

PRODUCT AESTHETICS AND CREATIVITY

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Abstract: Aesthetics is one of the most significant features in product design which can influence the success of product in the future market (Bloch, 1995; Herr, 2000). However the nature of beauty and attraction is still unknown and many designers are unable to objectively judge how their designs will be perceived by consumers in the market (Crilly et al., 2009). We suspect that one significant reason is the lack of a precise and comprehensive pattern of aesthetics which can improve confidence about the future interpretation of final product form. To fill this gap some previous research has been done by expert design researchers (Khalid and Helander, 2006). However, it seems that the real practical solutions to achieve the aesthetic perfection and also creativity, as an important part of aesthetics, have not been proposed yet. One of the most effective approaches in this field is to investigate the fundamental facts and their impact on the final gestalt.

Keywords: *aesthetic, beauty, attraction, creativity, product design, consumer, designer*

1. Introduction

Aesthetic as a value (Kieran, 1997) in product design can be assumed as a kind of consumer response in subjective interpretation (Crilly et al., 2004) or as an external reality in objective evaluation (Khalid & Helander, 2006). While a human brain is analysing rational principles in the object, the emotion is seeking a delightful pattern simultaneously (Norman, 2004). Both cognitive and affective aspects of aesthetic (Crilly et al., 2004) whether objective or subjective, can be meaningful in the human perception (Etcoff, 1999). While nature has been the first reference of the inspiration as a measure of beauty, the generation of the other artefacts and products among mankind evolution, has made a design space in which a preferred form does not necessarily follow the familiar natural shapes (Crilly et al., 2009) and the geometric or organic forms as a design element are utilised as a main source of three-dimensional imagination of the real product appearance (Hsiao & Chen, 1997). While as a sculptor, the form is a completely free and can evoke any concept with 3D construction, as a product designer, the function determines the form (Verma & Wood, 2001). Thus the imagination of product form follows a functionality (Verma & Wood, 2001) which has made typicality in the design world (Hekkert et al., 2003) as a major visual reference (Crilly et al., 2009). The essence of typicality is associated with consumer experience of desired product form which may have been using for a long time (Hekkert et al., 2003). In this situation, the user has gradually believed that the expected function can only be possible with this specific design (Hekkert, 2006). However, when designers try to reveal the hidden angles of novelty, the consumer view and expectation can be changed and the product design can be perceived as a creative effort (Liu, 2000). Although the novelty is an effective factor in increasing the attraction of product, the aesthetic perfection cannot be achievable in the absence of concinnity (beauty) (Crilly et al., 2004). In other words, a product appearance can be pleasant when it

is able to satisfy the both rational and emotional aspects of user response (Bloch, 1995). Despite a significant amount of investigations of human factors, the scientific reason of inherent preference of design principles (Hekkert, 2006) which have the mathematical templates such as symmetry and proportion or golden ratio (Papanek, 1974), and also emotional needs (Norman, 2004) are still unknown (Crilly et al., 2009). This paper will discuss the potential solutions of making an objective evaluation of aesthetic in product design with a special attention to creativity in order to construct the basis of a comprehensive pattern of beauty and attraction in product design. Firstly, the problems associated with different interpretation of aesthetic and the issues related to previous subjective research is mentioned. Secondly, the new response to develop a model of aesthetic perfection and creativity role will be revealed.

2. Different interpretations

The design of products usually is interpreted in different ways in the view of designer and consumer (Crilly et al., 2004; Hsu et al., 2000). This non-coordination has caused designers to hesitate about the future judgment of their designs in the market (Crilly et al., 2009). One of the possible reasons for this discrepancy is the independent interpretation which can construct the different basis of product form structure that may vary from consumer taste which may be a result of low level of communication between consumer and designer (Lai et al., 2005). In addition, there are enormous numbers of factors that can have an inevitable impact on the final response to a product design (Crilly et al., 2004). Social surrounding and the impact of other people's opinion, marketing influence, and cultural background are the obvious examples of the social impact on the construction of people preference (Bloch, 1995; Khalid & Helander, 2006). In addition, individual factors such as age, gender, knowledge, experience, and personality can affect the consumer perception of a product design (Crilly et al., 2004). The final impact which is a combination of social and individual impact can reveal the final consumer response to an intuitive reaction of a physical object. Although people perception of attraction is under the influence of this final impact, it follows a one psychological pattern (Hekkert, 2006). These constant features are based on human characteristics which are used as common adjectives between human and product (Langmeyer & Shank, 1994). These characteristics involve emotional content with social, altruistic, and affective values (Noble & Kumar, 2008).

3. Previous research

Apart from some objective measuring methods of aesthetic such as facial and vocal expression to measure the consumer response (which are still unable to reach the definite result) (Khalid and Helander, 2006), several studies have been conducted in order to achieve a scientific procedure in product design optimisation. Most of these studies have focused on characteristics of product form evaluation which is judged based on consumer opinion. In this part, the result of three recent investigations on multi-dimensional models will be evaluated.

3.1. Integrating the Kano model into robust design approach (Chen & Chuang, 2008)

This study has investigated optimisation methods by integrating Kano model which has divided into three different types of quality and the grey-based model which is based on level of resemblance to measure the correlation of the factors. This model has evaluated consumer preference based on questionnaire in two different situations in presence or absence of quality (Chen & Chuang, 2008).

Chen & Chuang (2008) claim that unlike previous conventional methods, Kano method has been constructed on the consumer satisfaction. This study has done an experiment on mobile phone design attributes in order to test this optimisation method in the real product design world. While even a small dot can affect the final product aesthetic, they claimed that "the screen, function button style and speaker receiver were not significant factors in aesthetic evaluation". After the several complex processes, the optimised design emerged. By looking at the final form, it will be relatively easy to understand that the mobile phone design which has been claimed as an optimised design, has not been able to reach the real aesthetic optimisation as far as the lack of design principles is obvious.

3.2. Measuring consumer perceptions (Petiot & Yannou, 2004)

This study which is based on semantic differential method (SDM) (Osgood et al., 1957) and multi-dimensional scaling (MDS) (Shepard et al., 1972) has been experimented on table glasses. The extracting semantic attributes is a process of proposing 15 glasses to 11 people and asking them to express their opinion about the character of the forms. Then the researchers have placed each design in the 2D perceptual space depends on subjective results. After several complicated processes two designs have been proposed as a candidate for new design. It seems that the result of this research is highly dependent on what a limited number of users have expressed. As was discussed, the consumer perception is affected by social and individual impacts which will determine the final decision. Without studying these impacts in a particular time with its specifications in an objective way based on psychological pattern, the outcome cannot be reliable.

3.3. Use of shape preference information in product design (Kelly & Papalambros, 2007)

In this research preference mapping (PREFMAP) and conjoint analysis have been used as analytical modelling methods. The base of the data has been emerged from the forty subjects and using a questionnaire with sixteen selective questions in assessing the differences between PREFMAP and conjoint, and 39 college-age individuals in the process of combining preference and engineering functionality in design of plastic cola bottle. The nature of questionnaire is a kind of noise in achieving the objective results which may reduce the accuracy of what exactly be needed in this particular field. The condition in which people answer, question type, design of questionnaire, and other impacts which may affect the respondent opinion temporarily, are the examples of noise.

As can be seen from the procedure and results of these studies, a complicated process has not necessarily led to optimised outcome if the data is not sufficient and precise. Using the data based on asking limited number of people opinion, cannot be assumed as an objective judgment. The final decision to choose or refuse a product (which should be a main concern of designers and manufacturers), is affected by a huge number of factors (Crilly et al., 2004). The optimised result can be achievable by using strong, precise, and objective data, not by the complexity of analysis.

In this situation, it seems that objective data are accessible only by applying an objective procedure. In order to develop this approach, the fundamentals should be defined as the elements of an objective construction. These fundamentals are associated with the very first definition of the concepts that have to be definite as a start point of the investigation. For instance, Etcoff (1999) states that the basic description of beauty is one of the controversial topics and experts have disagreement about the main features. Thus, in order to reach accurate results, the fundamental concepts should clearly be determined. In the process of achieving this goal, first of all it seems necessary to illustrate the situation, location, position, specifications, features, and peculiarities of aesthetic as a main conceptual subject of this study.

4. The theory of aesthetic visualisation

Beauty based on its definition should be a timeless reality which has remained unchanged over time. The perception of beautiful objects can be a rational relationship between the design elements based on mathematical rule which is called design principles. Although the scientific reasons for inherent beauty preference and human brain structure pattern in perceiving beauty have not been discovered yet, it has been implicitly proved over time while the perception of attraction depends on the time features. Psychological science is trying to develop the model in order to predict the people reactions in different situations which can change over different times. Thus, unlike beauty, attraction is an indirect response to what human can perceive based on numbers of factors which has been already discussed. In this situation, the beauty preference and human reactions have been relatively determined. Figure 1 shows an illustration of the location and theoretical shape of beauty (B) and attraction (A) in association with a product (P). Beauty is assumed as a timeless strip in which (D) is a dimension (fixed dimension means as soon as the dimension is determined, it will remain unchanged) and (X) is a location while it is fixed over time. As soon as the location and the dimension of beauty are discovered, it will be a constant concept. Attraction is a multi-dimensional concept in which the dimensions construct the shape. Also, location and time are the other specifications of the attraction. The purpose of time here which is indicated with letter (T) is not a time with its current definition, but

the main purpose is the features and specifications which are allocated to that specific time in which unlike beauty, attraction can appear in different shapes and dimensions. The concept of dimensions of product is assumed as design constraints (R) which has constructed the specific area. As can be seen, a product with larger design constraints cannot be completely fit in the beauty area. The intersection of attraction and beauty (AP) is indicated as an area of aesthetic perfection and the intersection of this area with the product will be the product aesthetic perfection (PAP). As can be seen from this figure, the attraction can be existed with different shapes in different times and sometimes it can cap the beauty partially or completely and sometimes not. Also a product can partially or completely be only attractive or only beautiful or both or neither. In addition, it can cap the different shapes of attraction in different period of time. Note that this figure is a 2D indication of multi-dimensional space and some dimensions such as (R) as a design constraint has a different dimension from the time. In order to define a mathematical formula, the (PAP) will be equal with the function of (R), (T), (X), and (D). By discovering the dimensions of aesthetic and beauty and also their locations and the specifications of different time impact, the variables will be determined and consequently the product aesthetic perfection can be measurable. To achieve this goal, all the effective metrics should be defined.

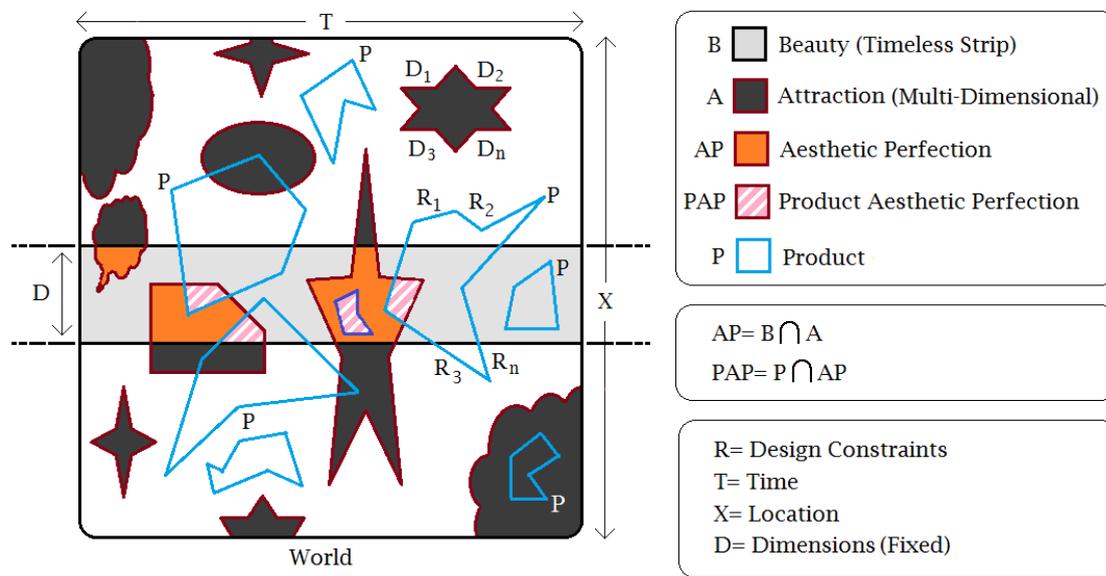


Figure 1. Illustration of product aesthetic perfection

5. Defining the effective metrics

To define the effect of one compound or complex, the components and effect of each component should be defined. The perception of the reasons of a phenomenon which is affected by a noticeable number of agents can be difficult without analysing all the effective factors (Robson, 1993). Aesthetic perfection can be assumed as a phenomenon which is highly impressible (Crilly et al., 2004).

To evaluate the aesthetic perfection and creativity role, all of these factors should be assessed and effect of each one should be analysed. As it will be discussed, the factors should be measurable and cognate which is called here, the metrics. With defining the metrics, a multi-dimensional model will be developed simultaneously in which the metrics can reveal the characteristics of the design in order to compare with the ideal position.

5.1. Metrics specifications

The metrics involve features and specifications which not only determine the nature of final combination, also will prove their capability to construct the robust basis and consequently the precise results:

1. Timeless applicability: The metrics are not allocated to a particular time but these are absolute variables in which they can reveal different results depend on different circumstances. These metrics are constructed based on human perception pattern and psychological reactions.
2. Versatility: These metrics can work for any kind of concepts in different situations without any external or internal limitation.
3. Comprehensive: The metrics cover both of emotional and cognitive aspects of design factors in which all the possible impacts are applicable.
4. Single digital pattern potential capability: All of the metrics can be capable to be coded and decoded to work as a digital pattern in developing relevant software.
5. Updatable: While technology and sciences progress, the new possible effects may be discovered. Thus, the new metrics can be added in the future which can increase the model accuracy and maturity.

5.2. The process of defining the metrics

The metrics should be defined as the effective measurement unit which will construct the model of product aesthetic preference:

6. Compiling the possible metrics: This is a process of discovering all the possible metrics. It will be started with general metrics and will be followed by more specific ones till all the possible metrics would be revealed. Although the number of metrics is important, the quality, essentiality, effectiveness, and efficiency of metrics can play a vital role.
7. Evaluating the metrics: All the metric should be evaluated to make sure they are efficient enough to use in the model. The measurement for evaluation is the amount of effectiveness of each metric on the final product aesthetic.
8. Adding the values to the metrics: One of the most significant stages is discovering the values for each metric. The level of effectiveness of each factor on final product should be considered.
9. Defining the units for values: All the values should be measurable in order to be capable to integrate into a model for extracting the logical results.
10. Unifying the units in the same concept: All the metrics should be cognate in units in order to make a rational connection with other values while interacting in the model.
11. Digitalising the units: The capability of being digitalised of units can be tested and some changes may be needed in order to coordinate the nature of units with digital values.
12. Clarifying the results: This is a process of converting results to the usable information based on the target which is generating comparable values to make an analytical comparison with the object analysis.
13. Defining the cognate procedure to evaluate a product form: The product form should be evaluated as well as the model. To indicate the weakness and robustness of the design, both analyses should be cognate.
14. Extracting results of product form evaluation: After product form analysis, the results of the evaluation which is based on the aesthetic model will be clarified in order to begin the comparison.
15. Comparing the model and form evaluation results and revealing the robustness and weakness: At the final step the result of product evaluation will be analysed in the aesthetic perfection model and defined criteria will be compared with product characteristic information.

5.3. Creativity role

One of the most useful definitions of creativity in design states that creativity is composed of the new variables which do not be utilised by designers in the normal design process (Gero & Maher, 1993). This can happen because designer is unaware of them. With defining the aesthetic perfection model, all the possible variables can be revealed and consequently the new dimensions of creativity will be obvious. By using this model, designers can be able to access two significant preponderances: firstly, they can observe the possible opportunities of creativity application; secondly, they can make sure that this creativity process will follow the consumer preference and satisfaction in both cognitive and emotional aspects in a defined framework of robust design criteria.

6. How product aesthetic model works

Aesthetics consists of beauty (cognitive response) and attraction (emotional response) (Crilly, 2004; Ulrich, 2006). In product design, beauty is affected by design principles and mathematical outcomes (Papanek, 1974) while attraction follows novelty (Hekkert et al., 2003) and aesthetic characteristics (pleasant traits) (Pham, 1999; Breemen et al., 1999). In this case, product design elements (form, material, texture, colour and graphics) are dealing with aesthetic components while interacting with the function which is affected by technology and ergonomics (De Angeli et al., 2006). In addition, moderators can affect the final judgment of product aesthetic by consumers. These factors have been divided into two main categories: real and virtual. Real moderators are included in product aesthetic nature while virtual moderators arise from external factors (Crilly, 2004; Hekkert et al., 2003; Hekkert, 2006; Bloch, 1995; Reich, 1993) (Figure 2). Another type of moderator also can happen in design process such as design tools which this model aims to eliminate these factors as much as possible. Thus it is not included in the model.

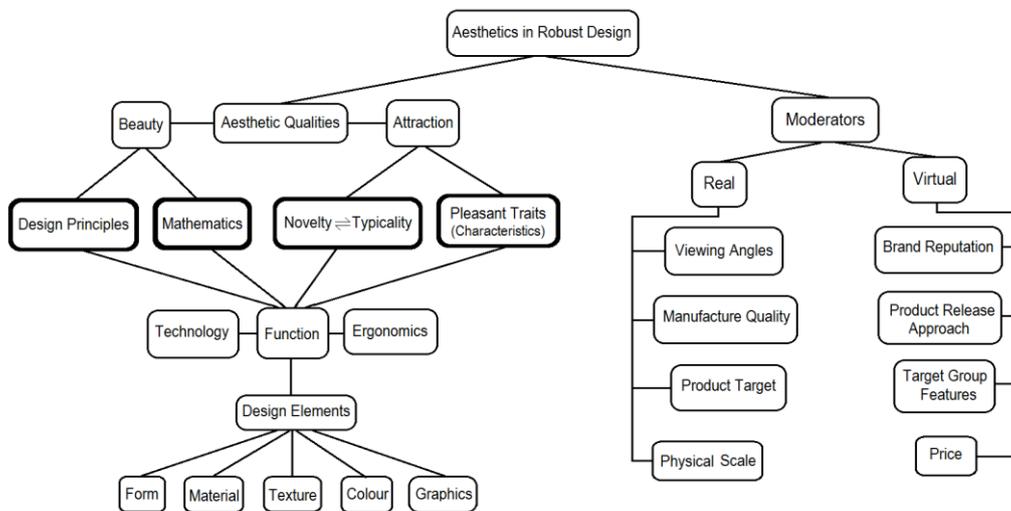


Figure 2. Constituent components of product aesthetic perfection

The metrics arise from the complimentary space in which each element of design is evaluated facing the aesthetic perfection qualities. Metric's properties consist of definition and instruction. The metric's instruction is an objective solution to measure a specific quality. Balance as a design principle in form or Pureness as a pleasant trait in material can be assumed as a sample of metrics. One of the objective solutions to measure and to evaluate the metrics is mathematics which can be feasible by converting the conceptual definition into a mathematical concept capable of quantification. By revealing the objective instruction of each metric, a strong tool of dealing with design will emerge in which creativity can be established based on a robust foundation.

7. Conclusion

This paper studied the theoretical process of developing an objective evaluation of aesthetic in which the variables can reveal the robustness and weakness of product appearance and explicate the opportunities and the possibilities for design creativity. This process which will led to a multi-dimensional model in the design space, can determine the position and location of each effective aesthetic perfection factor. It can be able to indicate the possible solutions to reduce ambiguity which is the result of neglect of fundamentals. There are significant advantages of this model compared to previous studies which three of them are mentioned in this part:

1. **Objectivity:** The main excellence of this model is the level of objectivity. Applying the data which has emerged from the subjective opinion of limited number of individuals cannot lead to the precise objective outcome. The model of aesthetic perfection uses the facts and

evidences of human perception and psychological pattern which can scientifically predict the responses in different circumstances.

2. **Universality:** This model which is divided into beauty and attraction attributes, is a universal and comprehensive template of the real satisfaction level of humankind. While analysing beauty is naturally less complicated, the attraction evaluation needs more complex assessment (Crilly et al., 2004). Thus, all the effective factors will be included to cover all of the possibilities at every location.
3. **Practicality:** The main aim of this model is to construct the practical instruction for the real design world which can be applied by professional or amateur designers, design companies, factories, researchers, and students in which the intension is to design a simple interface. In addition, this model can be capable to operate as software in order to enhance the performance and ease of use.
4. In the current situation, what is called design optimisation has not been satisfactory as a real operational solution for aesthetic preference (Crilly et al., 2004). The possible reason for this unsuccessfulness is that the starting point of current design process may not begin from the first. In other words, this process may need to be started from a point much earlier than what is considered now (Figure 3).

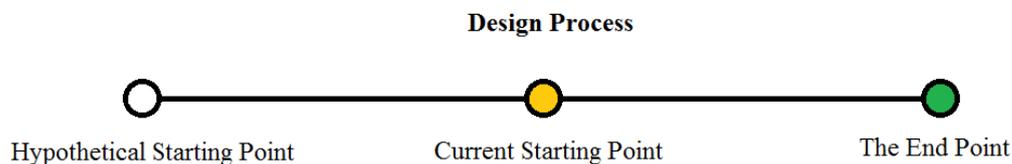


Figure 3. Current and hypothetical starting point in design process

The studies which analyse different aspects of product appearance perception such as cognitive or affective (Bloch, 1995), information or concinnity (Crilly et al., 2004), typicality or novelty (Hekkert et al., 2003), subjectivity or objectivity (Khalid & Helander, 2006), characters or attributes (Langmeyer & Shank, 1994), functional or emotional (Noble & Kumar, 2008), and recognition or identification (Crilly et al., 2009), should not only play with words. The solution will be a new approach for this kind of studies which have not been able to achieve the practical outcome. Crilly et al. (2004) state that designers still believe that “intuitive creativity” is the only operational solution in the design world. The possible reason is that designers usually feel about their works while they do not analyse the proof for what they believe that is delightful and acceptable. The lack of precise scientific model has caused that designers would not be able to trust this approach and they would become reluctant to think about other solutions rather than natural talent of understanding and creating aesthetic. If product designers assume their work as a part of art, and art as a part of conceptualisation, this situation can be more complex in a presence of functional approach and engineering stage. Meanwhile a scientific approach is a discovering process of what human inherently does as a designer or as a consumer in perception of product appearance with a combination of product functionality and manufacture phase to achieve the proof of final satisfaction level. This paper tried to elucidate and clarify a new path to reach this target. Although this path has not been traversed yet, it can be assumed as a new robust basis of the mysterious reality of human nature.

In order to develop and enhance this evaluation in the future, reviewing and comparing current design research and techniques seem necessary as a beginning level. After developing and justifying the methodology, devising a controlled test procedure/experiment to test the effectiveness of proposed model in an industrial and professional environment is suggested. In addition, analysing the test result data and modifying the design methodology (if necessary) can be considered.

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