Kansei Engineering: A Review On Perception Based Evaluation Methodology Of Door Handles

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Abstract

Keeping in view the importance of form in product design, a Kansei-based methodology of product design to establish quantitative relationship between customers' emotions and product form features is discussed in this paper. To design a good product, it's not only important that the product satisfies the function needs, but also fulfils the consumer's psychological estimation. The inclusion of consumer's need in addition to the technical aspect of product will determine the success of the product in the market. Kansei Engineering has been applied to many different industrial fields. In this paper a new application of Kansei Engineering in perception based evaluation of lever type door handles is discussed.

Keywords: Kansei engineering, Product form design.

1. Introduction

Kansei is an individual's subjective impression from a certain artefact, environment or situation using all the senses of sight, hearing, feeling, smell, taste and the sense of balance as well as recognition' (Nagamachi, 2001)[10]. Of course, this might seem irrational but in most cases even your personal Kansei may not be so unique and it can be grouped, categorised and measured in order to use it for e.g. product design. According to dictionary definition*: Kansei: Sensitivity of a sensory organ where sensation or perception takes place in answer to stimuli from the external world [9]*.

The Japanese term 'Kansei' consists typically of two different Kanji- signs 'Kan' and 'Sei', which in combination means sensitivity or sensibility. According to the Japanese Society of Kansei Engineering (JSKE) 'Kansei is the integrated function of the mind, and various functions exist during receiving and sending signals. Filtering, acquiring information, estimating, recognizing, modelling, making relationship, producing, giving information, presenting etc. are the contents of Kansei' (JSKE, 2004) *[11]*. In contrast to Shimizu et al. (2004) Kansei is not only an internal process but a process in constant contact with the outer world receiving external information, processing it and reflecting it back to the outer world. Today Kansei Engineering is an inter-disciplinary product design methodology that extends over the humanities, social sciences and natural sciences. It integrates affective elements in products already in the development phase. Nagamachi was a researcher pioneering the development of Kansei Engineering in an academic context. His approach was to develop Kansei Engineering as an 'ergonomic consumer-oriented technology for new product development aiming at implementation of a consumer's demand in the product. He defined Kansei Engineering as a technique for translating the human Kansei into product design elements. The term Kansei used in this context is narrower than the original meaning. Nagamachi states: Kansei is a Japanese word which implies a customer's psychological feeling and image regarding a new product.[3]

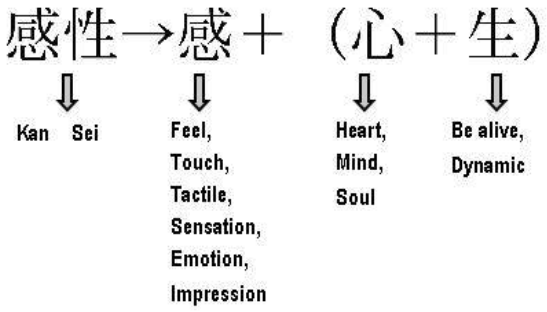

Fig 1: Etymology of Kansei Lee (2002)[11]

Therefore, this paper proposes a design method to quantify users' Kansei images. The product is decomposed into several feature elements, which are considered as evaluating attributes. With the utility value of attribute level for each attribute from conjoint analysis, the users' image preferences to design schemes can be obtained. On the basis of analysis

result, design parameters of the best scheme are further optimized by using computer simulation technique to improve the structure of the model. This method can find out the best design scheme to fit a certain perception of users, and make the design procedure systematic and transparent.

2. Kansei based method of perception based form evaluation-Case study of door handles

In this paper, a review on case study of lever type door handles is used to illustrate the practical application of the developed method. Overview of Kansei KE system [5] includes following steps:

- Selecting the product domain
- Sample collection and screening
- Defining the attributes
- Collection of Kansei Words
- Questionnaire survey
- Analysis using statistical tools

2.1 Selecting the product domain

This phase includes activities such as the definition of product type, market segment and target group. The domain is study-related, but for the robustness of the results the target group needs to be as much as possible homogeneous. Choosing the domain includes the selection of a target group, market-niche, and specification of the new product. Based on this information, product samples are collected, representing the domain. The Kansei Domain can be understood as the ideal concept behind a certain product. Despite the fact that a circle can never be drawn perfectly round, everybody knows what the perfect idea of a circle is. The Kansei domain is dealt with in the same way. It is an abstract super-ordinate mind structure while the representative products are either tangibles or intangible samples from this domain. As a result, a domain includes existing products, concepts and even still unknown design solutions. The task in this first step is to define the domain and find representatives (products, drawings, samples, etc) covering an as big as possible part of the domain.

2.2 Sample collection and Screening

Door handles samples marketed in India are collected using catalogues collected from markets and internet, roughly 72 pieces. To reduce the load and judgment of participants in the further investigation, the original samples are screened according to the definition of pictures, similarity of form, repetitiveness of style and etc. Finally, 20 samples are remained as the representative samples. To obtain a more objective result in the further survey, the 20 representative samples Fig .2 have been selected.

Fig 2: Representative sample of door handle designs.

2.3 Defining the attributes

In this step, the selected door handles are divided into six attributes, including body length, body height (distance from door), cross section, front shape, texture and material. After the morphological analysis on the 20 representative samples, each feature element can be divided into several types to form an analysis table of door handles form features. Here the six features of door handles can be considered as attributes, and their types are levels (Table 1).

Table1. Door handles attributes and levels

Length(mm)	Less than130	130-150	More than 150	
Height (mm)	Less than 50	50-70	More than 70	
Cross Section	Rectangular	Square	Circular	Oval
Front shape	Uniform Straight	Non Uniform	Convex	Concave
Texture	Smooth or Fine	Rough		
Material	Metallic	Non-Metallic		

2.4 Collection of Kansei words

Various Kansei words related to door handles are collected by asking sales people to write down the

Table 2. List of selected Kansei Words

Elegant-Poor
Creative-Ordinary
Traditional-Classic
Simple-Luxurious
Antique-Modern
Fragile-Durable
Graceful-Awkward
Harmonious-Imbalanced
Antique-Modern
Dynamic-Dull
Like –Dislike

customer words concerning the door handle designs. Other Kansei words have been collected from magazines related Kansei literature. The list of 20 Kansei words is shown in Table 2. A questionnaire is designed to investigate participants' preferences to the 20 representative samples of door handles under the 20 Kansei words. The questionnaire uses 5-level Likert Scale for the participants to rate the samples one by one for various emotions related to door handles. The 5 levels from left to right represent the scores from 1 to 5. The questionnaire decides the target Kansei words for statistical analysis.

2.5 Questionnaire survey

Most Kansei Engineering evaluations involve customer surveys. The main components of these surveys are questionnaires including different kinds of rating scales. In order to minimize the loss of information a good explanation, a clear structure and quick answering opportunities should be provided in order to increase the comprehensiveness. The quality is dependent on the presentation of the questions. A questionnaire is designed to investigate participants' preferences to the 20 representative samples of door handles under the 20 Kansei words. The questionnaire uses 5-level Likert Scale for the participants to rate the samples one by one for various emotions related to door handles. The 5 levels from left to right represent the scores from 1 to 5. The questionnaire decides the target Kansei words for further analysis. This is done via the regression analysis to build up models of the overall evaluation index "preferences" with the overall evaluation index as the dependent variable, and the image senses words as independent variables. An example of questionnaire structure is shown in Table 3.

Table3. Questionnaire survey for users' rating

Elegant	1	2	3	4	5	Poor

2.6 Analysis using statistical tools

Conjoint Analysis is a statistical technique used in market research to determine how people value

different features that make up an individual product or service. It is a method for weighting different product concepts against each other in order to identify which product attributes are preferred by a certain consumer group and the price they are willing to pay for it. For example, the combination of the different attributes like price, size, colour, brand etc. has a joint influence on the consumer decision whether to purchase the product or not. In the technique assumption is made in a way that if brand is seen as one of product attribute, then a consumer would spend more money on it such as Mercedes than Fiat with the same specifications. This analysis is based on the consumers‟ ability to rank concepts with different content in order to make a clear decision on how desirable the concept is. The analysis step includes establishment of consumer preference and relationship model.

- To establish Conjoint Analysis Model, it normally uses regression analysis model with dummy variable.

$$Ph = b0 + \sum_{i=1}^{I} bi\ xi + \in$$

Where
$\boldsymbol{P_h}$ supposed to be participant's preference to the $\mathbf{h_{th}}$ sample;
$\mathbf{b_0}$ and $\boldsymbol{b_i}$ are parameters to be estimated;
$\mathbf{x_i}$ is the second variable with the value of 0 or 1, which represents the status or level of the attribute.

- The relationship between utility of a product sample *U* and attribute-level a_{ij} is :

$$U[Target\ words] = b + \sum_{i=0}^{m} \sum_{j=1}^{ki} aij\ X$$

Where
U (Target words) is the total utility for a certain sample;
$\boldsymbol{a_{ij}}$ is the *j*th level's utility for the *i*th attribute;
k is the number of attribute level;
m is the attribute number. If the $\boldsymbol{j_{th}}$ level for the *i*th attribute exists, $\boldsymbol{X_{ij}}$=1. If not, *X*=0.

The calculated data decides the most important attribute factor and rest in descending order.

3. Conclusion

The first notion given to consumers by the product is its form, which is closely linked to user's Kansei. Form plays an essential role in product design, therefore this research proposes a review of Kansei-based methodology of door handle design and concentrates on customers' perceptual image, thus quantifies the target image by conjoint analysis. A regression model obtained for a given image can link the customers' perception and design description together and quantitatively represents their relationship. With this method, designers can directly find out which features affect a certain image most by comparing the importance weightings of features. In addition, for the substitute schemes, designers can easily find the best one which satisfies the image most by comparing the total utility values. The improved design parameters obtained from statistical analysis can provide suggestion to the conceptual design and redesign of the product.

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