Design Support System for Sightseeing Tours

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Abstract

The Japanese government has initiatives on promoting tourism. To fulfill various needs of tourists from many countries, sightseeing tours need to have large variations. This demands productivity improvement. Among others, determination of a sequence among tourist attractions is challenging due to its contextual feature. This paper proposes a design support method for service sequences. Network-structured models are employed to visualize the relationships among tourist attractions in three aspects: place, time, and content. Tour designs are evaluated using a simulation that incorporates multiple stakeholders. The usefulness of the proposed method is discussed via a case study with a prototype system.

Keywords

Service design • Service model • Service sequence • Knowledge management • Information visualization

1 Introduction

1.1 Background

In recent years, the service industry has accounted for a large proportion of Japan's economy and future demand for services is likely to increase. Many people are satisfied with the items required for daily existence, such as food, clothing, and housing. The service industry is required to provide people with new functions for leisure and self-realization. Thus, requests become more advanced and complex. It entails a much more demanding situation for the service industry. Furthermore, as individual worth and preferences have been diversified, a broad variety of requirements need to be satisfied.

However, to this day, many services have been designed to depend on individuals' skills. The service industry has been made to rely on the experience and sense of individual service designers, which manifests as product competitiveness of such services. Whether such a specific service design process that depends on individual skills has high productivity is difficult to state. Acquiring the knowledge gained through experience to enable better design takes a long time. In addition, this knowledge is integrated as tacit knowledge possessed by the individual, and sharing knowledge is difficult. The current service design process seems to have limitations.

To manage these problems, a discussion on improving service productivity has commenced. The Service Productivity & Innovation for Growth (SPRING) council [1] at the Japanese Ministry of Economy, Trade and Industry started multiple industry-university cooperation initiatives. As such, improving the productivity of services on the basis of scientific approaches has been researched and service design is actively being researched.

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1.2 Current Status of Sightseeing Tour Design

As part of a program to improve service productivity, in recent years, the tourism service industry as an area has become of particular interest [1]. Further, the Japanese government established a Tourism Nation Promotion Basic Plan [2] to attract foreign tourists through a stronger focus on this industry. In 2013, more than ten million foreign tourists visited Japan [3]. Because the 2020 Olympic Games will be held in Tokyo, the increase in tourists is expected to increase the demand for tourist services in the future. By attracting foreign tourists, travel companies hope to increase sales; however, to realize such a sales increase, they must meet the requirements of various tourists visiting from all over the world.

Travel companies aim to increase sales by designing a sightseeing tour to meet such diversified needs. However, because sightseeing tours are a typical service, which is designed by individual designers, the planning and operating capability of the current design approach is limited. Therefore, service design support systems have been called for to increase this planning capability.

In response to tourist requests, sightseeing tour designers list tourism resource candidates. Then, tourism resources are selected from the list of candidates, which determines the departure and possible order of the visits. The tour planner's experience and intuition are required to provide the appropriate tourism resource candidates and to decide on the sequence in which to visit places by considering the convenience of the tourists, the tourism resources, and the travel company. By incorporating a scientific approach in this effort, efficiency and labor-saving designs could be realized.

1.3 Related Research and Problems

The field of service science and service engineering has been established as a scientific approach to services. Generally, service science takes a reductive approach to the scientific analysis of the service. In contrast, service engineering is primarily a constructive approach [4]. This paper adopts the constructive approach to service engineering because the intention is to incorporate scientific methods into service design. As a prominent approach to incorporating scientific methods into service design, tools developed in product design can be adapted. Although the four unique characteristics of service—intangibility, heterogeneity, inseparability, and perishability (IHIP)—are said to represent the differences between service concepts and manufacturing concepts [5], the tools seem applicable to service design. The differences between products and services are also discussed in the Unified Services Theory [6]. In the service-dominant process, which is defined in [6], feedback from the service receiver can change the process immediately after the feedback while the process is running. However, such onsite adjustments could not be designed before the service is aligned in the marketplace. Thus, the former design or plan could be identical to that of the products.

In the following text, the goal of this paper is stated and the theory and methodology of service design studies conducted in the category of service engineering are reviewed. Yoshikawa [4] and Shimomura [7] provided the following definition: "Service is the activity of the provider that can change the state of the receiver to demanded state." To design a high-quality service, considering the state changes requested by the service receiver is necessary. However, because requests are dynamically changed by the receiver's state, accurately determining the receiver's request is difficult. In particular, if the service is provided by a plurality of service behavior, the receiver's state changes depend heavily on the provided sequence. This contextual aspect of service should be considered when designing services. Therefore, considering the sequence of a service and the resultant state change of the service receiver is necessary.

In addition, studies in tourism research have been conducted on the visiting sequence. CT-Planner, which is proposed by Kurata in [8] and [9], is a system that automatically generates a sightseeing tour plan on the basis of the data entered by travelers describing their tastes. When generating a sightseeing tour plan using CT-Planner, selecting a tourism activity and determining the visiting sequence are solved as traveling salesman problems that maximize the utility value calculated from travelers' tastes and visited features. Therefore, although a tour plan is developed by considering efficient movements, the best visiting order is planned considering a traveler's state changes.

1.4 Purpose of This Research and Approach Taken

This paper aims to propose a support method for service design that considers the order in which services are provided and applied to tourist sightseeing tour designs. Therefore, we attempt to develop a service model that represents the difference in efficiency and value (service providers and receivers) caused by differences in the service sequence.

In the proposed method, a service design is divided into a study stage and an evaluation stage. In the study stage, the sequence in which a service is provided is considered, which requires skills for effective planning. To be able to consider the sequence of services and to determine which are good or bad from the service provider and service recipient perspectives in the design study stage, this paper proposes a method for visualizing an evaluation of the sequence using a network. In addition, in the evaluation stage of the design, the proposed sequence from the perspective of both the provider of the service and the receiver is evaluated. A simulation method proposed by the authors in a previous study [10] is applied as an evaluation method.

2 Modeling of Tourism Resources and a Sightseeing Tour

2.1 Elements of the Tourist Resources Model

In this study, a tourism resources model presented by the authors in the previous studies [11] and [12] is used to represent the components of the tour. This model is expressed in units of each tourist activity of a sightseeing tour to represent the experiences of a single tourism resource. In addition, the movement between tourism resources is built into the tourism activity model. For the sightseeing tour, the following attributes are to be arranged in advance for the tourism service to be operable:

- Place: Location of tourism resources
- Time: Start time, end time, and standard required time of tourism services
- Supplier: Supplier of tourism services
- Content: Contents of the tourism services
- Reservation Element: Elements to be arranged in advance to operate the tourism service
- Capacity: Number of individuals in tourism services that are acceptable at a time
- Cost: Cost of tourism services

Figure 1 shows an example of the tourism resources model. Among the attribute elements, place, time, and content may retain a hierarchical structure to enable a comparison of the attribute elements using a distance calculation. The sum of the similarities of the attribute elements held by individual tourist resources is compared and the similarities between the tourism resources are obtained [12].

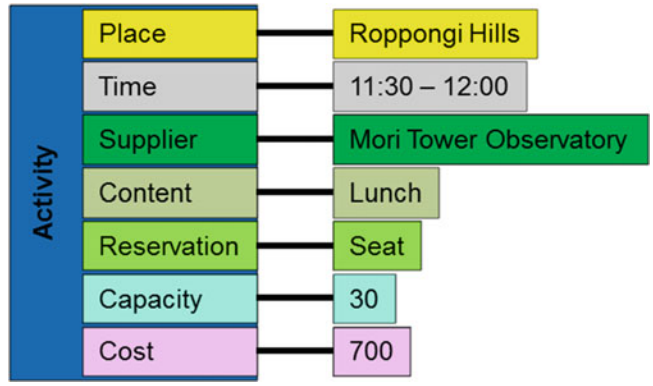


Fig. 1 Tourism resources model

Table 1 Tourism resources model of each stakeholder

Stakeholders	Role	Tourism resource information	Tourism resources model name
Customer (tourist/traveler)	Receiving tourism services	Wish to do	Request
Supplier (tourism resource)	Supplying tourism services	Able to do	Capability
Provider (travel company)	Operating sightseeing tours	Going to do	Activity

2.2 Multiple Stakeholder Viewpoints in the Tourism Resources Model

Each stakeholder's perceptions of the same information on the same tourism resources differ. Therefore, we defined a model (displayed in Table 1) from the point of view of three stakeholders: customer (tourist), provider (travel company), and supplier (tourism resources). By using the same model of tourist resources viewed from the perspective of all stakeholders, comparing the information between stakeholders is possible. By comparing requests and capabilities, it is possible to judge whether the capabilities provided by the supplier satisfy the customer requests. In addition, by comparing capabilities and activities, it is possible to judge whether the capabilities provided by the supplier operate the activities planned by its provider. Evaluating the same types of tourism resource models, deliberating alternatives is possible, such as by exploring similar tourism resources through a comparison of capabilities.

2.3 Sightseeing Tours Model

Multiple activities that determine the sequence are defined as a sightseeing tours model. However, simply placing activities together cannot guarantee that sightseeing tours are operable. Therefore, constraints for connecting activities are employed to ensure operability.

To enable the transition between two activities, the constraint is set that time and space assigned to the activity must be continuous—called a spatial-temporal constraint. Then, each activity in a tour must be operable. As previously mentioned, the operation of an activity is characterized by its attribute element. For example, "where can I" and "when to do" are defined by place and time. Referencing capability enables a check of whether the possible operation is done. Tourism activity, which is declared as an activity, should be guaranteed as capable of providing tourism activities. We call this operation a capability constraint.

3 Planning a Sightseeing Tour

3.1 Consideration of Order in Tourism Activities

We assume that providing a sequence of a service can be done only from the characteristics of a service receiver and the relationship between the target services. For example, for a receiver that hopes to receive significantly similar content, the continuous provision of similar content services is highly appreciated. In contrast, for a receiver who has no particular preference for content, the possibility is that he or she becomes bored with similar content, resulting in a negative evaluation.

In this case, by considering a semantic connection between the two services and the receiver's preferences, the designer must consider the order of the services. Therefore, the visualization model for the relationship between tourism resources using a network was developed for determining the sightseeing trip sequence. This model enables a design study by considering the semantic relationship between tourism resources. Sightseeing tours created using the network model were evaluated through a service simulation that considers the characteristics of the customer as a service receiver [10].

3.2 Use of the Network Model

We consider the nature of the relationship between tourism resources. By comparing the attribute element of the tourism resources, we can judge whether any relationship exists between the start and the end of these resources. We consider the context of the place, time, and content of the attribute element previously mentioned to create a network model of the three attribute elements of place, time, and content, which are considered associations between tourism resources. In the network model, a node represents each tourism resource and a link represents the relationship between two tourism resources. A link represents the relationship attributable to an attribute element of tourism resources at both ends using a thickness and color based on strength and type. Using a network created in this manner enables the completion of a design study by visually considering the relationship of the tourism resources (such as the presence of a type of uneven distribution or clusters of links).

We describe three types of network models that were defined for each attribute element. Table 2 provides a description of the network model. We create three types of network models for activity, capability, and request. Table 3 shows the information on the tourism resources model and the network model for each attribute element.

In the design study stage, we explicitly use this information to support the design study on the visiting sequence of the sightseeing tour activities. The order of sightseeing tours is determined when a bird's-eye view of the relationship between the activities in the network model is designed.

The detail of each network model is discussed below.

3.2.1 Place Network Model

Providing a strong link between geographically close tourism resources and a weak link or eliminating the link between tourism resources that are separated helps with visualizing the geographic distance relationships between tourism resources in the network model. A tourism resource cluster with a solid concentrated link has resources that are suggested as being near each other. Transfer efficiency is increased by continuously visiting nearby tourism resources because merit exists

Table 2 Features of each network model

	Meaning of the link	Features of the cluster
Place	Line width: geographic distance	Nodes (places) connect by links with thick line: places locate at the same area
Contents	Color: type of contents Line width: relevance	Nodes connect by the same colored link: with continuous visits, the element item becomes strong
Time	Direction of the arrow: design procedure Line width: difficulty for adjustment	Hub node: can flexibly respond to the sequence change

Table 3 Types of network model

Network model	Activity	Capability	Request
Place	Passage cost of sightseeing tours	Suggestion of visiting sequence from the viewpoint of passage	Desired area to visit
Time	Robustness of changing the schedule time	Suggestion of availability for tours from the viewpoint of the time constraints	Desired visiting sequence
Contents	Content item that is received in operation sequence	Suggestion of chunk of tourism resources that can be expected to have a synergistic effect	Desired content item to be received

to reducing the movement cost of the tour. However, tourism resources near one another reduce location variety—and may result in lower customer evaluations.

3.2.2 Time Network Model

Feasible succession between tourism resources is represented by a link, which satisfies the time constraints. Because some tourism resources have set end times or both start and end times, the time cannot be determined freely. By utilizing the directed links, the order of determination of the time to visit each tourism resource is recommended. As unnecessary reworks to adjust visiting time are reduced, design time can be shortened.

3.2.3 Content Network Model

In some cases, a synergistic effect occurs depending on the contents of the tourist services continuously received. For example, if a tourist visits a restaurant immediately after visiting another restaurant, the sightseeing tour may receive a low evaluation. Considering such synergistic effects is necessary. Possible synergistic effect is visualized as a color of the link between tourism resources, which is specified by contents the tourism resources have in common. It stands on an assumption that continuous visit to the same kind of tourism resources increases the impression on this content. When continuously visiting a set of tourism resources belonging to a cluster formed by the same type of link, the content common to the tourism resource is emphasized in the tour.

4 Design Approach to Planning Sightseeing Tours

The service designer creates a service policy to meet customer requests and then initiates the service design process. In sightseeing tour design, tourism resources are appropriately selected and aligned in a sequence to satisfy multiple customer requests. A multitude of customer requests are depicted as requests set in a request network. Analyzing request sets reveals the potential customer requirements. While referring to the request network, a designer operates the capability network, a candidate set of possible services. At this stage, the designer explores the possible design solution space. Then, while referring to the capability network, the designer operates the activity network, a set of services to be provided. At this stage, the designer specifies a design solution. If contextual links between elements are successfully conveyed in the transitions from request network to capability network and from capability network to activity network, the resultant activity network satisfies potential customer requirements (Fig. 2).

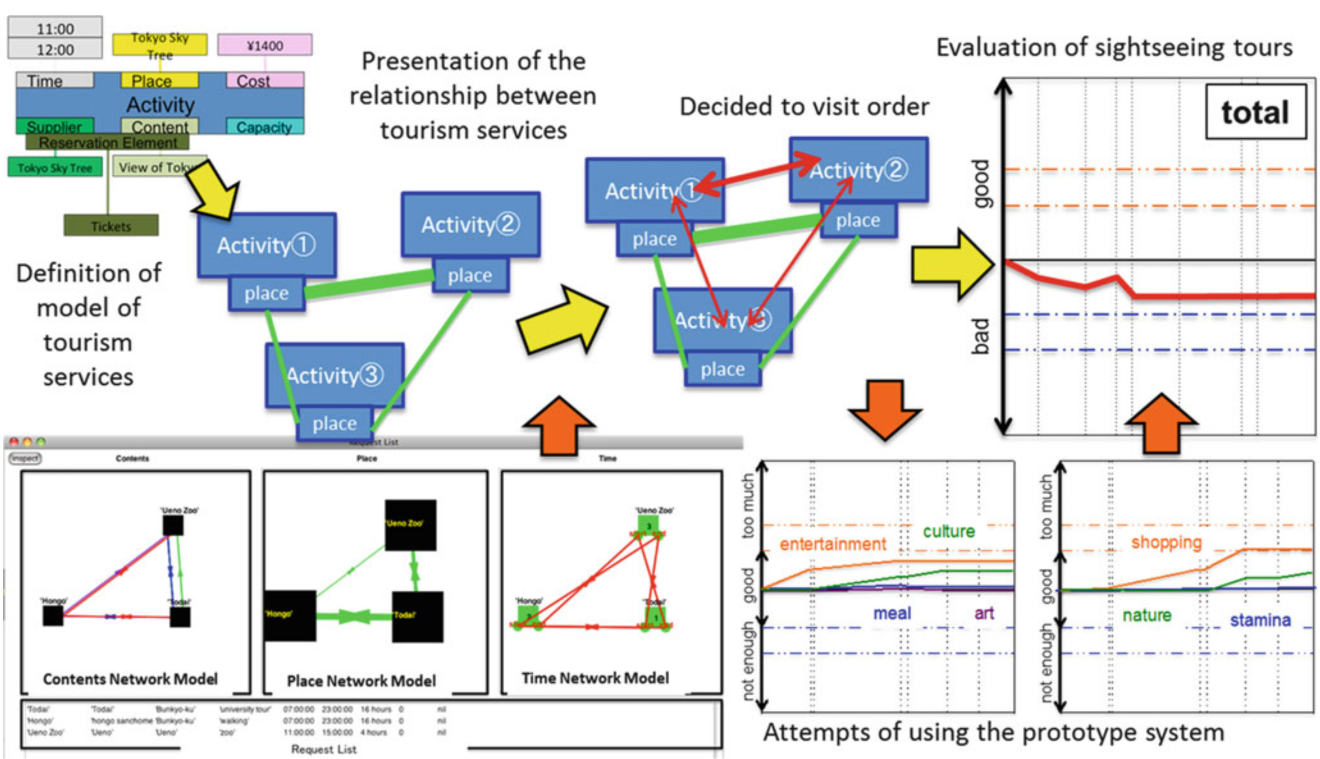


Fig. 2 Overview of sightseeing tour design

4.1 Determination of Capability Set

This section explains the search method for providing possible tourism resources that reflect individual requests. As previously mentioned, the ability to provide tourism resources is expressed as a capability. Several alternatives should be considered in the design study. As a result, a capability set that may be incorporated into a tour is formed. Because the capability set reflects requests, when the requests are later declared as activities adopted from this capability set, the activities reflect the requests. Additionally, input tourism resource information (a travel company holds all information on tourism resources) is presumed to exist in all capability formats. The method for creating and searching a capability set is as follows:

1. Create a single request for each customer request, and then create a set of requests.
2. Calculate a highly similar capability from a similarity calculation for the attribute elements from the request, and add it to the capability set.

When searching for a candidate set of capabilities in regard to the request set, finding a capability to satisfy each request is indispensable. However, a customer may not know each service well enough. Therefore, requests may not represent all customer requirements.

In such cases, the designer should be aware of the potential customer requirements. In the proposed service model, we assume that potential customer requirements can be read from the request set, in the context of a plurality of requests. The corresponding capability set should also convey the same context as the request set. Details of this method are presented by Mizushima et al. in [13].

4.2 Determining Activity Order

The visit sequence of activities is determined by referring to the capability network and request network, which is described as follows:

1. Create a network model of place, time, and contents using a request set.
2. Create a network model of place, time, and contents using a capability set.
3. Determine the combination of tourism resources that are visited successively from the capability network by referring to the request network.
4. Create an activity network from the capability network, which leaves only a link between capabilities for continuous visits.
5. Determine the time of each activity by referring to the activity network model.

When changing the network model, paying attention to the interdependence of the behavior of the network model of place, time, and contents is necessary. For example, changing the place network model of capability may unintentionally change the content network model of capability.

Responses to overt requests can be evaluated by checking whether the activity node exists in the activity network for each request node of the request network. In contrast, the potential requirements are represented as a link in the request network. Therefore, assessing the response to potential requirements is possible by observing the links that correspond to the activity network. In other words, a more similar shape and color of a network model better represents a tour that satisfies customer requirements.

4.3 Evaluation of Sightseeing Tour Plans

In Sects. 4.1 and 4.2, the method for completing a design study for sightseeing tours using a network model was discussed. The network model supports the design study by visualizing the information on place, time, and content that should be considered when engaging in a design. However, the sightseeing tours' effectiveness has not been evaluated. When adopting a final design, comparing and evaluating multiple tour proposals is necessary.

In this paper, the simulation of tourism services proposed in the previous study by the authors [8] is applied. In this proposed method, tourism services are evaluated by considering the satisfaction of services' stakeholders (customer, provider, and supplier). In addition to customer satisfaction, the supplier of each tourism resource and of the service's operation, i.e., the quality of the service when considering the provider's evaluation to operate the sightseeing tour, are evaluated. Service quality was assessed through these three evaluations. The following sections discuss the evaluation criteria for each stakeholder's satisfaction.

4.3.1 Customer Satisfaction

In the definition of service engineering, the customer is the receiver of a service and the change in the customer's state represents the value of the services. This proposed method assumes that the content of the activity influences the recipient's state change. We have developed a simulation model that can change the customer's state after an activity experience.

1. *Effect of customer's state*:
   The customer's characteristics are defined by the request, and the state of the previous experience of the activity is defined by the history of the activities. For customer characteristics, desired content elements are extracted from the content network of requests. The previous state of the activity is quantified by integrating the receiving amount of each element's contents before the activity.

Interchanging the order of the activities changes the integrated value of the receiving volume at the start of each activity. Therefore, the customer's state at the beginning of the activity differs. As a result, the state change in the activity also changes. The integrated value of the property and the receiving customer is the influence of the state of the customer at the time that the activity starts.

2. *Influence value of activity given by content*:
   The receiving amount of the content element of each activity is defined in advance. For each content element item, the amount that was proportional to the time spent on the activity defines the content of the activity.

The content effect of the activity from the amount of the received service obtained from the activity and the current state of the customer are defined by receptor sensitivity. The accumulated amount of each receptor's content element vector of the customer is calculated. From the integrated receptive amount, the overall state of the customer after the visit activity is defined. We evaluate the ability to keep high values and, thus, a high degree of customer satisfaction of sightseeing tours.

4.3.2 Provider Satisfaction

The provider works by performing a prior arrangement through negotiations with the supplier to operate the sightseeing tours. In this paper, such an arrangement is defined as a reservation element. This research introduced an evaluation of the difficulty of this arrangement. We define that fewer reservation elements and those with lower difficulty result in good tours for the provider. The difficulty of the arrangement of the reservation element is considered to be influenced by the visit time zone and the activity. This difficulty is defined as a function of time.

4.3.3 Supplier Satisfaction

Tourism resources have off times with fewer visitors and busy times with many visitors. If a supplier accepts tour visitors during a busy time, they might lose the customers who avoid suppliers because of long lines. Thus, an activity operated in an off time results in higher income than that operated in a busy time. We assume that busy or off times depend on the visiting time zone of the activity, and we defined supplier satisfaction as a variable that changes with time.

5 Prototype System Verification

5.1 Verification Example and its Parameter Settings

The prototype system is created to design and evaluate sightseeing tours using specific proposed methods. This verification example displays a comparative evaluation of the visiting sequence of a sightseeing tour. In addition, the content synopsis, reservation metrics, and supplier metrics are defined in Table 4.

In this paper, the verification example is as follows. The customer has requested a visit to Roppongi, Tokyo Tower, Ueno, and Shibuya. The evaluation process and the results based on the visiting order of these four places are shown below.

5.2 Evaluation of Plan Utilizing the Network Model

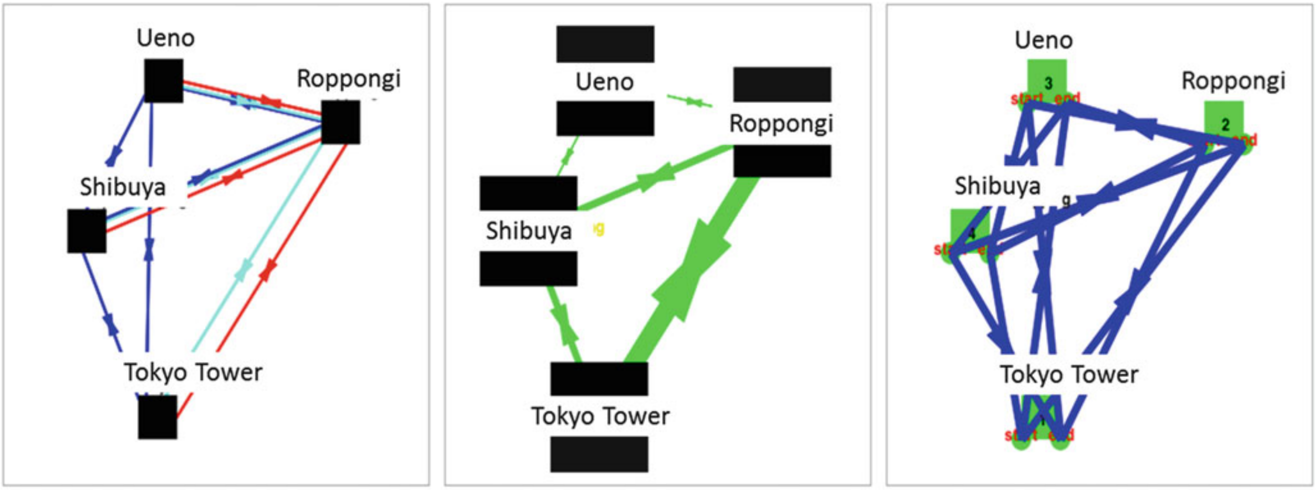
The request to visit Roppongi, Tokyo Tower, Ueno, and Shibuya was defined. The network model of the request was then created (Fig. 3). Using the network model of the request as the base, the capability network model was created. As each capability that fulfills all request criteria is found in the search, it is added to the capability network model (Fig. 4). In this verification example, the capability used for Roppongi Hills, Tokyo Tower, Ueno Zoo, and Shibuya is shopping.

Within the capability network, Roppongi Hills, Tokyo Tower, and Shibuya have relatively stronger ties to shopping, as derived from the place network (Fig. 4b), and form a cluster. This derivation indicates the tourism resource proximity between these three places. In addition, within the content network model (Fig. 4a), a shopping-related content link is formed between Roppongi Hills and Shibuya; it implies that this customer has the potential request to go shopping. Regarding the time network model (Fig. 4c), almost no time constraint exists for each of these resources; therefore, no specific features were formed.

Once the capability network is created, it is used as the basis for the activity network model that selects the tourism resources and to plan the order of visitation, thereby creating a sightseeing tour (Fig. 5). In this example, the visiting sequence prioritizes the resources with the closest geographical proximity, followed by prioritization by content continuity.

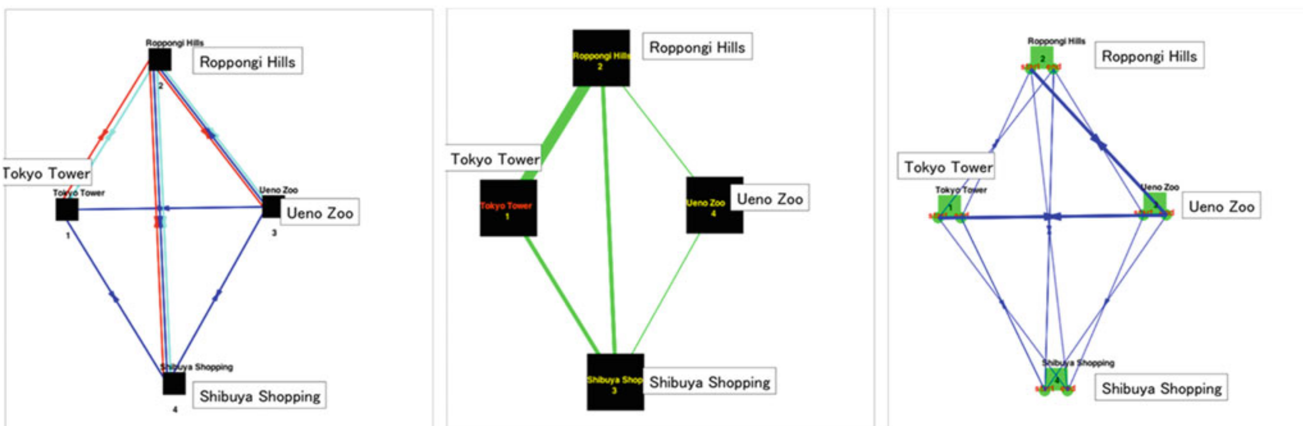
Table 4 Design study evaluation items in the validation example

	Item name
Items of content element	Hunger, fatigue, acceptability for arts, acceptability for culture, acceptability for entertainment, acceptability for nature, acceptability for shopping
Evaluation items of reservation element	Flexibility for arrangements, difficulty for arrangements, difficulty of reservation by time zone, difficulty of reservation by number of people
Evaluation items of supplier	Difficulty of supplying by time zone



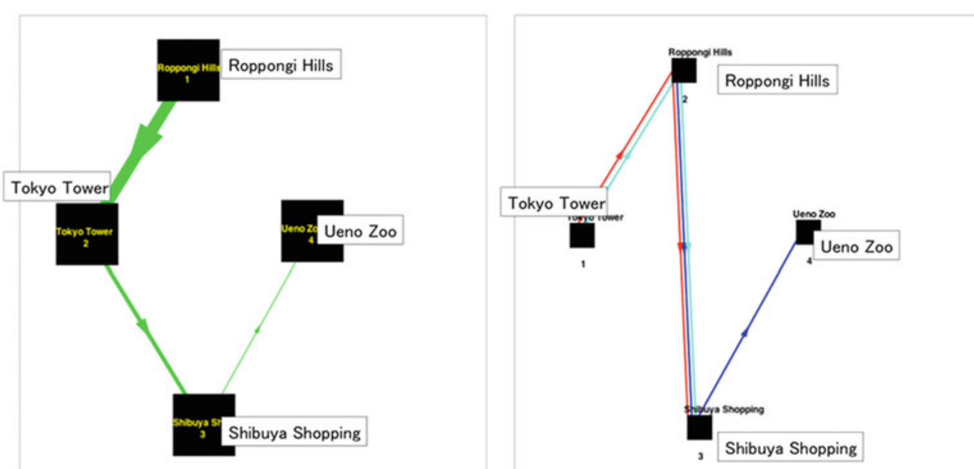
a) Contents Network b) Place Network c) Time Network

Fig. 3 Request network model



a) Contents Network b) Place Network c) Time Network

Fig. 4 Capability network model



a) Place Network of Sequence 1 b) Contents Network of Sequence 2

Fig. 5 Decision of visit order on network models considering synergistic effects

The visit sequence predominantly prioritizes geographical proximity, and the main capability used is the place network model (Fig. 4a).

To maximize the thick links between Roppongi Hills, Tokyo Tower, and Shibuya, the sightseeing tour itinerary starts with shopping at these three destinations, followed by a visit to Ueno Zoo.

The planning of the order of the items in the itinerary takes into account the content. Because the request parameter of the content network indicates a potential requirement for shopping, to emphasize this area, the itinerary includes, first, a tourism resource series linked to shopping. The capability of the content network model indicates the common link of shopping for Roppongi Hills and Shibuya. Therefore, to visit these places in succession, the itinerary order is changed to Tokyo Tower, followed by shopping at Roppongi Hills and Shibuya, then Ueno Zoo.

5.3 Design Review Using Service Simulation

This design review evaluates the created sightseeing tour plan. The sightseeing tour previously adopted determines only the itinerary order but does not account for the method of transportation and time used in transport. Therefore, a completed itinerary including additional details is required. Table 5 indicates the sightseeing tour draft planned using the determined visiting order. The evaluation results of this sightseeing tour proposal are subsequently shown. Although comparing multiple tour proposals is desirable, because this paper focuses on the use of a network model, only the itinerary based on visit order is considered.

Figure 6 shows the results of the evaluation from the customer perspective of the sightseeing tours in Table 5. Regarding whether all customer requests have been fulfilled and whether customers' strong request for shopping is reflected in the sightseeing tour, a high satisfaction rate was recorded. Table 5 does not indicate that the provider achieved high satisfaction because the activities did not require significant prior arrangement. In contrast, because shopping in Shibuya was arranged during peak hours, supplier satisfaction was low.

Therefore, the details of the sightseeing tour were arranged to perform the design evaluation. The received results are used again to refine the sightseeing tour.

5.4 Verification Considerations

This paper proposed a design study method using network visualization incorporating consideration of visit order. In the validation example, the order is not decided using purely the efficiency of moving between each place according to the place network model. The content network suggests a

Table 5 Planning verification item of verification example

Activity	Place	Content	Start time	End time
Tokyo tower	Tokyo tower	Tokyo view	10:00–10:15	11:15–11:20
Transportation	↓	Transportation	11:00–12:00	11:05–12:05
Roppongi Hills	Roppongi	City walk	12:00–12:30	14:00–15:00
Transportation	↓	Transportation	14:00–15:00	14:10–15:10
Shibuya shopping	Shibuya	Shopping	14:00–15:00	15:00–16:00
Transportation	↓	Transportation	15:00–16:00	15:50–16:50
Ueno Zoo	Ueno	Zoo	15:00–17:00	16:00–18:00

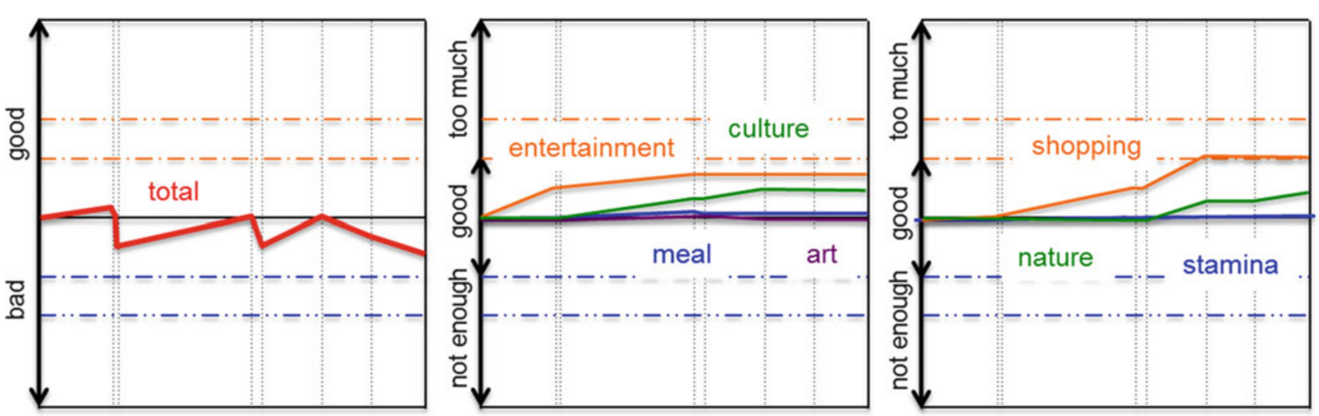


Fig. 6 Evaluation of sightseeing tours by customer state transition

potential request that is further supported by considering common content links between capabilities and arranging them by link order. Although a map may be used to verify the visualization of the place network, the advantage of this system is the ability to visualize the content of services and the links between these services. Furthermore, because the content network and the place network are not independent, reordering based on content can result in deteriorated conditions regarding place. The trade-offs between the different views are considered. In contrast, the design review and their relations remain to be verified. In this design study stage of the utilization of network models, information such as the mean of transportation and the time required between tourism resources have not been defined. However, these details were decided before the design evaluation. Therefore, the effects while transporting between places (e.g., scenery and congestion) and the best timing to visit each tourism resource (e.g., peak hours and view of sunset) are not accounted for in the design study stage. Even though the itinerary is the same, a change in the start time or visit duration of the tourism resources significantly affects the evaluations. A design support method that reflects these areas needs to be considered.

6 Conclusion

Regarding sightseeing tour planning, a support method was proposed to decide on the order of the services offered. For each activity in a sightseeing tour, its temporal factor (time), spatial factor (place), and semantic factor (content) relationship are visualized using a network model (each activity is a node), making it possible to use the model as support when designing and evaluating sightseeing tour itineraries. This method successfully depicts the contextual relationships between the activities in terms of time, place, and content. In particular, the content network indicates a contextual connection between the activities, which is usually managed implicitly.

The previously conducted service simulation research is used to evaluate the order of services, making it possible to evaluate the designed service. This simulation also partially incorporates the contextual aspect of the service, which is the state of the service receiver. Validity of the method is verified through a real prototype system used to plan sightseeing tours.

In this paper, we propose a computer-aided method to support the planning of a sightseeing tour itinerary. Although many forms of services exist, this method can be further developed and adopted for services with difficult order planning, such as tourism. The authors believe that the presented system can support situations for which planning requires consideration of the service attribute relationships that form multiple networks and for which services have multiple linkage points. Thereby, the method can contribute to increasing the productivity of the service industry.

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