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FORMULATION AND USE OF CRITERIA FOR THE EVALUATION OF AESTHETIC ATTRIBUTES OF PRODUCTS IN ENGINEERING DESIGN

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ABSTRACT

Constant and rapid technological progress, along with the evolution of design and production methods, permits the adoption of technological achievements and the embodiment of new features in products. Some of these features pertain to aesthetic attributes that make the key difference when competitive products are considered by customers and users. Evaluation of products with respect to these attributes may be done by forming proper criteria that could be used in engineering design process.

In the present paper, four (4) distinct groups of criteria are presented that address multiple aesthetic aspects of products. The criteria can be used for the aesthetic evaluation of product alternatives in combination with other conventional criteria from the field of engineering design. These aesthetic criteria - which are presented analytically and their formulation is also explained - refer to issues such as form, materials, color and simplicity that attract the focus of consumers and product users before making their final choice. The merit gained from their application is exemplified through a case study of the evaluation of three (3) coffee machines, performed according to Pugh’s Method.

Keywords: decision making, industrial design, product aesthetics, product evaluation

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1 INTRODUCTION

During new product development, it is crucial to exploit the available data, information and knowledge in the early design phases so that decisions made design more accurate, reliable and present least risk. The constant and rapid technological progress, along with the evolution of design and production methods, permits the adoption of technological achievements and their embodiment as new features into the new products. Some of these features are hardly used by the average product end-user or consumer. The rest, make the key differences when competitive products are considered. These differences are about the satisfaction of requirements and needs of consumers and refer –not only to engineering but also to aesthetic attributes of products (Creusen and Schoormans, 2005). Therefore, it is really important to have criteria/metrics concerning both the technological and the aesthetic aspects of a product. These criteria need to be clearly stated so that they can be subsequently used efficiently in any evaluation task pertaining to engineering design process.

Aesthetics can be noticed on top of Maslow's hierarchy of needs (Sarma and Van der Hoek, 2004), showing that people who are in an aesthetically pleasing environment or owning and using such products will get positive emotions such as satisfaction. Paul Rand states that "*without aesthetic, design is either the humdrum repetition of familiar clichés or a wild scramble for novelty. Without the aesthetic, the computer is but a mindless speed machine, producing effects without substance. Form without relevant content, or content without meaningful form*" (Heller, Balance and Garland, 1998) describing so the necessity of emotional reactions in every aspect of design.

Figure 1 presents graphically the approach adopted by the authors for the correlation of different factors that affect product selection by the customers. This approach conforms to the perception of product personality as a combination of aesthetic, associated, emotional and perceived product attributes (Ashby, 2011).

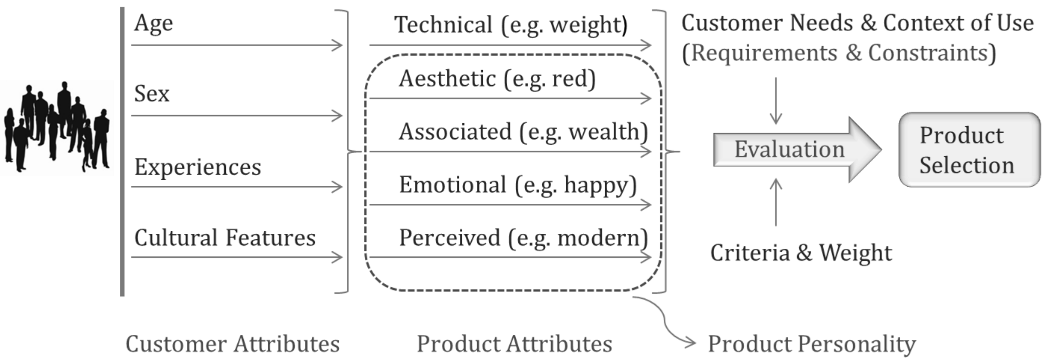


Figure 1: Representation of product selection procedure.

According to the above diagram, the customers, depending on their specific requirements, demands and wishes, interact with a product and realize its technical attributes and product personality in different ways. Therefore, evaluation criteria and weights should reflect this fact with respect to the general context that addresses issues such "when, where and why" the product will be used (Ashby, 2011). Additionally, the same criteria should contribute in obtaining optimal selection among a variety of alternatives that meet that requirements, demands, wishes and constraints.

Evaluation of alternatives is a task that characterizes engineering design and occurs in almost all design phases, at different levels of abstraction and for different purposes. Although there are different methods that are extensively used by the engineers, there is lack of knowledge about the types, categories and families of the engineering criteria needed for performing generically, efficiently and systematically this evaluation. This lack is greater if aspects of aesthetics are considered. As a result, evaluation of alternatives in engineering practice "omits" frequently the aesthetic aspect of the products being designed and leads to incomplete decision-making processes.

In conventional engineering design, the most used evaluation method is Pugh's Method (Decision Matrix) (Ullman, 1992) that performs tabular calculations of scores for alternatives according to a set of criteria and finally locates the best alternative according to the highest score obtained. In the present paper, four (4) groups of criteria are formed and proposed, all related with different aesthetic aspects of products. The three first groups refer to attributes, namely, form, materials and color, that are considered as the most significant ones that a candidate product should be evaluated for (Wen and Sun, 2012). The fourth group is about simplicity that is about how functional and usability aspects can enhance the aesthetic experience gained by users while interacting with a product; simplicity plays also a role in visual appeal (Berlyne, 1971). In the next section a detailed presentation of these criteria is provided. The formation of the criteria was proven to be a real challenge since no previous work had been done on the subject. To achieve that, a throughout survey of the relevant literature was performed and selected surveys were carefully studied. In section 3, a case study of the evaluation of three (3) coffee machines according to Pugh's Method is presented. In the decision matrix so formed, the four (4) groups are analytically listed and used for performing a weighted comparative evaluation (see Table 1).

2 FORMULATION OF EVALUATION CRITERIA

One of the first remarkable descriptions of how a good designed product should be comes from Braun's designer Dieter Rams, who formulated the "Ten Principles for Good Design" in the 1970s (Klemp and Ueki-Polet, 2009). Ramachandran and Hirstein (1999) have also suggested a framework to describe art's attributes, named as the "8 universal laws of art", including established attributes such as symmetry and contrast and novel ones such as isolation. Both approaches, however, are considered too abstract to be directly quantified and applied. Additionally, no reference exists about the specific product attributes that affect the achievement of these principles. The most systematical approach of customer's needs is that of Kansei engineering (Pitaktiratham, Sinlan, Anuntavoranich and Sinthupinyo, 2012), used as a tool for eliciting the emotions created to customers when they interact with products and services, by translating the semantics of the products into engineering parameters in a way similar to the well-known QFD method (Glenn, 2005). This approach, however, is different for each product category and cannot provide a universal criteria framework that can be systematically reused. Johnson, Lenau and Ashby (2003) made a survey on aesthetic and perceived product attributes ending up with an initial vocabulary for describing them, while also Ashby (2011) defines product personality. Finally, a framework for describing a product's style was presented by Chen and Owen (1997) who formed six categories of style attributes, namely form elements, joining relationships, detail treatments, materials, color treatments and textures.

In the present study, principles and concepts acquired from the literature, properly adapted and enriched, are taken into account in order to form a new framework. In this framework, instead of introducing simply criteria - as is the case with the previous approaches - groups of them are formed based on categories of aesthetic attributes. These groups are used for evaluating comparable alternatives of product configurations in combination with other technical criteria from the field of conventional engineering design so that an extended decision matrix (Pugh's matrix) is formed. They represent the visible and perceived attributes that product consumers and users focus on before making their final choice.

Much attention was also paid to preserve – as much as possible - the independency among criteria within each group and among groups, too. Below, each group of criteria is presented in details and its formulation is explained with parallel reference to the relevant literature.

2.1 Group 1: Form

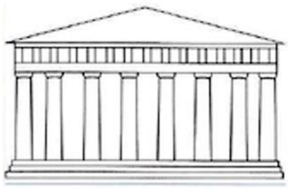
While consumers look at a product, they identify it as a whole by recognizing patterns from the basic shapes that constitute it (Weinschenk, 2011). Some of the criteria about form concern visible product attributes while the rest focus on the way those are being perceived; when all are used, they lead to the evaluation of the overall impression and appeal of the product's form. More specific:

1. *Number of parts*
   The total number of discrete visible parts of a product affects the ability of pattern recognition. In fact, less parts and compounds usually make the product more appealing, as the desired product's "personality", implemented through lines and shapes, is easier to be perceived. However, a modular designed product may be preferred if partial replacement will be needed.
2. *Form and shape complexity*
   Form complexity arises from the total number of lines and curves, the change of their direction on both the surface and the volume of a product, along with the amount, the kind and the combination of shapes that occur. In general, geometric shapes that can be drawn using a ruler or compass produce a feeling of control and order, while organic shapes that are freehand drawn

produce a natural feel (Pipes, 2004). For example, the gradient of straight and slope lines can express product dynamism or strictness (Creusen and Schoormans, 2005).

3. *Dimensions and Proportions*

   Total dimensions of the product along with distances and proportions between its parts and shapes constitute conventional design principles (Pipes, 2004). These magnitudes should be distinguished from pure ergonomic and functional aspects. Even though they can be chosen based on surveys and designers' instinct, *golden ratio* (Lidwell, Holden and Butler, 2010) is considered to produce aesthetically pleasing designs and is frequently used in architecture and products. (see Figures 2 and 3, (Lidwell, Holden and Butler, 2010)).



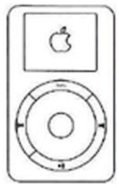


Figure 2: Golden ratio used in the Parthenon. *Figure 3: Golden Ratio used in Apple iPod.*

4. *Form Cohesion*

   The degree of cohesion of product form defines the achievement of the desired perceived attributes and style through meaningful combination and positioning of its substructures and design elements such as shapes and lines. To evaluate the degree of cohesion in a product, established design principles such as unity, contrast and balance can be considered. In order to achieve unity, the gestalt principles of perception can be used, the most important of whose are proximity, similarity, continuation, closure (Pipes, 2004) and the common fate principle (Lidwell, Holden and Butler, 2010). Contrast applied on a product's form can give variety within uniformity, may complete the conceptual framework and add an identity on small or large scale. Finally, symmetry (Pipes, 2004) and the rule of thirds (Lidwell, Holden and Butler, 2010) can be used as an example of achieving overall balance on product's form.

   Form Typicality/Novelty

   Terms such as "*ordinary*", "*extreme*", "*cool*", etc. can describe the overall form of a product and cause aesthetic reactions and perceptions like familiarity or innovation. Form typicality and novelty depend also on how the principle "*form follows functions*" is applied, as contemporary products tend to make those links less visible or even misleading. As an example, Hummer vehicle can be used as it still keeps military features even though it is no longer used that way (Lidwell, Holden and Butler, 2010). Also, a related study about various forms of chairs (Hung and Chen, 2009) showed that the ones with both unique and typical form characteristics seem to be more attractive and more likely to be bought.

5. *Form Timelessness*

   A product's aesthetic appeal can continue to provide sensory pleasure over its life time (Bloch, 1995). It is, therefore, an advantage to products that technically last long to be considered as appealing for an equally long period in their environment by making a "smooth transition" between the different eras and their trends. The average price of a product category should also be considered; a definitely higher demand for timelessness occurs, for example, for an expensive car than for a mobile telephone.

2.2 Group 2: Materials

For contemporary products, there is a wide variety of materials, each serving a different purpose. Therefore, there are a lot of different criteria that should be taken under consideration during material selection. These criteria should also be used for the evaluation of both technical and aesthetic aspects of the product, as the interaction with the materials activates all five basic senses. Ashby (2011) classifies the materials used in design in six categories: metals, ceramics, glasses, polymers, elastomers and hybrids that arise from those categories. When less technical requirements need to be met, paper can be added to those materials (Bramston, 2009).

Materials have measurable aesthetic attributes that are perceived through the senses and attributes associated with the different characteristics of the customers. There is a variety of 2D diagrams (Ashby and Johnson, 2002) that depict the range of measurable attribute values for different subcategories of materials, such as tactile warmth (from warm to cold) opposed to tactile softness (from soft to hard). Multidimensional diagrams are also used to present qualitative comparisons between the material categories to the total of attributes (Ashby and Johnson, 2002).

The perceived attributes can be described with characterizations such as “elegant-clumsy” and “honest-misleading” (Ashby and Johnson, 2002). They can also be used to describe more aspects of the product character and they are connected with the general context of product use. The criteria regarding materials with respect to the appeal and personality of a product are listed and explained below:

1. *Material Processes*

   The quality and the type of the processes used for forming product materials have a great effect on how the product is perceived. More specific:

   1.1 Shaping and Quality

   Materials of high quality can enhance the aesthetic value of a product by providing a feeling of robustness and reliability for both its external and internal parts and can even cover technical defects that could be noticed otherwise. Material quality can be perceived by the customers through attributes such as product weight and stiffness. For instance, between two products made by the same quality plastic, the heavier one may be perceived as more reliable.

   1.2 Surfacing

   Surface treatments can easily give a different character to the material. From plain it can become fancy and from classic to be perceived as a modern one. A typical example is the recent extensive use of “bushed aluminum” surfacing onto technological products in order to give a modern yet elegant style and make it appealing to a wider customer target group with different needs and requirements. It is argued that material use should be honest (Holm, 2006) bringing out their original processes. However, feasibility issues concerning cost and technical constraints require materials surfacing to imitate other, usually more expensive, materials. A common example is the use of plastic parts on a low price range laptop computer when aluminum cannot be used. The final result can either seem like enhanced plastic that meets customer desires or as a low-quality product.

   1.3 Joining

   In order a product to be manufactured, the subparts have to be joined using either permanent or non-permanent joints. The kind and the precision of the joints used define further the style of the product as well as its personality. For example, large tolerances usually contribute negatively to the perception of overall quality, unless if there is the intention to create a certain style (e.g. to give a perception of a handmade product).

   To effectively use that set of criteria in order to evaluate the effect of materials over products’ aesthetics, innovation and familiarity should be taken into consideration. A material is considered innovative when it comes as a result of recent research and finds its first application on the product. Familiarity arises from customers’ attributes, as they define the correlations between some product categories and commonly used materials as well as their context of use.

2. *Amount and Proportion of materials*

   Except of the processes used for the materials of a product, the amount and the proportion between them should be carefully determined because both affect the final perception. For instance, if a glossy finish on a plastic part of a laptop that is used to make a strict design more youthful is placed on large proportions compared to other materials, it can lead to an unaesthetic and misperceived product.

3. *Friendliness of the materials for the environment*

   The last criterion about materials is environmental friendliness. The feeling and the perception that a product exerts regarding its impact on the environment can make it more appealing to a lot of customers. To evaluate the environmental friendliness, there are appropriate tables describing both the production energy cost and the degree of each material’s recycling ability· however, to fully evaluate the product’s environmental friendliness more factors have to be examined too, such as its packaging and shipping.

2.3 Group 3: Color

When product customization is required and its achievement with form variations is considered as costly, color variations of the same product is an easy way for industries in order to meet customer needs and desires (Deng, Hui and Hutchinson, 2010). In product design, color is also used to group product features and draw attention at local level, as well as for boosting the desired product character (Lidwell, Holden and Butler, 2010). Researches have even shown that color affects customers' decisions more than the rest product attributes (Morris, 2011).

A color can be fully defined by three attributes: its lightness (light-dark), saturation (intense-dull) and hue (red, blue) (Holtzschue, 2011). The pure artistic approach of color theory calls for color harmony that can be accomplished by complementary, analogue, triadic and quadratic color combinations (Lidwell, Holden and Butler, 2010). For product design, however, where the aim is the desired product perception, the associations that lead to it are the most important factors that determine the colors to be used. An extended study has been made by Goethe and Eastlake (2006) which showed that since these factors depend on customers of different cultural features and sex, no general agreement can be achieved. The criteria about color are formed as follows:

1. *Total number of colors*
   The total number of different color hues that are used can express a different overall product personality. The dimensions of the product affect the number of colors that can be afforded to maintain the desired perception, thus making this criterion to be considered as a complex one.
2. *Color combinations and associations*
   In selecting product colors, customer requirements and context of use should be taken into consideration. Each color's association can define the overall combination's association, either by selecting a cohesive overall perception or with evident contrasts. For instance, if a toothbrush is designed, then the use of white and blue seems appropriate as calmness and cleanness is overall expressed, fitting to the context of its use.
3. *Functional character*
   There are special customer attributes, such as vision particularities, that can be characterized as color functional character. With this criterion, the need for feature grouping and highlighting can also be examined. Meeting those functional needs is not directly leading to aesthetic enhancement, but an overall care on a product is expressed that makes it more pleasant.
4. *Colors and materials collaboration*
   Color can affect a material in two ways: by bringing out the quality and its special properties or by imitating a - usually superior - material that cannot be used for mass production due to technical or financial reasons. Therefore, the way this collaboration is perceived has to be taken into consideration.
5. *Influence of color to form perception*
   Color combinations can affect the form of a product with their placement. For instance, when a dark color is surrounding a lighter one, product's overall dimensions can seem fairly smaller (Kingdom, Wong, Yoonessi and Malcoc, 2006).
6. *Innovative and familiar color selection*
   A lot of product colors have been linked with the original materials used for their production, like the usually brown or black coffee tables originally made from wood or molded metal and also with the color they were initially introduced with, as it is the case of "white appliances". Familiar (conventional) colors remain attractive for many customers and users while, in the framework of innovative approaches of enterprises, unexpected colors are attractive for others.
7. *Color area*
   Each color area on a product is determined by the emphasis that must be given concerning desired product character, usually choosing one color per discrete part. The hue and the intensity of the color used for an area should be taken also into consideration, as the use of a color like red in large proportions may not seem appealing if a classic product is being designed.
8. *Design patterns*
   In some occasions the use of colored design patterns of various shapes is desired and their semantics should be then examined if they fit the context of use.

2.4 Group 4: Simplicity

The fourth group of criteria is about simplicity. These criteria examine "how" the simplicity of the form, use and function of a product affects final perception and appeal by the customers. Nowadays, customers encounter high complexity and extended uncertainty in their daily routine and, therefore, they desire to return to the basics that seem more secure and understandable, as are products that present simple use. Simplicity can be defined as the effective use of the necessary elements in order to achieve the desired result and only that, without loss of design's personality. Well known quotes like Dieter Rams' "less and better" (Klemp, Ueki-Polet, 2009), Albert Einstein's "everything should be made as simple as possible, but not simpler" (Wikiquote, 2013), and also Antoine de Saint-Exupéry's "perfection is attained not when there is nothing more to add, but when there is nothing more to remove" (Wikiquote, 2013) can successfully describe simplicity's aesthetic aspect and the need to keep design's special characteristics untouched when simplifying a system. A lot of industries increasingly highlight their products' and services' simplicity in their marketing strategies.

The negative result of the large number of included features to products and services has been studied by Thompson, Hamilton and Rust (2005) and was characterized as *feature fatigue effect*. Their study showed that even though customers initially require increased capability, after purchase, usability turns out to be more valuable as the product becomes difficult to use.

The most thorough study of simplicity's aspects was conducted by John Maeda (2006). Among the "ten laws of simplicity" presented, the three first are the most appropriate ones - according to the author – in order to describe products' simplicity. Due to their adequacy, they can be used for evaluating product's simplicity by constituting a separate group of criteria.

1. *Reduce*

   The easiest way to simplify a system is by carefully reduce redundant functionality. To achieve that, the balance between how simple it can be made and how complex it has to be must be preserved (Maeda, 2006). When features that can be removed without significant penalty are gone, a method called S.H.E (Shrink, Hide, Embody) can be used (Maeda, 2006). Shrinking is based on the fact that smaller products cause lower expectations, so, if they are met, users will be more surprised. After shrinking, the complexity left must be hidden, trying different approaches; Swish army knife and the clamshell mobile phones are typical examples. Finally, in order for a so simplified product to be preferred, a greater value must be embodied by using better materials or by emphasizing on its quality during advertising.

2. *Organize*

   When a product's complexity has been reduced, the question "what goes with what?" has to be answered, as organization makes the components of a system to seem as fewer (Maeda, 2006). A method called S.L.I.P. (Sort, Label, Integrate, Prioritize) (Maeda, 2006) assists in that process. At first, features must be written down, sorted, and initial groups should be formed. Afterwards, they should be labeled, intergraded, and, finally, features highly prioritized should be merged into the same set. An example of how mind creates forms from context is shown in Figure 6, where the dots brought nearby tend to be perceived as one shape while they are still discrete elements. It is possible, however, that highly merged features can make the product's operation mode seem vague.

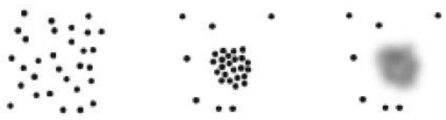


Figure 4. How groups are conceivably formed (Maeda, 2006).

3. *Time*

   When the interactions between the user and a product or service happen within a short time interval, this time-saving contributes in enhancing simplicity (Maeda, 2006). In order to achieve those savings, the S.H.E. approach can be used. Time can initially be shrunk by literally reducing it. Great applications of that method are the iPod shuffle that shuffles the songs it contains instead of letting the user manually choose them and Amazon's recommendation system that saves user from looking at the whole range of products (Maeda, 2006). Design techniques like Raymond Lowey's "streamlining" can also be used to make a product seem faster. These are the cases of trains where this technique was initially introduced (Maeda, 2006) and also the case of sharp desktop computer tower cases that aim to predispose about a fast computer system inside.

3 A CASE STUDY

In order to exemplify the use of the above four groups of criteria, three products were comparatively evaluated through Pugh's method. More specific, three commercial capsule system coffee machines have been chosen (machines A, B and C), presenting more or less the same engineering (technical) specifications and focus was paid to their comparison with respect merely to their aesthetic characteristics. Their brand names are omitted for obvious reasons.

Along with customers' requirements, the characteristics of the customer and the context of use have to be taken into consideration since they affect the evaluation. The products are already in the market, so the process presented is a reverse engineering one and the customer attributes and context of use are assumed. In particular, men of 20 to 30 years old, with characteristics pertaining to west culture features are set as target group, desiring modern, dynamic but somewhat austere products, intended for home use.

A decision matrix is formed that contains the groups of criteria and their weights (lines) along with the alternatives that are being evaluated (columns) (see table 1 below). Machine A is set as datum and on each criteria an integral value in the value range [-2, 2] is assigned for each of the rest two (2) alternatives as it is compared to the datum. Subjectivity is involved in this evaluation and this is due to the assumptions made concerning how product aesthetic attributes and personality would be perceived by the selected target group.

Equal weights (25 (%)) have been assigned to each one of the criteria groups and weights have been also assigned for each criterion in each group. Since the totals of the other two alternatives are both negative when compared to datum's "0", machine A is judged as the best alternative according to the evaluation criteria.

Table 1. Decision matrix for the aesthetic evaluation of three (3) coffee machines.

<table>
<tr><th rowspan="2">Criteria</th><th rowspan="2">Sub-criteria</th><th rowspan="2">Weights</th><th colspan="3">Alternatives</th></tr>
<tr><th>Machine A</th><th>Machine B</th><th>Machine C</th></tr>
<tr><td rowspan="6">Form</td><td>Number of discrete parts</td><td>2</td><td rowspan="16">DATUM</td><td>+1</td><td>0</td></tr>
<tr><td>Form and shape complexity</td><td>3</td><td>0</td><td>-1</td></tr>
<tr><td>Dimensions and proportions</td><td>4</td><td>0</td><td>-1</td></tr>
<tr><td>Form cohesion</td><td>5</td><td>-1</td><td>-1</td></tr>
<tr><td>Form typicality/novelty</td><td>5</td><td>+1</td><td>-1</td></tr>
<tr><td>Timelessness</td><td>3</td><td>-1</td><td>0</td></tr>
<tr><td rowspan="5">Materials</td><td>Material shaping and quality</td><td>6</td><td>0</td><td>-1</td></tr>
<tr><td>Surfacing</td><td>7</td><td>0</td><td>-1</td></tr>
<tr><td>Joining</td><td>6</td><td>-1</td><td>-2</td></tr>
<tr><td>Amount and proportions of material</td><td>4</td><td>0</td><td>-1</td></tr>
<tr><td>Material environmental friendliness</td><td>2</td><td>0</td><td>-1</td></tr>
<tr><td rowspan="5">Color</td><td>Number of colors</td><td>3</td><td>0</td><td>0</td></tr>
<tr><td>Color combinations and associations</td><td>5</td><td>0</td><td>0</td></tr>
<tr><td>Functional character</td><td>2</td><td>-1</td><td>0</td></tr>
<tr><td>Color-material collaboration</td><td>3</td><td>+1</td><td>-1</td></tr>
<tr><td>Color effect on form</td><td>4</td><td>-1</td><td>-1</td></tr>
</table>

	Innovative/familiar color use	5		+1	+2
	Color area	3		-1	0
Simplicity	Shrink	5		-1	0
	Hide	5		-1	-1
	Embody	5		0	-1
	Organization	5		0	0
	Time	5		-2	+1
	Total	**100**	**0**	**-32**	**-54**

4 CONCLUSIONS – FUTURE WORK

Evaluation of alternatives in engineering design should be performed systematically and should take into account – depending on the phase and the design task under consideration - all available data, information and knowledge. Therefore, it is undisputable that additional knowledge about aesthetics will not only enrich the overall design knowledge but will also guarantee the optimality of the outcome of the evaluation process.

Within this framework, in the present study, the attempt for forming some evaluation criteria about product aesthetics has resulted in identifying the most important theoretical and practical issues that should be addressed by those criteria. This identification has been done through: a. a survey of the relevant literature, b. studying of recordings of aesthetic attributes usually taken into consideration for choosing a product and c. analyzing surveys that have been conducted. Appropriate industrial design principles and product enhancement techniques, described in the relative literature, have also been taken into account in order to comprehend the ways consumers' perception about a product can be affected.

The issues so identified revealed the fact that there could be arranged in groups of two or more entities that contribute for obtaining a common major product characteristic (form, materials, color and simplicity) and which could be also used as weighted criteria in order to systematically evaluate product alternatives. For the present study and in order to show how these criteria could serve the evaluation process, Pugh's Method was used. The reason for that is its easy implementation the fact that it is very common among engineers and designers and, finally its capability to host criteria at different levels of abstraction and of different nature and origin. The use of the method was exhibited through a case study for three (3) coffee machines.

Evaluating systematically different product alternatives with respect to aesthetic attributes is indisputably a challenging subject from both theoretical and methodological points of view. It is reasonable, therefore, to argue that many of product attributes may not be identified at the same level by all potential users and some may not even be taken into consideration. Besides that, subconscious evaluation mechanisms are very personal to be successfully elicited, quantified and universally applied. Therefore, the authors continue their studies by addressing issues of extension of the criteria in order to include other, yet not recorded and studied attributes related to product aesthetics, by studying product enhancement methods in order to better acknowledge how customer requirements can take shape into physical attributes of a product and by organizing an environment in order to facilitate the collaborative estimation of criteria weighting and, thence, evaluation of alternatives. Finally, an examination of the dependency among the criteria and the design cases would be of major importance and could be studied by applying established methods such as Design Matrix Structure.

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