



Research on the Digital Development and International Communication Innovation Path of Museum Resources in Inner Mongolia Autonomous Region

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Abstract: Digital narrative has provided a new paradigm for the digitalization and international communication of museum resources. The museum resources in Inner Mongolia Autonomous Region, featuring distinct ethnic and regional traits, serve as a vital carrier of the pluralistic and integrated Chinese civilization. However, in the practice of digital development and international communication, these resources are confronted with practical predicaments, such as superficial application of technology, insufficient content innovation, and weak cross-cultural communication capacity. Based on the theory of digital narrative, this paper analyzes the core characteristics, current development status, and existing bottlenecks of museum resources in Inner Mongolia. It puts forward targeted innovative paths from three aspects: technological empowerment, content innovation, and communication optimization, and constructs a comprehensive guarantee system integrating talents, funds, policies, and industry-university-research cooperation. The research aims to promote the upgrading of grassland culture from digital archiving to digital narrative communication, enhance the international communication power and influence of grassland culture, and provide theoretical reference and practical models for the digital development of museums in ethnic minority areas and the international communication of their cultures.

Keywords : Digital Narrative; Museum Resources; Digital Development; International Communication; Grassland Culture; Inner Mongolia Autonomous Region

I. INTRODUCTION

Driven by the dual impetus of the Digital China initiative and the strategy of building a strong cultural nation, museum digitization has become a core trend in the preservation and dissemination of cultural heritage [1]. By virtue of cutting-edge technologies like virtual reality (VR), augmented reality (AR), and digital twins, digital storytelling breaks the temporal and spatial constraints in the dissemination of museum resources, enabling interactive, immersive, and multi-dimensional expression of cultural content. This has built an effective bridge for the cross-cultural dissemination of cultural heritage. Endowed with a rich heritage of grassland nomadic civilization, the Inner Mongolia Autonomous Region boasts abundant museum resources, including cultural relics of ancient northern ethnic groups and intangible cultural heritage of the grasslands. Nevertheless, the level of digital development in the region does not match its rich resource endowment, and traditional dissemination models can hardly meet the cultural communication needs of the digital age. Thus, the international influence of grassland culture urgently needs to be enhanced.

A review of the current domestic and international research status shows that the digital development of museums abroad started earlier, with a user-centered digital narrative practice system already established [2]. Domestically, research has mainly focused on the digital exploration of top-tier museums such as the Palace Museum and the Dunhuang Academy, while there is a noticeable lack of specialized research on the construction of digital narratives and the establishment of international communication systems for museums in ethnic minority areas [3]. Adopting methods of literature review, field research, and case analysis, this paper combines the actual situation of digital development in museums of the Inner Mongolia Autonomous Region, explores innovative paths for digital development and international communication from the perspective of digital narrative. It enriches the applied research of digital narrative in the field of ethnic minority museums and provides practical guidance for the digital construction of museums at all levels in Inner Mongolia, which holds both theoretical and practical value.



II. CONNOTATION, CHARACTERISTICS, AND APPLICATION VALUE OF DIGITAL STORYTELLING

A. Core Connotation

Digital storytelling represents an in-depth integration of digital technology and narrative art. It refers to the use of digital means to convert cultural content into story-driven, interactive, and multi-dimensional narrative texts, and promotes cultural dissemination and meaning construction through various forms such as text, images, sound, and virtual scenes [4]. It breaks the traditional one-way communication model of "narrator-audience", endows the audience with more participation and choice rights, and transforms them from passive recipients of cultural content into active participants and co-creators of meaning. In the field of museums, digital storytelling takes cultural relic resources as the core material and technology as the medium, transforming cultural relics from "static display" to "dynamic storytelling". Its core principle is "using technology to convey culture", which enables the vivid display of the historical culture and national spirit behind cultural relics.

B. Core Features

Digital storytelling has four core characteristics that adapt to the communication needs of museum resources: First, interactivity. It allows the audience to independently choose narrative paths and explore cultural content through human-computer and interpersonal interaction, thereby enhancing the sense of participation in visiting exhibitions [5]. Second, immersion. It uses technologies such as VR/AR to construct virtual historical scenes, and achieves in-depth connection between the audience and the cultural content through multi-sensory stimulation [6]. Third, multi-dimensionality. It integrates various carriers such as text, images, audio, and 3D models to comprehensively display the cultural connotation of museum resources [7]. Fourth, cross-temporal and cross-spatial nature. Relying on the Internet and mobile terminals, it realizes borderless dissemination of cultural content, providing possibilities for the international dissemination of museum resources [1].

C. Application Value

Digital storytelling has important value in the digitalization and international communication of museum resources: First, it promotes the dynamic inheritance of museum resources. By restoring the connotation of nomadic cultural heritage, which is characterized by mobility and experience, through virtual scenes, it facilitates the intergenerational inheritance of grassland culture. Second, it improves the effectiveness of cultural communication. With stories as the core, it reduces the difficulty of cultural understanding and enhances the audience's memory and emotional resonance [3]. Third, it breaks down cross-cultural communication barriers. Through intuitive expression forms such as visual and auditory communication, it adapts to the cognitive habits of international audiences and reduces cultural misunderstandings [2]. Fourth, it enriches the public service functions of museums, promotes the transformation of museums from "cultural relic collection institutions" to "cultural communication platforms", and realizes the in-depth integration of cultural resources with education, cultural tourism, and cultural and creative industries [8].

III. CURRENT STATUS AND CHALLENGES OF DIGITALIZATION OF RESOURCES IN INNER MONGOLIA MUSEUMS

A. Core Characteristics of Resources

The museum resources in the Inner Mongolia Autonomous Region have distinct uniqueness: First, prominent ethnicity. Centered on grassland nomadic civilization, they include cultural relics of ancient northern ethnic groups such as the Xiongnu, Xianbei, and Mongolians, as well as intangible cultural heritage such as Mongolian long-tune and Nadam Fair, serving as the core carrier of nomadic civilization. Second, distinct regionality. Closely linked with the geographical environment and ecological culture of the grasslands, they present diverse cultural characteristics of different regions such as the Liao Dynasty, Western Xia, and Mongolians, reflecting the ecological wisdom of nomadic peoples in harmonious coexistence with nature. Third, diverse resource types. Tangible and intangible cultural heritage coexist, forming a complete cultural communication system. Fourth, profound historical heritage. They have witnessed the exchange and integration between northern nomadic peoples and Central Plains agricultural peoples, highlighting the development track of the pluralistic and integrated Chinese civilization [9].

B. Current Status of Digital Development

In recent years, driven by the cultural and tourism department of the Inner Mongolia Autonomous Region, museums at all levels have gradually promoted digital construction and achieved initial results: Firstly, high-precision digital collection of some cultural relics has been realized. The Inner Mongolia Autonomous Region Museum has carried out 3D modeling for more than 700 representative cultural relics, and the Hohhot Museum has established the "Inner Mongolia Mural Digital Protection Technology Base" to promote the digital protection of grassland murals [10]. For instance, the Hohhot Museum adopts 0.1mm precision 3D scanning equipment for the digital collection of fragile murals, focusing on scanning more than 50 endangered murals in the Liao Dynasty tomb area to establish a special digital backup library. Secondly, basic digital experience projects have been developed, including online virtual guide systems, and pilot projects of interactive functions such as AR cultural relic introduction and virtual restoration have been launched in physical exhibition halls. A typical case is the AR mural restoration pilot in the Hohhot Museum, where visitors can scan murals with their mobile phones to view the dynamic restoration process and interactively understand the painting techniques of ancient grassland peoples. Thirdly, initial dissemination has been carried out through new media platforms, with digital resources and cultural relic stories released on WeChat, Tiktok, and overseas social media, attracting a certain degree of international attention. Fourth, the integration of digitalization with research and learning has been promoted, and digital experience courses such as mural restoration have been offered to enhance young people's cognition and identification of grassland culture [10]. Among them, the "Virtual Exhibition of Grassland Nomadic Civilization" created by the Inner Mongolia Autonomous Region Museum has received more than 500,000 online visits within half a year of its launch, of which overseas visits account for 12%, making it an important carrier for the international dissemination of grassland culture.

C. Core Development Issues

Despite some progress in the digitalization of museums in Inner Mongolia, there are still many urgent problems to be solved. The application of technology is superficial. The coverage of digital collection is limited and the precision is insufficient. Frontier technologies such as VR/Metaverse are only tentatively applied, resulting in the formation of "data islands" among museums at all levels and the lack of a unified digital management platform [1]. There is a lack of content innovation. Digital content mainly focuses on displaying basic information of cultural relics, without in-depth exploration of cultural stories. The integration of material and intangible cultural heritage narratives is insufficient, and personalized content for different audiences has not been designed [3]. At the same time, the international communication capacity is weak. The communication platform is single, the cross-cultural narrative transformation is insufficient, international cooperation and exchanges are scarce, and there is a lack of immersive and interactive communication forms [2]. There is a shortage of professional talents, especially those with comprehensive abilities in digital technology, museology, and cross-cultural communication. There is a disconnection between university talent training and the actual needs of museums [4]. The support mechanism is imperfect. Financial investment is limited, there is a lack of special policies for digital development, and the industry-university-research integration mechanism is not sound, making it difficult to form a joint force for development [5].

IV. INNOVATIVE PATHS FOR DIGITAL DEVELOPMENT FROM THE PERSPECTIVE OF DIGITAL STORYTELLING

A. Empowering with Technology to Build an Integrated Digital Technology Support System

Driven by technological innovation, technological application lays a foundation for digital narrative and helps to establish a comprehensive and integrated technical support system. First, comprehensive high-precision digital collection can be promoted through an expanded coverage scope. Technologies such as high-resolution 3D scanning and 8K ultra-high-definition photography can be adopted to construct digital twin models for fragile cultural relics including grassland murals and stone carvings, thus supporting digital preservation and virtual restoration of cultural relics [6]. Specifically, 3D scanning of more than 1,000 representative cultural relics in museums at all levels in Inner Mongolia can be completed within three years. The scanning precision of key cultural relics such as Xiongnu

gold and silver wares and Liao Dynasty murals can be controlled at 0.05 mm, and a unified digital twin database for cultural relics can be established.

Second, immersive digital narrative scenes may be created. VR/AR/MR technologies can be adopted to reconstruct virtual historical scenes such as the Yuan Dynasty Shangdu and the Xiongnu King City, and a “Grassland Cultural Metaverse Museum” can be established to realize spatiotemporally transcendent cultural interaction [7]. Cooperation with local technology enterprises can be carried out to develop VR experience equipment suitable for museum scenarios. More than 5 VR experience zones can be set up in the Inner Mongolia Autonomous Region Museum, focusing on the restoration of ancient Mongolian nomadic life scenes and the grand occasion of the Nadam Fair.

Third, a unified digital sharing platform can be established. Under the leadership of the cultural and tourism department, digital resources across the region can be integrated to support unified storage, management, and sharing of cultural relic information, and connections with domestic and international cultural digital platforms can be enhanced [9].

Fourth, the integration of digitalization and cultural relic protection can be promoted. Digital technology can be used to monitor the preservation status of cultural relics in real time. The cultural relic restoration process can be transformed into digital narrative content to help enhance public awareness of cultural heritage protection [10].

B. Developing a Digital Narrative System with Grassland Cultural Characteristics

Taking grassland culture as the core, further exploration can be conducted into its cultural connotation to construct a digital narrative system integrating ethnicity, storytelling, and interactivity. Firstly, core narrative themes can be explored. Focus can be placed on topics such as nomadic civilization, ethnic integration, grassland ecology, and national spirit to build a narrative content system with regional characteristics and comprehensively display the core values of grassland culture [1]. Secondly, integration of material and intangible cultural heritage narratives can be achieved. The connotation of intangible cultural heritage can be extended with cultural relics as the carrier, and integrated narrative works such as *Bronze and Pastoral Songs* and *Grassland Homeland* can be created to fully display the diverse characteristics of grassland culture [8]. For example, with Mongolian long-tune intangible cultural heritage as the core, a digital documentary series *Grassland Long Tune and Bronze Relics* can be created to link the rhythm of long-tune with the historical background of bronze relics unearthed in Inner Mongolia and present the cultural connotation of grassland nomadic civilization in an intuitive way. Thirdly, hierarchical and personalized narrative design can be implemented. Game-based challenge narratives can be provided for young people, memory-awakening narratives for middle-aged and elderly people, and cross-cultural symbol transformation for international audiences [2]. For international audiences, the horse-head fiddle can be transformed into a visual symbol with simple lines and strong recognition, and matched with short English narratives to reduce cross-cultural understanding barriers. Fourth, diversified creation of narrative content can be promoted. Various forms such as digital documentaries, interactive mini-games, and digital cultural and creative products can be developed. Public participation in creation can be encouraged to enrich the forms of digital narrative [3].

C. Constructing a Multidimensional International Digital Communication System

With the goal of international communication, communication resources can be integrated and communication methods innovated to build a multidimensional international digital communication system. Firstly, a three-dimensional communication matrix can be established. A communication system of “offline physical exhibition halls + online multilingual digital platforms + domestic and foreign new media” can be built to realize systematic and multi-channel dissemination of grassland culture [4]. Specifically, official accounts can be launched on overseas social media platforms such as Facebook and YouTube. Two to three multilingual (English, Russian, Mongolian) digital short videos can be released monthly to focus on the introduction of grassland cultural relics and intangible cultural heritage. Each video can be attached with simple cultural background explanations to adapt to the cognitive habits of international audiences. Secondly, cross-cultural narrative transformation can be promoted. Core cultural symbols such as horse-head fiddle, yurt, and Nadam Fair can be transformed into internationally recognized visual symbols to adapt to international narrative logic

and achieve accurate multilingual translation and content localization [2]. Thirdly, international cooperation and exchanges can be strengthened. Digital special exhibitions of grassland culture can be jointly created with top international museums. Exclusive channels for grassland culture can be opened on international cultural platforms. Participation can be enhanced in exchange activities of the International Council of Museums [9]. Fourth, integrated communication with cultural tourism and cultural and creative industries can be promoted. A “digital museum + grassland tourism” model can be constructed. Physical and digital cultural and creative products can be developed. Integration of narrative content with film, television, animation, and comic industries can be promoted to achieve breakthrough development in cultural communication [10].

Successful international communication practices of domestic cultural institutions offer clear lessons for grassland culture publicity. The Palace Museum has continuously released multilingual cultural content on overseas platforms such as YouTube and Facebook, establishing a stable international communication matrix and lowering cross-cultural understanding barriers through visual storytelling. Dunhuang Academy has held joint digital exhibitions with foreign museums and launched multilingual documentaries, effectively expanding global influence. These mature operation modes can serve as an important reference for shaping the international communication path of Inner Mongolia’s grassland culture.

V. DIGITALIZATION AND THE SUPPORTING SYSTEM FOR INTERNATIONAL COMMUNICATION

A. Establishing a Composite Talent Cultivation System Featuring "Local Training + External Introduction"

In response to the talent demand for museum digital development, a comprehensive talent cultivation system can be established. Curriculum reforms can be promoted in related majors such as museology, digital media art, and communication in universities in Inner Mongolia. Courses such as digital narrative and cross-cultural communication can be introduced, and internship bases can be jointly established with museums to cultivate local professional talents [5]. Specifically, curriculum adjustment for the museology major can be conducted in Inner Mongolia Honder College of Arts and Sciences and other local universities. A total of 36 class hours of digital narrative courses and 24 class hours of cross-cultural communication courses can be added each academic year. More than 3 internship bases can be established with the Inner Mongolia Autonomous Region Museum and Hohhot Museum to realize the integration of theoretical teaching and practical operation. Preferential policies for talent introduction can be formulated to attract professionals in fields such as digital technology, international marketing, and cross-cultural communication. Regular training sessions on digital technology and international communication can be organized for existing staff to improve professional capabilities [1]. For instance, a “dual-mentor” mechanism can be established between local universities and museums, where university supervisors offer theoretical instruction and museum experts provide field guidance in digital relic collection and immersive exhibition design. Meanwhile, advanced expertise can be introduced through university-enterprise cooperation, such as the technological support provided by Tianjin University for digital heritage protection at the Dunhuang Academy. Ningbo University’s micro-major program in digital museology also offers a reference for designing targeted courses to cultivate local professionals. In addition, professional training bases can be built to upgrade the digital and international communication capabilities of in-service museum staff.

B. Establishing a Diversified Funding System

Breaking away from the single fiscal appropriation model, funding sources can be expanded. Special fiscal appropriations can be increased, and a special fund for the digital development of Inner Mongolia museums can be established to give priority to supporting the digital collection of cultural relics and the creation of digital narrative content [2]. Through policy support, enterprises and social organizations can be guided to participate in digital construction, and activities such as collaborative development and brand sponsorship can be carried out [3]. For example, preferential tax policies can be introduced to encourage local technology enterprises to participate in the construction of the "Grassland Cultural Metaverse Museum", and a revenue-sharing mode of cultural and creative

products can be adopted to attract social capital investment. Participation in international cultural heritage protection projects can be enhanced. Financial support from international organizations and foreign foundations can be sought to provide financial support for international communication.

C. Improving Top-Level Design and Overall Planning

Government top-level design can be strengthened to establish a comprehensive policy support system. A special plan for the digital development of Inner Mongolia museums can be issued to clarify development goals, phased tasks, and implementation paths, and to coordinate digital construction of museums at all levels [4]. Tax incentives and financial support policies can be formulated to encourage industry-university-research cooperation between museums, universities, and enterprises. Protection of cultural intellectual property rights can be strengthened, and policies for the protection of digital content related to grassland culture can be improved. Museum digital development can be incorporated into the overall planning of a culturally strong region, and coordinated promotion can be achieved with cultural tourism integration, international cultural exchanges, and other related work [5].

D. Establishing a Multi-Party Collaborative Innovation System Integrating Industry, Academia, and Research

An industry-university-research integrated innovation system featuring "museums + universities + technology enterprises + cultural institutions" can be established to integrate resources from all parties. As the core subject, museums provide cultural relic resources and cultural needs; universities provide theoretical support and talent support; technology enterprises provide cutting-edge digital technology and technology development services; cultural institutions provide communication channels and international cooperation resources [9]. Joint laboratories and digital creation centers can be established to conduct digital narrative technology research, content creation, and international communication planning, and to improve the innovation capacity and practical effect of digital development [10]. For example, the "Grassland Culture Digital Narrative Innovation Center" can be jointly established by the Inner Mongolia Autonomous Region Museum, Inner Mongolia Honder College of Arts and Sciences, and local digital technology enterprises to focus on solving technical and content problems in the digital narrative of museum resources.

VI. CONCLUSION AND OUTLOOK

Digital storytelling is an important tool to promote the digital development and international communication of museum resources in the Inner Mongolia Autonomous Region. However, the current digital construction of museums in Inner Mongolia still faces multiple challenges in technology, content, communication, talents, and mechanisms. Only by establishing an integrated digital technology support system based on technology, building a digital narrative system with grassland cultural characteristics as the core, constructing a multi-dimensional international digital communication system with communication as the key, and improving a comprehensive support system with talents, funds, policies, and industry-university-research integration as the guarantee, can realize the in-depth integration of digital technology and grassland culture. This will promote the transformation of grassland culture from "static display" to "dynamic storytelling" and from "local dissemination" to "international dissemination", thereby enhancing the international communication power and influence of grassland culture.

This paper still has certain limitations, lacking empirical analysis on the specific creation models of digital narrative content and the specific methods of cross-cultural narrative transformation. In the future, empirical research on digital narrative projects can be carried out based on the actual cases of Inner Mongolia museums to deeply explore the creation path of grassland culture digital narrative. At the same time, a scientific evaluation system for digital development effects should be established to provide a basis for practical optimization. With the continuous iteration of digital technology, Inner Mongolia should further explore the application of cutting-edge technologies such as metaverse, artificial intelligence, and blockchain in digital narrative, deepen international cultural exchanges and cooperation, make grassland culture an important business card for Chinese culture to go global, and contribute to enhancing the international communication power and soft power of Chinese culture from the northern border [1].

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