Opportunities, Challenges and Suggestions for Creating Embodied Interaction Scenes for Tourists in Cultural and Tourism Scenic Spots from the Perspective of the Metaverse

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Abstract: The virtual-real integration characteristic of the metaverse brings new application scenarios for the high-quality development of cultural and tourism scenic spots. The values of immersion, embodied interactivity, and content production of culture and tourism metaverse can meet the new needs of the Internet-Generation for plaving experiences. Based on the embodied characteristic of the metaverse, this study conducted in-depth interviews with smart tourism suppliers' managers and collected relevant secondary data to discuss the opportunities and challenges faced by the application of digital technology in cultural tourism scenic spots from the and perspective of the metaverse. It is necessary for cultural and tourism scenic spots to create multiple embodied interaction scenes for tourists by constructing driving scene, content co-creation scene, technology scene, application scene, and marketing scene.

Keywords: Metaverse; Embodied Characteristic; Cultural and Tourism Scenic Spot; Opportunities and Challenges; Scenes

1. Introduction

In 2021, the social media platform Facebook was renamed Meta, which brought the "metaverse" into widespread attention. The concept of the metaverse and its related virtual experiences have had a certain impact on the hotel and tourism industry ^[1]. Although the virtual world cannot replace real-person travel, virtual technology makes tourism scenes more and more immersive, and then promotes digital natives to participate in metaverse tourism ^[2]. Cultural and tourism enterprises hope to create new hotel and tourism experiences, products, and services for consumers through the related

technologies and scene creations of the metaverse. Therefore, this article conducts a literature review on the relevant concepts and characteristics of the metaverse. Based on the embodied characteristics of the metaverse, it analyzes the opportunities and challenges faced by cultural and tourism scenic spots in the current metaverse and puts forward suggestions for creating embodied interaction scenes for tourists.

2. Literature Review

2.1 The Concept of Metaverse

The term "metaverse" first appeared in Neal Stephenson's science fiction novel "Snow Crash" published in 1992^[3]. The concept of "Avatar" was also proposed in the book. In the novel, the "metaverse" represents a parallel social virtual world created by computers^[4]. As the scope of the metaverse expands, there

are various different definitions. Some scholars believe that immersive or interactive online games are the predecessors of the metaverse. In games, users create avatars and interact with other players ^[5]. But now, the metaverse is often expressed as a medium for social interaction centered on exchanging interests and content^[6]. There are also scholars who define the metaverse by integrating concepts of technology and society. For example, the metaverse is an immersive socialized internet environment of a persistent and multi-user platform that integrates virtual environments, digital objects, and people for multi-sensory interaction based on the fusion of technologies such as VR and AR^[4]. The metaverse is a post-internet form with high immersion and strong interactive experience characteristics. which is comprehensively composed of emerging technologies such as the internet, artificial

intelligence, virtual simulation technology, augmented reality, and blockchain ^[7]. In fact, the metaverse is the virtualization of real society with the help of advanced technologies. It greatly influences human economic and social life, breaks the current rules, systems and barrier restrictions, and has interoperability with cultural and tourism enterprises in aspects such as scenes, business forms and paths ^[8].

2.2 Embodied Characteristics of the Metaverse

Embodiment is a hot topic in cognitive science. "Embodiment" means that body parts, body movements or body representations play a key role in cognition ^[9]. The metaverse is a highly immersive virtual space for the body. Body embedding technology realizes the integration of human and machine and continuous presence [10] The metaverse enables the body's perception to feel the scene and interact through technologies such as sensors and virtual reality terminals with the help of "avatars" [11]. The embodied interaction and virtual-real integration experience in the metaverse, on the one hand, need to achieve multi-sensory immersive experience through virtual reality technologies such as visual displays, HMD (head-mounted displays), and 3D rendering technologies ^[12]. On the other hand, "usergenerated content" and "Second Life" will bring new forms of participation ^[13]. Users use avatars to interact seamlessly in real and simulated environments. In addition, people's cooperation through social networks. and sharing collaboration and role dialogues in the virtual world create new values^[14].

2.3 Research on the Metaverse in the Cultural and Tourism Industry

Scholars have discussed the impact of the metaverse on the hotel and tourism industry from perspectives such as virtual tourism experience, customer value co-creation, and the impact at different stages of tourism. Gursoy, Malodia, and Dhir (2022) proposed a framework of conceptual four-quadrant metaverse virtual experience based on interactivity and motivation types, believing that the hotel and tourism industry must create unique immersive experiences to attract users' multi-sensory experiences ^[2]. Buhalis, Lin, and Leung (2022) regard metaverse tourism as a part of user experience and value co-creation. In

the interaction between tourism enterprises and users, customers are empowered by technology to co-create experiences ^[15]. The metaverse emphasizes the immersive interaction of tourists before, during, and after the tour, and supports the intelligent interaction between tourists and tourism organizations and destinations, making tourists dominant in both virtual and actual visits ^[1].

In terms of cultural heritage scenic spots, the metaverse has already been applied to a certain extent, such as the use of technologies like VR and AR. Buhalis and Karatay (2022) studied the cultural heritage experience of Generation Z in an MR environment^[1]. The results show that cultural heritage destinations should consider using MR to enhance consumer experience. Han, Dieck, and Jung (2017) established a user experience model of AR tourism applications in the context of urban heritage tourism ^[16]. Gabellone (2022) used digital twin technology to build a 3D model of a cultural heritage site and developed methods for online virtual tours and on-site guided explanations of cultural heritage-related contextual knowledge ^[17]. The combination of the metaverse and the cultural and tourism industry should not only explore application scenarios around the whole process of tourists' travel, but also need to realize realtime, networking, and visualization through technologies such as 5G and VR in the future [18]

3 Opportunities for Creating Embodied Interaction Scenes for Tourists in Cultural and Tourist Scenic Spots under the Metaverse

3.1 The Digital China Strategy Provides Favorable Policy Support

The Digital China strategy has further promoted the arrival of the digital economy era. Multiple government policies or work reports have mentioned that "metaverse" should be developed as a key area. In the "Action Plan for the Integrated Development of Virtual Reality Applications and Industry (2022-2026)" released in 2022, it was proposed to achieve breakthroughs in key application fields of virtual reality such as culture and tourism and accelerate the implementation of multi-scenario applications of "virtual reality + culture and tourism". In the "Guidelines for the Application of Smart Tourism Scenarios (Trial)" released by

the Ministry of Culture and Tourism in 2022, it is pointed out that "through technology empowerment, rich smart tourism scenarios are created to promote the innovative development and application of new technologies, new models and new forms of business in the tourism field." Ten typical smart tourism scenarios are selected, including encouraging tourism enterprises to use AR, VR, naked-eye 3D, holographic projection, etc. to create immersive scene experiences. The introduction of these metaverse-related policies provides good policy support for the creation of immersive scenes in cultural and tourist scenic spots.

3.2 The Market Scale of Intelligent Devices Is Gradually Growing

At the hardware level, the most critical element affecting the metaverse tourism experience is the device end. The virtual-real integrated experience of the metaverse requires the help of digital terminal technology to interact with existing multimedia hardware devices, and is finally presented on smartphones, PC terminals, and MR glasses. According to IDC data, in 2022, China's AR/VR hardware shipments exceeded 1.2 million units [19]. It is expected that by 2026, China's total investment in AR/VR will exceed 12 billion U.S. dollars. The development of Internet speed and the growing maturity of digital virtual service technology have created a hardware foundation for cultural and tourist scenic spots to create immersive scenes.

3.3 Core Enterprises in Artificial Intelligence Provide Industrial Supply Capacity

From the industrial perspective, the creation of embodied interactive immersive scenes already has certain industrial development conditions. According to the report released by the Shenzhen Artificial Intelligence Industry Association, in 2021, the scale of China's core artificial intelligence industry reached 341.6 billion yuan, and the number of artificial intelligence-related enterprises reached 7,796, showing the characteristics of steady development. From the perspective of industrial chain layout, enterprises in the basic layer of artificial intelligence account for 23.8%, those in the technology layer account for 17.3%, and those in the application layer account for 58.9%. Internet companies such as Tencent, Alibaba, Baidu, Meituan, Huawei, and ByteDance have also cooperated with cultural and tourist scenic spots to create metaverse projects. For example, Alibaba Yuanjing has cooperated with the Xi'an Museum to create the "Yuanjing Boyu" cultural and tourist metaverse project, and the digital virtual person "Ai Wenwen" jointly created by the National Museum of China and Tencent and other projects (see Table 1). The innovative development of the core artificial intelligence industry can empower the development and application of cultural and tourist scenes under the metaverse and enhance industrial supply capacity.

3.4 The Demand for Virtual-Real Integrated Tourism Experience Is Increasingly Prominent

From the consumer side, in the first half of 2022, global metaverse applications received 170 million downloads. Only two months after the launch of "Online Tour of Dunhuang", it received more than 12 million online visitors. In the Spring Festival of 2023, at least 24 museums issued cultural and museum digital collectibles. These digital collectibles were sold out immediately after being launched, and the purchasers were mainly history enthusiasts and young people of Generation Z. "Report on Gen-Z Tourism Consumption Trends" released in 2022 shows that "immersive experience of walking around" is an important travel style for Generation Z. More than half of them have watched cloud live-streaming tourism, among which 11.4% watch it frequently. The values of immersion, embodied interactivity and content production of metaverse tourism can meet the new needs of the Internet generation for playing experience

 Table 1. Metaverse Projects Cooperated by Internet Companies and Cultural and Tourist

 Scenic Spots

Metaverse Projects	Names	Functions	Cooperating Party
Avatars	"Ai Wenwen"	Having self-learning and self-adaptive capabilities, it can continuously update and enrich its knowledge base and explain	National Museum of China, Tencent

		cultural relic collections for global tourists who come here admiringly.	
	"Liu Sanjie"	It can sing folk songs and promote the beautiful landscapes of Guangxi in multiple languages.	Department of Culture and Tourism of Guangxi Zhuang Autonomous Region, Guangxi Tourism Development Group
	"Art Goose"	It has an exclusive "knowledge base", and the audience can have informative, interesting and emotional conversations with it.	National Grand Theatre, Baidu
	"Gu Xiaoyu"	It settles in the offline interactive screen of Deshou Palace as an "AI digital guide" to provide guidance and answers for tourists in the museum.	Zhejiang TV Station, Tencent
	"Qin Xiaoya"	It is the spokesperson of Qinqiang art and the official NPC of Qinqiang. Through diversified products such as related animations and movies, the growth of Qinqiang people is integrated into it, the spirit of Qinqiang is refined, and Qinqiang culture is told.	Xi'an Performing Arts Group, Xi'an Future Shape Interactive Entertainment Co., Ltd.
Virtual Experience Project	Zhangjiajie Planet	Construct a virtual world of Zhangjiajie scenic area through digital twin technology.	Zhangjiajie Metaverse Research Center, Zhangjiajie Branch of China Mobile Communications Group Hunan Co., Ltd., Migu Culture and Technology Co., Ltd.
	City of Fisherman's Lights	Based on the real event of the first successful rescue of a large sperm whale in China, integrating the harbor theme and the local natural and human landscapes, the scenes of Shipu town's fishing port, ancient town, Dongmen Island, temples, civilian houses, fishing boats and other scenes are digitally restored.	Ningbo Kaiyan Culture Development Co., Ltd., Meta Culture and Technology Co., Ltd.
	Datang · Kaiy uan	Build a building sand table of Chang'an City in the Tang Dynasty on a one-to-one scale according to the real proportion to restore the historical features of Chang'an City.	Xi'an Qujiang Datang Ever- bright City Culture and Commerce (Group) Co., Ltd., Taiyi Group
	Adventure Little Prince Metaverse Theme Park	Combined with AR, VR, and holographic projection technologies, it brings tourists a new immersive amusement experience and interesting interactivity.	Shenzhen Fairy Tale Dad Cultural Tourism Technology Co., Ltd., Shenzhen Huafu Information Technology Co., Ltd., Guangzhou S.P.I Design Co., Ltd.

Source of information: sorted out according to Baidu News.

4. Challenges of Creating Embodied Interaction Scenarios for Tourists in Cultural and Tourist Scenic Spots under the Metaverse

Technology Base

The metaverse creates a seamless switch between the real world and the virtual world. In this process, technologies and equipment such as XR play a connecting role. For XR equipment to achieve a real sense of immersion, higher resolution and frame rate, high-speed and

4.1 Limitations of the Metaverse

low-latency mobile communication technology and video compression algorithms are required. AI intelligent speech recognition requires automatic recognition, understanding and generation of speech in natural language. AI technology requires more advanced deep learning to allow users to freely explore and create. At present, intelligent sensors and intelligent chips are still the main factors restricting the development of China's artificial intelligence industry. The fatigue of the head and neck caused by the weight of VR headsets is also a limitation for long-term use [4]. Therefore, a better embodied experience in the metaverse cultural and tourism scene also depends on the development of relevant unique specialized, refined, and new technologies, such as the update and iteration of technology, digital twin intelligent somatosensory equipment, and digital virtual human technology.

4.2 The Benefits of Intelligent Construction of Cultural and Tourist Scenic Spots Are Not Obvious

According to the "2023 Statistical Bulletin on Cultural and Tourism Development", as of the end of 2023, there are 15,721 A-level scenic spots in the country. According to interviews, some scenic spots mainly purchase projects for infrastructure Wi-Fi, (e.g. monitoring, broadcasting, etc.), front-line business application (e.g. ticketing, secondary sales, etc.), network service platforms (e.g. e-commerce, APP, WeChat, mini-programs, etc.), and operation management platforms (e.g. public opinion detection, big data centers, tourist statistics analysis and intelligent scheduling, etc.), which are mainly for tourist services and comprehensive management. The procurement cost of these projects is relatively high, and the procurement cost of cultural and tourism complexes is even higher. Metaverse scenes such as digital virtual technology lack technical standards and national standards, and the costs are not uniform. The procurement cost has increased significantly. Only some large leading scenic spots have the strength to purchase. In addition, the output effect of investments in virtual experience technologies such as the metaverse is not as obvious as that of business and operation management categories in actual operations. Therefore, some cultural and tourist scenic spots hold a reserved attitude towards

metaverse scenes.

4.3 Room for Improvement in the Innovation of Digital Experience Products in Scenic Areas Still Remains

Before the metaverse concept became popular, virtual technology had already developed some virtual tourism scenarios, such as VR experience in scenic spots, AR display scene experience in cultural heritage scenic spots and museums, MR intelligent guide in museums, intelligent voice robots, driverless cars in scenic spots, and holographic image presentation of large-scale performing arts shows.

However, limited by technology, cost and other factors, the digital products provided by cultural and tourist scenic spots currently still have a big gap from the characteristics of the metaverse such as virtual-real integration, deep immersion, and human-computer interaction. At present, mainly the elements of the metaverse are used to extend the experience, such as developing digital collectibles, virtual clothing, virtual tour guides, etc., while the avatar identity, social network, content production, and value cocreation centered around "virtual digital humans" are still in the initial application form. The creation of digital experience products and scenarios still needs to be innovated around "second life" and "content production" in the future. According to interviews, there are phenomena of imitation and following the trend in cultural and tourist scenic spots, leading to homogeneous competition. Therefore, how to better excavate the IP value and cultural characteristics of the scenic spot itself and create differentiated tourism products is also a problem that needs to be solved.

4.4 Potential Data Security Risks and Social Ethical Risks Still Exist

In order to better carry out user experience, tourism enterprises need to collect some user information and biometric information, such as face information, volume capture data, spatial positioning, etc. Data collection and sharing among all parties may pose potential cyber security threats ^[14]. In addition, in the virtual world, users' conversations may be more exaggerated than in reality, and there may be phenomena such as verbal violence. There are also anti-social behaviors such as sadness, cyberbullying and harassment in the virtual world ^[20]. Therefore, it is necessary to build a legal barrier at the governance level to ensure the privacy and data security of the cultural and tourism metaverse, and also prevent the "social anomie" of the metaverse ^[21].

5 Suggestions for Creating Embodied Interaction Scenarios in Cultural and Tourist Scenic Spots under the Metaverse

5.1 Driving Scene: Gamified Interaction

Cao Guosheng and Li Jie (2023) points that one of the ways to realize the immersive tourism experience in the metaverse is to implant games into interactive scenes ^[22]. Games are considered the predecessor of the metaverse. As an entertainment project with strong interactivity, games not only endow players with avatars but also enable players to integrate into the game environment and participate in creating a virtual world. For example, Robox, known as the first metaverse stock, its core is to simulate the real world. Games have also accumulated a large number of user groups. These groups have a better acceptance of the metaverse. Therefore, when designing scenes, cultural and tourist scenic spots should incorporate the concept of gamification, fully explore the IP culture of the scenic spot, give the game scene a grand historical narrative background, and enhance the participation, interestingness and simulation of the scene by strengthening human-computer interaction and designing new gameplay.

5.2 Content Co-Creation Scene: Culture Integrate into Content Production

China's long-standing traditional culture provides rich digital resources for the reproduction of metaverse scenes. Using the concept of the metaverse to empower the design and development of traditional cultural and products. allowing tourists tourism to understand and perceive Chinese culture through virtual digital products, restoring scenic spots and cultural relics and historic sites with the help of AR/VR technology, "studying" in digital exhibition halls, and using IP virtual tour guides to explain the culture of scenic spots and carry out voice interactions to strengthen the characteristic cultural core of cultural and tourist scenic spots. The second is to let tourists participate in the reproduction of content, endow tourists with individual identities in the metaverse, and build leisure and entertainment

scenes through the creation of digital collectibles and cultural and tourism products.

5.3 Technical Scene: Integration of Virtual and Real World

Gursoy et al. (2022) believes that at present, experiences are unlikely virtual to completely replace real-world hotel and tourism experiences, but the prospect is optimistic ^[2]. The embodied interaction experience of integrating virtual and real is an important supplement to virtual tourism lacking a sense of presence. The first is to extend online scenes to offline ones, such as AR maps and AR real-life exploration games, forming online and offline interaction tasks, allowing tourists to play games while traveling. Secondly, offline scenes are Through digital created online. twin technology and modeling technology, a virtual world based on reality is constructed. For example, completing offline tasks can obtain online economic benefits, and tourists can also enjoy tourism, shopping, visiting museums, etc. in the metaverse, so that tourists can share time and space and interact in real time through virtual avatars.

5.4 Application Scene: Exploration Whole Process of Tourism

Tourism products have the characteristics of service products. The simultaneity and intangibility of production and consumption mean that the metaverse can feel the atmosphere and service of scenic spots in advance through the virtual world. For some users who cannot actually visit, the scene experience before traveling will stimulate their potential travel motives. The whole process of tourism is to fully explore typical application scenarios in all links before. during, and after traveling. For example, before traveling, AI technology generates tourist routes in scenic spots and provides panoramic experience of tourism scenes to provide convenience before traveling; during strengthen traveling, the cultural characteristics of scenic spots through game interaction; after traveling, through open and free creations such as travel notes vlogs and live broadcasts sharing, promote service, ritual, and emotional connections between tourists and scenic spots.

5.5 Marketing Scene: Bring Forth New Ideas into Business Model

Metaverse tourism is an ecosystem that generates a creative economy through virtual connections, physical connections, and the connection between virtual space and the real world. It has four business models: AR, lifelogging, mirror worlds, and virtual worlds ^[23]. It can be seen that the tourism scene in the metaverse can stimulate new Through business models. immersive technologies such as AR, VR, and MR, tourists can turn to 3D virtual space. In addition to the "try before you buy" brought virtual technology, the metaverse by constructed by integrating "culture and tourism + other industries" can drive the sustainable development of cultural and tourist scenic spots through social attributes and virtual digital human functions such as virtual music festivals, concerts, national trend festivals, secondary anime festivals, and Hanfu festivals. Research on tourists' purchasing patterns in the metaverse can also promote consumption in real tourist scenic spots. The metaverse culture and tourism centered on web.3.0 enhances the brand and positioning of cultural and tourist scenic spots through digital twin technology, can effectively change the behavior of tourists and stimulate real tourism.

6. Conclusions

The metaverse provides new opportunities and development space for the development of cultural and tourist scenic spots. Of course, we should also see the existing challenges and difficulties. Cultural and tourist scenic spots should be aware of the future trends brought about by changes in consumer demand and technological changes, innovate experience content, incorporate tourist immersive, embodied, social, and value cocreation characteristics of the metaverse in scene creation, and promote high-quality development of cultural and tourist scenic spots.

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