

SERVICE ELEMENT LEVEL CUSTOMIZATION FOR PRODUCT-SERVICE SYSTEMS USING CONTEXT- BASED ACTIVITY MODELING

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ABSTRACT

Product-Service Systems (PSS) can offer diverse values for customers in service-dominant manners to suit for various needs and wants of customers. A typical PSS would be composed of many service units, which are then comprised with several service elements in each unit. Each service element takes a service function and multiple activities of relevant stakeholders. Product elements are to be designed for each service element so that activities of relevant stakeholders are properly supported by affordance features of the product elements. Inclusion of a certain service unit in PSS or not would be related with business model level variation of PSS concepts. Once service units of a PSS are fixed, variations of PSS concepts can be made at the level of service elements. We propose a PSS customization method that the context elements of activities facilitate effective customization at service element level. An example of service element level customization is illustrated with the PSS case of Make-up Room Service where some make-up service elements and associated product elements are tailored to a few different contexts reflecting customer needs.

Keywords: product-service systems, service design, customization, contexts, experience design

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1 INTRODUCTION

As market competition intensifies and technological differentiation becomes more difficult, a megatrend of industry has been changed considerably from Technology-Driven to User-Driven. With the increased attention of user-centeredness, Product-Service Systems (PSS), which provides integrated solutions of products and services, have recently been of central interest to address diverse values of consumers and to pursue more profits. With diversification and flexibility of products and services, it has been raised a necessity of customizing products and services to fit personalized individual requirements. Therefore, research efforts are needed to explore effective ways to achieve customization of PSSs.

In mass customization research, Simpson et al. (2001) proposed the product platform concept exploration method, which is a formal method that facilitates the synthesis and exploration of a common product platform concept that can be scaled into an appropriate family of products. An effort for product customization has been introduced by Suh et al. (2007) who introduced a platform design process in response to such as future uncertainty and showed how to systematically pinpoint and value flexible elements in platforms. They addressed that it allows increased product family profit even with uncertain variant demand, and specification changes. In line with this, Kang and Hong (2009) suggested the concept of versatility that is distinctive from flexibility, and developed a platform that is versatile for highly effective differentiation to incorporate the preferences of customers. On the other hand, an effort has been made toward designing services for mass customization (Moon et al., 2011).

PSS was defined as a marketable set of products and services, jointly capable of fulfilling a user's need by Goedkoop et al. (1999) who originally defined PSS. It is also defined as a system of products, services, supporting networks and infrastructure satisfying customer needs and having a lower environmental impact than traditional business models and an integrated body of products and services and communication strategies that was conceived, developed and promoted by (a network of) actors to generate values for society (Mont, 2002, Mont, 2004 and van Halen et al., 2005).

PSS is composed of products and services that are closely related to each other. In the process of designing a PSS from a product, the product is divided into product components or technical aspects. Some of the existing product components are selected with consideration of new values. New product components, some of which could be out-sourced, can be added. Also new services, some of which are co-created services by service receivers and some are provided by service providers, can be designed and connected with product components in to provide news values.

The service part of a PSS is composed of *service units*, which are then comprised with several *service elements* in each unit. Note that a service element can be defined by identifying activities of service receivers and providers for a corresponding sub-function of the PSS (Kim et al 2011). For effective designing and handling of PSSs, several service elements are grouped into a high-level entity of a service unit. For example, to address different business model alternatives, a service unit could be included or excluded (Kim et al 2012a). Note that a service element can be included in more than one service unit (Wu 2011). Context-based activity modeling provides underlying utility in PSS representation (Kim & Lee 2011).

This paper introduces a PSS customization method that the context elements of activities facilitate effective customization at service element level. An example of service element level customization is illustrated with the PSS case of Make-up Room Service where make-up services and associated product elements are tailored to a few different customer needs. Before describing the proposed PSS customization method, context-based activity modeling that underlies the proposed customization method is reviewed and the example PSS case of Make-Up Room Service is presented.

2 CONTEXT-BASED ACTIVITY MODELING

Designing activities of various stakeholders that drive value proposition is a critical process in PSS design. Interactions between service providers and receivers are designed through association of their activities. Kim and Lee introduced the systematic method for designing activity which is described in detail using the context-based activity modeling method (Kim and Lee, 2011). Each activity is detailed using relevant elements of the activity as well as the context as shown in Figure 1. The core part of the activity description is the action verb and, the object is the object of the action. Thus, the activity is performed by the active actor, who is the subject stakeholder of the activity. The activity may have passive actor and/or third-party actor as well. Note that these stakeholders are modeled with their static

and dynamic properties, for example, preferences and emotional state respectively. Activity description is contextualized using the context elements; goal context, relevant structures, physical context, psychological context. The goal context addresses intent and reasons behind the activity. The relevant structures include structural entities of various PSSs related with the activity and physical context includes location, time, weather, lighting, sound etc. Psychological context includes affective and social context. The context-based activity modeling is a key enabler for effective customization.

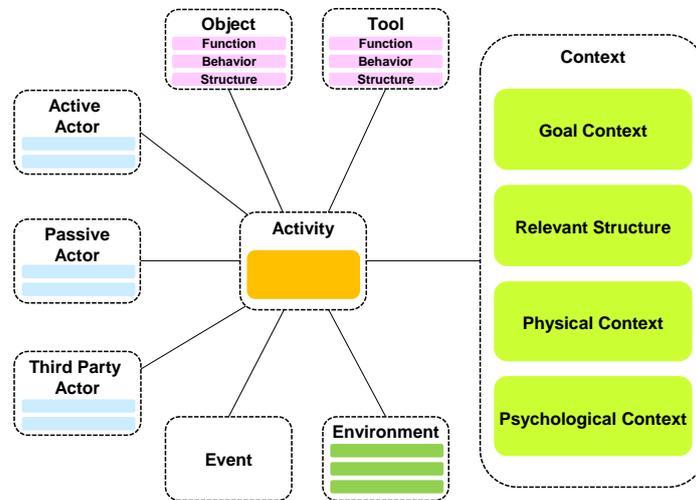


Figure 1. Context-Based Activity Modeling (Kim and Lee, 2011)

3 EXAMPLE: MAKE-UP ROOM SERVICE

Make-Up Room PSS has been designed to address the sudden need of a make-up, as in the case of unexpected party or business interview, and additionally make-up consulting and expert make-up services have been introduced in devising a proper business model. The overall scenario of make-up room service is illustrated in Figure 2. Once the customer enters (1), it offers a verification system for membership service (2) and allows the customer to do make-up herself by providing various kinds of cosmetics and tools (3). It also has the make-up consulting service (4), and provides expert make-up by serving professional (5). Additional payment (6) as applies and exit service (7) conclude the operation. These main services were defined as service units of make-up room service PSS. In next sections, the service element level customization method is presented using this Make-Up Room PSS.

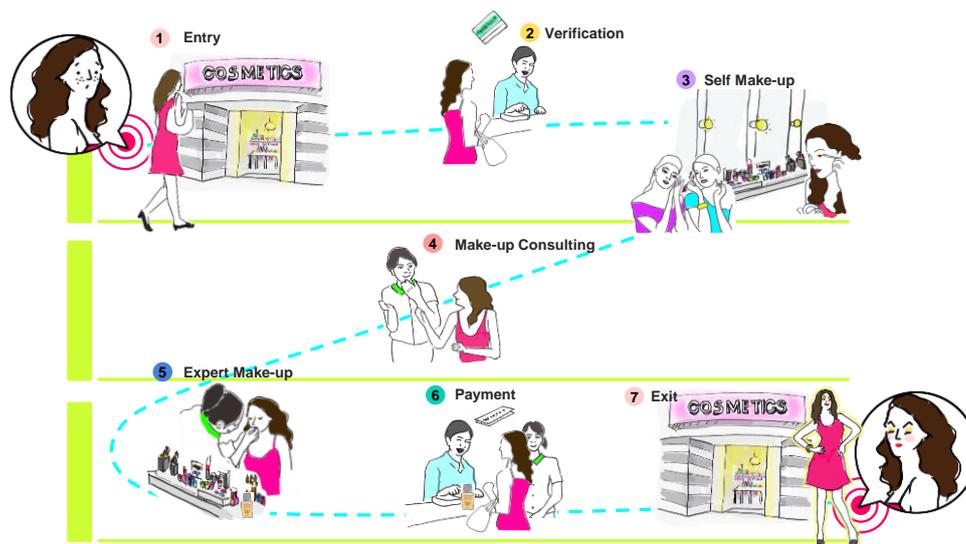


Figure 2. Scenario of Make-Up Room Service (Kim et al., 2012a)

4 SERVICE ELEMENT LEVEL CUSTOMIZATION

Different PSS concepts can be generated by including or removing service units based on business model designs. That is, inclusion of a certain service unit in PSS or not would be related with business model level variation of PSS concepts. Once service units of a PSS are fixed, variations of PSS concepts can be made at the level of service elements. For example, Make-Up Room PSS is composed of 7 service units as shown in Figure 3. The service unit of Expert Make-Up (SU5) is composed of 7 service elements; Ask for Expert Make-Up Service (SE5-1), Get Requirements (SE5-2), Provide a Seat (SE5-3), Get Expert Make-Up (SE5-4), Provide the Result of Expert Make-Up (SE5-5), Explain the Result (SE5-6) and Finish (SE5-7).

Each service element takes a service function and multiple activities of relevant stakeholders, and performs on a typical context. In Figure 3, when a typical context A is settled, the context specific Get Expert Make-Up service element SE5-4-A is devised. This element is called *independent* service element and indicated by a purple box. It means a customer would experience different service as specified by the context element. In Figure 3, three independent service elements SE5-4-A, SE5-4-B and SE5-4-C in the pink dotted square represent the variations of the Get Expert Make-Up service element specified by the context A, B and C respectively. Also Provide the Result service element have its variations specified with the context A, B and C in this example.

On the other hand, even when the context is changed, several service elements is not affected by the context. This kind of service element is called as *common* service element shown as a blue box in Figure 3. In other words, when context is changed, independent service elements will change to fit the context, while common service elements will be applied uniformly. These variations by reconstructing service elements facilitate the customization fulfilling the specific needs of different contexts.

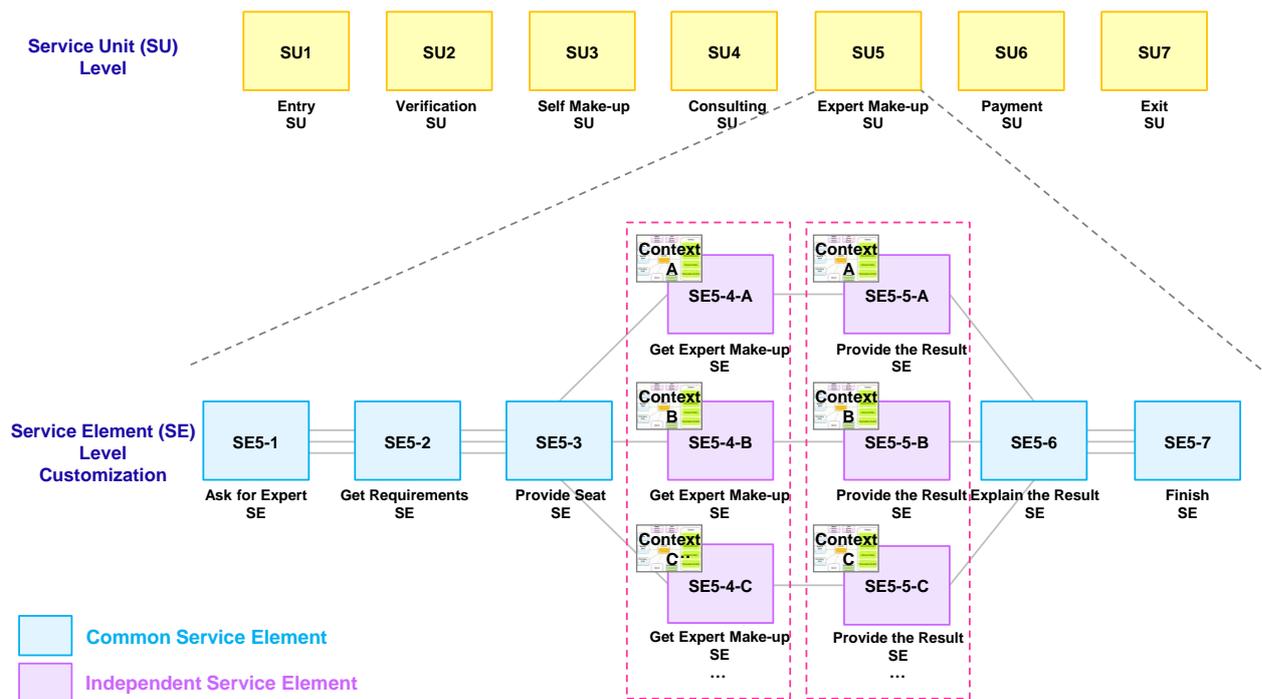


Figure 3. Schematic diagram of service element level customization for PSS

5 SERVICE ELEMENT, PRODUCT ELEMENT AND AFFORDANCE IN PSS REPRESENTATION

Designing PSSs involves designing of PSS functions as well as designing of activities of stakeholders. The service blueprint of the expert make-up service unit of make-up room service is shown in Figure 4-(a). The activities and the functions are combined by associating activities for each function (Kim et al., 2011). In Figure 4-(b), activities of Get Expert Make-Up service element and those of Provide the Result of Expert Make-Up service element of Figure 4-(a) are shown in detailed service blueprint. Get Expert Make-Up service element typically would be composed for 4 sub-steps of Skin-care, Base, Eye and Lip make-up as depicted. A Service receiver will have 4 difference activities and a service

provider will have 12 different activities reflecting those 4 basic steps. As these activities are linked to the function of Provide Expert Make-Up so that all these low level activities are belonging to Get Expert Make-Up service element. Likewise, Provide the Result of Expert Make-Up service element is decomposed as 2 activities of a service receiver and 4 activities of a service provider, and all these activities are linked to the function of Show Result.

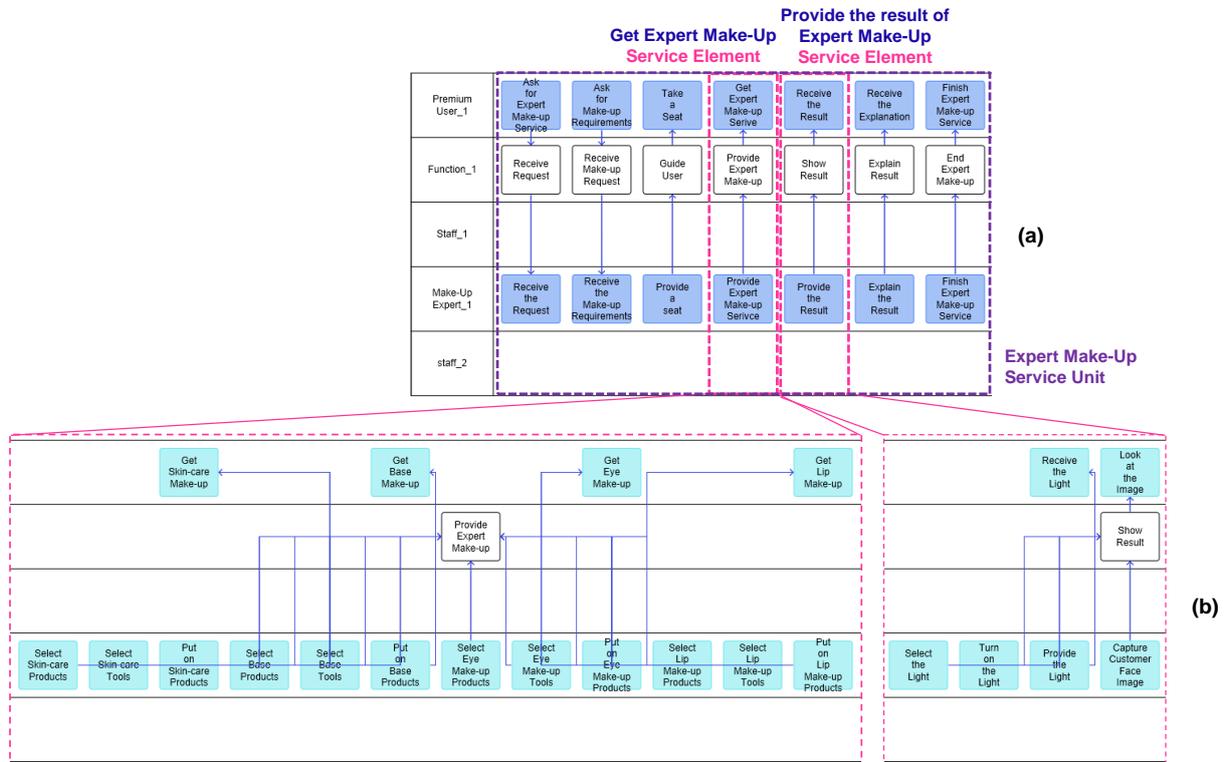


Figure 4. Exploration of service element and service unit from service blueprint

A service element is composed of stakeholders (who) as service providers, service receivers, their activities (what) and product elements (how) (Kim et al., 2011). The service element also can be schematically expressed as the block with input and output flows as Figure 5. There are three nodes for stakeholders (circular node), activities (square node) and linkage with product elements (diamond node). The stakeholders, service provider and service receiver, and the activities come from the service blueprint (Kim et al., 2011). By identifying interactions between service functions and stakeholder activities, *affordances* can be identified (Kim et al. 2012b). Affordances are the messages artifacts provide so that people activities are naturally induced from the messages when properly perceived. Structural elements of artifacts that provide affordance are called *affordance features* of the corresponding affordances. Once the affordances are identified, the product elements are to be designed. Product elements are touchpoints of the activities of the service element and are composed of the required affordance features. Note that the affordances play the role of linking the product elements to the service element. Therefore, a single service element has multiple product elements. The schematic diagram of PSS representation is given in Figure 5. Note that product elements are linked with the service element through the affordances.

6 ILLUSTRATIVE EXAMPLE OF CUSTOMIZATION AT SERVICE ELEMENT LEVEL

Effective customization of service is critically needed for service providers in delivering service when certain context elements are clearly identified. We demonstrate that a service element level customization for different contexts would be desirable by showing a special context of wedding for make-up service. Then, use two different contexts where product elements can also be customized again by using the make-up service. Note that simple and easy to understand example would be most suitable to explain the core concept of the customization method.

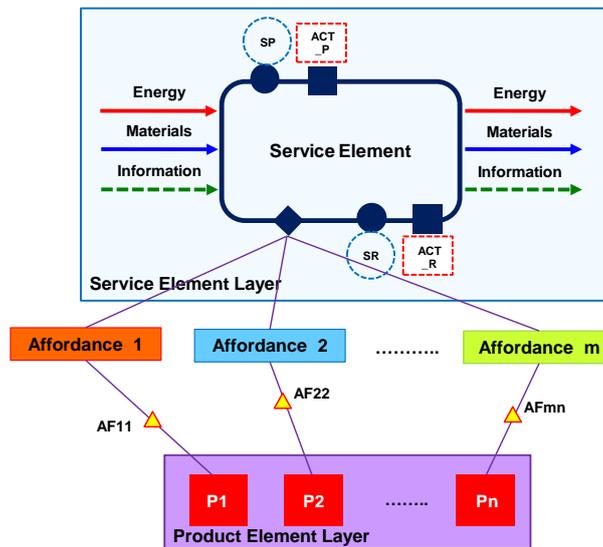


Figure 5. Schematic diagram of service element with affordance and product element (Kim et al., 2011)

For example, an expert wedding make-up service provider would be challenged to give high-quality make-up services to many wedding cases on a busy day. The context of wedding dictates typical make-up styles suitable for various key customers like a bride, bride's mother, and a sister of the bride. A typical make-up process is performed with skin-care, base, eye and lip make-up in this sequence. For bride's mother, typically in mid-fifties and wearing a pink tone traditional dress would get a very well *structured*, or customized, expert make-up to provide the typical image of bride's mother. Expert would use anti-aging skin-care products for skin, 1/2 tone color of her skin color products for base, monotone and wrinkles removal products for eye and indelible products for lip. On the other hand, if customer is bride, she will get the make-up by brightening skin-care products, pearl texture products for base to highlight her face line, glitters for shadow, thick eye lines and artificial eyelashes for highlighting eyes and sparkling lip gloss for lip. Thus is the case when the passive actor of make-up service has distinctive needs, and it can be facilitated by the context-based activity modeling as well. In this paper two different contexts for expert make-up service are considered to understand in detail the service element level customization; context A for getting party make-up and context B for getting job interview make-up.

6.1 Context A

In the context A depicted in Figure 6-(a), the make-up expert (active actor), who has provided the expert make-up service for party occasion (goal context), provides the result of make-up using the customized setting (relevant structures) for capturing the images of user as if it is Friday evening. As the main context is the goal context for party occasion, other elements of context-based activity model such as relevant structure would change to fit the goal. Properties of the make-up expert such as her dress could also be customized for the context of party as well. In this way, the service element Provide the Result would be adapted by the goal for party style and generated Provide the Result of Expert Make-Up service element specifically customized for context A.

6.2 Context B

In the context B illustrated in Figure 6-(b), the make-up expert (active actor), who has provided the make-up service for job interview (goal context), provides the result using make-up customized setting for business interview (relevant structures) to make-up for interviewee (passive actor) to transfer her images as if it is Wednesday morning. As the goal context changed from party style to job interview, other elements of context-based activity model would also change to achieve the goal context B. Properties of the active actor would change for job interview style and the structures and belongings also would be customized for interview make-up. Therefore, the context B specific Provide Result of Expert Make-Up service element is made to offer the environment suitable for interview.

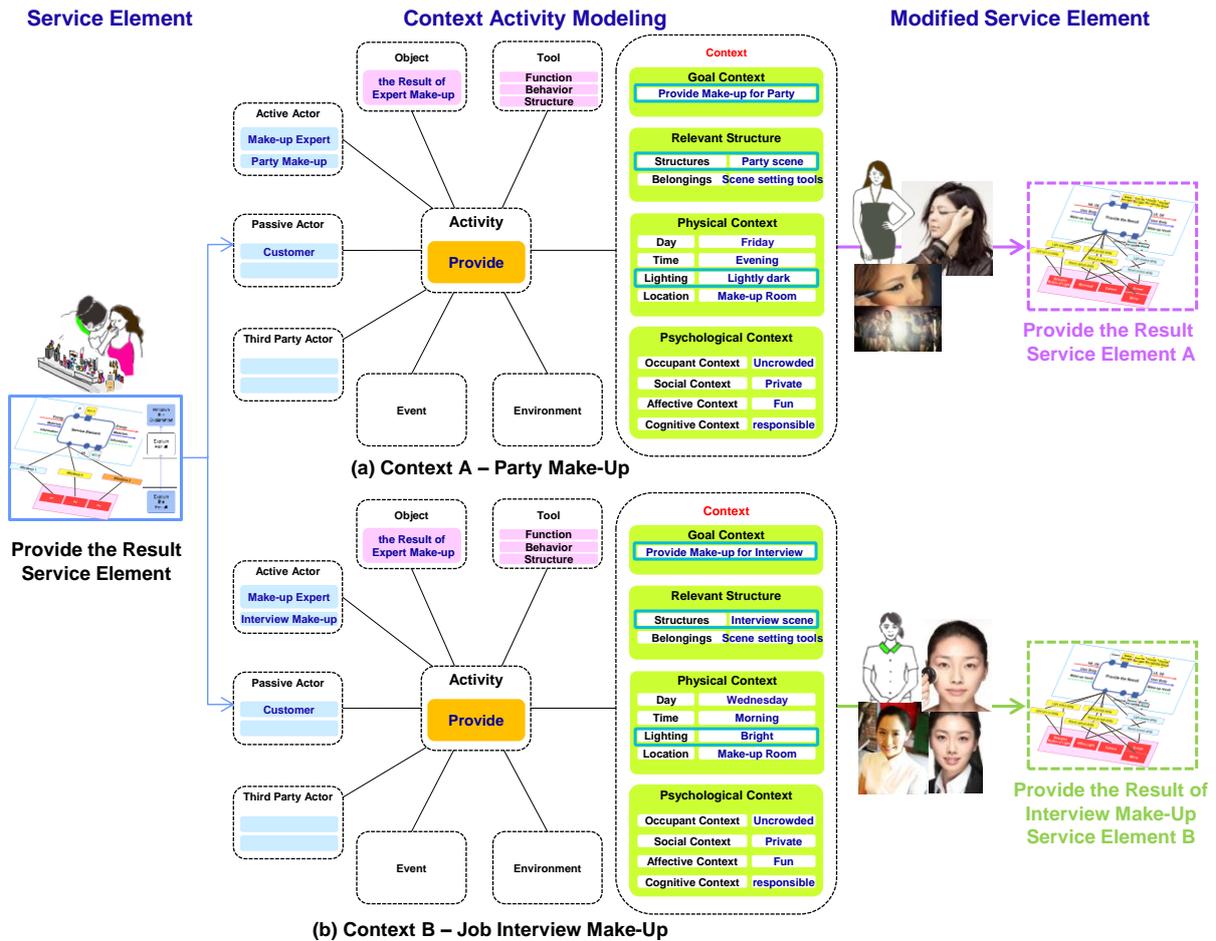


Figure 6. Exploration of changing the context and service element – Example of ‘provide the result service element’

6.3 Product Element Variations Reflecting Context Differences

In the first case of the service element of Provide the Result for party make-up as given Figure 7, the associated activities of the expert (service provider) were *select the light*, *turn on the light*, *provide the light* and *capture customers face image* and those of the customer (service receiver) were *receive the light* and *look at the image*. With these activities and function specified by context A, the service element Provide the Result is devised as given in Figure 7. The interaction of activities and relevant functions was analyzed and the affordances such as *light select-ability*, *light turn on-ability*, *light provide-ability*, *result capture-ability*, *result provide-ability*, *light receive-ability*, and *result receive-ability* were identified. To provide these affordances, the product elements of Selection Button of Light, Mirror-Ball, Camera and Screen were conceived. When the service provider showed the result of expert make-up to the customer, a mirror or a camera could be used to capture the user images for their special moment. In this case, camera happened to be chosen. To make a party atmosphere, mirror-ball lighting was selected.

In the second service element for context B of job interview make-up in Figure 8, the same associated activities are used, but with a different context. However, product element realizations of the affordances would change. Product elements of Selection Button of Light, Office Light, Camera, and Screen were devised. The customer who would have job interview may need to identify her images suitable for a job interview so the service provider could offer different lighting mood and specific way to reflect her images. The conceptual sketches and diagram of the service element of Provide the Result of Expert Make-Up for job interview are given in Figure 8.

For the two service elements with different contexts, only product elements were generated differently between the service element for context A and for context B because the associated activities and the affordances should be the same. Only product element realizations of the affordances would be

generated differently. In other words, after the context was fixed, the service element was identified and reconstructed and then the service element level customization was performed with the changes of product elements. This method provides effective and practical ways to develop customization of PSS

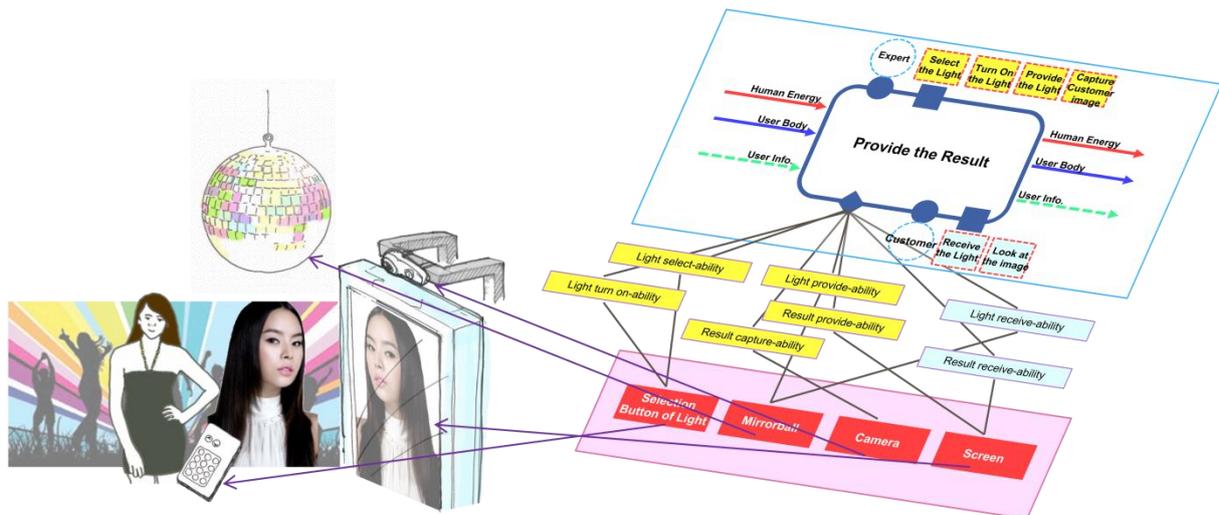


Figure 7. Schematic diagram of 'provide the result' service element for party make-up and the concept sketch of the product elements

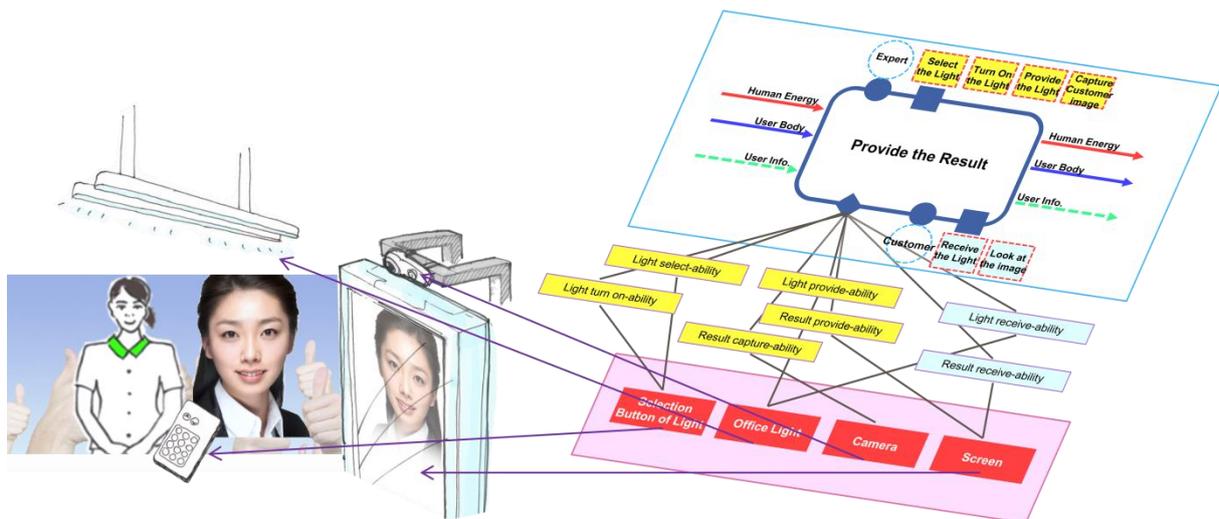


Figure 8. Schematic diagram of 'provide the result' service element for interview make-up and the concept sketch of the product elements

7 CONCLUSION

In this paper, a method for service element level customization for PSS using context elements of activities to facilitate effective customization has been introduced. A typical PSS would be composed of many service units, which are then comprised with several service elements in each unit. Each service element takes a service function and multiple activities of relevant stakeholders. Product elements are to be designed for the service element so that activities of relevant stakeholders are properly supported by affordance features that comprise the product elements. We also defined common service element which is not affected by the context, and independent service element which is affected by the context and changed. Therefore, depending on the context, the variations of PSS concepts can be made at the level of service elements. A specific context can be applied at the level of service element so that activities in the service element will be influenced by the context. Also the same context may be applied to more than one service element as in the case of the illustrative example of Make-Up Room PSS used in this paper. With specifications made on elements of activities in context-

based activity modeling, some service elements within a service unit are varied to adapt to different needs reflected in the contexts. Richness in activity description of the context-based activity modeling allows for diverse variations for activities to be specified. As both context-based activity modeling and service element representation using affordances have been developed beforehand, effective PSS customization method has been developed exploiting those.

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