

A Study on the Design of Physical Space Using Information Management, Artificial intelligence and Shared Economy

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Abstract. With the Fourth Industrial Revolution, artificial intelligence technology and sharing economy are used in various fields. In particular, innovation in physical space is implemented. Therefore, interest in shared office and shared beauty salon has increased recently. Shared office and shared beauty salon are used by the sharing economy and artificial intelligence technology. Currently, shared offices are installed and studied worldwide. However, compared to the shared office, there is a lack of research on shared beauty salon. In the future society, the form of beauty salon is expected to change to the form of shared beauty salon. Therefore, this paper conducts a study on the design and utilization of physical space using the sharing economy and artificial intelligence for shared beauty salon. The design characteristics of the shared beauty salon based on the sharing economy are as follows. The space of the shared beauty salon can be largely divided into two spaces. These two spaces can be divided into a private space and a shared space. Private space allows designers to perform their work autonomously without interference from others. Unlike private spaces, shared spaces are used by many people. And the artificial intelligence technology used in the shared beauty salon is as follows. First, whenever a customer visits a beauty salon, detailed information such as hair, scalp condition, and collar is recorded. Customer's accumulated data is analyzed through machine learning. Based on the analyzed results, it allows customers to provide the style they want even if the designer changes. By doing so, it is possible to provide a service that can maximize customer satisfaction. These studies can be used as basic theoretical data when designing and constructing shared beauty salon. And in the era of the 4th Industrial Revolution, this study is expected to help create innovation in the beauty salon space.

Keywords: Information Management; 4th industrial revolution; sharing economy; artificial intelligence

1 Introduction

1.1 Research Background and Purpose

In the era of the 4th Industrial Revolution, the impact of online technology on society continues to grow. This development of online technology makes the sharing economy an important concept. The sharing economy is particularly activated by online platforms. For example, using

Internet technology, shared spaces are applied to offices and housing. In particular, in the sharing economy, shared offices grow globally, and WEWORK is a representative shared office company. WEWORK is one of the representative innovative companies. The company started in New York in 2010 and currently has more than 800 branches worldwide. As such, the shared office creates innovation in the office culture. Similarly, a sharing economy is introduced in beauty salons, mainly in advanced countries such as Japan and Korea. These beauty salons are called shared beauty salon. In the future society, the form of beauty salon will be transformed into the form of shared beauty salon. In particular, in the shared beauty salon, various technologies related to the Fourth Industrial Revolution as well as the sharing economy are introduced. In addition, artificial intelligence technology is recognized as an important technology in shared beauty salon. Therefore, this paper studies the design and utilization method of physical space using the sharing economy and artificial intelligence for shared beauty salon. These studies can be used as basic theoretical data when designing and constructing shared beauty salon. And in the era of the 4th Industrial Revolution, this study will help create innovation in the beauty salon space.

1.2 Literature Review

In the era of the Fourth Industrial Revolution, innovation is carried out in various fields. Recently, space-based businesses are also innovating based on new technologies. In particular, many shared beauty salons are created in developed countries. However, research on shared beauty salon is still lacking. Therefore, this paper studies shared beauty salon. Therefore, first, the research related to the shared beauty salon is as follows. Piao Mei Hong et al. (2019) studied to understand the space required, area and scale of shared office space through case analysis of the shared office space in and out of the country, and to examine the comprehensive spatial characteristics for the space planning of shared office [1]. Yoon Ji Yeon et al. (2017) proposed a fashion sharing service development to settle the rational consumption culture along with the abandoned clothes problem [2]. Xiu-Fu Tian et al. (2017) began the empirical research with users of Chauffeured Car Services, and analyzed data with IBM SPSS 24.0 and IBM AMOS 24.0 [3]. Kang Bok Hui (2020) investigated hairdressers' awareness and perception of a shared beauty salon which has been rising in domestic cosmetology industry and search for a way for such shared beauty salon to grow in domestic market [4]. Hwang Kee Yeon et al. (2014) found the future that car sharing to be developed into an integrated sharing transport system incorporating other sharing modes and facilities including bikes, autonomous cars, parking, among other [5]. Cheon Byung You et al. (2018) explained the economic and social effects of sharing economy, platform, and blockchain in terms of how technology brings changes in the way the economy is organized [6]. Kim Hae Joong et al. (2016) provided an opportunity to enhance the competitiveness of sharing economy service under an uncertain business environment by way of identifying the success factors of the sharing economy service whose important is growing in recently years and the structural relationship between these factors [7]. Until now, a lot of research has conducted on the sharing economy and artificial intelligence. Unlike many studies on the sharing economy and artificial intelligence, studies on shared beauty salon are insufficient. Therefore, these research results have limitations in using shared beauty salon for design and operation. Therefore, in this study, the design and operation of the physical space of the shared beauty salon were studied. These research results can be theoretical basic data when establishing a shared beauty salon.

2 Research Method

This paper studied the characteristics and methods of space based on the shared beauty salon. In order to conduct this study, literature research on the sharing economy was conducted. Literature research was analyzed focusing on newspaper articles, books, and papers. In particular, literature studies mainly analyzed sharing services for physical spaces. In addition, various cases of shared beauty salons were analyzed. In addition, an analysis was conducted on the services provided by combining these shared spaces with IT technology. And based on these literature studies, the author visited a space that actually operates a shared beauty salon. Therefore, researchers conduct spatial design and service analysis of shared beauty salon. And the research method at this time is the participant observation. Through participant observation, the researcher analyzed the space. In addition, the researcher conducted an in-depth interview with the operator who directly operates the shared beauty salon. Based on the conclusion through this participant observation, the space design and utilization plan of the shared beauty salon were analyzed. The results of this study can be theoretical basic data when designing a physical space using the sharing economy.

3 A Theoretical Study

3.1 Artificial intelligence and Information Management

In the era of the Fourth Industrial Revolution, artificial intelligence technology is very important [8]. So this artificial intelligence technology is used in various fields. Recently, the industry has changed by introducing artificial intelligence technology in the beauty field. Artificial intelligence refers to a computer system that has human learning ability and intellectual ability. So artificial intelligence is the replacement of human intelligence by computers. And, Computers make reasonable judgments on behalf of humans. This artificial intelligence technology is used in various forms combined with the sharing economy. With the recent expansion of shared offices and shared beauty salons, artificial intelligence is widely used in this space. Artificial intelligence in shared beauty salons helps customers make reasonable judgments. For example, a shared beauty salon recommends the most appropriate hairdresser to customers through artificial intelligence. This recommendation allows customers to make reasonable choices. In addition, a system that allows customers to make reservations through artificial intelligence is also provided. Such artificial intelligence can provide many conveniences to customers.

3.2 Shared economy

The sharing economy began in the United States first and is a concept that emerged during the period of economic stagnation. This concept was activated after the 2008 global economic crisis. The sharing economy means not owning real assets but using them with others [9]. Representative companies based on the sharing economy include Didi Chuxing in China and Air B&B in the United States. The sharing economy has various advantages. First, the sharing economy has a positive effect on society as it can efficiently manage social costs. In addition, the sharing economy maintains a horizontal relationship between users. So there is a positive effect in human relations. For this reason, the sharing economy can be used as an alternative to the future society in a continuous economic downturn. Therefore, experts expect the sharing economy to

expand in various fields. In addition, consumer sentiment has shrunk due to the recent economic recession. For this reason, many consumers' interest in services using the sharing economy will increase.

3.3 Platform economy

The platform economy refers to an economic system in which goods and services are traded using big data and artificial intelligence in the era of the 4th industrial revolution. In the sharing economy, the platform economy is used as an important concept. Platform generally refers to a stop for transportation such as a train or bus. So, various people gather and exchange on the platform. As such, the platform economy is a business model in which various people gather to create mutual transactions with each other. As such, the platform economy plays a role in promoting exchanges between groups. With the recent development of mobile technology, various people can work on the platform beyond time and space. So now, global conglomerates do various businesses based on the platform economy. Representative companies include Apple, Google, and Amazon. These companies pioneer new markets and lead changes in existing markets through the platform economy. In particular, the platform economy provides new services in combination with the sharing economy.

3.4 Shared beauty salon

A shared beauty salon is a form in which several hairdressers share a space. A hairdresser is an independent business operator. So, these independent hairdressers gather and do business while sharing a single beauty salon space. Unlike conventional beauty salons, hairdressers pay fees for beauty spaces and share beauty facilities. As the era of the 4th Industrial Revolution activates the sharing economy, the demand for shared beauty salons also increases. In particular, many shared beauty salons will be established in Korea and Japan, and such shared beauty salons will be more active in the future (figure 1).



Fig. 1 Shared beauty salon

4 Case Study of Shared Beauty salon

4.1 Shared beauty salon in Japan

In Japan, not only public beauty salons but also various types of beauty salons coexist. Recently, there are many shared beauty salons in Japan. A Japanese shared beauty salon hairdresser is a private business operator and works under a lease contract with a shared office operator. Rental contracts are made by paying user fees per hour. The shared office provides not only personal space but also equipment to the hairdresser by the operator. And the shared office operator plays a role in attracting customers through various advertisements. Therefore, the shared office operator replaces the difficulties of hairdressers in various business activities such as attracting customers. By doing so, hairdressers in shared beauty salons can focus on their main jobs compared to hairdressers in other types of beauty salons. In particular, Japanese hairdressers improve their skills through these shared beauty salons. After this improvement, hairdressers start their own hair salon. Therefore, the shared beauty salon is also used as a spare space for start-ups for hairdressers who do not have regular customers (figure 2).

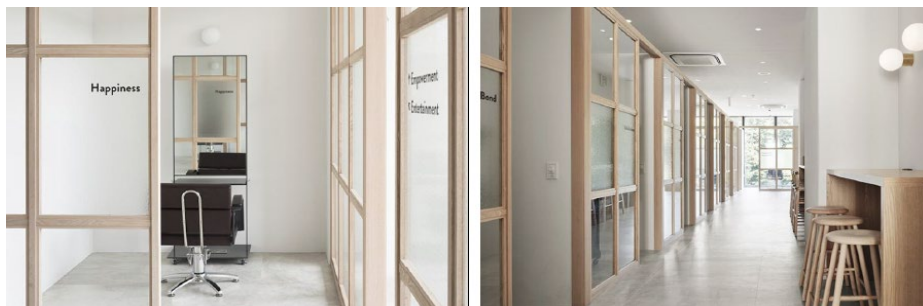


Fig. 2 Shared beauty salon in Japan [4]

4.2 Shared beauty salon in Korea

In the era of the 4th Industrial Revolution, shared beauty salons were created in Korea's beauty salons in Gangnam, Seoul, and recently, shared beauty salons have been expanded nationwide. Korean shared beauty salons give designers a lot of autonomy. Existing Korean beauty salons had a clear class system between designers. So the relationship between the designers has greatly reduced the efficiency of the work. This problem of Korean beauty salons is solved through a shared beauty salon. The operator of the shared beauty salon allows hairdressers to operate without any interference. In addition, a shooting studio is installed in the shared beauty room in Korea. So designers use these studios to promote to customers. And the operator of the shared beauty salon helps the hairdresser's marketing in various ways. Some shared beauty salons in Korea do tax and accounting on behalf of designers. As such, Korean shared beauty salons differ from existing beauty salons by providing various services to designers (figure 3).

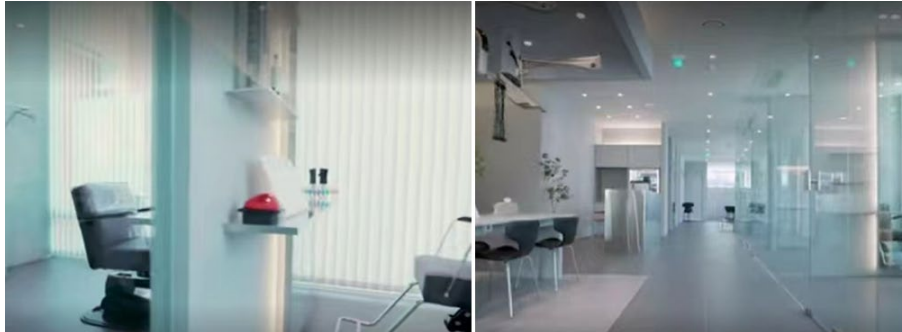


Fig. 3 Shared beauty salon in Korea

5 Design and Operation

5.1 Information Management application

O2O is a business model that connects online and offline. This O2O model is mostly used in shared beauty salons. This business model is a type of offline purchase after payment is made online. Therefore, consumers are a system that promotes sales of offline stores through platforms. This O2O model has the advantages of both online and offline. First, the O2O business can easily convey information about products and services to users. And this business can find customers online and offline. Because many people use smart-phones, people can use the O2O service through mobile. In the shared beauty salon, customers can obtain information through an online platform. For example, customers can check the designer's career or portfolio through an online platform. In addition, customers can check the price of each procedure and pay through an online platform. Therefore, customers can check and reserve designers who fit the time and style they want through the online platform (figure 4).

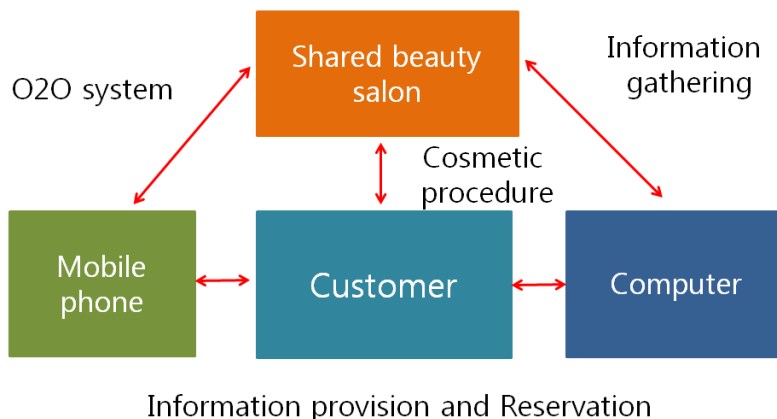


Fig. 4 Information Management application

5.2 Artificial intelligence application

Shared beauty salon uses artificial intelligence to innovate. The artificial intelligence technology used in the shared office is as follows. First, whenever a customer visits a beauty salon, detailed information such as hair, scalp condition, and collar is recorded. Customer's accumulated data is analyzed through machine learning. Based on the analyzed results, it allows customers to provide the style they want even if the designer changes. Therefore, using artificial intelligence, shared beauty salons can provide services that can maximize customer satisfaction. And the artificial intelligence system in the shared beauty room also has a system that recommends designers to customers. The artificial intelligence system analyzes customers and recommends the most suitable designer for them. At this time, the artificial intelligence system recommends the designer to the customer in consideration of the designer's strengths and specialties along with the customer's data. Therefore, the artificial intelligence system can present an advanced recommendation system to customers in a shared beauty room. So AI systems will be an innovative element in shared beauty rooms along with the shared economy. In addition, the shared beauty room can solve the manpower problem through unmanned ordering machines. When a customer enters a shared beauty room, a designer is recommended through an unmanned ordering machine at the entrance. Customers choose the hairstyle and procedure they want through the unmanned ordering machine. And the unmanned ordering machine recommends a suitable designer for the customer. So, through unmanned ordering machines, shared beauty salons create unmanned systems. In particular, customers do not need unnecessary conversations during the service. In addition, unmanned ordering machines can reduce costs through shared beauty salons. Moreover, unmanned ordering machines allow customers to create a reservation system through their smart-phones. If such a reservation system is expanded, sales in shared beauty salons will also increase (figure 5).

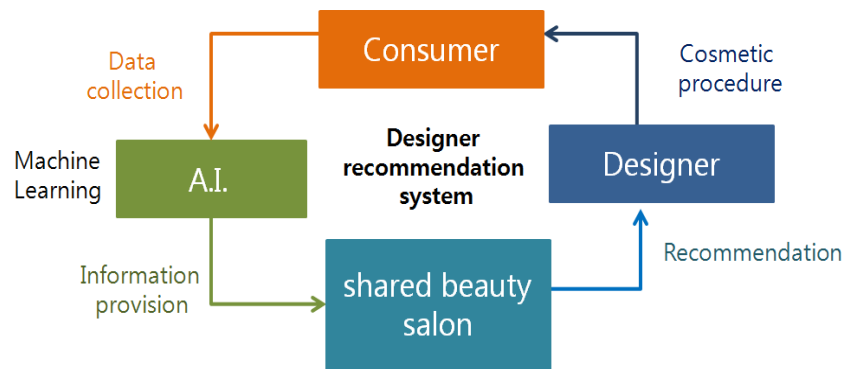


Fig. 5 artificial intelligence application

5.3 Shared economy application

The design characteristics of the shared beauty salon based on the sharing economy are as follows. The space of the shared beauty salon can be largely divided into two spaces (figure 6). These two spaces can be divided into a shared space and a private space. Private space is a space

where designers perform their work autonomously without interference from others. In this space, it is mainly composed of a space where hairdressers cut customers' hair. In addition, this space is separated from other spaces, allowing designers and customers to communicate in a comfortable atmosphere. A shared space is a space that many people use together. These shared spaces include rest areas, toilets, and reception tables. In addition, the shared space includes a joint service space. In addition, this joint service space becomes a space to wash customers' hair or dry their hair. The design and construction of the interior of all these spaces is paid by the shared office operator, and the hairdresser pays only the space fee to the operator (figure 7).

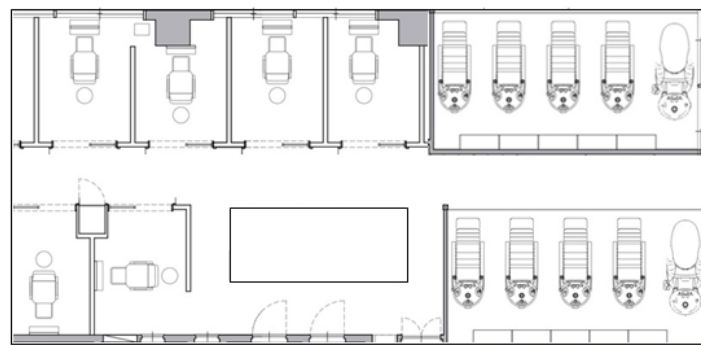


Fig. 6 Master plan of shared beauty salon

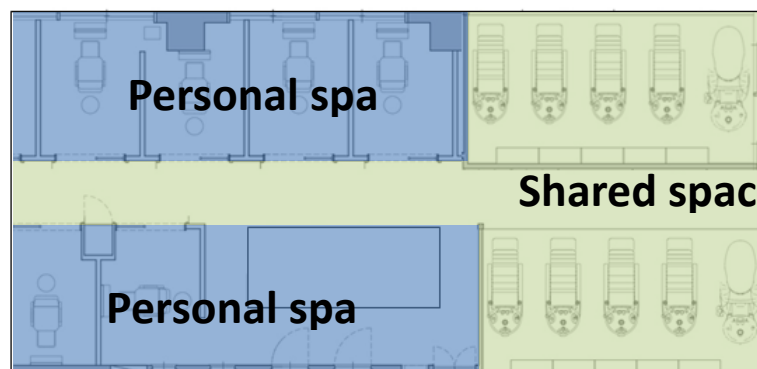


Fig. 7 Shared economy application

5.4 Artificial intelligence algorithm and Information Management

The artificial intelligence learning algorithms used in shared beauty salon are as follows. Although there are various learning algorithm, the algorithm commonly used in shared beauty salon is multiple logistic algorithm (figure 8). Control values are classified into time, temperature, light control, humidity, etc. And the logistic algorithm is controlled by a value between 0 and 1. Temperature, humidity, and lamp control are set according to the control value as dependent variables. The value of the dependent variable is adjusted according to the control value of the smartphone. Data obtained through the Internet of Things is accumulated through a database.

Such data learns control values appropriate for the environment by artificial intelligence. Through such machine learning, the most appropriate data value is generated for each situation. Based on these values, artificial intelligence automatically adjusts the dependent variable according to environmental values (figure 9).

$$P(Y = k|X = \vec{x}) = \frac{e^{\beta_k \vec{x}}}{1 + \sum_{i=1}^{K-1} e^{\beta_i \vec{x}}} \quad (k = 0, 1, \dots, K - 1)$$

$$P(Y = K|X = \vec{x}) = \frac{1}{1 + \sum_{i=1}^{K-1} e^{\beta_i \vec{x}}}$$

Fig. 8 Multiple Logistic Algorithm Formula [8]

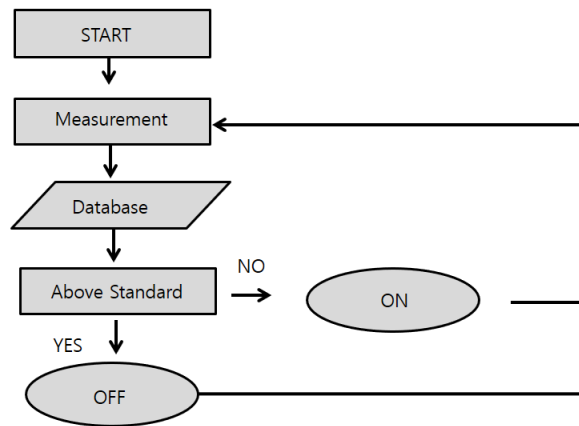


Fig. 9 Information Management Algorithm

5.5 Information Management of shared beauty salons

Shared beauty salons are operated differently from existing beauty salons. Existing hair salons are operated by the relationship between employers and employees. In addition, upper and lower-level relationships are established among designers. However, shared beauty salons generally have a self-working system for designers. So designers can work by setting their own working hours. Therefore, unlike traditional beauty salons, designers' profits are determined by their sales. In this way, a reasonable compensation system can be created. The operator of the shared beauty salon provides various services to designers so that designers can focus only on cutting customers' hair. For example, the operator of a shared beauty salon designs and constructs the interior of the salon. In addition, the operator of the shared beauty salon provides marketing as well as tax and accounting. In the future, hairdressers can develop into influencers through various marketing. For this development, the shared beauty salon helps hairdressers to show their capabilities in various ways. Therefore, it is expected that future hair salons will change from beauty salon-oriented marketing to designer-oriented marketing.

6 Conclusion

With the 4th Industrial Revolution, online technology develops. This development of online technology is important in a sharing economy that shares resources. The sharing economy is particularly active by online platforms. Recently, the sharing economy is also used in beauty salons in advanced countries such as Japan and Korea. This salon is called a shared beauty salon. The space of a shared beauty salon can be largely divided into two spaces. These two spaces can be divided into private space and shared space. In the private space, designers perform tasks autonomously without other people's interference. Shared space is shared by many people. In addition, artificial intelligence is used in shared beauty salon to achieve innovation. The artificial intelligence technology used in the shared salon is as follows. First, whenever a customer visits a hair salon, detailed information such as hair, scalp condition is recorded. The customer's accumulated data is analyzed through machine learning. Based on the analyzed results, it allows customers to provide the style they want even if the designer changes. Therefore, it is possible to provide a service that can maximize customer satisfaction. This study can be used as theoretical basic data when designing and constructing a shared office. And in the era of the 4th Industrial Revolution, this study is expected to help create innovation in hair salon space.

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