Service Design of Virtual Decoration Based on Human Factors Requirements

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ABSTRACT

This study considers virtual space as a service implementation site with many people and many machines participating. Menu interfaces, interactive objects, and virtual people in virtual space are considered service access channels in this system. Based on the method of service design, this paper builds a virtual home decoration design platform that users can participate in. First, analyze the user needs in the home decoration service process, especially in the design and planning process. At the same time, according to the characteristics of virtual media, summarize the capabilities of service participants and compilation constraints. Secondly, by reconstructing the human-machine collaborative relationship of service contact elements, a service system with multiple virtual channels and full process coverage is designed to complete the function assignment of a virtual home decoration design platform. Finally, comb the information architecture according to the system's functional requirements. At the same time, a virtual interaction prototype is developed based on the Unity platform. This study verifies the consistency of service design and human-machine system design in concept, process, and method. At the same time, based on the user's perception of service in virtual space, a virtual service contact model is constructed, and a design strategy for a virtual service contact channel that meets human-factor requirements is presented.

Keywords: Virtual reality, Home decoration, Metaverse, Service contact, Human-machine system design, Service design

INTRODUCTION

The research on home decoration services based on VR technology focuses on the service media innovation of "experience between templates" and "effect preview" links. Ikea's virtual boardroom applies VR media to furniture sales. The virtual roaming function of Kujiale applies VR media to the preview of the decoration effect. At present, there is a lack of research on layout design, as shown in Figure 1. In the design process, users need to use computer three-dimensional software. Such software requires users to have a strong spatial imagination and software operation level, so there is a strong professional threshold. The purpose of this paper is to create a virtual home decoration platform for users to do interior design in a virtual space. Users can achieve indoor layout through natural interaction such as grabbing and
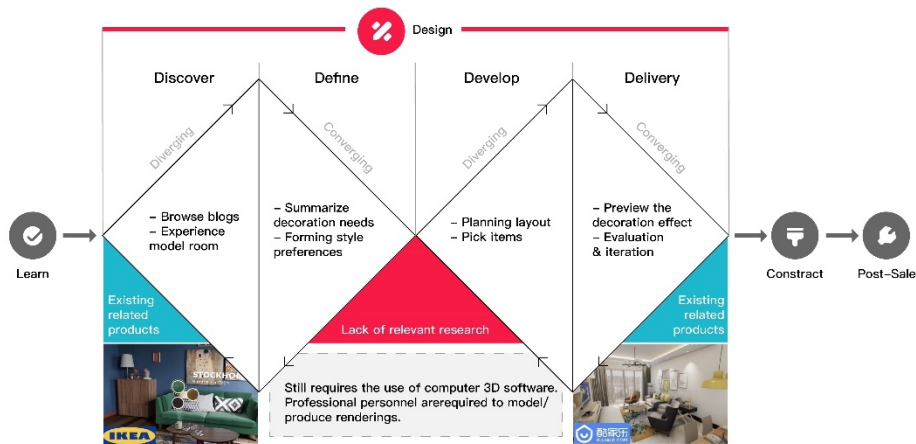
Figure 1: Current research status of home decoration design tools.

dragging. Virtual design tools help create a "what you see is what you get" design experience, thereby reducing the cognitive load of spatial imagination on users.

Service facilities are often viewed as a single service channel in service design. However, due to the diversity of virtual service access modes, it is inappropriate to view virtual reality devices as a single channel in the service system. The purpose of this study is to discuss whether treating menu interfaces, objects, and virtual humans in virtual space as multiple service channels can help to sort out the functions of virtual systems. This study will reshape the virtual service process and service delivery from the perspective of human-machine system design, rather than media innovation on a single link of service.

REQUIREMENTS ANALYSIS OF HOME DECORATION

The current home decoration design process conforms to the double-drill model as shown in Figure 1. It shows the user needs in four stages of home decoration design. In the early days, users were inspired by sample rooms and decoration case texts. In the process of browsing, constantly clarify their living needs and style preferences. In the later stage, users or design agents use computer-aided means for home decoration design. Finally, the scheme is previewed, communicated, discussed, and modified through display means such as effect maps.

At the same time, interviews and research found that home decoration design users can be divided into four categories: small white users, ordinary users, DIY users, and design agents, as shown in Figure 2. Small white users lack basic interactive skills and are therefore not suitable for using virtual home decorating design tools. Ordinary users are customized groups that can use general electronic equipment. They have less knowledge and experience in interior design, so they need to complete the design with the help and advice of design agents. DIY users have a good understanding of interaction and interior design, so they can complete the design task by themselves.

Figure 2: Personas of home decorating service participants.

To better understand the process of home decoration design, the author conducted home decoration design practice as a designer. Based on user interviews, summarize key pain points and possible reasons mentioned by users. Next, a linear regression analysis of the cause and pain point was performed using the Richter scale. The sample questionnaire includes 20 users who have received or are receiving home improvement design services. Thus, the three reasons that cause the strongest correlation between each pain point were statistically analyzed. The questionnaire results are shown in Table 1.

Table 1. Correlation analysis table of pain points and causes.

Pain Point	Cause	Questionnaire results
The gap between the design scheme and the case effect	Influenced by the designer's personal style	0.723
	The style of the sample room is difficult to refine	0.641
	The details in the sample room are difficult to reproduce	0.569
The gap between actual residence and design scheme	Unclear residential needs of users	0.833
	The display effect of the scheme is not true	0.792
	Difficult to express user demands	0.423
Inefficient communication between users and design agents	Difficult to express user demands	0.523
	The design agent cannot understand the user's demands	0.707
	Long modification cycle	0.636

DESIGN STRATEGY OF VIRTUAL HOME DECORATING PLATFORM

Service design considers the interaction between various stakeholders and other aspects of the system. Essentially, it is to solve the system human-machine problem between people, people, and material, people and information. The virtual home decoration platform has a variety of interactive

modes and objects and has the collaborative function of many people. It is a human-machine system with many people and many machines participating. Therefore, this study will expand the design of a virtual home decoration platform with the help of the concept, method, and process of service design.

Based on the research results, this study uses a service eco-map to describe the current home decoration service-related elements and system operation mode, as shown in Figure 3. Extract "enablers" that can solve user pain points and trigger service innovations, which are shown in red boxes.

Finally, a new virtual home decoration service system is summarized, as shown in Figure 4.

At the same time, the following key innovation opportunities are summarized:

1. Virtual Element Transplantation and Household Adaptation between Templates to Close Case Effect Gaps
2. Step-by-step design of functional layout and material style to reduce design complexity
3. Real-time modification of the scheme to reduce the modification cycle
4. Immersion preview of the project to help users establish their living needs and improve the display
5. Designers work with users to improve communication efficiency and user engagement
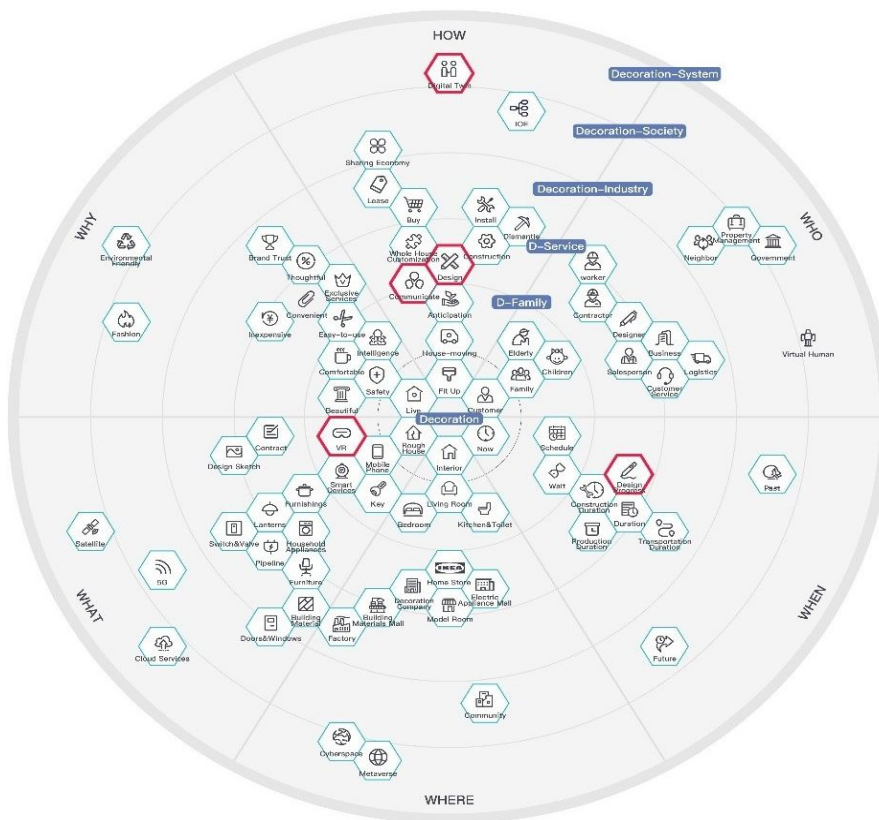
Figure 3: Service ecology map of virtual home decorating.
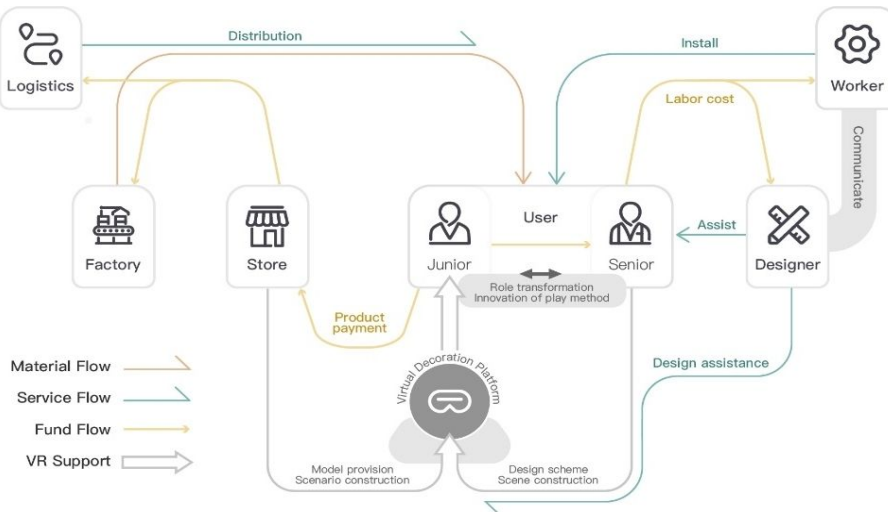
Figure 4: Service system map of virtual home decorating.

Virtual communities and virtual houses will provide scenarios as two services in the virtual home furnishing service system. They correspond to the sections of case browsing and scenario editing. Based on the above opportunities, the functional requirements of the virtual home decoration design platform in each stage of service are summarized, as shown in Figure 5.

This study uses service blueprints to allocate functions of a virtual home decoration design system. Consider the various interactive elements in the virtual home decoration platform as different service delivery channels, as shown in Figure 6. The interaction modes of virtual reality media can be
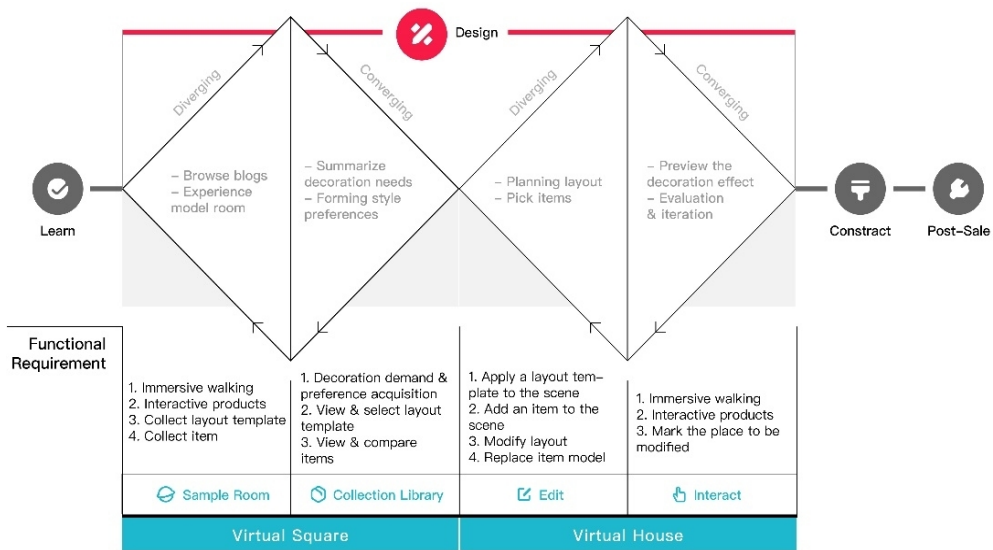
Figure 5: Functional requirement of home decorating platform.
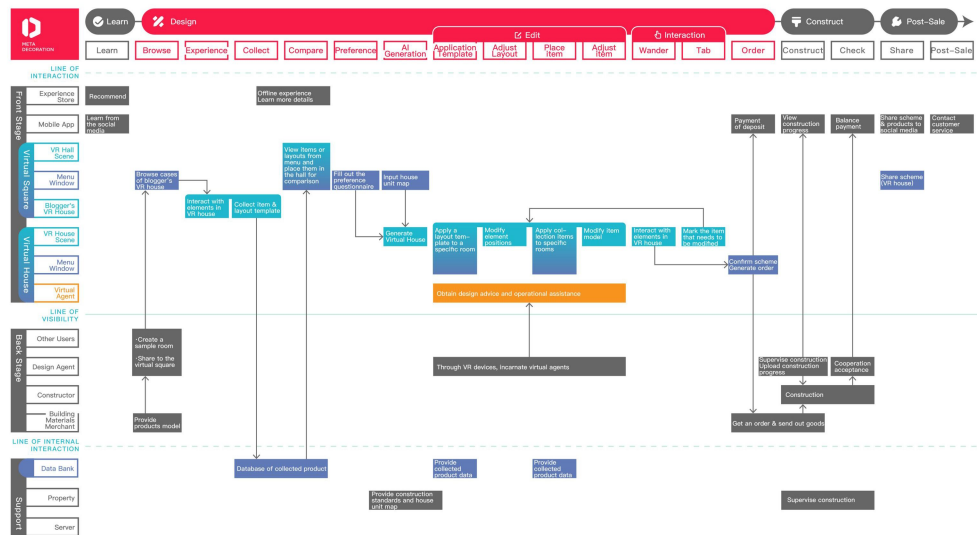
Figure 6: Service blueprint of virtual home decorating.

roughly divided into three categories: virtual object interaction, menu interface interaction, and virtual human interaction. The interactive mode of each service link is determined by its function. Service links with large amounts of information are usually implemented through menu interface class elements, which are represented in blue in the diagram. Links that require easy operation and visual display are implemented through virtual object class elements, represented by green in the diagram. Virtual people can collaborate remotely, shown in yellow. Other entity service channels are shown in gray.

The use of service design tools helps to establish a virtual way of interacting with each part of the process. Considering menu interfaces, objects, and virtual humans in virtual space as multiple service channels can effectively reduce the complexity of human-machine system design.

VIRTUAL PROTOTYPING

This research is based on the unity platform and HTC vive headworn reality device for prototype development. Including scene design, interface interaction design, and other work.

In the virtual square scene, users can enter the sample room and collect items, as shown in Figure 7.

In a virtual house scenario, users can intuitively modify the interior layout or edit the style of a single item, as shown in Figure 8. This is in line with the thinking mode of interior design, which edits the interior space from both functional and formal dimensions, reducing the cognitive burden of spatial information clutter on users.
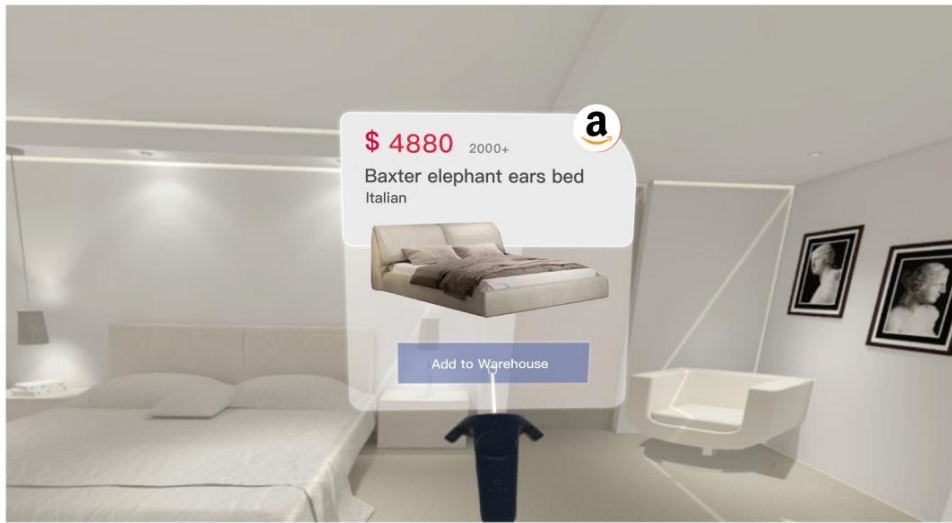
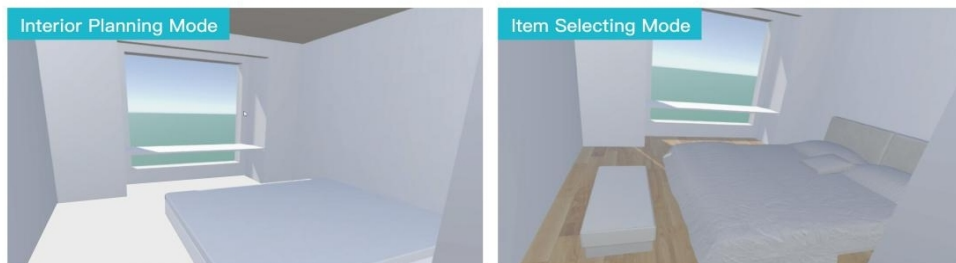**Figure 7**: Collect item in virtual decorating platform.

Figure 8: Two edit modes of virtual decorating platform.

CONCLUSION

This study explores the possibility of service implementation in virtual reality media by constructing a virtual home improvement design platform. In design practice, it has been found that services in virtual spaces can effectively compensate for the limitations of physical service contact and leverage the advantages of virtual media. Service contact modes in virtual space include menu interfaces, scene atmospheres, virtual objects, and virtual humans. Based on the service contact system model, the virtual media service contact model is formed by supplementing it with the service delivery relationships of the virtual service contact elements, as shown in Figure 9. In the future, this study will use virtual reality interaction prototypes and role-playing methods to evaluate and iterate the service system, thereby further verifying the usability of the virtual home improvement service system.

This study verified the role of service design methods in virtual platform design through design practice. Service design and human-machine system design have strong similarities in design concepts, processes, and tools, as shown in Figure 10. Compared with planar interface design, virtual system interaction design has complex elements and diverse interaction methods. It
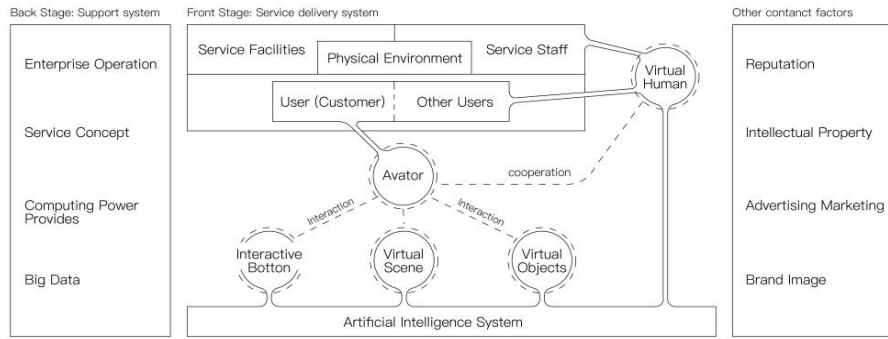
Figure 9: Virtual service contact model.

Figure 10: Comparison between service design and man-machine system design.

can be seen as a man-machine system involving multiple people and multiple machines. Using service design tools to allocate functions to various elements of a virtual platform can effectively reduce the complexity of virtual system design.

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