

AI-Assisted Interactive Cultural Tourism Planning: A Comparative Case Study of Lanzhou and Dunhuang

Yujing Zhang

Digital media and communication Sydeney University, Australia

Abstract: This paper studies how AI-assisted interactive technologies can support cultural tourism planning in Gansu Province, China, through a comparative study of Lanzhou and Dunhuang. By combining the new technology of generative AI with rich cultural resources from history, many projects have begun to offer users an all-encompassing and personalised experience rather than just passive observation. Use the Lanzhou cultural tourism AI matrix as the main implemented case and the Dunhuang digital heritage project as a comparative reference to explore how different forms of AI-assisted interaction can support cultural tourism engagement, commercial conversion and heritage communication in Gansu. Based on the above analysis, AI-assisted cultural tourism interaction can promote cultural participation by connecting digital participation with real-life tourism scenarios and local cultural resources.

Keywords: Artificial Intelligence, Cultural Tourism, Cultural Heritage, Gamification, Interactive Planning.

1. Introduction

At present, the two areas of cultural heritage protection and digital entertainment are being combined to develop new tourism products. In the past, cultural tourism has focused more on the inheritance of history. Most visitors only experience the heritage in static exhibitions, explanation boards and traditional souvenirs. Although the traditional model successfully preserved historical materials, it failed to attract the new generation of digitally native people who are more accustomed to agency, participation and personalised storytelling. A deficiency of traditional cultural products is that they are generally static; a physical souvenir bought once cannot offer new interactions or emotional rewards, and thus fails to motivate repeat purchases.

With the development of advanced artificial intelligence, generative algorithmic systems have begun to be employed in a new way for interactive planning of the cultural industry. Lightweight digital ecosystems and advanced procedural generation can now be used to build dynamic and adaptive narrative systems for cultural institutions based on individual user data. The new mode of technology can be used to recreate the old intellectual property as an interactive work that can be engaged with and adapted to various circumstances. Therefore, the boundary between digital gaming and physical cultural consumption is gradually disappearing, and hybrid commercial models that integrate online participation with offline economic transfer have begun to appear.

Representative AI-assisted cultural tourism and creative product experiments in Gansu Province were selected as the research objects, and cases with clearly documented interaction mechanisms and publicly available descriptions were focused on. As a major geographical and cultural centre of the old Silk Road, many historical events have occurred here. Although there is a rich body of materials, most of the academic research on the implementation of digital culture has focused on coastal or first-tier city technology hubs, and individual cases in the northwest have not been explored. Among them, the Lanzhou cultural tourism AI mini-game matrix is a typical case of online-to-offline conversion, and

the Dunhuang digital heritage project offers a good reference for how AI and game technology can be applied to heritage communication.

Given the above, this paper will address the following research problem: How can AI-assisted interactive technologies promote user engagement, cultural communication and tourism consumption conversion in Gansu Province's cultural tourism industry? To address this problem, the two representative but functionally different cases of the study are a Lanzhou cultural tourism AI matrix and a Dunhuang digital heritage project. Compare them to see whether the different forms of AI-assisted interaction serve different purposes in cultural tourism.

The rest of this paper is organised as follows. Section 2 presents the research methods and case-selection reasons. Section 3 introduces the theoretical basis for AI-assisted cultural tourism interaction. Section 4 compares the Lanzhou and Dunhuang cases and studies their different implementation paths. Section 5 shows the implementation plan and future development direction; Section 6 lists governance risks and deficiencies; finally, Section 7 concludes this paper.

2. Research Method

A qualitative comparative case study will be employed in this paper to investigate how AI-assisted interactive technologies are used in cultural tourism planning in Gansu Province. A comparative case study method is suitable for this research; that is, rather than determining the statistical effect of a single technology, one hopes to explore the differences in implementation mechanisms, cultural functions and tourism-related objectives of representative projects.

Lanzhou and Dunhuang were selected because they represent two different forms of AI-assisted cultural tourism practice. The Lanzhou cultural tourism AI matrix is selected as the main case because publicly available descriptions clearly present its interaction mechanisms, merchant participation and links between online activities and offline tourism consumption. In contrast, the Dunhuang Digital Heritage Project is chosen as a comparison case because its main purpose is the presentation of digital heritage,

immersive experience and cultural communication, rather than direct commercialisation. Therefore, the three contents of this paper are user-engagement mechanisms, cultural-communication functions, and the connection between digital interaction and tourism consumption.

Based on the public project information and related academic studies, this paper analyzes. No primary data were collected, and there is no statistics or quantitative analysis in this study. Projects such as AR-based museum souvenirs and Zhangye Danxia interactive scenarios are not included in the confirmed comparative cases because their implementation status has not been sufficiently documented in the publicly available materials reviewed in this study. Instead, they are only mentioned as future-oriented application scenarios.

3. Theoretical Foundation and Technological Mechanism

In theory, the foundation of artificial intelligence-assisted cultural and creative planning is generally considered to be the convergence of procedural content generation (PCG), generative artificial intelligence and interactive narrative design. Procedural content generation is the automated creation of game data, such as levels, maps and rules, and does not need to be designed by humans all the time [12]. PCG can be used to build a large-scale, non-linear exploration environment for cultural mini-games at a relatively low computational cost, and each user will have a different combination of historical features.

Recently, the development of Artificial Intelligence-generated Content (AIGC) has been advancing at a high speed. Simple generative adversarial networks have been extended to build large-scale complex models of language and images that can generate high-contextual and semantically accurate text and pictures in real time [4]. An attribute that supports the development of "generative agents" in interactive cultural planning with human-like thinking, memory and emotion is required. These agents do not have a fixed script and can begin a free-flowing conversation with users at any time about history to create an active and engaging learning environment.

In addition, the integration of these generative systems in game design should also have a particular kind of interactive narrative. Interactive narrative in intelligent systems seeks to reconcile users' desire for autonomy with the requirements of narrative coherence for authors [9]. In the game of cultural heritage, this means that the AI should offer several choices in dialogue or historical events for players, but they must still be factually accurate and culturally appropriate. Therefore, the story branches of AI-driven cultural games should be dynamically altered according to the user's behaviour and include cultural rules to ensure historical accuracy.

The above computation technology can also be used in the cultural industry, and in doing so, we will change our very conception of "play". Artificial and computational intelligence in games is no longer limited to the previous two; now, it has begun to create works of art and produce emotionally moving works of art [1]. AIGC and PCG can be used to quickly build, deploy and iterate lightweight game experiences for cultural interactive planning. These mini-games are digital expansions of the physical heritage site, and through them, users can have an in-depth, personalised and highly scalable cultural experience that is not available in traditional media.

4. Comparative Case Analysis of Lanzhou and Dunhuang

Compare the matrix of the Lanzhou cultural tourism AI mini-game with that of the Dunhuang digital heritage project to explore different implementation logics for AI-assisted cultural tourism. The first typical case is the Lanzhou cultural tourism AI mini-game matrix. Four native cultural mini-games were released directly within a popular social media application for this project, and these lightweight mini-programs did not need to be installed separately by users [5]. Among them, the most technologically advanced was an interactive dialogue game with a generative AI persona of Huo Qubing, a well-known general in ancient China. A large language model-based generative agent can provide users with an interactive historical dialogue and various story experiences, but such content still needs to be verified by experts for historical accuracy [8]. The matrix also added the casual game 'Lanzhou Pinball', a yellow river raft racing simulation, and a digital blind box collection system. The design of gamification successfully enhanced the tourists' sense of achievement by directly connecting in-game achievements with real-life commercial rewards [6]. Publicly available descriptions indicate that the Lanzhou project has linked digital interaction with merchant participation and offline visits for tourism consumption [11]. Therefore, this case provides a good example of how AI-assisted cultural interaction can be combined with an online-to-offline tourism model. A feature of the Lanzhou model is that it links digital games to local cultural symbols and the lives of real-life merchants. The Lanzhou model is a low-threshold entertainment option for the general public, and users can earn cultural participation points by playing mini-games to receive real commercial benefits. Therefore, it serves as the main case for discussing the implementation logic examined in this paper.

The Dunhuang Digital Heritage Project can serve as a reference case and is not a fully commercialised O2O model. Its value is not in quick-consumption conversion, but in providing a full-round cultural experience for people interested in heritage through high-definition scanning, game-engine rendering, cloud-based access and AI-assisted character performance. The platform uses AI-assisted visual generation and rich artistic resources from the Dunhuang murals. Serious games for cultural heritage have been used widely in education for a long time [2], but this platform has introduced an innovative user-generated content model powered by artificial intelligence. Users can enter an immersive digital environment created by high-definition scanning and game-engine rendering, support cloud-game delivery, and use AI-driven facial expression technology. Dunhuang is more suitable for being regarded as a case of cultural communication rather than the Lanzhou case; its focus is on digital reconstruction, immersive experience and heritage engagement, and not directly on commercialisation.

Based on the above analysis, Lanzhou and Dunhuang are two different forms of AI-assisted cultural tourism implementation. The Lanzhou model focuses on commercialisation to some extent. AI-assisted mini-games can attract users' attention and interest to participate, and at the same time, game-based rewards have been established to link digital participation with local merchants, offline visits and consumption. The Dunhuang Model is about the spread of culture. Digital heritage resources offer the basis for

immersive experiences, and AI-assisted interaction can help people learn about history and culture. Therefore, the main results will be deeper cultural experience and heritage communication rather than immediate commercialisation.

5. Implementation Strategies and Future Application Pathways

Based on the Lanzhou core case and the Dunhuang comparative case, some implementation strategies for AI-assisted cultural tourism and creative-product planning in Gansu can be derived. First, the AI-assisted cultural products should have a light-weight entry mechanism. The large all-in-one application may be too complicated for the tourists to use. Ecosystem-embedded mini-programs can make cultural interaction convenient for tourists to access in their daily lives. A low-friction entry mode is needed because tourists may only wish to participate for a short time after being introduced to it.

In addition, the construction of an integrated Online-to-Offline (O2O) commercial closed-loop system needs to be realised to convert digital interaction into real economic benefits. The experience economy believes that the value of consumption is also created in the form of stages, memories and participation [7]. The Lanzhou mini-game matrix is a typical case of this. Physical discounts, restaurant vouchers and exclusive cultural products can be used as rewards for reaching certain levels in the digital game and are linked to local commercial circulation. The AI mini-game function of this model aims to turn users' digital interest into actual visits and purchases of goods or services from merchants.

Second, generative AI can be used to support organised cultural co-creation rather than free-form content creation. As shown in the case of Dunhuang digital heritage, guided tools for remixing, redesigning and interacting with historical resources can increase users' emotional connection to the culture of heritage. Artificial intelligence can reduce the technical barrier and allow more people without professional training to engage in cultural creation under good curation and historical knowledge. Democratised co-creation keeps the living spirit of cultural intellectual property and spreads it widely through social media.

Future projects will also enhance the Design based on small-scale pilot tests and user feedback. The proposed evaluation will be used for future implementation and was not carried out in the current study. In addition to the two representative cases above, AR-based museum souvenirs should be viewed as a future application direction rather than a confirmed implementation case. Digital museum resources are also required to extend the experience of home visits and continue cultural education after leaving the museum [10]. As large-scale official deployment has not been properly documented, this model should be used with caution in terms of planning feasibility. AR-based souvenirs can extend the life cycle of physical cultural products by adding artifact interpretation, virtual badge collection and task-based exploration for tourists after they leave the museum. Augmented reality can be used to add living, interactive digital information to the real world at cultural heritage sites [3]. Therefore, this case should be regarded as an implementation-oriented planning model rather than a fully verified multi-museum deployment.

The resources in Zhangye Danxia and Shandan Horse Pasture are more suitable for discussion as a future-oriented

application case. According to the public announcement, Zhangye Danxia has already introduced technology-driven cultural tourism in low-altitude tourism, drone performances, digital science popularisation facilities and immersive screen-based experiences. In the future plan, AI-generated Silk Road horse avatars, Danxia landscape skins and interactive travel narratives may be developed; however, such designs need to be clearly separated from the implemented projects and evaluated through pilot tests before being promoted as mature cases.

6. Limitations and Governance Risks of AI-assisted Cultural Interaction

AI mini-game generation can offer new prospects for cultural tourism and creative product promotion, but there are also deficiencies. The first risk is historical inaccuracy. Generative AI can create realistic but fake historical figures, religious symbols and local customs. Given that the subject is Silk Road heritage, even a small error in fact will lead to a misunderstanding of local history. Therefore, the AI-generated dialogue and story branches need to be verified by historians, museum staff and cultural heritage specialists before being released to the public.

The second kind of risk is algorithmic bias and cultural reduction. If the training data is dominated by popular internet aesthetics, the system may reduce rich local culture to simplified or exaggerated stereotypes, such as overly conspicuous foreign symbols, simplified ethnic costumes, or excessively commercialised religious elements. Gansu Province has a very long history of Buddhism and the Silk Road, many different ethnic groups, and many places where Buddhism has been practiced for centuries. AI cultural works should not make the sacred or historically significant shallow entertainment.

The third is a lack of privacy. AI mini-games often collect behaviour data, such as click paths, game selections, location information, reward redemption records and consumption habits. Although the above data can help improve the design of cultural products, there are also risks of privacy infringement and commercial surveillance. The institution of culture should be transparent about how the data will be collected and used, and should avoid excessive profiling of tourists. Only by combining technological innovation and historical research to build a moral-governed system that protects privacy, etc., can AI-assisted cultural interaction become a stable form instead of a short-lived trend on the Internet.

7. Conclusion

This paper studies how AI-assisted interactive technology can support cultural tourism planning in Gansu Province, and compares the cases of Lanzhou and Dunhuang. The Lanzhou cultural tourism AI matrix serves as the representative case, and its gamified digital interaction can also be integrated with merchant participation and offline tourism consumption. At the same time, the Dunhuang Digital Heritage Project has also created a new experience for the public by using digital reconstruction and artificial intelligence.

Therefore, the two pathways for AI-assisted cultural tourism are presented in the following comparison. Lanzhou is a commercial-conversion model; AI-assisted mini-games drive users to play, and the rewards of these games connect digital participation with local merchants' offline visits and

consumption. Dunhuang is a model for culture-communication: digital heritage resources provide an immersive experience, AI-assisted interaction increases user engagement in historical narratives, and thus promotes cultural understanding and inheritance dissemination. As shown in the above comparison, there is no single mode of implementation for AI-assisted cultural tourism; instead, the technological Design and evaluation criteria need to be adapted according to the main goals of each project.

Based on the above cases, a practical way has been developed. First, the AI cultural products should be easy to use, such as mini-programs and QR-code access, to lower the threshold for tourists. Second, the games should be related to specific local cultural symbols and not be general entertainment models. Third, the online achievements can be linked to offline stores, exhibitions, souvenirs and tourist routes to form an O2O conversion loop. Finally, projects that are still in the planning stage, such as AR museum souvenirs or Zhangye Danxia game scenarios, should be introduced as future applications and tested in a small-scale pilot before being mentioned as mature models.

AI-assisted cultural tourism should not be regarded as an ideal good-technology solution. In the design of AI-assisted cultural tourism systems, historical accuracy, algorithmic bias, privacy protection and religious or ethnic sensitivity should all be considered. AI for Gansu should not replace the work of cultural interpretation, but rather help local heritage resources enter a new stage of interaction and commerce. Therefore, a good model should integrate culture and creativity, digital technology and commerce, and ethics.

References

- [1] Yannakakis, G. N., & Togelius, J. (2015). A panorama of artificial and computational intelligence in games. *IEEE Transactions on Computational Intelligence and AI in Games*, 7(4), 317–335. <https://doi.org/10.1109/TCIAIG.2014.2339221>
- [2] Mortara, M., Catalano, C. E., Bellotti, F., Fiucci, G., Houry-Panchetti, M., & Petridis, P. (2014). Learning cultural heritage by serious games. *Journal of Cultural Heritage*, 15(3), 318–325. <https://doi.org/10.1016/j.culher.2013.04.004>
- [3] tom Dieck, M. C., & Jung, T. H. (2017). Value of augmented reality at cultural heritage sites: A stakeholder approach. *Journal of Destination Marketing & Management*, 6(2), 110–117. <https://doi.org/10.1016/j.jdmm.2017.03.002>
- [4] Cao, Y., Li, S., Liu, Y., Yan, Z., Dai, Y., Yu, P. S., & Sun, L. (2023). A comprehensive survey of AI-generated content (AIGC): A history of generative AI from GAN to ChatGPT. *arXiv preprint arXiv:2303.04226*.
- [5] Chen, Y., Li, X., Li, Q., & Li, W. (2022). Exploring customers' switching from native to lightweight apps: A push-pull-mooring framework perspective. *Industrial Management & Data Systems*, 122(12), 2633–2656. <https://doi.org/10.1108/IMDS-04-2022-0234>
- [6] Wang, D., Park, S., & Fesenmaier, D. R. (2012). The role of smartphones in mediating the touristic experience. *Journal of Travel Research*, 51(4), 371–387. <https://doi.org/10.1177/0047287511426341>
- [7] Pine, B. J., II, & Gilmore, J. H. (1998). Welcome to the experience economy. *Harvard Business Review*, 76(4), 97–105.
- [8] Park, J. S., O'Brien, J. C., Cai, C. J., Morris, M. R., Liang, P., & Bernstein, M. S. (2023). Generative agents: Interactive simulacra of human behavior. *Proceedings of the 36th Annual ACM Symposium on User Interface Software and Technology*, 1–22. <https://doi.org/10.1145/3586183.3606763>
- [9] Riedl, M. O., & Bulitko, V. (2013). Interactive narrative: An intelligent systems approach. *AI Magazine*, 34(1), 67–77. <https://doi.org/10.1609/aimag.v34i1.2449>
- [10] Marty, P. F. (2008). Museum websites and museum visitors: Digital museum resources and their use. *Museum Management and Curatorship*, 23(1), 81–99. <https://doi.org/10.1080/09647770701865410>
- [11] China Daily. (2025, May 9). Lanzhou digital interaction ignites the May Day holiday and builds a new model of western cultural, commercial and tourism integration. *China Daily*.
- [12] Shaker, N., Togelius, J., & Nelson, M. J. (2016). *Procedural content generation in games*. Springer. <https://doi.org/10.1007/978-3-319-42716-4>