

Designing Smart Museum Experiences: Generative AI, Cultural Interpretation, and Human Agency

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Abstract—The increasing adoption of generative artificial intelligence in cultural institutions is reshaping how museum experiences are designed, accessed, and interpreted. In the context of smart museums, AI-based systems are often introduced to enhance personalization, support visitor engagement, and expand access to cultural content. However, their integration also raises a critical question: should AI merely optimize information delivery, remain fully subordinate to human control, or become an epistemic collaborator in the construction of cultural meaning?

This paper addresses this question by proposing a conceptual framework for smart museum experience design grounded in the evolving relationship between humans and AI. We argue that generative AI should be conceived neither as an autonomous system governing interpretation nor as a mere instrument under human control, but as an epistemic collaborator capable of enriching cultural interpretation while preserving human agency and curatorial responsibility.

Rather than framing smart museums as technologically enhanced environments centered on automation, this work argues for a human-centred perspective in which AI contributes to interpretation without replacing either the curator’s mediating role or the visitor’s interpretive autonomy. The contribution of the paper is twofold: first, it extends the debate on human–AI interaction into the domain of museum and heritage experiences; second, it provides a theoretical basis for designing smart museum systems that are not only efficient and interactive, but also culturally meaningful, ethically grounded, and epistemically generative.

Index Terms—e-Culture and e-Tourism, Smart Museums and Culture, generative AI, human–AI interaction, cultural interpretation, epistemic collaboration

I. INTRODUCTION

Museums are increasingly adopting intelligent and data-driven systems to support communication, accessibility, personalization, and audience engagement [4], [3]. In this context, the notion of the *smart museum* has emerged as an extension of broader smart city and smart culture paradigms, where digital infrastructures are expected to enhance visitor experience and make cultural heritage more interactive, adaptive, and accessible [5].

Recent developments in generative artificial intelligence have further accelerated this transformation. Conversational interfaces, adaptive storytelling systems, multimodal content generation, and recommendation mechanisms are opening new possibilities for museum mediation, while also challenging traditional assumptions about authorship, interpretation, and

curatorial responsibility [6], [2]. Yet museums are not neutral repositories of information; they are interpretive spaces in which knowledge is framed, negotiated, and experienced through cultural mediation [5], [4].

For this reason, the integration of AI into museum environments should not be understood only in terms of technical efficiency or information delivery. Rather, it calls for a conceptual shift from instrumental and automation-oriented approaches toward models that preserve the plurality, situatedness, and openness of cultural interpretation.

This paper builds on an evolutionary view of human–AI interaction structured around three broad configurations: AI as a controlling system, human control over AI, and AI as an epistemic collaborator [6], [1], [2]. We argue that this trajectory offers a useful framework for rethinking smart museum experiences. While the first two configurations emphasize either technological dominance or human supervision, the third opens the possibility of designing AI systems that participate in interpretive processes without displacing human agency.

Our claim is that generative AI can support museum experiences most meaningfully when conceived not as an autonomous interpretive authority, nor as a mere passive tool, but as a collaborative epistemic agent that enriches access, interpretation, and engagement while remaining embedded within human-centred design principles [1], [2]. On this basis, the paper proposes a conceptual framework for the design of smart museum experiences and discusses its implications for cultural interpretation, curatorial mediation, and visitor agency.

II. FROM AI CONTROL TO EPISTEMIC COLLABORATION IN MUSEUM EXPERIENCE DESIGN

The relationship between artificial intelligence and human action has often been described through oppositional models in which either machines control decision-making processes or humans fully govern technological systems [6]. In museum contexts, this tension becomes especially significant because interpretation is never a purely functional act: it is a cultural, epistemic, and often affective process. Designing smart museum experiences therefore requires a more nuanced understanding of how AI shapes, constrains, or supports the production of meaning.

A first configuration can be described as *AI control*. In this model, intelligent systems organize access to cultural content

through recommendation engines, automated narratives, predictive guidance, or adaptive interfaces that orient the visitor's path. While such systems may improve efficiency and personalization, they also risk narrowing interpretive possibilities by privileging opaque forms of algorithmic selection.

A second configuration shifts the emphasis toward *human control over AI*. Here, the objective is to ensure that technological systems remain transparent, accountable, and subordinate to human intentions. In the context of museums, this implies preserving curatorial authority, explicability in content generation, and a clear distinction between institutional interpretation and machine-supported mediation.

A third and more promising configuration is that of *AI as epistemic collaborator*. In this perspective, generative AI does not replace human interpreters, curators, or visitors, but enters into a dialogic relation with them. Its role is to support exploration, expand contextualization, generate alternative connections among artifacts, and foster richer interpretive engagement. In museum settings, such collaboration may involve adaptive narrative prompts, visitor-responsive interpretive pathways, or conversational interfaces capable of stimulating reflection rather than merely delivering answers.

This shift from control to collaboration does not eliminate the need for human oversight; rather, it situates oversight within a broader relational framework. Human agency remains central, but is no longer understood only as the ability to command or restrict technology. Instead, agency becomes the capacity to engage critically and creatively with AI in a shared interpretive process. In smart museums, this perspective is particularly relevant because cultural experience depends on openness, plurality, and the possibility of multiple legitimate readings [5], [1].

III. DESIGNING HUMAN-CENTRED SMART MUSEUM EXPERIENCES

If smart museums are to become spaces of meaningful cultural engagement rather than technologically enhanced delivery systems, their design must be grounded in a human-centred understanding of interpretation. Generative AI can support this goal only when it is integrated in ways that preserve the autonomy of visitors, the responsibility of curators, and the situated nature of cultural meaning.

From this perspective, a smart museum experience should satisfy at least three design principles. First, AI systems should support *interpretive openness*. Rather than narrowing the encounter with cultural heritage into optimized or predetermined pathways, they should facilitate multiple perspectives, contextual enrichments, and exploratory forms of access. Second, they should ensure *curatorial accountability*. Even when AI-generated content is used, the institutional and epistemic responsibility of the museum must remain visible and governable. Third, they should promote *visitor agency*. Visitors should not be passive recipients of adaptive outputs, but active participants in a dialogic interpretive experience.

This approach implies rethinking the role of AI in museum design. Instead of functioning as a hidden layer of optimiza-

tion, AI should become an explicit mediating presence whose contribution can be questioned, negotiated, and reflected upon. In this sense, smart museum experiences become not only personalized or interactive, but also epistemically rich: they encourage visitors to engage with heritage as something to be interpreted, not simply consumed [5].

The design implications of this framework are both practical and theoretical. Practically, it suggests the development of interfaces and systems that privilege conversation, contextual plurality, and reflective engagement over mere efficiency. Theoretically, it extends current debates on human-AI interaction into the cultural domain, showing that museums offer a particularly fertile context for examining how AI participates in the production of meaning.

IV. CONCLUSION

This paper has argued that the design of smart museum experiences can benefit from an evolutionary understanding of human-AI interaction moving from AI control, to human control over AI, and finally to AI as an epistemic collaborator. Applied to museum and heritage contexts, this trajectory makes it possible to move beyond both techno-deterministic and purely instrumental views of AI.

Our central claim is that generative AI should not be conceived as an autonomous authority that governs interpretation, nor as a neutral tool entirely reducible to human command. Rather, it should be designed as a collaborative epistemic presence capable of supporting richer forms of cultural interpretation while preserving human agency, curatorial responsibility, and the openness of visitor experience.

By bringing together smart museum design, cultural interpretation, and human-centred AI, the paper contributes a conceptual framework for discussing the role of generative AI in cultural heritage environments. This framework may serve as a basis for future research on museum interaction design, digital heritage mediation, and the ethical and epistemic implications of AI-supported cultural experiences.

REFERENCES

- [1] C. Ardito, T. Colafiglio, C. Pomo, and T. Di Noia, "From Tool to Epistemic Collaborator: Rethinking Human-AI Interaction," to appear in the post-proceedings volume of the workshop *Rethinking Artistic Research in the Age of AI: New Frameworks, HCAI Practices, and Challenges*, co-located with *AVI 2026: International Conference on Advanced Visual Interfaces*, Venice, Italy, June 8–12, 2026.
- [2] T. Colafiglio, C. Ardito, C. Pomo, and T. Di Noia, "Exploring AI-Supported Artistic Practices through Human-Centred AI," to appear in the *Proceedings of AVI 2026: International Conference on Advanced Visual Interfaces*, Venice, Italy, June 8–12, 2026.
- [3] M. Carrozzino and M. Bergamasco, "Beyond virtual museums: Experiencing immersive virtual reality in real museums," *Journal of Cultural Heritage*, vol. 11, no. 4, pp. 452–458, 2010.
- [4] P. F. Marty, "Museum websites and museum visitors: Before and after the museum visit," *Museum Management and Curatorship*, vol. 22, no. 4, pp. 337–360, 2007.
- [5] L. Ciolfi, A. Damala, E. Hornecker, M. Lechner, and L. Maye, Eds., *Cultural Heritage Communities: Technologies and Challenges*. London, U.K.: Routledge, 2018.
- [6] B. C. Smith, *The Promise of Artificial Intelligence: Reckoning and Judgment*. Cambridge, MA, USA: MIT Press, 2019.