STUDYING EMOTIONAL DESIGN IN LADIES WRIST WATCHES

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ABSTRACT
Nowadays there are practical methods in emotional design. Quality Function Development (QFD) and Kansei Engineering are two methods which can be used to design emotional products. In this paper QFD and Kansei Engineering are integrated to study users' interest in product design. Firstly 100 ladies wrist watches were selected among 1350 ladies wrist watches. These 100 watches were chosen based on their differences characteristics and design. 22 properties were defined for selected watches. Then these 100 watches were clustered in 10 categories bases on the defined properties. Clustering was used to find out the most related properties for each watch. A representative watch was chosen for each category. The representative watch covered the most number of properties in each category; therefore 10 watches were selected to be studied. Kansei Engineering was employed to study the watches. According to the choice of domain in Kansei Engineering, the representative watches were studied with 12 Kansei words. The study was done by questionnaire and interview. 96 ladies, between 20-30 years of age, were selected randomly. The users' expressions were closely observed. The participants were asked to evaluate each watch on 12 Kansei words. The analyzed data showed that there is a direct relation between the users' emotions and properties of the watches. As a result for each representative watch some Kansei words were recognized. It means that Kansei words described users' emotions on each watch. Due to the findings, it was concluded that the users' emotional needs were translated to product properties.

Keywords: Emotional design, QFD, cluster analysis, Kansei, ladies watches

1 INTRODUCTION

In today's highly competitive and diverse market, it's difficult to analyze users' desires and preferences by applying conventional marketing techniques. A well-designed product should not only meet users' physical requirements but also provide their psychological needs. To support the process, various techniques have also been developed such as FMEA (Failure Mode Effect Analysis), DFMA (Design for Manufacturing and Assembling) and QFD (Quality Function Deployment) [1]. Quality Function Deployment (QFD), which is a method for translating the voice of the customer to Engineering specifications, provides a systematic model to design an object according to customer requirements.

In recent years many designers have focused on emotional design. Emotional design is a knowledge which relates to users' emotions and effects of the products on the users. Since the emotions appear unconsciously to the users and it is related to users' experiences, figuring out the emotions is not easy [2]. In the decade that all the products have a reliable function, successful product is a product that aims user's interests [3]. For this aim, emotional and personal experiences must be translated and measured with qualitative tools [4]. Kansei Engineering is one of the practical methodologies which concerned joy and desirability in product design. This methodology makes connection between appearance and experimental properties.

2 LITERATURE REVIEW

2.1 QFD

QFD is a structured method used to identify and priorities customer requirements, and to translate these requirements into engineering specifications for systematic deployment throughout a company at each stage of product or process development and improvement. The concept of QFD was introduced in Japan by Yoji Akao in 1966, and QFD has become the accepted methodology for development of products and services in Japan [5]. In the early 1980s, QFD was introduced at Xerox, and since then American businesses have exhibited substantially growing interest in using it. According to [6], QFD is a method for developing a design quality aimed at satisfying the consumer and then translating the consumer's demand into design [7]. There are several approaches to QFD in which a number of matrices are used to organize and relate pieces of data to each other, in the four-phase model [8] which is more customary in western countries, the QFD, the House of Quality (I) is run first, translating customer demands into engineering characteristics and ranking them in order of their importance. These data are the starting point for the second phase, where the critical parts of a new product are identified and ranked according to the importance. In the following step the key production processes are reviewed (III) and improved if necessary. Phase four focuses on the role of the production personnel and the impact on product quality (Figure 1).

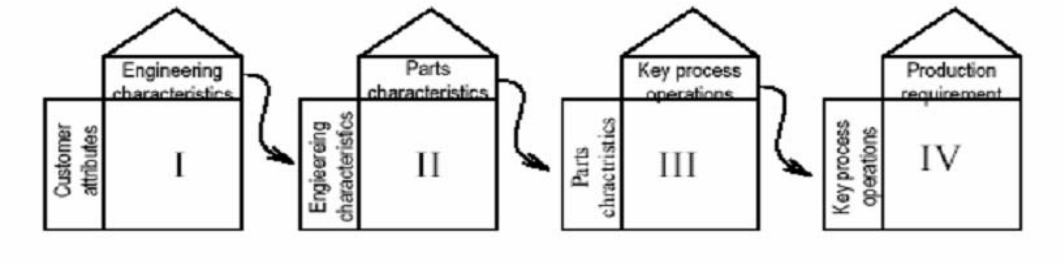

Figure 1. Four phases of QFD [8]

The House of Quality starts with a "What-How" Matrix that identifies the wants, desires, and needs of the customer [9]. These customer requirements are shown on the left part of the House of Quality. The ceiling of the House, the horizontal axis below the roof, shows the design or technical requirements, while the body of the House visually displays the relationships between the customer requirements and design specifications. The symbols used in each box, if any, show whether the relationship between the two corresponding elements is strong or weak, positive or negative. In this way the House of Quality quickly reveals patterns and identifies weak points in the design requirements. The Interaction Matrix, also known as the Correlation Matrix, is the "roof" of the House of Quality (Figure 2). It is established to determine the technical interrelationships among the design requirements. This information is valuable as the basis for decisions regarding technical trade-offs [5].

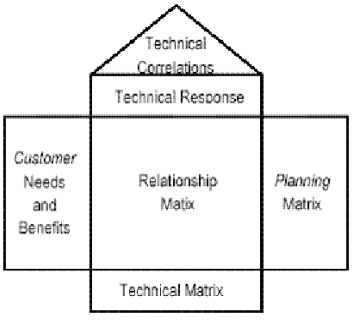

Figure 2. The House of Quality

In recent years, QFD has been widely applied for different purposes and in different environments. Although a considerable number of publications reviewed have been on product design, they mostly focused on technical rather than aesthetical aspects of products. These four were application of QFD for the design of Ceramics tea pot [10], worsted fabrics [11], had-made carpet [12] and knife [13].

2.2 Kansei

Kansei Engineering was established in Hiroshima International University by Professor Nagamachi about 39 years ago. Kansei Engineering is an applied methodology which makes connection between appearance and experimental properties. In this methodology impressive elements with emotional aspects are recognized and applied in product design [14]. In Kansei Engineering qualitative information which is gained by interview and observation will be translated to quantitative information. The information will be analyzed and used as an image icon in product design. Words are useful tools in understanding and uncovering users' emotional needs. Emotional needs can be expressed by psychological functions such as behavior, facial and body language, physiological response such as heart rate, EMG and EEG [15]. Kansei Engineering has five different types. This study carried out with Kansei Engineering type I and II. The process consists of different steps including choice of domain, spanning the semantic space (collection of words, Kansei structure, and statistical methods), spanning the space of properties and synthesis.

3 METHODOLOGY

In this study QFD and Kansei Engineering are used to translate users' emotional needs to design specifications. "Ladies watch" as a product with aesthetics feature was selected as the case for this study. Taking QFD and Kansei as a bases, eight stages were considered to design

1. Collecting and classifying the sample
2. Finding Kansei words to understanding users' emotional needs
3. Evaluating the Samples by the customers
4. Recognizing the effective parameters in customer's choice

A random sample of 96 ladies between 18 to 24 years old was selected.
Taking 95 percent confidence level and 10 percent error, the sample size of 96 was calculated from the following formula for attribute data (with p=0.5):

$$n = \frac{z_{\frac{\alpha}{2}}^{2} . p.q}{e^{2}} \qquad (1)$$

A random sample's evaluation of product provides the data for analysis.

4 RESULTS AND ANALYSIS

4.1 Collecting and classifying the sample

At first 1350 ladies watches were collected. 100 watches were selected among 1350 watches. As many watches were similar, the selection was based on the difference in appearance of the watches. In order to classify the samples, the cluster analysis method was used. Cluster analysis is a statistical method that identifies group of samples that behave similarly or show similar characteristics [16]. Cluster analysis with binary variables of physical properties was used to group the 100 chosen designs. These variables were defined based on the presence or absence of a factor. The defined properties were:
Circle display, square display, rectangle display, formic display, leather strap, metal strap, fabric strap, plastic strap, jewel-studded, sport, formal, decorative form, geometric form, indirect joint between display and strap, direct joint between display and strap, skin display, lidded, simple display, simple strap, complex display, complex strap, with pointer. Based on the defined properties 0, 1 table was made for 100 watches (Table 1). The 100 watches were categorized to 10 clusters. This procedure was done by SPSS software. In each cluster the watches with similar properties were gathered. Then from each cluster one watch was selected as a representative watch. The representative watches had the most score in physical properties in each cluster. As a result 10 watches were selected to study (Figure 3)

Table 1. Matrix of properties of the samples

Properties / Watch	Circle	square	rectangle	formic	leather	metal	fabric	plastic		simple	simple	complex	complex	with
Watch 1	1	0	0	0	0	0	0	1		1	0	0	1	0
⋮														
Watch 100	1	0	0	0	0	1	0	0		0	0	1	1	1

Figure 3. Ten selected samples

4.2 Finding Kansei words to understanding users' emotional needs

To understanding users' emotional needs 150 Kansei words were gathered. The Kansei words were gathered based on product domain and physical properties. The words which had the most impression were recognized. The 12 Kansei words were:
Luxury, unique, cute, lovely, grandeur, elegant, efficient, kind, aggressive, modern, old, reliable.

4.3 Evaluating the Samples by the customers

The customers (96 samples) were asked to evaluate the watches by considering Kansei words (Table 2).

Kansei Words / Watch	Luxury	Unique	Cute	Lovely	Grandeur	Elegant	Efficient	Kind	Aggressive	Modern	Old	Reliable
1	1.1	2.167	13	4.3	2.3	2.1	13	2.2	27	5.4	30	5.5
2	39	6.502	2.1	17	1.1	63	1.1	16	1	3.2	4.2	4.5
3	5.5	7.534	3.2	22	11	11	19	23	0	3.2	9.5	29
⋮												
9	3.3	7.534	4.2	8.5	31	0	14	2.2	20	13	5.3	20
10	0	2.167	2.1	13	18	0	6.7	9.8	0	2.2	7.4	11

Table 2. Importance of Kasei words in the samples by the customers

4.4 Recognizing the effective parameters in customer's choice

By matrixes in QFD methodology, the connection among physical properties and Kansei words were recognized. For each Kansei word a matrix with column based on physical properties and row based on Kansei words was created. Taking the House of Quality methodology the relation between each Kansei words and physical property was studied. The weights of the characteristics of watches were specified in terms of the relation between the characteristics and Kansei words. Each characteristic was defined in terms of zero or one, based on the presence or absence of factor as explained before. The score of each characteristics in any word was calculated by multiplying the weights by the relationship number (Table 3).

Table 3. Matrix for obtaining characteristics

Reliable															
watch	weight	Circle display	square display	rectangle display	formic display	leather strap	metal strap	fabric strap	plastic strap	jewel-studded	…	simple strap	complex display	complex strap	with pointer
1	5.5	1	0	0	0	0	0	0	1	0	…	0	1	1	0
2	4.5	1	0	0	1	0	1	0	0	1	…	0	1	1	1
3	28.9	1	0	0	0	0	1	0	0	0	…	1	0	0	1
⋮															
9	20	1	0	0	0	1	0	0	0	0	…	1	1	0	1
10	11.1	0	1	0	0	0	0	0	1	0	…	0	0	1	1
Total	100	63	34	0	9	46	36	0	19	18	…	74	50	26	94

5 DISCUSSION

The analyzed data from the questionnaire showed an obvious connection among product properties and users' emotional needs. Users' priority of selecting watch were 3, 4, 9, 8, 2 and 7 equivalent, 5 and 6 equivalent and the last one watch number 1.

Watch number 2 had the most score in words luxury. Watch number 3 had the most score in lovely, efficient, kind and reliable. Watch number 4 had the most score in words unique, cute and modern. Watch number 5 had the most score in a word aggressive. Watch number 6 had the most score in a word old. Watch number 3 and 8 had the same score in word efficient. Watch number 9 has the most in a word grandeur among other watches. As the data showed, the specific physical properties will elicit specific emotion in users.

By adopting the defined physical properties and the gathered data, these points are gained:

Watch number 2 with skin and circle display, complex metal strap, jewel-studded and decorative form was related to word luxury and elegant. Watch number 3 with circle display, simple strap and geometric form was related to word lovely, efficient, kind and reliable. Watch number 4 with triangle display and strap had the most difference with other model of watches. These properties were related to words unique, cute and modern. Watch number 5 with detailed circle display and a wide strap – wider than usual- was related to word aggressive. Watch number 6 with rectangle display and jagged number in display, simple black strap was related to word old. Watch number 8 with rectangle display, wide strap and geometric form was related to word efficient. Watch number 9 had big circle display, black wide strap and geometric form. There was a golden distinct cross on its display. These physical properties were related to word grandeur.

6 CONCLUSION

The main aim in this study was to translate users' emotional needs to physical properties. QFD and Kansei Engineering were applied in the study. The study showed a direct connection among physical properties and users' emotional needs. As an example word luxury was related to word properties such

as jewel-studded, formal, decorative form, and complex display. It should be mentioned that there were the same result in other words and properties. The word unique was related to physical properties such as complex display and decorative form. Word cute was related to complex display and strap. In this study QFD matrixes were used to translate qualitative data to quantities data and Kansei words were applied to express users' emotions. In order to that it can be concluded that the users' emotional needs were translated to physical properties. The study also shows the importance of the role of methodology in product design and is concluded that the design methodologies should be mentioned in design education.

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