

Initial Exploration of the Transformation of Technology Museums Empowered by Artificial Intelligence

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Abstract: Traditional science and technology museums are facing challenges in the rapid advancements in science and technology. These challenges include limited exhibition formats, outdated methods of conveying information, and inefficient resource management. However, with the rapid development of artificial intelligence technology, there is an opportunity to overcome these challenges. Artificial intelligence technology, specifically in the field of natural language processing, has made significant progress in improving multilingual understanding and generative models. This advancement can greatly enhance the learning experience for diverse audiences. In addition, the development of computer vision technology focuses on scene understanding, video analysis, and visual inference. These advancements can provide a more immersive and engaging exhibition experience at science and technology museums. This paper aims to explore how traditional science and technology museums can integrate and redesign artificial intelligence technology to better meet the needs of their audiences. By doing so, it can improve the effectiveness of science and technology communication and enable museums to adapt more flexibly to the rapidly changing science and technology landscape. The findings of this study can provide strategic considerations and guidance for the future development of science and technology museums.

Keywords: Science and technology museums; Artificial intelligence; Science and technology innovation; Public education.

1. Introduction

A traditional science and technology museum is an institution dedicated to the dissemination and presentation of scientific and technological knowledge. Its main tasks include educating the public, arousing interest in science and technology, presenting the history and development of science and technology, providing hands-on experience and interactive opportunities, promoting innovation and popularising scientific and technological knowledge. However, traditional science and technology museums face a series of problems and difficulties when facing the challenges of the rapid development of science and technology.

Firstly, the exhibition form of traditional science and technology museums is relatively one-sided and does not provide enough interactivity and personal experience. Secondly, traditional science and technology museums have an relatively traditional way of conveying information. The explanations in the exhibitions are usually based on text and simple diagrams, which do not meet the learning needs and styles of the different target groups audiences. In addition, traditional science and technology museums have problems in managing resources and updating exhibits, which makes it difficult to track and update exhibits in a timely manner, resulting in a delay in science and technology information. Moreover, traditional science and technology museums are lagging behind in socialisation and digitization. They do not fully utilise social media and digital technologies, resulting in their inability to build a closer interaction and feedback mechanism with visitors.

Artificial Intelligence, as an emerging technology, is in a phase of rapid development. The development trends include, continuous breakthroughs and innovations in natural

language processing, computer vision, and so on.

In natural language processing, future trends will focus on improving multilingual understanding and generative modelling. This includes better understanding of context, facilitating transfer learning between languages and better understanding of abstract concepts and reasoning.

In the field of computer vision, future trends will focus on scene understanding, video analysis and visual reasoning. This means that systems will be able to better understand the semantic information in images and videos and make conclusions and decisions.

Finally, the deep penetration of AI into various industries such as healthcare, finance and education will accelerate. Tailored medical diagnoses, smart financial services, personalised educational experiences, etc. will become the norm and contribute to AI technology playing an increasingly important role in social and economic development.

This paper will first explore how science and technology museums can transform with new technologies in the context of AI development to enhance the audience experience, promote science and technology education and adapt to the needs of the digital era.

2. Aspects of Artificial Intelligence Empowerment

The application of artificial intelligence technology brings unprecedented opportunities and challenges for the transformation of existing science and technology museums. It not only improves the personalization and interactivity of visitor experience, but also offers the possibility of smarter and more efficient management and educational delivery. Through this integration, science and technology museums

are taking a more solid step forward to meeting public demand and promote the popularization of science and technology and cultural heritage.

First, in terms of visitor experience, the study *Interactive Narratives under Digital Guided Tours in Museums* suggests that smart tour systems and interactive exhibits provide a deeper and more personalized experience [1]. With the help of recommendation systems, science and technology museums can offer customized tours based on visitors' interests and history, deepening their understanding of science, technology and culture. Second, AI contributes to the preservation and management of exhibits, as shown in *Review and Prospect of Virtual Simulation Work in Cultural Heritage*, which demonstrates impressive results in the preservation and restoration of exhibits using virtual simulation technology [2]. *A Review and Prospect of the Application of Interpretable Artificial Intelligence in Electric Power Systems* shows that the application of AI technology in the management and operation of resources has achieved remarkable results and provides a more sustainable development path for science and technology museums [3]. Finally, science and technology museums are creating immersive exhibition experiences by combining augmented reality and virtual reality technologies. The application of these technologies not only enriches the interactive and educational nature of science and technology museums, but also provides a more sustainable development path.

2.1. Interactive and Practical

The Science and Technology Museum promotes the basic skills and interests of the public by setting up interactive experience areas where visitors can have hands-on experiences with AI technologies such as programming, robot operation, VR/AR technologies, etc. The basic concepts, development history, technical principles and application scenarios of AI are displayed and explained in the museum to help the public understand the basics of AI technology and improve their technological literacy. Workshops, lectures and courses on AI are regularly organised to provide the public with knowledge about AI in an easy-to-understand way and improve their technological literacy. In addition, cooperative relationships with domestic and foreign AI research institutes, companies and universities will be established to jointly promote the development of AI technology.

The Artificial Intelligence Exhibition and Experience Area of the Science and Technology Museum provides a platform for the public to practise and explore, where visitors can identify and solve problems to gain a better understanding of AI technology. It not only attracts youngsters, but also allows parents to participate together with their children, improving the relationship between parents and children while encouraging their interest in science and technology. By demonstrating the application of AI in various fields, the audience is encouraged to think innovatively and across boundaries, and develop problem-solving skills.

2.2. Innovation and Progressive

The Science and Technology Museum will not only exhibit existing mature AI technologies, but also focus on cutting-edge technologies and future development trends, so that visitors can learn about the most advanced AI technologies. The Science and Technology Museum will use modern technological means, such as Virtual Reality (VR), Augmented Reality (AR), projection technology, etc. to make

the exhibition content more vivid and three-dimensional and enhance the audiences's sense of immersion. An interactive experience area has been set up to allow the audience to experience first-hand the application of AI technology in their lives, such as meta-universe, augmented reality, virtual applications, etc., so that the audience can have a more intuitive understanding of the actual application scenarios of AI technology.

The Science and Technology Museum aims to promote the progress of AI science and technology, improve the scientific and technological knowledge of the public, and promote the development of the industry in a series of aspects, such as exhibition content, resources, experience, education, cooperation, policy guidance and industrial services. It provides a platform for the public to communicate and discuss with professionals in the field of AI, promotes the exchange of ideas and knowledge sharing between the public and experts, realises AI science and technology education for the public, improves the scientific and technological understanding and education of the public, and contributes to the cultivation of AI talents and the development of science and technology in China. Green and Sustainable

Do not pay you The Science and Technology Museum focuses on environment friendliness and resource conservation in its design and construction. For example, environmentally friendly building materials are selected, energy-saving devices and systems are used and the building's thermal insulation and energy efficiency are improved. An intelligent energy management system is used to monitor and optimise energy consumption in real time in order to reduce energy waste and improve the efficiency of energy. Minimise the impact on the environment when organising exhibitions and activities, for example by reducing the use of paper materials and promoting the use of renewable resources. Visitors are also encouraged to use public transportation or environmentally friendly modes of transportation such as cycling and walking to reduce the use of private vehicles and reduce emissions.

Science and Technology Museums raise public awareness of environmental protection through exhibitions and activities, so that more people pay attention to green development and sustainable development. As a public institution, the Science and Technology Museum has a responsibility to communicate the concept of sustainable development to society. To set an example of sustainable development through its own activities and operations. To promote a sense of social responsibility and encourage companies and the public to adopt more environmentally friendly and socially responsible behaviour.

3. Literature Data Analytics and Personalized Experiences

3.1. Leveraging Visitor Data for Enhanced Experiences

In this study, visitor data is collected and analysed in depth using AI techniques to achieve a deeper understanding of visitor behaviour and needs. Key metrics include visit duration, visit paths, interactive behaviours, etc. This data is processed using data mining and machine learning algorithms. By using Apriori or FP-Growth algorithms to discover correlation rules between visitor behaviours, we can combine visitor behaviours with personalized experiences to provide a more accurate and personalized technological interactive experience for different visitors.

The following specific surveys were used to investigate and collect data on the preferences of the visitors to the Science and

Technology Museum by means of a trivia quiz.

Table 1. Research on visitor satisfaction at science and technology museums

	options (as in computer software settings)	Percentage
1. Your gender	A. Men	55.7 per cent
	B. Women	45.3 per cent
2. Your age	A. Under 8 years of age	15.4 per cent
	B. 8-10 years	19.5 per cent
	C. 11-14 years	30.0 per cent
	D. Over 14 years of age	35.1 per cent
3. Are you interested in science and technology museums?	A. Very interested	28.1 per cent
	B. Interested	27.3 per cent
	C. Not too interested	36.3 per cent
	D. Not interested	8.2 per cent
4. What is the purpose of your visit to the Science and Technology Museum? (Multiple choice)	A. Occasional passers-by	0 per cent
	B. Recreation and relaxation	29.8 per cent
	C. Visiting as a tourist attraction	10.1 per cent
	D. Expanding scientific horizons	29.5 per cent
	E. Learning about science	27.4 per cent
	F. Other	3.2 per cent
5. What time do you like to choose to come to the Science and Technology Museum? (Multiple choice)	A. Holidays	35.25 per cent
	B. Summer and winter holidays Saturdays and Sundays	34.12 per cent
	C. Summer and winter holidays Monday to Friday	20.16 per cent
	D. Other	10.47 per cent

From the data, we can see a simple survey of the basic information of the Science and Technology Museum's audience, the purpose of the museum visit and the reason for the time. In terms of age, 84.6% of visitors are over 8 years old, which suggests that visitors of this age have their own choice of preference, and they will choose the area they want to visit according to their own ideas; Regarding the question of "the purpose of coming to the Museum of Science and Technology", from the data, the number of people who choose leisure and recreation, relaxation, broadening scientific horizons and learning scientific knowledge is higher than others. From the viewpoint of the visitors, the Science and Technology Museum is the best place to visit. From the viewpoint of visitors, the construction of science and technology museums is necessary, and people visit science and technology museums in the hope that they can relax and broaden their scientific horizons and conform to the national positioning of science and technology museums to improve the scientific and cultural quality of the public and disseminate scientific knowledge. It can be seen that the visitors to the Museum of Science and Technology time is concentrated in the summer and winter vacations on Saturdays and Sundays or holidays, the trip will usually choose the parents of children free time to play, part of the other time to visit, it can be seen that the primary and secondary schools in Nanjing are organized to visit the Museum of Science and Technology every semester for the collective visit of students, which are consistent with the data of this survey[4].

3.2. Designing Personalized Experiences for visitors

When designing personalized experiences, we use artificial intelligence technology to offer customized technological interactive experiences for different visitors.

(1) Personalized recommendations based on visitor data: According to visitors' interests and preferences, we select preferences for various exhibition projects through data screening, such as interactive experience with AI exhibits, science and technology knowledge popularisation and education, and interesting Q&A experience, and recommend suitable exhibits and interactive projects for each visitor to enhance the immersive experience of the Museum of Science and Technology for visitors.

(2) Personalized experience of cloud visit: By using social media to promote the activities and exhibits of the Science and Technology Museum, visitors can access the digital exhibits with the help of virtual reality, augmented reality and other technologies on the Network Science and Technology Museum platform to visit the museum in the cloud. At the same time, visitors can view the exhibits from an all-round, multi-angle and multi-vision perspective, select the exhibition area for directional viewing, and shorten the booking time to provide visitors with an online convenient visit experience.

(3) Voluntary services: Utilizing artificial intelligence technology to calculate peak times for science and technology visits, selectively and reasonably arranging the number of volunteers to assist visitors, enabling volunteers to guide and release the flow of people in the Science and Technology Museum to prevent overcrowding in the Science and Technology Museum and guiding the planning of reasonable arrangement of routes, while, explaining the details of the the Science and Technology Museum exhibits to visitors to give them a satisfactory experience of the Science and Technology Museum.

(4) Interactive communication and emotional recognition: through artificial intelligence to recognize the emotional state of visitors, real-time adjustments to the display content and

interactive methods, while at the same time on the network to conduct online voting and discussion activities, to encourage the public to participate in science and technology museums to discuss and make rationalization suggestions support and actively encourage visitors to participate in the construction and development together. Improve visitor participation and satisfaction and rationalize emotional adjustment.

4. Conclusion

This paper illustrated by the study of artificial intelligence fusion to the science and technology museum exhibition space has a certain value, while the exhibition space of each region of the design division will show the function of the science and technology museum in depth, refreshing.

In the design of the exhibition area, the most advanced exhibits of AI technology were used, which are both the charm of human history and the integration of technological innovation. The design of the exhibition area allows visitors to be the first to experience the development of science and technology, and at the same time, AI is integrated into every detail of the exhibition area. And virtual reality technology is applied to all aspects of the exhibition, such as the restoration of settings and exhibits. In this way, visitors can create a unique atmosphere, and see and touch more historical and immaterial contents in the full immersion experience, so that visitor's multidimensional senses are fully mobilized, and they can experience the exhibits on display in the process of "Seeing, Hearing, Touching and Understanding". In this way, users can mobilize their multidimensional senses to the maximum so that they can "see, hear, touch and understand" the indescribable charm of the products on display, and gain comfort and psychological satisfaction, so that virtual reality technology creates real added value [5].

When using the exhibits, it becomes clear that the exhibits are easy to use and interactive, so that scientific and technological knowledge can be conveyed and explained in an interactive way. Furthermore, interacting with the scientific and technological exhibits stimulates visitors' interest and curiosity, arouses enthusiasm for thinking and innovation, and has a certain enlightening effect on learning about artificial intelligence.

With the development of society and the advances in science and technology, the scientific literacy of the public has improved. Students of the new era are no longer satisfied with the "indirect experience" of acquiring scientific knowledge in the classroom, they want to go to science and technology museums to have the "direct experience" of operating interactive and dynamic demonstration-type exhibits to acquire scientific knowledge [6]. In the process of

future development and scientific and technological innovation, science and technology museums, as the carriers of popular science education, are able to convey scientific knowledge to the public in a more intuitive and interesting way and improve scientific and technological literacy. By presenting the latest scientific and technological achievements and innovative technologies, the museum can arouse the public's interest in scientific and technological innovation, promote scientific research and technological development, encourage industry to invest in new technologies, research and development, and promote industrial modernization and innovation. Moreover, socialized experiences and international cultural exchanges help to promote understanding and cooperation between different cultures and form a global scientific and technological cultural community. The event provides rich and diverse technology experiences and plays an active role in improving the efficiency of resource utilization, promoting green technological innovation and facilitating the development of society towards sustainable development.

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