The Customer Implicit Requirements Acquisition and Conversion Due to the Free Association and Metaphor Mapping

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Abstract: In consideration of the characteristics and conversion difficulties of implicit customer requirements, the psychological metaphor elicitation method, which consists the free association, image mapping, is used to mining and expressing the implicit customer requirements, and the gestalt logic system is used to map them to product technical traits. It is not only realizing the mapping from the implicit customer requirements to the technical traits, but also expressing the mapping relationship explicitly through the visual images and psychological metaphor words, so it provides a feasible way to interpret implicit customer requirements and convert it into product technical traits.

Key words: NPD, implicit requirement, free association, metaphor mapping, gestalt logic system

1. Introduction

Capturing the customer requirements is an essential stage of new product development (NPD). We can use the traditional methods, such as the questionnaire to obtain the explicit requirements (Goffin and Lemeke, 2004), and use QFD to convert the requirements into product specifications (Andreas et al. 2009; Guzin and Latif, 2009). But

customers can't always adequately express their needs, and the implicit requirements are more important and difficult to obtain and convert. More and more researchers are prefer to use KE (Nagamachi, 1995)or ZMET (Coulter and Zaltman, 2001) to solve the problem. These methods are helpful but still have flaws, such as the excessive guidance and hard to quantify. Therefore, a new method due to the free association and metaphor mapping was put forward to express the implicit requirements and map them to product specifications.

2. Methods and process

2.1 Acquisition method

Natural language is often the most easy way of description and understanding, with the ability of expression and rich in semantics. But it's difficult to present the real requirement and mining the data, for its vagueness, ambiguity and inconsistency. Image is the most accurate information projection forms (Christensen and Olson, 2002). It can convey the information that one feels but cannot express (Zaltman, G., & Coulter R.1995), through the visual stimulation form of intuitive, specificity and accuracy. By using the free association which is a famous psychological technique to interpret the most representative image in a specific theme, the metaphor can be elicited and the implicit requirements can be expressed.

2.2 Conversion method

Metaphors are widely applied in designed objects and serve as a powerful means for communication. In the case of metaphors, two objects or ideas that appear different on the surface are brought together because they share an underlying property (Lakoff & Johnson, 1980). Since products are always multimodal, they allow for metaphorical mappings between various sensory modalities. There are two different concepts of domain category, one is the customer requirements of the product, the other is the product specifications that can stimulate customer psychological feelings. The existence of metaphorical relationship is hidden in the customers' brain which can transform with the customer psychological feelings.

The metaphor logic system is trying to use the formal patterns to describe the metaphors. The metaphor logic system using the gestalt rule can regard the two propositions which have some similarities and few differences as

the analogy. It can be defined as: $\alpha \prec \beta$ (Zhang Wei and Zhou Chang-le, 2004). So using the gestalt metaphor logic system, the requirements can be convert into product specifications (Figure. 1).



Figure.1 The model of research methods

2.3 Research process

The research process can be divided into 8 steps:

Step1-Determining a specific theme

The specific theme must be given at first, so the meaningful information can be collected. There are many ways to ensure the theme, such as the target customers interview, marketing position and so on. Maybe there are several themes at one time, and the themes can be defined as $T = \{t_1, t_2, ..., t_n\}$, then we can choose the $t_i (1 \le i \le n)$ according to the important degree to do the mapping in turn.

Step2-Choosing the subjects

Choose some persons from the target consumers as the subjects. It can defined as $C = \{c_1, c_2, ..., c_m\}$. To ensure the operability and validity, the number of subjects *m* is set at average between 10 to 50.

Step3-Collecting the images

Let the subjects to collect the representative images to express the theme t_i individually, and collect all the images of all the subjects. Using the important degree evaluation method based on fuzzy set theory (LI Yan-lai etc., 2007) to rank the images importance, and the best representable images gallery can be formed as,

$$p(t_i) = \{p_{i,1}, p_{i,2}, \dots, p_{i,s_i}\}$$

Meanwhile, the importance of image is $q(p_{i,1}) \ge q(p_{i,2}) \ge \cdots \ge q(p_{i,s_i})$.

 S_i represents the number of the images, different theme may has different number. $q(p_{i,j})$ represents the importance of p_j in t_i .

Step4-Free association of the selected images

Lead the subjects to say whatever they thought by focusing on the specific selected image one by one. Collect the information and use deep interview to extract the metaphor words of every image as a set, which can be defined as,

$$w(p_{i,j}, c_k) = \{w_{i,j,k,1}, w_{i,j,k,2}, \dots, w_{i,j,k,l_{i,j,k}}\}$$

And $l_{i,j,k}$ represents the metaphor words number of $p_j \text{ in } {t_i}$ by $c_k (1 \le i \le n, 1 \le j \le s_i, 1 \le k \le m)$. Step5-Decomposing the product

Let the designers to decompose the product elements in pictures, such as the figures, functions and so on. And the product elements gallery can be defined as $E = \{e_1, e_2, ..., e_f\}$, f represents the number of the product elements.

Step6-Free association of the product specification

Lead the subjects to say whatever they thought by focusing on the specific product element. Collect the information and use deep interview to extract the metaphor words of every product specification image as a set, which can be defined as,

$$w'(e_g, c_k) = \{w'_{g,k,1}, w'_{g,k,2}, ..., w'_{g,k,l'_{g,k}}\}$$

And $l_{g,k}$ represents the metaphor words number of e_g by $c_k (1 \le g \le f, 1 \le k \le m)$.

Step7-Mapping the metaphor of images to product specification

If
$$w(p_{i,j}, c_k) \cap w'(e_g, c_k) \neq \phi$$
, there is an semantic expression intersection between $P_{i,j}$ and e_g for c_k . That is, $r(p_{i,j}, e_g, c_k) = 1$.

If
$$w(p_{i,j}, c_k) \cap w'(e_g, c_k) = \phi$$
, there is no intersection between $p_{i,j}$ and e_g for c_k . That is,
 $r(p_{i,j}, e_g, c_k) = 0$.

And $r(p_{i,j}, e_g, c_k)$ represents the metaphor relationship between $p_{i,j}$ and e_g for c_k .

Step8-Discovering the metaphor relationship

The metaphor relationship between $P_{i,j}$ and e_g can be defined as,

$$h(p_{i,j}, e_g) = \bigcup_{k=1}^{m} w(p_{i,j}, c_k) \cap w'(e_g, c_k) = \{w_1'', w_2'', \cdots, w_{l_{i,j,g}}''\}$$

And $l_{i,j,g}$ represents the metaphor words number in common.

The degree of the metaphor relationship between $P_{i,j}$ and e_g can be calculated as,

$$d(p_{i,j}, e_g) = \frac{\sum_{k=1}^{m} r(p_{i,j}, e_g, c_k)}{m} \times 100\%$$

To the subjects or target customers, the correlative degree between $P_{i,j}$ and e_g reflects the concern level of the product specification, and the concern level can be defined as,

$$q(e_g) = \sum_{\substack{1 \le i \le n \\ 1 \le j \le s_i}} q(p_{i,j}) \times d(p_{i,j}, e_g)$$

3. Case study

By using the mobile mobile phone as an example, the methods were verified.

Step 1-Determining a specific theme

By interviewing the users of mobile phone, it was found that many people want to have a mobile phone with high-quality feel. So the specific theme was confirmed as "the high-quality feel".

Step2-Choosing the subjects

20 target consumers were invited to attend the research as the subjects.

Step3-Collecting the images

20 subjects collected 51 images that can express the "the high-quality feel" independently, such as clothes, books, scenery and so on. By calculating the frequency and rating the importance of the images, some of the representative images were selected, such as silk nightgown, cashmere coat, piano and diamond.

Step4-Free association of the selected images

Lead the subjects to do the free association one by one. They can say whatever they thought when watching the presented image.

For example: A girl named Qing said that "just like eating a chocolate" when she was watching the image of silk nightgown, so the more questions should be asked to get the metaphor, such as "what is the feel to eat a chocolate". And she answered "smooth, sweet, soft", so these three words are collected as,

$w(Silk - nightgown, Qing) = \{smooth, sweet, soft\}$

All subjects' metaphor words to each images by the same way were written down in separately.

Step5-Decomposing the product

The mobile phone was decomposed into parts by several designers. And the most acceptable partition was confirmed by summarizing all the outcome.

The mobile phone is divided into contour, screen, the battery cover, camera, decoration and so on. And the contour is divided into straight or curving, the battery cover is divided into different colors and so on.

Finally, the designers made on the images of the decomposing mobile phone specifications.

Step6-Free association of the product specification

The subject chose one of the images of the decomposing mobile phone specifications and did a free association.

For example: A girl named Qing said that "I thought about my mother's hair" when she was watching the curve contour image. And she was asked to answer a few more questions, such as what's the similarity between the curve contour and the mother's hair? The answer was that they both made her feel "warm, soft, comfortable, beautiful". so these four words are collected as

$$w'(curve-contour, Qing) = \{warm, soft, comfortable, beautiful\}$$

All subjects' metaphor words to each images by the same way were written down in separately.

Step7-Mapping the metaphor of images to product specification

By using the gestalt metaphor logic system, the metaphor mapping was achieved between the images and the product specifications.

For example: To Qing, there is an semantic expression intersection between the silk nightgown and curve contour, which can be described as,

$$w(silk - nightgown, Qing) \cap w'(curve - contour, Qing) \neq \phi$$

And that is to say: nightgown \prec curve contour, and

r(silk - nightgown, curve - contour, Qing) = 1

So the metaphors in requirements and mobile phone specifications were found. It intended that people can feel the high-quality feel as the same soft as the silk nightgown from curve contour.

Step8-Discovering the metaphor relationship

For example: To Qing, the metaphor relationship between the silk nightgown and curve contour is

$h(sikl - nightgown, curve - contour, Qing) = {soft}$

All the results of 20 subjects were collected and a part of the results are presented as follows and the important mobile phone specifications can be confirmed (Figure.2).



Figure.2 The mapping between the high-quality feel and mobile phone specifications

In the mapping figure, it can be found that the plain surface of a mobile phone makes people feeling like smooth as a silk nightgown, shiny as a piano. Therefore, a man who likes to wear a cashmere coat and likes the steady textures is tending to choose a mobile phone with matte surface touch and wide shape. So the implicit requirements were finally converted into product specifications. And the most concern specifications can be identified as long shape, plain surface touch and curve or straight corner contour.

4. Conclusions and discussions

As the design theme was definite, the psychological free association can be used to elicit the metaphor of the implicit requirements and the product specifications, without complicated research processes and easier to do for subject than ZMET. By using the metaphor logic system, the metaphor mapping relationship is formed between the requirements and product specifications. Not only the free association was carried out one by one without excessive leading which assures the research being faithful to the real feel of subjects, but also the metaphor mapping was carried out by the same person which assures the consistency. More usefully, the mapping relationship and degree can be quantification, so the most important and difficult things in the process of the NPD how to acquire the customer implicit requirements and convert them into product specifications can be solved.

And the limitation of our research is that it can't be used in the NPD without specification theme. And it requests the experienced or be trained interviewers to conduct the free association. In the actual operation processes, it was found that it's difficult for subjects to find images, and the analysis of implicit requirements is a process of knowledge accumulation and reuse, so the database of images is need to be established to make the research to be faster and simpler. The research we presented in this paper is only the first step, although it has some limitations, the methods was verified as a feasible way to acquire and convert the implicit requirements.

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