LUND
UNIVERSITY
Campus Helsingborg

Perspectives and new trend of Kansei/Affective Engineering

Mitsuo Nagamachi, Ph.D., CPE, CPEJ

User Science Institute, Kyushu University
4-9-1,Shiobaru, Minami-ku, Fukuoka 815-8540 Japan

nagmit@za3.so-net.ne.jp

Keywords: *Kansei Engineering, Affective Engineering, Customer-oriented, SD scale, Factor Analysis, Quantitative Theory, Rough Sets Theory,*

Category: Conceptual paper

1. Introduction

There are two ways of a product development, one is called as “product-out” philosophy which implies the manufacturer provides technology and design specifications according to decision making of the manufacturer’s side. Another way is “market-in” philosophy which means consumer-orientation for a product development. By this philosophy a manufacturer considers the consumer’s needs and wants and these are transferred to the product function and design. Nowadays the consumers desire consumer-oriented product development, because they have a lot of goods at home and they want to have goods more needed and attractive, very sensitive to their personality.

Kansei Engineering aims to develop such a product that people want to have deeply in their mind. The term of “*kansei* “ implies psychological feeling and needs in mind. Before purchase of a passenger car, every one imagines in mind of “powerful engine”, “easy operation”, “beautiful and premium exterior, “cool and relaxed interior” and son. These words express the kansei, and the consumers willingly want to have such a kind of vehicle, if the manufacturer realizes a vehicle just fit to their imagination. However, it is regret that we have not ever had such science and technology as to treat technologically psychological feeling and needs (kansei).

The kansei engineering is able to grasp the consumers’ kansei, to analyze the kansei using statistical methods, and to transfer the analyzed data to the design domain. Nagamachi founded the kansei engineering around in 1970 in Hiroshima as a customer-oriented product development. He has engaged in the development of the kansei engineering for over 35 years and developed a lot of the kansei products and the kansei engineering methods (Nagamachi, 1974; 1989; 1995; 1996; 1998; 2002: 2005)

2. Methods of Kansei Engineering

2.1 Kansei Engineering Type 1

Kansei Engineering starts from decision of product strategy as design domain as well as the target. Then, we collect the kansei words related to the product domain. Usually, we collect 30-40 kansei words, adjectives or sentences of feeling, and construct 5-point or 7-point SD (Semantic Differentials) scale.

We collect the product samples, 20-25 different kinds, and identify item/category of each sample. The item means a category like size, width, colour, style, function,etc., and the category implies more detail features, like red, yellow, green, blue for colour item.

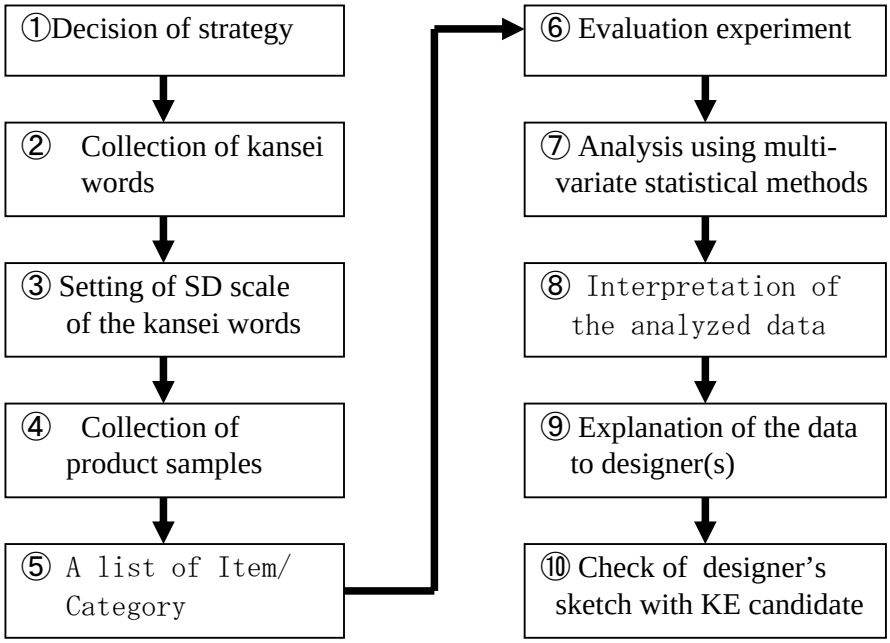

Fig.1 A flow of the kansei engineering type I.

The subjects evaluate each product sample on the 5-point SD scale sheet and the evaluated data are analyzed using multivariate analysis like Factor Analysis, Regression Analysis, Quantification Theory Type I, II, III and IV, etc. Among these analytical methods Quantification Theory Type I is very excellent technique which is feasible to find a relational design rules between the kansei and the design specifications. Recently it becomes clear that Rough Sets Theory is more excellent, and that it finds decision rules fit to the kansei as if the designers think in mind.

2.2 Category classification method

After a survey is conducted and the zero-level product concept is decided, the concept is broken down to more detail subconcepts and this procedure continues to nth level. In this stage the subconcepts are decided in detail from the ergonomic experimentations. This is very easy to understand and we always apply this method.

2.3 Kansei Engineering System

Kansei Engineering System means a computerized-assisting system to support a designer work or a selection of goods by a customer. The system has several databases, inference engine and other subsystems, and the customer inputs his/her kansei into the system, the intelligent system works and calculate to get the final

conclusion, namely a design candidate. We constructed FAIMS, HULIS, ViVA systems.

2.4 Virtual Kansei Engineering System (ViVA)

ViVA consists of Kansei Engineering part and Virtual Reality part related to kitchen design. It has 10,000 wives database and intelligent system, and if a wife inputs her kansei into the system, the system outputs a design candidate of kitchen. A plenty of customers utilized the system and they were satisfied very much with the outputted design by the system.

2.5 Rough Sets Theory

Rough Sets Theory was founded by Dr. Z. Pawlak which is able to deal with ambiguous and uncertain data like the kansei. The kansei has in general nonlinear characteristics and Rough Sets Theory can deal with both linear- and nonlinear data. Statistical method treats independently each data, but Rough Sets Theory can find decision rules with group meaning in If-Then style.

(About other methods and more detail, see Nagamachi, 2002)

3. Applications of the kansei engineering

3.1 Japanese style of refrigerator

Nagamachi has developed more than 20 kansei products so far and in this paper we see some number of samples with explanation of the process.

Fig. 2. An old type (left) and the kansei refrigerators (right).

Japanese used to use one door or two door type of refrigerators in the old days. Sharp asked Nagamachi to introduce the kansei engineering in the development division and the project team tried to apply it to the new design of refrigerator. The team visited a monitor house to take pictures during wife cook behaviour. We found such a curious picture that the wife bent her back to take out vegetables from two-door refrigerator. Her bent posture needed about three times as much as in standing posture. As she felt hard work at that time, this is a kind of kansei. Our job was to reduce her high load by changing refrigerator redesign. By Nagamachi's suggestion, the team proposed Sharp to change the vegitable position from bottom to top area as shown in the right of Figure 2. Sharp was successful in redesigning and all refrigerators in Japan changed to new style, freezer to bottom and vegetables to top area.

3.2 The kansei shampoo and treatment

Milbon which is a maker of cosmetic goods asked Nagamachi to introduce the kansei engineering to the company. Following Nagamachi's suggestion, the company organized a concurrent engineering team which means all managers jointed to the project team from the beginning. They have learned first what the kansei engineering was, and the team started the kansei survey by visiting salons. They interviewed 200 ladies on hair care as well as hair problems. These data were analyzed by Quantification Theory Type III to get segmentation of hair kansei and their problems.

The zero kansei concept was decided from the analyzed data as "Soft touch and Rashly hair". The zero-level concept was broken down to 4th stage following Category Classification procedure and on 4th stage subconcept contents were transferred to R&D Institute to create about 600 different test materials.

Fig. 3 The kansei shampoo (left) and treatment (right)

Test materials were checked about the kansei fitness to the zero concept by applying on hair mannequin with human hair and as a result test material were reduced in number until just 20. After then we applied the remained test material on real monitors' hair and finally we selected just one of shampoo and treatment.

We continued the development about a container and perfume. Concerning a container design, we followed Kansei Engineering Type I. After collecting the kansei words and 62 different containers, we conducted evaluation experiments using the 5-point SD scale sheet. After calculation by Quantification Theory Type I, we obtained good results on the relational rule. Figure 3 illustrates the conclusion of the kansei engineering.

3.3 Kansei computerized system, ViVA

As building a real kitchen costs expensive, we have attempted to use a combination of Virtual Reality Technology and Kansei Engineering which is called Virtual Kansei Engineering (ViVA). Based on 10,000 wives layout data, we constructed part of kitchen kansei engineering and another part of virtual space engineering. A wife sitting down in front of a computer, she inputs her family data, life style data and finally her kansei, namely image of the new kitchen. Then the kansei kitchen system begins to work and show her the 3-dimensional kitchen design on the screen. All people were surprised in this stage and if no need of change in design, she is able to walk through in the computerized space to have a virtual experience.

ViVA system became very popular in Japan and a lot of people visited to see it even from overseas. As the customers visited to Matsushita Electric Works show room, the sales cost was almost zero. Accordingly the company has got a lot of profit

from the kansei computerized system (ViVA).

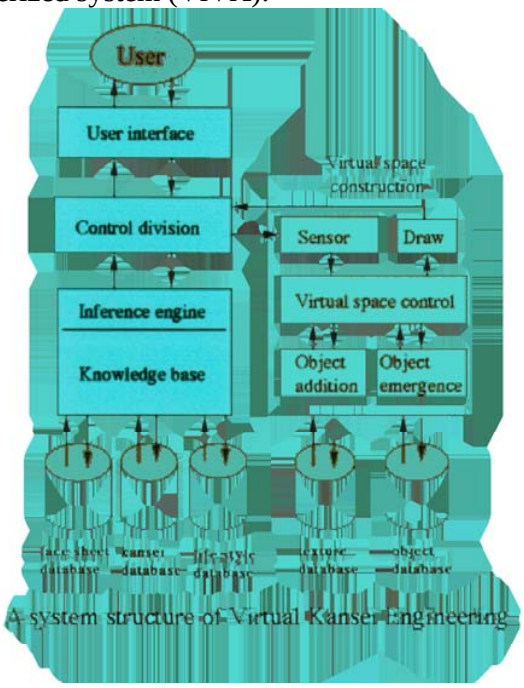

Fig.4 Virtual kansei system (left is the kansei engineering and right virtual reality).

3.4 Kansei Ergonomics

Usually the kansei engineering is able to design the kansei product and it is almost every time successful in an excellent product development. However, the kansei engineering is not enough to get success. We need ergonomic sense some times.

Matsushita Electric Works, Ltd and Nagamachi jointly approached to apply to production of a new toilet. In this project, we considered three points;

1) As wives are very serious about environmental problem, we decided to reduce water four/fifth, namely the new toilet uses only one/fifth water compared with an ordinary toilet. We realized this matter by direct connection to water facility.
2) Japan has been the highest aging society and all manufacturers should consider elderly people. For the elderly standing up easily, we equipped two arm rests on toilet and the new toilet is tilted in 5 degree forward to assist their standing up.

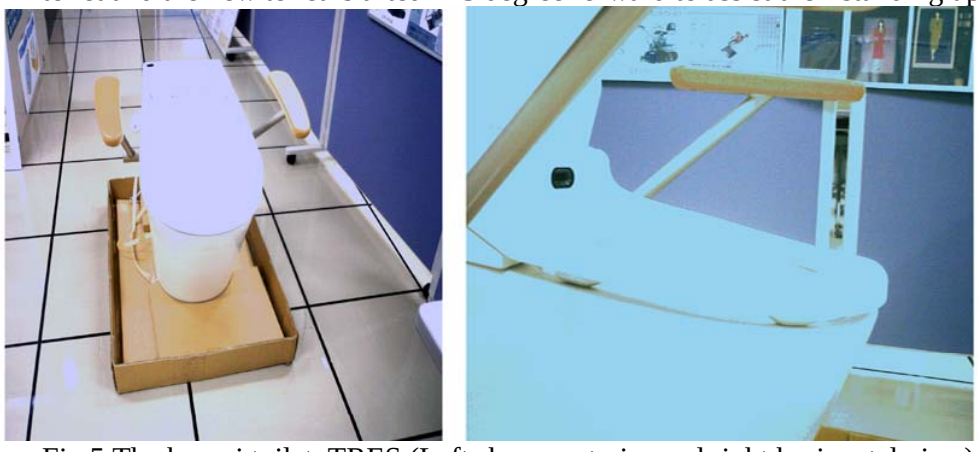

Fig.5 The kansei toilet, TRES (Left shows exterior and right horizontal view).

3) We arranged eight different toilets from different makers and the subjects with age of 23-65 sat down on each toilet for evaluation of the kansei 5-point SD scale.

The evaluated data were analyzed by Quantification Theory Type I and we obtained the relational rules between the kansei and toilet physical features (item/category). Based on these data we modelled 3-dimensional toilet seat illustrated in Figure 5 (right side). You can see the artistic module of toilet surface shape.

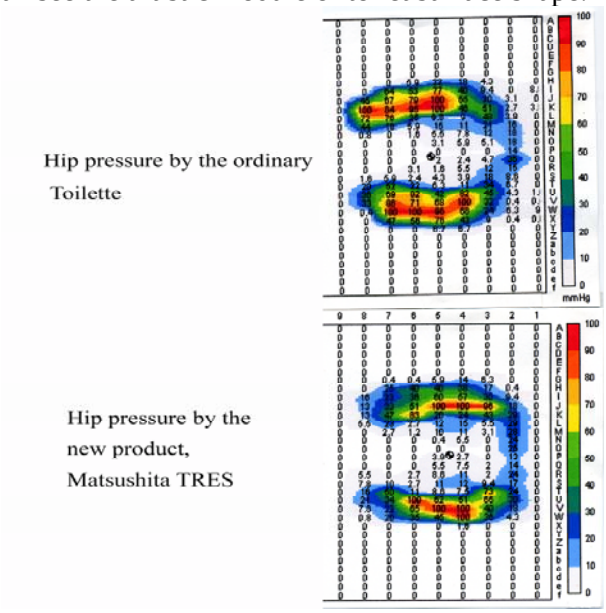

Fig. 6. Measurement of body pressure on ordinary (upper) and kansei toilet (lower).

We examined the kansei toilet, TRES how much the comfort will be different between them. We put the body pressure FSK sheet on the toilet seat and the subject sat down on the pressure sheet. Figure 6 illustrates the body pressure for ordinary toilet (upper figure) and for TRES (lower one). The black strings on the both wings mean the largest pressure. The upper toilet shows wide and longer string than lower toilet, which implies the upper toilet received high pressure influencing on thigh part, but lower one received on a limited area, namely only on middle area of both wings. From this result of body pressure, ergonomically saying, flattering effect on a little wide area will emerge the comfortable feeling, not small area like on just bone.

In this research, the kansei toilet needed ergonomic sense to realize the comfortable success which of design is called"**Kansei Ergonomics**" (Nagamachi, 2007).

4. Remarks

In 1970 Kansei Engineering was born in Hiroshima as a new research branch of Ergonomics and Nagamachi and his colleagues have engaged in the new technology for 35 years. The society has changed over the world. People want to have goods fit to their needs and wants, namely *kansei.* People seek affective and emotional products nowadays.

Kansei Engineering has extended to more technological and intelligent, but it still stand on humanware philosophy. It became wider and deeper in academic sense, that is, Kansei Engineering to Kansei Ergonomics and to Kansei Rough Set Engineering Nagamachi, 2006; Nagamachi et al; 2007, Nishino, 2005; Nishino et al, 2006a: 2006b; 2006c; Hirata et al, 2007).

We always collaborate with designer group in the final stage, because the designer(s) is invariant key person in order to create the excellent products with which the customers are satisfied and enjoyable. Kansei Engineering/Kansei Ergonomics just provides the sensible and sensitive data analyzed by a technology based on the human kansei. The collaboration of the kansei engineer with the excellent designer should be needed.

Finally, **the manufacturers should consider deeply to produce "Product Quality" fit to "Customer's Kansei Value"**. A customer has a hierarchy of value and he/she wants to have enjoyable and satisfied life. All people, from children to elderly people, or any person want to enhance their QOL. They expect the service men's smile and greetings. This is a kind of product quality. The enterprise people should provide an excellent product quality to fit a customer's kansei value. In social life, every body should response with high product quality to people who want to expect it. The implications of Kansei and Kansei Engineering will be, and should be very popular and standard discipline.

REFERENCES

Hirata Okamoto, R. (2007); Comparison between statistical and lower / upper approximations rough sets models for beer can design and prototype evaluation. 10th International Conference of QMOD, 2007.

Nagamachi, M.(1974): A study of emotional technology, *Jap. J of Ergonomics*, 10 (2), 121-130.

Nagamachi, M. (1989): *Kansei Engineering*, Kaibundou, Tokyo.

Nagamachi, M. (1995): *Introduction to Kansei Engineering*, Japan Standard Association, Tokyo.

Nagamachi, M. (1996): Kansei Engineering and its applications, *Jap. J. of Ergonomics*, 32 (6), 286-289.

Nagamachi, M, (1998): Kansei Engineering: A new consumer-oriented technology for product development. In W. Karwowski & W. S. Morris (Eds.), *The Occupational Ergonomics Handbook*, pp. 1835-1848.

Nagamachi, M. (2002): Kansei Engineering in consumer product design, *Ergonomics in Design*, 10 (2), 5-10.

Nagamachi, M. (2005): *Product Development and Kansei*, Kaibundou, Tokyo

Nagamachi, M. (2007): From Kansei Engineering to Kansei Ergonomics, *Ergonomia* (in print).

Nagamachi, M.(2006): Kansei Engineering and Rough Sets Model, *RSCTC*, LNAI, 4259, Springer,.27-37, (2006).

Nishino, T.(2005): "Rough Sets and Kansei", In Nagamachi, M.(ed.) (2005), Product Development and Kansei, Kaibundo, Tokyo.

Nishino, T. Nagamachi, M and Tanaka, H. (2005). Variable Precision Bayesian Rough Sets Model and Its Application to Human Evaluation Data, *RSFDGrC*, LNAI 3641, Springer, 294-303.

Nishino, T. Nagamachi, M and Tanaka, H. (2006a): Variable Precision Bayesian Rough Sets Model and Its Application to Kansei Engineering, *Transactions on Rough Sets V* (*International Journal of Rough Set Society*), LNCS 4100, Springer, 190-206.

Nishino, T., Nagamachi, M. and Sakawa, M. (2006b): Acquisition of *Kansei* Decision Rules of Coffee Flavor Using Rough Set Method, *Kansei Engineering International*, Vol. 5, No.4, 41-50.

Nishino, T., Sakawa, M., Nagamachi, M., Kato, K. and Tanaka, H (2006c).: A Comparative Study on Approximations of Decision Class and Rule Acquisition by Rough Sets Model: An application to the Design of Children Shoes, *Kansei Engineering International*, Vol. 5, No.4, 51-60.