Proposal of a Measuring Method of Customer's Attention and Satisfaction on Services

Yohei Yoshimitsu[1], Koji Kimita[2], Tatsunori Hara[1], Yoshiki Shimomura[2], Tamio Arai[1]
[1] Dept. of Precision Engineering, School of Engineering, University of Tokyo, Tokyo, Japan
[2] Dept. of System Design, Tokyo Metropolitan University, Tokyo, Japan

Abstract

Now a day, with the emerging growth of the service industry, manufacturing companies are convinced that their products must be strengthened with service. Thus, we have developed a new discipline called Service Engineering that aims to produce a novel method to design service from an engineering viewpoint. In this paper, the authors propose an evaluation model that enables service designers to measure receivers' satisfaction. The authors proposed the "Satisfaction – Attribute Value Function" as an evaluation model that suits man's behavior. Applying to an example, the result of our method had richer information than the result of conjoint analysis.

Keywords:
Customer Satisfaction, Value Engineering, Service Evaluation, Service Engineering

1 INTRODUCTION

The life cycle periods of products are shortened in recent years, and service is paid attention as a way to achieve high additional value. Design process of services needs to include an evaluation that allows the designer to know how the service is rated by customers. In conventional engineering, manufacturing products are evaluated by functions they have. As services are artifacts as same as products, the same method as for manufacturing products is considered applicable to service design. From the same point of view, we assume that the customer evaluates properties of its functions and feels satisfied. However, service is likely to be evaluated more subjectively. Therefore, we need a new model that represents man's subjective behavior. This paper aims at proposing an evaluation method for service designers that makes this degree of satisfaction to be measured as quantitative value. This quantitative value of customer satisfaction enables the designer to know, for example, how much the price can be increased after modified the service, or clear up which functions are needed for each marketing segment.

In second chapter of this paper, models and concepts proposed in Service Engineering [1] that our proposal is based on are introduced. In third section, we introduce two current evaluation frameworks: Kano Model from Engineering and Prospect Theory from Behavioral Economics. In forth and fifth chapter, we propose a new evaluation method combining these methods. In sixth chapter, an application of the method is shown, and we make a comparison with conjoint analysis. Conclusions are argued in seventh chapter.

2 SERVICE ENGINEERING

2.1 Definition of service

Service is generally perceived as an activity that changes the state of a service receiver [1]. Figure 1 defines service; a service receiver receives service contents from a service provider through a service channel in order to change own states by the contents. This state of a service receiver is called RSP (Receiver State Parameter).In this definition, a service receiver is satisfied by only means of how much the receiver's states are changed preferably.

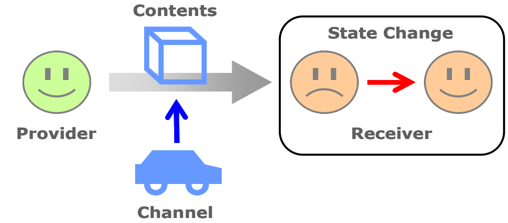

Figure 1. Definition of Service

2.2 View model

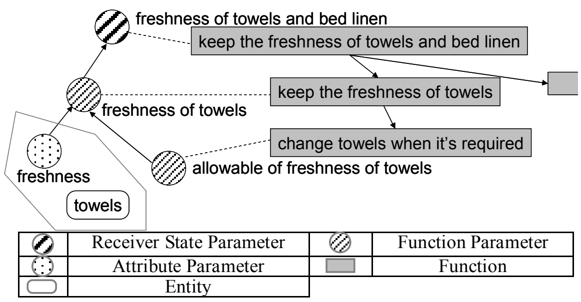

Figure 2. View Model

As Figure 2 shows, a model written in the form of network diagrams is called View Model [1]. The top node, a hatched circle, indicates RSP. A square represents a function that influences a parameter connected with a dotted line. Each node represents either function or attributes of a service. The nodes surrounded by the solid line at the left bottom illustrate the realization structure.

A Function Parameter (FP), influencing directly to the RSP, is called Contents Parameter (CoP) and FP influencing indirectly through CoP is called Channel Parameter (ChP). Each substantial artifact, constructing a service, is defined as entity, of which attributes are defined as attribute parameters (APs).

2.3 Existing Evaluation Method

To design service effectively and more value-added, designers needs a method to compare multiple services. We proposed Analytic Hierarchy Process (AHP) [2] based importance analysis method of RSPs, a QFD [3] (Quality Function Deployment) based importance analysis method of CoPs, and an influence analysis between a RSP and FPs using Dematel [4] method [5]. These methods enabled service designers to know which part of service should be paid attention and made them easier to improve services. However, these methods cannot make the designer know how much upgraded service is improved. For this purpose, we need a method that evaluates services totally using the viewpoint of service receivers.

3 SATISFACTION MODELS IN OTHER FIELDS

Some studies have dealt with customer satisfactions. Karl Albrecht categorized relationships between customer's expectation and provided products into four levels [6]. Bernd H. Schmitt advocated the concept of experimental marketing and categorized customer experiences into SENSE, FEEL, THINK, ACT, and RELATE [7]. In this chapter, two models on customer satisfaction used in our model is introduced.

3.1 Kano Model

A customer satisfaction model was proposed for quality management by Kano [8]. This model categorizes quality attributes into five kinds of elements according to customer satisfaction: attractive quality element, one-dimensional one, must-be one, indifferent one, and reverse one. Figure 3 illustrates the first three quality elements out of the five. Horizontal axis indicates the state of physical fulfillment on a parameter. Attractive quality elements influence little to customer satisfaction, even if they are not fulfilled physically. This is because the elements are strongly expected. On the other hand, must-be quality elements are recognized as matters of course, and thus makes great dissatisfaction once they are little fulfilled.

Figure 3. Customer Satisfaction Model by Kano

3.2 Prospect Theory

Prospect theory was developed by Kahneman and Tversky [9], which was originally proposed as a criticism of expected utility model in economics. It describes how individuals evaluate losses and gains based on empirical evidence. It consists of two theories: value function and weighting function. The former describes the relationship of value to gains and losses as illustrated in Figure 4. Its horizontal axis shows gains and losses in the form of absolute values such as an interest of investment or a reward of lottery. The origin indicates the prospect of the individual, which is called a reference point. Its asymmetry implies that losses give a stronger impact than gains. This feature is called loss aversion. Note that the curve in Figure 4 turns saturated when the losses or the gains become farther from the reference point.

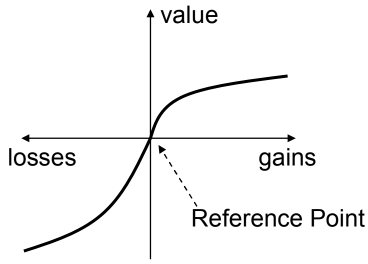

Figure 4. Value Function of Prospect Theory

The weighting function represents that individuals behave according to a psychologically biased probability rather than its theoretical probability. Individuals often misunderstand the occurrence probabilities of phenomena, i.e., an individual expects the preferable phenomenon in higher probability than in its actual one when the probability is very low.

4 CUSTOMER SATISFACTION EVALUATION

In this chapter, we propose a new evaluation method for customer's satisfaction. First, we define function called Satisfaction-Attribute Value function. This enables the designer to calculate satisfaction of the receiver. Second, we propose an evaluation flow that uses the S-AV function.

4.1 Satisfaction - Attribute Value Functions

We propose the "Satisfaction - Attribute Value (S-AV) function" in this section. The definition of the S-AV function (S_r) is a bunch of mappings between satisfaction (S_{FP}) of a receiver for an RSP and FP values of a service (Equation 1). Here, satisfaction is expressed as a real number from -1 to 1. The designer can estimate satisfaction of the receiver for an RSP by using the S-AV function according to the value of FP.

$$S_{FP} = S_r(FPValue) \quad (1)$$

We defined the word satisfaction as change of an RSP according to the definition of service. The designer hardly knows the change of the RSP, which is an internal state of a receiver. However, the designer can estimate the change of the RSP from changes of FPs, because the RSP is influenced by FPs. The value of FP is expressed in the form of attribute value that is quantitative and visible by the designer. That is, the designer can estimate how the satisfaction changes by changes of FPs by using the S-AV function. A set of questionnaires to the receivers is used to decide the S-AV function. Details are described in Chapter 5.

4.2 Experimental Appraisal Importance and Attention Importance

The satisfaction for the service is given by the weighted sum of satisfaction for each RSP. We assume that the weight is determined by two classes of importance, “experimental appraisal importance” and “attention importance”. The former is accumulated through repeat receptions of a service and inversely proportional to the satisfaction. The latter is used when the receiver evaluates after receiving the service. This importance is proportional to the level of satisfaction (or dissatisfaction). We introduce attention importance to decide weight of a FP for following evaluation steps.

4.3 Evaluation Steps

[Step 1] Describe Service in View Model

In first step, the designer has to describe supposed service in view model. Above all, the designer should decide a persona of the receiver. Persona is a virtual character of the receiver. Therefore, to decide the persona is just as same as to decide target customer in marketing process. Describing the service in the view model, the designer can decide RSPs that the receiver has and relationships between FPs and affected RSPs.

[Step 2] Decide Weight for each FP

Although a view model has a network structure of FPs, each FP does not influence equally on the RSP. Therefore, to decide which FPs are more influential, the designer allocates weights to each FP. This step is done by the existing evaluation method using QFD and Dematel.

[Step 3] Find S-AV Function for each FP

In third step, setting S-AV functions on each FP, the designer can define relationships between satisfaction about the RSP and each FP value. Namely, each FP has just one S-AV function. S-AV functions should be set on FPs placed at the end of the network structure. Instead of setting S-AV functions on these FPs, the designer can set on FPs that is affected by a few of these FPs. In this case, the designer needless to set S-AV functions on FPs that are affected only by those already have S-AV functions.

[Step 4] Set Attribute Parameter Values

In this step, the designer configures supposed attribute value on FPs have S-AV functions. By setting attribute values, he/she becomes to be able to know supposed degree of satisfaction given by each FP.

[Step 5] Calculate Receiver Satisfaction

Finally, the designer can calculate receiver’s satisfaction for the whole service. Satisfactions about each RSP are given by following Equation 2. This equation means satisfaction about RSP is given by weighted sum of S-AV functions. Here, w_{FP} is weight value obtained in Step 2.

$$S_{RSP} = \sum w_{FP} S_{FP} \tag{2}$$

Satisfaction for the whole service is also calculated by the weighted sum of satisfactions for RSPs, given by Equation 3. w_{RSP} is the weight value given by the existing evaluation method for allocating weight of each RSP using AHP.

$$S = \sum w_{RSP} S_{RSP} \tag{3}$$

This satisfaction about the whole service is given as a real number from -1 to 1 as same as return value of S-AV function.

5 FINDING S-AV FUNCTION

In this chapter, we argue a concrete method to find S-AV function defined and used in the previous chapter.

5.1 Characteristics of the S-AV function

S-AV function is one of so-called perceptions-minus-expectations models [11]. The basic ideas of these models are that the receiver evaluates difference between the service expected and the service actually received. SERVQUAL [10], which is one of the famous evaluation methods for service, is perception-minus-expectations model, too. Moreover, our S-AV function has following characteristics from the prospect theory.

Reference Point

Satisfaction is decided by difference between a service that the receiver expected and an actual service. Moreover, the expectation strongly depends on receiver’s knowledge, experience and other personal factors. Therefore, we match the reference point to the personal differences in S-AV function. Using the concept of the reference point, S-AV functions are represented by a combination of two functions connecting at an attribute value that the receiver expects. They are called gain side function and loss side function respectively. Generally, the receiver’s expectation has two levels: desired and adequate [11]. The reference point indicates an adequate level rather than a desired level. The range from the adequate level to the desired level is called zone of tolerance. This means attribute values, which are inferior to the adequate level, lead the receiver to dissatisfaction. On the other hand, attribute values exceed the adequate level satisfies the receiver.

Loss Aversion

According to an experiment of the prospect theory, the receiver would judge it as “loss” and behave to averse loss, if an quality element of the service was worse than expected. Therefore, the loss aversion feature in the prospect theory is applicable to S-AV function. However, this hypothesis involves a contradiction with the kano model, because loss at attractive quality does not cause dissatisfaction according to the kano model. This contradiction is caused by difference of viewpoint. The value function in the prospect theory discusses the whole value of a service. On the other hand, the kano model argues a part of a service. Accordingly, some parts of the service could be ignored, even if actual qualities were worse than expected. S-AV function has the same viewpoint as the kano model. Hence, we introduce loss aversion feature only if the FP is categorized as One-Dimensional function. This means S-AV function has a constraint expressed as Equation 4.

$$|S_r(a+b)| < |S_r(-a+b)| \tag{4}$$

(a is margin from the reference point,
b is attribute value on the reference point)

Decrease of Response

Satisfaction for a service generally converges if a functional performance was improved to some extent. This trait is caused by the same psychological reason as the decrease of response to value by increasing gains or losses. Therefore, the decrease of response feature also can be applied. That is, the shape of S-AV function has a constraint expressed as Equation 5 and 6.

If AV is better than the reference point, then

$$\frac{d^2 S_r}{d(AV)^2} < 0 \quad (5)$$

If AV is worse than the reference point, then

$$\frac{d^2 S_r}{d(AV)^2} > 0 \quad (6)$$

5.2 Classification of the S-AV function

Applying Prospect Theory, S-AV function obtained three constraints for its shape. Moreover, classifications of quality elements proposed by Kano model suggest further constraint to decide the shape of the S-AV functio. Hence, we introduce Kano's three quality elements to classifications of FPs as the following.

Attractive Function

If the FP is an attractive function, a decline in the functional performance will not be effect on the satisfaction of the whole service. Therefore, S-AV function on the FP has a constraint expressed as Equation 7.

If AV is worse than the reference point, then

$$S_r(AV) = 0 \quad (7)$$

One-Dimensional Function

The FP categorized as an one-dimensional function has no additional constraint except Loss Aversion mentioned before.

Must-Be Function

Likely as attractive function, if the FP is a must-be function, a functional performance exceeding receiver's expectation will not contribute to the satisfaction for the whole service. Therefore, the S-AV function on the FP has a constraint expressed as Equation 8.

If AV is better than the reference point, then

$$S_r(AV) = 0 \quad (8)$$

Consider these constraints enumerated thus far, the shape of S-AV functions are to be constructed as Figure 5.

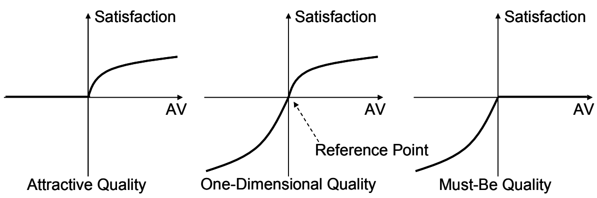

Figure 5. Shapes of S–AV Functions

5.3 Deciding the S-AV function

To calculate numerical satisfaction, a concrete numerical equation needs to be decided. However, how precise the numerical parameters of the equation are less important, because the shape of function has larger decisive magnitude for satisfaction value itself. Accordingly, the shape of the function has to be decided carefully through the result of market survey and user test on target segment.

In this section, we propose a simple method to decide approximate S-AV function in the form of numerical equation needed to calculate a numerical satisfaction value. Here, we represent each side of the S-AV function using an exponential function expressed by Equation 9.

$$S_r = a\left(1 - e^{-\frac{b}{a}(v-c)}\right) \quad (9)$$

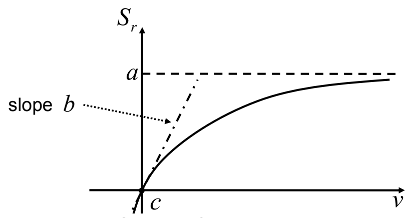

Figure 6. Shape of Approximate Function

In the equation, parameter ***a*** means the converged maximum satisfaction, parameter ***b*** means the slope at the reference point, and parameter ***c*** means the attribute value at the reference point. Variable *v* is an input value of this function that means attribute values. Figure 6 shows the shape of this function.

We selected this approximate function in the point of easiness to set the parameter values and capability in satisfying the constraints by the shape. An S-AV function is constructed with two exponential functions that have different parameter values. If the FP is categorized as an attractive or a must-be function, it should be set under the rule of Equation 7 or 8 respectively.

In the following part of this chapter, let us discuss the simplified method to decide an S-AV function using these exponential functions individually by categories of FP.

Attractive Quality Function

The designer has to determine two sides of functions. A function for attribute values exceeding the reference point is called gain side. Another function, which is inferior to the reference point, is called loss side. If the FP is categorized as an attractive function, only the gain side function needs to be decided, because the satisfaction value of the loss side function is always zero (Equation 7).

To keep consistency with one-dimensional quality element argued below, assume that an attractive function can provide 0.5 as the satisfaction value at the maximum. Generally, an attractive function is the receiver's need that is not yet generally recognized, so that we decided maximum satisfaction provided by the best attribute value available in the market as 0.4, leaving buffer to further satisfaction. Thus, the designer can decide parameters of Equation 9 by setting parameter ***c*** to receiver expected attribute value, parameter ***a*** to 0.5 and parameter *b* to satisfy maximum attribute value in the market.

One-Dimensional Function

If the FP is categorized as one-dimensional function, the designer start with the side that has the range of attribute value available in the market is wider. The function of this side is decided as the same method as attractive quality. Except the point if this side is the loss side, the minimum satisfaction value at the worst attribute value is decided as -0.8. According to the loss aversion feature in the prospect theory, the absolute satisfaction value in the loss side is twice as large as one in the gain side. It is empirically known that the magnitude of dissatisfaction by losses is 2 to 2.5 as much as it of satisfaction by gains [9].

Secondary, the designer work on with the other side. As same as the first side, the designer set a pair of an attribute value and a satisfaction value. In this side, we use the attribute value that its distance from the reference point is as much as the maximum / minimum attribute value in the market used in previous step. The satisfaction value at this attribute value is decided under the same rule as previous step, would be 0.4 or -0.8.Thus, the combination of these two functions constructs the S-AV function.

Must-Be Function

Strategy to decide S-AV function for a FP of must-be function is the same as above two kinds. Namely, decide satisfaction value at the minimum attribute value in the market to -0.8. The gain side function is expressed as Equation 8.

By using above methods, the designer becomes to be able to decide S-AV function as the concrete numerical equation.

6 APPLICATION TO AN EXAMPLE

6.1 Door-to-door parcel delivery service

To verify the proposed method, we performed an experiment settled on door-to-door parcel delivery services. We conducted a survey and described the service on the view models. We focused on redelivery part of the service and listed four RSPs: “flexibility of redelivery”, “in advance notification of parcel arrival”, “deliver parcel in safety” and “accept changes of address or time for delivery flexibly.” Related FPs for each RSP are listed as shown in Table 1.

Table 1. List of RSPs and FPs (partial)

RSP	FP
Flexibility of redelivery	(a) earliest redelivery hour
	(b) latest redelivery hour
	(c) Max. days to keep parcel (in the center)
	(d) Fastest redelivery time from order

6.2 Method

We decided the S-AV function by using a questionnaire about one of the RSPs "flexibility of redelivery.” Respondents are person living alone or whose family going out on daytime (n=8). We prepared questions for each FP as shown in Table 2 based on a method that Ernzer had improved [12] the original Kano method [8]. Additionally, we conducted conjoint analysis to the respondents in order to make a comparison with our method. For conjoint analysis, we prepared four services that have different attributes, is shown in Table 3. The respondents were asked to order the Service A-D. Also, AHP [2] analysis was conducted to find out importance of FPs.

Table 2. Questions about (A) expectation and (B) kano class

1. earliest redelivery hour	
(A) Which do you think is the nearest quality you expect?	1. before 6 AM 2. 6 AM 3. 7 AM 4. 8 AM 5. 9 AM 6. 10 AM 7. after 10 AM
(B) What do you feel if actual quality would be different from your expectation?	1. An earlier option must be available 2. An earlier option is preferable 3. It’s all well and good 4. I wouldn't mind

Table 3. Profiles for conjoint analysis

Attribute \ Service	A	B	C	D
(a) Earliest redelivery hour	6 AM	6 AM	9 AM	9 AM
(b) Latest redelivery hour	7 PM	11PM	7 PM	1 AM
(c) Max. days to keep parcel	5 days	9 days	11 days	5 days
(d) Fastest redelivery time from order	30 m	6 h	6 h	2 h

6.3 Result

Table 4 shows the questionnaire result. Each data in the table is the mode value of effective answers.

Table 4. Classifications of FPs and Expectations for FPs

Result \ FP	Earliest redelivery hour	Latest redelivery hour	Max. days to keep parcel	Fastest redelivery time from order
Class	A[1]	O[2]	O	O
Expectation	8 AM	10 PM	11 days+[3]	1h 10m
Conjoint imp.	24.12%	20.15%	14.10%	41.63%
AHP imp.	0.096	0.26	0.23	0.41

1. Attractive function 2. One-Dimensional function
3. Longer than 11 days

Table 5. Result of S-AV function evaluation

	Service A	Service B	Service C	Service D
S_r (a)	0.40	0.40	0	0
S_r (b)	-0.99	0.45	-0.99	0.50
S_r (c)	-0.058	-1.00	-1.00	-0.058
S_r (d)	0.30	-0.26	-0.67	-0.68
Satisfaction for RSP[1]	-0.19	-0.18	-0.58	0.016
S-AV rank[2]	3	2	4	1
Conjoint rank	3	2	4	1

1. Weighted sum of S_r using AHP importance in table 4
2. Sorted by satisfaction for RSP

Moreover, S-AV functions were described based on expectation in Table 4 (Figure 7). Horizontal axises show attribute value, and vertical axises show satisfaction. Each shape of S-AV functions was decided by question B in table 2. The range of attribute value was decided by an actual service. Although the earliest redelivery hour of the actual service was 8 AM, we used 6 AM as the best realistic attribute value. Latest redelivery hour of an actual service is 9 PM. Therefore, the range was assumed 9 AM – 11 AM. Maximum days to keep parcel of the actual service are 90 days.

Table 5 shows the result of evaluation using S-AV functions in Figure 7. In this evaluation process, we used AHP method to decide importance of FP to preserve independence from conjoint analysis.

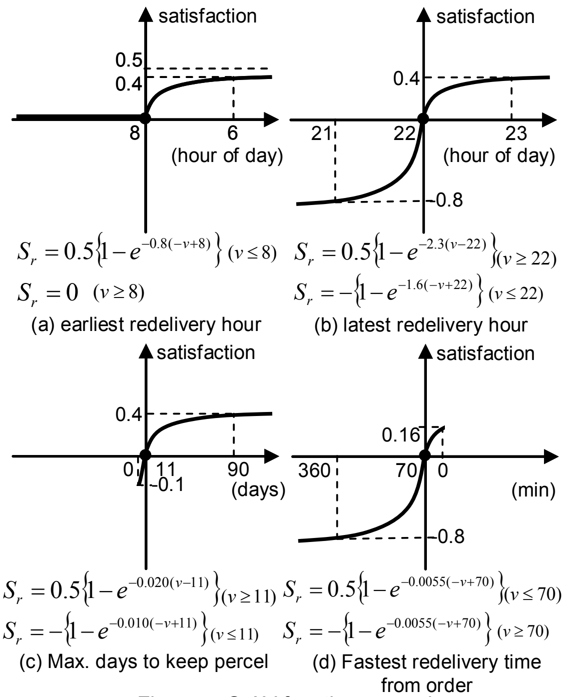

Figure 7. S-AV function examples

6.4 Discussions

Comparison with the conjoint analysis

The S-AV rank in table 5 was equal to the result of the conjoint analysis. Moreover, our method is superior to the conjoint analysis in three points:

- Free from limitations of the conjoint analysis: number of profile and number of attribute.
- Shows not only rank but also degree of satisfaction
- Less dependent on questionnaires, because S-AV functions can be reused.

Individual differences in questionnaire result

In this example, we used the mode value to extract the represented value. However, the variance of each question was different: the variance of expectation of (c), (d) was larger than (a), (b). This information could be used to categorize respondents and make another persona. If another persona was made, the S-AV function in Figure 7 would be changed and the evaluation would result differently.

7 CONCLUSION

This paper proposed a model for service designers to calculate satisfaction of the service receiver. The designer assumes the receiver's satisfaction by his expectation for each function. Using the model, the designer calculates satisfaction from the concrete attribute values that represent properties of each function in actual service. By applying the method to an example, it was proved effective and possible to predict the changes of satisfaction quantitatively when the designer changes attribute values on some FPs. Moreover, the method enables the designer to know differences of each receiver clearer than conjoint analysis. This allows the designer to propose more efficient and value-added improvement policies. Future works include clarifying how the receiver changes importance for each RSP by receiving service repeatedly. Besides, we will introduce a concept of cost to the method and getting up to real service receiver.

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