

# Exploring the Evolution and Challenges of Digital Media in the Cultural Value of Dunhuang Frescoes

Si Chen<sup>1</sup>, Verly Veto Vermol<sup>2</sup>, Hasma Ahmad<sup>3</sup>

## Abstract

*Leveraging digital communication, the rapid evolution of modern media technologies heralds unprecedented opportunities for the dissemination of this extraordinary artistic heritage. The emergence of digital technology, virtual reality, and social media has ushered in new platforms for the display of Dunhuang frescoes, presenting audiences with immersive encounters and interactive experiences. Harnessing these digital tools to illuminate the history, cultural meanings, and artistic nuances of Dunhuang frescoes has emerged as a compelling research frontier. Against this backdrop, this study embarks on an exploration of the contemporary state, challenges, and prospects of Dunhuang frescoes dissemination, guided by the lens of digital media evolution. By investigating the mechanisms of communication, the channels of digital media, and audience responses intricately woven into the fabric of Chinese Dunhuang frescoes art, the research aims to unearth the transformative impact of digital media technology on dissemination. Moreover, it seeks to unravel the intricate interplay of factors such as artists, audiences, and social contexts that shape the communication process. This research project is fueled by a trio of pivotal questions: What transformations do digital media evolution bring to the strategies of Dunhuang frescoes dissemination? How does digital media evolution influence the artistic representation of Dunhuang frescoes? What are the perceptions and experiences of audiences across various digital media platforms? Through qualitative research methods, triangulation, and oral narrative analysis, the study will delve into these questions, illuminating the evolving dynamics of Dunhuang frescoes art dissemination within the context of digital media evolution and artistic communication theories.*

## Introduction

The Dunhuang frescoes, located in the Mogao Caves of Gansu Province, are a precious legacy of ancient Chinese art. These murals, which span several dynasties and showcase unique artistic styles, are rich in historical, cultural, and religious insights, significantly contributing to the understanding of Chinese civilization[1,2]. They occupy a special place in the realm of cross-cultural exchange, particularly in the context of Buddhism, serving as a vital medium for artistic communication between the East and West.

Originating in the 4th century and continuing until the 14th century, the Dunhuang frescoes are a supreme representation of Buddhist art. They are key to studying ancient China's religious, historical, and social life and are vivid evidence of cultural exchange along the ancient Silk Road. The content of these frescoes is diverse, including religious narratives, depictions of historical figures, mythological tales, and scenes of everyday life, all reflecting the creativity and imagination of ancient artists. Their diversity and uniqueness not only mirror the development of indigenous Chinese art but also incorporate artistic elements from India and Persia[3,4,5].

The artistic value of the Dunhuang frescoes lies in their exquisite painting techniques, rich use of color, and profound religious and philosophical connotations. They are not only visual interpretations of Buddhist doctrines but also reflections of human wisdom and spiritual quests. These frescoes transcend the boundaries of mere art, serving as a cultural bridge connecting ancient and modern times, as well as the East and West[6,7].

In the history of Chinese art, the Dunhuang frescoes hold an indispensable position, profoundly influencing both ancient Chinese art and subsequent artistic creations. As a treasure of Chinese and Asian culture, the Dunhuang frescoes showcase the profound depth and unique charm of Chinese civilization,

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<sup>1</sup> College of Creative Art, Universiti Teknologi MARA, 40450 Shah Alam Selangor, Malaysia. Email: 2022212946@student.uitm.edu.my. (Corresponding author)

<sup>2</sup> College of Creative Art, Universiti Teknologi MARA, 40450 Shah Alam Selangor, Malaysia. E-mail: verly@uitm.edu.my

<sup>3</sup> College of Creative Art, Universiti Teknologi MARA, 40450 Shah Alam Selangor, Malaysia. E-mail: hasma669@uitm.edu.my

holding immense value for the study and preservation of Chinese and Asian cultural heritage.

The Dunhuang Grottoes were excavated from the pre-Qin period to the Yuan Dynasty. Through continuous construction over ten dynasties, spanning more than a thousand years, a rich Buddhist grotto art encompassing Buddhism, history, science and technology, and culture was formed. Currently, the Mogao Grottoes in Dunhuang preserve 45,000 square meters of murals and over 2,000 painted sculptures, and are known as a treasure trove of world art. Over time, the Mogao Grottoes have been influenced by both natural and human factors. [8]The deterioration of the grottoes has become increasingly severe, and some murals have vanished.

Although the existence of incomplete murals reflects its true historical state, according to the basic principles of cultural relics protection, intervention should be minimized and the status quo should be maintained. However, in view of the aesthetic value of mural paintings and the needs of historical, artistic and cultural research, it is expected that the complete form of mural paintings before damage can be restored in order to retain the information in ancient mural paintings to the maximum extent. At present, digital restoration technology is widely used to restore the integrity of Dunhuang murals. Unlike traditional restoration methods, which work directly on the physical mural, digital restoration focuses on supplementing the missing parts in the digital image. The digital mural reproduction is based on the physical mural, but is independent of the original, ensuring that it does not affect the original state of the physical mural, but presents the visual effect of the mural in digital form when it is complete.[9] Through this digital technology, Dunhuang digital murals can be used as digital data storage, display and promotion, providing visual reference for audiences and researchers, and also providing a reference standard for the protectors of physical murals, which has important social, cultural and practical value.

In addition, the research also uses interview and other research methods, aiming at how local and global audiences can better interact with digital media intermediaries and platforms and perceive the charm of Dunhuang murals. In addition, for researchers, conservators, local communities and tourists, it focuses on the digital preservation, research and dissemination of Dunhuang murals, and how to better use digital media tools and platforms to promote the interpretation of Dunhuang murals and provide more valuable data for research.[10]

## Literature Review

### *The Dunhuang Frescoes Art Dissemination*

The art of Dunhuang frescoes in China is a treasure in the world cultural heritage, and the application of media technology can break through traditional time and space limitations[11]. allowing more people to understand and appreciate the unique features of Dunhuang frescoes. It not only provides a convenient way for the audience, but also provides more resources and tools for researchers and art enthusiasts, promoting the dissemination and research of Dunhuang frescoes art [12]. However, there is still a lack of in-depth research on the concept and classification of Chinese Dunhuang frescoes art. Further research can reveal its connotation, development trend, role and significance in art communication, and promote its dissemination and development.

### *The Relationship between Digital Media Evolution and Art Communication*

The theory of digital media evolution offers a fresh perspective and theoretical foundation for investigating art communication, underscoring the influence of digital technology and the Internet on various aspects of art, including creation, communication, and consumption patterns [13]. However, there is currently limited research on the specific role and impact of digital media evolution in the dissemination of Dunhuang frescoes. Moreover, there is a dearth of studies exploring the advantages, disadvantages, and interactive effects of different forms of digital media in the communication of mural art. Therefore, further research is needed to delve deeply into the mechanisms and outcomes of digital media evolution on the communication of Dunhuang frescoes. This research can contribute to advancing the development and influence of Chinese mural art in contemporary communication [14].

### *The Influence of Media Evolution*

The evolution of digital media has had a profound impact on the dissemination of Dunhuang mural art [15]. With the development of media such as photography, printing, digital technology, and virtual reality, audiences have gained access to more extensive, intuitive, and convenient ways of appreciating and learning about Dunhuang murals, enhancing their sense of participation and interactivity, and promoting a deeper understanding of Dunhuang mural art and cross-cultural exchange [16]. Furthermore, the continuous evolution of digital media has provided new means for the preservation and protection of Dunhuang murals, including high-precision digital restoration, which helps extend the lifespan of Dunhuang murals and defend them against various threats, ensuring the precious cultural heritage is passed on to future generations. Additionally, digital media has enriched educational and research resources related to Dunhuang murals, offering scholars and researchers opportunities for in-depth study and education, while also sparking public interest in art and history. Importantly, digital media plays a significant role in cultural exchange and tourism promotion, allowing tourists to gain deeper insights into and experiences with Dunhuang murals, thereby enhancing cultural experiences and fostering cultural exchange. Social media platforms within the digital media sphere also promote public participation and interaction, expanding the reach of cultural dissemination and offering more possibilities for digital research on Dunhuang murals.

### *Theoretical Framework*

Based on literature review, organize and summarize research results, identify commonalities, differences, and connections, form research perspectives and theoretical frameworks, guide research and help understand the relationship between media and the dissemination of Dunhuang frescoes art, the following theories to be applied in this paper are:

#### *The Five W Communication Model*

This study draws inspiration from H. Laswell's Five W Communication Model, encompassing the key elements of Who, Says What, In Which Channel, To Whom, and With What Effect [17]. Through an analysis of the role of digital media in the dissemination of Dunhuang mural art, this model serves as a guiding framework for an in-depth examination of crucial factors. These factors include participants (artists and audiences), shared content, communication channels employed, target audiences, and the effects generated on the perception and engagement with art. By comprehensively exploring these elements, a more holistic and systematic understanding of the role and impact of digital media in the dissemination of Dunhuang mural art can be achieved.

#### *Audience Engagement Theory*

This theory explores the extent to which audiences actively participate in media consumption [18]. By applying Audience Engagement Theory, the research investigates how the development of digital media encourages collaborative creation and shaping of Dunhuang mural art by both artists and audiences. The study takes into account the interactive nature of digital platforms, prompting audiences to engage more actively and deeply, thereby enhancing their overall participatory experience.

#### *Theory of Communication Effects*

The theory of communication effects aims to delve into the micro and macro impacts of communicative actions on individuals and society. Grounded in this theory, this study investigates how digital media contributes to the global dissemination of Dunhuang mural art, spreading information to art forums worldwide [19]. Adhering to the principles of communication effects research, the study places particular emphasis on conducting a dual in-depth analysis of individual cognitive changes and broader societal influences. This research framework aids in comprehensively understanding the actual outcomes and potential impacts of digital media in the dissemination of Dunhuang mural art.

### *Interpersonal Communication Network Theory*

Drawing inspiration from the theory of interpersonal communication networks, this study explores how communication networks influence problem-solving and information dissemination [20]. The research specifically analyzes the role of digital media in enhancing audience appreciation and interactive experiences with Dunhuang mural art. By establishing a networked environment, digital media facilitates the exchange of information, thoughts, and emotions among the audience, thereby deepening their connection with the art. This study aims to provide a comprehensive understanding of how digital media, through the establishment of communication networks, promotes the appreciation and interactive experience of Dunhuang mural art.

### *Media Presentation and Content Theory*

This theory focuses on how different media presentation formats influence content delivery. In the context of Dunhuang mural art, the study considers the implementation of 3D immersive presentation through digital media. This theory guides an exploration of how immersive media formats enhance the quality of art dissemination, providing audiences with a more enriching and captivating experience [21]. Drawing upon these theoretical foundations, it provides a structured approach for a comprehensive examination of the multifaceted impacts of digital media on the dissemination of Chinese Dunhuang mural art. This framework serves as a powerful tool for analyzing the intricate relationships between communicators, content, channels, audiences, and effects, facilitating a profound understanding of the influence and role of digital media in the dissemination of Dunhuang mural art.

## **Discussion**

The exploration of the evolution and challenges of digital media in the cultural value of Dunhuang frescoes presents a fascinating intersection of ancient art and modern technology. The Dunhuang frescoes, as a testament to ancient Chinese artistry and cultural exchange along the Silk Road, hold immense historical and artistic significance. However, they face numerous challenges, including threats from natural elements and human interference, which jeopardize their long-term preservation. In this context, the emergence of digital media technologies offers unprecedented opportunities for disseminating and preserving this extraordinary artistic heritage[22].

The integration of digital technology, virtual reality, and social media platforms has transformed the presentation and interpretation of Dunhuang frescoes, providing audiences with immersive encounters and interactive experiences. Through digital platforms, individuals can now explore the history, cultural meanings, and artistic nuances of Dunhuang frescoes in ways that were previously unimaginable. This evolution not only enhances the accessibility and understanding of the frescoes but also opens up new avenues for research, education, and cultural exchange.

Through the innovative design of the visual elements of the picture book through digital technology, visitors can better understand the profound history and connotation of Dunhuang culture. By using digital means, the stories, patterns and colors in Dunhuang murals can be selected and innovated, and presented to the audience in a more vivid and attractive way. By exploring design elements such as visual art style and dynamic effects, the values, religious beliefs and artistic characteristics of Dunhuang culture can be effectively disseminated, so that people can experience the extraordinary charm of Dunhuang culture in a more comprehensive way.

One of the key focuses of this study is to investigate the transformative impact of digital media evolution on the dissemination of Dunhuang frescoes. By examining the mechanisms of communication, the channels of digital media, and audience responses, researchers aim to uncover how digital media technologies have revolutionized the strategies and effectiveness of frescoes dissemination. Through qualitative research methods such as in-depth interviews, verbal protocol analysis, and triangulation, the study seeks to capture diverse perspectives and experiences related to the use of digital media in engaging with Dunhuang frescoes[23,24].

Furthermore, the theoretical framework outlined in the study provides a comprehensive lens through which to analyze the complex dynamics of media evolution and artistic communication. Drawing upon theories such as the Five W Communication Model, Audience Engagement Theory, and Interpersonal Communication Network Theory, researchers aim to elucidate the interactive relationship between digital media, artists, audiences, and cultural heritage. By exploring the cognitive changes, societal influences, and interactive experiences facilitated by digital media, the study offers valuable insights into the evolving role of technology in shaping the dissemination and preservation of Dunhuang frescoes.

Moving forward, the study suggests several avenues for further research and action. Case studies and comparative analysis could provide insights into the effectiveness of different digital media approaches in disseminating and preserving Dunhuang frescoes. Integration of visual materials can enhance the presentation of the frescoes' beauty and significance, while engagement with local communities and international collaboration can foster cross-cultural dialogue and knowledge exchange. Additionally, policy recommendations, educational initiatives, and longitudinal studies can contribute to sustainable preservation practices and increased awareness of Dunhuang frescoes' cultural value.

The rise of digital technology and media has eliminated the restrictions of time and space, and promoted international cultural interaction and information flow. The mural art of Dunhuang is not only a treasure of traditional Chinese culture, but also a key evidence of cultural exchanges along the ancient Silk Road between Asia and Europe. This historical passage has promoted the mutual complement and progress of the cultures of the countries along the route. As one of the forms of artistic expression, Dunhuang murals record the cultural content and artistic style of the ancient Western regions and Chinese civilization in an intuitive visual language. From the genetic level of cultural memory, Dunhuang mural art has deep resonance and attraction with the culture of other countries. In addition, the digital visual design and reproduction of Dunhuang mural art helps to spread Dunhuang culture quickly and accurately across the globe. Through the comprehensive design of diversified digital forms and physical forms, people with different cultural backgrounds can feel the long history of Chinese culture, the exquisite visual language and aesthetic spirit of Dunhuang art from multiple communication and experience dimensions. At the same time, the establishment of digital visual gene resource library of Dunhuang murals not only helps the spread of Dunhuang culture in the digital era, but also promotes the value sharing and cultural exchange among people in different fields including artists and designers around the world, so that people can innovate and apply Dunhuang murals art through digital media and design means.

### Limit

Although the research on the evolution and challenges of digital media in the cultural value of Dunhuang frescoes presents a comprehensive and insightful exploration, there are several limitations and shortcomings that need to be addressed:

**Scope Limitations:** This study mainly discusses the role of digital media in the dissemination and preservation of Dunhuang murals, but does not touch on the sociopolitical background, religious significance and influence on contemporary art. If these aspects are included in the scope of research, it will be helpful to understand the cultural value of mural painting more comprehensively .[25].

**Methodological Constraints:** Methodologically, the study proposes qualitative research methods, such as in-depth interviews, verbal protocol analysis, and triangulation, but does not detail specific sampling techniques, data collection procedures, or potential biases. In addition, over-reliance on qualitative data may limit the generality of the findings and ignore the complementary insights that quantitative analysis may provide.

**Theoretical Framework Limitations:** In terms of theoretical framework, the study adopts communication theories such as the Five W communication model and audience engagement theory, but does not critically assess the applicability or limitations of these theories in the context of Dunhuang murals.



A more detailed discussion of the intersection or divergence between these theories and the unique features of murals will help to enrich the theoretical framework.

**Limited Engagement with Stakeholders:** Finally, the study mentions the importance of engaging with stakeholders such as artists, audiences, and local communities, but does not elaborate on engagement strategies and potential challenges involving stakeholders with different perspectives and interests. Stronger engagement strategies will foster dialogue and collaboration among stakeholders, thereby enriching research and enhancing its relevance and applicability.

## Conclusion

In depth interviews is a method of in-depth communication that captures the views, experiences and insights of experts, artists and audiences. In this study, researchers will select relevant experts, artists and audiences in the field of Dunhuang frescoes through face-to-face interviews to provide an deep understanding of their cognition, evaluation and experience of dunhuang mural art communication. These interviews can reveal the influence of media evolution on the communication strategy, form and effect of Dunhuang frescoes, and at the same time can reflect the audience's attitudes and needs for artistic communication from different perspectives.

Verbal Protocol Analysis is to study the words, emotions and opinions of the audience through in-depth interviews and text analysis, so as to understand how they perceive and interact with the dissemination of Dunhuang frescoes under different media. This approach can capture the subtle changes in the audience's emotion and cognition, and reveal how the media evolution affects the audience's artistic appreciation experience and interaction style. Through text analysis tools, researchers can identify keywords, emotional colors, and opinion trends to better understand the connection and interaction between the audience and the art.

Triangulation is a qualitative research method that collects information from different angles to fully understand complex phenomena. In this study, the researchers will comprehensively examine the influence of media evolution on the spread of Dunhuang frescoes from the perspectives of artists, audience and media itself. By collecting and integrating the opinions, attitudes and opinions of different participants, researchers can construct a panoramic analysis to gain a deep insight into the impact of media evolution on communication effect, artistic expression and audience interaction.

Based on the content provided, here are some suggestions on what else can be done with the paper.

### *3D And Virtual Reality (VR) Technology Applications*

With the advancement of technology, digital picture books are ushering in revolutionary changes. Through 3D modeling and virtual reality technology, these picture books are able to present more realistic and immersive visual effects. Readers only need to wear a VR device to instantly travel to Dunhuang and interact with the millennia-old culture. They can roam freely in the virtual world, observe the details of each mural in detail, and even interact with flying fairies to experience the breadth and depth of Dunhuang art. This new way of reading not only revitalizes traditional culture, but also opens up new ways for education and cultural dissemination.

### *Dynamic Multimedia Elements*

Dunhuang digital picture book design tends to add multimedia dynamic elements, using animation effects, parallax scrolling, interactive interface, etc., so that picture books have a more vivid and lively expression, increase readers' sense of participation and interaction, and stimulate their interest and curiosity in reading. Through these technical means, the traditional Dunhuang art can be revitalized, allowing readers to feel as if they are in the magnificent world of Dunhuang murals and feel the charm of the millennia-old culture.

### *Responsive Design and Adaptive Layout*

With the popularity of multiple devices, Dunhuang digital picture books need the ability to have responsive design and adaptive layout to adapt to the display requirements of different screen sizes and devices. This ensures that the picture book presents the best visual effects and user experience on a variety of devices. With flexible layouts and scalable graphics, users get a consistent, high-quality reading experience whether on a phone, tablet or computer. In addition, responsive design can also improve search engine optimization (SEO) effects, increase traffic, and let more people appreciate the unique charm of Dunhuang culture.

### *Fusion of Traditional and Modern Elements*

The design of Dunhuang digital picture books should incorporate modern design elements and technical means while retaining traditional Dunhuang art features. This convergence results in unique and creative visuals. Through the use of traditional painting techniques such as hand-painted illustration, ink effect, and the flow of lines, combined with the use of digital tools, unique visual effects are created, making the picture book present a perfect fusion of tradition and modernity. Tend to use rich and bright colors, but also can attract the eyes of readers, enhance the attractiveness of reading and artistic sense. Pay attention to the content concise and clear, avoid excessive decoration and complex visual effects, so that readers can easily understand and accept the information, improve the efficiency and convenience of reading.

### *Build a Data Resource Library and Add a Digital Experience Center*

With the deepening of the academic research on Dunhuang cultural heritage, researchers are faced with the challenge of collecting massive data. In order to improve the efficiency of research, it is particularly critical to build a personalized and in-depth cloud database of Dunhuang culture by using cutting-edge technologies such as cloud computing and big data. By collecting, sorting and calculating information, classical documents can be digitized and uploaded to the cloud, and relevant data and existing research results can be integrated for orderly classification and entry. Featured columns such as Dunhuang relics, Dunhuang art and extended documents will be expanded according to their own characteristics, and Dunhuang documents, artistic works and academic achievements will be systematically incorporated into the cloud platform, which will facilitate users to search and query, and provide solid data support for academic research.

In order to truly inherit and promote Dunhuang culture, we should not be limited to superficial cultural symbols, but should use modern technological means to bring Dunhuang culture into contemporary society and innovate its digital display. By establishing digital art experience centers in several regions and promoting the experience mode of "cultural relics + digitalization", the art of Mogao Grottoes in Dunhuang can be "taken out of the cave", so that elements such as murals and statues can be "activated", Dunhuang culture can be displayed in a new form of science and technology, and the sensory experience of the audience can be fully stimulated, and the interaction with Dunhuang culture can be realized across time and space. This innovative approach can attract the younger generation, enhance the understanding of Dunhuang mural culture through personal experience and interaction, so that more people of different cultural backgrounds and age groups can contact and love Dunhuang culture, feel its artistic charm, and thus expand the spread of Dunhuang culture.

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