KEER2010, PARIS | MARCH 2-4 2010
INTERNATIONAL CONFERENCE ON KANSEI ENGINEERING AND EMOTION RESEARCH 2010

DESIGN WITH EMOTIONAL APPROACH BY IMPLEME-NTING KANSEI ENGINEERING- CASE STUDY: DESIGN OF KETTLE

Nasser Koleini Mamaghani [*a], Marjan Tajoddini [b]

[a] *Department of Industrial Design, School of Architecture and Environmental Design, Iran University of Science & Technology, Iran.*
[b] *The University of Art, Tehran, Iran.*

ABSTRACT

In recent years, applying emotional methods as subjective evaluation process of contents in the product design community is increasingly concerned. One of the most promising methods that integrate design, emotions, engineering and computer is Kansei engineering. It has been demonstrated that if the consumer's feeling and image (Kansei) of a product in mind could be implemented in the new product, consumer would be more satisfied with the product. The purpose of this study was to measure the Kansei of a product evokes in a customer's mind, and as a case study designing a new kettle was programmed. 10 samples of different types of kettles were used in the physical part. Products are evaluated on semantic differential scales and also categorized in respect to theirs attributes. A list of adjectives was complied that impressions and sensations people receive from kettle, and then a total of 30 words were selected and used in semantic part. A 7-point scale questionnaire using these words was found suitable. 70 subjects participated in our study and they asked to fill in questionnaire based on their subjective evaluation. The samples were analyzed and statistical methods are then used to find correlation between attributes and perceived expression or users feelings. In developing new products this statistical data is used to make decision on the properties of a new design. Afterward, based on all finding and results, some candidate samples were designed. In the next stage of our study, the new design of kettle was again validated by questionnaires and recommendations for final design were given.

Keywords: *Kansei engineering, Product design, Semantic Differential method*

---

* **Corresponding author**: Department of Industrial Design, School of Architecture and Environmental Design, Iran University of Science & Technology, Narmak, Tehran 16846, Iran, email: koleini@iust.ac.ir

1. INTRODUCTION

In today's highly competitive market, developing new products that meet consumers' needs and tastes is a crucial issue in product design. To improve attractiveness, a well-designed product should not only satisfy requirements, defined objectively but should also satisfy needs, by essence subjective [2, 7, 9]. In order to predict the success of a product, to control and to optimize its performances, one has to make explicit both sides of the need, subjective and objective. A lot of systematic methods, dealing mainly with usage functions, have been developed in engineering design to obtain successful products [10]. These methods are efficient to assess and validate product prototypes with a scientifically based argumentation. But there is a lack of such a methodology when one addresses esteem and aesthetic functions (brand image, personal aesthetics, current trends or fashion) [15]. So as to ensure the development of product semantics in a rational and scientific way, we are proposing a methodology which takes users' perception into account. It combines methods and techniques derived both from engineering design and marketing [3, 13]. From engineering methods, we keep the fact that users' needs are expressed in advance with design specifications, so that design solutions or concepts are assessed according to evaluation criteria. From marketing, we use techniques which allow to comprehend users' perceptions and to grasp consumers' feelings and appraisal [1, 11]. Our methodology addresses the four design stages, in an integrated manner: a) understanding the need related to product semantics, b) finding relevant criteria to characterize and express the need, c) specifying the requirements of a new product, and d) assessing the performances of new solutions. Kansei Engineering has been recently developed as a user-oriented technology for new product development and has been applied successfully in the product design field [10]. Kansei Engineering is a process of linking the users' feeling (Kansei) of a product, represented by image word pairs, to the product design elements, using a survey or an experiment. Various scientific approaches have been gathered by Japanese researchers under the name Kansei Engineering. This research aims at exploring the structure of emotions by building a database on consumer feelings. To achieve this goal, we have chosen kettle as a case study.

2. MATERIAL & METHODS

2.1. Kansei engineering methodology

It seems to be a common agreement among designers of the importance of emotional design and the need for practical methods within this field. There are few complete methodologies available in this kind of research. Emotions have been linked to product properties for decades in Japan. Nagamachi [10] used the term "Emotional Engineering" already in the seventies and Yamamoto used the term "Kansei Engineering" for the first time in 1986. Kansei Engineering methods build models in which peoples emotional responses to design are linked to the product properties. It is a methodology that integrates affective elements already in the developing process. A great benefit of Kansei Engineering is that it can be used to link a variety of product properties to product emotions. Kansei Engineering is today a well established design methodology and commercial available service in Asia. The product image of users' perception is called Kansei in Japanese. The term Kansei is imbedded in the Japanese culture in a way that is difficult to translate into words [5]. A specific Kansei arises when a human is subjected to an artifact in a certain environmental context [9, 14]. Kansei may be easier to experience than define by a western person. Kansei

is an individual subjective impression from a certain artifact, environment or situation using all the senses of sight, hearing, feeling, smell, taste, recognition and balance [6, 10]. Kansei incorporates the meaning of the words: sensitivity, sense, aesthetics, feelings, emotions affection and intuition. Shimizu sees Kansei closely related to sophisticated human abilities such as sensibility, recognition, identification, relationship, making and creative action where the process of biding together these concepts also is part of the Kansei [12]. The most common way of measuring the Kansei is through words. The words reflect elements of the Kansei. They are just external descriptions of the Kansei within a person's mind. Elements of the Kansei may be absent because we do not have words to describe all emotions.

2.2. Kansei Process

The different models within Kansei Engineering focus on translating the Kanseis into product properties [8]. The output does not necessarily reflect the true Kansei somebody has about a product. Schütte [15] compares the outcome with a picture of the real thing that is flatter, less contrasted and more static than the original. He proposed model is a six step process were different methods may be used within each step. These steps are: a) choice of domain, b) spanning the semantic space, c) spanning the space of properties, d) synthesis, e) test of validity, and f) model building. This Kansei process model proposed by Sch□tee [15] was used in our study.

2.2.1. Choice of domain

In this research we chose 10 kettles of different types which were used to map properties from within the product domain.

Figure 1: Domain kettles (10 samples used in the Kansei experiment)

2.2.2. Spanning the semantic space

Collection of Kansei words- words describing the product domain were selected through different sources. All worlds describing the product domain were registered. No critical evaluation was done in this first step. All words describing kettles within the chosen domain were included in the first gathering of words. After brainstorming and collecting words, we reduced words up to 31 two poled appropriate words (Table 1).

Table 1: The final 31 Kansei words

familiar – unfamiliar	ergonomic–non-ergonomic	powerful – weak
serious – funny	worm – cold	feminine –masculine
controllable– uncontrollable	exiting – boring	dynamic –static
simple – elegant	light – heavy	simple– complicated
flexible – inflexible	different – usual	modern –traditional
free – restricted	desirable – undesirable	formal – informal
enjoyable – annoying	high quality – low quality	fragile – tough
natural – artificial	soft – hard	creative – repeated
functional – aesthetic	small – big	comfortable-uncomfortable
portable – importable	smooth – rough	durable – endurable
safe – dangerous		

2.2.3. Spanning the space of properties

Different kettles chosen in this article were categorized to look at varying features like shapes, proportions, materials, detailing etc. The main elements building up the kettles were container, spout, lid and handle. Varying properties within each of these elements were identified.

2.2.4. Survey kettles

10 kettles representing the space of properties were included in the test. These were represented in pictures that had been done as similar as possible in contrasts, sizes etc to be comparable in the test. The pictures were also of good enough quality and shading to represent the three dimensional shapes of the products.

2.2.5. Questionnaire

A 7-point scale questionnaire was used in this study. In this step participants were asked to describe their ideal kettle on the semantic scales using semantic differential method [4, 12]. Participants were 70 people of both genders. The survey was carried out on A4-long papers and the participants were given a brief introduction about how to fill in the survey. They were asked to fill in the first that struck them for each product sample and not to compare the scales. It should be noted that in order to find ideal value of each words this questionnaire also filled by 15 design specialist.

Synonym □□□□□□□ Antonym

Figure 2: A 7-point scale questionnaire used in the survey

2.3. Statistical Analysis

Factor analysis, cluster analysis, and cross-tab analysis as well as one-sampled t-test (2-tailed) are used to analysis data.

3. RESULTS AND DISCUSSION

We added the scores of each word, comparing to ideal values which were found by design specialists. Then we credited the scores to 100, and made the percentage of ideal product. So we can compare general impressions to the product. The result was that some data were not achieved as predicted. The most important Kansei for ideal kettle were quality, being smooth, durable, natural, and next being enjoyable, functional, familiar, and creative. Less important Kansei were being dynamic, soft, light and exiting. Factor analysis method simplifies the data and makes clear the relations between variables. In this analysis, all words were classified in two parts which we named as factor 1) user mood and factor 2) practical purpose. Factor1- user mood included words: familiar, simple (not complicated), enjoyable, powerful, frail, creative, natural, smooth, modern, free, different, desirable, worm, feminine, simple, serious, flexible, dynamic, exiting, soft, and formal. These are the impressions that the users may have while using kettle. Factor2- practical purpose included words: functional, controllable, portable, ergonomic, light, high quality, small, comfortable, durable, and safe. This factor contains words which describe functional aspect of product. It should be noted that these important Kansei should be selected as design specifications in the final designing stage.

According to all finding results and analysis we can classify Kansei words into the clusters analysis which has been shown in table 2 In this classification, high score Kansei are placed in cluster 2 and 9, and cluster 3, 4, and 8 include low score Kansei. The words modern and natural may seem not compatible or even at two different poles, but have the same scores. We can make such judgments that can lead us to design better.

Table 2: Results of cluster analysis

Culster 1	Culster 2	Culster 3	Culster 4	Culster 5	Culster 6	Culster 7	Culster 8	Culster 9	Culster 10
Familiar	Natural	Serious	Exiting	Free	Safe	Ergonomic	Light	High quality	Portable
Simple (not complicated)	Smooth	Flexible	Soft	Different	Functional	Small	Comfortable	Durable	
Enjoyable	Modern	Dynamic	Formal	Desirable	Controllable				
Powerful				Worm					
Fragile				Feminine					
Creative				Simple (not elegant)					

By using cross-tab analysis, the variable properties could be compared with the Kansei scores. The result reveals the distribution of mean Kansei values for the properties. Each property was evaluated in relation to each Kansei. Those properties that only were present for mean Kansei ratings above 4.5 were defined to have positive influence on the Kansei if the opposite property only were present for negative values (less than 4.5 on the Kansei scale). Properties only present for negative Kansei scores were evaluated to have negative influence on the given Kansei word. The output from the cross tabs analysis verifies the result from the cluster analysis. All Kansei words within each cluster had matching properties. No clusters had Kansei that were depending on opposite properties. The collected data was also treated with a one-sampled t-test (2-tailed) that showed normal distribution of the data. Distribution of the data was also inspected manually. The questionnaires were again

given to participants to score the candidate samples. As mentioned above, the best Kansei were quality, being smooth, durable and natural and in the next level being enjoyable, functional, familiar and creative. We conducted reconfirmation survey about the new design of kettles to whether the new ones fitted to the customer's upgrade feeling. We utilized the same Kansei words which we used in the former research. The final model is the validated result from the synthesis.

Table 3: Cross-Tab analysis results

Kansei words	Container			Spout		Lid		Handle	
	Sphere	Cylinder	Triangular	Long	Short	Same material with container	Different material with container	Next	Up
Familiar	x			x		x	x		x
Serious				x				x	
Controllable	x	x		x	x	x	x		x
Simple	x	x		x	x	x	x	x	x
Flexible	x								x
Free		x					x	x	x
Enjoyable	x		x	x		x	x		x
Natural	x			x	x	x	x	x	x
Functional	x	x		x	x	x	x	x	x
Portable	x	x		x	x	x	x		x
Ergonomic	x								x
Exiting		x		x					x
Light	x				x		x		x
Different		x	x						
Desirable	x			x		x			x
High quality	x		x		x	x	x	x	x
Soft	x	x				x			x
Small	x							x	x
Smooth	x	x	x	x				x	x
Worm	x		x	x					x
Powerful	x	x	x	x				x	
Feminine	x			x					x
Dynamic				x					x
Simple	x	x		x	x		x		x
Modern	x		x	x			x		x
Formal			x			x		x	
Fragile			x						x
Creative	x		x						x
Comfortable	x			x	x	x	x		x
Durable	x			x		x	x	x	x
Safe	x			x		x	x	x	x

4. CONCLUSSION

This study has showed an overview of techniques to support the well established Kansei engineering process for design of new product. This technique presented in current study is inevitably simplifications of the consumers purchase decision. Emotions are complex. We can describe some parts of them with words. Following Kansei engineering procedure introduced by Schütte we collected the Kansei words related to the evaluation of kettle and collected the

product samples. The evaluated data were analyzed by multivariate analysis and then we decided the new design specifications based on the statistical calculation.

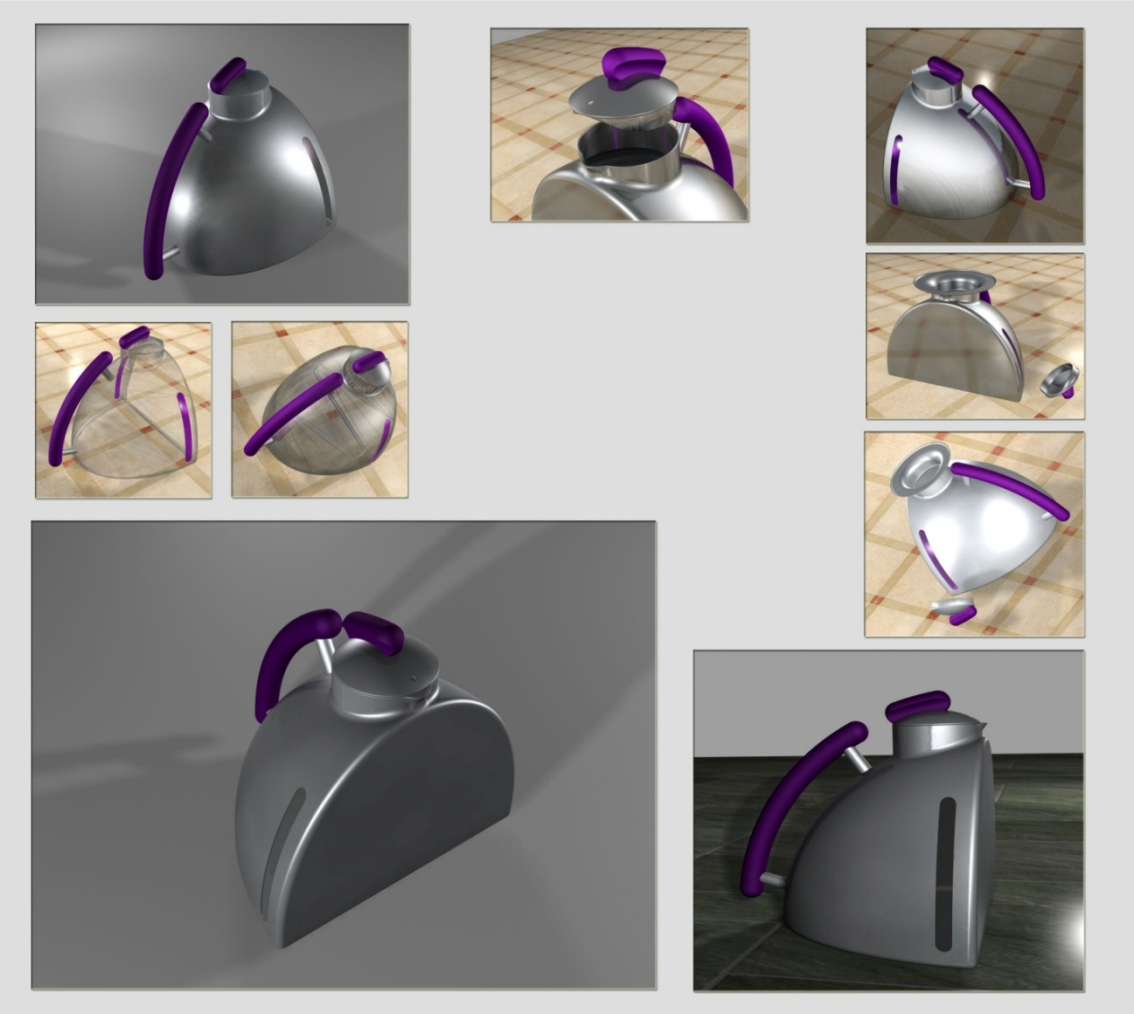

Figure 3: Final design

Kansei Engineering maps the relations between words that give a more in depth description of a certain emotion. Even product properties and emotions can be linked mathematically with Kansei Engineering. The new designs were reconfirmed by another Kansei survey and final design was near to excellent and more emotional over the old ones. Kansei engineering is a reliable design tool for those interested in emotional design. It is also a flexible tool that can be used within parts or in the whole design process. This article and case study illustrates how it can be used with few involved actors in the process and give a reliable result.

REFERENCES

1. Antoni M. and Schutte S. Learning Development from Engineering, *In the Proceeding of QMOD,* Pusan Korea 2002.
2. Aune A., Leadership and Management for Quality– *a Dicipline called Quality Technology. (Eds Edvardson B. And Gustafsson A.),* The Nordic School of Quality Management,1999.
3. Crosby, P.B. *Quality without tears: The art of hassle-free management*, McGraw-Hill, New York, 1984
4. Guilford, J.P. *Psychology Methods*, McGraw-Hill Publishing Company, New York. 1971.
5. Hashimoto S., Kansei as the third target of information processing and related topics in Japan, *In proceeding Kansei- The Technology of Emotion Workshop*, pp. 101-104, 1997.
6. Ishihara, S., Ishihara, K., Nagamachi, M. and Matsubara Y, An analysis of Kansei Structures on Shoes Using Self-Organizing Neural Networks, *International Journal of Industrial Ergonomics*, Vol. 19, pp. 93-104, 1997.
7. Kano N., Seraku N., and Takahashi F. Attractive quality and must be quality. *Quality*, vol. 14 No.2, pp. 39-44, 1984.
8. Grimath K., *Kansei Engineering. Linking emotions and product features*. Department of Product Design, Norwegain University of Science and Technology, pp.13-16, 2005.
9. koleini Mamaghani, N., Khorram, M., "Kansei Engineering: Affective and emotional design", *In the proceeding of the first international conference on ergonomics, Tehran, Iran, May 7-8, 2008.*
10. Nagamachi, M. Kansei Engineering. An ergonomic technology for a product development, *In the Proceedings of IEA'94*, 1994.
11. Nagamachi, M. (1995): Kansei Engineering: A new ergonomic consumer-oriented technology for product development, *International Journal of Industrial Ergonomics*, Vol. 15: pp 3-11, 1995
12. Osgood and Tannenbaumn, P.H. *The Measurement of Meaning*. University of Illinois Press. Illinois,1957.
13. Shirley Coleman, Kathryn Smith, Data mining sales data for Kansei Engineering, *Industrial Statistics Research Unit (ISRU)*, The Stephenson Centre, University of Newcastle upon Tyne, Claremont Road, Newcastle upon Tyne, UK NE1 7RU
14. Schutte Simon, Jorgen Eklund, Design of rocker switches for work-vehicles-an application of Kansei Engineering. *Applied Ergonomics*, Vol.36, pp. 557-567, 2005.
15. Schütee Simon., *Designing Feeling into Product*, Linkoping studies in science and technology, thesis No: 946, Division of Quality and Human System-Engineering. Linkoping University, Sweden, 2002.