

## **A influência dos requisitos projetuais sustentáveis na estética dos artefatos ecologicamente orientados**

### ***The influence of sustainable design requirements on the aesthetics of ecologically oriented artifacts design***

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#### **Resumo**

Este artigo aborda a estética com foco no desenvolvimento de artefatos industriais sustentáveis, pois as pesquisas sobre o desenvolvimento deste tipo de produto pouco têm contemplado a estética, enfatizando-a como importante para a efetivação de soluções ecologicamente orientadas. Tem como objetivo compreender quais requisitos projetuais atualmente praticados podem interferir na aparência dos produtos, contribuindo para a elaboração de indicadores estéticos que configurem uma nova tipologia de artefatos. Para isto, foi realizada uma revisão de literatura que buscou elencar os principais elementos configurativos dos produtos industriais, seguido por um apanhado dos principais requisitos para o desenvolvimento projetual de artefatos ecologicamente orientados. As informações geradas pela revisão permitiram o cruzamento dos dados entre elementos configuracionais e requisitos sustentáveis, que foram analisados a partir da pertinência e possibilidade de interferência na estética dos artefatos. Como resultado foram gerados 10 indicadores estéticos que podem contribuir para a discussão acerca da efetivação dos produtos sustentáveis enquanto nova tipologia de produtos.

**Palavras-chave:** Palavra-chave 1; artefatos industriais 2; sustentabilidade 3; estética

#### ***Abstract***

*This paper approaches aesthetics with a focus on the development of sustainable industrial artifacts, because research on the development of this type of product has little contemplated the aesthetic, emphasizing it as important for the implementation of ecologically oriented solutions. Its objective is to understand what project requirements currently in place may interfere with the appearance of the products, contributing to the development of aesthetic indicators that configure a new typology of artifacts. Thereunto a literature review was carried out that sought to list the main configurative elements of industrial products, followed by a survey of the main requirements for the project development of ecologically oriented artifacts. The information generated by the revision allowed the crossing of the data between configurational elements and sustainable requirements, which were analyzed from the pertinence and possibility of interference in the aesthetics of the artifacts. As a result, 10 aesthetic indicators were generated that can contribute to the discussion about the realization of sustainable products as a new product typology.*

**Keywords:** 1; industrial artifacts 2; sustainability 3; aesthetics

## 1. Introduction

Among the approaches to aesthetics is that of "science of sensory perception," which studies the understanding of reality through perception and considers everything that is perceived sensorially by the senses to be aesthetic. In this perspective, aesthetic quality can be included in product ergonomics studies, which aim to satisfy human needs, contributing to the proper interaction between users and artifacts, providing psychological comfort. It is expressed by the combination of shapes, colors, materials, textures, among other attributes that aim to make artifacts pleasant. (IIDA, 2005, p.316). It starts from the design needs related to the sensations provoked by the surroundings - environments or artifacts, and with the preferences or values of the individuals. (COSTA FILHO, 2012).

According to Vezzoli (2010, p.49), aesthetics play a fundamental role in the effectiveness of sustainable solutions, since an ecologically oriented product without being perceived as an improvement compared to obsolete solutions, "is not enough." This demonstrates the need for research that can bring strategies in this field, differentiating the products ecologically oriented from the others, thus favoring their recognition by consumers, by means of some own aesthetic.

Walker (2005) addressed this theme in his paper "Unmasking the Object: Restructuring Design for Sustainability," stating that sustainable objects "will be" markedly different from existing products, as well as having a very different aesthetic typology. For the author, "an aesthetic typology is not based on the function of the product, but rather on tactile and visible points of form and finishing", which could connect the aesthetic qualities of the artifacts with their modes of "unsustainable production". Aligned with this thought, the author proposed aesthetic identifiers that collectively would be useful in distinguishing harmful practices from, being able to characterize types of "unsustainable" consumer goods.

The author chose to create indicators that describe the aesthetic typology of conventional products, still based on unsustainable practices, which according to him would have the appearance corresponding to his means of production. However, when analyzing the products considered at present as environmentally sustainable, one notices, in fact, a great similarity with the conventional products, different from what was presented by the author. This is because the products considered environmentally sustainable are derived from manufacturing processes that, although they follow different design guidelines, aligned with sustainable practices, still consist predominantly of industrially produced objects with the same type of conventional product design, therefore, with similar aesthetics.

So, what would be the path to developing a proper aesthetic for environmentally sustainable products? For the authors of this article, the answer lies in the field of design, whose competence is the configuration of artifacts, based on design decisions that can provide the product with a differentiated aesthetic.

In order to contribute to the resolution of the aforementioned question, this article lists the main design requirements adopted for the development of sustainable artifacts present in the literature in order to understand which can interfere in the appearance of the products, contributing to a different aesthetic and thus setting up indicators for the development of an appearance appropriate to this new product typology. With this bias, it is conjectured that

the products developed from sustainable practices can also establish aesthetic markers that contribute to their recognition as a more adequate solution to the consumer.

The research is relevant, since in the design there is a centralization of environmental sustainability efforts focused on the adoption of practices that focus during the technical project and the production of these artifacts, away from the project scope other approaches that could also positively impact the quality and acceptance of these artifacts face to the conscious consumers.

Even if the differentiation between ecological and conventional products is of great relevance to the current context, a deficiency in the communication of the attributes related to the former orientation of the products is still perceived, which has the information regarding environmentally sustainable actions restricted almost in its entirety to the use of certification, often misplaced in the product or in the composition / configuration of products made solely from the designer's experience, which does not find theoretical bases that aid in the aesthetic development from this type of artifact. According to Löbach (2001, p.56), the ideal would be to search for more objective data on the needs of the project, through interviews and tests with users, which fostered the establishment of aesthetic aspects in a more rational way.

This article aims to contribute to the discussion about the aesthetics of sustainability, advancing design research to areas that provide a basis for the aesthetic development of ecologically oriented artifacts, through indicators that can be emphasized in the design process, reflecting in appearance of the artifacts its ecological orientation, which in turn can facilitate the recognition of this category face to the consumer, increasingly focused on less harmful solutions to the environment.

## **2. Theoretical considerations**

In order to achieve the objectives of this article, it was necessary to carry out a literature review on the bases for the aesthetic configuration of the artifacts, as well as the search for design requirements driven to ecologically oriented products, which was given through scientific articles and books of the area.

This procedure allowed the construction of a base for the search for aesthetic indicators with potential for the elaboration of an aesthetic proper to ecologically oriented products. For this, the authors sought to connect the requirements presented for the design field to the configurator elements of the artifacts, showing how they can behave to convey through their appearance information regarding the ecological orientation of the products.

### **2.1 Aesthetic configuration of artifacts**

It is possible to seek information for the aesthetic development of artifacts from concepts brought by the author Löbach (2001) in his book "Bases for the configuration of industrial products", in which the author presents the aesthetics applied to the field of industrial design.

Löbach (2001, p.60) states that the configuration of industrial products aims to provide the product with aesthetic functions that enable its perception by people, in addition to aiming to attract people's attention to the product, provoking the purchase. (IBID, 2001, p.63).

In the aesthetics of the object it describes the visual features of the object and its qualities, which can be investigated through empirical aesthetics. The data presented by this model provide the basis for the development of design guidelines applicable by the designer, which makes this professional an emitter of messages in the form of industrial products. (LÖBACH, 2001, p.157).

But for this to happen it is necessary that all aesthetic features of the products be known and enumerated, making it possible to design a new industrial product that meets the values set in the design process by the industrial designer and that corresponds to the aesthetic needs of the user. (LÖBACH, 2001, p.158). According to Walker (2005) to develop some aesthetic typology certain aesthetic identifiers may be proposed, so that to be common to many consumer goods, and thus become collectively useful in distinguishing unsustainable practices.

In this work, it is proposed that the aesthetic indicators for sustainability should be based on the configurational arrangement of the product, which according to Löbach (2001, p.159-160), "is determined by the set of configurator elements" that can influence the sensitivity and ideas of users. The configurative elements can be described as bearers the aesthetic information of a product, and its selection and combination, by the industrial designer, will define the reaction that the future user will present to the product.

For Löbach (2001), "the form of the industrial product is the sum of the elements of the configuration and of the reciprocal relations that are established between these elements". The designer should experiment on the effects that can be obtained with the help of the configurative elements, because only based on such experiences it may be made the right combination between the elements and thus achieve the desired effects. This arrangement, according to the author, comprises the figure that consists of the value before the non-figure, and is composed of the following main elements:

Configurable elements of industrial artifacts
Shape
Material
Surface
Color

**Table 1: configurative elements. Source: Löbach, 2001.**

The union between these elements and their arrangement will be responsible for the constitution of the "Figure" of the artifact, which refers to "the type of its configurative elements, its set, its quantitative distribution and its relation to the whole." (Löbach 2001, p.166). These in turn entail two factors:

Factors	Definition
<b>Order</b>	<ul style="list-style-type: none"> <li>• Small number of configurative elements;</li> <li>• Small amount of sorting features</li> </ul>
<b>Complexity</b>	<ul style="list-style-type: none"> <li>• High level of elements</li> <li>• Large number of sorting features</li> </ul>

**Table 2: factors of the figure. Source: Löbach, 2001.**

The conscious use of these elements contributes to the construction of more effective messages face to the public, since according to Munari (2009, p.68), visual communication takes place by means of several messages and may be intentional, through previous elaboration. Dondis (2007, p. 25), the visual elements are manipulated with an emphasis changeable by the techniques of visual communication, in which the solutions are governed by the posture and intended meanings.

## 2.2 Project requirements for sustainable products

Sustainability discussions have affected many areas of knowledge, including the field of design, which has since sought ways to reduce the impact of the exacerbated production of material goods through design solutions that minimize environmental damage from the production of artifacts. The theoretical contributions in this regard arise through requirements that aim to reduce the use of environmental resources, and are presented by authors involved with this issue, through books and specialized articles.

To enable to understand these requirements, a survey of the main ones was carried out, addressed by Moraes (2010), in the book "Metaproject: the design of the design"; Manzini and Vezzoli (2011), in the book "The development of sustainable products: the environmental requirements of industrial products" and Platckeck (2012) in the book "Industrial design: ecodesign methodology for the development of sustainable products".

To understand them and from them to be able to elucidate paths to an aesthetic proper of sustainable industrial artifacts, it was decided to create "categories", since many of the requirements were presented by more than one author, with different approaches, which would make the execution of the research goals harder. With the categorization, a synthesis of the requirements was accomplished, crucial factor for the progress of the project.

The following are the excerpts found in the aforementioned books and the 7 categories to which they were attributed in this research:

REQUIREMENTS PRESENTED IN THE LITERATURE	CATEGORIZATION
<ul style="list-style-type: none"> <li>• Use of few raw materials in the same product; Use of few components in the same product; Optimization of the thickness of the product casings; non-use of metal exemptions in</li> </ul>	<b>MINIMIZATION</b>

<p>thermoplastic products; not use of information stickers made from materials that are not compatible; (MORAES, 2010, p.69).</p> <ul style="list-style-type: none"> <li>• Minimize the use of resources in production, distribution and during use. (MANZINI and VEZZOLI, 2011, p.117-134).</li> <li>• Material reduction: product dimensions, reduce volume. (PLATCHECK, 2012, p.106).</li> </ul>	<p>Minimization of raw materials, components, thicknesses, dimensions, volume, metallic exemptions, and adhesives / parts incompatible.</p>
<ul style="list-style-type: none"> <li>• Choice of natural resources and processes with low environmental impact; choice of materials and process with low environmental impact, as well as low impact energy resources. (MANZINI and VEZZOLI, 2011, p.147-168).</li> <li>• Optimize production techniques; (PLATCHECK, 2012, p.106).</li> </ul>	<p><b>LOW ENVIRONMENTAL IMPACT</b></p> <p>Adoption of low environmental impact processes, materials, techniques and energy resources.</p>
<ul style="list-style-type: none"> <li>• Extended product life; (MORAES, 2010, p.69).</li> <li>• Optimizing product life: designing durability and reliability; facilitate updating, adaptability, repair, reuse, refacing; intensify use. (Manzini and VEZZOLI, 2011, p.188-208).</li> <li>• Develop products with adequate time of use. (PLATCHECK, 2012, p.106).</li> </ul>	<p><b>EXTENSION OF LIFE</b></p> <p>Intensify product use from adaptability, ease of repair, reuse and durability.</p>
<ul style="list-style-type: none"> <li>• Use of compatible thermoplastic materials; (MORAES, 2010, p.69).</li> <li>• Recycling: Adopting cascade recycling, choosing materials with efficient technology, facilitating collection and transportation after use, identifying materials, minimizing the number of incompatible materials, facilitating cleaning, composting and combustion. (MANZINI and VEZZOLI, 2011, p.211-242)</li> <li>• Consider possibilities for reuse, reprocessing and recycling of the entire product or parts of the material. (PLATCHECK, 2012, p.106).</li> </ul>	<p><b>RECYCLING</b></p> <p>Compatibility and reduction in the number of materials adopted.</p> <p>Facilitate cleaning.</p>
<ul style="list-style-type: none"> <li>• Ease of disassembly and replacement of components. (MORAES, 2010, p.69).</li> <li>• Facilitating disassembly: Minimize and facilitate operations for disassembly and separation; use systems with reversible joints; use fastening systems that can be easily opened; use easily separable materials when crushed; use easily separable ingredients in already crushed materials. (MANZINI and VEZZOLI, 2011, pp. 243-267)</li> </ul>	<p><b>DISASSEMBLY</b></p> <p>Facilitate splitting, separation and replacement of components.</p>
<ul style="list-style-type: none"> <li>• Distribution system: returnable packaging, avoid unnecessary materials; (PLATCHECK, 2012, p.106).</li> </ul>	<p><b>PACKING</b></p> <p>Avoid unnecessary materials.</p>
<ul style="list-style-type: none"> <li>• Predict reduction in energy, water or auxiliary materials consumption. (PLATCHECK, 2012, p.106).</li> </ul>	<p><b>USE</b></p> <p>Reduce consumption of subsidiary resources while using the product.</p>

**Table 3: Categories of requirements. Source: author based on the research done**

In a first analysis it was observed that the requirements presented by the authors referred predominantly to the configurational elements shape, material and surface, dispensing

another crucial element for the aesthetics of the artifacts, the color. To close this gap, we searched for results from a study by Clementino et al. (2017), entitled "Less is more: consumers' perception about the use of color in sustainable packaging", which aimed to understand how the color can be used in sustainable artefacts in order to facilitate consumers' perception about their orientation and, although it takes as its research object only the packaging, could provide indications for future investigations within the field of the aesthetics of sustainable artefacts in general. With this research was added one more category, as set out below:

REQUIREMENTS PRESENTED IN THE LITERATURE	CATEGORIZATION
<ul style="list-style-type: none"> <li>Reduction in the variety of colors; reduced saturation and increased clarity. (CLEMENTINO et al., 2017)</li> </ul>	<p><b>COLOR</b></p> <hr/> <p>Reduction in saturation levels and color quantity adopted.</p>

**Table 4: Additional requirements category. Source: author based on research done**

At the end of this process it was possible to obtain 8 categories of requirements related to the project development of sustainable artifacts. But, it was necessary to reflect on which could in fact be attributed to aesthetics, that is, could reflect on the appearance of the product. Thus, the categories of "packaging" and "use" were excluded, since the former refers to a specific artifact found as wrapping of other artifacts, and which does not necessarily interfere with the aesthetics of the products to which it is wrapping, and the second for showing up after consumption of the artifact. The following categories were remained after the requirements analysis:

1. Minimization;
2. Low environmental impact;
3. Life extension;
4. Recycling;
5. Disassembly;
6. Color.

These categories were interpreted as likely to interfere in the appearance of sustainable industrial artifacts, which in turn may contribute to the construction of aesthetic indicators appropriate to this product typology.

### **2.3 Aesthetic indicators analysis table for ecologically oriented artifacts**

The literature review allowed the analysis of the resources currently used to develop industrial artifacts more in keeping with the environmental reality, factors that also show up relevant for the advances in the researches related to the aesthetics of ecologically oriented artifacts, which in turn may contribute to its effectiveness while a new typology of products.

To make this possible, it was necessary to cross the 6 categories of selected requirements with the information on aesthetic development presented by Löbach (2001), in section 2.1. The authors analyzed which categories had the potential to interfere in which configurational element, which generated indicatives from the crossing of the informations, resulting in the following table:

CONFIGURATION ELEMENTS	REQUIREMENT CATEGORIES	AESTHETIC INDICATORS	COMMENTS
<b>Shape</b>	+ - Minimization - Extension of life - Disassembly	= • Reduction of size; • Reduction in the number of components; • Apparent resistance; • Adaptability*.	*Shapes that favor new uses and repairs (such as modular structures).
<b>Material</b>	+ - Low environmental impact - Recycling	= • Materials compatible with each other; • Reduction in the amount of materials used; • Adoption of recycled materials.	xxx
<b>Surfaces</b>	+ - Recycling	= • Adoption of few resources for finishing*; • No grooves / protrusions**	*Adoption of few resources such as paints, varnishes and other materials that make recycling difficult;  **Reduce grooves and protrusions that make surface cleaning difficult for recycling.
<b>Color</b>	+ - Reduction in color	= • Reduction in the amount of color and saturation employed.	xxx

**Table 5: Relationship between requirements and aesthetic elements. Source: author based on research done**

In addition to the elements, it was also important to understand how they should theoretically behave to expose the ecological orientation of the artifacts, which resulted in the following arrangement:

Figure	Set, quantitative distribution and relation with the whole
<b>Order</b>	<ul style="list-style-type: none"> <li>• Small number of configurative elements;</li> <li>• Small amount of sorting characteristics</li> </ul>

**Table 6: Behavior of the figure in relation to the aesthetic configuration of sustainable artifacts. Source: authors based on their research**



The "order" was more adequate in this context since the requirements point to the reduction in the number of configurational elements, which in turn demonstrates the need for a reduced amount of characteristics for ordering.

### 3. Discussion

From the information gathered in the course of this research, it was possible to understand that the presently practiced design requirements for the development of sustainable artifacts can interfere in the appearance of ecologically oriented products, showing an interesting way to advance the discussion about the aesthetics of sustainable artifacts industrial.

The requirements studied were able to intervene in the way how the elements inherent in the aesthetics of the artifacts behave - shape, surface, material and color, which in turn can allow the development of aesthetic indicatives that dialogue with a large quantity of products produced in the present, configuring an aesthetic typology. This is relevant, since according to Walker (2005), to construct an aesthetic typology the proposed aesthetic identifiers must be common to many consumer goods, and thus become "collectively" useful in distinguishing practices.

The initial sketches, presented in this article, suggest the following aesthetic markers:

<b>AESTHETIC INDICATORS FOR ECOLOGICALLY-ORIENTED INDUSTRIAL ARTIFACTS</b>
Reduction of size;
Reduction in the number of components;
Apparent strength;
Adaptability;
Compatible materials each other;
Reduction in the number of materials used;
Adoption of recycled materials;
Adoption of few finishing appeals on surfaces;
No grooves / protuberances
Reduction in the amount of color and saturation employed
<b>CONFIGURATIONAL ARRANGEMENT</b>
Order

**Table 7: Aesthetic markers for sustainable industrial artifacts. Source: authors based on their research**

These markers can be used by design professionals as a way to communicate about the orientation of products, and thus their effectiveness as a solution more appropriate to the environment face to the public, distinguishing the ecologically oriented products from the others.

But for the validation of these aesthetic indicators it is necessary to apply tests in products that emphasize these markers, which in turn make possible the understanding about which ones actually contribute to the construction of the sustainable aesthetic typology, besides investigating if those can be applied in different types of industrial products. According to Vezzoli (2010), the aesthetics of sustainability must originate in sustainable values and take various forms, depending on the context and the designer.

#### **4. Conclusion**

The application of aesthetics as a differentiator of ecologically oriented artifacts has not yet been widely explored in the field of design, although it is a valuable way to distinguish this new category of products as more appropriate to the environmental reality. The solutions presented in the literature focus on the technical development of the product, leaving aside issues related to how the designer should expose to the consumer the orientation of these artifacts, facilitating their recognition.

The obtained results showed that the design requirements already established in the literature can provide aesthetic indications about the orientation of the artifacts, being possible to be guided in them to the development of a typology proper to the sustainable artifacts, which in turn can contribute to the recognition and consumption of less harmful material goods.

The content presented refers to an initial study, which aims to contribute to the field of sustainability aesthetics, requiring the application of validation tests, but already demonstrates results in favor of the discussion about the aesthetics of sustainability and the role of design in pursuit of distinguishing between the products involved with the environmental cause and the others. This is possible since the products developed under sustainable practices, adopting sustainable project requirements and from these, are able to present indicators that contribute to their recognition as a more adequate solution face to consumer, factor that shall be investigated in future work.

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