Kansei Engineering: Development Methodology

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ABSTRACT

Kansei engineering, sometimes referred to as 'affective engineering', is the foremost product development methodology by translating customer's psychological feeling and needs on this product into product's design parameters. This process allows you to model customer's instantaneous feeling and emotions for ensuring your product or service evokes desirable customer's emotional responses. It was developed in Japan in the early of 1970s and now is widely spread among Japanese companies. In the early of 2000s, it has been new departures for Kansei engineering that is in the applied science, psychology and neural sciences. In this paper, the Kansei engineering is discussed in the various topics in Japanese lifestyle such as business and multimedia information processing. The authors took a general view of them in relation to knowledge based on engineering from the view points of the own authors.

Keywords: *Kansei engineering, affective engineering, Kansei business, multimedia information processing, human beings, comfortable lifestyle.*

1. INTRODUCTION

In the recent, there are many products and services which has been made us possible to take a comfortable life. Therefore, it is important to create some new products and services to succeed in markets by making emotional impact on the customers. Impression of a product is the one of key word for the decision of purchasing by customers. This leads us to Kansei engineering which aims to develop or improve products or services by translating customer's feelings and demand on the product's design parameters in business way.

In the new century, one of the main targets is the construction of a wealthy and comfortable society appealing to person's mind. The key technologies for driving is the multimedia information processing based on Kansei content which can produce delightful feeling for users and can realize the comfortable social life.

In this paper, a general view of definitions of Kansei and Kansei engineering are shortly described. History of development of Kansei engineering is given briefly. Some researches developed using Kansei engineering are presented in various topics of Japanese lifestyle.

2. WHAT IS KANSEI ?

The definition and interpretations of Kansei from various points are presented in this section.

2.1 Definition on Japanese Dictionaries

The term 'Kansei' in Japanese consists of typically two different Kanji-signs: 'Kan' and 'Sei', which means sensitivity or sensibility described in Fig. 1.

According to the Dainihon Japanese dictionary [1], the definition of Kansei is the sensitivity of a sensory organ where sensation or perception takes place in answer to stimuli from the external world.

Many dictionaries now define Kansei as 'sensitivity', that Kansei had the same meaning in classical literature. Unfortunately, 'sensitivity' is not complete as the meaning as Kansei,

In [2], Kansei is defined as an internal concept with three basic of taste/sentiment, feeling and emotion. This model is presented in Fig. 2.

2.2 Definition on Japanese Society

According to the Japanese Society of Kansei Engineering (JSKE), Kansei is the integrated function of the mind and various functions extist during receiving and sending signals [3]. The process of filtering, acquiring information, estimating, recognizing, modeling, making relationship, producing, giving information or presenting that are the contents of Kansei.

3. DEFINITION USED IN ENGINEERING AND BUSINESS

In [1], the definition of Kansei engineering has been concluded the definition used in engineering and business which should be considered to be a series of information processing for processes of sensation, perception, cognition, sentiment and expression on the basis of the definition of Kansei of information processing cognitive psychology. More practically, Kansei should be thought to be a series of reactions from sensation to mental responses or sensation and sentiment.

In [4], the definition of Kansei engineering has been given as Kansei is the impression somebody gets from a certain artifact, environment or situation using all their senses of sight, hearing, feeling, smell, taste as well as their recognition.

4. WHAT IS KANSEI ENGINEERING?

Kansei Engineering is a kind of important product development methodology. First, it translates customer's impression, feelings and demands on the existing products or concept to design solutions and parameters. Second, it shows how Kansei is translated into design [6]. So, the design by Kansei Engineering parametrically links to customer's emotional response to the products/services with their properties and characteristics. Consequently, the products can be designed to bring forwards the intended feeling of customer.

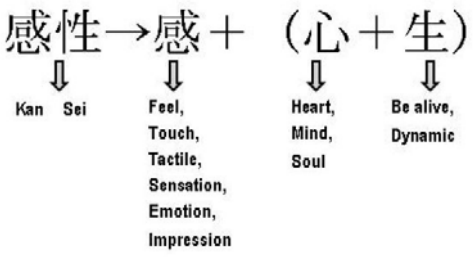

Fig. 1 *Linguistics of Kansei [5]*

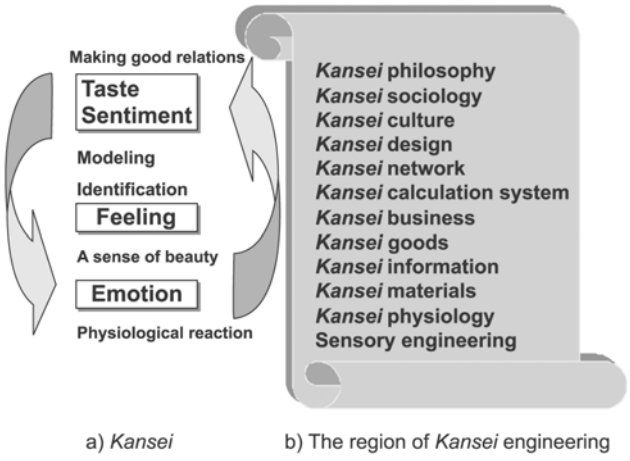

Fig. 2 *Model of Kansei [2]*

5. HISTORY OF DEVELOPMENT OF KANSEI ENGINEERING

Kansei Engineering that was founded by Professor Mitsuo Nagamachi; Professor Emeritus of Hiroshima University. With a psychology and medical school education, Professor Nagamachi was appointed to the Engineering Management group there in the early 1970s to develop and emotional ergonomics for product design [6]. He described it as emotional technology or 'emotional engineering'.

The word 'Kansei' was first used in 1986 by K.Yamamoto; manager of Mazda Motor Corporation when he delivered a speech at Michigan University. [7].

The term 'Kansei engineering' was soon adopted by Prof.Nagamachi.[8] In the decade to 1995, he created many statistical and knowledge engineering systems in order to translate a customer's feeling and image for a product into design elements.

Applications spread to automotive (Mazda, Nissan), cloths industry (Wacoal, Goldwin), electronic home products (Sanyo, Sharp), Office machine (Fuji, Cannon), Cosmetics (Shiseido) and other sectors. [8]

In the early 2000s, Kansei engineering has seen new departures, not only in the design product, but also in the applied science linking with robotic intelligence, psychology and neural sciences. The Japan Society of Kansei Engineering was established on October 9, 1998 and has published an international journal in English [3]. The Society goes beyond the conventional boundaries between the humanities and the social sciences fields such as education, economics, management, etc. and to the natural sciences fields such as medicine, information technology, computer systems and fuses together a broad range of academic fields to launch and develop the new scientific technique.

6. BUSINESS BASED ON KANSEI ENGINEERING

There are quite a number of new products in traditional Japanese lifestyle have been developed in recent years. In this section, two kind of traditional Japanese products are presented based on Kansei engineering for product development support systems.

6.1 Wet Cotton Hand Towels called "Oshibori"

When you come into cafes and restaurants in Japan, you will be given a glass of water and *oshibori. Oshibori* is a kind of small wet towels to wipe face and hands. Serving *oshibori* is one of the long-standing traditions in Japan. In order to assess the qualitative and sensory characteristics of *oshibori*, an evaluation using cotton and paper for *oshibori* has been presented in [9]. This paper reported that the cotton *oshibori* were assessed more favorably than paper *oshibori* in many aspects.

Then, an extension of work to identify the feeling of comfort associated with woven cotton *oshibori*, including the various sizes and thicknesses of *oshibori* are studied focusing on the viewpoints of 'gender' and 'generation' in [10]. The details of size, color, woven design, yarn count, weaving density, thickness and weight of each sample are shown in Table 1. The evaluation sheet used in the experiment is shown in Fig. 3. This work concluded that the female felt the changes in thickness, weight and moistness of *oshibori* more sensitive than the male subjects.

7. PICKLES IN JAPANESE CUISINE

There is a long history of pickling in Japanese cuisine. It has been applied to '*takuan*' (radish) for a side dish in meal sets, '*umeboshi*' (plum) filling in rice balls and '*gari*' (pickled ginger) on the side in sushi and other Japanese foods. Only rarely are pickles as the main dish, but many Japanese feel a meal is incomplete, if no pickle dish in a set of meal.

In the recent, the Western foods have crept onto Japanese dining tables, it has become more difficult to distinguish consumers' tastes and preferences among pickles [11]. Because of this traditional products have tended to stick to traditional patterns and the market has made it difficult to introduce innovations.

It has also been difficult to forecast sales of new products. Therefore, the pickle industry will be forced to make better use of its data on customers' tastes, actions, attract new customers, identify the direction for its products and predict the next successful products. These viewpoints above in the design and development of pickles products have been reported in [12], [13]. The results have convinced the industry to modify both the shapes of pickles and design of packaging products. These have lead to other possibilities for expanding sales in the future.

Therefore, an extended study in [14] is described an attempt to create a product development system that provides quantitative and simple assessments of pickle products with a database of consumers' Kansei using a neural network as the basis for analysis. Fig. 4 shows the structure of the multilayer neural network and some example of the learning by the neural network is presented in Fig. 5.

As shown in Fig.6, the product development support system is presented. When a product has been predicted to show 'LOW' for less sales forecast, the product parameter can be changed and then this system can be reused in another cycle of assessments. The result showed that the higher ranking for a product that were interested for buying. This system can be expected to provide quantitative and speedy estimates of sales indicated a strong relation of Kansei assessments by consumers with the product development support system.

Table 1 *Sizes, color, woven design, yarn count, weaving density, thickness and weights of cotton oshibori [10].*

No.	size (cmxcm)	color	woven design	yarn count	weaving density (number/2.54cm) warp	weft	thickness (mm)	weight(g) dry	wet	unit weight (g/m²)
C-1	20x20	white	pile	20/1	17	21	1.52	13.0	32.5	812.5
C-2	20x20	white	pile	20/1	16	22	1.84	13.6	34.0	849.4
C-3	20x20	white	pile	20/1	19	19	1.99	15.0	37.5	937.5
C-4	20x20	white	pile	20/1	18	22	2.29	16.0	40.0	1000.0
C-5	20x20	white	pile	20/1	18	24	2.44	16.7	41.7	1041.7
C-6	25x25	white	pile	20/1	17	21	1.63	20.8	52.1	833.3
C-7	25x25	white	pile	20/1	17	21	1.89	22.3	55.6	890.0
C-8	25x25	white	pile	20/1	18	22	2.02	24.5	61.3	980.0
C-9	25x25	white	pile	20/1	19	22	2.35	25.7	64.2	1026.7
C-10	25x25	white	pile	20/1	18	20	2.55	27.8	69.6	1113.3
C-11	30x30	white	pile	20/1	17	21	1.69	28.8	72.1	800.9
C-12	30x30	white	pile	20/1	17	20	1.89	30.7	76.8	852.8
C-13	30x30	white	pile	20/1	19	19	2.10	33.7	84.2	935.2
C-14	30x30	white	pile	20/1	18	22	2.34	36.0	90.0	1000.0
C-15	30x30	white	pile	20/1	16	18	2.65	39.0	97.5	1083.3
C-16	35x35	white	pile	20/1	20	23	1.75	41.3	103.3	843.5
C-17	35x35	white	pile	20/1	20	22	1.96	44.3	110.8	904.1
C-18	35x35	white	pile	20/1	16	17	2.16	47.8	119.6	976.2
C-19	35x35	white	pile	20/1	19	22	2.40	51.0	127.5	1040.8
C-20	35x35	white	pile	20/1	17	20	2.62	54.2	135.4	1105.4
C-21	40x40	white	pile	20/1	18	21	1.79	52.8	132.1	825.5
C-22	40x40	white	pile	20/1	17	20	2.12	60.4	150.9	943.0
C-23	40x40	white	pile	20/1	16	17	2.50	68.5	171.3	1070.3
C-24	40x40	white	pile	20/1	18	19	2.58	70.7	176.7	1104.2
C-25	40x40	white	pile	20/1	16	17	2.80	76.0	190.0	1187.5

Fig. 3 *Evaluation form of the experiment [10].*

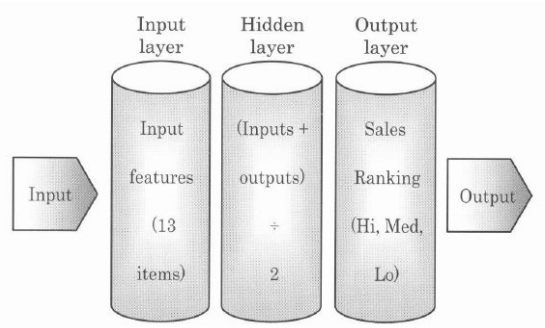

Fig. 4 *Structure of the multilayer neural network [14].*

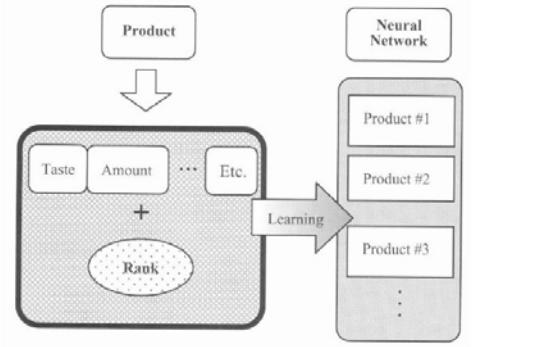

Fig. 5 *Example of the learning by the neural network [14].*

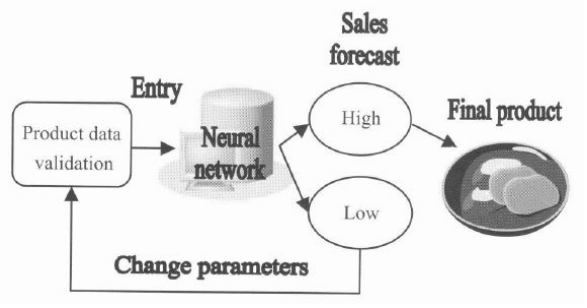

Fig. 6 *Product development support system [14].*

8. MULTIMEDIA INFORMATION: DIGITAL AUDIO-VISUAL CONTENTS ON KANSEI ENGINEERING

One of the key technologies for driving force in next age which appealing to person's mind and realizing the comfortable social life is the multimedia information processing [15]. Especially, the multimedia contents can produce comfortable feelings a new concept as Kansei contents, which are used for a measurement of man's sensibility satisfaction and the application procedures for the achievement of wealthy and friendly society.

In Japan, now there are also increasing opportunities for users to view video presentations in the work environment. The quality of image created by High vision systems is well illustrated that a technical standard has been established for projection systems in movie theaters [16]. So, the video content providers have begun to demand a method for quality management of projector systems.

In [17], this study is intended to provide viewers with the same sensory impressions of any given video production, regardless of the mode of viewing. This work focused on liquid crystal display (LCD) and digital light processing (DLP) projectors, which was performed to examine viewer assessment of image contents based on viewers' sensory evaluations of differences between the display types. The image projection system is shown in Fig. 7.

The results indicated that if display devices were adjusted to remain within some range of color reproduction, there was no problem of differing perceptions for dynamic contents, but adjustments must be more precise for static content.

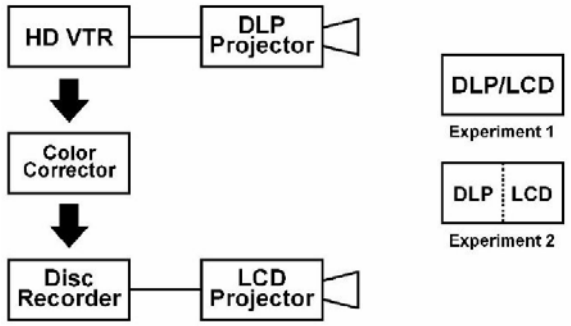

Fig. 7 *Image projection system [17].*

When you see some digital contents through different types of display of TV, LCDs of laptop or small displays of cellular phone, etc. their impression would be different due to the difference of image size, resolution, luminance and color. In the way of commercial via Internet called 'e-shopping', this is a serious problem for advertisement of e-shopping, where the same merchandise should be looked the same in any kind of display ideally [18], [19].

Therefore, [20] has been presented the result focusing on the effect of the lightness contrast, as well as the effect of absolute lightness of main object based upon Kansei evaluation of color image and investigate their relation to image size. The lighting set-up for the photography of test images is shown in Fig. 8 and there is no image processing utilized. These results show that advertisement or information distribution through mobile phone network should be taken in the way that lightness of main object should satisfactorily high to make a quality of Kansei impression. This study provides useful data for both e-shopping creators and designers handling artistic images.

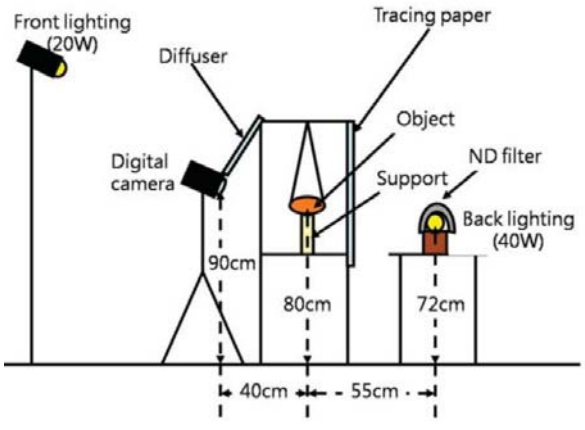

Fig. 8 *Lighting environment for photography of sample of test images. [20].*

9. CONCLUSION

In this paper, the Kansei engineering was discussed in the various topics in Japanese lifestyle such as business and multimedia information processing. While referring to Kansei or Kansei engineering and their recent trends that were related to sensory, feelings and emotional evaluation. Many researches of Kansei engineering in Japan have been made it possible to take a comfortable life for people in this recent.

REFERENCES

[1] S. Nagasawa, "Kansei and Business", *Kansei Engineering International: International Journal of Kansei Engineering*, vol. 3, No. 3, pp. 3-12, 2002.

[2] Y. Shimizu, T. Sadoyama, M. Kamijo, S. Hosoya, M. Otani, K. Yokoi, Y. Horiba, M. Takatera, M. Honywood and S. Inui, "On-demand production systems of apparel on basis of Kansei Engineering", *International Journal of Clothing Science and Technology*, vol. 16, pp. 32-42, 2004.

[3] [Online]. Available: http://www.jske.org

[4] M. Nagamachi, "Workshop 2 on Kansei Engineering", in *Proceedings of International Conference on Affective Human Factors Design*, Singapore, 2001.

[5] S. Lee, A. Harada and P.J. Stappers, "Pleasure with Products: Design based Kansei", *Pleasure with Products: Beyond usabitlity*, W. Green and P. Jordan (eds.), Taylor & Francis, London, pp. 219-229, 2002.

[6] S. Schütte, "Engineering Emotional Values in Product Design: Kasei Engineering in Development", Ph.D. dissertation, Department of Mechanical Engineering, Linköpings Universitet, Linköping, Sweden, 2005.

[7] K.Yamamoto, "Japans Automotive Industry: It's Strength", Special Lectures by Top Management, Faculty of Business Administration, Asia University, Tokyo, 1992.

[8] Quality Technology and Management Group, University of Palermo, *Kansei Engineering* [Online]. Available: http://www.dtpm.unipa.it/QTM

[9] Y. Soeta, T. Kitamoto, H. Hasegawa and M. Kasuga, "Subjective Evaluation of Comfortableness of Wet Cotton and Paper Hand Towels *"Oshibori" "*, in *Proceedings of Inter-national Workshop on Advanced Image Technology (IWAIT)*, pp. 154-157, January 2008.

[10] Y. Soeta, T. Kitamoto, H. Hasegawa and M. Kasuga, "Study on Factors of Favorable Wet Cotton Hand Towels *"Oshibori "*, *Kansei Engineering International Journal*, Journal of Japan Society of Kansei Engineering, vol. 11, no. 1, pp. 19-25, 2012.

[11] M.Shigeo, "An Introduction to Pickles", Japanese Food Newspaper Ltd., November 2000.

[12] E. Endo, T. Ohba, M. Sato and M. Kasuga, "Image Impression Analyses of Pickles for Product Development based on Kansei Engineering", *Kansei Engineering International*, Journal of Japan Society of Kansei Engineering, vol. 6, no. 1, pp. 39-44, 2006.

[13] E. Endo, Y. Naeki, T. Ohba, M. Sato and M. Kasuga, "Impression Analysis of Goods Image and Its Applicationn Based on a View Point of KANSEI", in *Proceedings of International Workshop on Advanced Image Technology (IWAIT)*, Jeju, Korea, pp. 127-132, January 2005.

[14] E. Endo, T. Ohba, M. Kumagai, M. Sato and M. Kasuga, "Proposol for Product Development Support System for Pickles based on *Kansei* Engineering", *Kansei Engineering International*

Journal, Journal of Japan Society of Kansei Engineering, vol. 7, no. 2, pp. 129-135, 2008.

[15] M. Kasuga and M. Sato, "To Expanding Application Horizons of User Friendly Digital AV Contents on Kansei Engineering", Invited paper, in *Proceedings of International Display Workshops (IDW)*, Kyoto, Japan, vol. 11, pp. 1503-1506, December 2004.

[16] "Digital Cinema System Specification V 5.1", Digital Cinema Initiatives, LLC, March 31, 2005.

[17] T. Mori, T. Shimizu, S. Yamane, M. Sato and M. Kasuga, "*Kansei*-based Investigation of Methods for Projection of Digital Content", in *Proceedings of IEEE Region 10 Conference (TENCON)*, Melbourne, Australia, November 2005.

[18] M. Chae and J. Kim, "Do Size and Structure Matter to Mobile Users? A Empirical Study of the Effects of Screen Size, Information Structure and Task Complexity on User Activities with Standard Web Phones", *Behaviour & Information Technology*, vol. 23, no. 3, pp. 165-181, 2004.

[19] L.R. Duchnicky, A.P. Kolers, "Readability of Text Scrolled on Visual Display Terminals as a Function of Window Size", *Human Factors*, vol. 25, no. 6, pp. 683-692, 1983.

[20] Y.C. Chen, T. Ishikawa, T. Shirakawa, T. Eda, H. Oguro, S. Guo, M. Sato, M. Kasuga and M. Ayama, "Effects of Lightness Contrast and Image Size on Kansei Evaluation of Photographic Images", in *Proceedings of International Conference on Kansei Engineering and Emotion Research (KEER)*, Paris, France, pp. 1128-1138, March 2010.