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A customer value model for sustainable service design

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ABSTRACT

To reconsider the current mass production paradigm and to increase the added value of products, largely from knowledge and services, we have examined services from an engineering perspective. Service Engineering aims to provide services that provide a high degree of customer satisfaction. However, customer requirements for services are easily affected by the services that they receive. To ensure a successful relationship with customers, it is necessary to consider all of the changes in customer requirements at the design stage. To serve this need, this paper proposes a model for expressing changes in customer requirements from the viewpoint of service design.

1. Introduction

Environmental problems have become increasingly serious over the last couple of decades. To solve these problems, we need to reduce the volumes of artifacts that are produced and consumed to an adequate, manageable size, however without decreasing our current quality of life. Consequently, we must shift to a new paradigm that aims at qualitative satisfaction rather than quantitative sufficiency. In other words, economic growth should be decoupled from consumption of materials and energy [1].

To achieve this paradigm, products should have higher value, based primarily on knowledge and service content, rather than mere materialistic worth [2]. In this context, the concept of 'Product-Service Systems' (PSS) [3–5] has been attracting considerable attention, as it creates new value by coupling a product with a service.

Services create value without abandoning materials, and therefore can continuously create value throughout the entire life cycle of a product. Consequently, the use of PSSs can be an approach for dematerializing products without losing value [6,7]. In this dematerialization by services, the level of customer satisfaction generated toward a service plays an important role in compensating for the compromise in materialistic value of the products. For example, in the literature of environmentally conscious design, it has been pointed out that environmentally conscious products need to decrease environmental impacts in consideration of customer demands [8–10].

At this point in time, only a few studies have focused on the design of these types of services [11–13]. Consequently, very few methodologies exist for the support of service design from the customer satisfaction perspective (e.g., [14,15]). For this reason, we have initiated a fundamental Service Engineering research study that is designed to examine services from an engineering viewpoint.

Service Engineering has been investigated previously by several research groups [16–18]. We also have previously proposed concrete engineering methodologies for the design and evaluation of services [10,19] and have developed a computer-aided modeling tool called 'Service Explorer' [19]. In Service Engineering, a method is proposed to design and evaluate services from a customer's viewpoint [32]. In this method, in the same manner as methods used in product design (e.g., [20,21]), customer weighting of requirements for a service is quantified in terms of the customer importance attached to the functions of the service. Therefore, it is useful for service designers to evaluate the design solution accordingly, and to determine the concrete points to be investigated. However, customer weighting of requirements is easily affected by the quality of service that they have already received. In order to provide a service that continuously satisfies customer requirements, service designers should take into account the immediate desires of their customers, as well as the needs that arise as a result of the service they provide.

On the marketing side, on the other hand, several theoretical frameworks have been advanced to ascertain the changes in customer requirements that have developed across the services received [22–30]. For the purpose of marketing, these frameworks

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treat abstract concepts such as satisfaction of a service, expectation of a service, and quality of a service. For an engineering design, however, it is necessary to approach a service from the perspective of concrete service components such as its functional and quality elements.

This paper applies the methods proposed from the marketing perspective to service components from the engineering design perspective. On this basis, we then propose a model for expressing the changes in customer weighting of criteria, brought about by the quality of service that the customer has received. The proposed method is verified through its application to a practical case.

2. Modeling method for service

2.1. Overview

Service is defined as an activity between a service provider and a service receiver that results in a change in the state of the receiver [19]. According to the definition, a receiver is satisfied when his/her state changes to a new, desired state. For the purpose of Service Engineering (SE), the design of services must be based on the state change of a receiver. Therefore, it is necessary to find a method of expressing these state changes.

States of the service receivers are represented as a set of parameters called receiver state parameters (RSPs), which represent customer value in SE [19]. All RSPs are assumed to be observable and controllable. RSPs are changed by 'service contents' and 'service channels,' as shown in Fig. 1. Service contents are materials, energy, or information that directly change the receiver's state. Service channels transfer, amplify, and control service contents and indirectly influence the state change of a service receiver.

The parameters expressing service contents are called content parameters (CoPs). In the same context, the parameters of a channel that affect the content parameters, and indirectly influence RSPs, are called channel parameters (ChPs). In this study, the state change of a service receiver and a service are expressed as the combination of all of these parameters: RSPs, CoPs and ChPs.

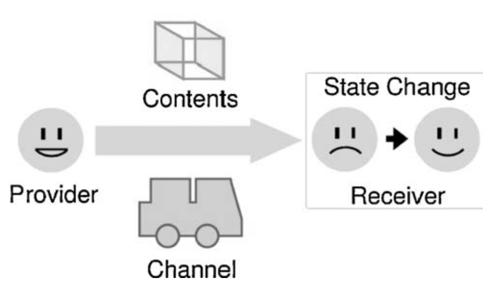

Fig. 1. Definition of service.

2.2. Service design process

Fig. 2 illustrates the service design process, introducing the customer's viewpoint. The remainder of this section describes the service design process in detail.

2.2.1. Step 1: Extraction of the RSPs of a service customer

For the extraction of the RSPs of a service customer, a persona is described as the first step. The persona is a tool that provides a simplified description of the customer and works as a compass in the design process [31]. According to this persona, a scenario is subsequently developed that clarifies the context in which the service is received. The scenario is described in the form of a state transition graph, since the purpose of receiving a service is to change the receiver's state into a more desirable one. The receiver's state is represented as a set of parameters called state parameters (SPs). These represent the internal/external state of a receiver and have a causal relationship. From the SPs, the RSPs, which correspond to target parameters in the service design, are extracted. Any SP can be defined as an RSP; however, for a meaningful design to be realized, RSPs must be observable and related to the concrete requirements of a service customer. The adequate representation of a service customer's requirements using RSPs is one of the most important steps in this service design process.

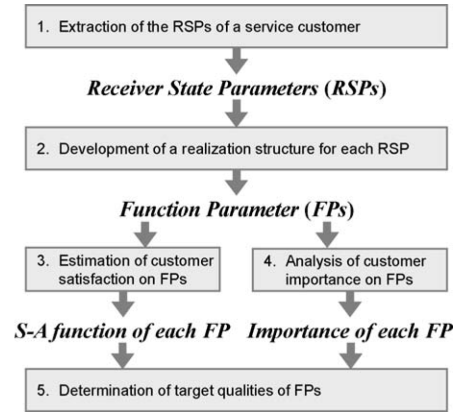

Fig. 2. Service design process introducing the customer's viewpoint.

2.2.2. Step 2: Development of a realization structure for each RSP

In this step, the service designers determine a realization structure for each RSP. A view model is proposed to represent the realization structure for changing an RSP.

A view model is described in terms of the functional relationships among RSPs, CoPs, and ChPs. In SE, it is assumed that service contents and service channels are comprised of various functions. These functions are then expressed by function names (FNs) as lexical expressions and by function parameters (FPs) as target parameters of the functions. Thus, the FPs that are directly related to RSPs are identified as CoPs, while those indirectly influencing RSPs are ChPs.

The realization structure comprised of CoPs and ChPs is also associated with artifacts that actualize the functions in the view model. Artifacts in the view model represent not only physical products but also facilities, employees, and information systems.

As shown in Fig. 3, the view model works as a bridge from an RSP to artifacts. Thus, it allows service designers to clarify the roles of the artifacts in consideration of the RSP.

2.2.3. Step 3: Estimation of customer satisfaction with FPs

To estimate satisfaction for FPs, we adopt a nonlinear function in SE, called an S–A (Satisfaction–Attribute) function [32]. An S–A function is described as a logistic curve, since customer satisfaction changes little when the perceived quality exceeds/falls below a certain value.

The S–A function (S_r) is a value function that quantifies customer satisfaction with an FP (S_{FP}) by the quality of that FP. The designers determine an S–A function for each FP that is directly related to an RSP. The input value of the S–A function is the quality of an FP proposed by the designers, and the output is customer satisfaction with the affected RSP.

In the S–A function, customer expectations are used as a comparison standard in the estimation. In the service marketing literature, it is accepted that the difference in quality from that expected is perceived as the satisfaction [22,26,33–35]. The estimation regards that the customer is to be satisfied with a