

## **AESTHETICS AND INDUSTRIAL PRODUCT DESIGN**

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**Abstract.** In today's cost competitive global markets industrial design and aesthetics is a significant lever in distinguishing products from others to potential users. The market success of industrial products strongly depends on their aesthetic character, i.e. the emotional reaction that the product is able to evoke. The paper presents the potential problems and opportunities for the integration of requirements and industrial design.

### **1. INTRODUCTION**

Styling is a creative activity where the designer's goal is to define a product that evokes a certain emotion while satisfying the imposed constraints. Therefore, a better understanding of human reactions can allow an easier satisfaction of market wishes and tastes. On the other hand, the complete design of new products requires multidisciplinary expertise and consequently it results from the collaboration of several actors (Project Manager, Design Engineers, Designers, System Engineers, Marketing Specialists, Ergonomics Specialists, Economists, End-User). It is then clear that the formalization of the design intent underlying the product specification may improve the communication quality among the involved actors, who can belong to different departments in the same company, e.g. styling and engineering, or to external suppliers.

To find the relationships between geometrical elements of a product shape and its aesthetic characters is the key to innovate the modeling tools by enabling the specification of those values of shape characteristics and parameters that, once processed by a computer system, could compute the design model conforming to the original intention.

In the first part of paper is presented the research methodology. In the second part of paper is identify the relationships between a product's shape characteristic and its emotional message.

### **2. THE RESEARCH METHODOLOGY**

The Research Methodology used was a multidisciplinary one, centred mainly on the research methods specific to marketing and mathematical statistics, with transmission and transformation of gathered information in statistical data. The research consisted in optimization of different methods and techniques, which are specific to the following domains: design, marketing, psychology - sociology, ergonomics, etc. The main processes to develop the research methodology are:

- Acquisition - For acquisition information from the user can use a research tool (questionnaire). For stocking the information provided by the user we propose the usage of a data base (Access);
- Processing - information processing is done with statistical software (SPSS);
- Using-Reusing - for information integration in the design process is used software (QFD -Quality Function Deployment).
- Dissemination - virtual prototype presentation (3D simulation).

The tools presented are not competition but complementary.

### 3. THE RESULTS OF RESEARCH

The “relationship” between aesthetics and industrial design is found to be dependant on several factors: cost reduction needs, manufacturing processes, technology, user requirements, customer satisfaction, to the value placed on emotional influence of product design, and even philosophical issues about the human condition. [3]

To explore the possible relationships between product shape and aesthetic character, it is first necessary to identify a common language based on proper words and definitions used by designers in their daily activity, able to cover the description of aesthetic aspects beside the emotional reactions of a generic observer. The analysis of the relation between terms describing aesthetic properties of lines and shapes, and terms describing emotions associated with geometric elements has been conducted through a three-steps process:

- identification of a vocabulary of terms actually used to describe shapes of industrial products;
- verification of the usability of the vocabulary to properly identify the aesthetic and emotional character of product shapes;
- identification of terms adequately associating aesthetic and emotional character with specific lines or shapes.

First, a large set of internal documents, brochure and papers describing industrial products from an aesthetical point of view, has been supplied from the industrial partners. It allowed to collect the proper words and definitions currently used by the designers in their working activity, representing the first vocabulary.

Table 1 provides example questions and responses from the questionnaire. It is found by this research that the aesthetics input is an increasingly important aspect and must take place at the start of the design. This process is inspired by requirement from company, end-user and design shows. It is further enhanced by an awareness of the market and associated tools for such awareness. The aesthetics become iteratively developed as the designers sits and works through the design. Important inspiration from a process of *LIFESTYLE ANALYSIS* leads to appreciation of aesthetics and development of a desirable product.

No.	Example Questions	Example Responses
1	What do you believe is the difference between aesthetic and engineering design?	They are both part of the same goal but they are different goals for each one. Aesthetics comes from engineering as much as engineering comes from aesthetics.
2	What is your definition of a good aesthetics design or product?	Does the job with a degree of style to it. Generates an emotion in some one. Gives them passion or enjoyment rather than being a lifeless lump of materials.
3	How do you find maintaining aesthetics through the design life cycle?	Often very time consuming. Constant contact with the engineering sector via e-mail and phone. Sometimes things have to be changed to make it work better in production.

**Table 1. Example questions and responses from the questionnaire**

However there is always a lot of aesthetic input from past experience, witch can be through everyday life or specific situations that spur the designer towards preferring one design decision to another.

Manufacturing of today’s products is increasingly based offshore resulting in several communication challenge between the design companies, the end-users and the manufacturers. This is often do not approach the product from the same direction as the

designers. Sometimes it was observed that engineering analysis activity provided several alternatives for material weight reduction or redistribution. In this case the alternative which was most aesthetically pleasing was taken. Clearly in these cases industrial design took priority during optimisation. A problem found was that it is not easy to demonstrate the immediate advantages of the aesthetics for the product as a total when faced with the resulting engineering changes they cause. Problems can be caused because the engineers are often not open to the new techniques and ideas presented by the designers. Due to tradition and lack of up-to-date knowledge the result is a knock on effect for the designers in terms of time-to-market and therefore product development. This is a potentially important area which might be addressed in further work.

A preferential product has been described as a product which satisfies requirements with a degree of style, so that appropriate emotions can be generated in the user. It can be contended that one of the most important realisations is that preferred product must push design forward and challenge the industry, not just accept the boundaries.

The engineers need the support of the design engineers and the design today are bridging the gap between the marketing and the engineering teams aiming to produce a desirable functional product. Finally some example generic responses from the interviews are found below:

- "It is very important that life style analysis leads to aesthetic appreciation and the development of a desirable product;"
- "The brand can be an aesthetics aspect or quality of the product, making it prominent on the shelf against its competitors;"
- "The aesthetic input is a vital aspect and must take place at the start of the design;"

Maintaining the aesthetics definition was deemed to be important since this was highlighted by the company interviews. For example as the product passes along its design lifecycle it is adjusted and changed for numerous reasons. These adjustments are not always sensitive to the aesthetics and without close observation and checking by the design teams, there is a possibility that the final product would finish in a very different form from that of the initial concept.

**The first step** used was in defining the product requirements, recorded in a Product Requirements Specifications Documents. Example categories for the product design requirements were: economical, functional, ergonomical, ecological, AESTHETICAL, emotional (Table 2).

Requirements	Features
<b>The economical requirements</b>	are those which impose the quality of the product at the minimum cost.
<b>The functional requirements</b>	refer to what is expected from the product, which are the global function and the service functions that have to be carried out by the product.
<b>The ergonomical requirements</b>	refer to the characteristics of the product which bring about additional comfort in usage
<b>The ecological requirements</b>	refer to the product manufacture, use and integration within the natural environment, as well as its recycling when is no longer used.
<b>The AESTHETICAL requirements</b>	refer to the impact of the product over the users senses (subjectively expressed), the most remarkable being the visual effect correlated with the product market image. These needs generally aim at the form, color, surfaces texture and the overall dimensions of the product.
<b>The emotional needs</b>	is considered the most difficult category to be defined and evaluated, because it refers to the product impact over the user's emotional side. For example, various characteristics of the product may create the feeling of luxury, wealth, safety, etc. to the user. An important aspect of the emotional needs is the fact that they are difficult to be measured and almost impossible to be predicted.

**Table 2. User Requirements**

The second step was the conceptual design.

Once de concepts were sufficiently developed, a Design Weighed Matrix [4] was used to directly compare concepts via de chosen requirements. The Design Weighed Matrix is shown in Table 3

Requirements	Symbol	Importance Rating	Concept 1	Concept 2	Concept 3
Economical	R <sub>1</sub>	5	+	+	+
Functional	R <sub>2</sub>	5	+	+	+
Ergonomical	R <sub>3</sub>	5	+	#	#
Ecological	R <sub>4</sub>	2	#	#	#
AESTHETICAL	R <sub>5</sub>	5	+	/	+
Emotional	R <sub>6</sub>	3	/	/	/
<b>Performance Ranking</b>			1	2	3

**Table 3. Importance rating for user requirements**

The Design Weighed Matrix is a simple but systematic method which precludes a designer somehow “falling in love with his design”, as observed by a respondent to the questionnaire earlier employed. It was found that aesthetics and function were concurrent considerations. The rating of aesthetics was found to be highly subjective and in need of a systematic approach to preclude the effect of personal preferences.

#### 4. CONCLUSIONS

Activities such as structural analysis and development of function are linked with concepts of look, feel, emotion and subjective appreciation of the product.

The extraction of user satisfaction and requirements only represents the first step of an extensive integration process. Without the purposeful forwarding and application oriented preparation the user information for the enterprise is worthless. Effective use of user information is only possible by its systematic, context-oriented integration into the working environment of the product developer.

The integration of users into product development must not be seen as a single project, but as long-term, continuous management task. User orientation as part of the enterprise strategy will, in the coming years lead to a transformation of the enterprise organisations from a traditional, monolithic organisation form to a end-user-driven organisation form. The “Relationship” is found to be a potential area for development in new value adding for products and is also motivated through philosophical debate.

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