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Research on the Application of Artificial Intelligence in Museum Exhibition Design

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Abstract: With the rapid development of information technology, artificial intelligence has developed rapidly, and is gradually widely used in all walks of life, which has a profound impact on social development. In the field of museum exhibition design, artificial intelligence also plays a role that cannot be ignored. Relevant designers should pay attention to the role of high-tech in the information age in promoting the development of the museum industry, innovatively introduce artificial intelligence technology, and promote the development of the museum to follow the pace of the time and better cater to the needs of the audience. In this context, this paper will first briefly expound the relevant concepts of artificial intelligence and museum exhibition design, then briefly discuss the application principles of artificial intelligence in museum application in museum exhibition design, and finally explore the relevant application paths, aiming to give full play to the application value of artificial intelligence in museum exhibition design, innovative design direction, and create diversified design forms. To provide visitors with a more novel tour experience, improve the recognition of the museum at the social level, and strengthen its role in cultural construction through scientific and technological means.

Keywords: Artificial intelligence; Museum exhibition design; Applied research

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1. Introduction

The museum is an important cultural institution, as it contains a wealth of historical and cultural heritage. It is an important place for people to understand the development of all aspects of society at all times both locally and abroad. It is a bridge connecting the past and the present, communicating different cultures and ideas, and an important meeting point of society and culture. However, with the continuous development of society, people's spiritual and cultural world is constantly enriched, the traditional museum exhibition design has been unable to meet the needs of the audience, the attraction of the audience is insufficient, and the number of visitors is declining. How to cater to the trend of the time, promote the innovation and development of museum exhibition design, improve the quality of the display effect, and cater to the cultural needs of the audience? Promoting the

inheritance and development of Chinese excellent traditional culture and improving cultural attraction has become an urgent matter for relevant personnel.

2. Definition of concepts

2.1. Artificial intelligence

Artificial intelligence (AI) refers to the technology and science in which machines mimic human intelligence. It aims to enable computer systems to perform tasks that require human intelligence by constantly drawing knowledge from data, performing language understanding, image recognition, sound processing, and even making complex decisions. The core of AI is algorithm and data processing, which can perform operations such as prediction, classification, and recognition in massive amounts of information, and automatically discover rules and patterns among them through machine analysis and deep learning. At present, artificial intelligence is widely used in medical care, finance, education, transportation, and many other fields, which can not only improve work efficiency but also reduce labor costs, to create a convenient, intelligent, and efficient work and life mode. Artificial intelligence has endowed machines with humanized characteristics, which are gradually changing people's lifestyles and social forms.

2.2. Museum exhibition design

The museum exhibition is a spatial interpretation of its exhibits. Practical and beautiful design can not only effectively present the information of the exhibits, but also increase the experience of the visitors. The exhibition design of museums should always take the exhibits as the core, highlight their appearance characteristics and profound connotation as the guide, and establish a scientific and beautiful exhibition sequence and space layout. The museum should be composed of exhibition halls with different themes, which display exhibits of different types and historical backgrounds. Using a visual recognition system and multimedia display system, each exhibition hall can be connected, to realize the interaction and integration based on categories [1]. The exhibition design of a museum should not only highlight the characteristics of a single exhibit and a single exhibition hall but also closely follow the theme of the museum, to deeply depict the historical portrait and tell the historical story.

3. The application principles of artificial intelligence in the design of museum exhibits

3.1. Focus on visitor experience

The role of museum exhibition design is to ensure that every visitor has a good experience. Artificial intelligence technology can intuitively and vividly show the appearance characteristics, history, and culture of the exhibits, so that visitors can have a deeper understanding of the story behind the exhibits, to enrich their unique experience. High-tech means can create virtual reality, shorten the psychological distance between exhibits and visitors, and stimulate visitors' interest in history and culture, to take the initiative to learn relevant historical and cultural knowledge. At the same time, artificial intelligence can collect user data and accurately depict user portraits, thus forming an efficient feedback channel. Museum exhibits can adjust the exhibition layout and interactive links in time according to users' needs, create a relaxed and pleasant visiting atmosphere, and leave a deep impression and unforgettable visiting experience for them. Taking the visitor experience as the core is an important way and principle to optimize the museum exhibition design, and is the main line to continuously improve the user experience [2].

3.2. Take the narrative technique as the direction

Exhibits should not only show their appearance features in an all-round way but also describe their historical background in depth, to stimulate the strong interest of visitors by creating an engaging storyline, to achieve high-quality exhibitions. Firstly, artificial intelligence can construct a multi-dimensional narrative framework, which can be transmitted through various media forms such as text, images, video, and audio, to enrich visitors' sensory experience and deepen their memory and understanding. Through the narrative technique, the exhibits are endowed with profound cultural and historical connotations to increase the hierarchy of the story. Secondly, the narrative of artificial intelligence has the characteristics of strong logic and coherence, which can help visitors clarify the time order and causality of the story behind the exhibits, ensuring that the story chain is interlinked and fascinating. Thirdly, the narrative of artificial intelligence can increase the emotional resonance and interactive experience. By analyzing the behavior habits and emotional preferences of visitors, the narrative rhythm and expression mode can be adjusted in time to stimulate the resonance and interest of visitors.

3.3. For sustainable development

The application of artificial intelligence technology in museum exhibition design is not only to improve the quality and level of the exhibition but also to commit to the sustainable development of the museum. On the one hand, artificial intelligence overcomes the limitations of traditional museum exhibitions and is conducive to showing the characteristics and connotations of the exhibits in an all-round way, to stimulate the interest of visitors and attract them to approach the museum and the history [3]. On the other hand, artificial intelligence should ensure the foresight and flexibility of museum exhibition design, to adapt to the development trend of future information technology and changes in the needs of museum visitors. In general, artificial intelligence should give play to its advantages and characteristics of intelligence, fully perceive environmental changes and market needs, and continuously improve visitors' experience with the purpose of environmental protection and sustainable development, to ensure the educational significance, interest, and interactivity of museum displays.

4. The application value of artificial intelligence in museum exhibition design

4.1. It is conducive to improving space utilization

The traditional museum exhibition space design is mainly based on plane space, by screening the types of items, adjusting the order of the exhibition, rendering the theme and atmosphere, and some museums add video or explanation equipment. However, the audience can only mobilize the visual and auditory experience of the exhibits, lacking a certain degree of interactivity. Not only the space utilization efficiency is low and the display content is limited, but it is also not conducive to enhancing the audience's viewing experience [4]. The application of artificial intelligence technology can realize the efficient application of real space, expand the display content of planar space to three-dimensional space, strengthen the development space of cultural expression, integrate the audience's sense of touch into the scope of the exhibition, enhance the audience's viewing experience, and show more cultural value information for the audience with the help of efficient museum exhibition space utilization [5]. The traditional museum exhibition design is constrained by the real space, and can only display content within the specified layout and scope. Artificial intelligence technology can break the constraints of real space and combine the infinite space of the virtual world with the real world, which can not only add sufficient display content in the infinite space but also realize the requirements that the real world cannot achieve. The rich and integrative displays provide visitors with a fantastic and novel viewing experience.

4.2. It is conducive to enhancing cultural transmission

The application of artificial intelligence technology to the design of museum exhibits should make full use of its intelligent decision-making, natural language processing, perception, and recognition functions to help visitors understand the deep connotation of the exhibits and strengthen the cultural transmission value of the museum. On the one hand, artificial intelligence technology can detect the physical coordinates of the visitors in real time, build a complete coordinate, quickly show the surrounding exhibits to users, formulate a perfect browsing route, improve their viewing efficiency, and further enhance the effectiveness of cultural transmission. In addition, virtual reality technology can be applied in the process of audience viewing the exhibition. Specifically, virtual reality technology can extract the personal emotional color of the audience, integrate the audience's behavior into the virtual environment, enhance the interaction between the audience and the exhibits, create an immersive viewing environment, understand the cultural value of the exhibits more deeply and comprehensively, and give full play to the attribute of cultural relic value transmission. It can be said that artificial intelligence technology meets people's personalized exhibition needs, integrates the audience's personal information into the exhibition link, and all information display is based on the personal cognitive level, and the exhibition route is based on personal behavior habits and interests, to enhance their interest in in-depth research of information on exhibits. With the help of the educational value and cultural connotation of museum exhibits, the cultural transmission attribute is strengthened.

4.3. It helps to enrich the audience's sense of experience

With the advent of the era of digital intelligence, people's demand for the spiritual world continues to increase. Conventional museum exhibition forms are difficult to meet the increasing needs of visitors for personal spiritual value. With the maturity of artificial intelligence technology, human-computer interaction has reduced the language requirements for the audience. The development of its natural language function, just like friendly and good communication with a friend, brings a more natural and convenient exhibition experience and good interaction process to the visitors. In addition, virtual reality technology is the expansion of space, which is also reflected in breaking the limitation of time and space. Visitors can use different equipment and methods to view the exhibition online through the museum client at different times and places and use virtual enhancement technology to bring different digital experiences for visitors. This measure can not only bring diverse experiences to visitors but also further play the social attributes and cultural intelligence of the museum, enhance the social influence and cultural attraction of the museum [6]. At the same time, the digital museum display design also plays a role in the secondary protection of physical cultural relics, extending the retention time of cultural relics as far as possible and inheriting traditional cultural values.

5. Application strategies of artificial intelligence in museum exhibition design

5.1. Build a digital exhibition process to improve the audience's exhibition experience

With the continuous development of information technology, museum exhibition forms have undergone various forms of changes, from the most basic graphic display to interactive digital display, and the application of artificial intelligence has promoted the development of exhibition design in the direction of digitalization. On this basis, museum exhibition design can be combined with browsing lines. Artificial intelligence auxiliary tools such as interactive display platforms and exhibition spaces are integrated into the intelligent exhibition process design, which innovates exhibition forms and improves visitors' experience. Usually, the museum exhibition hall has a fixed exhibition sequence, and the exhibition space is set up based on this to provide a better viewing experience

for visitors. However, the traditional guide displays information in the form of pictures and texts that is too large to accurately grasp the key information, and it is unable to lock the area of interest in time, resulting in uneven distribution of energy and time, and a reduced sense of experience. Artificial intelligence technology has powerful data processing and analysis capabilities. Compared with the traditional unified information recommendation for the audience, it can analyze the characteristics of the audience according to the public data of the audience's network platform, and then recommend intelligent targeted guide routes, directly targeting the main points of the audience, so that they can start from their area of interest to achieve a balanced distribution of time and energy, allowing a better experience. At the same time, the relevant designers can also use artificial intelligence technology to interact with the audience by voice, give full play to its value in speech recognition and rational thinking, solve real-time problems for the audience, including tour routes, cultural knowledge, etc., and close the connection between the museum and the user to realize the integrated comprehensive guide. Adding artificial intelligence to the museum guide route can also set customized expansion content according to the intelligent analysis of different audiences, provide different levels and different depths of exhibition content for different visitors, and try to meet the spiritual needs of each audience.

5.2. Build an intelligent service platform to strengthen the quality of museum services

Museums have multiple social attributes such as culture, education, and leisure, and the service objects are also multiple and complex. To better meet the specific needs of various groups at all levels, relevant personnel can use artificial intelligence on the service platform to reduce the workload of museum staff, improve work efficiency and quality, reduce the waiting time of visitors, and strengthen the service quality of the museum. Conceptually, the intelligent service platform should maintain the core idea of "people-oriented", and set up multi-level and comprehensive intelligent services from the perspective of visitors to meet the different needs of visitors. However, the current artificial intelligence is still in the development stage, and it is still not well adapted to this work, so the intelligent service platform cannot use artificial intelligence as the whole labor force. The combination of artificial services, timely for the audience to solve the events that artificial intelligence cannot handle, to achieve a two-prong approach. Technically speaking, the museum should first use the existing mature Internet technology to build a perfect service system, and then innovatively integrate artificial intelligence technology into it. Based on ensuring the mature intelligent service platform system of the museum, the museum should constantly enhance its interactivity and autonomy, and create a faster, more convenient, and more intelligent platform for society and the public. In terms of service channels, the museum can carry out online and offline two levels at the same time. Artificial intelligence services can not only be applied to the online service platform, but also can provide personalized and accurate help for visitors by using virtual reality technology, speech recognition technology, and positioning technology, and can also be applied to offline intelligent services and combined with artificial services. This can improve the overall experience of visitors and the operational efficiency of the museum.

5.3. Building an information electronic database to improve the efficiency of information dissemination

Artificial intelligence has efficient data processing ability, autonomous learning ability, decision-making and planning ability, etc., which plays an important role in many fields. In the process of innovative exhibition design, museums can use artificial intelligence to build a large number of information electronic databases with perfect information processing systems, improve information dissemination rates, and create a diversified museum

exhibition design style. In the process of constructing an electronic database, the museum should focus on the cultural value of the product itself, combine it with the industry scene, and realize real intelligence. In addition to the ornamental significance of the exhibits, it is more important to imply a lot of information of the time, which can be recorded through the form of labels, to integrate and summarize the museum exhibit resources more reasonably, and provide convenience for later creation. For example, when organizing museum exhibits, the staff can start with simple label classification such as age and category, or they can excavate the deep meaning contained in it for detailed research, and constantly improve the organization, richness, and integrity of electronic databases. The advantage of an electronic database is that, in addition to the information contained on the surface of cultural relics, it can also connect the links between exhibits, historical events, and related people, to strengthen the information transmission between products and further enhance the research value. It can also answer and display the questions of the observers more conveniently, and optimize the information transmission between the museum and the visitors. In addition, an intelligent display system can be built to customize the exhibition content. Specifically, the museum should actively introduce advanced technology from science and technology enterprises or other research and development organizations, and implement it into the cultural industry, interpret the cultural significance of the museum in practice, and make the museum display space become a highly liberal and interactive platform under the promotion of artificial intelligence, dynamically convey content to visitors, and achieve diversified display effects.

5.4. Make full use of new media technologies to enrich the exhibition design forms

With the continuous advancement of the information age and the rapid development of multimedia technology, the museum exhibition design has an increasing potential, which can bring a more vivid and intuitive viewing experience to the audience, integrate video, animation, audio, and other forms into the display content, and improve the attractiveness and viewing value of the product. In the era of digital intelligence, virtual reality technology is becoming more and more mature. Museums can take advantage of its simulation of real scenes to create real and vivid situations for observers, fully display the historical background and environment of the exhibits themselves, create an immersive and immersive feeling, and help visitors obtain richer and more detailed product information. It can also interact with the exhibits by wearing virtual reality technology equipment, to provide more interesting and personalized visit services. For example, the New York Museum of Natural History has used virtual reality technology and 3D scanning technology in the dinosaur display part to convert the exhibits into digital models and render virtual reality scenes, so that the audience can observe the details of the products from multiple angles and improve the attraction of the exhibits. In addition, other new media technologies, such as big data and cloud computing, can also be applied in the field of museum exhibition design to improve the accuracy and intelligence of management. For example, big data technology can store museum exhibits in the form of data in the backend, providing technical support for projects such as exhibit scheduling and cross-industry cooperation of museums.

5.5. Combining mixed reality technology to experience multimodal interaction

With the rapid development and wide application of artificial intelligence technology, human-computer interaction has become an inevitable way of life in people's daily lives. People gradually adapt to the new changes brought about by the era of digital intelligence. In the field of museum exhibition design, relevant designers have also applied human-computer interaction to the process of audience viewing to realize a multimodal interactive

experience. Mixed reality technology blends the real world with the virtual world to create an unprecedented virtual experience with a sense of reality for people. Through the deep integration of multi-level virtual technology, the technical advantages of virtual reality technology and virtual enhancement technology are integrated to strengthen the user experience. The characteristics of human interaction in mixed reality technology are not only fusion, but also multimodal interaction, context awareness, and real-time feedback. On the one hand, it can fully mobilize the senses of visitors. Multimodal interaction means that visitors can use vision, hearing, touch, and other senses to interact with each other in a mixed-reality environment, feel the digital museum exhibition design from multiple angles, and experience more efficient and natural human-computer interaction. When museums display cultural relics, digital technology can collect various information such as language, images, and eye movement to realize information exchange between humans and machines, build an exhibition space that mixes virtual and real technology, enhance the immersion and interactivity of cultural relics exhibition, and further enhance the perception experience. For example, when the museum displays the Stone Age-related stone cultural relics, it can simulate the production of cultural relic models, so that visitors can experience the texture and quality of the period in person. At the same time, the sensing device is set in the model, which is combined with mixed reality technology to carry out immersive interaction through gestures, haptic feedback, and language signals. For example, visitors can hold stone agricultural tools, combine with mixed reality technology to create a Stone Age farming environment, by waving agricultural tools, "through" history, and have a deeper perception of the development of production tools brought by scientific and technological progress. On the other hand, virtual reality technology has a keen perception ability of the user's context environment, which can combine the physical location, movement posture, and even combine the analysis of body data, integrate the analysis of emotional factors, and constantly adjust the interaction mode and interaction content to provide more targeted and personalized interactive services. The system also needs to pay attention to feedback messages in real time, respond to user operations promptly, and provide accurate replies, which not only ensures that visitors understand the system status and operation process but also provides a good viewing experience.

5.6. Gamification elements should be integrated to enhance the interest of the exhibition

Artificial intelligence technology provides new ideas and possibilities for museum exhibition design. Relevant personnel can integrate gamification elements into museum furnishings with the help of high and new technologies to improve interest in the exhibition. Relevant designers set up game places in specific areas of the museum and use artificial intelligence technology to set up diversified game forms to meet the different needs of audiences of different ages and cognitive levels, stimulate the curiosity and challenge of the audience, stimulate the subjective initiative and participation enthusiasm of the audience through the game link, and guide them to explore the content of the museum in depth and obtain different tour experiences. The advantage of applying artificial intelligence to the game link is that the virtual game means can avoid the large noise generated by the game equipment and affect the browsing experience of other tourists. It can also effectively avoid damaging the basic equipment and important cultural relics in the museum. In addition, artificial intelligence technology can provide visitors with a rich variety of game forms through a few devices, reduce the space occupied, and provide more venues for exhibition design. In addition, online museums can be developed, the visiting site can be transferred to the client, and different exhibition forms can be provided for visitors so that they can enjoy the museum experience without leaving home. Specifically, museums can provide immersive exhibition experiences for visitors with the help of virtual enhancement technology, panoramic dynamic video, and other forms, effectively expanding the

depth and breadth of the museum's scope of influence, and enhancing the audience's sense of participation. In addition, the online museum can also close the distance between the audience and the museum, provide a platform for the audience to speak freely, share their browsing experience, put forward relevant opinions and suggestions, and reform from the perspective of audience needs to improve public satisfaction.

6. Concluding remarks

Museums carry multiple meanings such as historical inheritance, education and inspiration, and social exchange. At the same time, they shoulder the function of scientific and technological innovation display. The application of artificial intelligence in museum exhibition design is becoming more and more in-depth, which has brought revolutionary changes to the exhibition form, audience experience, and cultural inheritance of museums. Therefore, the development of museum exhibition design should follow the pace of the time, actively introduce new and advanced technologies, build an intelligent communication platform with artificial intelligence technology as the core, strengthen the two-way interaction between exhibits and visitors, and improve the cultural attraction of museums. Looking back on the past and looking forward to the future, it is hoped that the research content of this paper can introduce artificial intelligence technology into the museum exhibition design, provide reference value, further improve the recognition of the museum at the social level, and create a more innovative and cultural museum for the people.

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