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"The Aesthetics of Retro futurism Style in Product Design and Its Impact on Sustainability

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Abstract

Product design aesthetics are considered one of the fundamental design factors that attract consumers to acquire products, as they reflect the prevailing tastes of societies across different cultures, particularly when these aesthetics support sustainability in both design and production in order to preserve environmental aspects.

Recent trends in product design have revealed the emergence of contemporary design styles that incorporate visual characteristics, forms, and color schemes inspired by the past, yet reinterpreted through a modern lens that aligns with technological advancement and users' future-oriented expectations. These designs maintain a distinctive and exceptional character, characterized by unique aesthetic qualities. Through analysis, it has been found that such styles embody numerous attributes that contribute to product sustainability.

Accordingly, studying the reasons and motivations behind the tendency of public taste to revisit the past in shaping future design aesthetics and formal expressions becomes essential, particularly in terms of understanding the impact of this trend on design sustainability. This research aims to explore the underlying motivations that may contribute to the emergence of a design style rooted in the past, identify its key characteristics, and examine its relationship with sustainable design strategies. Furthermore, the study seeks to determine the extent to which the retro style influences sustainability in industrial product design.

The research hypothesizes that, if the positive impact of the retro style on design sustainability is established, this will in turn encourage designers to adopt and further develop this style within contemporary product design practices.

Keywords

Retro, product design, design aesthetics, Nostalgia, sustainability, sustainable design strategy.

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Introduction:

Rapid technological advancement and the dominance of technological styles in industrial product design are considered among the main factors that have triggered users' nostalgia for the past, including its visual language, forms, and details. This tendency has led to the emergence of new design styles that blend the characteristics of the past with the modernity of the present, evoking a sense of familiarity and emotional resonance, and strengthening the user's attachment to the product.

There are numerous contemporary design schools and trends that adopt this philosophy in producing product designs characterized by originality and distinctiveness. These styles vary according to different cultures, as well as the stored memories and accumulated user experiences throughout life, which often generate an internal desire to see specific visual expressions in products that reflect a personal perception of the past.

Within this context, the retro style has emerged as one of the most effective design approaches for creating innovative products with a renewed character, where technology is integrated with historical references in a way that satisfies users' nostalgic emotions. In recent years, with the growing emphasis on environmental concerns and the importance of sustainability in design, the success of product design has increasingly depended on achieving sustainability across both design and manufacturing processes.

Therefore, studying the positive impact of the retro style on product sustainability can significantly encourage its wider adoption, due to its beneficial environmental implications, and can motivate designers to further develop and apply its principles and characteristics within contemporary product design practices.

The Problem:

Studying users' preferences and motivations toward the Retro style, which has become increasingly popular, and examining its relationship with sustainability in industrial product design, as well as determining whether this style plays a positive or

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negative role in supporting product sustainability.

Aims:

To identify the importance of Retro design style in product design and determine the relation of retro and Sustainability

Methodology:

Collecting Data & analysis

Review of literature:

1- What Retro style?

The term "retro" is widely utilized across various industrial fields. It originates from the Latin prefix retro, which means "backwards" or "in past times." From a general standpoint, the term refers to something that is "related to, reminiscent of, or involving things from the past" (The American Heritage Dictionary, 2009).

The concept of "retro-futurism" emerged from the fusion of two words: "retro" and "futuristic," both directly connected to the notion of time. As Roselló (2013) explains, the word "retro" is derived from Latin and signifies the act of imitating or reproducing objects from earlier times. In contrast, "futuristic" pertains to a future context, where dissatisfaction with the present leads people to envision and construct the future from a past-oriented perspective (Roselló, 2013).

Influenced by avant-garde magazines from the 1980s and 1990s, the term "retro-futurism" was first introduced by American publisher Lloyd Dunn in 1983. A year later, the concept was further explored through a Smithsonian Institution exhibition titled "Yesterday's Tomorrows: Past Visions of an American Future," which showcased a collection of popular imagery representing past visions of the future (Donnelly & Hayward, 2012).

Terms like "retro-futurism" and "retro-modernism" are used to reinterpret historical design movements-such as the "Space Age" and "Atomic Age"-through a modern lens. This approach reflects the reimagining of past aesthetic values within a contemporary context. As a result, futuristic visions from the 1950s and 1960s have been revitalized in today's design practices as a retro-futurist aesthetic. While both approaches preserve the aesthetic essence of the past, they pursue different objectives. Retro-modern design focuses on strengthening users' emotional connections to history while meeting functional demands and contemporary lifestyle needs. Retro-futurist design, on the other hand, merges the futuristic imagination of the past with modern technologies, appealing to those seeking a blend of nostalgia and innovation. Both approaches offer distinct contributions to product design by presenting varied interpretations of aesthetic values from both past and future.

The Rivian R3 stands as a prime example of retro-modern design aesthetics, whereas the Tesla Cybertruck is a significant symbol of the retro-futurism movement. Vehicles like the Volkswagen ID Buzz illustrate how these design approaches-once mainly associated with concept cars such as the Hyundai Heritage Series Grandeur EV, Peugeot E-Legend, Honda HP-X, and Hyundai N Vision 74-have successfully transitioned into mass production, highlighting the commercial appeal of this aesthetic trend.



Rivian R3



Tesla Cybertruck

Figure 1- Retro style in modern car industries

Several studies have confirmed the positive relationship between design aesthetics and product sustainability. These studies indicate that aesthetically appealing products encourage users to retain them for longer periods, reduce disposal rates, enhance users' psychological satisfaction, and decrease their desire for replacement. In addition, they highlight that certain aesthetic aspects have a positive impact on product sustainability, including:

Emotional Attachment: The stronger the user's emotional connection to a product, the more likely they are to retain it for a longer period.

Identity: When a product reflects the user's personality and self-image, it becomes an integral part of their identity.

Symbolism: Products that carry emotional meanings or symbolic values tend to have greater longevity and user retention.

Simplicity and Clarity: Simple and clear aesthetics remain appealing over time and reduce the impact of changing fashion trends.

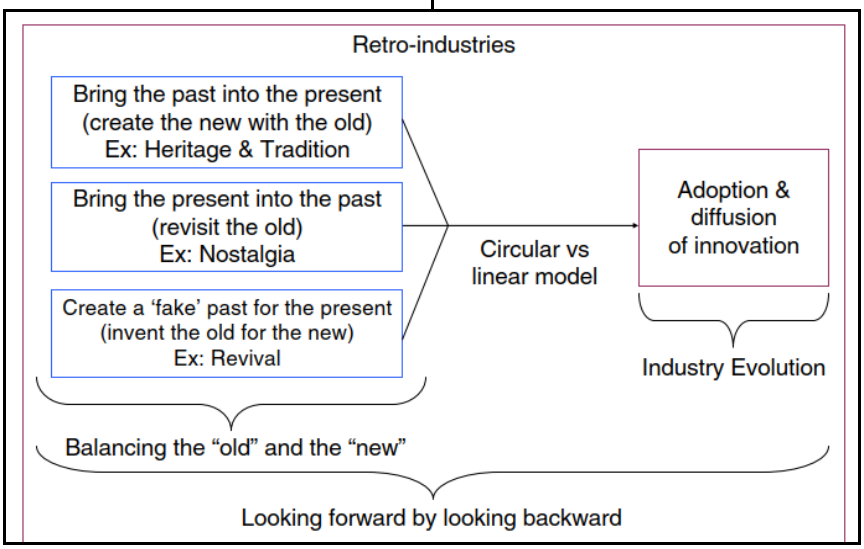
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Aesthetic Innovation: Creativity in aesthetic design enhances product uniqueness and extends its lifespan in use

Other studies have introduced the concept of retrogression as an alternative perspective for analyzing, understanding, and adopting innovation and its diffusion within the context of industrial development. These studies identified marketing and managerial factors that influence the adoption and diffusion of innovation within the Retro style context. They demonstrated that heritage, traditions, and nostalgia, along with the revival of the past, play a central role in explaining the emergence and development of this style and its impact on users. The Retro style combines a sense of modernity with a feeling of security associated with the past through its revival. Furthermore, these studies confirmed that looking back to the past provides valuable insights into the evolution of industry.

While most studies adopt a "looking forward" approach (Klepper, 1996), So the Dejavu Effect is no more a feeling or a mental construction (Brown, 2001). Hence, this type of industries represents a rich research agenda.

The following diagram illustrates a model for the adoption and diffusion of innovation in retro industries and clarifies the nature of the relationships between the past and the present within industrial contexts. It explains the concept of retrogression by showing that bringing the past into the present with its original identity and characteristics is referred to as heritage or tradition. In contrast, bringing the present into the past through the influence of certain contemporary features is described as nostalgia. Meanwhile, the revival of an entire past—along with its attributes, environment, and reality—recreated in the form of simulation is defined as revival.



A model of adoption and diffusion of innovation in retro-industries Figure 2 –

2- Why Retro style?

Users' desire to return to the past arises from specific motivations, which can be summarized as follows:

Personal Direct Experience: The user's desire to relive a direct personal experience from the past and the nostalgia associated with practicing it again.

Cultural Direct Experience: The desire to re-engage in a specific collective cultural behavior previously experienced with other individuals or groups.

Interpersonal Indirect Experience: Being influenced by others' personal experiences of the past, even without having lived through them directly.

Virtual Indirect Experience: Being influenced by the cultural experiences of others that have left a distinctive impact, leading to a desire to virtually relive or reinterpret those experiences.

These perceived experiences foster a persistent sense of nostalgia among users, encouraging them to engage with product designs and aesthetics that evoke the revival of past experiences in an innovative form. Such designs also enhance users' sense of security by allowing greater emotional control through the product usage experience

This makes the analysis of these factors in industrial product design essential, as such design approaches have gained widespread acceptance among users and attract a broad base of admirers across different age groups. Moreover, they open new horizons for diversity and uniqueness in design, while creating opportunities for innovation through the use of more authentic elements and previously established usage patterns and experiences.

There are various design approaches and methods that achieve the Retro style by applying different

design concepts, each influencing the way the past is referenced. These approaches allow designs to reach diverse outcomes. The following are different concepts for these approaches, some of which rely on a direct return to the past, others on the revival of certain past symbols, or the re-creation of past usage experiences, all aimed at evoking a sense of nostalgia in design in an innovative way.

Nostalgia design: leverages the power of sentimentality and familiarity by incorporating elements from the past into modern designs

Emotional design: the concept of how to create designs that evoke emotions which result in positive user experiences.

Symbolic design: utilizes visual elements to represent abstract ideas, concepts, or meanings, often beyond their literal form

Heritage design: incorporating historical and cultural elements into contemporary design

Vintage design: Design styles and aesthetics inspired by the past, typically from at least 20 years ago, but often evoking styles from the early to mid-20th century.

Postmodernism: a broad intellectual and cultural movement that arose in the mid-to-late 20th century as a reaction against modernism.

memory centric design: designing systems where memory access is the primary focus, aiming to minimize data movement between memory and the processor, leading to improved performance and energy efficiency.

Experimental design: a systematic approach to product development that leverages data and user feedback to iteratively improve a product.

Each of these approaches contributes to building the Retro identity of the intended product and shaping its external appearance, which reflects its impact on users and leaves a mark on their usage experience. Examining the relationship between aesthetic form and sustainability reveals certain characteristics of non-sustainable products (Zafarmand, Sugiyama & Watanabe, 2003)

Philosophy	Context	Elements
- Confrontation with nature - Global Standardization - Ignore local culture identity	- Obsolesce - market led design - Short life fashion and style - Exceedingly attractive, Innovative, and distinctive	- Irrelative form & function - Hidden construction and material used in the object - sharp shape - high contrast and vivid color - highly polished & shiny surface

This illustrates the philosophical dimension of non-sustainable products, whose aesthetics are characterized by direct confrontation with nature and the aim of standardizing norms. They tend to overlook cultural aspects. At the contextual level, such products have a short lifespan, are designed according to supply and demand and commercial competition, follow fast-changing fashion trends, prioritize profitability, and often exaggerate form and design to create impractical attractiveness. At the level of design elements and aesthetics, form and function are often disconnected: aesthetics lack clear functionality, manufacturing methods or materials are concealed, shapes are sharp, colors are highly contrasting, and surfaces are excessively glossy or shiny. While these features may enhance product sales and stimulate users' desire to acquire them, they do not support sustainability in design or usage.

In contrast, when examining Retro-style design and analyzing its emergence, it is evident that it largely presents an opposite approach to these characteristics. Its designs, across different cultures and historical periods, are distinguished by: Visual Hierarchy- Vintage color- simple typography- Historic symbolism- Temporal simulation- contrast, fusion, cohesion between old and new- Hand craft effects- Simplicity with nostalgia- repetitive geometric pattern- repurposing old shaped and icons- classic detaining- authentic material- reinterpretation and adaption- retro visual experience- compact size and big functionality.

Each historical period across different cultures possesses distinctive characteristics and unique usage experiences, which serve as a rich source of inspiration for designers. By studying these periods, designers can extract various features to create diverse design lines that reflect the Retro style. As previously mentioned, designs such as the Rivian R3 and Tesla Cybertruck incorporate many of these features and have received strong user acceptance. Examining different cultures reveals that many designs adopting this style have succeeded due to their positive outcomes in supporting design and product sustainability. Retro-style design has also become globally popular in lighting units, which achieved success because of their simple forms and direct functionality, among other styles.

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Industrial Lighting Design emerged in the late 19th and early 20th centuries, specifically during the Second Industrial Revolution (1870–1914).

In the late 19th century, the first electric lamps appeared with simple metal designs. They were primarily used in factories, warehouses, and workshops, with a focus on practicality: strong illumination, durability, and the ability to withstand harsh usage.

By the early 20th century (1900–1930), industrial lighting became more widespread with the expansion of electricity. It was employed in factories, train stations, and large industrial buildings. This period saw the development of well-known forms such as the Metal Shade and Exposed Bulb designs.

By the mid-20th century, this style remained prevalent in industrial settings, but it gradually transitioned into kitchens and restaurants as part of its practical appeal. Designs such as the Wire Cage around bulbs were introduced for protection.

From the late 20th century to the present, this style experienced a revival in the 1990s and early 2000s as part of the Loft and Industrial Style in interior design. It became widely used in restaurants, cafés, and homes to create a vintage (Retro) or elegant industrial atmosphere.

Egyptian product design also reflects this approach, as ancient Egyptian culture has been rich in diverse details throughout history. Egyptians excelled in various crafts and industries, and as Egyptian history progressed, it underwent multiple social and cultural transformations. These changes gave rise to handcrafted practices and innovative product designs that embodied the characteristics of each historical period, from the Pharaonic era through the Christian and Islamic periods to the modern era. Each period contributed distinctive symbols, products, and unique usage experiences, which represent a rich source for contemporary design. For example, the analysis of certain simple products from Egyptian collective memory that were influenced by the Retro style demonstrates their widespread success in use after being redesigned through a contemporary approach.

1- The kerosene lamp:

The kerosene lamp, also known as the oil lamp, is a lighting device that operates by burning kerosene or petroleum. Over time, it evolved to include mantle lamps (sometimes referred to as pressure lamps or air lanterns) as well as portable lamps. The origin of these lamps is rooted in the need for illumination in the absence of electricity. The kerosene lamp operates on the principle of heating kerosene vapor, which ignites and produces a strong light as it passes through a special fabric or mesh known as the mantle.

A typical kerosene lamp consists of a fuel reservoir, a mechanism for raising the mantle, the mantle itself (also known as the mesh), which glows due to heat to emit light, and a glass enclosure that protects the mantle from airflow. These lamps first appeared in the 19th century and became a primary lighting source in areas without access to electricity. During the 19th and early 20th centuries, kerosene lamps were among the most widely used lighting devices worldwide, particularly in rural regions.

In contemporary contexts, the use of kerosene lamps has diversified while preserving their original identity. They are now commonly used as decorative elements in homes, restaurants, and hotels to create a heritage-inspired or romantic atmosphere, as emergency backup lighting in areas with limited electricity, or for outdoor activities such as camping. The design of the kerosene lamp evolved through several historical stages, which can be summarized into three main phases, as illustrated in the following figure.



Figure 4 - Retro style lamb

To this day, many designers and industries continue to draw inspiration from the kerosene lamp, using its heritage identity and distinctive formal lines as a reference for reinterpretation within contemporary designs. It continues to enjoy wide popularity across various cities, cultures, and countries. Moreover, its original manufacturers remain committed to producing and developing it, as it has become a symbolic reference for embodying the Retro style in design.

2– Egyptian Wooden Chair:

The production of bamboo and wooden chairs in Egypt has a very long history, with Egypt emerging as one of the earliest civilizations to excel in the manufacture of wooden seating furniture since ancient Egyptian times. Traditionally, these chairs were produced using locally available raw materials such as palm fronds and reeds, and they were commonly found in homes and cafés as affordable and comfortable pieces of furniture. Despite the spread of other types of furniture, such chairs remain widely used in traditional cafés.

Designers have shown growing interest in the iconic Egyptian wooden chair, with many seeking to reinterpret it by modifying certain formal features and colors while preserving its core identity. This reinterpretation has enabled its use in high-end restaurants, as the chair evokes a sense of safety, simplicity, and connection to cultural heritage. Through continuous development, wooden chairs have taken on multiple forms and have been adopted by well-known brands. Examples of this evolutionary transformation from past to present are illustrated in the following figure.



Figure 5 - Retro style in chair design

The previous analytical examples of the Retro style demonstrate that its concept in design is no longer limited to a return to a specific historical era. Rather, it involves revisiting any past period that left a positive impact on users or influenced them through a particular product design or usage experience. This influence may be conveyed through symbols, lines, colors, compositions, or individual and collective usage experiences. Such elements create an emotional imprint on users, generating a desire to recall and reinterpret them in a contemporary form that aligns with current expectations, while preserving the positive emotional values of the past, such as feelings of safety, nostalgia, and escape from rapid and continuous technological change.

In contemporary design, an examination of the latest design trends and their development reveals that returning to the past has become a decisive future direction for many design approaches. In this sense, the past represents the foundation of modern design languages, as revisiting and reinterpreting it through contemporary forms has become central to many design trends that achieve wide acceptance.

Across different cultures, countries, and societies, the past is rich with symbols and experiences that serve as strong stimuli for designers to develop innovative design approaches and unique solutions. Accordingly, the Retro design style is characterized by a set of key features, including:

- Reinterpretation and adaptation of symbols and usage experiences from the past into contemporary forms
- Blending the old with the new, creating a balanced dialogue between tradition and modernity
- Design simplification, relying on clear and basic geometric forms
- Attention to classical details that reinforce the product's historical identity
- Returning to original and traditional materials, emphasizing authenticity and durability
- Use of natural, primary, and direct colors, as well as the combination of contrasting color schemes
- Avoidance of excessive detailing, maintaining visual clarity and coherence
- Emphasis on functionality, ensuring a strong relationship between form and use
- Simple and direct compositions, supporting ease of understanding and use
- Reconnection with nature and instinctive human values in design

By studying and analyzing key sustainability strategies in product design, a strong similarity can be identified between many characteristics of the

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Retro style and the attributes of sustainable products. Accordingly, this research aims to demonstrate the positive role of these characteristics in achieving a beneficial environmental impact through design approaches that are widely accepted by users and possess continuous potential for innovation and development.

3- Sustainable product design strategies:

Sustainability in industrial product design has become a primary requirement that designers must consider, focusing on efficiently and effectively meeting environmental demands throughout both the design and manufacturing processes. Sustainability is no longer limited to pollution control or biodegradability; rather, it aims to create products that are environmentally friendly, economically efficient, and easy to use. This broader perspective presents a challenge to traditional design and manufacturing practices.

- Okala Strategy wheel:

1- Design for Innovation
2- Design for Reduced Material Impacts
3- Manufacturing Innovation
4- Reduced Distribution Impacts
5- Reduced Behavior and Use Impacts
6- System Longevity
7- Transitional Systems
8- Optimized End-of-Life

- Gupta, S., Danagayach, G.S. and Singh, A. (2015) Strategies for Sustaining Product Design and Development. Conference paper, Malaviya National Institute of Technology, Jaipur, January.

Designs for the Environment:

The concept of 'eco design', 'green design', or 'life cycle design', concerns the design of products, by applying environmental criteria aimed at the prevention of waste and emissions and the minimization of their environmental impact, along the material life cycle of the product

Sustainable life cycle assessment:

The fundamental idea of sustainable life cycle management is the concept of a shared responsibility of all life cycle stakeholders. Along the product life cycle different stake holders have opportunities to improve social, economical and environmental aspects. This can be done based on tools addressing the dimensions of sustainability like Life Cycle assessment (LCA), Life Cycle Costing (LCC) and Social Life Cycle Assessment (SLCA

Product service system:

Sustainable production and consumption is an issue of current international concern. Many different approaches and concepts have been developed over the last decades to address environmental problems, such as cleaner production, cleaner technologies, waste minimisation and recycling approaches, eco-design and design for sustainability . A new trend of product-service systems (PSS) that has the potential to minimise environmental impacts of both production and consumption is emerging

Product Stewardship:

Product stewardship a concepts and tool that support industrial activities toward sustainable development in the manufacturing and design (Environmental Management System, Eco-efficiency and Eco-innovation) [11]. Product stewardship is an environmental management strategy. In Product Stewardship all stages of product design manufacturing are involve (design, production, sale and marketing) [12]. Product stewardship is an important strategy for product design and manufacturing

Le Mouëllic, M., Ventura, A., Heller, K., Loh, A., Roch, R., Spitzbart, J. and Zanotelli, P. (2023) 'Six Strategies for Designing Sustainable Products', Article, 27 March.

Circularity Design for disassembly Design for end-of-life collection Design for reuse Enable material traceability Enable material homogeneity	**Product efficiency** Variable energy consumption Energy consumption efficiency Material consumption efficiency Change consumer behavior
Longevity and effective usage Design for repairability and maintenance Design for upgradability and adaptability Design to last Design for remanufacturing Design for multiple uses	**Dematerialization** Content reduction Design for value Digitization Weight reduction Minimal material and packaging Generative design
Next-best materials selection Renewable and biodegradable material Recycled material Recyclable material Lightweight material	**Green supply chain** Frugal processes and operations Detoxified processes Standardization and modularity Design for logistics

Based on the matrix presented in the following table (Zafarmand, S. J., Sugiyama, K., & Watanabe, M., 2003), the researcher demonstrated the precise relationships between product aesthetics and product sustainability, illustrating how aesthetic attributes are reflected in sustainability outcomes as follow:

Aesthetic Durability:
Closely associated with product life extension, reusability, and repairability, as aesthetically durable products remain appealing over time, thereby reducing users' tendency to dispose of them prematurely.

Upgradability and Modularity:
Strongly support disassemblability, repairability, and reusability, since modular design facilitates maintenance and component replacement instead of discarding the entire product**.**

Simplicity and Minimalism:
Linked to reduced material and energy use and environmental compatibility. Simple design minimizes waste and unnecessary material consumption**.**

Logicality and Functionality:
Support maintenance, repair, reuse, and product life extension, as logically designed and functional products are easier to use and tend to have longer lifespans**.**

Natural Forms and Materials:
Associated with harmony with the environment and local production, as they enhance environmental compatibility and contribute to reducing the carbon footprint**.**

Local Aesthetic and Cultural Identity:
Support local design practices and strengthen the relationship between the user, the product, and the designer, fostering a sense of belonging and appreciation of cultural value**.**

Individuality and Diversity:
Related to the user–product relationship and environmental awareness, as aesthetic diversity creates a personal connection with the product, increasing users' willingness to retain it for longer periods**.**

Aspects of Product Sustainability / Aesthetic Attributes	User–Product Relation	User–Designer Relations	User's Environment Awareness	Product Life Extension	Harmony with Environment	Reduced Material/ Energy Use	Local Design/ Production	Serviceability	Reparability	Renewability	Disassembly	Recyclability
Aesthetic Durability	●			●	❍	●		❍	●	❍		
Aesthetic Upgradability & Modularity	❍	❍	●	●		❍	❍	●	●	●	●	●
Simplicity & Minimalism	❍	❍				●			●	❍	●	●
Logicality & Functionality	●	●		●		❍			❍		❍	
Natural Forms & Materials	●	●			●		❍					●
Local Aesthetic & Cultural Identity	●		●	❍	●		●					
Individuality & Diversity	●	❍	●	●			❍	❍				

Aesthetic and Sustainability: The Aesthetic Attributes Promoting Product Sustainability
(Zafarmand, S.J., Sugiyama, K. & Watanabe, M., 2003**) -** redrawn by author **-**

4- Retro style & sustainability :
From the previous discussion, several sustainable product design strategies and key specifications necessary for a product to be considered sustainable can be identified. The analysis also highlights certain similarities between the characteristics of products designed in the Retro style and the specifications of sustainable product design in terms of form and function. The following figure presents a model illustrating the interaction between product aesthetics and product sustainability, emphasizing the key features associated with the Retro style that both support sustainability and influence user experience

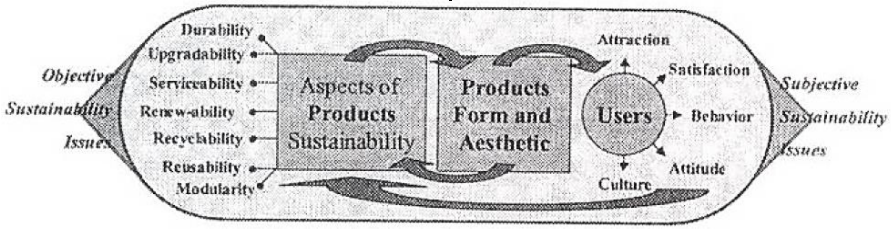


Figure- 6 : Model of interactions of product aesthetic and product sustainability

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This model describes the aforementioned relationship through the subjective aesthetics of the product, which support its objective sustainability specifications. User satisfaction, behavior, cultural influence, and attraction to product aesthetics- when aligned with sustainable product specifications- can enhance user satisfaction through the product's form and aesthetic qualities.

Moreover, there are additional dimensions of reinterpreting the past in a contemporary context. Sustainability extends beyond economic considerations to include environmental, social, and cultural aspects that reinforce product sustainability.

Designing products in the Retro style contributes to extending product life, as it strengthens the emotional bond between the user and the product (Emotional Durability), since users associate the product with the past and the feelings it evokes. This approach also reduces excessive consumption, as the relationship between the user and the product transforms it into a unique piece rather than a temporary fashion trend. Socially and culturally, it preserves visual identity by reintroducing cultural and historical symbols, supporting cultural diversity rather than global uniformity, which can become monotonous and prompt quick replacement. Consequently, reviving the Retro style fosters intergenerational connections and creates a dialogue between the past and the present. The following table presents a comparison of Retro style features and their impact on product sustainability.

Item	Characteristics and Features of Retro Design	Sustainability Relationship
Form & morphology	Curved and Smooth Lines Familiar Geometric Shapes (circles, ovals, cubes) Visual Balance and Simplicity in Details Return to Classical Proportional Harmony	Reducing Manufacturing Complexity: Leads to lower energy consumption. Extending Aesthetic Lifespan: Enhances resistance to fashion obsolescence. Strengthening Emotional Attachment through Familiarity: Fosters a deeper user–product bond.
Color & finish	Earthy or Vibrant Colors Inspired by a Specific Era Moderately Saturated, Non-Striking Colors Use of Naturally Colored Materials (wood, copper, leather)	Visual Sustainability: Prevents visual fatigue or boredom over time. Use of Untreated Materials: Reduces emissions and environmental impact. Color Association with a Historical Culture: Enhances cultural sustainability.
material	Combination of Traditional and Modern Materials Integrating Traditional Materials (wood, metal, natural fabrics) with Modern Techniques Recycling Materials from Previous Products (Upcycled Materials) Tactile Surfaces that Highlight Craftsmanship	Supporting the Circular Economy: Encourages reuse, recycling, and resource efficiency. Highlighting Craftsmanship: Enhances user appreciation of the product and reduces rapid replacement. Reducing Carbon Footprint: Using sustainable materials minimizes environmental impact.
symbolism	Symbols and Shapes from Preferred Historical Periods Eliciting Emotional Response and Nostalgia A Design Language that Connects the User with the Past	Strengthening Emotional Attachment to the Product Creating Emotional Durability Enhancing Protection of Cultural Identity and Design Diversity Fostering Dialogue between the Past and the Present
function	Clear and Simple Functions: Avoid unnecessary complexity. Emphasis on Mechanical Components over Excessive Electronics Ease of Repair and Maintenance	Ease of Maintenance: Leads to a longer product lifespan. Clear and Direct Functionality: Minimizes unnecessary details. Reduction of Electronic Waste Sustainable Economy
Visual lines & properties	Use of Classical Proportions, such as the Golden Ratio	Visual Comfort: Reduces stress and contributes to users' psychological

Item	Characteristics and Features of Retro Design	Sustainability Relationship
	Calm Horizontal and Vertical Lines Balance between Mass and Space	sustainability. Balanced Design: Stands the test of time.
user interaction	Sensory User Experience (texture, sound, material scent) Simplified Interface and Interaction Eliciting Nostalgia and Personal Appreciation	Encouraging Long-Term User–Product Relationships Extended Product Use without Replacement
production & lifecycle	Design Suitable for Remanufacturing or Repair Use of Modular Components (Modular Design) Limited Production instead of Mass Production	Reduces Industrial Waste Facilitates Reuse Achieves a Balance between Economic Efficiency and Sustainability
culture identity	Reinterpreting Local or National Symbols within a Contemporary Language Preserving the Visual Values of Previous Eras Integrating Elements of Tangible Heritage	Cultural and Moral Sustainability Strengthening National Identity Resistance to Global Design Trends

5- Result:

Retro experience & sustainability:

The Retro style not only supports product aesthetics and identity but also influences the way users interact with the product. It does so by evoking familiar past experiences and preserving usage memory over time.

- Cognitive sustainability

In this context, the user possesses a product-related usage memory (e.g., how to open a radio or rotate the volume knob). Applying the same user experience in a contemporary form reactivates cognitive memory, reducing the product's learning curve and creating a sense of psychological and cognitive comfort because the interface is familiar. This also helps lower mental fatigue and encourages users to maintain a longer-term attachment to the product.

For example, modern Retro Typewriter Keyboards, which resemble old typewriters, provide users with a sense of control and nostalgia without requiring them to learn a new interaction.

- Intergenerational Experience:

Retro design transfers user experiences from one generation to another, creating a cultural and cognitive bridge. New generations can understand how interactions occurred in the past, while current users regain comfort with familiar usage patterns. This promotes cultural and cognitive sustainability over time and reduces the technological gap between age groups.

For example, modern vinyl players use digital technology but preserve the experience of "placing the needle and playing music manually," providing a shared experience across generations.

- Functional familiarity:

Humans naturally prefer what is familiar. Retro design effectively provides this sense of familiarity, allowing users to feel competent with the product from the first interaction. This encourages longer product use and helps users resist unnecessary consumerism.

For example, Marshall Amplifiers feature analog-like button interfaces and controls while being digital internally, providing a familiar experience for fans of vintage equipment.

- Narrative Sustainability

Retro design does not only provide functionality but also conveys an inherited usage story. The product transforms from a mere "tool" into a "symbol" that narrates a personal or cultural history. This reinforces values such as long-term attachment to the product (attachment longevity) and reduces disposable consumption (throwaway culture).

For example, Casio Retro watches retain the 1980s design, telling a "generation's story" and giving users a sense of identity and continuity.

- Holistic Experience

Retro design integrates form, function, and experience in a comprehensive manner. Every design element (shape, material, sound, interaction) contributes to the sustainability of the overall experience. This embodies the concept of Sustainable UX Design—a user experience that remains emotionally and cognitively sustainable over time.

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- Research result:

From the above, it can be concluded that there are clear relationships between the application of Retro style in product design and the sustainability of the product itself. This is illustrated in Figure 6, which shows that the relationship between sustainability and Retro design exists on two equally important levels: style sustainability and user experience. Both factors directly influence the user–product attachment, encouraging longer-term product ownership and reducing the user's repeated desire to replace it.

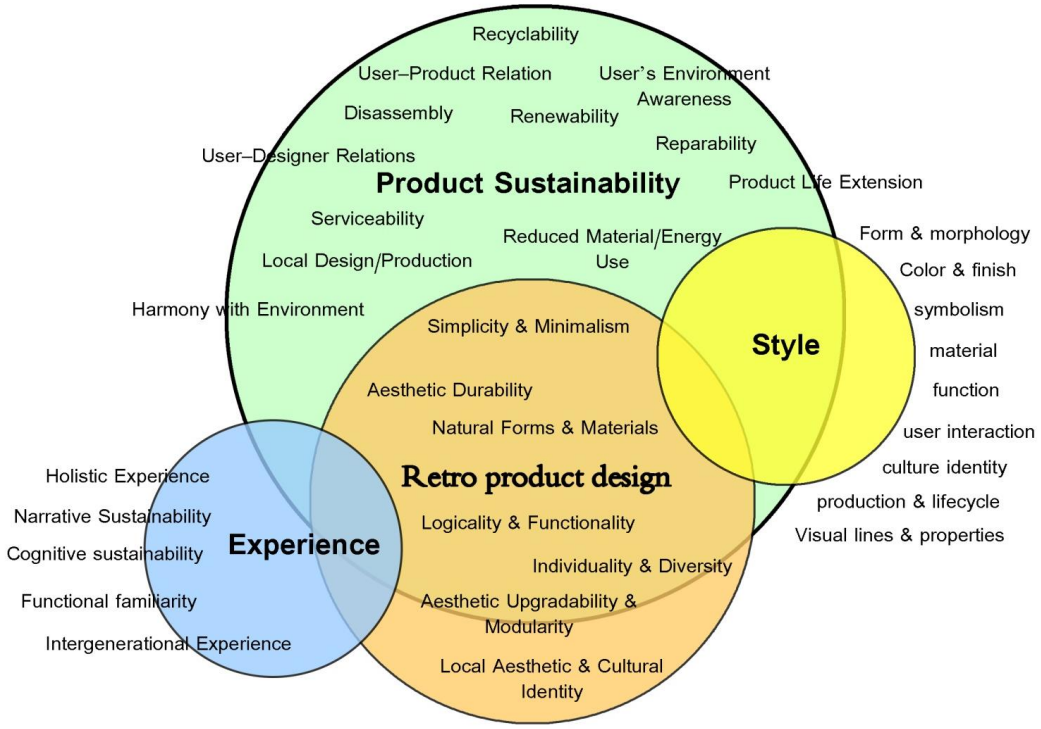


Figure- 7 : relation between retro style and sustaibility

Conclusion:

The study concludes that retro-inspired product design plays a significant and positive role in enhancing product sustainability. Products designed in a retro style often evoke emotional connections, nostalgia, and cultural continuity, which strengthen users' attachment and extend product lifespan. This emotional durability reduces the tendency toward premature replacement and supports more sustainable consumption patterns.

Moreover, retro aesthetics typically emphasize timeless forms, quality craftsmanship, and material durability- attributes that align closely with sustainable design principles such as longevity, repairability, and reuse. By merging historical design values with contemporary technologies and eco-conscious materials, retro design bridges past and future, fostering a more responsible and enduring relationship between users and products.

In essence, retro-style design not only revitalizes cultural identity and aesthetic appreciation but also contributes meaningfully to environmental and social sustainability. It demonstrates that aesthetic and emotional dimensions are essential complements to technical and functional aspects in achieving truly sustainable product design.

Recommendations:

The study recommends that researchers and practitioners in the field of product design strengthen the connection between Retro style and product design as a means to promote sustainability.

- Raising awareness about the Retro style in design, supported by recent statistics on the growing user interest in this trend, and assessing its impact on enhancing users' emotional attachment to products and reducing replacement rates.
- Designing products inspired by the past in a contemporary way that harmoniously combines classical lines with modern technological features, achieving a balance between authenticity and modernity.
- Encouraging further research and exploration by designers and scholars to identify aesthetic characteristics inspired by the past that can be integrated into sustainable contemporary design practices.
- Integrating the concepts of Retro style into design education curricula to raise students' awareness of the importance of visual heritage and historical aesthetics as a foundation for

modern creativity and a means of supporting cultural sustainability.

- Reinterpreting and upcycling traditional design elements within new products that reflect the spirit of Retro style, contributing to waste reduction, resource efficiency, and the promotion of a circular economy.

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