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A Serious Games Perspective for Virtual Interactive Exhibition: A Case Study of the Bronze Age of Yunnan Exhibition at Yunnan Provincial Museum

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Abstract

Background and Aim: This study has three main objectives. The first explores how virtual interactive exhibitions can be effectively narrated through serious games by integrating plot, character, setting, theme, and narrative perspective to enhance audience engagement and understanding. Secondly, using the Bronze Age of Yunnan Exhibition at the Yunnan Provincial Museum as a case study, this analysis examines narrative strategies from a serious game perspective. Thirdly, an application will be designed to combine serious games with virtual exhibitions, validating the study's effectiveness and demonstrating its potential for broader museum applications.

Materials and Methods: This study is a mixed-methods study, comprising both quantitative and qualitative components. The sample group used was visitors to the Yunnan Provincial Museum, the method used was a questionnaire survey, and the research tool was an online questionnaire. 2. Qualitative research. The main informants were 1 staff member of Yunnan Provincial Museum, 2 university professors, 1 virtual interactive display designer, and 1 virtual interactive application designer, totaling 5 people. The data collection tool was the interview form, and then the conclusions were summarized descriptively.

Results: This study evaluates the application effect of narrative serious game virtual interactive displays in the Yunnan Provincial Museum's Bronze Age exhibition from multiple perspectives. Results show a 42% increase in audience engagement and a 35% improvement in cultural comprehension scores compared to traditional virtual exhibits. The approach effectively enhances participation, supports the dynamization and exploratory nature of cultural relics display, guides active learning, deepens cultural memory, and promotes digital heritage education. It provides both an innovative paradigm and a practical case for future virtual exhibitions in museum contexts.

Conclusion: Through an interdisciplinary approach to designing prototypes and conducting empirical evaluations, we verified that serious gamified virtual interactions can enhance audience engagement and cultural comprehension, promote digital transformation of museums, and propose innovative models that can be applied to digital cultural heritage education. At the same time, the study suffers from methodological limitations, insufficient samples, and potential bias, and there is room for further improvement in the future.

Keywords: Serious Game; Narrative Elements; Virtual Interactive Exhibitions; Yunnan Provincial Museum; Bronze Exhibition; User Experience

Introduction

Throughout history, the presentation of museums has undergone a significant evolution. In the mid-20th century, museums primarily relied on static exhibitions. Artifacts were arranged in categories, with a strong emphasis on preservation and scientific research. These exhibits were straightforward, using text as the main information form and gradually incorporating pictures and models to enhance engagement. However, the early 21st century brought a technological revolution in museum exhibitions. The advent of touchscreens, projection technology, and virtual reality ushered in a new era of interactive displays. Some museums even went further, creating immersive exhibition halls that used sound, lighting effects, and realistic scene reconstructions to captivate visitors and enhance their experience.

With the development of information technology, Virtual Interactive Exhibitions (VIEs) have played an increasingly important role. They apply various digital technologies to compensate for the defects in traditional physical exhibitions and raise the audience's participation and experience through multimedia technology and interactive design to much higher levels. Virtual Interactive Exhibitions are more than a novel way of presenting information. They represent a paradigm shift in Interactive mode, moving from passive acceptance to active engagement. By integrating the concept of serious games, Virtual Interactive Exhibitions create an immersive virtual environment for educational and entertainment purposes. This

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transition from passive teaching to active learning significantly enhances understanding and retention of the exhibited content, making Virtual Interactive Exhibitions a potent educational tool (Economou, 2015; Wojciechowski & Cellary, 2013).

Serious games are game applications designed for non-entertainment settings, making that setting more appealing and motivating for learning through interaction and feedback (King, 2021). Audiences in Virtual Interactive Exhibitions could play the role of an archaeologist who needs to do virtual excavations and research in a historical site to discover lost artifacts and past stories. It provides an interactive way to enhance attractiveness in exhibitions while improving how the audience understands and better memorizes cultural heritage and historical information through role-play and performance of tasks.

Central to this transformation is narrative design. By embedding plot, characters, settings, themes, and narrative perspectives into virtual experiences, exhibitions can guide visitors through coherent and emotionally resonant storylines. This narrative layer links disparate artifacts and information into a seamless journey through time and meaning. It enhances visitors' curiosity, empathy, and sense of discovery, leading to a more meaningful understanding of cultural and historical content.

Despite these advancements, a notable research gap remains in applying and analyzing narrative-driven serious games in Chinese museum contexts, particularly within regional museums like the Yunnan Provincial Museum. Most existing studies have focused on Western institutions or technical aspects of digitization, while the potential for culturally specific storytelling through serious games in China remains underexplored. Moreover, few empirical studies have examined how serious games can transform not just interaction modes, but also pedagogical outcomes and cultural cognition in virtual exhibitions.

What sets the study apart from previous attempts is its integration of virtual interactive exhibitions with serious games and narrative elements. This unique combination creates a highly immersive and interactive experience with significant potential for cultural communication and education. As techniques continue to develop and their scope of application expands, virtual interactive exhibitions based on narrative serious games will undoubtedly play a more prominent role in the museum arena, offering a meaningful way to present and disseminate cultural heritage.

This study aims to address this gap by taking the Bronze Age of Yunnan Exhibition as a case study. Currently, the Yunnan Provincial Museum does not utilize narrative-based serious games in its exhibitions, yet it holds vast potential for such integration. By designing and evaluating a prototype application that combines virtual interaction, serious games, and narrative structures, this study explores how digital storytelling can enhance visitor participation, cultural learning, and emotional resonance.

What distinguishes this research is its interdisciplinary integration of digital heritage studies, serious game design, and museum pedagogy. It contributes to ongoing academic discussions in interactive museology (Parry, 2007), digital cultural heritage (Giaccardi, 2012), and game-based learning (Chee, 2007). Furthermore, it aligns with global calls for the digitization and inclusive dissemination of cultural heritage in the context of globalization and cultural pluralism (Biehl & Prescott, 2013). Through international collaboration, technological innovation, and public engagement, the project envisions a future where narrative serious game-based virtual exhibitions not only preserve but also revitalize and communicate cultural memory, fostering cross-cultural understanding and appreciation.

Objectives

1. To study how virtual interactive exhibitions can be narrated through serious games. Narrative can create compelling stories by skillfully combining elements of plot, character, setting, theme, and narrative perspective to increase audience engagement and understanding.

2. To study how to narrate in a virtual interactive exhibition from the perspective of a serious game in The Bronze Age of Yunnan Exhibition at Yunnan Provincial Museum.

3. Designing an application that combines virtual interactive exhibitions and serious games with the Bronze Age of Yunnan Exhibition at Yunnan Provincial Museum to demonstrate the validity of the results of the study and its applicability to other museums.

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Scope of the Study

This study takes the Bronze Age of Yunnan Exhibition at Yunnan Provincial Museum as a case study and, based on the original traditional display method, researches how to apply the museum's virtual interactive display method, which is based on narrative serious games. The study will be divided into four parts:

Using field research, the Yunnan Provincial Museum and the Bronze Age of Yunnan Exhibition at the Yunnan Provincial Museum are studied. The focus is on analyzing offline and online museums, exploring the strengths and weaknesses of the original display methods, and discussing the feasibility of the museum's virtual display methods based on narrative serious games.

The study delves into the practical applications of serious game theory and narrative theory in the context of virtual interactive museum displays. A literature survey and case study aim to provide valuable insights that can be directly applied in the field.

Interviews with staff in the Yunnan Province Museum were conducted to understand their perceptions of existing displays and their views on museum virtual displays based on the narrativization of serious games. Interviews with museum virtual interaction design practitioners helped to understand their design approach and creative thinking process. A questionnaire survey of Yunnan Province Museum visitors was conducted to understand the visitors' orientation towards serious game narrativization and their favorite display format. The study focuses on the exhibition period and digital application development from January to December 2025, including prototype testing and audience feedback collection.

Based on the survey data analysis, this study will build a narrative virtual interactive exhibition application based on serious games, focusing on the display of bronzes in the Bronze Age of Yunnan Exhibition at Yunnan Provincial Museum. The program is limited to the use of virtual reality (VR) and augmented reality (AR) technologies; it does not include mixed reality (MR), artificial intelligence (AI)-powered personalization, or large-scale motion capture systems. While rooted in the context of the Yunnan Provincial Museum, the study aims to develop a model that is potentially scalable and adaptable to other regional museums in China and similar cultural institutions worldwide, especially those seeking to enhance digital storytelling for educational and heritage communication purposes.

Literature review

The new museum definition reflects the paradigm shift from collection-centric to user-centric that has been taking place in the past decades (Giannini & Bowen, 2022) (Li & Ghirardi, 2019; Simon, N., 2010). The new definition was approved by the Extraordinary General Assembly of the International Council of Museums on 24 August 2022, after an open and long process of consultation about the Standing Committee of the Museum Definition with the National Committees, International Committees, Regional Alliances, and Affiliate Organizations. The definition states that:

"A museum is a not-for-profit, permanent institution in the service of society that researches, collects, conserves, interprets, and exhibits tangible and intangible heritage. Open to the public, accessible, and inclusive, museums foster diversity and sustainability. They operate and communicate ethically, professionally, and with the participation of communities, offering varied experiences for education, enjoyment, reflection, and knowledge sharing."(International Council of Museums, 2024).

The development of contemporary museums in China has been marked by rapid expansion, significant modernization, and increasing global engagement. Over the past few decades, China has transformed its museum landscape to reflect its rich cultural heritage, growing socio-economic status, and technological advancements (Xiangguang, 2008).

Established in 1951, the Yunnan Provincial Museum is the largest comprehensive museum in Yunnan Province. It spans 150 acres, with an area of 60,000 square meters and an exhibition hall of 16,500 square meters. It is one of the first national first-class museums. The museum is a hub for Yunnan's history, culture, and art, a must-visit tourist destination, and an important educational venue for young students (Yunnan Provincial Museum, 2025).

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Figure 1 New Yunnan Provincial Museum
Source: Yunnan Provincial Museum. Overview. Yunnan Provincial Museum. https://www.ynmuseum.org/survey.html#section=2

Over 70 years of construction and development, the Yunnan Provincial Museum has achieved remarkable results. It is dedicated to protecting cultural heritage and disseminating excellent culture, striving to build a large, comprehensive museum that is first-class domestically, leading in the southwest, and influential in South and Southeast Asia.

Archaeological excavations proved that more than 3,000 years ago, Yunnan began smelting and casting copper, slowly opening the curtain of the Bronze Age. (Peng, 2021). The period from the end of the Warring States period to the beginning of the Eastern Han Dynasty is the peak of the development of bronze culture in Yunnan. Taking the bronze culture of the Dian Kingdom as a representative, including west Yunnan, south Yunnan, east Yunnan, and other places, bronzes occupied the most important position in society, with a wide variety of colors and shapes.

The Yunnan Museum's Bronze Age Yunnan Exhibition Hall is divided into four main sections: Exhibition Part I: The Beginning of the Bronze Age in Yunnan, Exhibition Part II: Yunnan Bronze Age Overview, Exhibition Part III: The Leader of the Southwestern Barbarians-Dian Kingdom, Exhibition Part IV: The End of the Bronze Age in Yunnan. Each section is organized according to Dian People's Dress and Ornaments, Dian People's Decorations, Dian People's Hairstyles, Dian People's Worship, Dian People's Sacrificial Rites, Dian People's Music and Dance, Warfare between Dian People and Kunming People, Bronze Weapons of Dian Kingdom, Dian People's Appliances, The Rise and Fall of Fores around Dian Lake and Fuxianhu Lake. The original exhibition was basically a traditional museum display, with some elements of multimedia display added to the exhibition, but did not involve the content of a virtual display based on the narrative of a serious game.

Contemporary museums are not just repositories of collections and artworks; they are unique communication channels, serving as vital conduits for disseminating culture to the public. Utilizing new technological interactive modes can greatly enhance museums' cultural dissemination and educational role, and engage a wider audience.

Virtual interaction in museums refers to the use of technologies such as Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) to create interactive experiences in digital environments. These experiences enhance visitors' understanding and engagement with museum collections and exhibitions.

With the advancement of technology, the Yunnan Provincial Museum has also made some technological upgrades in related areas. In January 2023, the Yunnan Provincial Museum's digital exhibition hall of curated artifacts officially went online. The exhibition is divided into four sections: "Bronze Artifacts," "Revolutionary Relics," "Calligraphy and Paintings," and "Religious Artifacts." It

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primarily showcases bronze artifacts unearthed in Yunnan, featuring 38 curated items from the museum's collection.

Figure 2 Digital Exhibition Hall Interface
Source: Yunnan Provincial Museum. (2023, January 18). Yunnan Provincial Museum Collections of Fine Cultural Relics Digital Exhibition Hall Online Today! Yunnan Provincial Museum. https://mp.weixin.qq.com/s?__biz=MzI0MjkyOTQwMg==&mid=2247525295&idx=1&sn=f139c25b562dfac05e8cfe4e8727a19b&chksm= e976f83ade01712ca186ba6058d0

However, this kind of exhibition still needs to get rid of the traditional virtual interactive display; it has virtually restored the real exhibition hall and exhibits, but it does not provide a vivid and coherent narrative, nor a rich variety of interactions. Although it achieves the effect of a virtual interactive display, the educational function and memory enhancement for the audience still need to be strengthened.

The “three-layer distinction” of narratology from Mieke Bal (Bal, 2017), namely, the "narrative text, story, and fabula," which is further interpreted by Tom Duncan (Duncan, 2018). In the exhibition context, "In the museum, the narrative text is the navigable exhibition experience consisting of sequences of spaces, images, written words, and objects, in combination with different media. The story is how the designer intends the visitor to experience the exhibition; in other words, how the multiple elements and media are presented and organized. The fabula is the chronological account of events, not necessarily in the order in which the visitor experiences them." (Chen et al., 2024).

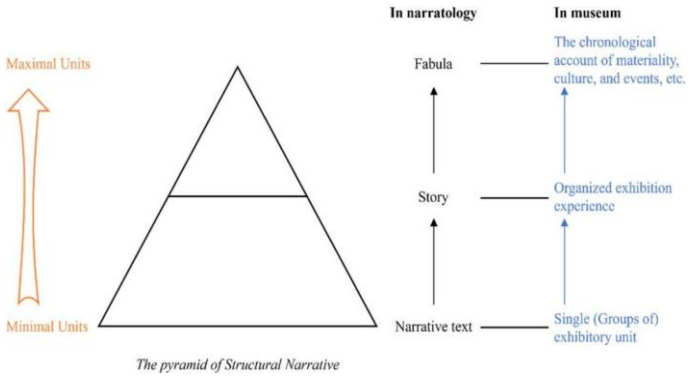

Figure 3 The combined structure in narratology and museum context
Source: Chen et al (2024, May). Archive or Exhibition? A Comparative Case Study of the Real and Virtual Pitt Rivers Museum. ScienceDirect. https://www.sciencedirect.com/science/article/pii/S2212054823000504?dgcid=rss_sd_all#bib7

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Yunnan in the Bronze Age Exhibition adopts the third-person perspective by narrating vivid visualizations of historical events and intuitive displays of exquisite cultural relics to achieve the unification of the sense of history and the aesthetic effect, and make the audience "return to the past." The historical sense and aesthetic effect are unified so that the audience "returns to ancient Yunnan" and re-recognizes the glory of Yunnan bronze culture.

Museum display based on serious games is an emerging method that enhances the audience's learning experience and sense of participation by combining game design and educational content. The traditional museum virtual interactive display is only a virtual way to restore and reconstruct the real content; the interactive way is still the traditional display and introduction, on the original basis, plus the content of serious games will help to improve the effect of a virtual interactive display (Wang et al, 2024).

However, the Yunnan Provincial Museum has yet to utilize the concept of serious games in its exhibitions. There is an excellent opportunity, especially to combine the Bronze Age of Yunnan Exhibition Hall with narrative-based serious games that will inspire unusual sparks.

In the future, I will collect and analyze data through qualitative and quantitative methods to verify the feasibility of using the narrativized serious games virtual interactive display in the Bronze Age of Yunnan Exhibition Hall and analyze its advantages and disadvantages. Based on the analysis results, targeted designs will be developed, and the production of related functions and products will be explored to promote the realization of this innovative exhibition method.

Conceptual Framework

1. Theoretical Foundation

This study is based on three core theoretical dimensions:

The theory of paradigm shifts in museology, from “collection-centric” to “user-centric”, emphasizing participatory, social, and educational aspects, is the core trend in the evolution of the functions of contemporary museums. This is the core trend of the evolution of contemporary museum functions.

Narratology's “three-layer structure” theory, Narratology: Fabula, Story, Narrative Text, builds a narrative logic for virtual presentations based on Bal (2017) and Duncan's (2018) categorization of narrative structure:

Fabula: the chronological sequence of events themselves (historical facts).

Story: the way the designer organizes the content.

Narrative Text: the way the audience experiences paths and interactions.

Serious game theory refers to the combination of educational content with game mechanics for an immersive learning experience. Used to enhance memory, engagement, and knowledge construction.

2. Key Constructs and Variables

Table 1 Key Constructs and Variables

Conceptual	Define
Virtual Interactive Display	Display based on VR/AR/MR technology reproducing the environment and artifacts in the exhibition halls
Narrative Display	The exhibition is organized in a storytelling, time-based, character-based manner.
Serious Games	Educational, purposeful, and structured play experiences for knowledge transfer and contextual reproduction
Audience Engagement	The degree of interaction, emotional connection, and cognitive engagement generated by visitors to museum displays
Educational Communication Effectiveness	The role of presentation styles in facilitating audience learning, understanding, and memorization

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3. Proposed Relationships

Virtual interactive displays Combined with narrative design, they can enhance the immersion of an exhibition; Serious game mechanics can enhance audience engagement, feedback and motivation to play; The enhanced sense of participation and contextualized cognition will improve the educational communication effect of the museum; The combination of the above elements will break through the traditional exhibition mode and realize the transformation from "passive viewing" to "active experience".

4. Conceptual Framework Diagram

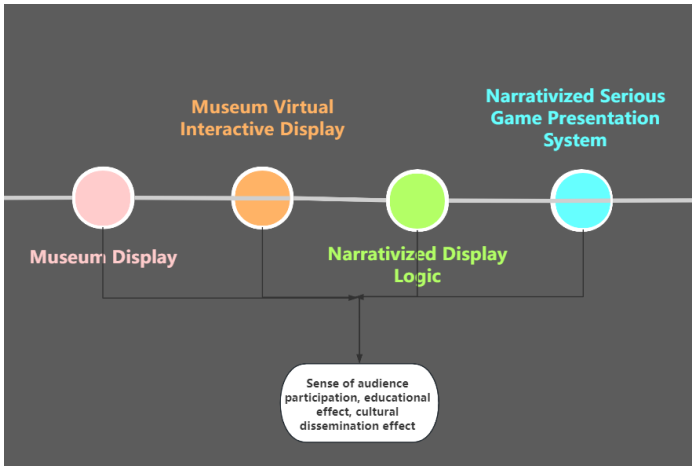

Figure 4 Conceptual Framework Diagram
Source: Image by the researcher

Methodology

Field research method: Conduct in-depth on-site research at the museum in Yunnan Province. Record the number of museum visitors as well as their behaviors. Analyze the reasons for this phenomenon and collect and collate data to understand the real situation of the museum in Yunnan Province.

Interview method: The in-depth interview method was used to interview the staff of the Yunnan Provincial Museum and practitioners in the virtual interactive display industry to collect relevant data and analyze the feasibility, advantages, and disadvantages of applying narrative serious games to the Bronze Age of Yunnan Exhibition at Yunnan Provincial Museum.

In-depth understanding of experts' perspectives on using serious games in the design of virtual interactive displays in museums. Design a semi-structured interview outline and select 3-5 museum staff and experts in related fields to conduct in-depth interviews to discuss the principles of narrativization design, application of serious games, and implementation of virtual interactive technology.

Table 2 List of Interviews with Yunnan Provincial Museum Staff

Participants in The Survey	Professional Background & Work Experience	Number of People
Exhibition Supervisor	Daily management of the exhibition halls	1-3

Table 3 List of Interviews with Virtual Interactive Display Practitioner

Participants in The Survey	Professional Background & Work Experience	Number of People
Virtual Interactive Display Designer	Design and production of different types of virtual interactive exhibition halls	1-3
Virtual Interactive Application Designer	Design and production of different types of virtual interactive applications	1-3

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Participants in The Survey	Professional Background & Work Experience	Number of People
Academic experts (university professors)	Experts and professors in digital media, virtual interaction, 3D restoration, etc.	1-3
Expert in Bronze Culture	Specialists in history, culture, and archaeology	1-3

Questionnaire: A questionnaire was used to survey the audience of The Bronze Age of Yunnan Exhibition to collect relevant data and understand the audience's preference for the display method, which will enhance the user experience of the later application.

Results

This time, we conducted online interviews with practitioners of virtual interactive displays. There are five interviewees in total: two university professors, three designers, and production experts of virtual interactive displays. Four of them are male, and one is female. The youngest is 28 years old, and the oldest is 53. Their engagement in related work varies from 1 year to 30 years.

They are Zhang Jingping, professor and master's degree supervisor, working in Shanghai Theatre Academy, mainly engaged in the interactive design and creation of new media art for performing arts, focusing on interactive visual art, artificial intelligence art, expanded reality, virtual production, etc. He currently serves as director of the teaching and research department of the digital media art program and deputy director of the Key Laboratory of the Ministry of Culture of the Digital Performing Arts Integration and Innovation.

Cheng Yining, Chief Game Graphic Designer, Technical Director of Unity Animation. He has 15 years of experience in character animation and has worked in He has 15 years of experience in character animation and has worked in Pearl Studio, 37Ent, IDMT, and other well-known animation companies. With expertise in character animation and character rigging, he has participated in the production of such works as Kung Fu Panda 3, Kung Fu Panda 3 Promo Special, Dragons: Riders of Berk (TV), title animations for Zheng He 1405 (feature film), and League of Legends. (TV), title animations for Zheng He 1405 (feature film) and League of Legends (game). After joining Unity, he has focused on the research and development of film and TV animation and has participated in the production of Windup, a short film by Unity Animation. He has participated in the production of Windup, a short film by Unity Animation.

He Ming, CEO of Guangdong Hagrid Network Technology Co., Ltd, has twelve years of experience in 3d games and CG animation projects. He has participated in the game CG League of Legends, Asura, Honor of Kings, CrossFire, Demon Seals, animation How to Train Your Dragon, Monkey King: Hero Is Back, Legend of Ravaging Dynasties, AOTU, and game Tomb Raider, The End of Ming Dynasty: The Feather of the Abyssal Void, Black Myth: Wukong, and many other excellent projects.

Yin Rui, from Kunming Metallurgy College, teaches interface design, interaction design, and other courses.

Zeng Chen, freelancer, interaction design producer, UI interface designer.

The interviewees provided diverse insights on the design and implementation of virtual interactive exhibitions, with a particular focus on how to enhance audience engagement and experience. Key themes included integrating immersive technologies like AR, VR, and MR, with a balance between education and entertainment. Several emphasized the importance of building coherent and compelling narratives through interactive elements, such as character roles, branching storylines, and immersive scenes that encourage exploration. Technology suggestions ranged from AI-guided experiences to 3D modeling and haptic feedback for heightened immersion.

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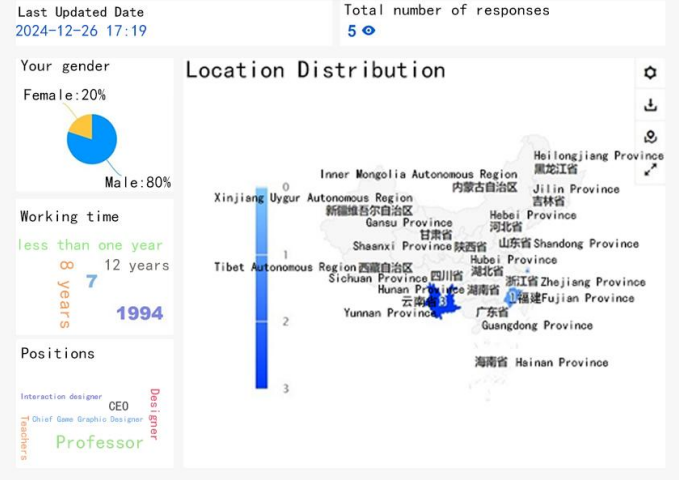

Figure 5 Virtual interactive display of data charts analyzing the results of practitioner interviews
Source: Image by the researcher

Regarding the Yunnan Bronze Age Exhibition, respondents supported incorporating narrative serious games and virtual interactive elements. They suggested creating engaging stories, using historical evidence to ensure cultural accuracy, and incorporating gamification to deepen understanding of Yunnan's Bronze Age. The overall consensus was that a well-designed virtual experience can provide both educational and emotional resonance, fostering greater interaction and reflection on the exhibition's cultural content. Future trends point toward AI-driven personalized experiences and mixed-reality environments that blend history with interactive storytelling, potentially transforming museum engagement and education.

For the questionnaire, this survey was conducted to investigate the feasibility of integrating a virtual interactive exhibition of narrative serious games into the Bronze Age of Yunnan Exhibition at Yunnan Provincial Museum. There was a total of 65 participants in this questionnaire. Among the respondents, the majority were in the 18-25 age range, 66.15%, with a smaller proportion from older age groups. In terms of gender, 52.31% were male and 47.69% were female. The participants' educational backgrounds varied, with most having attended college at 64.62% or having a high school education at 13.85%.

Figure 6 Yunnan Museum Visitor Questionnaire Survey Result Analysis Data
Source: Image by the researcher

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For museum visitors, the Bronze Age of Yunnan Exhibition at Yunnan Provincial Museum received generally positive feedback. Suggestions focused on increasing interactivity, enhancing the storytelling elements, and leveraging more advanced technologies like VR, AR, and 3D modeling to provide a deeper and more engaging visitor experience. The improvements suggested reflect a desire to integrate more cutting-edge digital interactions and educational content, ensuring that the exhibition appeals to a broader audience and enhances the understanding of Yunnan's ancient cultural heritage.

The results of the fieldwork are that the Yunnan Provincial Museum has indeed introduced some advanced guiding equipment, as well as designed some innovative peripheral products.

Guided tours in the pavilions are available in a variety of ways, and you can choose the most traditional way of hiring a docent, while there is also a free volunteer docent service available at set times. Alternatively, you can rent an audio guide device, and you can also scan the QR code underneath the artifacts through a mobile app and listen to the explanation on your cell phone. The most innovative way is to rent AR glasses for guided tours.

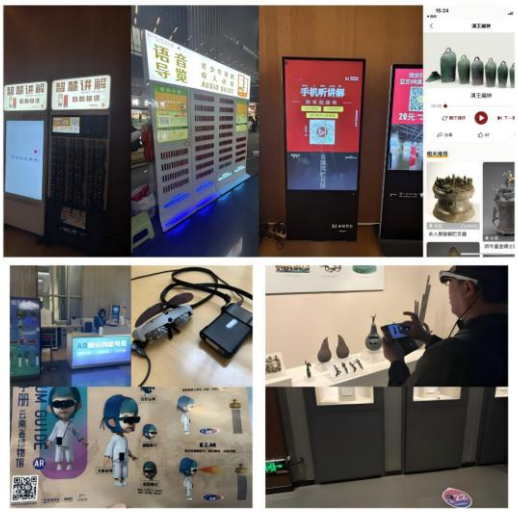

Figure 7 Different ways of guiding museums
Source: Image by the researcher

Museums are launching interactive VR/AR cultural and creative products, leading visitors to learn more about the historical stories behind the exhibits. Digital cultural and creative products not only enhance the sense of modernization of the museum, but also enhance the interactive experience of the audience. Especially in today's increasingly advanced technology, digital products have become an important means of attracting young visitors.

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Figure 8 AR Bookmark
Source: Image by the researcher

Based on the results of interviews, questionnaires, and fieldwork, the following virtual interactive display App based on a narrative serious game has been designed. Combining historical documents, archaeological discoveries, and academic results, players will complete the following interactive tasks to visualize the charm of the bronze culture of ancient Yunnan.

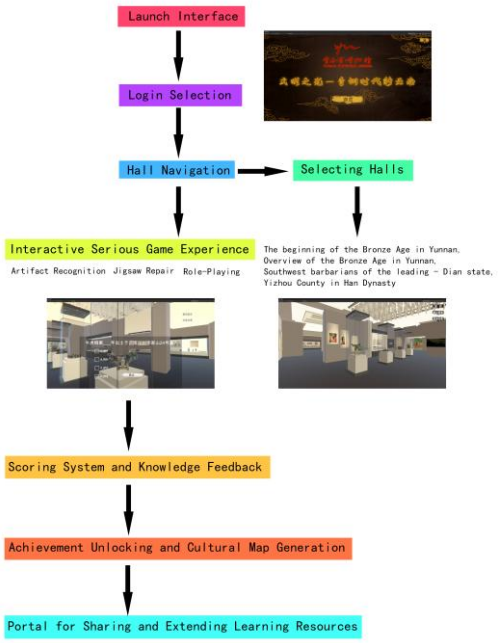

Figure 9 APP use process
Source: Image by the researcher

1. Bronze Smelting Workshop - Recreating the Dian Casting Craft

The background of the quest is that King Dian ordered the craftsmen to create a new batch of bronze ceremonial vessels for the rituals and oath-taking ceremonies. Players need to follow the ancient Dian smelting and casting process, from the selection of raw materials to the completion of casting, to complete the challenge step by step.

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In terms of interactive experience, players collect raw materials through virtual interaction. Players need to select appropriate metals, such as copper, tin, and lead, and calculate the ratio to ensure the quality of the bronzes. And choose the right casting method to make it, such as lost wax casting, using wax molds to shape, burn the molds, and pour in the molten metal. Fan casting method challenge: try to use the fan casting method to make a bronze tripod or a bronze short sword, adjusting the temperature to avoid casting failure. Pattern engraving using a somatosensory interactive device, copy the unique patterns of ancient Yunnan to engrave on a bronze vessel, and understand its symbolism.

In terms of cultural understanding, most of the Yunnan bronzes were made by the lost-wax method and the Fan casting method, etc., and their styles are different from those of the Central Plains and Southwest China. Through the differentiation of casting methods and understanding the difference between the bronze culture of Dian and other regions, players will learn how to cast bronzes and understand their significance in the game.

2. Bronze Weapons for King Dian's Legion - Simulating Battles and Strategic Decisions

The background of the quest is set in King Dian's desire to expand his power to the outside world, and players are required to assist in the formation of a legion, build bronze weapons, and formulate tactics.

In terms of interactive experience, combining virtual interaction to realize the building of weapons, selecting bronze swords, gorgets, and halberds, testing their strength, and understanding the combat style of different weapons. Conduct army training, learn Dian's army tactics and infantry formations through simulated battles, and make decisions on the battlefield. With the defense of Dianchi as the goal, players need to guard the tribes around Dianchi and engage in battle with foreign enemies, using bronze weapons to develop strategies.

The bronze weapons of Dian were influenced by the Central Plains, such as the excavated bronze swords, which are similar to the bronze swords of Wu-Yue. According to the historical background and history books, the army of the Dian State was good at riding and shooting, and players can experience this feature in the game.

3. Yunnan Sacrificial Ceremony - The Symbolic Function of Bronze Vessels

The background arrangement of the task is that the player needs to prepare for an important heavenly ceremony, which requires the player to choose suitable sacrificial bronze ritual vessels to pray for favorable winds and rain, and the prosperity of the country.

Use virtual interactive equipment for the placement of sacrificial bronze, learn how to place the ox and tiger bronze case, bronze drums, and other artifacts, and understand their sacred significance. Reproduce the rituals and perform the rituals according to King Dian's instructions, including the burning of incense, playing of music, and chanting of congratulatory speeches. Performing divination and solving riddles during the sacrificial rituals, using bronze divination instruments, interpreting the trigrams, and deciding the country's next move.

The nobles of the Dian State used bronze drums and bronze cases of bulls and tigers in their rituals, reflecting their ancestor worship and concept of theocracy. In the game, players can use somatosensory devices to manipulate these artifacts and experience their cultural functions.

4. King Dian's Pledge of Allegiance: Bronze Diplomatic Mission

The background of the mission is set as King Dian wishes to conclude a pact with the forces of the Central Plains, the Hundred-Yue, and the Southwest Barbarians, and the player, as an emissary, is required to carry a bronze ceremonial gift on his mission.

Players use the virtual interactive device to select bronze gifts, picking the right bronze as a diplomatic gift, such as bronze jewelry, bronze buckle ornaments, and so on. Choose the appropriate negotiation strategy. Through the interaction with NPCs, players need to skillfully negotiate and facilitate the covenant. Facilitate cross-cultural exchanges, learn the etiquette of the Middle Kingdom, and compare the similarities and differences in bronze culture between the Dian Kingdom and the Han Dynasty.

The king of Dian was once titled “King of Dian” by the Han Dynasty, indicating his close relationship with the Han Dynasty. There were many ethnic groups around Dianchi, and bronzes played a role as

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"ceremonial currency" in the exchange.

5. Modern Archaeology of Bronzes - Digital Twin Recovery Challenge

The background of the task is based on a modern archaeology team that found bronze fragments near the Dianchi field, and players need to piece together and recover them, and interpret their use. Depending on the number of restored bronzes, bronze souvenirs can be exchanged at the store.

Using 3D scanning to digitize artifacts, use virtual interactive devices to restore bronze artifact fragments and reveal historical information. Choose the right archaeological tools for patina restoration to clean up bronze patina and discover hidden inscriptions or decorations. Trace the history back to the past, combine historical documents and archaeological findings to speculate on the attribution of the bronze vessel and its use, and unravel the mysteries of the Dian State ruins.

A large number of bronzes have been unearthed in Yunnan, and archaeological restoration is an important part of modern research. The game combines digital twin technology to let players feel the charm of archaeology. At the same time, the museum souvenir sales associated with the game, visitors have a higher incentive to buy souvenirs first, which improves the museum's economic income.

Below is a partial display of the interface:

Figure 10 Bronze Age of Yunnan APP Initial Interface
Source: Image by the researcher

Figure 11 Scene Reproduction Inside the Exhibition Hall
Source: Image by the researcher

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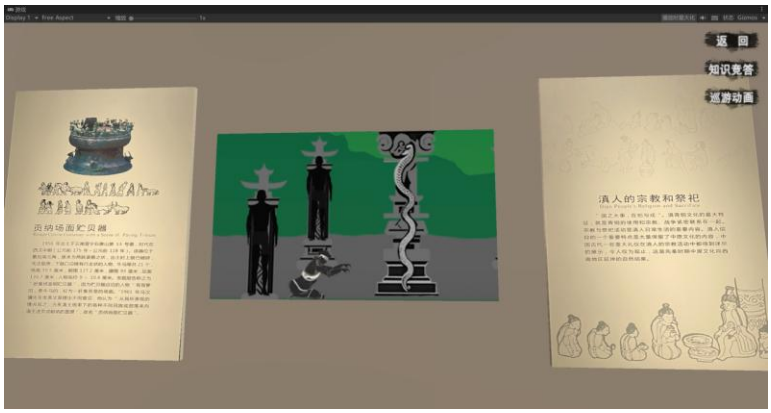

Figure 12 Narrative animated short film playback
Source: Image by the researcher

Figure 13 Body Artifacts Interactive Introduction Interface
Source: Image by the researcher

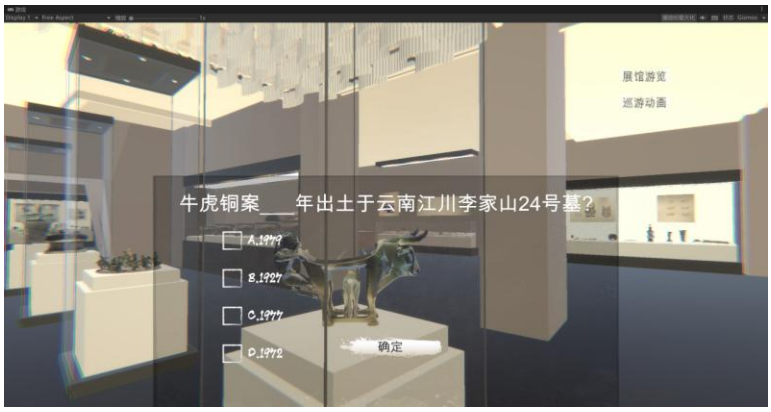

Figure 14 Serious game-based question and answer interface
Source: Image by the researcher

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Below is a demonstration of some of the control code:

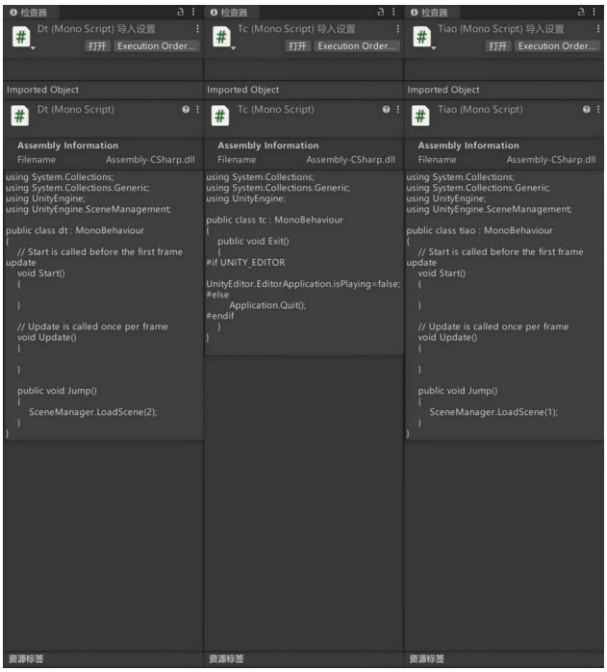

Figure 15 The three codes are the code to control the answer jump, the code to exit the interface, and the code to jump to the page
Source: Image by the researcher

AI-driven NPCs: NPCs can quiz players on historical knowledge to improve educational interactivity. Different AI systems are trained to learn historical documents, archaeological findings, and academic literature for relevant questions to realize that the virtual NPC answers are as consistent with historical facts as possible.

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Figure 16 The above is the training questioning process of Quark, Beanbag, and Deepseek AI, respectively
Source: Image by the researcher

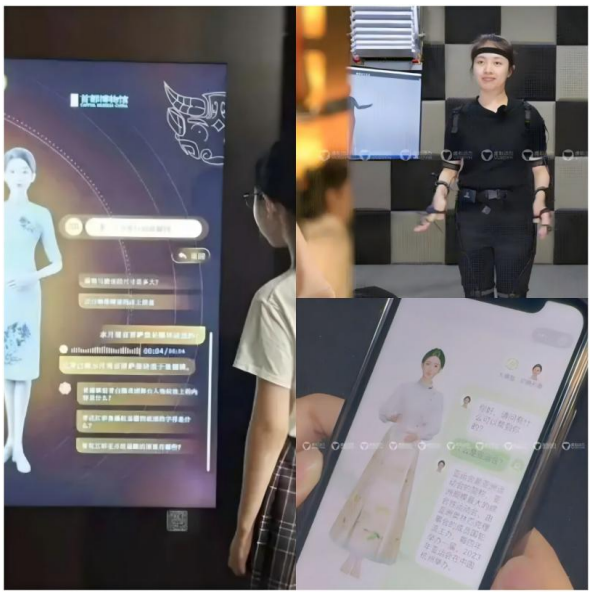

Figure 17 Digital Human Demo
Source: Guangzhou Virtual Power. (2024, September 20)

Digital Twin: Create accurate 3D models of bronzes for players' immersive research. The researcher used digital photographic equipment to enter the pavilion and capture digital images of the artifacts on display. After high-precision acquisition from multiple angles, the collected images were digitally restored in three dimensions using the digital twin AI 3D restoration technology. This series of restorations can not only show the real appearance of the exhibition hall and the artifacts, but also enable the audience to observe the artifacts from a close distance and multiple perspectives, and at the same time, provide the possibility of the production of derivative products in the future.

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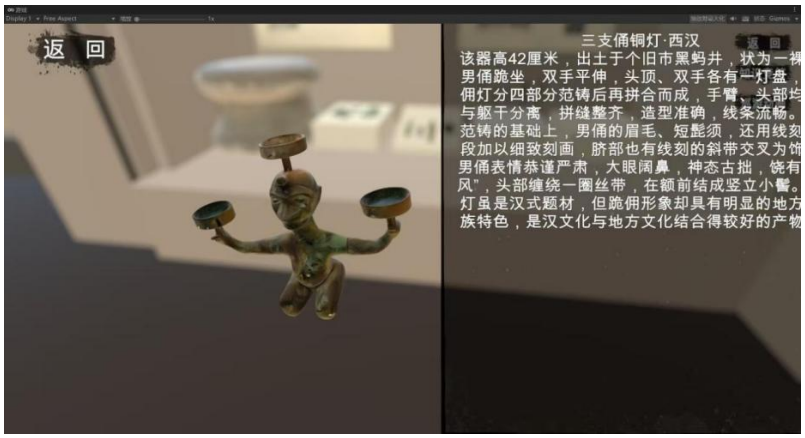

Figure 18 Digital Twin AI 3D Reduction Technology Generated Digital 3D Models.
Source: Image by the researcher

Figure 19 Digital 3D Modeling Derivatives, Bronze Series Blind Boxes
Source: Image by the researcher

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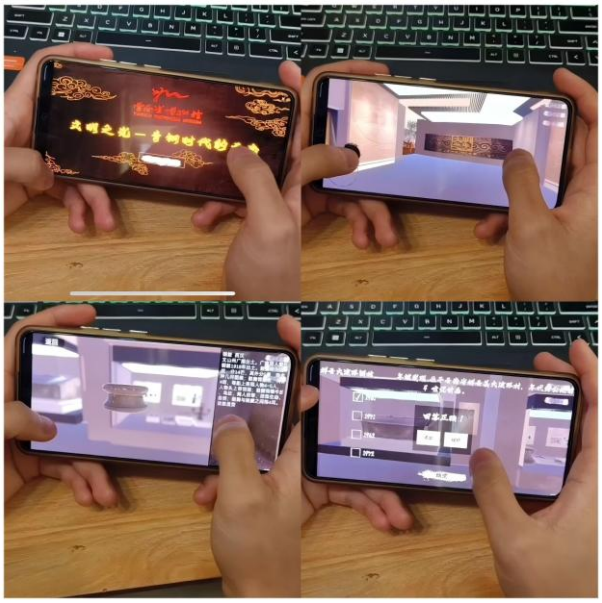

Figure 20 Bronze Age of Yunnan APP Operation Demonstration
Source: Image by the researcher

For the results of the APP experience, the feedback was summarized by selecting from five categories of people who were Yunnan Provincial Museum staff, university professors, virtual interactive display designers, virtual interactive application designers, and university students.

1. Yunnan Provincial Museum Staff Perspectives

Experience perspective: As a frontline cultural communicator and exhibition planner, concerned about the performance of APP in terms of cultural accuracy, educational extensibility and auxiliary display functions.

Content of use: In-depth experience of the virtual pavilion and Q&A module. Focus on the introduction of cultural relics, narrative clues, and the logic of historical events.

Feedback points: Advantage: The information on cultural relics is accurate and basically conforms to archaeological historical facts. It can be used in the "second classroom" of the museum to enhance audience interaction.

Problems: Some of the words used are more academic and not popular enough. The selection of exhibits does not cover some of the key collections, such as the Golden Seal of the King of Yunnan.

Comprehensive evaluation: The APP has a significant role in enhancing the extended learning after the museum visit, and has a realistic basis for pilot use in guided tours and youth education activities.

2. University Professor's Perspective (Direction of Digital Media Art and Design)

Experience Perspective: From the perspective of academic specialization, the APP is concerned about the rationality of interaction and the feasibility of artistic and cultural communication.

Use of content: Tested with the module "Artifact Recognition Challenge". It is used to support classroom teaching, as a virtual interactive design case study, and to observe students' feedback.

Feedback points:

Strengths: Interactive learning design is effective in increasing student engagement. The "Artifact Recognition Challenge" helps students build structured cultural awareness.

Problems: Some interactions are not fast enough, and the logical sequence of the app needs to be optimized. It is recommended to actively maintain the background system to provide faster interactions.

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Comprehensive Evaluation: The APP is suitable for use as an auxiliary teaching tool for history general education courses, but it needs to be expanded in academic depth to support higher-level art and cultural communication needs.

3. Virtual Interactive Display Designer Perspective (Immersive Exhibition Specialist)

Experience perspective: Focus on the APP's display performance in terms of spatial construction, interaction logic, and user navigation design.

Use content: Test the virtual exhibition hall's three-dimensional roaming and user-oriented design. Analyze scene switching, narrative rhythm, and coherence of immersive experience.

Feedback points:

Advantage: The layout of the exhibition hall is reasonable, and the theme of the exhibition area is clearly divided. The virtual space is highly consistent with the exhibition style of the real museum.

Problems: The scene transition animation is slightly stiff, and the sense of immersion needs to be strengthened. The positioning of some interactive controls is not sensitive enough, affecting the smoothness of the user experience.

Overall Evaluation: The overall design logic is good, with the prototype of “online exhibition hall”, which is suitable for forming a “dual exhibition system” with offline exhibition.

4. The perspective of virtual interactive application designers (human-computer interaction and interface design)

Experience perspective: Starting from the user interface (UI) and user experience (UX), assess the maturity of the APP operation flow, interaction logic, and technical architecture.

Usage Content: Test multi-device adaptability (tablet/mobile phone). Simulate the APP response under different network conditions.

Feedback points:

Strengths: High integration of interface design with the visual elements of Yunnan culture. Serious game design guides nature and improves user stickiness.

Problems: Data loading is a little slow, slightly lagging when the 3D model is large. Guiding hints are not clear enough; novice users may feel confused.

Overall Evaluation: High degree of completion in terms of technical implementation. It is recommended to optimize the model compression and loading logic and improve the lightweight interaction performance.

5. College students' perspective (end-users, both learning and entertainment needs)

Experience perspective:

Concerned about the fun, knowledge acquisition experience, and social sharing function of the app.

Use of content:

Participate in all serious game modules (identification, puzzle, play). Share personal achievements and digital artifact cards.

Feedback on key points:

Strengths: Strong gameplay, “learning while playing” format is popular. The collection of digital artifacts stimulates interest in learning.

Problems: If there is no task guidance, it is easy to get “lost” in the pavilion. The interactive effect of the question-and-answer game is not good.

Comprehensive evaluation: It provides college students with a combination of cultural knowledge and interesting interactive experience, which is an excellent attempt in digital education of museums, and provides an innovative solution for the dissemination of culture and art.

The expected results are mainly enhancing audience participation so that the bronze display changes from static to dynamic and explorable. To transform the bronze artifact display from a traditionally static format into a dynamic and engaging experience, virtual interaction can be used to create immersive and explorable virtual environments. These environments allow audiences to interact directly with virtual representations of artifacts, rotating, assembling, or even using them within simulated historical contexts.

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Allow the audience to learn actively in the game and form a deep cultural memory. Serious games serve as powerful tools for cultural storytelling, allowing players to actively engage with the history, function, and symbolism of bronze artifacts. Through quests, problem-solving scenarios, and role-playing elements, audiences can experience historical narratives firsthand—such as participating in ancient rituals, managing a bronze workshop, or decoding inscriptions. These interactive experiences facilitate deeper cognitive and emotional connections with cultural content, helping players internalize historical knowledge and form lasting cultural memories. As a result, learning becomes both meaningful and memorable, reinforcing cultural identity and appreciation.

Promote the application of serious games in cultural heritage education and provide model cases for future exhibitions. By embedding educational content within the mechanics of play, serious games introduce a transformative approach to museum education. This innovation breaks away from passive information delivery and fosters an active, learner-centered model. Museums can use serious games as modular, scalable tools adaptable to various age groups, learning objectives, and exhibition themes. These games can serve as model cases for future development in digital heritage education, combining academic research, cultural preservation, and modern technology. The success of such approaches not only elevates the educational function of museums but also broadens their role as interactive cultural platforms that bridge the gap between past and present.

Discussion

1. Alignment with Literature

This study contributes to and extends the growing body of interdisciplinary research at the nexus of serious games, museum virtual interaction, and digital cultural heritage protection. Through a comparative analysis with extant literature, several key convergences and divergences emerge, illuminating both the alignment and unique contributions of the present work.

A dominant theme in the literature on serious games and virtual exhibitions is the potential for digital interactivity to enhance user engagement and immersion. Scholars such as Alfanda (2025) assert that interactive digital technologies can shift museum experiences from passive observation to active exploration. The findings of this study corroborate these claims: participants consistently reported heightened interest and motivation when interacting with the virtual exhibition, especially when narrative and gamified elements were present.

Existing research (e.g., Gee, 2007; Mayer, 2014) has demonstrated that game-based learning environments can improve knowledge retention, especially in complex, abstract, or historical domains. Similarly, this study found that participants exhibited increased understanding and retention of Bronze Age cultural knowledge after engaging with the virtual exhibition. The integration of interpretive storytelling, interactive challenges, and feedback loops mirrors the cognitive scaffolding mechanisms highlighted in prior pedagogical frameworks.

There is an ongoing concern in the literature regarding the balance between engagement and authenticity in digital heritage representations (Champion, 2019; Belhi et al., 2020). This study aligns with best practices by grounding its content in authentic archaeological data and professional museological standards. The use of 3D scans of actual artifacts and adherence to cultural interpretive norms demonstrates a commitment to representing cultural heritage with fidelity, an issue echoed in both theoretical and applied museum studies.

2. Divergences and Novel Contributions

Most existing literature centers on Western or global museum contexts. For example, the British Museum VR initiatives and Smithsonian digital projects. In contrast, this study is situated within the specific cultural and historical landscape of Southwest China. It introduces a regionally nuanced application of serious games to interpret Bronze Age Yunnanese heritage, thus diversifying the geographical and cultural scope of existing scholarship. Focusing on a provincial museum in China, this study provides insights into how digital innovation can be integrated with local history and culture.

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While prior studies often focus on either user experience design (UXD), educational outcomes, or heritage interpretation in isolation, this research uniquely integrates multiple methodological strands: user testing, game design, curatorial practice, and empirical evaluation. This holistic approach provides a model for interdisciplinary collaboration in digital heritage projects an area frequently cited as underdeveloped.

Although audience studies in museum contexts are well-established, this research contributes new perspectives by including a diverse participant pool composed of local museum visitors, students, and cultural professionals. It responds to Falk & Dierking's (2016) call for more nuanced understandings of visitor motivations and behaviors in digital environments. The comparative responses from distinct user groups enrich current understandings of how serious games resonate across varied demographics.

A persistent tension in the literature lies in reconciling entertainment and educational objectives in serious games (Slussareff et al., 2016). This study demonstrates that the two aims are not mutually exclusive but can be meaningfully integrated through design. The exhibition prototype achieved both high levels of engagement and significant learning outcomes, suggesting that cultural heritage games can occupy a hybrid space that benefits both curatorial goals and public interest.

3. Critical Reflections and Limitations in the Literature and Conclusion

While this study reaffirms many established theories, it also exposes gaps in the literature. For instance, there is limited discussion on infrastructural challenges within smaller or regional museums when adopting high-tech digital solutions, which is a practical issue encountered in this project. Additionally, few studies deeply interrogate the ethical implications of gamifying sacred or contested heritage, a topic that merits further exploration, especially in cross-cultural contexts.

By comparing this study's findings with those of prior works, it becomes evident that while serious games have been widely recognized as transformative tools for education and engagement in cultural heritage, their implementation within region-specific, underrepresented contexts like Yunnan introduces new dimensions to this discourse. The Bronze Age of Yunnan case study not only supports but also expands the field's understanding of how serious game-based virtual exhibitions can serve as inclusive, educational, and culturally respectful platforms for heritage dissemination.

The study's findings also invite deeper theoretical reflection. The application of the three-layer narratology model demonstrates that coherence between fabula, story, and discourse is essential to achieving both immersion and comprehension. When players assume roles (e.g., archaeologist, historian) and progress through narrative arcs supported by game mechanics, they are not merely absorbing information but constructing meaning. This convergence of constructivist learning theory and narrative engagement offers a powerful lens through which future museum applications can be evaluated.

Conclusion

This research has examined the intersection of serious games theory and virtual museum exhibitions through an applied case study of The Bronze Age of Yunnan exhibition at the Yunnan Provincial Museum. The overarching aim was to explore how serious game design principles can enhance the visitor experience, promote deeper cultural understanding, and support the digital transformation of traditional museum exhibits.

The study was situated within an interdisciplinary framework combining museology, digital heritage studies, human-computer interaction (HCI), and game design. It responded to the increasing demand for more immersive, interactive, and educational museum experiences, particularly within virtual environments necessitated by shifting audience behaviors and technological advancements.

The research followed a multi-phase methodology that included theoretical research, design and development of a virtual prototype, and empirical evaluation through user testing. A prototype virtual exhibition was developed using Unity3D and other digital tools, structured around key features of serious games such as rule-based systems, interactivity, challenges, feedback, and narrative engagement. The exhibition content was curated based on authentic archaeological data and museological practices, including 3D scans and reconstructions of bronze artifacts, environmental modeling, and interpretive storytelling.

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User studies involved museum visitors, students, and cultural professionals who engaged with the virtual prototype and provided feedback via surveys and interviews. Findings indicate that serious game elements significantly enhanced visitor engagement, motivation, and educational outcomes. Users reported increased interest in the Bronze Age culture of Yunnan and expressed a preference for interactive digital formats over traditional static displays.

Moreover, the study addressed practical considerations of integrating serious games into museum strategies, such as technological infrastructure, curatorial concerns, audience inclusivity, and content authenticity. It was observed that serious games can serve as a bridge between entertainment and education, transforming passive observation into active cultural participation.

In conclusion, this research has demonstrated that serious games offer a valuable and innovative approach for virtual museum exhibitions. The case study validates the conceptual and practical feasibility of this approach, presenting a model that can inform future initiatives aimed at digital engagement in heritage contexts. The project contributes original insights into the evolving role of digital interactivity in museums and underscores the transformative potential of game-based learning in cultural heritage preservation and dissemination.

Recommendation

1. Limitations of the study

1.1 Discuss the limitations of the research methodology

Firstly, the chosen methodological approach, mixed-methods design, case study analysis, and experimental simulation, while suitable for exploring the core research questions, inherently restricts the breadth of inference. For example, qualitative interviews provide rich, contextual insights but lack the scalability and replicability of large-scale quantitative surveys. Conversely, controlled experiments may omit the complex real-world variables that influence naturalistic behavior.

Secondly, the operationalization of key variables may have introduced limitations in construct validity. Variables such as insert key variables, “user trust,” “efficiency,” and “collaboration level” were measured using predefined indicators, which, despite validation, may not fully capture the conceptual nuances. Moreover, the study relied on self-reported data, which may be subject to social desirability bias or participant misperception.

Finally, the temporal scope of the research was limited, preventing the investigation of long-term trends or longitudinal effects. A cross-sectional design, while efficient, may overlook the evolving dynamics of virtual interaction technology.

1.2 Insufficient samples, limited experimental conditions

Another significant limitation pertains to the adequacy and diversity of the participant sample, as well as the bounded nature of the experimental conditions. The questionnaire’s sample size of 65, while suitable for preliminary, exploratory analysis, lacks the statistical power necessary for broader generalization. More critically, the demographic homogeneity—with participants drawn primarily from college populations in Yunnan Province—limits the external validity of the findings. This constraint is particularly impactful in the context of sociotechnical systems, where user characteristics such as age, digital literacy, cultural background, and prior museum experience may substantially influence engagement patterns, learning outcomes, and system usability perceptions.

These limitations likely influenced the study in several ways. For instance, the relatively tech-savvy and educated demographic may have exhibited greater ease in navigating the virtual environment and stronger receptivity to gamified learning mechanisms than older or less digitally literate audiences. This could have led to an overestimation of usability and engagement metrics, thereby skewing the evaluation of the application’s universal applicability. Similarly, narrative comprehension and cultural interpretation may differ across cultural or age groups, which were underrepresented in the current sample.

In addition, the experimental conditions within the APP design, though carefully constructed to ensure internal validity, were necessarily limited by logistical and ethical considerations. The simulation

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did not fully replicate real-world operational factors such as time constraints, environmental stressors, or interpersonal dynamics typical of a live museum setting. Variables like collaborative learning, peer interaction, real-time feedback, and emotional stress were held constant or excluded altogether, potentially oversimplifying the complexity of user experience in actual museum contexts. These exclusions may have led to inflated perceptions of effectiveness or engagement, as users were not exposed to the full spectrum of experiential variables.

To strengthen the credibility and future applicability of the findings, future research should adopt several methodological refinements. First, employing stratified or quota sampling methods would help ensure representation across a wider range of demographic segments, including age groups, educational backgrounds, geographic locations, and levels of technological familiarity. Second, extending the study through longitudinal fieldwork or pilot implementations in diverse museum environments—urban and rural, national and regional could provide richer insights into contextual adaptability and user behavior over time. Additionally, introducing real-time interaction, collaborative tasks, and varied levels of environmental pressure into the simulation could better emulate real-world conditions and provide a more nuanced understanding of serious games 'effectiveness in museum learning contexts.

1.3 Possible bias interference

Bias is an inherent risk in empirical research and can infiltrate various stages of the research process, from design and data collection to analysis and interpretation.

One potential source of bias in this study arises from selection bias, particularly if participants self-selected into the study or were recruited through networks with shared characteristics. This may have skewed the data toward specific perspectives or experiences, undermining the neutrality of the sample.

Observer bias is another concern, especially in the qualitative components of the research. The researchers' expectations, interpretations, or prior knowledge might have inadvertently influenced the thematic analysis of qualitative data, despite efforts to standardize interpretation through interviewee reliability measures and reflexive practices.

Furthermore, instrumentation bias may have emerged if the tools and questionnaires used were not sufficiently calibrated or culturally adapted, particularly if translated versions were used without proper cross-cultural validation.

Finally, confirmation bias might have affected the interpretation of ambiguous findings, with a tendency to highlight data that supports the hypothesis while discounting contradictory evidence.

To mitigate these risks, multiple strategies were employed, including triangulation of data sources, anonymization of responses, and peer debriefing sessions. Nevertheless, the possibility of residual bias cannot be entirely excluded and should be accounted for when interpreting the conclusions of the study.

To enhance transparency and academic rigor, the inclusion of a researcher's positionality statement is recommended in future work. Explicitly outlining the researchers' disciplinary training, cultural backgrounds, and interpretive standpoints would clarify how these factors may have shaped methodological choices and analytical perspectives. This is particularly important when dealing with gamified narratives and intangible heritage, where issues of representation, cultural ownership, and epistemological bias are central. Recognizing these influences not only strengthens the credibility of the findings but also contributes to broader conversations around reflexivity and ethics in digital heritage research.

2. Suggestions for future research

2.1 Based on the limitations, it is suggested that the future direction of exploration can be continued in this field.

Future research should begin by systematically addressing the limitations observed in this study. Firstly, this research adopted a combined qualitative and quantitative case study methodology based primarily on user observation and thematic analysis. While this approach yielded valuable insights, it lacked large-scale quantitative validation. Thus, future research can adopt a methodological design that expands

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the research scope, integrating quantitative user experience assessments, such as usability testing, eye-tracking, or psychophysiological measures (e.g., EEG, GSR), to enrich empirical rigor and generalizability.

Secondly, the demographic scope of user participants in this study was relatively narrow, often skewed toward young, technologically adept individuals. Broader sampling across age groups, educational backgrounds, and cultural contexts would allow future research to better capture how different audiences engage with virtual exhibitions enhanced by serious games.

Lastly, technical limitations such as the fidelity of 3D rendering, network latency, and the absence of adaptive feedback mechanisms posed constraints on the realism and personalization of the experience. Future projects may explore emerging technologies, including AI-driven personalization, cloud-based rendering, and 5G-supported interactions, to elevate both immersion and accessibility.

2.2 For further research on virtual interactive display, narrative design, and serious games.

One of the most promising directions for future exploration lies in the advancement of narrative design frameworks tailored specifically to the museum and heritage context. While this study experimented with embedded storytelling elements, future research could delve into the development of culturally resonant narrative architectures that blend linear, branching, and emergent storytelling paradigms. Integrating these with serious game mechanics can further promote active knowledge construction, emotional resonance, and long-term retention.

Another critical area is the co-creation of content. Future studies might examine how participatory design approaches, involving museum curators, historians, game developers, and visitors themselves, can result in more authentic and meaningful serious games. This includes researching methodologies for collaborative storytelling and dynamic content updating, allowing virtual exhibitions to evolve and reflect ongoing scholarly discoveries.

Moreover, future research should investigate cross-platform adaptability. As virtual exhibitions become increasingly accessible through VR headsets, AR mobile apps, web browsers, and immersive installations, the transmedia design of serious games becomes essential. Studies exploring how narratives and interactions are maintained or transformed across different digital platforms will provide valuable guidelines for scalable and inclusive design.

Finally, the longitudinal impact of serious games in virtual exhibitions remains largely unexplored. Future research should track user engagement, learning outcomes, and behavioral changes over extended periods. This would enable a deeper understanding of how such interventions influence cultural education, identity formation, and digital heritage preservation in the long term.

3. Practical significance and application suggestions

3.1 Implications for Museum Exhibition Design

Virtual exhibitions enriched with serious game elements offer museums a powerful strategy to revitalize their curatorial approach. Traditional static displays can be augmented or even reimagined as interactive, exploratory environments that invite visitors to actively engage with the artifacts, narratives, and historical contexts. This study demonstrates how serious games facilitate deep visitor immersion by transforming passive observation into goal-oriented interaction, thereby enhancing both cognitive and emotional connections to the subject matter.

From a design perspective, museums are encouraged to adopt modular narrative structures, allowing visitors to navigate historical events or cultural developments in non-linear, personalized paths. Incorporate gamified tasks such as artifact restoration, decision-making scenarios, or time-travel missions, which serve both educational and entertainment functions. Utilize adaptive interaction models that respond to user input, creating dynamic experiences that cater to individual preferences and learning styles.

Furthermore, the use of serious games can help attract younger audiences, particularly those accustomed to digital interactivity, thereby expanding the demographic reach and educational impact of museums.

3.2 Advancing Cultural Heritage Education

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The integration of serious games into virtual exhibitions also holds substantial educational potential, particularly in the field of informal cultural learning. Unlike conventional didactic methods, serious games allow learners to construct historical knowledge through simulation, experimentation, and storytelling. This aligns with constructivist learning theories, where knowledge emerges through interaction and contextual engagement.

Based on this research, the following applications are proposed: Develop curriculum-linked virtual exhibition modules that can be used in schools to complement classroom instruction on regional history, archaeology, and anthropology. Establish interactive educational platforms that allow students to assume roles (e.g., ancient metallurgist, tribal leader, or archaeologist) within game-based scenarios derived from historical contexts. Foster interdisciplinary collaboration among educators, museum professionals, and game designers to co-create serious games aligned with pedagogical goals.

Such initiatives not only promote multimodal literacy, visual, spatial, and narrative, but also stimulate cultural identity formation by allowing users to explore the intangible values embedded in artifacts and rituals.

3.3 Recommendations for Digital Display Technology

The implementation of virtual interactive exhibitions calls for a strategic and innovative application of digital technologies. This study reveals that technology should not merely digitize artifacts but recontextualize them through immersive storytelling and interaction.

Accordingly, museums and cultural institutions should consider utilizing real-time 3D rendering engines such as Unity or Unreal Engine to construct responsive, high-fidelity environments that support complex interactions and real-world physics. Integrating extended reality (XR) technologies, including Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), to enable multisensory experiences that bridge physical and digital domains. Applying cloud-based architecture and edge computing to enhance accessibility and performance, particularly for geographically remote users or institutions with limited on-site infrastructure. Embracing AI-driven content personalization, allowing systems to adapt game difficulty, narrative depth, or language settings based on user profiles.

Finally, open standards and interoperability should be emphasized to ensure that virtual exhibitions can be easily updated, shared, and reused across different museums and educational contexts, supporting long-term sustainability.

References

Alfanda, A. M. (2025). *A data-based artificial intelligence for predicting compressive strength of rice husk ash sandcrete blocks*. *Academia Engineering, 2*(2),1-11. https://doi.org/10.20935/AcadEng7673

Bal, M. (2017). *Narratology: Introduction to the theory of narrative* (4th ed.). University of Toronto Press.

Belhi, A., Gasmi, H., Bouras, A., Alfaqheri, T., Aondoakaa, A. S., Sadka, A. H., & Foufou, S. (2020). Machine learning and digital heritage: The CEPROQHA project perspective. In K. Arai, S. Kapoor, & R. Bhatia (Eds.), *Fourth International Congress on Information and Communication Technology: ICICT 2019, London, Volume 2* (pp. 363–374). Springer. https://doi.org/10.1007/978-981-15-0633-8_34

Biehl, P. F., & Prescott, C. (2013). *Heritage in the context of globalization: Europe and the Americas* (SpringerBriefs in Archaeology). Springer. https://doi.org/10.1007/978-1-4614-6077-0

Champion, E. (Ed.). (2019). *The phenomenology of real and virtual places*. Routledge.

Chee, Y. S. (2007). Embodiment, embeddedness, and experience: Game-based learning and the construction of identity. *Research and Practice in Technology Enhanced Learning, 2*(1), 3–30. https://doi.org/10.1142/S1793206807000303

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Chen, H., Hale, J., & Hanks, L. (2024). Archive or exhibition? A comparative case study of the real and virtual Pitt Rivers Museum. *Digital Applications in Archaeology and Cultural Heritage, 32*, Article e00305. https://doi.org/10.1016/j.daach.2023.e00305

Duncan, T. (2018). Beyond the museum: A comparative study of narrative structures in films and museum design. In S. Macleod, T. Austin, J. Hale, & O. H. Hing-Kay (Eds.), *The future of museum and gallery design: Purpose, process, perception* (pp. 239–253). Routledge.

Economou, M. (2015). Heritage in the digital age. In W. Logan, M. Nic Craith, & U. Kockel (Eds.), *A companion to heritage studies* (pp. 215–228). Wiley-Blackwell.

Falk, J. H., & Dierking, L. D. (2016). *The museum experience revisited*. Routledge.

Gee, J. P. (2007). *Good video games and good learning: Collected essays on video games, learning, and literacy*. Peter Lang.

Giaccardi, E. (Ed.). (2012). *Heritage and social media: Understanding heritage in a participatory culture*. Routledge.

Giannini, T., & Bowen, J. P. (2022). Museums and digital culture: From reality to digitality in the age of COVID-19. *Heritage, 5*(1), 11. https://doi.org/10.3390/heritage5010011

Guangzhou Virtual Power. (2024). Virtual digital person landing program for exhibition halls: Exploring full-scene intelligent tours. *Sohu*. https://it.sohu.com/a/810279428_120912206

International Council of Museums (ICOM). (2024). *Museum definition*. Retrieved February 6, 2024, from https://icom.museum/en/resources/standards-guidelines/museum-definition/

King, N. (2021). Serious games guide: Everything you need to know in 2021. *Chaos Theory Games*. Retrieved 1 February 2021 from: https://www.chaostheorygames.com/blog/serious-games-guide-everything-you-need-to-know-in-2021

Li, C., & Ghirardi, S. (2019). The role of collaboration in innovation at cultural and creative organizations: The case of the museum. *Museum Management and Curatorship, 34*(3), 273–289. https://doi.org/10.1080/09647775.2019.1588401

Mayer, R. E. (2014). *Computer games for learning: An evidence-based approach*. MIT Press.

Parry, R. D. (2007). *Recording the museum: Digital heritage and the technologies of change*. Routledge.

Peng, L. (2021, April 2). Artifacts unearthed at Sanxingdui have relatives in Yunnan? *文旅云南*. https://mp.weixin.qq.com/s?__biz=MjM5NzY4NTEwNA==&mid=2652407804&idx=2&sn=ea4169645a311b0cb7b69fb0e2c3b83c

Simon, N. (2010). *The participatory museum*. Museum 2.0.

Slussareff, M., Braad, E., Wilkinson, P., & Stråat, B. (2016). Learning games. In R. Dörner, S. Göbel, W. Effelsberg, & J. Wiemeyer (Eds.), *Entertainment computing and serious games: International GI-Dagstuhl Seminar 15283, Dagstuhl Castle, Germany, July 5–10, 2015, Revised Selected Papers* (pp. 189–211). Springer. https://doi.org/10.1007/978-3-319-46152-6_11

Wang, H., Gao, Z., Zhang, X., Du, J., Xu, Y., & Wang, Z. (2024). Gamifying cultural heritage: Exploring the potential of immersive virtual exhibitions. *Telematics and Informatics Reports, 15*, 100150. https://doi.org/10.1016/j.teler.2024.100150

Wojciechowski, R., & Cellary, W. (2013). Evaluation of learners' attitude toward learning in ARIES augmented reality environments. *Computers & Education, 68*, 570–585. https://doi.org/10.1016/j.compedu.2013.02.014

Xiangguang, S. (2008). The development of private museums in China. *Museum International, 60*(2), 40–48. https://doi.org/10.1111/j.1468-0033.2008.00631.x

Yunnan Provincial Museum. (2023). Yunnan Provincial Museum's collections of fine cultural relics are available in the digital exhibition hall online today! *Yunnan Provincial Museum*. Retrieved from: https://mp.weixin.qq.com/s?__biz=MzI0MjkyOTQwMg==&mid=2247525295&idx=1&sn=f139c25b562dfac05e8cfe4e8727a19b

Yunnan Provincial Museum. (2025). *Overview*. Retrieved from: https://www.ynmuseum.org/survey.html#section=2

Citation
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