

Influence of Aesthetic Properties on Stimulating Emotional Responses

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Abstract

The purpose of this paper is to provide a framework that demonstrates the role of aesthetic properties in stimulating emotional experiences. The framework is constructed as the answer to the question: "What are the consequences of the stimulus of aesthetic properties on product related emotions and experiences?". The focus of the study is in investigating the links between the visual qualities of the products and the emotional experiences. The immediate sensorial experiences transpire during the initial steps of the relationship between human and the product. These experiences are the results of the interaction between the visual qualities and the sense of sight, inevitably influencing the emotional evaluation process of the interaction. This initial interaction stimulates long-lasting emotions and perceptions related to the product that provide inferences on prospective experiences, the quality of the continuing interaction, and induced feelings. The perception about the product is the key path leading to creating emotional experiences since different perceptions stimulate different emotions filtered through different experiences about the same product. Thus, it becomes essential to disclose the nature of the connections between the two parts of the initial interaction; human and aesthetic properties of the product. An empirical study is performed to present emotional evaluations of the subjects when they are exposed to a product for the first time.

Keywords: Design, Aesthetic Properties, Emotions, Emotional Responses, Experiences.

Introduction

The signs and the information about the outer world reach to human brain resulting in perception of the environment. In particular for a designed product, the most prominent signs and information are its visual properties (Bloch, 1995). Consequently, the perception of a product and its most prominent qualities are gained by the sense of sight (Arnheim, 1967). These prominent visual properties of a product are formalized by the aesthetic properties that reflect the surface information (Taylor *et al.*, 1999).

The aesthetic properties introduce the fundamentals of the relationship between human and the product by initiating and determining the course of the interaction. During interaction, the information broadcast by the product is received by subjects who are exposed to the product—either intentionally or unintentionally—primarily by the sense of sight. Therefore, the visual stimulation—or the visual interaction—is primary when the perception of a product

is considered (Asatekin, 1997).

The aesthetic properties of a product are the most dominant factors not only in delivering the first impression but also in stimulating emotions about the product. These properties are integrated into the design process to evoke some particular emotions and behaviors by affecting the emotional evaluation process of the interaction (Asatekin, 1997). The emotional benefits that define the feelings and the mood of a person during interaction determine the quality of the relationship. This relationship is embodied by the emotional reactions given to the product, which are therefore direct consequences of the perception of the aesthetic properties. For instance, the emotional resonance with an attractive and beautiful product provides sensory pleasure and stimulation (Bloch, 1995). The aesthetic and emotional expectations of the human are fulfilled by the sense of pleasure provided by these aesthetic properties (Macdonald, 1998). The initiation of the interaction becomes directly related to the aesthetic properties due to the fact that the aesthetic properties draw the attention and influence the way of the continuing interaction and induced emotions (Tractinsky *et al.*, 2000). The emotional responses that are triggered by the aesthetic values (Yoshimura and Yanagit, 2001) help define the attitudes towards the products (Tractinsky, 1997) in all stages of interaction. The emotional satisfaction and the pleasurable feelings related to the products are evoked by the exposure to the aesthetics of the products and last during the usage period (Jordan, 1998).

In this paper, a survey-based study is performed in order to investigate the correlation between the aesthetic properties of a product and emotional responses. Next section discusses the motivation and the details of the empirical study. The results and the analysis of these results within the framework of design and emotion are discussed in section “Experimental Results”. Conclusion and final thoughts are presented in section “Conclusion”.

Empirical study

The experience during the human-product interaction results in a perception about the product. This perception evidently affects the extent of the emotional reactions towards the product. An empirical study is performed in order to examine the relationship between the emotional reactions and the aesthetic properties of a product. The study concentrates on resolving the links between the emotions evoked and the aesthetic properties of a product

during the first time exposure to the products. The main emphasis of the study is to capture the immediate emotional responses motivated by the particular aesthetic properties.

The empirical study is formulated using the Semantic Differential (SD) method (Chen *et al.*, 1997; Hofmesteeer *et al.*, 1996; Ishihara *et al.*, 1997; Kim *et al.*, 1998; Maurer *et al.*, 1992; Wikstrom, 1997). SD method is a well-known procedure where each concept is rated with predetermined bipolar likelihood scales by multiple subjects aiming to identify the overall properties of a product or understanding of a concept. In this study, the application of the method is composed of three steps. The first step is to define the sample products to be used in the study. The following step is the identification of the contrasting adjective pairs, which form the bipolar semantic scales of the questionnaire. The final step is the evaluation of the sample products by the subjects using the predefined set of adjectives representing the possible emotions. The subjects are asked to mark bipolar semantic scales to evaluate the sample products with dissimilar aesthetic properties by the adjectives and define one or more aesthetic properties as the determining motive(s). The sample products are presented visually to the subjects using the pictures shown in Figure 1.

Sample products

During the design period of the questionnaire, eight (8) table-clock designs with dissimilar forms, colors, materials, and graphic elements, which are taken as the main aesthetic properties of a designed object, are selected as the sample product group. The table clocks are suitable for a study focusing on the aesthetic properties due to several reasons. Among the many, some are that the table clocks are very accessible in daily life, occasionally used as decorative elements which emphasize the visual quality of the products besides their functionality and available in many different shapes and sizes. In the context of the study, only the images of the table-clocks are presented to the subjects in order to make the subjects concentrate merely on the visual aspects of the sample products.



Figure 1, Sample Set of the Study

Semantic differential scales

Fourteen (14) semantic bipolar scales are constructed with contrasting adjective pairs in order to collect the data regarding the immediate emotional responses towards a product. The adjective pairs are selected to span the representations of a wide range of possible emotions during initial human-product interaction. These fourteen pairs of adjectives which are collected from the studies that utilize the SD method, are selected as; ‘attractive-repulsive’, ‘masculine-feminine’, ‘inert-active’, ‘warm-cold’, ‘childish-mature’, ‘modest-impressive’, ‘modern-traditional’, ‘refined-rough’, ‘calm-playful’, ‘outstanding-ordinary’, ‘charming-drab’, ‘exciting-boring’, ‘serious-extreme’, and ‘creative-standard’. The quantity and the particular selection of the bipolar scales are within the feasibility of the presented work and can be altered for generalized application.

The subject group

The study is performed with a 40-subject group where the 55% of the group are female and 45% are male participants. The ages of the subjects varied from 23 to 43 while the average is 28. All the subjects who voluntarily participated in the study are college graduates with diverse backgrounds other than design related professions. The age variation of the subjects is considered irrelevant, however, the selection of subjects with backgrounds other than design related professions is considered crucial for survey objectivity. The rationale for such selectivity of subjects is that the perspective and experiences of an individual with previous design experience can be considerably deviant with respect to the perspective and experiences of an ordinary user towards a given product.

Experimental results

A sample product group of eight (8) is evaluated with the SD method consisting of fourteen (14) bipolar scales. In the study, the aesthetic properties are considered as the primary motives for the evaluations. For each aesthetic property, a frequency is computed demonstrating the effectiveness of that property on the evaluations as seen in Table 1.

Sample	Color	Form	Material	Graphic elements
1	25%	36%	17%	22%
2	25%	33%	19%	23%
3	29%	22%	30%	19%
4	26%	29%	26%	19%
5	24%	38%	28%	10%
6	20%	40%	26%	14%
7	25%	31%	26%	17%
8	22%	38%	27%	13%
Average	25%	33%	25%	17%

Table 1, Effectiveness of the aesthetic properties in the evaluations of sample products

It is seen that the frequency of each aesthetic property differs for each individual sample product. However, considering a general perspective, the aesthetic property 'form' has the highest frequency with 33% among the four properties. The property 'material' and the property 'color' rank second and third most effective property with identical frequency of

25%, and the property 'graphic elements' is the least mentioned and the least effective property with 17% of frequency. These values signify that the property 'form' is primarily effective in the perception of the table-clock samples.

Sample products

The evaluations for each sample product are analyzed in order to derive the degree of effectiveness of each aesthetic property on the perception of each sample product. The degree of effectiveness is represented by frequency of each aesthetic property.

'Sample 1'; with its black plastic amorphous entity is rated as the most "modest, rough and ordinary" design among the sample products. The property 'form' is the dominant aesthetic factor (Table 1) in the evaluations of 'Sample 1'. However, the dominance is not entirely due to appreciation of the design. It is indicated by some subjects that the design of this product is out of fashion due to its form. It is found necessary to note that the dominance of a particular aesthetic property in product perception is not always a result of its pleasurable form. Such perception decisions are generally governed by the distinct character of the aesthetic property either in a positive or negative manner.

As some of the subjects informally mentioned, combination of the natural look of metal material and its classic and traditional square form have driven them to rate 'Sample 2' as the most "repulsive, mature, cold, traditional, drab, boring and standard" product. The basic square image without any variation by the overall form and material is most likely the underlining reasons for these evaluations. The evaluations for 'Sample 2' reveal two important facts about the perception of aesthetic properties. The property 'form', as reported, leads to negative emotional reactions on 'Sample 2' by a dominant frequency of 33% (Table 1). On the contrary, another property that leads to negative emotional reactions is the property 'material' which is the least dominant property. These conclude that the negative or positive perceptions about a product can be due to the "prominent" major or minor effects of the aesthetic properties. For instance, a product with an overall positive image can preserve its positivity despite of possible minor negative effects of one of its aesthetic properties. As another example, for a product with an average image, a slightly more noticeable property can become the most dominant aesthetic property in perception.

'Sample 3' is mentioned to be the most "feminine, active, impressive, playful and extreme"

product among the samples. The property 'material' has the highest frequency with 30% on the evaluation of this product. 'Sample 3' is the only sample where the property 'material' is the dominating factor in decision making (Table 1). The fur material of the product is indicated to be very impressive at first sight. The two aesthetic properties 'material' and 'color' have very close frequencies on the perceptions due to the high correlation of the zebra-like, black and white color combination with the fur material. In the off-the-record conversations with the subjects, the material and the color of this product are the results leading to the perception of one of the most attractive products of the group while its form is found relatively ordinary. It is interesting to note that in the perception of an unorthodox, challenging design for an everyday product, the subjects are intentionally or unintentionally directed to investigate more of the most noticeable feature. For 'Sample 3' the most noticeable feature compared to the other products of the group is the property 'material'. This property is the dominant perception factor and thus must be carefully chosen to increase the positivity of the overall perception of the product.

'Sample 4' is not rated as 'most' in any of the adjectives. The property 'form' is the most dominant motive (Table 1). Since the pale blue color of the sample product is dependent on the translucent plastic material of the product, the property 'color' and the property 'material' have identical frequencies. The frequencies of the aesthetic properties for 'Sample 4' propose a well-balanced product. The average quality of the product is well distributed between the aesthetic properties. As stated earlier, for such a product, an unbalanced aesthetic property can be dominant and affect the overall perception of the product.

Majority of the subject group found the amorphous wooden table-clock (Sample '5') as the "warmest" one of the suite of table-clock designs. The property 'form' is the most frequently mentioned property, and the 'graphic elements' has its minimum influence in the entire sample product group (Table 1). In 'Sample 5', three of the four aesthetic properties—'form', 'material' and 'color'—combined form up to 90% of the influence on perception. The dominance of these properties over the 'graphic elements' indicates that the property 'graphic elements' is not disturbing the balance of the product. Such a distribution could occur in several cases. One example of such a case is a product where the dominant three properties have outstanding qualities where the last property has average quality. Another example is a product where the three dominant properties have noticeable below average qualities, degrading the overall quality of the product. Regardless of the quality of the last property,

the three below average properties lead to an overall negative perception about the product. Scrutinizing the results of the bipolar scales in depth for each particular product is able to constitute an efficient and realistic method to improve the design of the product.

‘Sample 6’ is selected as the most “attractive, modern, refined, outstanding, charming, exciting and creative” product of the group, due to its 'android-like hi-tech' form as stated by the subjects. The property ‘form’ has its highest level of effectiveness on the evaluation of 'Sample 6' among the samples (Table 1). The highly appreciated and noticeable 'form' of the product combines with the quality of the 'material' forming its futuristic image. The image of the technological refinement created both by the 'form' and the 'material' of the product is rated as the impression of this product. These properties present so bold characters that the effect of the 'graphic elements' remains insignificant.

‘Sample 7’ is the most “masculine, inert, calm, serious” design with a prismatic form. The form covered with a leather-like material creates an impression of quality and prestige as some of the subjects mentioned informally during the questionnaire. The prismatic form of the product has a frequency of 31% (Table 1), constituting the most effective aesthetic property. The form of the product has an evident influence on the perceptions of the product. However, the aesthetic property 'material' is the dominant factor on the overall impression of ‘Sample 7’. The impression of the 'material' proposes connections to the impression of leather in other life contexts leading to placing the product into similar contexts.

‘Sample 8’ is selected to be the most “childish” design among the products. The cylindrical form with rounded edges has the highest degree of frequency with 38% (Table 1), and the natural look of wooden material comes is next. The general perception of the product leaning toward 'childish' is driven by an influence of dominating property 'form' with the combination of the softly finished material. This perception is not supported by the design of the 'graphic elements' along the same line of thought, thus the presence of low frequency for this aesthetic property. Also note that in some cases, a major unbalance between the influences of the aesthetic properties could occur due to the overwhelming influence of one of the properties compared to others, not necessarily due to the low quality of the less effective property.

Analyzing the results for the suite of sample products, an overall degree of effectiveness for the four aesthetic properties is obtained. As presented earlier, the highest to lowest frequency

of effectiveness for the aesthetic properties are in the order of 'form', 'material', 'color' and 'graphic elements'. The results of the analyses for samples 4 through 8 conform to this general perspective of effectiveness, while samples 1 through 3 diverge from the general perspective. In the evaluations of the products 'Sample 1' and 'Sample 2' emotions are stimulated primarily by the property 'form', followed by 'color', 'graphic elements' and lastly by 'material'. The 'materials' of these two sample products are the least effective properties since the subjects found the materials very standard and indistinct. Unlike 'Sample 1' and 'Sample 2' but still diverging from the standard, property 'material' is most effective property in the evaluations of 'Sample 3'. The property 'color' is also significant in the evaluation of 'Sample 3'. It is interesting to note that the highest frequencies for the properties 'material' and 'color' are recorded for 'Sample 3' among the suite of samples. Also interesting to note is that the aesthetic property 'color' is significant for all the samples, however is never selected to be the most dominant property in product perception.

The distribution of frequencies for the two aesthetic properties 'color' and 'form' are intertwined for the two product samples 'Sample 3' and 'Sample 6'. The highest frequency for the property 'color' is reported for 'Sample 3' while the lowest frequency is reported for 'Sample 6'. The frequency for the property 'form' is opposite to the property 'color', recording the highest for 'Sample 6' and the lowest for 'Sample 3'. Also for 'Sample 3', the highest frequency for the property 'material' is recorded (similar to the property 'color'). Based on these reported frequencies, samples '3' and '6' are selected as the two most significant products of the group. Overall, 'Sample 3' is very dominant with its material and color combination. 'Sample 6' is also very distinct with its form while the reflection of the material adds another dimension to the impression of the product.

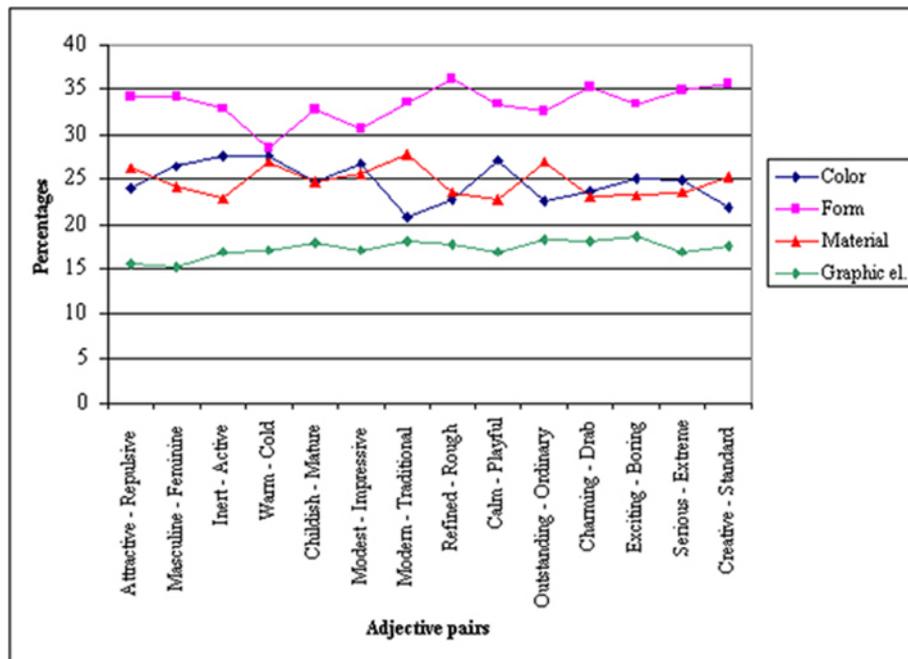


Figure 2, Effectiveness of the aesthetic properties in the evaluations with adjective pairs

Contrasting adjective pairs

In this section, the correlation between the effectiveness of aesthetic properties and the contrasting adjective pairs representing the perceptions and emotions is discussed. The results present that in the overall projection, the property 'form' is the most effective and the 'graphic elements' is the least effective motive for all of the adjective pairs. Figure 2 presents the correlations between each aesthetic property and the adjective pairs.

The aesthetic property 'form' is the most dominant factor in product perception. Similarly, the property 'form' is also the most dominant factor in determining the intensity of each adjective pair. The property 'form' has the highest correlation among the four aesthetic properties for all of the contrasting adjective pairs (Figure 2). The highest frequency of 'form' is for the adjective pair of 'refined-rough' and the lowest frequency for 'warm-cold'. On the other hand; for the aesthetic property 'color', the highest correlation is in the evaluation of the sample products with the adjective pair of 'warm-cold' and the lowest is with the 'modern-traditional' pair. The property 'material' has its highest for the pair of 'modern-traditional', while the lowest is for the 'calm-playful' pair of adjectives. Finally for the property 'graphic elements', the highest correlation is for the pair of 'exciting-boring' and the lowest is for the pair of 'masculine-feminine'.

The adjective pair 'warm-cold' has opposite effects for the aesthetic properties 'form' and 'color'. The correlation of the property 'color' is at its highest for this adjective pair, whereas the property 'form' is at its lowest (still the highest among the four aesthetic properties). The pair of 'modern-traditional' presents a similar situation considering the aesthetic properties 'color' and 'material'. The correlation of the property 'material' is at its highest with this adjective pair (28%). On the contrary, the property 'color' is at its lowest compared to the correlation with the rest of the adjective pairs. In 8 of the all adjective pairs, the properties 'color' and 'material' demonstrate close correlations with respect to each other within a 1% differential. For instance, for the adjective pair 'childish-mature' these two properties present identical degrees of correlation (25% each).

Conclusion

The human-product interaction is initiated with visual stimulation. The aesthetic properties of the products that form the visual qualities and the characteristics of the products stimulate emotions related to the products during the initial interaction. The immediate emotional responses given to the aesthetics of the products are principal regarding the perceptions about the products. The emotional resonance with the predefined aesthetic properties; 'form', 'color', 'material', and 'graphic elements' provides the communication line for interaction and influence all stages of interaction by defining the extent of the emotions. However, understanding the nature of the effects helps form the correlation between the emotions and aesthetics in the context of human-product interaction.

For this purpose, an empirical study is performed in order to investigate the intensity of various emotions when the subjects are exposed to the image of the products. The classification of the emotions is outlined with fourteen contrasting adjective pairs, which form the bipolar scales of the SD method. The results of the study present that the effectiveness levels on the represented emotions differ for each of the aesthetic properties. Evaluation of the eight (8) table-clock samples with dissimilar aesthetic properties by the SD method, where the determining aesthetic properties are indicated as the motives for evaluations, reveal that the aesthetic property 'form' has the primary influence on the emotions. Although the property 'color' and the property 'material' have shifting degree of effectiveness on the evaluations, from a general perspective, the property 'material' is more effective than the property 'color'. The close and the shifting effects of these two properties

are due to the relationship between the color and the material of a product such that the color might reflect the natural look of the material or the color can be driven from the potentials of the material. Furthermore, the sample products are analyzed individually to investigate the influence of aesthetic properties in the perception of a sample product. The aesthetic property 'form' is also the most distinct motive on determining the levels on the bipolar scales.

The study verifies the effects of the aesthetic properties on the emotions evoked by the products. The integration of the aesthetics to the design process offers various emotional experiences. It is essential to define their effects to create desired experiences and offer pleasurable emotions. In this study, however, merely the initial interaction and the first impression of the products are considered. The emotional responses to variations of only one aesthetic property must be studied in order to derive a more detailed understanding on the influences of a particular aesthetic property.

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