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METHOD FOR AESTHETICS DESIGN IMPROVEMENT

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Abstract

The design process in industry is changing rapidly in the last years, in order to meet the challenges of globalisation. Among the variables in product design, shape parameters have a relatively strong influence on the success of the product in the market. This is especially true for parameters controlling the visual appearance of consumer goods. Decisions about the type and values of the parameters are therefore critical, and it is of utmost importance the improvement and unification of design education process, in order to ensure that these findings may be transferred to industry. This paper presents a systematic method for aesthetics design improvement based on the process of parametric design analysis, together with design examples aimed for industrial designers.

Keywords: Aesthetics, Industrial Design, Innovation Vs Design

1. Introduction

In general, the technical functions together with its construction structure and aesthetics properties of the selected technical solution, determine the configuration and the appearance of the product. Nowadays in relation to many consumers' products, the aesthetics properties are as important as technical functions. While ensuring that all the technical and economic requirements are fulfilled, the industrial designer should develop also the overall appearance of the product based on human feelings and values. Because of this, technical criteria and aesthetics properties should be considered in product design improvement.

Product designers want to evoke specific target customer responses. They communicate their aesthetic intents to target customers by means of the shape, composition and physical properties of the designed product. While a designed product can trigger definite aesthetic responses to observers, it is not easy to relate these responses to the characteristics of the product [1], [2].

For that reason, we developed a method able to describe how aesthetic intents can be related to the shape of a product. The design analyses are oriented to the improvement and unification of design education process in order to ensure that these findings may be transferred to society.

2. The General Method

Parametric Design Analysis [3] is one of the most efficacy education methods in the field of the Industrial Design. The principal purpose of this method is to fulfil the necessity for a systematic knowledge process to support the improvement of product design. Because of the complex nature of modern technology, the designer has to deal with the increasing complexity of product design, and with the specialised knowledge that goes with them. In consequence one of the major difficulties in improving the product design nowadays, are frequently related to conceptual design phase, which requires great knowledge about the *state-of-the-art* and modern trends in product design. The main objects of Parametric Design Analysis are the design and optimization of the Layout and Form Design of industrial products. It is mainly concerned with *adaptive* and *variant designs*, and is applied to the generation of new designs for existents technical systems. The design analysis is characterised by the application of aesthetics parameters in a systematic method that leads to the determination of the best formal concept for the product under improvement. The recommended working steps are established in full harmony with the flow of work defined by Pahl and Beitz [4] as shown in Figure 1.

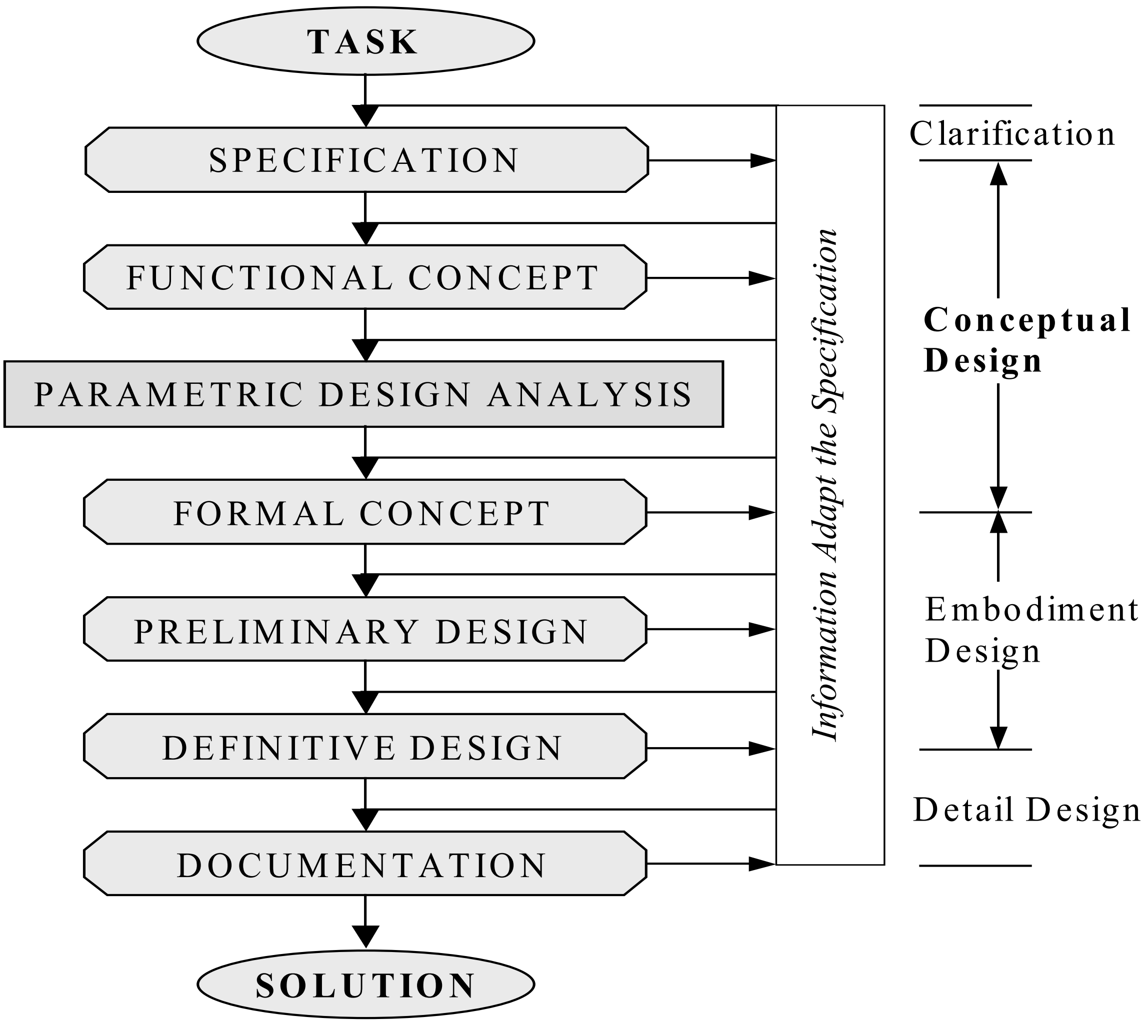


Figure 1. Design Process associated with Parametric Design Analysis

3. Method for Aesthetics Design Improvement

The Method for Aesthetics Design Improvement is divided in two main phases of development, as shown in Figure 2. The first one called *Information* involves the basic steps of *clarification of the task* and *conceptual design phase*, and starts with the collection of information on the requirements to be embodied in the new design for the product, related to the preliminary product idea. These steps are followed by the identification of essential problems, which are the clarification of the overall function and the essential constraints for which solutions have to be found. The overall function is divided in sub-functions according with its main purposes. The meaningful and compatible combination of sub-functions produces a so-called function structure that can be represented as a system structure, consisting of sets of ordered sub-systems interrelated by virtue of their properties and construction characteristics. The function structure is satisfied by definite physical principles, and is relate to the system structure through its required form design features, called solution principles. To satisfy the overall function, the solution principles for the various sub-systems have to be combined in rough dimensioned layouts, called *functional concept*.

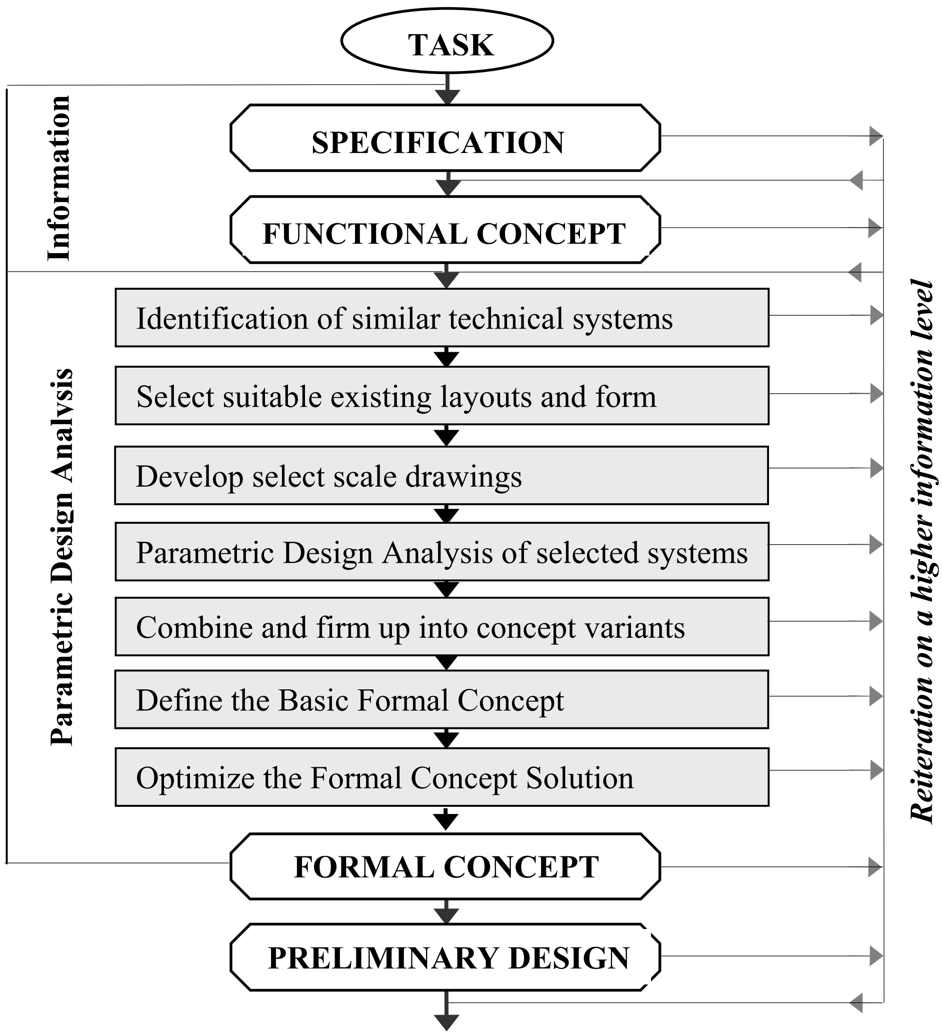


Figure 2. Steps of Parametric Design Analysis Phase

The second phase is called *parametric design analysis*, and starts with the identification of similar technical products or assemblies, in which several sub-functions or parts of its function structure correspond with those for which a solution is being sought. The development of this step includes up-to-date literature research in technical publications, as well as the careful identification of similar sub-systems in modern products of competing companies. Next, it is necessary to make a careful selection of the suitable existing layouts and form designs, in order that the only systems to be selected are those having a direct relation to the preliminary solution concept as a whole or on part of it. This step should be characterized by the development of scale-dimensioned drawings as accurate as possible.

The establishment of qualitative evaluation parameters for the design analysis of engineering systems uses frequently values from 0 to 10. However, the use of detailed evaluation bases makes difficult the evaluation of the subjective aspects of aesthetics criteria. In this case, experience shows that it is more profitable the employment of values that allows more objective qualitative evaluations, through the use of a less detail scale of values or through the recommended employment of a simple binary scale, as shown in Table 1. The analysis of aesthetics properties of a product can be done by reference to several different criteria. In spite of that, experience shows that aesthetics criteria can be arranged in three groups. Each one of these groups is related to specific guidelines, which in turn are associated to determined methods of development, as presented in Table 2.

Table 1. Qualitative Evaluation Parameters for Aesthetics Criteria

Values	Qualitative Meaning	
0 - 1	Unsatisfactory solution	Unsatisfactory Solution (< 50 %)
2 -3	Weak solution	
4 - 5	Tolerable solution	
6 - 7	Appropriate solution	Satisfactory Solution (≥ 50 %)
8 - 9	Good solution	
10	Very good solution (Ideal)	

In this way, evaluation parameters for aesthetics criteria analysis can be expressed in relation to their degree of adequacy to stipulated specifications or expected results. In the design analysis process, the designer verifies the correlation between the layout and form design features, with its correspondent stipulated functions and aesthetics properties for which they where designed or need to be evaluated.

The development of aesthetics design analysis is facilitated by the deliberate abandonment of an optimistic approach in favour of a critical and corrective one, and is realised systematically by recourse to the *method of persistent questions* [4]. These analysis are based on design oriented criteria, and lead to the identification of the features involved, which in turn, may suggest new formal concepts for the product under evaluation. The method of persistent questions looks for answers for the following questions:

1. The form design features satisfy the aesthetics criteria, or not?
2. What is the form design feature directly responsible for that?
3. What is the optimum form design features required to satisfy the aesthetics criteria?

The answers of these questions characterise a knowledge process in *conceptual design phase*, aimed to the discovery of logical, physical and form design features related to the technical functions and aesthetics properties. This process leads to the identification of the features involved, which frequently suggest new formal concepts variations for the product under development. The meaningful and compatible combinations of these form design solutions with the *functional concept* establish a new and improved *form concept* for the product.

Table 2. Basic Aesthetics Configuration Criteria, Guidelines and Methods

Criteria	Guidelines	Methods
Overall Form Structure		
Identification of Form	Clear identification of overall configuration	Systematic variation of the product structure and overall configuration
	Ordination of subsystems in an identifiable way	Divide into clearly distinguishable areas or group of subsystems
Unity of Form		
Integration of Subsystems	Minimise the number of different forms	Compose clear and embody arrangement for subsystems
	Minimise the variations in form position	Orientation of subsystems along the product's main axis
Harmony between Subsystems	Aim for similar forms and contours	Integration of each subsystem in pieces with similar contours
	Aim for harmony between Layout and Form Design	Compose a clear and embody arrangement for the overall form, oriented by similar contours for every subsystem.
Stylistic Form Features		
Intended Expression	Compactness: Aim for maximum compactness impression	Minimise outer shape space requirements
	Smoothness: Aim for a simple, uniform, streamlined, pure and embody style.	Replace sharp corners and joints by rounded corners and fillet joints, for each subsystem and for the overall form.
	Lightness: Aim for maximum lightness impression	Projected area of upper subsystems smaller than lower subsystem's area
	Stability: Aim for maximum stability impression	Gravity centre of overall system's projected area positioned above and inside limits of the base, or lower subsystem
	Desired Style: Aim for specific stylistic features for target markets (e.g.: modern, classic and other styles).	Modern: Overall form composed by curved lines and rounded corners, Aggressive: Sharp edges combined with streamlined appearance, Classic: Overall form based in straight lines, with clear identification of the form Specific style: Overall form based on specific stylistic form features.

4. Design Examples

An example of principle results of the application of the Method for Aesthetics Design Improvement is shown in Figures 3 and 4, related to the redesign of a much known telephone design. For the purpose of this example, it was realized only the main aesthetics design analyses necessary to basic improvement the product, which in this case involves only some form features of one subsystem in relation to the overall system. The principle evaluation steps employed by the aesthetics analyses are shown in Tables 3 and 4.

The capacity of the Method of Parametric Design Analysis in providing the improvement of the design is based on the following premise. *If it is possible to identify the reasons why a certain form aspect doesn't accomplish a certain function, then the designer can deduce directly of the done observations, which are the necessary form aspects to the satisfaction of the requested function*. As example of this process, the analyses presented in Table 3 observe the adequacy of the design of the *headset* in relation to the *base unit* of the telephone and the pertinent aesthetic criterion. These analyses are aimed to settle down if the form is adapted or not for the accomplishment of the observed function, and mainly, they try to describe - through the *general comments* - the reasons that define if each geometric characteristic assist or not the aesthetics purposes for which they were conceived.

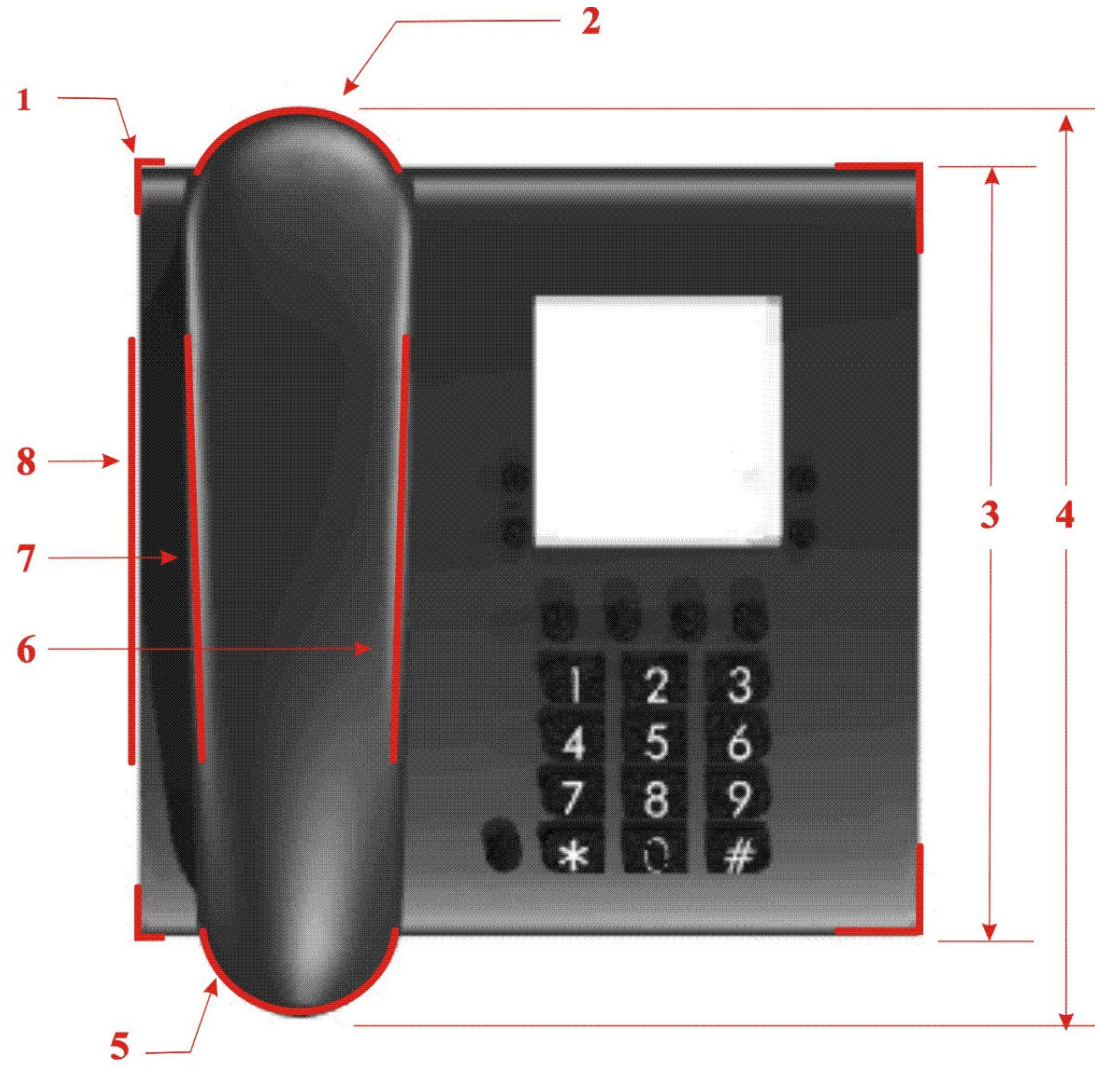
Best Right View	Best Left View
	

Figure 3. General Perspectives of the Design under Improvement

Top View	Right View
	

Figure 4. General Orthogonal Views of the Design under Improvement

Table 3. Development of Aesthetics Design Analyses – Upper View



References	General Comments
1	Right angle corners of the *base unit* do not compose a clear and embody arrangement for the overall form.
2	The rounded contour of the handset top contour is not in harmony with the right contours of the *base unit.*
3	The dimension of the *base unit* do not compose an embody arrangement with the *base unit*, as it is smaller than the *handset.*
4	The dimension of the *handset* is much bigger compared to the *base unit*, and because that do not provide a compactness impression.
5	The rounded contour of the handset bottom contour is not in harmony with the right contours of the *base unit.*
6 - 7	The outlines of the *handset* are not in harmony with the typical straight lines of the *base unit*.
8	The typical straight lines of the *base unit* are not in harmony with the rounded outlines of the *handset*.

Table 4. Development of Aesthetics Design Analyses – Lateral View

References	General Comments
1	The curved line of the *handset* top part is not in harmony with the curved line of the *handset* bottom part (Ref. 2).
1 - 2	The curved lines of the *handset* are intended to give lightness impression for the *handset*, but instead of that, gives an instability impression for the subsystem.
2	The curved line of the *handset* bottom part is not in harmony with the curved lines of the base unit (Ref. 8 – 9).
3	The massive area of the *handset* upper part does not provide lightness impression.
4 - 5	The curved lines of the *handset* top part are not in harmony with the typical curved lines of the *base unit* (Ref. 6 – 11).
6 - 11	The rounded corners of the *base unit* lateral view are not in harmony with the outline of the *handset*.
7 - 10	The dimension of the *handset* is much bigger than the base unit, and do not provide compactness impression for the overall system.
8 - 9	The curved lines of the *base unit* are not in harmony with the outline of the *handset*, principally in relation to reference 2.
	The curved lines of the *base unit* are very well designed and give the main form design characteristic for the overall system.
	The curved lines of the *base unit* give a lightness impression for the overall system, and are in harmony with the intended expression of modern style.
12	The outlines of the *handset* bottom part do not agree with any form design features of the overall system.

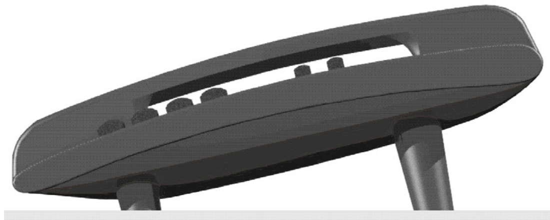
Top View	Right View
	

Figure 5. New Aesthetic Formal Concept Developed – Orthogonal Views

Best Right View	Best Left View
	

Figure 6. New Aesthetic Formal Concept Developed – Perspective Views

Table 3 and 4 shows the principle evaluation steps employed by the aesthetics analyses related to the formal concept of the existing product, together with the correspondent suggestions for redesign that lead to the development of a new aesthetics Formal Concept for the product under improvement. These analyses shows that the aesthetic design of the handset is the main cause of the lack of harmony of the overall system, and because of that, this subsystem was the only one improved.

The main results of the application of the method for aesthetics design improvement are presented in Figures 5 and 6. The repetition of the aesthetics analysis process over each subsystem of the product, and principally for the overall system, leads to the development of the optimised aesthetic Formal Concept Solution for the new product.

5. Conclusion

The paper focuses on the issues related to a practical coupling of intended aesthetic impressions and shape design. The method presented improves the entire product development process and has the advantage that design modifications are easy to obtain and alternative geometries can quickly be generated. This would enable the optimization of the particular variable against a requirement from the market, in the conceptual design stage.

The method of Aesthetics Design Improvement based on Parametric Design Analysis characterises a knowledge process in conceptual design phase that leads to the development of an improved overall appearance for the product based on human feelings and universal values. The efficacy of the method presented brings the conclusion that the process of aesthetics design improvement can be a natural and direct consequence of a logical parametric analysis process related to the product's aspects of form and function. The design analyses are oriented to the improvement and unification of design education process in order to ensure that these findings may be effectively transferred to society.

References

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