

Research on the Design and Application of Commercial Space of Intelligent Technology under the Theory of Technology Affordance

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Abstract

This paper takes the spatial design of commercial space as the research object, takes the intelligent design of intangible cultural heritage needlework space in Changzhou City as the research goal, analyzes the current situation of needlework space design and the development and application status of intelligent design technology, and uses design to promote the development value of commercial space and realize the importance of economic value of commercial space. The qualitative research method was used to collect relevant policy and literature research data, and the quantitative research used questionnaires and evaluation forms to analyze the characteristics and development direction of intelligent design of commercial space in Changzhou through field research and interviews. The research results show that: 1. The intelligent design of commercial space in Changzhou is insufficient, and there is a lack of influential mature space and brand; 2. The design of Changzhou's intangible cultural heritage space should form a certain influence, so that the design of intangible cultural heritage space should be differentiated, the exhibition should be dynamic, and the technology should be intelligent, so as to build a future technical system for the design of Changzhou's intangible cultural heritage commercial space.

Keywords: Technical Affordance, Intelligent Technology, Design of Commercial Space

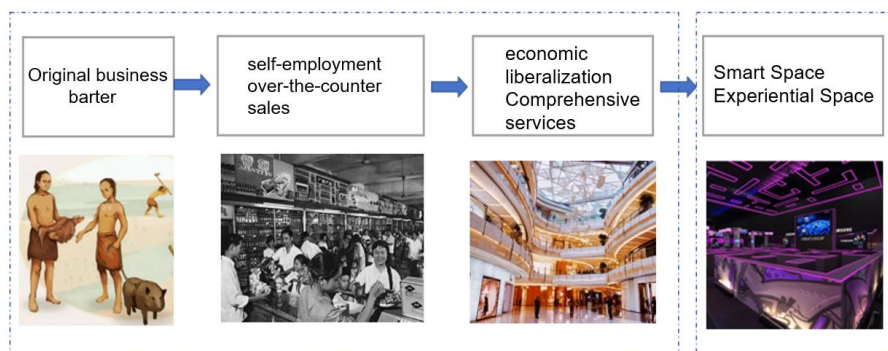
1. Introduction

The concept of "big data" was first proposed in the 2014 Government Work Report. From the State Council's "Big Data Development Action Plan" to the 2023 Government Work Report, the development of the digital economy been highlighted again. In the future, we will vigorously develop the digital economy, accelerate the digital transformation of traditional industries and small and medium-sized enterprises, focus on improving and intelligence

capabilities during the transformation process, and the combination of industry and digital represents the advanced productive forces of the future. In the context of developing digital productive forces, regions across the country have conducted in-depth exploration and expansion of the commercial applications of "digital intelligence", the design of commercial spaces has become the main practice industry for commercial "digital intelligence".

Commercial space design possesses the practicality, artistry, and scientific nature of the design industry, while also having the economic value of buying and selling. This creates the cross-over and inclusiveness of commercial space design. Since the 1950s, the marketing model of commercial space has evolved from the original exchange of living and production materials, through a economy with unified operations and separate counter sales; From the various retail stores and service facilities concentrated on providing comprehensive services during the economic opening-up period of the 1990s, to experiential commercial spaces of the e-commerce era today. Advanced information technology and intelligent equipment have improved the operational efficiency of commercial spaces. By utilizing data collection, analysis, and mining, the space layout optimized, the operational efficiency and service quality are enhanced, thereby improving the consumer experience and satisfaction. The above advantages of commercial space design are based on technological affordance usability, and implementability. Enhanced consumer experience and satisfaction, the advantages of the above commercial space design are based on technical feasibility, usability, and implementability. As shown in Figure 1:

Figure 1: Analysis of commercial space development



Source: Author

The development of commercial space at this stage is integrated with the overall development of society, which has an important incentive effect on the development of local. Meanwhile, the integration of "culture-commerce-tourism" in local development promotes the progress and exploration in design and technology of commercial space, becoming a new for mutual development and common prosperity. Policy guidance and technological support are continuously utilized to explore the cultural, experiential, and intelligent aspects of future commercial spaces.

The theory of technological affordances emphasizes the interactive practices of technology, environment, and actors. Based on the theory of technological affordances, it mainly around the actual spatial exhibition design, using VR, AR, and other virtual reality technologies as representative ways of combining technology and art to achieve intelligent immersive scene representation. The study on the comfort of the experience was conducted using quantitative analysis and other research methods, and the reasonable principles of the combination of techniques were summarized. Based on the theory of technological affordances, in the design of commercial spaces, methods such as data analysis, automated design, and virtual reality can be used to improve design efficiency, optimize user experience, and reduce operating costs; This study aims to explore the social and economic value of intelligent design in commercial spaces through the application of technical design in real-world cases, focusing on methodology, spatial experience, and evaluation composition.

The research area boundary is Changzhou, mainly focusing on the intelligent design of Changzhou's commercial space. Changzhou is an ancient cultural city with a history of more than 3,200 years, located in the southern part of Jiangsu Province and the hinterland of the Yangtze River Delta. It is adjacent to Wuxi, Nanjing, Shanghai and other cities, and has superior location conditions. With a total area of 4,385 square kilometers, the main tasks of the "14th Five-Year Plan" are to strengthen technological innovation and breakthroughs, and to do a good job in intelligent manufacturing. Due to the particularity of its location and the degree of urban development, the future intelligent development of regional commercial space has certain research significance. Based on the study of Changzhou's commercial space, the distribution of business districts in Changzhou was investigated, and each administrative district basically has its own business district, which is divided into the following according to the large-scale flow of people:

Table 1: Distribution of business districts in Changzhou

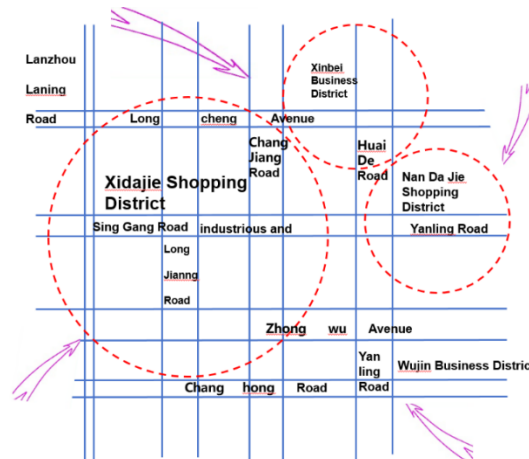
No.	Business district	Shopping mall
1	Nandajie Business District	Nan Street Pedestrian Street, Lemon Metropolis, Taifu Department Store, Department Store Building, New World Building, Park
2	Wenhua Palace Business District	Shopping mall, Wansheng North Shore City, Taifu
3	Xinbei Wanda business district	Wanda Plaza, Toyotomi International, Sun City, No.1 Street
4	Wujin business district	Yaohan, Wujin Shopping Center, Fox, Tesco

Source: Author

Focusing on the case study of commercial space in Changzhou City, Jiangsu Province and the surrounding developed regions, At the same time, focusing on the design and application of actual cases in the later stage, the emotional, interactive and intelligent display design research was carried out on the commercial cultural experience space dominated by Changzhou random needle work. The latest achievement of the fourth scientific and technological revolution - artificial intelligence technology is reasonably integrated into the indoor exhibition space of

Changzhou's intangible cultural heritage, creating an intelligent and intelligent commercial exhibition space to meet its material and spiritual needs. As shown in Figure 2:

Figure 2: Changzhou Tianning District



Source: Author

Research Objective

This research aims to application status of intelligent technology types in the design of commercial space in Changzhou.

2. Literature Review

By introducing the theories and concepts related to this study, the research results of domestic and foreign scholars, and some specific cases of smart business exhibition space, This paper analyzes the characteristics and current situation of the exhibition design of commercial space with cultural characteristics in Changzhou, so as to provide support for the research and analysis of the intelligent design practice of commercial space in Changzhou.

Based on the research trend of intelligent commercial space design in China, the literature of CNKI database in the past 10 years is used as the data source, and the keywords intelligence, interior design, and exhibition design are used as the search keywords, and the number of retrieved documents is as follows, as shown in Table 2 below:

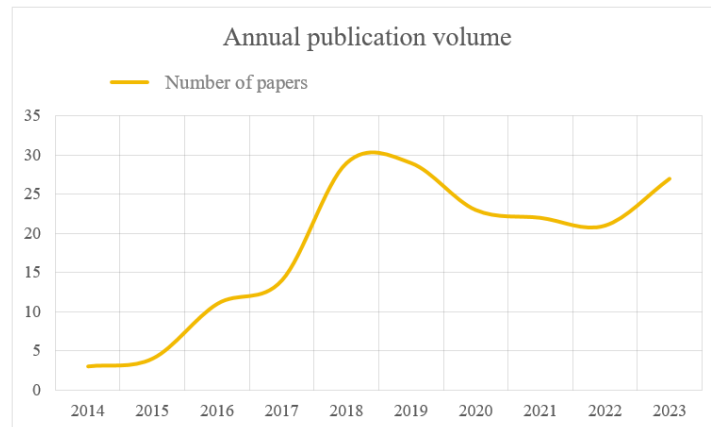
Table 2: Keyword intelligent, interior design, exhibition design search document type distribution

Type	Quantity
Smart home	113
Interior design	112
Practice and Research on Interior Space Design	27
Artificial Intelligence	29

Source: China National Knowledge Infrastructure (CNKI)

An analysis of the annual distribution of relevant information based on the literature. As shown in Figure 3:

Figure 3: Change in annual publication of keyword-related papers



Source: China National Knowledge Infrastructure (CNKI)





From the above two tables, it can be seen that the research on intelligent interior space design in China has shown steady growth in both theory and practice, and the demand of the market and industry for intelligence has attracted the attention of the academic community, and the research enthusiasm continues to rise.

In terms of theoretical research, Xue Juan expounded the concepts of interaction and interaction, and discussed the interactivity, nonlinearity, spatio-temporal extensibility, and multi-dimensionality of spatial organization, circulation planning, and new media technology from the perspective of creating spatial interaction needs design. With the help of the design case of Wuzhong Museum, the empirical discussion of the case is carried out, and finally the essence and law of the interactive design of the exhibition hall in the future are proposed, and the possibility of the new situation of the exhibition space is explored. (Xue, 2021) Zhou Yu elaborated that digital media art, as a product of the modern information society, is a digital technology that combines art theory with the technology of digital media application, and transcends the two-dimensional boundary of the two-dimensional form of digital technology (Zhou, 2021)

As an important branch of new media art, interactive installation art is an emerging and comprehensive art form that is interactive, experimental, entertaining, and cross-disciplinary (Cao, 2011) Long Xin elaborated on the way of intelligent design, which can effectively improve the experience perception of tourists in the tourism commercial space, so as to improve the satisfaction of tourists with the commercial space. (Long, 2022) Wei Wei combined the design case of digital exhibition system to explain how the new digital interaction concept affects the relationship between the value of the subject and object of the exhibition. (Wei, 2021) Lei Tingting discussed the introduction of participatory and interactive virtual technology into commercial space design, and the effectiveness and forward-looking of

commercial building interior design through data collection and model construction. (Lei, 2021) Luo Ying discussed the integration of new media art and commercial space design as an innovative form of design (Luo, 2023). There are currently relevant cases in China, As shown in Table 3:




Table 3: Domestic Case Studies

Name	Real scene pictures	Characteristics
Danqing Theater		Full-sensory Experience Immersive Theater
"Tea, Life, and People"		Digitalinteractive experience scene
"Bitter Sweet Memories"		Virtual dynamic display
Weightless Restaurant		Interactive experience scenario

Source: Author

The concept of artificial intelligence was put forward at the Dartmouth Conference in 1956, and then the trend of international academic circles emerged, and from the perspective of practical application, the concept of intelligence was applied to the practice of architecture and space, and it has flourished in Europe, the United States, Japan and other countries around the world. For example, the Atelier des Lumières, the first digital art museum in Paris, was opened, and the activity of design, from traditional pavilion design to digital intelligent technology design, has always evolved in parallel with technology and has never lagged behind. With the development of the experience economy, new forms of commercial space such as "Lifestyle Center" have emerged, and the application of intelligent design has become more and more common. Related Cases, as shown in table 4:

Table 4: Virtual technology applications

Name	Real scene pictures	Characteristics
Rain House		Dynamic interaction
Magic carpet		Virtual reality device
"Seasons" Sensing Device		Dynamic induction video Playback device

Source: Author

The progress of technology has provided people with the possibility of understanding the multifaceted nature of things, and constantly improved people's ability to perceive things. In the process of constantly perceiving and understanding space, the way of transmitting and receiving information has also changed, thus creating a rich and diverse personality needs of people in the digital age. As the third space of human activities, the commercial exhibition space plays an extremely important role in people's work and life, and at the same time meets the needs of the spiritual level, the visual artistry brought by the technical design provides a very important spiritual nourishment for modern consumers.

The need for self-renewal of commercial space display design stems from the rapid changes in the market, the diversity of consumer behaviors, and the continuous emergence of new technologies. Commercial space display design needs to pay close attention to market dynamics, understand the latest consumer trends, consumer preferences, to ensure that the design strategy can keep up with the pace of the market and meet the actual needs of consumers. The development of virtual reality (VR), augmented reality (AR), artificial intelligence (AI) and other technologies has driven the improvement of space design services, and information technology has promoted the diversification of communication methods between people and spaces, breaking through people's cognition of traditional exhibition space design, and the design concept of "immersive experience" is constantly maturing, and the development of science and technology has provided new possibilities for commercial space exhibition design. At the same time, the practical application cases of these technologies show

that there are still many problems in the exhibition space that has been opened, on the one hand, it is manifested that the space experience effect depends on technology; On the other hand, the degree of intelligence of technology is not high, and it lacks integrity and systematization. Whether it is the problem of technology or expression, it reflects the current demand for the intelligent improvement of commercial exhibition space design, and the solution of the problem will inevitably promote the improvement of the intelligent effect of space design.

3. Methodology

1. Literature analysis method

Sort out a large number of literature materials closely related to intelligent digital technology, interactive technology and space design, grasp the latest trends in commercial space design related to the application of intelligent digital technology, collect the scientific achievements of the cross-implementation of commercial space design and intelligent space intelligent technology, and summarize the current research blank areas, so as to put forward the innovation points of the paper. Through the analysis and combing of literature, this paper analyzes the development trend of commercial space intelligent design and the trend and possibility of space intelligent design. Through the collation of these two aspects of the literature, the materials supporting the views of the paper are formed, so as to demonstrate the views and ideas of this study.

2. Field research method

According to the topic, the commercial space, cultural space, exhibition space, etc. are investigated, photographed and data are collected, the current situation of commercial intelligent design in Changzhou and surrounding areas is obtained, the existing data materials are formed, and the interactive design of commercial space is systematically explored in combination with the actual characteristics of each space.

3. Qualitative research

It is based on the researcher himself as a research tool, and uses a variety of data collection methods (interviews, observations, and physical analysis) in a natural situation. It is an activity that conducts in-depth and holistic exploration of research phenomena, forms conclusions and theories from primary sources, and acquires an explanatory understanding of the behavior and meaning construction of the research object through interaction with the research object.

4. Research tools

Research tools include the use of questionnaires and assessment forms. The researchers will collect data through questionnaire surveys, and will select the relevant groups and participants in the intelligent exhibition design of the commercial space, and distribute questionnaires to

them. Participants are volunteers over 18 years old, male or female, including students, design experts, participants, and needlework researchers. Obtain their cognition, needs and opinions on the intelligence of commercial space exhibition design and space experience. This provides a comprehensive picture of respondents' perceptions of the field and extracts key information from them. Through the evaluation form, the design effect and space experience effect of intelligent exhibition of commercial space were comprehensively evaluated. By formulating a scientific and reasonable index system, the elements are quantitatively analyzed, and the corresponding weights are given according to the actual situation, and finally an objective and accurate evaluation result is obtained. The evaluation form is distributed to practitioners related to commercial space design, relevant industry departments, experts and scholars, and other stakeholders such as media organizations and social organizations, so as to form comprehensive feedback from multiple perspectives. Promote the form and technical application of intelligent exhibition design of commercial space to be more scientific and reasonable. Through the use of questionnaires and evaluation forms, we can obtain rich and diverse and reliable data support in digging deeper into the digital application and commercial space exhibition design in Changzhou.

The data obtained through the questionnaire survey can play a guiding role in the design of commercial space by using intelligent technology and functional area setting, which has guiding significance for the planning of space, the selection and application of intelligent technology and equipment in space design.

4. Results

Based on the characteristics of Changzhou's regional business circle, there are five main commercial circles in the urban area, each of which is composed of multiple commercial complexes and shopping malls, and the current situation is analyzed, and the problems are as follows:

1. Increase appeal and alleviate the problem of reduced foot traffic

According to the survey of several commercial complexes in several commercial circles in Changzhou, and the spatial research of Wujin Wanda Shopping Mall, the flow of people in the internal commercial and external Jinjie commercial spaces is small, and the commercial popularity is not good, and the number of operators in the commercial space is small except for holidays, weekends and other times.

2. Serious commercial homogeneity

Taking the design of commercial space as an example, the space of various formats is homogeneous in terms of design form, material use, lighting design, etc., and the brand characteristics are not prominent, and there is a lack of brand space effect that can gather passenger flow.

3. Commercial space design keeps pace with the times and highlights design creativity

Commercial space needs to create a unique and attractive shopping or experience environment for consumers, highlight the creativity of space design, in-depth research on the preferences and needs of the market and consumers, find out the differentiated design points, and use the latest digital technology, such as virtual reality (VR), augmented reality (AR) and interactive installations, to enhance the characteristics of commercial space, and design a commercial space that is not only in line with the trend of the times but also has a distinctive personality.

4. Timely updating of hardware facilities in commercial space design

Timely updating of the hardware facilities of commercial space design is an important way to maintain the competitiveness and attractiveness of commercial space. The design of commercial space hardware facilities can be updated in a timely manner to adapt to market changes, improve customer experience, and improve operational efficiency. Through space design and planning, touch screens, electronic maps and other intelligent guidance equipment, intelligent experience spaces and equipment, self-checkout machines, etc., to improve customers' shopping efficiency and experience.

According to the current problems, from the theoretical research and practical case analysis, the results are analyzed as follows:

4.1 It is feasible to activate the vitality of commercial complexes and commercial spaces: From the perception and needs of the designers of the space design to the participants, the design of commercial space needs to be upgraded. From the analysis of the surveyed population on the intelligent design of space, it can be seen that the acceptance of the market and users is that the intelligent design of commercial space is feasible.

4.2 Technological Development Ensures the Enhancement of Intelligent Design in Commercial Spaces: The design of commercial space has changed from focusing on functionality and aesthetics in the past to focusing on humanization, experience and sustainability, and the transformation of concept has provided more ideas for the wisdom of commercial space design. It is an inevitable trend for commercial space design to develop from intelligence to intelligence, and the continuous development of 5G technology, AI interactive equipment, and immersive experience technology provides strong support for the intelligent upgrading of commercial space.

4.3. The intelligent design of commercial spaces highlights creativity and enhances user experience: The commercial space using AR (augmented reality) and VR (virtual reality) technology optimizes the space layout and streamline design, digital art and interactive installations, enhances the artistic sense and interest of the space, creates a unique immersive shopping experience, and uses big data to analyze customer behavior, regularly collect customer feedback and operational data, and evaluate the effect of intelligent design.

5. Conclusion

By analyzing the current situation of commercial space design, we can effectively formulate the methods and strategies of intelligent commercial space design in line with the current actual situation, and design the performance effect of commercial space in Changzhou, Jiangsu Province, so as to avoid the excessive use of technology and the exhibition effect that cannot accurately express the format and brand connotation of commercial space.

The space design of Changzhou's local intangible cultural heritage needlework is effectively combined with intelligent exhibition, so that the commercial space design is differentiated, the exhibition is dynamic, and the technology is intelligent, and the future technical system of commercial space design is built around the current situation and needs of commercial space design.

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