307

A Virtual Customer Needs System for Product Development

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Abstract

We have developed a system that can simulate customer answers in accordance with Kano model. The purpose is to identify the minimal number of respondents needed in determining whether or not a product attribute is attractive, must-be, indifferent, reverse, or alike.

1. Introduction

Product development is a complex engineering task wherein a great deal of intellectual and physical resources, methods, and tools are involved [1]. Figure 1 shows the product development cycle that consists of Strategic Goal, Customer Needs Assessment, Conceptualization, Product Realization, and Satisfaction. In this study, we deal with the issue of Customer Needs Assessment. To know the needs of the customers for a given product (or a set of products), the usual practice is to use questionnaires and obtain the opinion of customers. This raises a fundamental question that is how many customers should be asked to make a reliable conclusion. To support a product development team by providing the answer of the above question, a simulation system can be used, as schematically shown in Fig. 1. This paper is written from this context. The remainder of this paper is as follows. Section 2 shows the basic considerations to simulate the customer answers. Section 3 shows some results, which is followed by the concluding remarks of this study.

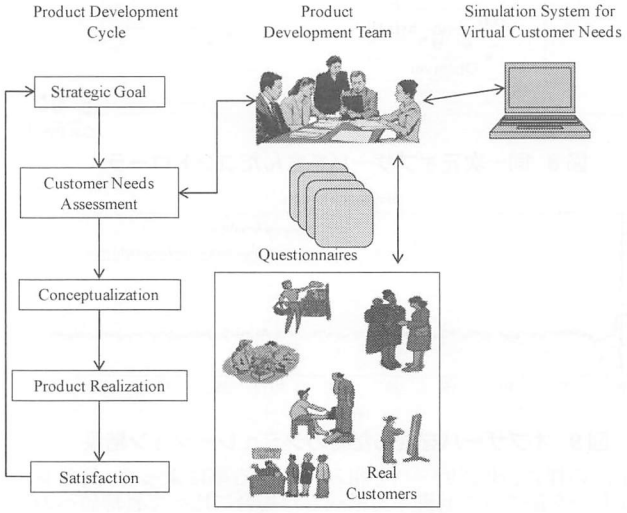


Figure 1. The contest of this study.

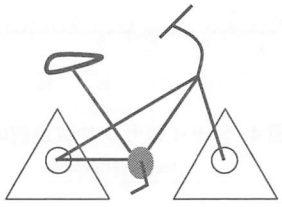
2. Kano-model-based customer answers

There are many models for customer needs assessments. One of the well-respected models is Kano model [2]. To implement Kano model, a two-dimensional questionnaire is prepared for each product attribute. One of the parts of a questionnaire is called *functional* part and the other is called *dysfunctional* part. A respondent selects Like, Must-be, Neutral, Live-with, or Dislike from the functional part assuming the proposed attribute *is working*. A respondent also selects Like, Must-be, Neutral, Live-with, or Dislike from the dysfunctional part assuming that the proposed attribute *is not working*.

Functional Answer:	Dysfunctional Answer:
Like	Like
Must-be ✔	Must-be
Neutral	Neutral
Live-with	Live-with
Dislike	Dislike ✔

(Must-be, Dislike) → Must-be

Figure 2. A Must-be attribute.



Functional Answer:	Dysfunctional Answer:
Like	Like ✔
Must-be	Must-be
Neutral	Neutral
Live-with	Live-with
Dislike ✔	Dislike

(Dislike, Like) → Reverse

Figure 3. A Reverse attribute.

The combination of functional and dysfunctional answers is then used to know whether or not the proposed attribute is *Attractive (A)*, *One-dimensional (O)*, *Must-be (M)*, *Indifferent (I)*, *Reverse (R), or Questionable (Q)*. For example, consider the case shown Fig. 2 where the product attribute is a "circular-shaped bicycle wheel". The circular-shaped bicycle wheel is a Must-be attribute ("*Atarimae*" in Japanese). As such, a respondent most likely answers Must-be from the functional part and Dislike from the dysfunctional part. Figure 3 shows another example, wherein the product attribute is a "triangular-shaped bicycle wheel." In this case, the answer would be Dislike from the functional part and Like from the dysfunctional part. This leads to a conclusion that the product attribute (triangular-shaped bicycle wheel) is Reverse attribute.

Kano model provides a mapping between two-dimensional answers and attribute status, as shown in Table 1. Therefore, to

simulate customer answers in accordance with the Kano model, it is important to simulate functional answers (X) and dysfunctional answers (Y) independently and then map the combination (X,Y) into a Kano evaluation ((X,Y)→Z) shown in Table 1. Note that X, Y ∈{Like, Must-be, Neutral, Live-with, Dislike} and Z ∈ {A, O, M, I, R, Q}.

Table 1. Kano evaluation (Z) of product attribute.

Functional Answers (X) (↓)	Dysfunctional Answers (Y)				
	Like	Must-be	Neutral	Live-with	Dislike
Like	Q	A	A	A	O
Must-be	R	I	I	I	M
Neutral	R	I	I	I	M
Live-with	R	I	I	I	M
Dislike	R	R	R	R	Q

3. Results

Based on above consideration, a simulation system is developed using MS Excel™. Due to space limitation the system is not shown here. To use the system, the user needs to input the probabilities of Like, Must-be, Neutral, Live-with, and Dislike for both functional and dysfunctional parts. The system uses Monte Carlo simulation of discrete events [3] and provides the probability of Kano evaluation. The user can define how many times he/she wants to run the simulation. For example, consider the case of Must-be attribute, as shown in Fig. 2. For this case, a most-likely probability distribution of functional/dysfunctional answers is shown in Fig. 4.

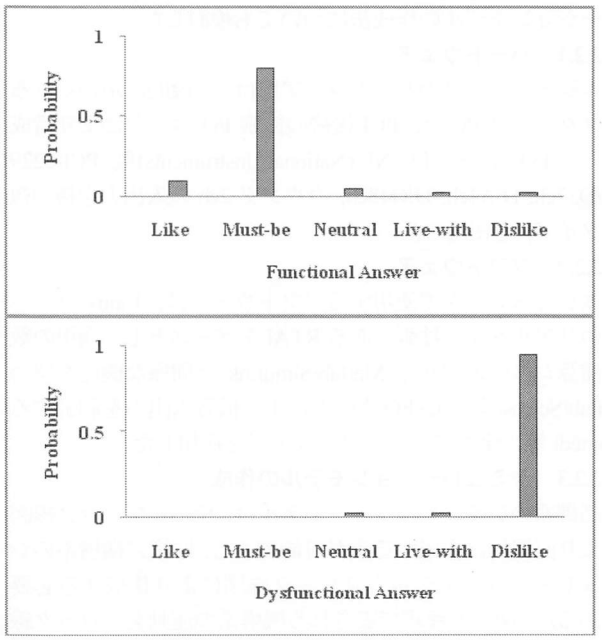
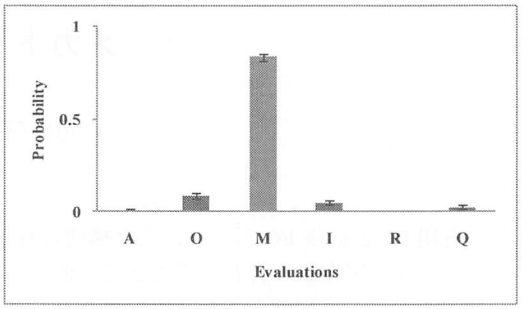
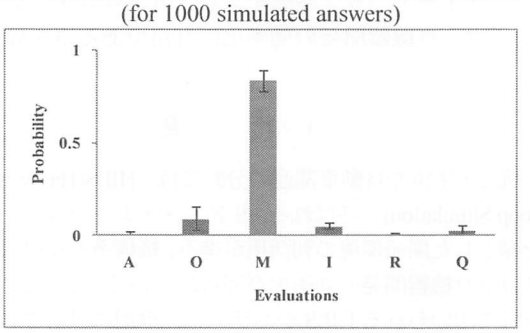


Figure 4. Probabilities of functional and dysfunctional answers.

Based on these probabilities the simulation system has been used to simulate functional and dysfunctional answers independently and to identify the corresponding Kano evaluation. The probabilities of Kano evaluations of the simulated answers are observed. The results of 1000 and 100 simulations are shown in Fig. 5.



(for 1000 simulated answers)



(for 100 simulated answers)

Figure 5. Variation in the simulated evaluation.

The above results imply that if someone relies on answers from 100 respondents and get relative frequencies of functional and dysfunctional answers similar to those shown in Fig. 4, he/she can definitely say that the underlying attribute is a Must-be attribute. This also implies that one can use the survey of 100 respondents to prove clearly whether or not an attribute is Must-be or something else. Further study will be carried out to determine the threshold number of respondents for such attributes as Attractive, One-dimensional, Indifferent, and Reverse.

4. Concluding Remarks

A simulation system has been developed to simulate Kano-model-based customer answers and evaluation. Using this system a product development team can identify beforehand how many customers that should ask to determine whether or not a product attribute is Attractive, Must-be, One-dimensional, Indifferent, or Reverse.

References

(1) K. Fujita and T. Matsuo, Survey and analysis of utilization of tools and methods in product development, *Trans Japan Soc Mech Eng Ser C* 72(713) (2006), 290–297 (in Japanese).

(2) N. Kano, N. Seraku, F. Takahashi, and S. Tsuji, Attractive quality and must-be quality, *Hinshitsu* 14(2) (1984), 39–48 (in Japanese).

(3) A.M.M.S. Ullah and J. Tamaki, Analysis of Kano-Model-Based Customer Needs for Product Development, *Systems Engineering*, (in print).