Research on the Construction of Information Content in Digital Interactive Communication of Architectural Sites

Sha Chunfa[1], Zhao Yijing[2*], Liu Xuan[3]

Shachunfa@ujs.edu.cn[1], 1374283472@qq.com[2*], 2024696433@qq.com[3]

School of Art, Jiangsu University, Zhenjiang, China

Abstract: Architectural heritage sites represent tangible remains of historical intangible culture. Digital interactive communication employs digital media to disseminate information to users while enabling interaction, providing users with a richer experience. However, it also encounters various issues, including optimizing information narration and user interactive experience. This research emphasizes the critical role of narrative design and interactive information design, considering multiple influencing factors to enhance users' understanding, engagement, and interactive experience with architectural heritage sites. It leverages database construction and content element extraction for information content creation, aiming to meet user needs and expectations.

Keyword: Digitalize interactive communication; Architectural relics; Information content construction; Information Design

1. Introduction

Architectural heritage relics serve as crucial material carriers of human spiritual civilization, possessing rich cultural connotations and values. Various forms of preservation and dissemination, such as physical restoration at the original or relocated sites, the development of heritage parks for tourism, and the exhibition of related artifacts in museums, have effectively protected and conveyed the cultural significance of these sites. However, physical restoration is associated with high costs and the potential for irreversible damage. Recurring 'maintenance-induced' damage is a common issue. Additionally, due to temporal and spatial constraints, heritage parks, museums, and similar exhibition formats often fall short of authentically replicating the original appearance of heritage sites. This limits the expression of architectural functional value and weakens the visitor experience, often leading the audience to remain in a state of superficial perception, characterized by a mere 'visit and go' attitude.

In the digital age, interactive media has provided diverse formats for the virtual reconstruction, representation, and dissemination of architectural heritage sites, fundamentally changing the traditional approach to heritage site cultural communication. This presentation mode is characterized by its intuitiveness, strong interactivity, and comprehensive exhibition of heritage site cultural knowledge, resulting in rapid development. However, due to the inadequate platform or application information architecture for information dissemination, the communicated information lacks systematization, exhibits low relevance to heritage site culture,

ICIDDT 2023, November 03-05, Zhenjiang, People's Republic of China

DOI 10.4108/eai.3-11-2023.2342222

and suffers from unclear thematic presentation. Therefore, its attractiveness is limited.

2. Connotations of Architectural Heritage Sites

Architectural heritage sites represent historical remnants of human activities, constituting clusters of buildings constructed for various purposes. Often, their above-ground structures are in a state of poor preservation or have entirely disappeared. However, this does not rule out the presence of abundant artifacts and traces buried underground[1]. They serve as vital tangible evidence of the development of human material culture, characterized by their humanistic aspects, incompleteness, and immobility. These sites are numerous, widely distributed, spanning different ages and regions, and exhibit significant variations in terms of their state of preservation, remnants, and environmental conditions.

3. The concept and current situation of digital interactive transmission

3.1 Concept of Digital Interactive Communication

Digital interactive communication is a method of disseminating information to users through digital media. Leveraging digital interactive technology, it involves processing and presenting information, including language, text, images, audiovisuals, and more, on digital platforms. Users can engage in dynamic interactions and information sharing with the information and other users, making this form of communication bidirectional, real-time, and highly efficient.

3.2 Constituent Elements of Digital Interactive Communication

Taking an information dissemination perspective, the digital interactive communication process primarily comprises four fundamental elements.

Firstly, the communicator serves as both the provider of information and the organization or system responsible for transmitting it. Secondly, the medium functions as the carrier and medium for information transmission. It acts as the platform for delivering information, encompassing various interactive mediums such as internet terminals, mobile devices, and computers, including mobile applications. It's important to note that the choice of the interactive medium significantly influences the construction of information content. The third element, the recipient, consists of individuals who receive the information. These users engage with the information through interactive mediums, actively participating in information exchange and offering feedback. Lastly, the information content represents the specific information transmitted through the medium. This content takes various sensory-perceptible forms, including text, images, audio, video, and more. Its role is to intuitively convey information, thereby enhancing the recipient's information reception experience. Additionally, it also encompasses interactive information design based on user behavior, directly impacting the selection of the interactive medium.

3.3 Current Status of Digital Interactive Communication of Architectural Heritage Sites

Digital interactive communication transcends the constraints of physical space and time by creating virtual environments as interactive platforms. Users actively participate in these environments, receive real-time feedback, and engage in interactions with information related to heritage sites.

Utilizing holographic projection-based media, users can perform interactive actions like grasping. This is commonly applied in indoor spaces such as museums, where splendid scenes offer an entertaining way to explore heritage site cultures. However, this approach relies on fixed locations and specialized equipment, limiting its adaptability for disseminating information across various contexts. Additionally, using internet-based interactive media, users can access platforms, web-based H5 content, social networks, and more to conveniently gain insights into relevant information.

Leveraging virtual interactive media, information content is efficiently and engagingly communicated. Virtual Reality (VR) utilizes computers to construct three-dimensional virtual environments of heritage sites. Combined with head-mounted displays and handheld input devices, users experience immersive sensory interactions. 'Plovdiv Timeline' creates virtual scenes that make users active participants, allowing exploration and interactive experiences unrestricted by time and space[3]. Augmented Reality (AR) blends the virtual with the real, identifying environments and allowing real-time interaction without detracting from users' interest in exploring. Baidu uses visual positioning as a core technology to superimpose extensive virtual information onto physical scenes, achieving digital visual representation of the Yuanmingyuan Dashuifa Site (see Fig. 1)[3]. Mixed Reality (MR) extends VR and AR technologies, facilitating natural interactions among people, machinery, and environments. Based on MR devices and technology, Yao Luji designed a mixed reality teaching system for Chinese architectural history, effectively enhancing students' proactive learning and information transmission (see Fig. 2)[4].

Fig. 1. Baidu AR Recreation of the Yuanmingyuan Dashuifa Site

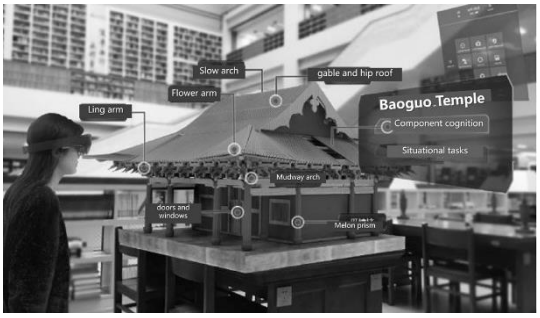

Fig. 2. Interface of MR Chinese Architectural History Teaching System

Building interactive digital scenarios through digital interactive media provides an immersive experience and effectively enhances the dissemination of information content. However, in some cases, the information content delivered is chaotic, lacks a clear theme, and lacks a systematic interactive framework, which can deter user engagement, making it challenging to ensure the long-term dissemination of architectural heritage site culture.

4. Digital Interactive Communication of Architectural Sites

4.1 Architectural Heritage Site Digital Interactive Communication Characteristics

4.1.1 Narrativity of Information Content

Originally referring to storytelling, narratology has evolved to focus on narrative models, the composition of narrative texts, structural principles, and narrative laws.

Currently, heritage site communication through interactive media is plagued by issues such as an unclear narrative theme and a disorganized narrative structure. These problems hinder the effective portrayal of the spatial and temporal narrative characteristics inherent to architectural heritage sites. Introducing narratology concepts such as non-linearity, chronological, and analepsis narratives, as well as different narrative perspectives, can break the limitations of space and time for Information content transmission， encouraging users to engage in autonomous exploration and creative thinking during interaction. Interactive media narratives can nonlinearly represent and narrate the history of architectural heritage sites, and the interactive environment should be more than just a three-dimensional model but an attractive and rich in cultural information digital place[5].

The extraction, processing, analysis, deconstruction, and reconstruction of architectural heritage site-related data help determine narrative texts and further plan narrative themes, narrative perspectives, and narrative logics.

4.1.2 User Experience in Information Interaction

The concept of interactive communication is originally based on human-to-human interaction. In digital interactive communication spaces, it also expands the interaction between people and information, and users, as individuals, perceiving the level of information content after interaction. This reflects their inner emotional inclinations and value orientations[6].

In the current digital interactive communication of heritage sites, the technology often dazzles. Users engage in the experience as "readers" and are unable to provide effective feedback or express real-time emotions. They cannot engage in two-way interaction with the information, which leads to unmet user expectations and a poor user experience. Additionally, architectural heritage sites reflect the craftsmanship spirit, cultural customs, and other sentiments. Simple interactive displays fail to deliver the cultural information and value of the sites to a deeper level.

Drawing on user experience theories, Determine the user's role in architectural heritage site interactive communication. This tailored approach enables a precise understanding of user needs and experiences, enhancing the long-term effectiveness of interactive communication. Applying the five elements of user experience, the construction of information content should move from abstract to concrete, focusing on user requirements, user operation processes, and the impact on user experiences to improve alignment between user interaction and internal expectations.

4.2 Information Content Framework for Digital Interactive Communication of Architectural Heritage Sites

In the interactive communication of architectural heritage sites, the disseminators of information content are typically relevant cultural preservation organizations, research institutions, and the like, while the users encompass tourists, scholars, and researchers. Different types of architectural heritage sites hold distinct cultural values. When selecting interactive media, it is important to have a comprehensive understanding of different terminal sensors, touchscreen interaction types, virtual reality, augmented reality, and other digital technology features to invoke diverse hardware devices and provide multiple interactive pathways for presenting information content.

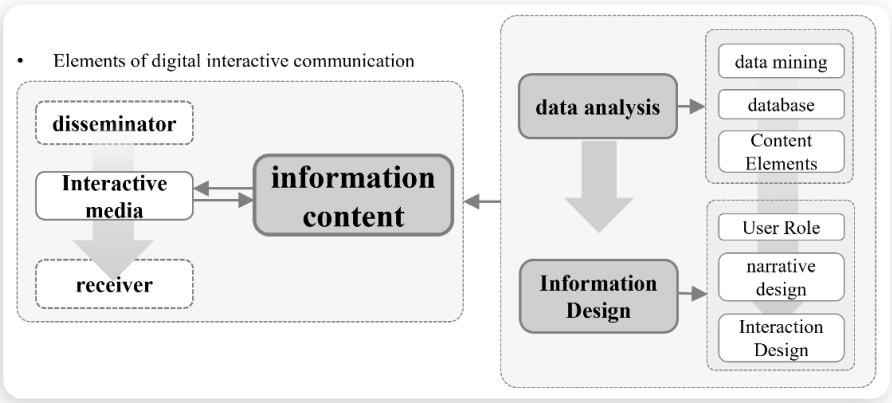

Fig. 3. Information Content Framework for Digital Interactive Communication of Architectural Heritage Sites

Leveraging the characteristics of digital interactive communication for architectural heritage sites, information content planning and design can be systematically developed through data analysis and information design. Initiated by these two key components, the framework for constructing information content in the digital interactive communication of architectural heritage sites is established (see Fig. 3). This framework aims to enhance the readability and

interactive experience of the information. Data analysis involves the processing and integration of scattered cultural data, the establishment of an information database for architectural heritage sites, the extraction of content elements for dissemination, and the creation of user roles to guide narrative and interaction design.

4.3 Information Data Acquisition and Analysis

4.3.1 Establishment of Information Database

Information is derived from vast objective data, and raw data must be organized and condensed to become information. By utilizing relevant methods in digital data analysis, a massive amount of data can be collected, mined, analyzed, and processed to gain insights into the research status, communication status, tourist users, and other related information about the heritage sites. Relevant data is extracted, categorized, and stored, leading to the creation of an information database that contains various types of content such as text, images, videos, audio, models, and more[7].

The lifecycle of a building, from construction to abandonment, from discovery to public presentation, is a lengthy and complex process. It encapsulates various aspects of culture, including the unique history, art, and craftsmanship associated with architecture. Data collection and archiving for architectural heritage sites come from two main sources: the material and non-material aspects. Utilizing methods such as 3D laser scanners, drones, high-definition cameras, and more, physical data related to the heritage site's entity, the surrounding environment, and other physical characteristics are collected. This includes data on the physical characteristics of the heritage site's entity and its surroundings, such as morphology, dimensions, and material properties.

4.3.2 Content Element Extraction

According to theories related to cultural communication, the information within the database can be categorized into three main types concerning heritage sites: basic information, extended information, and derived information (see Fig. 4). These categories form the content elements that are available for information design[7].

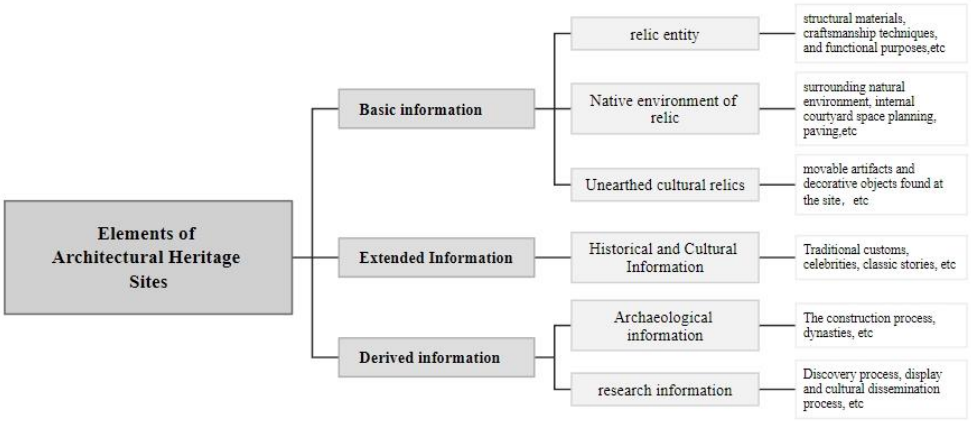

Fig. 4. Elements of Architectural Heritage Sites

The basic information of building a site includes: the ontology information of the site, including the structural materials, process technology, functional purposes, etc. of its original buildings; Original environmental information refers to the information of the original large area of the site, including the surrounding natural environment, street environment, etc. Small environmental information of the site includes internal courtyard space planning, courtyard paving, etc; Excavated cultural relics from the site include movable cultural relics that can reflect the architectural culture of the site, such as functional tools, building structural components, etc.

Extended information regarding heritage sites refers to the historical and cultural information reflected by the architectural heritage site and related unearthed artifacts. This includes the historical context in which the site exists, social aspects, events related to the site, customs, cultural activities, and more. These aspects constitute the non-material cultural information associated with the architectural heritage site and serve as a primary source of information for constructing interactive communication content.

Derived information from the site encompasses the information generated during the process from the site's discovery to its presentation to the public. This includes dynamic information currently disseminated about the site and information related to archaeological excavation, preservation, and research work on the site.

4.4 Information Design

Following the analysis and extraction of relevant data and core content of architectural heritage sites, it is necessary to engage in information design for digital interactive communication, aiming to enhance the effectiveness of communicating architectural heritage sites.

4.4.1 User Role Determination

After preliminary research, the user roles of interactive communication applications can be further determined, which can be distinguished based on age, gender, cultural background, interests, digital literacy, and other aspects. This helps to identify the needs and experience expectations of the user group, and provides suitable information content for different people. After user differentiation, data is collected through relevant methods such as questionnaires, interviews, and focus groups, and user demand research is conducted considering factors such as user information needs, experience expectations, and interaction preferences.

Based on the research results of user classification and requirements, different user roles can be formulated, and relevant user profiles can be drawn to develop targeted information content. For example, students in middle school may want to gain a deeper understanding of history and culture, and require educational information and useful learning resources.

4.4.2 Narrative Design

Initiating narrative design based on multisensory experiences can effectively engage users in visual, auditory, tactile, olfactory, and other sensory perceptions to receive information. This approach helps create immersive information interaction experiences, enhancing users' receptivity to communicated information. Visualizing elements of heritage site-related content, including visual elements such as images, text, and symbolic elements, allows for the construction of a visual space for interactive communication, thus creating immersive

interactive environments and contexts. For instance, based on the basic information of the architectural heritage site, a three-dimensional model or image of the site can be virtually reconstructed as fundamental visual information for interactive communication[8].

Additionally, hearing is the second most important sense after vision, and auditory information plays a crucial role in constructing dynamic scenes. By combining the extended information of the architectural heritage site, designing the soundtrack in digital spaces and providing sound feedback during interactive operations can enhance the overall user experience.

4.4.3 Interactive Information Design

In line with user experience theory, information design is a step-by-step process. Focusing onuser requirements, user operation processes, and the impact on user experiences to improve alignment between user interaction and internal expectations.[9][10].

(1) The Strategy plane, we set interaction goals based on user expectations, needs, and earlier data analysis, selecting the initial interactive medium.

(2) The Scope plane, breaks down these goals further, organizing information coherently. For instance, we can separate it into recognizing architectural structures and scenario tasks. These could include 3D models, component disassembly, and interactive narratives.

(3) The Structure plane, creates the logic for user interactions, focusing on user behavior like gestures and movements. Users may interact with gaze, voice, and gestures to explore architectural structures.

(4) The Skeleton plane, manages interface layout and design. Visual styles depend on the heritage site's context. We use visual elements and text to visualize cultural information, fostering immersive experiences.

(5) The Surface Plane, adds visual details and sensory elements like haptic feedback and auditory design, adhering to specific design standards.

5. Summary

In the context of the digital information age, the rapid and widespread dissemination of vast amounts of information has become explosively overwhelming. The diversity of digital media has shattered the traditional static and immobile modes of showcasing and communication at architectural heritage sites. Digital interactive communication at architectural heritage sites aims to leverage the cultural essence of these sites.

Acknowledgments. This paper is funded by the 21st batch of research projects initiated by Jiangsu University (No. 21C529), Special Project on the Application Research of Social Sciences in Zhenjiang City "Research on the Culture of the Yangtze River Grand Canal" (No. 2023DYL12), Philosophy and Social Science Research Fund for Universities of Jiangsu , China (NO. 2022SJYB2217). 2023 Jiangsu Provincial Social Science Applied Research Excellent Project (NO. 23SYA-033).

References

[1] Li Haiyan, &Quan Dongji (2007) A review of research on the protection and utilization of major archaeological sites both domestically and internationally Journal of Northwest Polytechnical University (Social Sciences Edition)(03), 16-20.

[2] Network, D. A. (2022-03-14). Interactive + virtual, you can also play in the museum. Retrieved from https://www.d-arts.cn/project/project_info/key/MTIwMTUyMzg2MjKDuZdor4ascw.html

[3] AR, B. (2019-07). Technology Revealed | We used VPAS to "resurrect" the Great Water Law of the Old Summer Palace 160 years ago. Retrieved from https://mp.weixin.qq.com/s/X7ptBUIwq8xkFa_u28KklQ

[4] Yao Luji,&Zhang Li (2019) Design and Implementation of a Chinese Architecture History Teaching System Based on Hybrid Reality Technology Computer applications, 39(09), 2689-2694. Retrieved from https://kns.cnki.net/kcms/detail/51.1307.TP.20190521.1617.004.html

[5] Ghani, I., Rafi, A., & Woods, P. (2020). The effect of immersion towards place presence in virtual heritage environments. Personal and Ubiquitous Computing, 24(6), 861-872. doi:10.1007/s00779-019-01352-8

[6] Ning, W. (2014). The Latent Appreciation Effect of Interactive Design in Internet Communication. Paper presented at the 2014 IEEE 11TH INTL CONF ON UBIQUITOUS INTELLIGENCE AND COMPUTING AND 2014 IEEE 11TH INTL CONF ON AUTONOMIC AND TRUSTED COMPUTING AND 2014 IEEE 14TH INTL CONF ON SCALABLE COMPUTING AND COMMUNICATIONS AND ITS ASSOCIATED WORKSHOPS.

[7] Maietti, F. , Giulio, R. D. , Piaia, E. , Medici, M. , & Ferrari, F. . (2018). Enhancing heritage fruition through 3d semantic modelling and digital tools: the inception project. IOP Conference Series: Materials Science and Engineering, 364, 012089-.

[8] Acierno M , Cursi S , Simeone D ,et al.Architectural heritage knowledge modelling: An ontology-based framework for conservation process[J].Journal of Cultural Heritage, 2016.DOI:10.1016/j.culher.2016.09.010.

[9] M.J. Merchán, P. Merchán, & E. Pérez. (2021). Good practices in the use of augmented reality for theissemination of architectural heritage of rural areas. Applied Sciences, 11(5), 2055.

[10] Garrett, J. J. (2010). The elements of user experience (2nd ed.). New Riders Publishing.