Kansei Quality Control in Product Development

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When one is pursuing a high degree of satisfaction from the user's viewpoint, as advocated by human-centered design, user *kansei* or sensitivity is becoming increasingly important in addition to elements that are easy to measure and evaluate objectively such as work efficiency, frequency of operating errors, processing speed, storage capacity, portability and ease of installation (size and weight), durability, and power consumption. Elements that can satisfy kansei are called kansei quality. Fujitsu defines kansei quality using a conceptual model of mood shifting consisting of six elements. Using this model, Fujitsu is conducting trials on extracting important items related to kansei quality from each product and turning those items into a checklist for use in product development. This paper introduces Fujitsu's conceptual model of kansei quality and describes kansei quality control in the product development process using this model.

1. Introduction

Human-centered design (HCD) is a concept that emphasizes the user's viewpoint in the system design process. When one is making an all-out effort to achieve a high level of user satisfaction, it is important to consider not only those elements of a system that are easy to evaluate objectively—such as the user's work efficiency and frequency of operating errors—but also the user's degree of satisfaction in terms of *kansei*, which is a Japanese word that is sometimes translated as "sensitivity".[1)]

The *Shin Meikai Kokugo Jiten* (New Clear Understanding Japanese Dictionary) defines kansei as "intuitive mood shifts caused by impressions received when a person is subjected to external stimuli". As reflected in the expressions "refining sensitivity" and "a highly sensitive person", the concept of sensitivity is often used when describing how sharp a person's senses are or how impressionable a person is, i.e., when expressing the depth of a person's senses. It is also used when describing a stimulus that acts strongly on a person's sense perception and sensibility as in the expressions "a sound that a person is sensitive to" and "texture that stimulates a person's sensitivity".

Stimuli that induce mood shifts in a person come from a variety of elements making up a product. Fujitsu considers such elements that produce kansei-appealing stimuli to be a form of quality, and for this reason, it is conducting trials on applying quality control methods to kansei quality.

This paper introduces Fujitsu's approach to controlling kansei quality in the product development process.

2. Kansei quality model

In general, kansei quality can be understood as "the quality of products and services evaluated on the basis of user kansei" or "quality expressed

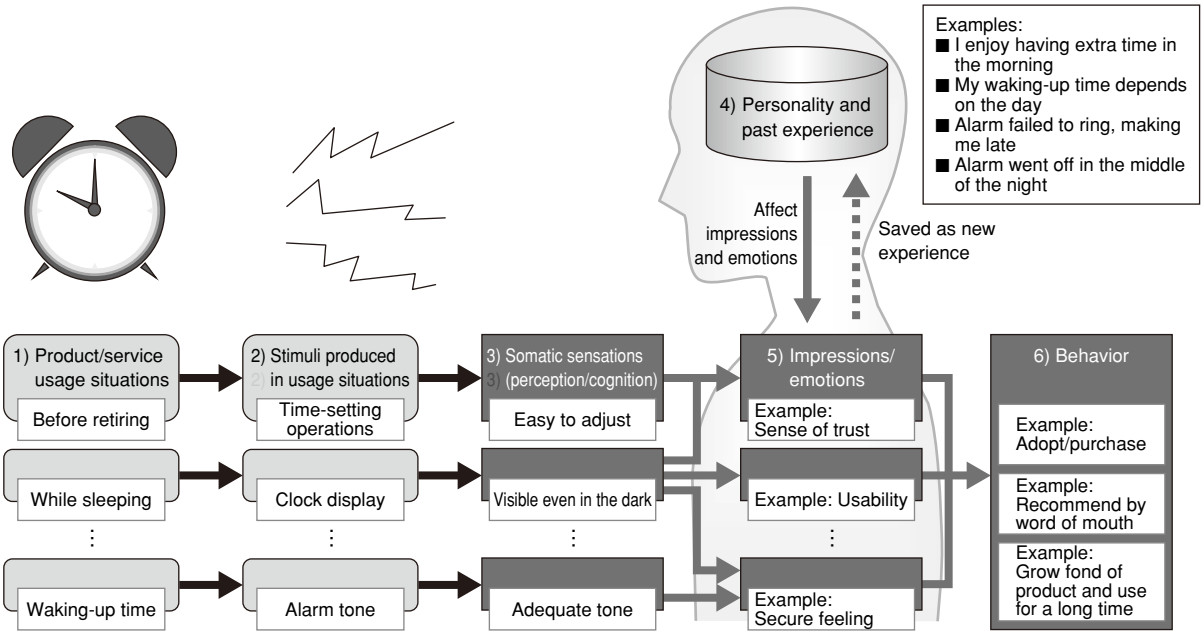

Figure 1
Kansei quality conceptual model (alarm clock example).

as images or feelings induced by the stimulation of user kansei". However, there is some ambiguity in the relationship between kansei-related mood shifts and the stimuli that induce those shifts and the elements of products that produce those stimuli. To clarify this mood-shift-inducing process, Fujitsu has adopted a conceptual model consisting of the following six elements (**Figure 1**).

1) Product/service usage situations
2) Stimuli produced in usage situations
3) Somatic sensations (perception/cognition)
4) Personality and past experience
5) Impressions/emotions
6) Behavior

This model places element 3) (somatic sensations) at the contact point between the user and the outside world. On the left, elements 1) and 2) constitute phenomena in the outside world external to the user, and on the right, elements 4) to 6) constitute mood shifts internal to the user. Element 6) (behavior), though, is observable, and since it can be objectively recorded together with phenomena in the outside world, it can provide valuable clues for inferring mood shifts.[2),3)] In this model, with the aim of clarifying the stimuli-producing situations and stimuli sources, we categorize the situations in which the product or service is used [element 1)] and specify the stimuli produced in those situations [element 2)].

Next, somatic sensations [element 3), the interface with the outside world] can, in general, be analyzed in detail in terms of three processes: sensing (acceptance of stimuli by receptors), perception (awareness of accepted stimuli such as heavy and hot), and cognition (identifying the perceived things). In the proposed model, however, it is important that no stimuli are missed, so we lump the three processes together into one element as "somatic sensations (perception/cognition)". Thus, without making any particular distinctions between sensing and perception, we take them to include the five senses (sight, hearing, smell, taste, and touch), the sense of balance, and somatic sensations as well as space perception, time perception, etc. The sense of touch can be further divided into senses of temperature, pain,

pressure, vibration, etc.

Stimuli incorporated as "somatic sensations (perception/cognition)" form impressions and emotions [element 5)] while being affected by personality and past experience [element 4)]. "Personality and past experience" means one's generational influences, habits, expectations, value system, etc., which differ from one person to the next. For any one product or service, the element of somatic sensations (perception/cognition) may be heavily dependent on a specific somatic sensation or formed of multiple somatic sensations.

Impressions and emotions that are formed from somatic sensations can be expressed by kansei keywords such as "sense of trust", "usability", and "secure feeling". The user will behave in some way in reaction to these impressions and emotions. This model focuses on behavior [element 6)] because of its importance to quality control. Some examples of desirable behavior are "purchase", "grow fond of a product and use it for a long time", and "recommend by word of mouth", while undesirable behavior includes "discontinue use" and "speak badly of a product".

At Fujitsu, controlling kansei quality means planning and designing product specifications by accurately inferring the above internal processes, controlling product elements that produce stimuli, and promoting behavior based on desirable emotions while preventing undesirable behavior by suppressing the generation of undesirable emotions.

3. Quality control process

To incorporate kansei quality in product quality control, one must specify usage conditions for each product and kansei quality with respect to users. Fujitsu is conducting trials on controlling kansei quality by the following process: clarify each kansei-quality item in the product planning stage, turn those items into a checklist, create a design that aims to satisfy specified targets, and evaluate conformance after design and development (**Figure 2**).

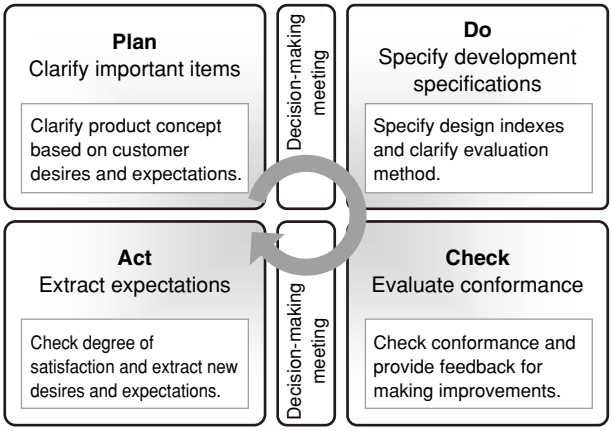

Figure 2
Kansei quality control process.

The above four steps correspond to the Plan-Do-Check-Act (PDCA) cycle. Here, required items are clarified in the Act and Plan steps, a solution is created through design work in the Do step, and the results of that design are evaluated in the Check step. This is an HCD process. A step to decide whether design/development and product formation should proceed can also be incorporated.

In the Plan stage, kansei-quality items to be turned into a checklist are expressed as "impressions and emotions" in the kansei-quality model. They may also be expressed as "somatic sensations (perception/cognition)" or "stimuli produced in usage situations" depending on the item. If possible, they will be expressed as concrete product specifications. These items must clarify and express target levels. The following index keywords can be used when describing targets. They will also provide some understanding of the present level of user satisfaction.

1) Customer is enthused
2) Customer is impressed
3) Customer takes for granted
4) Customer can tolerate
5) Customer gets angry

For example, targets may be described as "simple operation that impresses the customer" and "quiet operating sound that the customer can

tolerate". As for items to be made into a checklist, only important items related to the product's overall concept are extracted—no attempt is made to prepare an exhaustive list. The checklist-evaluation step evaluates conformance and the extent of target achievement mainly on the basis of heuristics (empirical rules) used by people in charge.

4. Procedure for extracting important items

We analyze and extract important items of kansei quality in accordance with the kansei-quality conceptual model while specifying usage situations and users for each product. These tasks can be done together with concerned personnel in a workshop format using pasteboards and sticky notes (**Figure 3**).

Figure 3
Meeting for extracting important items.

4.1 Collecting and analyzing information about personality and past experience

To understand the target users of a particular project, usage conditions and user characteristics must be understood in accordance with the HCD design process. Various methods can be used to understand usage conditions and user characteristics such as making on-site observations, giving out questionnaires and holding interviews, and performing user tests.

Making on-site observations becomes increasingly important as the number of unknowns in the target usage increases, as in the development of new products. On-site observations aim to determine user features and behavior, the type of work performed, and the work environment (workplace, equipment, etc.). Observation techniques include observing and recording behavior while following around specific users (shadowing), observing and recording conditions at fixed points, and recording the behavior of specific users in the form of a photo journal. Then, to add explanations and interpretations to the information recorded in on-site observations, questionnaires and interviews can be used to clarify the intent and degree of satisfaction of recorded behavior. These can range from one-to-one interviews to group interviews and paper- or Web-based questionnaires. Which technique or techniques to use is decided on the basis of the number of users, associated costs, and desired information. User tests can also be given to determine problems and the extent of errors in operations that are difficult to discern by observations and questionnaires/interviews and to uncover fatigue that is otherwise difficult to detect. If one lets users actually operate a system or its prototype in a controlled environment, user thought processes can be verbalized and actions measured and recorded with the result that actual usage conditions can be better understood.

In addition, the Persona method can be used to share the information obtained by the above techniques with concerned personnel. This method uses that information as a basis for creating a virtual user with a name, age, hobbies and interests, lifestyle, etc.

4.2 Analyzing situations where products and services are used

Using the above information about users, we prepare a list of usage situations, making sure that none are missed. Overlooking any usage situations would affect subsequent steps where

impressions and emotions as well as behavior are analyzed. In particular, stimuli felt by the user might go unnoticed and it might be impossible to discern the meaning of some aspects of user behavior. In other words, important items of kansei quality might be missed.

Taking an alarm clock as an example, the situations of setting the alarm and waking up (when the alarm rings) are obvious, and the designer would consider stimuli from these situations accordingly. However, there may also be stimuli completely unintended by the designer that generate feelings of dissatisfaction nonetheless. These could be the (tick-tock) sound that the clock makes while one is sleeping and the inability to see the clock display in a dark room when checking the time upon waking up. Of course, the results of subsequent analysis and examination might reveal that the effects of such stimuli on impressions and emotions are extremely small, but from the viewpoint of quality control, taking no measures as part of a control process (deciding that such effects can be ignored) and doing no checking and failing to control quality are two different things.

4.3 Analyzing stimuli and somatic sensations (perception/cognition)

We here analyze stimuli that generate somatic sensations via usage situations. Stimuli such as light, color, sound, smell, taste, and heat are easy to understand because of their association with sensory organs. However, care must be taken not to miss less obvious elements like time perception, a sense of thin air as on a mountaintop, and a sense of dusty surroundings that are not directly related to sensory organs. If such elements are difficult to describe as physical stimuli, it is permissible to use expressions like “hard to breathe” and “dusty”.

Performing this analysis through comparison with competing products or other tools and equipment used at the same time in situations where the target product is used can make it easier to uncover stimuli that are otherwise difficult to notice. If stimuli can be analyzed and extracted in concrete terms, it becomes easier to come up with specifications for specific elements of the target product (such as surface finish, operation panel design, product dimensions and weight, running of operation section, and operating sounds).

4.4 Examining impressions/emotions and behavior

This is the process that uncovers impressions and behavior related to the purchase and use of the product in question. Impressions and behavior, which are formed in reaction to a number of stimuli, can be expressed as kansei keywords. Examples of such keywords are given in the following section.

We narrow down these impressions, emotions, and types of behavior to those elements that we want to aim for in the product. In short, we need to establish a product concept—elements that the company would like to promote in the product must be matched with elements that will generate satisfaction in the user. User experiences in being satisfied or dissatisfied can be easily surmised from past product-related claims and thank-you letters.

5. Kansei quality keywords

A kansei keyword may be thought of as a name describing the property implied by a pair of contrasting adjectives, as used in the semantic differential (SD) method. Some examples are “fineness” for “fine–rough”, “cleanliness” for “clean–unclean”, and “sense of trust” for “reliable–unreliable”.

“Usability” may also be used as an item of kansei quality. It can be broken down into more detailed elements like easy–hard to use, understand, and see. These individual elements may also be used as kansei keywords.

Further decomposition leads to keywords associated with the senses (such as contrast, rough/smooth, and hot/cold). Items broken down

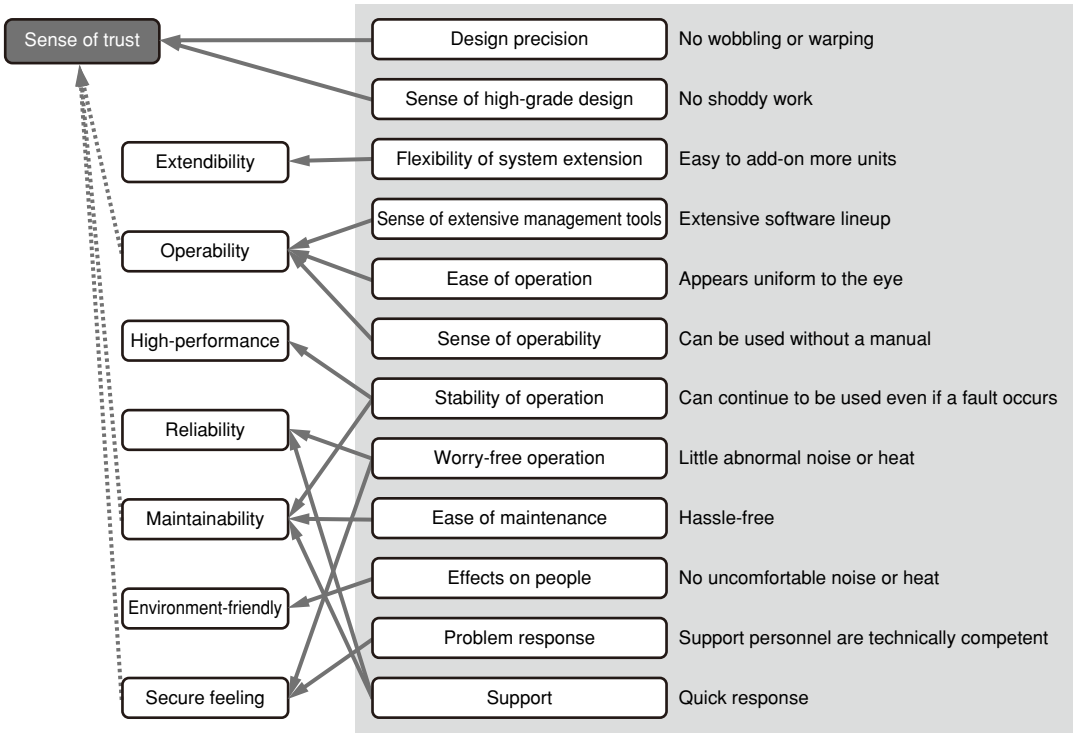

Figure 4
Example of Kansei quality keywords for a server.

to this extent can often be measured as physical quantities and interpreted as stimuli.

A discussion for defining "sense of trust" in relation to a server product may propose such constituent elements as "high-precision" and "high-grade" for design, "user friendly" and "consistent" for user operations, "stable" and "state discernable" for server operation, and "responsive" and "powerful support technology" for support (**Figure 4**).

Having a rigorous understanding of such kansei-element relationships leads to a more accurate examination of how stimuli affect kansei. Practically speaking, however, creating expressions that concerned personnel can agree upon as a product concept is sufficient for discussing stimuli that affect kansei and product specifications that are the source of those stimuli. Accordingly, the process proposed here does not correlate or systematize kansei keywords in detail.

6. Kansei quality checklist

A kansei quality checklist may list kansei keywords themselves, perceived stimuli analyzed or examined in conjunction with kansei keywords, or concrete product elements, plus the target level of each such item (**Table 1**).

The target level of a certain kansei quality item is expressed in terms of customer reaction, i.e., the customer is enthused, is impressed, takes for granted, tolerates, or gets angry. In the event that concerned personnel cannot agree on a target level solely on the basis of a kansei keyword, an outline of the usage location or stimuli analysis may be given. The target level may also be expressed in the form of concrete performance specifications. The above work is performed in the Plan step of the PDCA cycle.

Moreover, in the event that stimuli cannot be analyzed in detail because of a highly abstract kansei keyword, they may be analyzed in the Do development step. Quality function deployment

Table 1
Example of Kansei quality checklist.

Kansei quality evaluation item	Target level	Conformance	Comment
Secure feeling Noise emitted from product should not generate uncomfortable or unpleasant feelings.	Customer tolerates	Conforms	Compared with existing products, noise is hardly discernable making for a customer impressed level.
Sense of durability No uncomfortable feelings with work precision should be generated by wobbling or squeaking in the product door.	Customer takes for granted	Conforms	
Sense of order Colors and surface finishes of parts making up product have a uniform feel.	Customer takes for granted	Conforms	
Usability Protuberances or certain shapes that can facilitate operation in the dark should be incorporated.	Customer is impressed	Conforms	Shape of connector section can be determined although with some groping generating a feeling that cables can be connected without hassle.
Usability Displays (characters, pictograms, labels, etc.) should be arranged for easy viewing considering places where the product will be installed.	Customer takes for granted	Does not conform	Connector-section display is out of view and cannot be checked.

(QFD) can be used to expand kansei quality elements into concrete product quality elements.

In the Check step where the results of design are evaluated, designers themselves or concerned personnel check the extent to which the design has attained target levels on the basis of a heuristic evaluation. Questionnaires or user tests can also be given using a prototype product to make the evaluation even more accurate. Suitable results are now being obtained by heuristic evaluations in terms of accuracy and efficiency, but studies are underway to find evaluation techniques that are even more accurate and efficient.

7. Conclusion

Introducing a standard method for logically deriving kansei quality, which has tended to rely on intuition in the past, can improve kansei quality and reduce dispersion in results. We have been able to turn such a method into a process for uncovering customer needs and desires as part of a quality control process. This process must draw on all data and evaluation techniques cultivated in HCD to determine user trends, gain insight into user values and experiences, and extract stimuli that evoke emotions and enthusiasm. Looking forward, more data needs to be accumulated and new evaluation techniques need to be introduced to improve element extraction and analysis efficiency and accuracy. Our aim is to further integrate data accumulation and techniques and to expand the use of this process.

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