

# Methods of Analysing Images based on Kansei Engineering

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**Abstract**—Kansei Engineering (KE) develops methods of translating and embedding perceptual and emotional qualities in product design features. In design, product emotion plays an important role in encouraging product quality and sustainability. Emotions are complex conscious states that play an essential role in our daily lives. Several methods and tools exist and used to assist the process of evaluating users' emotional experience with the products. This paper aims to develop the process of evaluating users' emotional experience using the semantic differential method in classifying the Kansei attributes. Image feature extraction is a key issue for concept recognition in images, and particularly emotions. In evaluating the product images, KJ Methods based on KE Model used to develop the full range of emotional keywords and their affinity cluster. The result shows that this method will be a good reference to design studies that involved with users' subjective emotional experience with product design

**Keywords**—Kansei, visual images. Semantic differential, KJ methods

## I. INTRODUCTION

In product development, the issues on product function, aesthetics, technology and culture are all important in portraying the product images. Improving this product requires knowledge about how product attributes affect the consumers. This will evoke a positive impact and make the consumer buy the product as well as creating desire in purchasing the product. Creating desire requires profound affection, which is very complex from a combination of sensing, emotional, behavioural and spiritual experiences. The affective methods or *Kansei Engineering (KE)* methodology is able to evaluate the emotional experience in more accurate semantic dimension.

The emotional user experience research offers a new perspective on the user oriented view of interactive product quality [1]. The process of accessing the subjective emotion commonly begins with the identification of representative emotional keywords. This has been done in different ways such as a free selection method, regression analysis, and by document review. The literature revealed that a good reference for emotional keywords and their affinity does not exist. The paper describes the work in developing a full-range of

emotional keywords, and clustering their affinity by the use of KJ method.

The aim of this study is to develop the process of evaluating users' emotional experiences in more accurate semantic dimension. Image feature extraction is a key issue for concept recognition in images, and particularly emotions.

## II. KANSEI ENGINEERING STRUCTURE

*Kansei engineering* is a method used to convert a customer's ambiguous image product into detail design [2]. In the *Kansei engineering*, the psychological measurement is conducted as an impression technique in order to quantify *Kansei*, and the physiological measurement as well as physiological measurement is conducted as an expressive technique. *Kansei engineering* has been introduced in a few years back and highly been practiced in most of the Japanese product companies. It has been evaluated as the advance technology of product development, which expresses the customer demand in design domain. *Kansei engineering* has been functioning as an ergonomic customer oriental technology for new product development. It is highly based on the human cognitive model in creating a satisfying product for each user. *Kansei* could be explained as building human oriented information physical system by natural functions or computer applications.

The feeling that people have with the product can be addressed using either qualitative or quantitative methods. *Kansei Engineering (KE)* is a very new consumer-oriented product development technology that aims to transfer customer's perceptions, feeling and mental images into a tangible product. When a consumer wants to buy a new product, he or she express it with words such as "gorgeous, beautiful and strong with an inexpensive price". KE is able to interpret and transfer the psychological implications of these words to the details of the product design. In assembling the *Kansei* methods it is first to recognize these four major elements should involved stated in Figure 1.

In summarizing how the system works: when the consumer uses the KE system he or she will input his or her "feeling" words related to the desired product. The KE system receives these words firstly through a word database and checks whether it can recognize them or not. If positive, the system will transfer the words to the knowledge base. In this turn, the knowledge base will match the rule-base and the image-base. Finally, the system decides the aspects of design details and the controller of KE system pulls out and displays the

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appropriate parts and colours on the screen. The KE system can be used both to support the consumer's choice of product and the designer's decision for the product development. Examples of some applications of this technique are suitable for fashion design, automobile door, car interior design, office chair, etc. This method may cause a revolution in the design process of consumer products in the future.

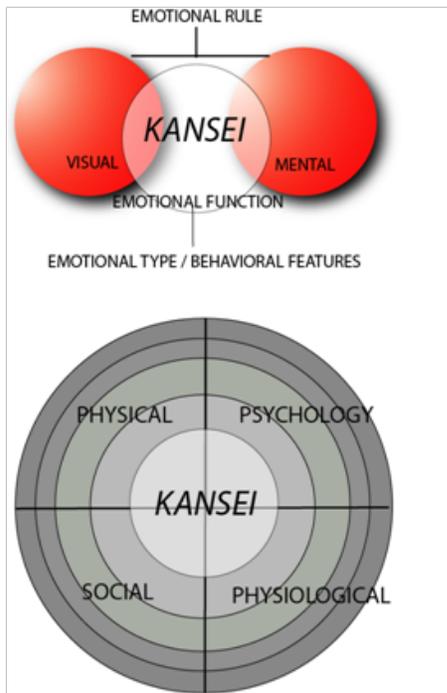


Fig. 1 Construction of Kansei component

### III. COMPONENTS IN KANSEI ENGINEERING (KE)

There are few analytical methods used in studying the relationship between design elements aesthetic values in product design. Conjoint analysis and Quality Function Deployment (QFD) that quantify consumers' perceptions offered a helpful guide for product development. In developing Kansei structure for product design, KE type 1 was used in building up specific classification of new product towards design elements. The main component in KE consists of Semantic Differential Method and KJ Methods of analysing images. This is the basic requirement in understanding the perceptual preferences by the user in future products. SD method (Semantic Differential) scales were applied in categorizing the sample attributes. It is a measuring instrument to obtain the connotative value of an object or an image. This method is important for modelling the semantic space, which shows the relations between samples and the meaning of the adjective words.

Emotion is important to product design because virtually all the decisions we make are made because of either how we feel, or how we anticipate we'll feel. Recent research in Neuroscience has shown that without the feedback provided by our emotions, we have difficulty making even simple decisions, like what clothes to wear in the morning. The effects

of emotion directly influence much of the way we perceive our everyday lives, affecting how we categorise information, make decisions, evaluate risks and solve problems [4]. Within emotional research literature, the term used for the way that emotions affect cognition is "emotional effect". In product development, Kansei method or also known as an effective method has been applied to optimize the emotional appeals for the form elements of products. This quantitative method helps designers analyse the relationships between Kansei images and product form. In addition, due to individual difference and various user preferences, several Kansei image spaces have been developed for understanding users' affective response toward products. Users' experienced to express their visual observation characteristic of products based on various emotional expression words. These unconscious words were recorded and extracted in KE methods.

In Kansei the main measurement involved with the psychological measurement, then it is always measured by physiological value as well as physical values as shown in Fig. 2. When Kansei is measured, these three corresponding relationship is incorporating in identifying the value of the products.

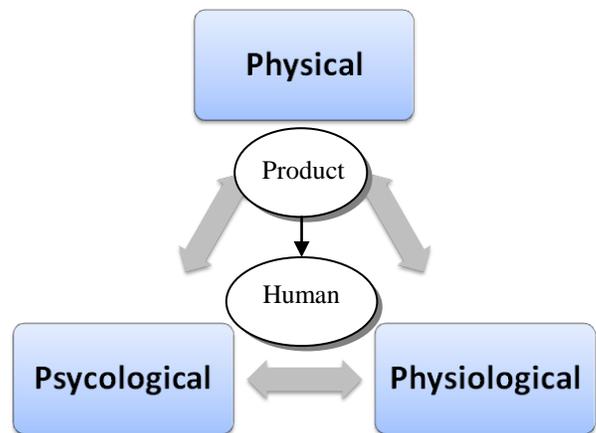


Fig. 2: Important elements in Kansei evaluation

Kansei Engineering is a consumer-oriented technique for new product development. In product design, it is applied to translate consumers' favourite feelings or images into physical design elements. The basic research process and the first steps of analysing images includes at least five steps as follows (Tanoue et al. 1997, Nakada 1997, Jindo et al. 1995):

(1) Collecting product pictures and Kansei adjectives. It is easy to collect both items in the marketplace such as websites of producers, catalogues, magazines and commercials. Then, researchers need to eliminate duplicates or similar ones and organize Kansei adjectives as polar adjective pairs for later use.

(2) Refining samples. Via pilot user survey and statistical analysis, the product pictures to which no Kansei adjectives relate and those Kansei adjectives to which no product pictures correspond could be eliminated. That is, the refined product

pictures and Kansei adjectives will correspond well to each other.

(3) Building the relationships between product pictures and Kansei adjectives. A series of questionnaire and statistical analyses are applied to investigate a specific group of participants' (or even just one participant's) subjective evaluation and preference. Based on this subjective measurement, the relationships between representative product pictures and Kansei adjectives could be linked.

(4) Analysing product form. The purpose of this step is to describe the product form as a combination of form elements that contribute to the Kansei image. For example, an electric shaver could be decomposed as a body, a blade, a control panel, a switch and grabbing surface, etc.

(5) Synthesizing product form. Usually, the same participants are asked to evaluate a group of virtual products against preferred Kansei adjectives as criteria. After this evaluation is processed by quantitative methods, such as an Artificial Neural Network, which styling alternative of a form element contributes to portray a certain Kansei image could be identified. In other words, the optimal product form with specific Kansei images can be created.

#### IV. KANSEI ENGINEERING METHODS

Traditionally user has focused much on the usability of products. Mostly in product development the influence of a product has on the user has been described through customer satisfaction. These measures say little about the interaction between the user and the artefact. Future product development enhances the application of mass customization. The tendencies in product development make it likely that many future products will be functional and fulfil the customer's needs. One task for product development in this context is to be able to capture customer's considerations and feelings about products and transfer these emotional aspects into the excellent product design. Functionality, attractiveness, ease of use, affordability and safety are all attributes that are expected by the users in their everyday product.

*Kansei* engineering is a method used to convert a customer's ambiguous image product into detail design. The feeling that people have with the product can be addressed using either qualitative or quantitative methods. In order to select appropriate adjectives to describe multiple Kansei images of the product, a well-organized Kansei space with various adjectives is needed. Several statistical methods such as KJ Method, Cluster Analysis, Semantic differential (SD) and Factor Analysis are able to construct *Kansei* spaces for specific purposes respectively. In analysing product images using KJ Method and Semantic Differential (SD) method will guide the designer to pay considerable attention to aspects such as feelings and types of products that should be designed or provided. These feelings pertain not only to the form or physical aspect but to observe their emotion towards the products.

#### A. Indexing Words using KJ

KJ method (sometimes referred to as affinity diagram) named after its inventor, Kawakita Jiro, in 1960s as one of the Seven Management and Planning Tools for successful project planning [5]. It allows groups to quickly reach a consensus on priorities of subjective, qualitative data [6]. Spool conducted a study to compare the results of affinity cluster developed by 15 different teams, and proven that they produced exactly the same result. This amazing output provides proven of the accuracy of the KJ method to produce objective results. KJ method can be used as a tool to gather large amounts of language data (e.g. ideas, opinions, issues) and organize them into groupings based on their natural relationships. In Fig. 3 and Fig.4, illustrates this research methodology involving the adoption of the KJ method to the group Affinity of KW's. In this research the method is divided into four phases, namely Initial Study, Exploratory Study, KJ Method, and Confirmatory Study. The first phase of the method begins with the determination of the focus domain as a starting point to generate KW. The methods of developing Kansei world's (KW) using KJ methods were divided into four stages:

1. Initial study: Identification of product/visual images, synthesis initial Kansei Words
2. Exploratory Study: Brainstorm and gathering Kansei Words using physical and psychological experiences
3. KJ Methods: display Kansei keywords on the cards, sort all the keywords into groups and categorize each group.
4. Confirmatory Study: validate the suitability of KW in each header (category) and develop the final cluster for KW

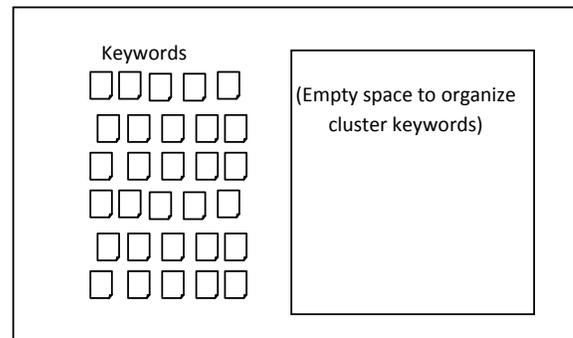


Fig. 3: Random keywords extracted by the user

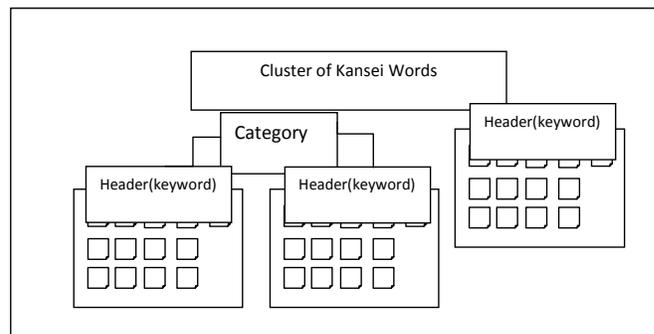


Fig. 4: Illustration of the final Cluster of Kansei words (KW) using the KJ method

*B. Semantic Differential*

Semantic Differential (SD) method by Osgood [7] is another method of analysing images accurately. In parallel with the research using KJ methods as described above, SD method will illustrate a better view from the findings. To illustrate, by applying Cluster Analysis, *Kansei* adjectives can be hierarchically categorized into an organization chart, as shown in Figure 3. The higher an adjective the broader meanings it signifies. These adjectives were gathered through brainstorming of words that emotionally responded by the subjects. Adjectives in the same branch are of similar meaning while in different ones are of different meaning. For example, "Pretty" comprises "beautiful", "attractive" and "fine looking". "Natural" indicates "fresh", "environmental" and "healthy". Obviously, this hierarchical space clarifies the pedigrees among *Kansei* adjective [3]. However, it cannot provide about different *Kansei* adjectives such as antonyms or independent ones. Table I illustrates the cluster component for each category developed from KW attributes.

TABLE I  
EXAMPLE OF KANSEI ATTRIBUTES IN CLUSTERS

Extracted Keywords		
NATURAL	ACTIVE	PRETTY
fresh	dynamic	fine
green	fast	joy
environmental	busy	beautiful
healthy	exciting	glorious
organic	quick	attractive
plain	energetic	fine-looking
basic		

Table I shows an example of *Kansei* Words from the clothes product image categories tabulated from Principal Component Analysis and these KW were recognized in order to obtain an objective assessment of user' feeling and mental expressions of the products. The SD method will provide sufficient results on the type of criteria needed or expected in the products. Visual appearance in clothing or any products mainly involved with visual perception that refers to the information acquired from the object via *Kansei* recognition. These criteria mainly focused on the users' physiological capacities during the evaluation.

Overall relations to the cloth's appearance can be given an appropriate value of sensibility. Somehow, the keywords also could contain those approaches with pairs of opposite adjectives or attribute pairs as in Fig 5. Analysing responses based on the SD method through the factor analysis, will contribute to the product identification clearly based on the user's perceptual and emotional needs. This is a method in which a determined as an ideal vector, and positioning for new products is determined based on that direction.

V. KANSEI VALUE IN PRODUCT ANALYSIS

The KE plays an important role in the product development process. There are two ways of applying the KE. First, the support from the consumer's or user's decision for a choice of the products and the second is supported from the designers'

decision on product development. These criteria will affect the information in producing the best product. By analysing the relationships between human and product, the features and the essences of the processed product can be improved.

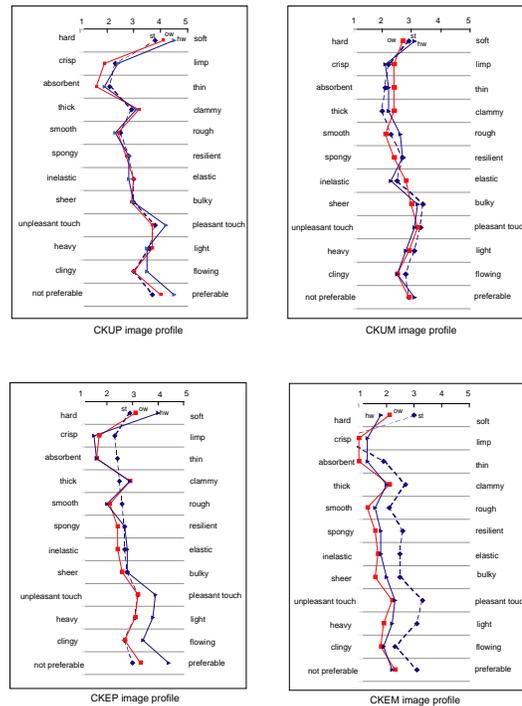


Fig. 5 : Kansei attributes on SD method

*Kansei* Engineering will capture both users and designers idea explanations through various aspects of emotion that can create pleasure with the products. An ontological framework, planning also can be developed using KE as well as product deployment or product life stages. These are all the area that is based on consumer attributes, consequents correlation structure which is important in the design process and its planning.

VI. CONCLUSION

The *Kansei* Engineering system is to survey or analyse the users to grasp their feelings at the beginning product development. The process of identifying consumer needs is an integral part of the larger product development process and most closely related to the conceptual design, design selection, competitive benchmarking and establishment of product specification. With this specification, the manufacture satisfied that they fully recognized the consumer needs. In *Kansei* engineering approach systematically identifying the consumer's needs and implementing them in product design.

This paper discusses the basic types of analysis using *Kansei* model. These methods will perform better understanding of product images and forms on its first steps of evaluation. Based on this study and observations, in *Kansei* Engineering profound affection of :

- i) Sensing experience; sensing experience are often related in *Kansei* Engineering related to emotions.

ii) Emotional experience: emotional experience is a result of sensing experience in a more comprehensive manner.

iii) Behavioural experience: these experiences reflect users' behaviours when interacting with products.

iv) Social interactions: building social interactions and relations between the user and products.

v) Intellectual cognition: these experiences relate to quality attributes of products.

Using *Kansei* can extend a concept of words in the *Kansei* semantic network. The combinations of emotional parameter values may be a good implementation to check the effectiveness approach in product development and its appearance.

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