by age range. The majority of participants fall into the younger active consumer segments, with 3 participants each in the 20–30 and 31–40 age ranges. Two participants are represented in the 41–50 age range, while the 51–60 and 60+ age categories each include one participant. This distribution ensures a strong representation of active consumers alongside valuable perspectives from older age groups, contributing to intergenerational diversity. (b) Gender Distribution of Participants: This bar chart displays an ideally balanced gender distribution among the participants, with 5 males and 5 females. This equal representation is a methodological strength, ensuring that the viewpoints of each gender are equally weighted and minimizing potential gender-related biases in data interpretation. (c) Occupation Distribution of Participants: This bar chart details the occupational diversity of the participants, reflecting an intentional effort to capture a broad spectrum of professional experiences and perspectives. The “Technical/Engineering,” “Education,” and “Healthcare” categories each include 1 participant, while “Creative/Design” and “Business/Sales” each have 2 participants. The largest category, “Other,” comprises 3 participants, likely encompassing roles such as “Environmental Activist,” “Retired,” and “Entrepreneur” as detailed in Table 1. This occupational variety is crucial for gathering diverse insights into product aesthetics, functionality, and perceived value, informed by distinct professional contexts.



(a)



(b)

Figure 1. Cont.

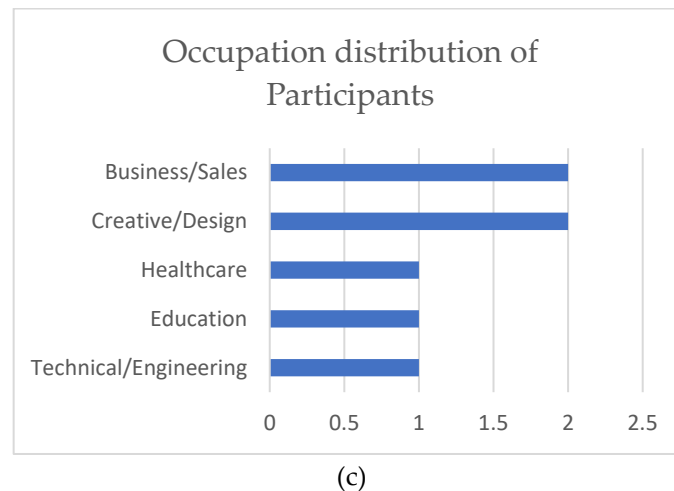


Figure 1. Demographic Distribution of Focus Group Participants: (a) Age Distribution of Participants; (b) Gender Distribution of Participants; (c) Occupation Distribution of Participants. Source: Own study, based on semi-structured interviews with participants (P1–P10). Detailed anonymized summaries are provided in Supplementary File S2.

2.3. Data Collection Procedure

The data collection procedure was structured to allow for a progressive exploration from general reactions to in-depth analysis. The core of the methodology was the use of physical stimulus products to anchor the discussion in a concrete, multi-sensory experience. Two pairs of products were selected, each containing a conventional and a green alternative with identical functionality, as presented visually in Figure 2.



Figure 2. Stimulus products used in the focus group session. (a) Pair 1: toothbrushes (model–conventional vs. Bamboo–green); (b) Pair 2: water containers (PET–single-use vs. reusable). Source: Supplementary File S2, created by the authors.

The selection of stimulus products followed a principle of maximized contrast between design archetypes. For the toothbrush pair (Figure 2a), the conventional plastic model was chosen as a representative of the “technical” paradigm: it features a complex ergonomic shape, multi-material construction (different plastics for handle and grip), vibrant colors, and a glossy finish, all communicating advanced industrial design, performance, and precision typically associated with established brands. In contrast, the Bamboo toothbrush was selected to represent the “natural” paradigm, characterized by its minimalist design, a single primary material (bamboo) for the handle with its inherent wood grain, and an unadorned aesthetic that evokes simplicity, authenticity, and ecological responsibility.

Similarly, for the water container pair (Figure 2b), the single-use PET bottle, with its clear, smooth PET plastic body, standard screw cap, and glossy, brightly printed label, represents the norm for mass-market, convenience-oriented products. This was contrasted with the reusable bamboo and stainless steel bottle, which, through its prominent use of bamboo for the outer casing and stainless steel for the interior, communicates durability, a premium tactile experience, and a long-term commitment to waste reduction through its robust, understated aesthetic. Through this careful selection, we aimed to create a clear visual and material tension, prompting participants to articulate and justify their preferences beyond the products' basic functionality.

The focus group session, moderated by one of the authors, followed a semi-structured guide (see Supplementary Material S1) designed to lead participants through a sequential exploration of the products. During the session, the moderator employed active facilitation techniques to ensure balanced participation and to minimize potential dominance or groupthink effects. These techniques included addressing direct questions to quieter participants, reformulating ideas for validation, and encouraging the expression of divergent viewpoints, thereby ensuring the authenticity and diversity of the collected data. This three-phase approach—visual assessment, tactile assessment, and contextual assessment (price)—allowed for the relative isolation of the impact of each type of cue. Table 2 summarizes this perceptual journey, correlating each phase of the protocol with the participants' key activity and the main qualitative finding that emerged.

Table 2. Sequential structure of the focus group protocol and key findings. Source: Supplementary File S2, created by the authors.

Protocol Phase	Key Participant Activity	Main Finding Derived from Data	Representative Quote
I. Visual Evaluation	Choosing the preferred product based solely on visual observation from a distance.	Two opposing aesthetic paradigms emerged: some preferred the “high-tech” look of plastic, others the “natural” aesthetic of bamboo.	P1 (Engineer): “I choose the conventional toothbrush. The design is clean, precise, it looks like a medical product.”/P2 (Architect): “I choose the bamboo toothbrush without hesitation. It’s elegant in its simplicity.”/P3 (Sales Manager): “Plastic is solid, heavy, gives the feeling that it’s well-made. Bamboo is too light, seems fragile. My preference is reinforced.”/P2 (Architect): “The feeling confirms my choice. Bamboo feels alive. Plastic is cold, lifeless.”
II. Tactile (Haptic) Evaluation	Physically handling both products and describing sensations.	The tactile experience generally confirmed the initial visual preference: plastic was associated with “solidity,” bamboo with “warmth” and “authenticity.”	P4 (Teacher): “[I would pay extra because] I feel I’m making the right choice.”/P6 (Accountant): “[I would pay extra] only if I had concrete data that it lasts 50% longer. Otherwise, it feels like a tax on emotions.”
III. Contextual Evaluation (Price)	Making a final purchase decision in a scenario where the eco product has a premium price (+50%).	Willingness to pay the premium was fragmented and dependent on individual value systems (ethical, aesthetic, functional, or safety considerations).	

2.4. Data Analysis

The focus group session was audio and video recorded, and subsequently transcribed verbatim. The transcribed data, along with observational notes taken during the session, formed the primary dataset for analysis. We employed a thematic analysis approach, as

outlined by Braun and Clarke (2006), to systematically identify, analyze, and report patterns (themes) within the data [21]. This iterative process was conducted manually and involved several stages:

- **Familiarization with the Data:** The transcription was read and re-read multiple times by both authors to achieve a deep immersion in the content, noting initial ideas and potential patterns. This involved active reading, highlighting interesting statements, and jotting down preliminary thoughts in the margins.
- **Initial Coding:** In the first coding cycle, segments of the text (phrases, sentences, or paragraphs) were assigned initial codes that captured the essence of the participants' statements. This was an open coding process, where codes were generated inductively from the data, without a pre-existing coding framework. For instance, statements like "looks primitive" or "clean, precise" were coded as 'perception of industrial quality', while "warm, organic" or "imperfection gives character" were coded as 'appreciation of natural aesthetics'. These codes were noted directly on the transcripts or in separate documents.
- **Generating Initial Themes:** Codes were then grouped into potential themes based on their conceptual similarity and recurring patterns. This involved sorting and arranging the individual codes into broader categories. For example, codes related to 'hygiene concerns about bamboo', 'preference for smooth surfaces', and 'association of plastic with medical standards' began to coalesce into the broader theme of 'Technical & Hygienic Paradigm'. Similarly, codes such as 'aesthetic simplicity', 'authenticity of natural materials', and 'connection to nature' grouped into the 'Natural & Authentic Paradigm'. This was facilitated by using different colored highlighters, sticky notes, or tables to visually map relationships between codes.
- **Reviewing Themes:** These initial themes were then reviewed against the entire dataset to ensure they accurately reflected the meanings in the data and that no significant data was overlooked. This involved checking for internal homogeneity (data within a theme cohered meaningfully) and external heterogeneity (clear distinctions between themes). We refined the boundaries of each theme and considered whether any themes needed to be merged, split, or discarded.
- **Defining and Naming Themes:** Once validated, themes were refined, clearly defined, and given concise, descriptive names that captured their core essence. This led to the final three central themes presented in Section 3: "The Perceptual Dichotomy—'Technical & Hygienic' vs. 'Natural & Authentic'," "The Role of Haptic Experience as a Validation (or Invalidation) Factor," and "The Premium Price—Justified as an 'Ethical Tax' or Rejected as a 'Tax on Feelings'."
- **Producing the Report:** The final stage involved selecting compelling illustrative quotes for each theme and weaving them into a coherent narrative that directly addressed the research question.

This systematic manual approach enhanced the rigor and trustworthiness of our qualitative analysis by ensuring a deep engagement with the data at every stage.

3. Results

The analysis of the qualitative data revealed three central themes describing how aesthetics and materiality influence consumer perception of sustainable products. These themes are not mutually exclusive but represent archetypes of thought that can coexist or conflict within the same consumer's mind.

3.1. Theme 1: The Perceptual Dichotomy—“Technical & Hygienic” vs. “Natural & Authentic”

The most prominent finding was the existence of two fundamentally opposing sets of mental associations triggered by the design of the two product types. The coexistence of these two opposing perceptual frameworks is further illustrated in Table 3, which compares how participants interpreted the same design cues.

Table 3. The perceptual dichotomy of design cues: Contrasting interpretations from focus group participants. Source: Supplementary File S2, created by the authors.

Observed Design Attribute	“Technical & Hygienic” Paradigm (Negative Interpretation of the Eco Product)	“Natural & Authentic” Paradigm (Positive Interpretation of the Eco Product)
Material (Bamboo vs. Plastic)	Interpretation: The natural material is perceived as unhygienic, fragile, and low-quality. Participant example: P10 (Doctor): “The porous texture of bamboo confirms my concern. How do you clean it properly? Smooth plastic is the medical standard.”	Interpretation: The natural material is perceived as authentic, pleasant to the senses, and responsible. Participant example: P2 (Architect): “The feeling confirms my choice. Bamboo is light, warm, organic. It feels alive. Plastic is cold, lifeless, inert.”
Overall Aesthetics (Minimalist vs. Complex)	Interpretation: The minimalist design of the eco product signals amateurism and lack of technology. Participant example: P1 (Engineer): “The [conventional] design is clean, precise, looks like a medical product. The bamboo one looks... primitive.”	Interpretation: The minimalist design of the eco product signals elegance, honesty, and alignment with current trends. Participant example: P5 (Design Student): “It’s much more on-trend. Minimalist aesthetics, natural material—everything communicates a modern, conscious lifestyle.”
Packaging (Cardboard vs. Plastic Blister)	Interpretation: Simple cardboard packaging is seen as cheap and unprotected. Participant example: P3 (Sales Manager): “In its cardboard box, it looks like something sold at a market. The sealed one seems from a big, serious company.”	Interpretation: Cardboard packaging is a strong, direct signal of the brand’s environmental responsibility. Participant example: P4 (Teacher): “The cardboard packaging immediately tells me the producer considered environmental impact. It’s a sign of respect.”
Finish and Weight (Imperfect vs. Perfect)	Interpretation: Low weight and small imperfections of the natural material indicate fragility and lack of quality control. Participant example: P6 (Accountant): “Bamboo is very light, which reinforces my impression that it’s not durable. I would always be careful not to break it.”	Interpretation: Low weight and imperfections are reframed as signs of uniqueness and authenticity. Participant example: P4 (Teacher): “I don’t mind if it’s not perfectly smooth. The material’s imperfection gives it character.”
Familiarity of Design (New vs. Known)	Interpretation: The unfamiliar design of the eco product generates skepticism and is perceived as a risk. Participant example: P8 (Retired): “This blue one (plastic). I recognize it. That’s what a toothbrush looks like. The wooden one... it’s strange. I stick with what I know.”	Interpretation: The new design of the eco product is a desirable differentiator, an escape from the banality of mass-market products. Participant example: P2 (Architect): “The other one is just a piece of plastic, visually noisy, generic.”

- The “Technical & Hygienic” Paradigm: A significant segment of participants, particularly those with a technical (P1-Engineer) or medical (P10-Physician) background, associated the conventional plastic product with positive values such as precision, hygiene, and safety.

“I choose the conventional toothbrush. The design is clean, precise, it looks like a medical, technological product. The other one, made of bamboo, looks... primitive.” (P1)

“The porous texture of the bamboo confirms my concern. How can it be cleaned effectively? Smooth, non-porous plastic is the standard in medicine for this exact reason.” (P10)

For this group, perfect finishes, smooth materials, and complex designs signal a controlled, industrial manufacturing process, which is considered superior and safer.

- The “Natural & Authentic” Paradigm: Another segment, often with a creative (P2-Architect, P5-Design Student) or ethically-oriented (P4-Teacher) profile, interpreted the same cues in the opposite way. The green product was associated with authenticity, warmth, and responsibility.

“I choose the bamboo toothbrush, without hesitation. It is elegant in its simplicity. The material is warm and has a visible texture. The other one is just a piece of plastic, visually noisy, generic.” (P2)

“I don’t care if it’s not perfectly smooth. The imperfection of the material gives it character.” (P4)

For this group, the simplicity of the design and the “imperfections” of the natural material are signals of honesty and uniqueness, in contrast to the “soulless” uniformity of plastic.

3.2. Theme 2: The Role of Haptic Experience as a Validation (Or Invalidation) Factor

The study showed that while the initial decision is often visual, physical interaction (haptic) plays a crucial role in confirming or refuting the first impression.

- Confirmation: For participants who initially preferred the green product, the tactile sensation of the natural material amplified their preference.

“The sensation confirms my choice. The bamboo is light, warm, organic. It feels alive. The tactile connection with a natural material is much more pleasant.” (P2)

- Invalidation: For other participants, the haptic experience invalidated any initial visual curiosity.

“The plastic is solid, heavy, it feels well-made. The bamboo is too light, it seems fragile, like a toy.” (P3)

Weight and density emerged as important haptic heuristics for durability, while texture was an indicator of hygiene or authenticity.

3.3. Theme 3: The Premium Price—Justified as an “Ethical Tax” or Rejected as a “Tax on Feelings”

The introduction of a +50% premium price for the green product acted as a catalyst, forcing participants to clearly articulate their value systems (Table 4).

Table 4. Matrix of justification for the premium price of the green product. Source: Supplementary File S2, created by the authors.

Participant Profile (Archetype)	Acceptance/Rejection of Premium Price	Main Reasoning (Illustrative Quote)	Analytical Conclusion
Ethical Consumer (P4)	Acceptance	“I feel I’m paying for the right choice. It’s a small price for a more peaceful conscience.”	The price is a voluntary “ethical tax,” a payment for alignment with personal values.
Aesthetic Consumer (P2, P5)	Acceptance	“I pay for design, for the material, and for the pleasant feeling. It’s an investment in an object that brings me aesthetic joy.”	The price is a payment for a superior sensory experience and membership in an aesthetic “tribe.”

Table 4. Cont.

Participant Profile (Archetype)	Acceptance/Rejection of Premium Price	Main Reasoning (Illustrative Quote)	Analytical Conclusion
Pragmatic Consumer (P1, P6)	Rejection	“Why would I pay more for a product that seems less durable? I would only pay if it were proven to last longer.”	The price is accepted only if it justifies a quantifiable functional or durability advantage (return on investment).
Skeptical/Safety-Oriented Consumer (P10)	Conditional Rejection	“I would only pay if the manufacturer presented studies showing bamboo has superior antibacterial properties. Without evidence, it’s a risk.”	The price is accepted only if supported by scientific evidence that mitigates perceived risk (hygienic/medical).
Traditionalist Consumer (P8)	Rejection	“Never! Why pay more for something strange that may not even be good? It’s a scam.”	The premium price for an unfamiliar product is perceived as deceitful, lacking any trust basis.
Status-Oriented Consumer (P3, P9)	Rejection	“Value lies in the brand and perception of a premium product, and the bamboo toothbrush has none of that.”	The premium price is accepted only for well-known brands. For new products, it is rejected if not supported by status signals.

- Acceptance as an “Ethical Tax” or “Investment in Values”: Participants oriented towards sustainability or aesthetics justified the price as a conscious payment for non-functional benefits.

“I feel like I am paying for the right choice. It’s a small price for a clearer conscience.” (P4)

“You are not just paying for the toothbrush, but to be part of an aesthetic ‘tribe’. It’s a statement piece.” (P5)

- Rejection as a “Tax on Feelings” or “Unjustified Marketing”: Participants with a pragmatic, technical, or economic worldview rejected the premium price in the absence of a demonstrable functional advantage.

“I would pay the higher price only if the producer gave me concrete data that the bamboo brush lasts 50% longer. Without such proof, it’s just a tax on feelings.” (P6)

“Why would I pay more for a product that looks cheaper and seems less durable? The value lies in the brand and the perception of a premium product.” (P3)

4. Discussion

The results of this qualitative study offer a nuanced perspective on the challenges that sustainable products face at the point of sale. They show that design is not merely a “wrapper” for sustainability, but a complex language that can be interpreted in radically different ways by diverse consumer segments.

4.1. There Is No Universal “Sustainable Aesthetic”

The main finding is that there is no single aesthetic formula for the success of a green product. The dichotomy between the “technical” and “natural” paradigms suggests that designers and marketers must make a strategic decision: which consumer archetype are they addressing? Attempting to please everyone risks creating a hybrid product with no clear identity, which fails to fully convince any segment. A product aiming to

communicate safety and efficiency (e.g., for an audience like P10-Physician) should adopt a different visual and material language than one aiming to communicate authenticity and a connection to nature (e.g., for an audience like P2-Architect).

4.2. Positioning Against Existing Literature and Specific Contribution

To highlight the specific contribution of this paper to the field of sustainability, it is useful to compare it with other studies that directly investigate consumer perception of green product or packaging design.

A significant similarity lies in the exploratory purpose and methodology of our study, as observed in previous works with works such as that of Steenis et al. (2017) [20]. They used a mixed-methods approach, including focus groups, to understand how different designs of sustainable packaging (e.g., bioplastics) are perceived by consumers. Similar to our findings, they discovered that innovative materials can generate both positive (sustainability) and negative (lack of functionality or safety) associations [20]. Our study builds on this direction but focuses more deeply on the aesthetic dichotomy (“Technical & Hygienic” vs. “Natural & Authentic”) as a central explanatory framework for these ambivalent perceptions.

The fundamental difference, and thus our unique contribution, is evident when comparing our study to experimental research testing the “unfilled promise” of sustainable design, such as that by Pancer et al. (2017) [22]. In a series of experiments, they demonstrated that when packaging has a strong green visual design (e.g., natural colors, images of leaves), consumers may paradoxically infer that the product inside is less effective or efficient [22]. Their study masterfully answers the question, “What unintended effects can green aesthetics have?”, showing that sustainable design can create a perceived trade-off between ethics and efficacy.

Our study complements and nuances this perspective. While Pancer et al. focus on the “sustainability vs. performance” trade-off, our qualitative data reveals another, often antecedent, trade-off: “sustainability vs. safety/hygiene.” When our participant P10 (Physician) rejects bamboo due to its porous texture, her concern is not related to brushing efficiency but to microbiological risk. Therefore, the specific contribution of our paper is the identification of this fundamental perceptual barrier (hygiene/safety), which can precede and override any subsequent consideration of product performance. We do not just show *that* sustainable design can fail, but we explain *why*, by uncovering a set of mental heuristics (“smooth = clean,” “porous = dangerous”) that designers of sustainable products must actively address and counteract.

4.3. Materiality as a Central Message

The study underscores the critical importance of materiality. In a market saturated with marketing messages (greenwashing), the material itself becomes the most honest and convincing messenger. Unlike text on a package, a tactile sensation cannot be “faked” [10]. Choosing a material that not only *is* sustainable but also *communicates* sustainability through its texture, weight, and temperature can be a decisive differentiator.

4.4. Beyond Visual and Haptic: The Auditory and Olfactory Signature of Sustainability

Although our study focused on visual and haptic cues, the focus group dynamic suggests that a complete product experience is multi-sensory. Participant perceptions appear to be influenced, at a subconscious level, by auditory and olfactory stimuli that reinforce the “Technical & Hygienic” vs. “Natural & Authentic” dichotomy.

The auditory dimension of the interaction seems to function as an important cue, particularly in the act of opening the package, a concept explored in the field of product sound design [23]. Unpacking a plastic blister pack (like that of the Aquafresh toothbrush)

produces a sharp, crackling sound, which can be associated with the technical paradigm—an industrial sound that signals sealing and security but can also be perceived as aggressive. In contrast, opening a cardboard box (like that of the Colgate Bamboo toothbrush) produces a muted rustle, an organic and discreet sound. It is plausible that this “quieter” sound contributed to the perception of “respect” and “calmness” expressed by participants like Ana (P4). Similarly, the sound of a bamboo cap screwing onto stainless steel (the VanaVita bottle) is often a full-bodied one, denoting precision and solidity, unlike the thin “click” of a PET cap.

The olfactory dimension, though subtle, also appears to contribute to the overall product perception, an aspect aligned with sensory marketing research that highlights the role of smell in shaping preferences [24]. Conventional plastic is generally odorless, a characteristic that reinforces the perception of an “inert,” “sterile,” and “medical” material (P1, P10). This olfactory neutrality aligns perfectly with the “Technical & Hygienic” paradigm. On the other hand, natural materials have a distinct olfactory signature. The bamboo handle has a very faint, woody, natural scent. This olfactory stimulus, though subtle, contributes to the construction of a perception of “authenticity” and a “living product” (P2), reinforcing the “Natural & Authentic” paradigm. The smell of recycled cardboard, often perceived as “clean” and “earthy,” acts similarly as a cue of ecological honesty.

Although not directly measured, these additional sensory dimensions appear to work in synergy with aesthetics and materiality, creating a complete sensory signature for each product. It is this signature that ultimately validates or contradicts the brand’s sustainability story in the consumer’s mind.

4.5. Implications for Design and Marketing

Based on these findings, we formulate three practical implications:

1. Segmentation based on values, not demographics: Companies should segment their audience not just by age or income, but by their value systems (e.g., “safety seekers,” “authenticity seekers,” “rational optimizers”).
2. Design as a coherent story: The visual aesthetics, materiality, packaging, and price must tell the same story. A bamboo toothbrush (authentic material) in a plastic blister pack (conventional packaging) creates a cognitive dissonance that undermines trust.
3. Educating the consumer through design: To overcome perceptual barriers (e.g., “bamboo = fragile”), design can incorporate elements that subtly communicate durability (e.g., a thicker cross-section, a metal reinforcing element) or hygiene (e.g., a protective cap, a visible certification).

4.6. Study Limitations

We acknowledge the inherent limitations of this research. As a qualitative study based on a single focus group of 10 people from a specific cultural context (Romania, urban), the results cannot be statistically generalized. The goal was to generate hypotheses and in-depth understanding, not to measure the prevalence of these attitudes in the general population. This is a fundamental characteristic of qualitative research, where the goal is to generate in-depth understanding and hypotheses rather than to measure the prevalence of attitudes or behaviors across broad demographics. The small sample size, while appropriate for achieving thematic saturation and exploring nuanced perceptions, does not allow for inferential statistical analysis. Therefore, the findings should be interpreted as contextual insights and potential frameworks for understanding consumer behavior, rather than definitive statements about the general market.

Furthermore, several potential sources of bias warrant discussion:

- **Sampling Bias:** While we employed purposive sampling to ensure a diversity of profiles, the recruitment process was non-random, and participants were self-selected. This means that individuals who chose to participate might have a pre-existing interest in sustainability or consumer products, potentially leading to a sample that is not entirely representative of the broader consumer base and thus potentially skewing the insights.
- **Moderator Bias:** Although active facilitation techniques were used to ensure balanced participation and minimize groupthink, the moderator's presence, personality, and questioning style could subtly influence participants' responses or guide the discussion in certain directions.
- **Social Desirability Bias:** Participants might have felt inclined to express more "pro-environmental" attitudes or preferences they perceived as socially acceptable, even if these did not perfectly align with their actual behaviors or privately held beliefs. The group setting of a focus group can sometimes amplify this effect, as individuals may conform to perceived group norms.
- **Product Brand Influence:** Another limitation is the use of products with well-known commercial brands (e.g., Colgate, Aquafresh). While our questions were formulated to focus explicitly on design attributes, we cannot completely rule out the confounding variable of brand loyalty or pre-existing perceptions associated with these brands. Future studies could benefit from using unbranded, neutral products to better isolate the pure impact of aesthetics and materiality.

The chosen stimulus products represent only a small fraction of the universe of sustainable products (toothbrushes and water bottles). Future studies could explore other product categories (e.g., electronics, textiles, food packaging) or quantitatively test the hypotheses generated here on representative samples to assess their broader applicability.

Additionally, being conducted in a specific Romanian cultural context, it is possible that certain associations (e.g., a degree of skepticism towards "artisanal-looking" products, or specific cultural associations with 'natural' vs. 'industrial' aesthetics) may be more pronounced. The cross-cultural validity of the perceptual dichotomy identified here remains an open question, and international comparative studies would be necessary to test the universality of these paradigms.

Finally, a limitation of the current study design is its exclusive focus on the visual and tactile senses. As our discussion suggests, it is highly likely that auditory (e.g., the sound of opening the package) and olfactory (e.g., the scent of the materials) stimuli play an important, albeit subconscious, role in shaping perceptions. A promising direction for future research would be to design studies that isolate and measure the impact of these additional senses to build a truly holistic understanding of the complete sensory experience of sustainable products.

5. Conclusions

This research demonstrates that, in the on-shelf competition, sustainable products fight not only on the basis of price and functionality but also on that of sensory perception. Visual design and materiality are not superficial aspects but powerful cues that can attract or repel consumers based on deeply ingrained mental associations.

The study identified a fundamental tension between two visions of "quality": one anchored in the technical perfection of the industrial era and another in the authenticity of natural materials, specific to the new sustainability paradigm. The success of the widespread adoption of green products will depend on the ability of designers to navigate this tension and to create objects that are not only better for the planet but also commu-

nicate this benefit in a compelling sensory language for their target audience. To build a sustainable future, we must design not only better materials but also stronger perceptions.

Building upon the insights generated by this qualitative exploration, several avenues for future research emerge to deepen our understanding:

- **Quantitative Validation and Generalization:** Future studies could quantitatively test the hypotheses generated here (e.g., the prevalence of the “Technical & Hygienic” vs. “Natural & Authentic” paradigms) on larger, statistically representative samples across different demographics, thereby assessing the generalizability of our findings.
- **Cross-Cultural Comparative Studies:** Since this study was conducted within a specific Romanian context, it would be crucial to investigate the perceptual dichotomy and associated value systems across diverse cultural contexts (e.g., Western Europe, Asia, North America). Such studies could determine whether these aesthetic preferences are universal or culturally specific, and how they impact purchase intention.
- **Multi-Sensory Product Experience:** Beyond visual and haptic cues, future research should systematically examine the role of auditory (e.g., packaging or product-use sounds) and olfactory (e.g., natural material scents, absence of artificial smell) stimuli in shaping consumer perceptions of sustainable products. Experimental designs that isolate and measure the impact of each sensory dimension would be especially valuable.
- **Longitudinal Studies on Product Adoption:** Exploring how initial sensory perceptions translate into long-term adoption and loyalty to sustainable alternatives would provide important insights into consumer habit formation and the sustained influence of design.
- **Targeted Design Interventions:** Applied research could focus on developing and testing specific design interventions (e.g., incorporating visual cues of hygiene into natural products, or tactile elements that convey durability) to bridge the perceptual gap between ethical intent and consumer acceptance, tailored to different consumer segments.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/su17209082/s1>, S1: Semi-Structured Focus Group Guide and Methodological Protocol; S2: Detailed, Anonymized Summaries of the Focus Group Discussion.

Author Contributions: Conceptualization, A.-M.N. and P.P.; methodology, A.-M.N. and P.P.; software, A.-M.N. and P.P.; validation, A.-M.N. and P.P.; formal analysis, A.-M.N. and P.P.; investigation, A.-M.N. and P.P.; resources, A.-M.N. and P.P.; data curation, A.-M.N. and P.P.; writing—original draft preparation, A.-M.N. and P.P.; writing—review and editing, A.-M.N. and P.P.; visualization, A.-M.N. and P.P.; supervision, A.-M.N. and P.P.; project administration, A.-M.N. and P.P.; funding acquisition, A.-M.N. and P.P. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Romanian Ministry of Education and National University of Science and Technology Politehnica Bucharest through the PubArt Program.

Institutional Review Board Statement: The study was approved by the Ethics Committee of the National University of Science and Technology Politehnica Bucharest (protocol code Nr. 20/18.09.2025).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available in the Supplementary Material. Further inquiries can be directed to the corresponding author.

Acknowledgments: The authors would like to thank the participants of the focus group for their time and valuable insights, which were essential to the completion of this research.

Conflicts of Interest: The authors declare no conflict of interest.

References

- Geissdoerfer, M.; Savaget, P.; Bocken, N.M.P.; Hultink, E.J. The Circular Economy—A New Sustainability Paradigm? *J. Clean. Prod.* **2017**, *143*, 757–768. [\[CrossRef\]](#)
- European Commission. *A New Circular Economy Action Plan for a Cleaner and More Competitive Europe*; COM (2020) 98 Final; European Commission: Brussels, Belgium, 2020. Available online: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0098> (accessed on 15 May 2025).
- Bocken, N.M.P.; de Pauw, I.; Bakker, C.; van der Grinten, B. Product Design and Business Model Strategies for a Circular Economy. *J. Ind. Prod. Eng.* **2016**, *33*, 308–320. [\[CrossRef\]](#)
- Gleim, M.R.; Smith, J.S.; Andrews, D.; Cronin, J.J., Jr. Against the Green: A Multi-Method Examination of the Barriers to Green Consumption. *J. Retail.* **2013**, *89*, 44–61. [\[CrossRef\]](#)
- Liu, X.; Kim, T.-H.; Lee, M.-J. The Impact of Green Perceived Value Through Green New Products on Purchase Intention: Brand Attitudes, Brand Trust, and Digital Customer Engagement. *Sustainability* **2025**, *17*, 4106. [\[CrossRef\]](#)
- Tanner, C.; Wölfling Kast, S. Promoting Sustainable Consumption: Determinants of Green Purchases by Swiss Consumers. *Psychol. Mark.* **2003**, *20*, 883–902. [\[CrossRef\]](#)
- Pickett-Baker, J.; Ozaki, R. Pro-Environmental Products: Marketing Influence on Consumer Purchase Decision. *J. Consum. Mark.* **2008**, *25*, 281–293. [\[CrossRef\]](#)
- Richardson, P.S.; Dick, A.S.; Jain, A.K. Extrinsic and Intrinsic Cue Effects on Perceptions of Store Brand Quality. *J. Mark.* **1994**, *58*, 28–36. [\[CrossRef\]](#)
- Bloch, P.H. Seeking the Ideal Form: Product Design and Consumer Response. *J. Mark.* **1995**, *59*, 16–29. [\[CrossRef\]](#)
- Rex, E.; Baumann, H. Beyond Ecolabels: What Green Marketing Can Learn from Conventional Marketing. *J. Clean. Prod.* **2007**, *15*, 567–576. [\[CrossRef\]](#)
- Gulzar, Y. Who Is Buying Green Products? The Roles of Sustainability Awareness and Brand Trust. *Sustainability* **2024**, *16*, 7875. [\[CrossRef\]](#)
- Testa, F.; Iraldo, F.; Vaccari, A.; Ferrari, E. Why Eco-Labels Can Be Effective Marketing Tools: A Case Study on the European Ecolabel. *J. Clean. Prod.* **2015**, *105*, 225–235. [\[CrossRef\]](#)
- Hekkert, P. Design Aesthetics: Principles of Pleasure in Design. *Psychol. Sci.* **2006**, *48*, 157–172. Available online: https://www.researchgate.net/publication/26514491_Design_aesthetics_Principles_of_pleasure_in_design (accessed on 20 May 2025).
- Karana, E.; Hekkert, P.; Kandachar, P. Material Considerations in Product Design: A Guide for Selecting Materials for Product Experience. In *Materials Experience*; Karana, E., Pedgley, O., Rognoli, V., Eds.; Butterworth-Heinemann: Oxford, UK, 2014; pp. 21–36.
- Peck, J.; Childers, T.L. To Have and to Hold: The Influence of Haptic Information on Product Judgments. *J. Mark.* **2003**, *67*, 35–48. [\[CrossRef\]](#)
- Suh, M. Exploring the Impact of Sustainability Trade-Offs: The Role of Conditional Morality in Sustainable Consumption. *J. Behav. Decis. Mak.* **2024**, *37*, 702–718. [\[CrossRef\]](#)
- Luchs, M.G.; Swan, K.S.; Creusen, M.E.H. The Sustainable Product-Service System Preference Paradox: The Role of Perceived Diagnosticity of Sustainability Information. *J. Prod. Innov. Manag.* **2016**, *33*, 284–301. [\[CrossRef\]](#)
- Ji, S. Aesthetics of Sustainability: Research on the Design Strategies for Emotionally Durable Visual Communication Design. *Sustainability* **2022**, *14*, 4649. [\[CrossRef\]](#)
- Krueger, R.A.; Casey, M.A. *Focus Groups: A Practical Guide for Applied Research*, 5th ed.; Sage Publications: Los Angeles, CA, USA, 2014. Available online: <https://books.google.ro/books?id=tXpZDwAAQBAJ&printsec=frontcover&hl=ro#v=onepage&q&f=false> (accessed on 27 May 2025).
- Steenis, N.D.; van Herpen, E.; van der Lans, I.A.; Ligthart, T.N.; van Trijp, H.C.M. Consumer Response to Different Designs of Sustainable Food Packaging. *Appetite* **2017**, *118*, 91–103.
- Braun, V.; Clarke, V. Using thematic analysis in psychology. *Qual. Res. Psychol.* **2006**, *3*, 77–101. [\[CrossRef\]](#)
- Pancer, E.; McShane, L.; Noseworthy, T.J. The Unfilled Promise of Sustainable Packaging. *J. Assoc. Consum. Res.* **2017**, *2*, 353–369. [\[CrossRef\]](#)
- Spence, C.; Wang, Q. Sensory Expectations Elicited by the Sounds of Opening the Packaging and Pouring a Beverage. *Flavour* **2015**, *4*, 35. [\[CrossRef\]](#)
- Krishna, A. An Integrative Review of Sensory Marketing: Engaging the Senses to Affect Perception, Judgment and Behavior. *J. Consum. Psychol.* **2012**, *22*, 332–351. [\[CrossRef\]](#)

Disclaimer/Publisher’s Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.