

RESEARCH ON THE DIGITAL EXHIBITION OF CULTURAL RELICS FOR CROSS-CULTURE COMMUNICATION: CASE STUDY ON CHINA-GREECE COOPERATION ON TERRACOTTA WARRIORS

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ABSTRACT:

With epidemics blocking offline interactions, it is difficult to organise events such as tours of major heritage sites and outbound exhibitions of cultural relics, and new paths need to be expanded for the presentation of cultural heritage and intercultural education efforts. With the booming development of digital technology, the integration of online virtual presentation and interactive technology and the innovative design of 3D scenes provide new solutions for the intercultural communication of these precious and immovable cultural relics (e.g. archaeological sites), etc. This project is based on the Sino-Greek cooperation around the online presentation of heritage items such as the Terracotta Warriors and Horses of China and the precious collection of the National Archaeological Museum of Greece, in order to present and On the basis of communicating the value of heritage and the connection between Chinese and Greek civilisations, the project explores the development of a virtual space that integrates the Terracotta Warriors and Horses pits, the interactive virtual display of cultural relics, and the display of the achievements of scientific and technological conservation of cultural relics, so as to realise the cross-cultural exchange between China and Greece and fulfil the educational function of heritage.

1. INTRODUCTION

The COVID-19 pandemic, which emerged in 2020, has caused significant changes in the world landscape and people's lifestyles. As a result of the pandemic, the educational function of cultural heritage sites and museums has been severely impacted due to the ban on tourism. The traditional trajectory of education and dissemination of cultural heritage has been disrupted, and there is a growing demand for online exhibitions. The decreased social openness of museums and heritage sites has created a need for digital construction to become the basis for the development of online exhibitions. The application of digital technologies in the field of cultural heritage has broken the boundaries of physical space and offers new possibilities for the education and dissemination of cultural heritage during the pandemic.



Figure 1. Parallel Space: Meeting the Terracotta Army in Greece—Home Page

In this context, the China-Greece Digital Exhibition of Cultural Heritage was born, taking the Year of Cultural Tourism between China and Greece as an opportunity to showcase the Terracotta Warriors and Horses World Heritage Site to the world through digital technology in a variety of interactive online formats. The project is an innovative approach to cross-cultural heritage education in the digital age, featuring the Terracotta Army figurines from both the National Archaeological Museum of

Greece and the Terracotta Army figurines from China's museum jointly exhibited in the virtual exhibition hall of the National Archaeological Museum of Greece, and receiving nearly three million views. The project explores the use of digital technology in the Web 3.0 era to increase the visualisation of cultural heritage interpretation in a collaborative model of government, museum, and technology enterprise, and promote cultural heritage intercultural education.

2. RESEARCH LITERATURE

2.1 Related Works

Various countries are experimenting with the integration of virtual and interactive online technologies for heritage education. The ANQA project in Syria allows visitors to explore heritage sites in Damascus through virtual tourism technology, photogrammetry, laser scanning, and storytelling text interpretation. This approach helps to educate the world about heritage through storytelling texts, contributing to post-disaster recovery activities to preserve heritage (Brzezicki et al., 2017). The Smithsonian Institution, the largest museum and research institution in the United States, offers a range of online learning resources and courses through digital technology and online education platforms, including cultural heritage, natural sciences, and other areas, to users worldwide (Nobby & Xiao, 2016). The Indian government's Digital India initiative aims to create a digital cultural heritage hub using virtual and augmented reality technologies to provide global users with the opportunity to visit India's cultural heritage online (Wang & Wu & Zhu, 2022). The Greek World Foundation's virtual reality team has developed a virtual travel system that reconstructs the ancient city of Miletus and the Temple of Olympian Zeus, providing visitors with a three-dimensional virtual tour (Athanasios et al., 2001). Tsinghua University in China has explored more multimedia interactivity in bringing cultural relics to life and has developed the immersive digital audio-visual display project "Into the Qingming Shanghe Tu," which

includes virtual reality experiences such as scenes from the painting showing the cityscape, virtual character dialogues, and immersive sound effects, a rare multimodal digital display project for a specific cultural object in China (He & Ma, 2006).

2.2 Issues

However, the current methods of online exhibition and dissemination of cultural heritage still face several issues. Poor authenticity experience, single interaction methods for online exhibitions, and limited outreach of physical artifacts for offline exhibitions are common issues (Lv, 2022), like replicating offline exhibitions to online with panoramic roaming, and without further adaptive design. The existing methods of online exhibition of cultural heritage generally use a combination of offline physical exhibition real-world collection and graphic hotspots. They rely on a single form of heritage knowledge dissemination that does not account for the vast differences in the needs of different groups of people, such as professionals, amateurs, and the general public.

In terms of three-dimensional data content support-related technology, the current three-dimensional reconstruction of cultural relics mainly uses three-dimensional laser scanning technology, structured light scanning technology, and other new technologies. 3D scanners based on 3D laser scanning technology or structured light scanning technology can obtain the 3D coordinates, reflectivity, color, and other data information of each point on the surface of an object in high resolution and fast manner. However, 3D scanners have some limitations, such as difficulty scanning completely when the hollow structure of an object is more complex. In terms of 3D depth estimation, the Tsinghua University team has proposed unsupervised and multi-task learning-based single-frame depth and multi-frame camera pose estimation, achieving a strongly robust and highly generalizable depth and pose estimation model. Good results were obtained in both indoor and outdoor scenes. In terms of 3D presentation and interaction technology, game engines such as Unity3D and Unreal, and web-based Web3D technology are currently the mainstream means of online 3D presentation. China also has its intellectual property rights for Web3D development software technologies such as Web Max, VRPIE, and Converse engine software.

3. RESEARCH OBJECTIVES

This paper summarizes and analyzes the successful experience of the China-Greece cooperation on the digital exhibition of the Terracotta Warriors in terms of content design and online interactive technology integration and explores ways to further strengthen the online display and interpretation of cultural relics, especially for archaeological sites, precious cultural relics that are not easy to leave the country or not conducive to long-term exhibition and display, and to adopt appropriate content and interactive methods for cross-cultural people, resulting in a more immersive way for the public to experience the remote sites, appreciate the exquisite details of cultural relics, and understand the cross-cultural knowledge online. The exhibition is designed to provide the public with a more immersive experience of distant sites, exquisite details of artifacts, and more accessible cross-cultural knowledge.

4. METHODOLOGY

This study is a summary of the project Parallel Space: Meeting the Terracotta Warriors in Greece, and a theoretical and methodological system of intercultural communication based on

digital technology integration. Based on a thorough understanding of the current status of international practice projects in this field, this paper systematically and structurally perceives the practical experience of intercultural communication of cultural heritage based on digital integration with the online exhibition as a channel through a comprehensive study of the practical approach to intercultural communication facilitated by technology in this project. It explores the intrinsic drivers and innovative expressions of cultural heritage intercultural education and communication in order to promote new development of cultural heritage intercultural education and communication.

5. RESEARCH CONTENTS

5.1 User requirements and system functional architecture

This project is designed for the Greek who do not know the history of China or the Terracotta Warriors as the target group. In terms of content, we not only emphasize the comparison of chronology and types of cultural relics to make the Greek audience understand the history and characteristics of the Terracotta Warriors more easily, but also further explain the joint efforts of China and Greece in the conservation of cultural relics from the theme of scientific and technological conservation, so that the public can understand that the conservation of cultural relics is a global and widespread cause. In terms of technical application, considering the professionalism of cultural relic interpretation, the relevance of cultural relics and archaeological sites, and the connection between Chinese and Greek cultural relics, the project adopts site roaming, cultural relic virtually display, and virtual exhibition to guide the public, especially the youth, to understand cultural relics with different interactive ways online to enrich the fun and intuitiveness.

This project reach more people and make it easier for the Greek public to get access to the links by linking the official websites of the Emperor Qinshihuang's Mausoleum Site Museum and the National Archaeological Museum of Greece at the same time, and the application of load-balancing and elastic computing technology will make access more convenient for the global public and display multimedia resources more smoothly to strengthen the online experience.

5.2 Cross-Cultural Communication in the China-Greece Discourse

Greece and China are geographically distant and have vastly different cultural backgrounds. Therefore, creating cultural resonance between audiences from completely different cultural backgrounds in an online exhibition is a significant challenge in cross-cultural dissemination of cultural heritage. To build a discourse that facilitates understanding for people from different cultural backgrounds, one can choose similar cultural objects from similar time periods, integrate them in a common virtual scenario, and present the digitized objects online in a well-known museum's exhibition hall.

The "Dialogue Across Time and Space" virtual exhibition takes visitors to Gallery 13 of the National Archaeological Museum of Greece, where an online virtual exhibition is set up in a real-life gallery to introduce the historical background and cultural features of the Chinese Terracotta Warriors and the sculptures of the Young Sculptor of Croesus at the National Archaeological Museum of Greece. The statue of the youth of Croesus, made of Parian marble, dates from around 540-515 B.C., and is meant to commemorate the young warrior Croesus,

who died in battle. The Terracotta Warriors and Horses of Qin, the highest-ranking of the more than 2,000 terracotta warriors and horses unearthed in China, was made around 250 B.C. The similarity of the two exhibited objects allows viewers of different cultural groups to compare and contrast them from their own cultural perspectives. Through the detailed presentation and aesthetic interpretation of the two collections, the exhibition helps the audience to quickly build a macroscopic understanding and realize the dialogue between the ancient civilizations of Greece and China in virtual time and space.

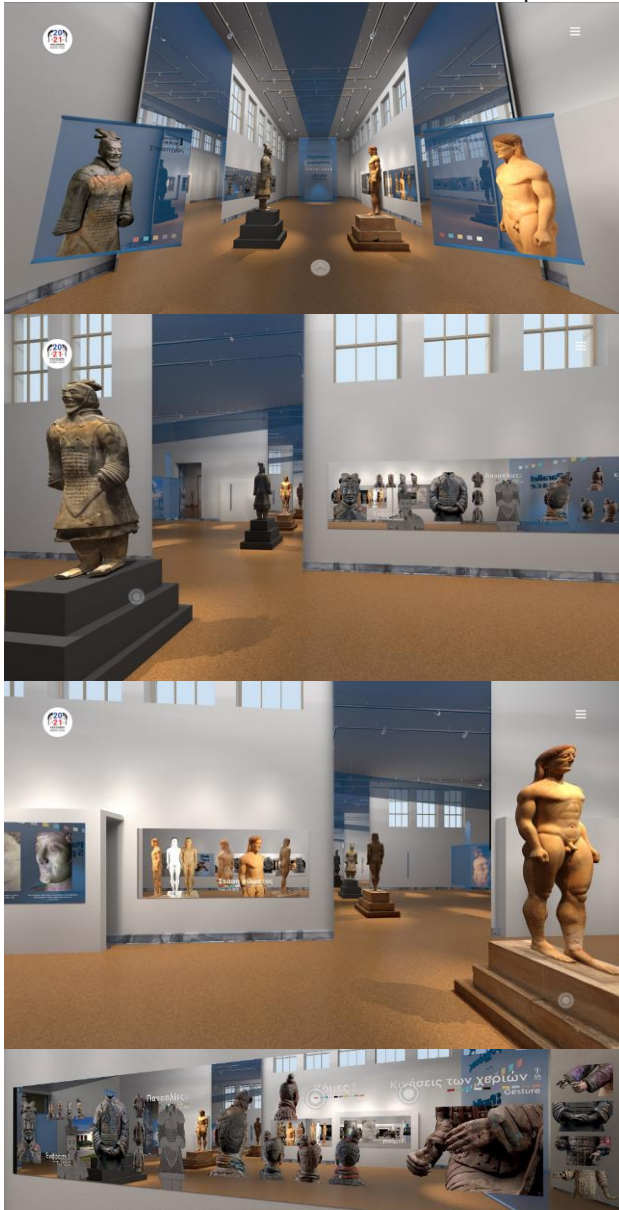


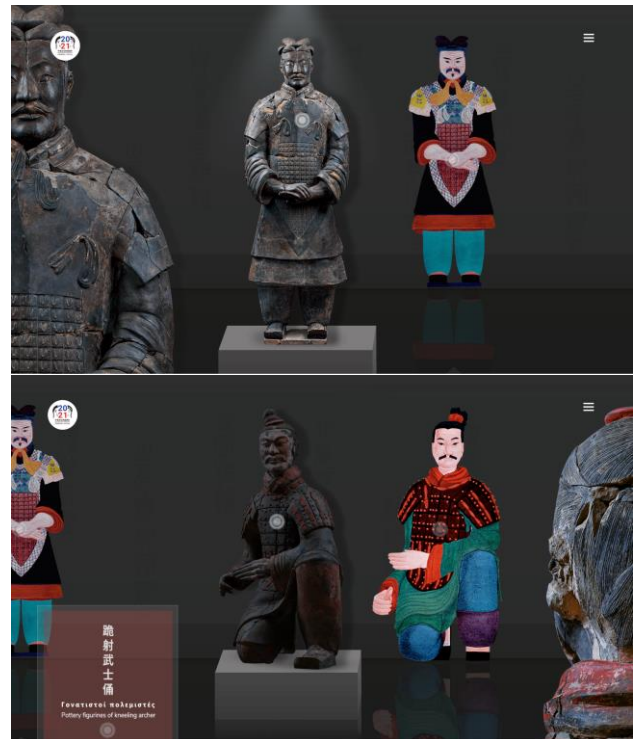
Figure 2. Virtual No.13 Hall of National Archaeological Museum of Greece

The presentation of the precious cultural heritage of the two countries enables a virtual dialogue between two civilizations that have undergone many vicissitudes. This experience allows the audience to recognize the commonalities between different civilizations on opposite sides of the globe and highlights the shared pursuit of different civilizations and peoples from a global perspective. This exploration of the global nature of cultural heritage in intercultural education and communication underscores the cultural mind of mankind in heritage exchange, the human consensus that all civilizations live together in

harmony and beauty, and the dissemination and education of world cultural heritage from the perspective of building a common future for humanity. Through in-depth and storytelling interpretation, combined with the familiarity of the target countries, the education of cultural heritage penetrates into the hearts of the audience in an interesting way. This approach reconstructs the scientific and cultural connotations of cultural heritage, making it an essential bridge between civilizations and nations.

5.3 WebGL-Based Construction of Realistic 3D "Virtual Lab" Space (2.5D)

As technology advances, restoring and protecting cultural relics has become a global effort, and showcasing the technological protection of the Terracotta Warriors and Horses of Qin and the Terracotta Warriors of Young Greek Soldiers is an important aspect of cross-cultural exchange between Chinese and Greek civilizations. To highlight the sense of technology, a 2.5 virtual gallery with real 3D space has been built using WebGL technology. This innovative approach employs landscape browsing and sets different relative movement rates through four layers of scenery, forming a virtual space with 3D realism that can be manipulated through drag-and-drop interactions across the screen. This creates a more visual representation of the concept of a "science lab." By using this technology, the development of a virtual space for science laboratories with 3D realism has been achieved, overcoming the challenges of slow loading of real 3D data on the Internet and the complexity of click-and-see operations that are typically required.



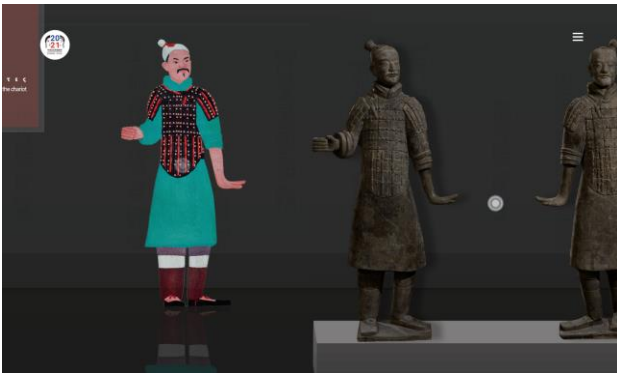


Figure 3. Terracotta Warriors Colour Restoration Process

The interpretation of scientific and technological conservation can be hindered by specialist vocabulary that is difficult to understand. To address this challenge, the physical Qin Terracotta Warriors artifacts and painted restoration images are compared and demonstrated on the same screen using click interaction (Fig.3). This enhances the visualization of the results of the painted restoration and vividly reflects the colorful features of the Qin Terracotta Warriors.



Figure 4. Visualising Complex Archaeological Techniques

The intuitive and visually engaging presentation of cultural heritage based on WebGL technology lowers the barriers to

cross-cultural communication and reduces the difficulty of understanding cultural differences and background knowledge in the presentation of cultural heritage. This interactive experience increases the audience's engagement and bridges cultural differences, providing a deeper means of communication between cultures.

5.4 Virtual Site Presentation through UHD Panoramic Technology

Traditionally, museum exhibitions display artefacts in isolation with basic information provided through illustrations and text. However, the context of the excavation site in relation to the artefacts is also important for showcasing, and digital technology can help achieve this experience and communication goal.

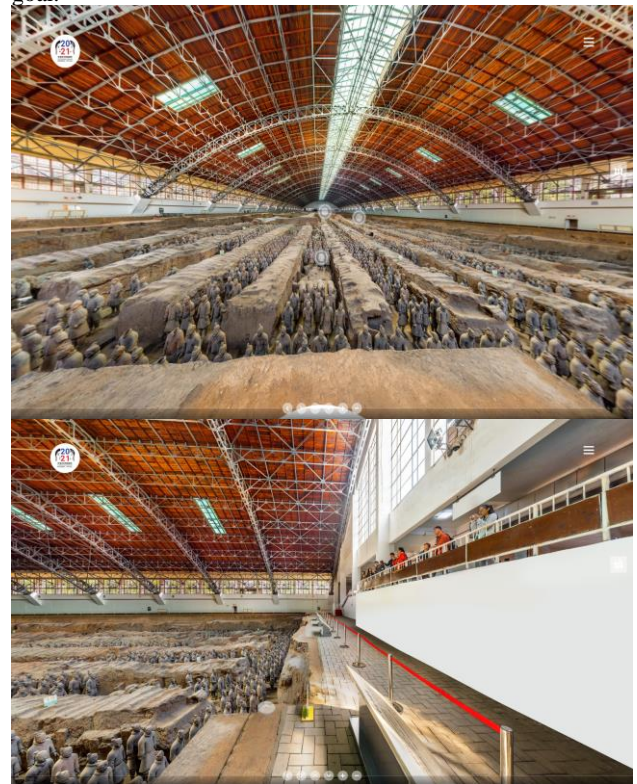


Figure 5. Panoramic View of the Terracotta Warriors Pit

The UHD(ultra-high definition) panoramic technology used in high-precision data collection of the Terracotta Warriors excavation site, combined with 3D ultra-high definition panoramic roaming technology, allows viewers to experience both the "mega-scene" of the macro display and the "ultra-high definition detail" of the micro display online. This technology brings the display of the Terracotta Warriors back to the actual site of its excavation - the Terracotta Warriors' Pit in the Mausoleum of the First Emperor of Qin. By reinforcing the link between the excavated artefacts and the site, the audience gains a more comprehensive understanding of the context of the artefacts and gains a macroscopic perception of them. Through cross-cultural communication, the artefacts are brought back to their place of excavation, allowing the online audience to see the Terracotta Warriors not just as pictures on a digital screen but to visit the site from the same perspective as the real audience. The link between the viewer's perspective to the site pits, where individual Terracotta Army artefacts can be seen in "ultra-clear detail" using high-definition digital recording of artefacts.

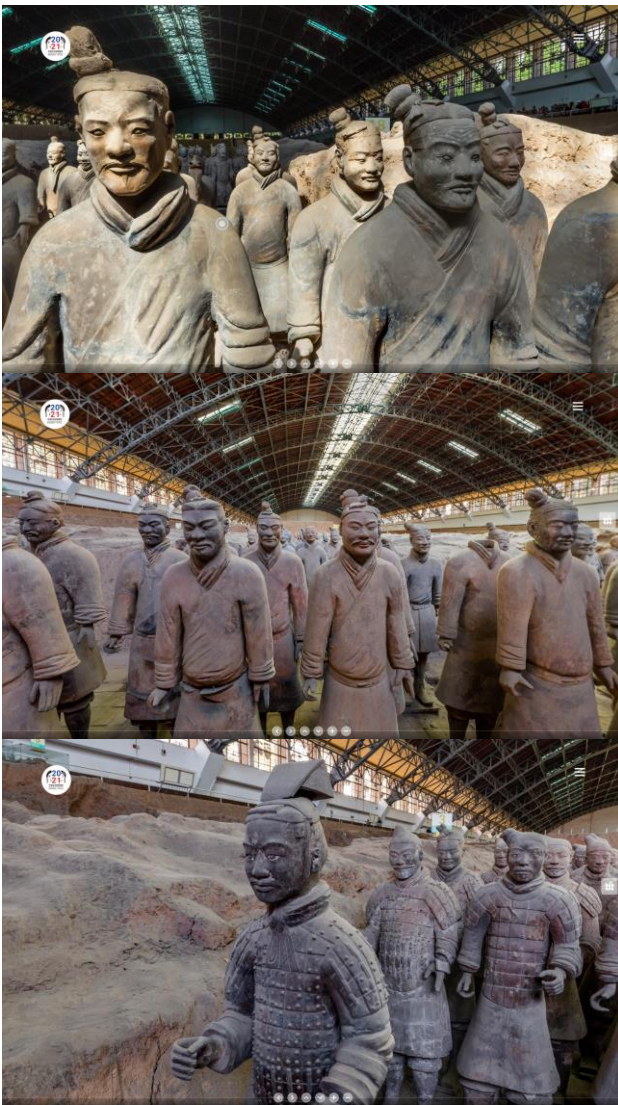


Figure 6. UHD Technology to See the Terracotta Warriors in Detail

The virtual presentation of the site based on ultra-high-definition panoramic technology enhances the sense of place in the online experience of cultural heritage for viewers from different cultural backgrounds, helping them to understand the historical period and cultural connotations of the artefacts more deeply. This technology also guides viewers to explore and learn more about the site, forming a sustainable cross-cultural communication based on cultural heritage.

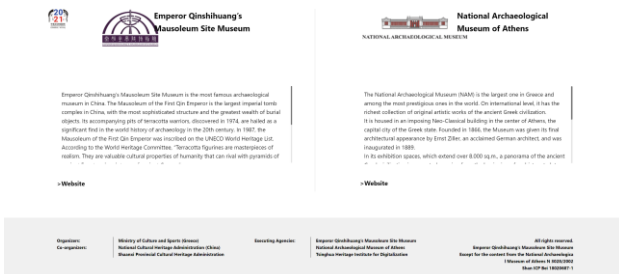


Figure 7. Link to the Heritage and Museum Page

The construction of an educational communication system for cultural heritage in the new digital era includes four thematic

exhibition halls according to a predetermined narrative line, providing a guided tour model. (Fig.8)



Figure 8. Four Thematic Exhibition Halls Page

The audience can choose thematic exhibition halls according to their preferences and their knowledge of the Terracotta Army, with the content of each hall being relatively independent and complete, in line with the non-linear tour habits of internet users. This project is a breakthrough from the traditional mode of communication, which focuses only on the external image of material entities, such as tours, lectures, and speeches. The focus on the material image in the traditional mode is a fragmented communication of aesthetic and cultural values, which is not conducive to a systematic understanding of the values represented by cultural heritage by people from different cultural backgrounds. This project transforms the traditional mode of communication and education into an immersive, interactive, and enjoyable mode of education, replacing propaganda and lectures with interaction, and changing communication and education from passive acceptance to active exploration.

6. CONCLUSION

With the advancement of the Web 3.0 era and ongoing digital technology updates, online display and interaction technology have become crucial solutions for cross-cultural display and communication of cultural heritage. With a focus on the core value of cultural relics or archaeological sites and the goal of authentic display, integrating online display and interactive technology based on the Internet, ultra-high definition panoramic virtual roaming, real 3D spatial environment rendering, and other elements can create an immersive and diverse virtual space. This allows for the presentation of precious cultural relics that cannot leave the site or be displayed out of the country, and enables the cross-cultural public to gain a deeper understanding of the historical background and cultural connotations of the sites and artifacts through different interactive methods. Through this approach, audiences can better understand the value and significance of cultural heritage by visualizing the form and characteristics of heritage and sites through online interaction, while also enhancing the efficiency of cultural heritage communication through engaging presentations.

In the post-popular era, cross-cultural communication of cultural heritage should also focus on a content-based production and development model, which explores the spiritual connotations represented by cultural heritage and presents them in a structured, interesting, and humanized way with the support of advanced technology. By using the value of cultural heritage as the core content of educational communication and integrated advanced digital technology as a loudspeaker for intercultural educational communication content and an amplifier for

communication effectiveness, a common value perception of cultural heritage that is beneficial to people from different cultural backgrounds can be promoted. By deeply exploring the spiritual connotations of cultural heritage, this approach can provide a more comprehensive and meaningful understanding of the importance of cultural heritage in the contemporary world, and help to build stronger connections between cultures.

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