

Museums as Digital Media: A Literature Review of Cultural Heritage Promotion Strategy Through the Case of Dunhuang Academy

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Abstract. Digital media has transformed how cultural heritage reaches people by extending museums' reach beyond physical spaces and enabling audiences to interact with cultural content. However, relatively little is known about how varying digital structures shape audience engagement. This review examines how museums use digital media to communicate cultural value by distinguishing among database, narrative, interactive, and produsage logics. Using Dunhuang Academy as a case study, the review synthesizes museum communication and new media theories with research on its digital initiatives, including the Digital Dunhuang Open Material Library, virtual tours, interactive experiences, and digital cultural products. The analysis suggests that these forms serve complementary functions. Database structures expand access and provide multiple pathways for exploration, while narrative structures provide contextual interpretation. Interactive experiences connect learning with user action. Produsage extends cultural circulation through audience participation. Together, these findings suggest that digital media does not simply replace traditional museum communication but reshapes how cultural heritage is accessed, interpreted, and circulated.

Keywords: Digital Heritage, Museum Communication, Participatory media, Dunhuang Academy

1. Introduction

With the emergence of digital platforms, the dissemination of cultural heritage gradually shifts from physical presentation to digital communication that transcends the spatial and temporal limitation. Cultural heritage sites and museums around the globe have begun using digital storytelling as their way of promoting culture value. Notably, social media has further changed the relationship between the museums and their audiences, allowing cultural communication to move beyond one-way broadcasting toward more participatory forms in which audiences can interact with and contribute to the circulation of cultural contents [1].

However, digital media is often treated as a single and undifferentiated category. Existing research rarely breaks down the structural traits of digital media such as the logic of a database, the logic of a narrative, and the participatory logic of produsage. This makes it significant to examine

how museums combine these traits into a comprehensive communication strategy. Therefore, this review sets out to answer how digital media functions as a medium through which museums communicate the cultural value of their collections by analyzing these specific traits.

To address this question, the review synthesizes museum communication theory and new media theory, illustrated by the digital initiatives of Dunhuang Academy, a case with well-documented digital strategy including archival databases, guided virtual tours, and large-scale audience participation. Uncovering the core traits of digital storytelling is significant for museums to develop a more integrated and engaging digital strategy in cultural promotion and audience engagement.

2. Paradigms of traditional and digital museum communication

Museums have traditionally functioned as places that display selected and organized cultural objects within a physical space. According to Carol Duncan, a museum's spatial layout, circulation routes, and the sequence of galleries function as a form of ritual, guiding visitors through an institutionally structured experience and communicating particular cultural values through the arrangement of objects and space [2]. However, museum communication is not entirely a one-way process in which visitors simply absorb institutional interpretations. According to Hooper-Greenhill, audiences also actively construct meaning from their own cultural experiences and perspectives [3].

The development of digital media provides new possibilities for museums to enable interaction beyond physical museums. Museums use social media such as blogs, podcasts, and content-sharing platforms to engage users. Different digital systems organize cultural information in different ways. One way to examine these differences is to distinguish between different structures of digital media in organizing cultural information. This distinction is particularly suitable for Dunhuang Academy, whose digital strategies include searchable database, virtual tours, interactive experiences, and digital cultural and creative products.

3. Database and narrative logics in digital heritage communication

According to Manovich, digital media can organize information through different structural forms: database and narrative. A database presents a collection of elements that users can search for, access, and navigate in multiple sequences, whereas a narrative organizes information through a more guided progression [4]. This distinction is especially relevant to the dissemination of cultural heritage because digital platforms provided audiences with access to the same cultural materials while structuring their experience in different ways.

3.1. Database logic: autonomous and decentralized cultural access

Dunhuang Academy's digital initiatives illustrate these two forms clearly. The database logic can be observed in Digital Dunhuang Open Material Library and its Open Material Library, which provides users with searchable and downloadable visual materials, allowing users to access and explore cultural resources more easily. Instead of entering a museum or cave and following a spatial sequence determined by the site, users can approach digital materials freely. This changes the psychological structure of cultural exploration. In a physical exhibition, attention is partly directed by architectural movement and spatial proximity. However, in a database environment, attention can be directed by the user's own interests, keywords, categories, or visual preferences.

The library offers access to a large collection of high-resolution digital materials. According to Hu et al., the Mogao Cave Panorama Digital Library functions as an end-user-oriented product of

the Digital Dunhuang project, in which reconstructed 360-degree cave scenes are presented to viewers to explore virtual spaces through their own navigation [5]. Users are no longer required to encounter every cultural element in the same sequence. They can pause, return to particular visual details, change their viewing direction, and construct their own route through the available environment. From a psychological perspective, this may increase the sense of autonomy by allowing users to make choices about what to attend to and how long to explore it. However, greater autonomy does not necessarily guarantee deeper understanding. Users may select visually attractive or personally interesting materials while overlooking the historical relationships that connect those materials to a broader cultural context. From Manovich's framework, its communicative significance lies in changing the structure through which audiences can access it.

3.2. Narrative logic: contextualized and guided heritage interpretation

In contrast, the Cloud Tour Dunhuang mini-program demonstrates a more narrative form. In digital heritage, this means that historical information, architectural spaces, and individual murals can form a narrative arc when they are arranged together through historical storytelling rather than being put separately. The Cloud Tour Dunhuang initiative therefore represents more as a digital reproduction of the physical site. Rather than simply presenting viewers with cultural resources for individuals to explore, the virtual experience allows audiences to have an immersive encounter with the Mogao Caves where individual cultural elements are situated within a broader context [6]. Within this context, narrative does not simply mean telling a linear story. It can connect cultural materials together so that individual murals, caves, spaces, and historical information are encountered within a broader interpretive framework.

According to Jin and Liu, the Cloud Tour mini-program had accumulated more than 50 million visits and over 10 million users by the end of 2021 [6]. The Digital Dunhuang Open Material Library reported to receive more than four million views within two years of its launch [7]. More importantly, these initiatives demonstrate how a single cultural institution can combine database-based access with narrative-based communication. This distinction is important because access does not necessarily produce understanding. A high-resolution image may allow users to examine visual details, but it does not automatically provide the historical or cultural relationships through which those details become meaningful. Narrative-oriented digital communication addresses this limitation by contextualizing selected materials. Rather than replacing database access, however, narrative can build upon the same body of digitized cultural resources and reorganize them into a more coherent interpretive experience. Dunhuang Academy's strategy therefore suggests that database and narrative logic should not be understood as mutually exclusive alternatives. Database structures provide the cultural materials and multiple pathways through which users can explore them, while narrative structures connect selected materials and provide contextual relationships that guide interpretation.

Research on virtual museums further supports this distinction. Pietroni et al. argue that virtual museum experiences can combine contextualization, narration, personalization, and interactivity to support sensory immersion and emotional involvement [8]. More recent research by Chang and Suh found that elements of digital storytelling, including interest, emotion, and educational value, can influence presence and immersion in virtual museum exhibitions [9].

4. Interactive storytelling and active audience engagement

Therefore, the engagement of Dunhuang's digital storytelling cannot be explained simply by the digitization of cultural heritage. Instead, existing initiatives demonstrate how interaction can be

incorporated into the process of cultural learning. For example, the later Digital Library Cave experience allows users to enter a digitally reconstructed world to observe murals, sculptures, and historical objects in detail, and interact with historical characters across different time periods. Users can encounter eight historical figures and move across four different periods while gradually discovering information about the history of the cave through interactive storytelling. This interactive structure is significant because cultural knowledge is connected to users' actions. In the Digital Library Cave, historical information is embedded within interaction, while musical elements and visual reconstruction contribute to a more immersive atmosphere of experience.

This structure can be explained by psychological ideas of active learning and agency. When information is encountered through purposeful action rather than presented as a continuous block of explanation, the user is required to make choices about where to direct attention and what to investigate next. The potential value of interaction therefore does not simply lie in making heritage "fun." Its stronger communicative function lies in the fact that action can form part of the process through which relationships among cultural materials are discovered.

5. Produsage and decentralized cultural circulation

The concept of produsage describes environments in which the distinction between producer and user becomes increasingly blurred, as users do not simply consume finished content but also contribute to its development, modification, and circulation [9]. From this perspective, the question is no longer only how cultural institutions design experiences for audiences, but also what happens when audiences are involved in determining how cultural content acquires new meanings.

It is particularly relevant to Dunhuang Academy's digital strategy because the increased availability of digitized cultural materials creates conditions under which cultural content can move beyond its original platforms. Once images and other cultural products become accessible through digital platforms, they can also become materials that audiences select and circulate in new contexts.

Research on Dunhuang-related digital cultural content demonstrates this expansion of audience activity. According to Ai et al., the digital circulation of Dunhuang culture has encouraged audiences to engage with cultural symbols. Dunhuang-related images can be incorporated into new visual works and circulated through broader digital networks [10]. They examined user evaluation of Dunhuang's digital cultural and creative products on Weibo, including interactive products, games, and music, finding that users engaged heavily with game characters and cosmetic items derived from Dunhuang's mural imagery, produced their own fan art and short-form videos, and their cumulative discussion formed what the researchers term a "Dunhuang CACP circle," a self-sustaining network of enthusiast-generated content extending well beyond anything the Academy itself scripted. This finding suggests that produsage allows the database mode to generate ongoing cultural circulation rather than a single act of consumption: every user who downloads a high-resolution scan and repurposes it becomes an additional and unpaid node in the museum's communication strategy, extending the institution's reach into networks it neither owns nor directly manages. When related visual elements are incorporated into games, interactive experiences, music, or other creative products, they enter formats through which contemporary audiences already communicate, play, and share content. The cultural material is therefore not merely preserved or displayed, rather, they are remediated for new media environments to facilitate broader circulation.

Ai et al. further demonstrate that this circulation occurs across different online communities rather than through a single undifferentiated "audience" [11]. Their semantic network analysis identified networks involving official media and museums, while also pointing to communities associated with traditional clothing and cosplay that could contribute to the promotion and

communication of Dunhuang-related cultural and creative products. This suggests that digital heritage can enter communities with different existing interests and media practices. However, these communities may not necessarily emphasize the same aspects of Dunhuang. Their participation can therefore expand cultural reach while also producing selective patterns of attention.

Taken together, the literature suggests that Dunhuang Academy's digital communication strategy cannot be understood simply as a shift from traditional museum communication to a more participatory digital model. Instead, different forms of digital media distribute different kinds of agency across the process of cultural communication. Database structures expand access and exploration, narrative structures provide contextual relationships, interactive experiences connect cultural learning to user action, and produsage extends participation into the circulation and, where evidenced, further creation of cultural content. The process can therefore be understood as a progression from access, to contextualization, to interaction, and finally to circulation.

6. Conclusion

This review examines how digital media, through the specific traits of database access, narrative sequencing, and produsage, functions as a strategic medium through which museums communicate the cultural value of their collections, using Dunhuang Academy's digital initiatives as a case in point. The literature reviewed points to a clear conclusion: digital strategy works through the combination of two structurally different modes rather than the substitution of one for the other. Together, the database form and narrative form are amplified by an audience that does not just consume but actively repurposes what it is given. Digital media, in other words, introduces a new set of choices about which parts of that value actually get seen.

However, this review has limitations. It draws primarily on secondary and platform-reported statistics rather than independently collected data, and it builds its argument around a single, unusually well-resourced case, which may not be generalizable to museums with smaller budgets or less institutional support. Future research should use replicable data collection and compare work across multiple museums and heritage sites, paired with closer attention to how platform algorithms shape which content format succeeds, examining whether this holds true across the wider landscape of museum digital promotion.

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