

Chapter 54

From Walls to Worlds: Co-creating Heritage Narratives with AR Murals

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Abstract

Exploring the definition of heritage as a set of relationships with the past, this research looks at obstructions in equitable access to heritage. Recent decades saw heightened interest in intangible heritage, driven by digital media's use for transmitting heritage. Immersive technologies enrich on-site experiences and virtual tours, challenging narratives, power dynamics, and access to heritage sites.

In places like Egypt, local inhabitants are often excluded from economic gains from tourism and denied agency over heritage narratives, resulting in a loss of ownership. This research investigates how augmented reality (AR) murals can facilitate equitable heritage management through education, participation, and diverse discourse, while also evaluating the inherent technological risks. Methodologically, it defines tangible and intangible heritage notions for **marginalised communities** and frames IT's role through heritage theory and prototypes. A comparative analysis of AR projects in Cairo, India, China, and Europe informs solutions for participatory design.

Keywords: *Augmented Reality (AR) Murals, Cultural Heritage Preservation, Intangible Heritage, Participatory Design, Digital Restoration*

Introduction

Augmented reality (AR) murals stand at the intersection of street art, digital media, and heritage^{1,2} preservation, transforming static walls into interactive experiences through overlaid animations, sound, or narrative³. Heritage is more than monuments; it is a living relationship between people and the past, frequently reflecting unequal power dynamics⁴. In many developing nations reliant on tourism, communities are excluded from heritage narratives and economic benefits. Digital tools such as AR offer ways to document, share, and interpret heritage, but they also raise questions about representation, authenticity, and access. This article assesses how AR murals can serve as catalysts for inclusive heritage

¹Gregory Ashcroft defines heritage as the use of the past for contemporary purposes, including political and social ones (Ashworth, 2008).

²Al-Ibrashy, May, 'Heritage in the Street: Megawra | BEC's Athar Lina Initiative in Historic Cairo'. *The Journal of Public Space*, 6 (n. 1) (April 2021): 241–56 <https://doi.org/10.32891/jps.v6i1.1462>.

³Soto-Martin, Ovidia, et al., 'A Digital Reconstruction of a Historical Building and Virtual Reintegration of Mural Paintings to Create an Interactive and Immersive Experience in Virtual Reality', *Applied Sciences* 10, no. 2 (2020): 597. <https://doi.org/10.3390/app10020597>.

⁴Heritage is understood as a constant rethinking and redefinition cultural values by different agents—social groups, media, institutions, which are also constantly changing (Kolesnik, Rusanov, 2020, p.1).

management, drawing on examples from Egypt's Al Khalifa district and international initiatives (Figure 1).



Figure 1: Wings of Khalifa Mural.

Obstacles to Equitable Access

In historic districts like Cairo's Al Khalifa, residents frequently face displacement and exclusion from tourism and redevelopment, which favours outside interests. The area's rich built heritage (mosques, mausoleums) is coupled with a vibrant intangible culture (festivals, stories)⁵, but communal practices like the Mawlid of al-Sayyida Sukayna⁶, are often curtailed, undermining their role as placemakers. Similarly, in India's Shekhawati region, decaying nineteenth-century *haveli* murals are admired by tourists, but local communities see little benefit, contributing to neglect and damage⁷. These instances show heritage as contested terrain, where power determines which narratives are amplified and which communities are excluded.

Al Khalifa Murals

The Al Khalifa project, executed in collaboration with the Megawra Built Environment Collective, clearly demonstrates the capacity of AR murals to support community-centred heritage. Initial interventions near the Ahmad Bey Kohya Mosque involved painting four murals that combined local legends⁸ and scenes of daily life, which were subsequently activated via the Artivive app (Figure 2). The

⁵Arafa, Maram, 'Festivals as Catalysts for Spatial Transformation', *IASTE Working Paper Series* 313 (2020): 66–82.

⁶A religious festival celebrating the Muslim Saint al-Sayyeda Sukayna.

⁷Dawatwal, Priyanka, and Nirupama Singh, 'Digitization of Shekhawati Murals Using Augmented Reality Technology', *ShodhKosh: Journal of Visual and Performing Arts* 4, no. 2SE (2024): 247–55
<https://doi.org/10.29121/shodhkosh.v4.i2SE.2023.634>.

⁸The former British Empire by a British officer Robert Grenville Gayer Anderson, left an important contribution documenting the area's culture in the form of a book containing a retelling of the legends related to the area -

aim was to show that heritage belongs to residents and can be a source of pride and livelihood⁹. Feedback mixed enthusiasm and discomfort: some residents voiced discomfort with the focus on female figures¹⁰ or the monochrome palette—the project successfully engaged the community and highlighted intangible heritage. Building on this success, the participatory Wings of Khalifa mural (Figure 3) involved local teenagers in both the conceptualisation and painting phases¹¹. Its accessibility through both Artivive and Instagram encouraged social media sharing, demonstrating AR's motivational power for youth engagement and its role in fostering strong ownership while actively countering community tokenisation.

Maram Arafa's work on the Mawlid of al-Sayyida Sukayna illustrated the potential for preserving intangible heritage by using AR to virtually re-enact the discontinued *al-Zaffa*¹² procession, with content from songs and memories recorded by teenagers (Figure 4). This capability to revive practices that have vanished from public space and educate new generations about cultural traditions is also evident in global efforts, such as the digital reconstruction of seventh-century murals at China's Zhao Yigong Tomb using Adobe Aero, to document and reimagine the originals. Interplay of visual art, fashion, and ritual in Tang-dynasty burials emphasised the artwork's ritual significance and accessibility without endangering the originals¹³. In both contexts, AR becomes a bridge between tangible artefacts and intangible values¹⁴.

“The Legends of the Creatan Woman's House”. These stories not only tell the legends passed on in the area since old times and told to Gayer Anderson by a Sheikh living in the house but also his own telling of how he came to be a custodian of the house. Gayer Anderson commissioned a contemporary local artist Abdel Aziz Abdu, from the area of Khalifa to create illustrations in the form of copper plates for each of the legends, leaving a beautiful testimony to the local folk art of his time and visual interpretation of the stories.

⁹Following Athar Lina's philosophy, “Athar Lina (The monument is ours) believes that only when cultural heritage is beneficial to the community, will the community become an active partner in its conservation” <https://atharlina.com/about/>

¹⁰The coffee-owner, however, was delighted. Amm Mustafa, a 60-something gruff man loved the drawing and his judgment proved to be sounder than ours. The women were not just accepted; they were appreciated and soon became a landmark that brought the coffee shop more business. It became common for strangers visiting the neighbourhood, for its many mawlids (saint day celebrations) for example, to meet at “the coffeeshop with the women”. Ibrashi, *Heritage in the Street: Megawra | BEC's Athar Lina Initiative in Historic Cairo*, 245.

¹¹<https://www.tandemforculture.org/stories/al-khalifa-love-wings/>.

¹²After the outbreak of COVID-19, the Egyptian Authorities implemented precautionary measures to limit gatherings by canceling a number of activities, including *mawlids*. For two consecutive years, al-Khalifa did not witness the festivals of al-Khalifa. No one can predict how long the cancellation of *mawlids* will last, and if they will return. And if they return, it is unclear if they will have the same appearance, spatial effect, and rituals or whether they will change or be downsized (Arafa, 2020, p.74).

¹³Zheng Sun, ‘Intangible Heritage Restoration of Damaged Tomb Murals Through Augmented Reality Technology: A Case Study of Zhao Yigong Tomb Murals in Tang Dynasty of China’, 2024 <https://ssrn.com/abstract=4588557>.

¹⁴‘While tangible heritage often gains more attention than intangible heritage in cultural protection, it is still imperative to acknowledge that intangible heritage complements and substantiates the historical, cultural and artistic context’ (Zhen, 2024, p.1).



Figure 2: One of the AR murals in Al Khalifa and the AR view in ARTIVIVE on a mobile phone.



Figure 3: Implementation of the Wings of Khalifa mural with local youth.



Figure 4: Mural marker for the Mawlid of al-Sayyida Sukayna's Zaffa experience.

Remembering and Reactivating

Beyond Cairo, AR is established as a tool for urban revitalisation and conservation, primarily through the capacity to reclaim and reactivate place. The Augmenting Angri project in Italy¹⁵ employed AR to digitally restore and tour 20 decaying murals, stimulating interest in neglected neighbourhoods and initiating dialogue on local identity, including contentious social issues like organised crime¹⁶. Similarly, the digitisation of the fragile Shekhawati murals in India, utilising open-source tools to create AR overlays, helps democratise access to this open-air gallery. This initiative highlights the efficacy of low-cost technologies in contributing to preservation and attracting donations for conservation, thereby offering a replicable model for cash-strapped communities globally¹⁷. Collectively, these diverse projects underscore AR's significant potential in education, conservation, and comparative research on mural traditions.

Ethical and Technical Imperatives for Sustainable AR

The effective and ethical deployment of AR in heritage requires rigorous consideration of both technical choices and ethical governance. Technical decisions fundamentally impact project sustainability, notably the ongoing shift from marker-based AR—which relies on physical tags and can be impractical on fragile surfaces, as observed in projects like Al Khalifa and Angri—to marker-less, geospatial approaches that utilise GPS and computer vision. Future research, such as Bauer et al.'s *Augmenting Murals*¹⁸, suggests that marker-less AR is achievable, thus eliminating the need for intrusive signage, a necessity in sensitive archaeological sites.

For long-term sustainable AR projects, one must simultaneously address critical ethical issues. Foremost is inclusive representation: projects must mandate the involvement of local stakeholders in content creation to ensure narratives accurately reflect their lived experiences and avoid exoticisation. Workshops like those run by Michalczyk and Arafa serve as successful models for amplifying marginalised voices. Relatedly, the ease of digital creation introduces the risk of low-quality replicas and misinformation, which can trivialise cultural assets¹⁹. Therefore, maintaining scholarly rigour demands a careful balance between creativity and accuracy, supported by transparent curation of sources. Critics also caution that excessive or entertainment-driven overlays turn historic sites into theme parks, undermining their cultural significance.

¹⁵Pagliano, Annachiara, 'Between Memory and Innovation: Murals in AR for Urban Requalification in Angri (SA)', In *Representation Challenges: New Frontiers of AR and AI Research for Cultural Heritage and Innovative Design*, edited by Unknown, (Conference Proceedings, 2023).

¹⁶Similarly as in the case of the Zaffa in Khalifa, in Angri young people were often unaware of very recent history, such as local hero General Gennaro Niglio's fight against the mafia (Pagliano, 2023, p.135).

¹⁷Their deterioration reflects not only environmental stress but also socioeconomic changes: many haveli owners migrated, leaving their houses unattended, (Dawatwal, Priyanka, and Nirupama Singh. 2024, p.248).

¹⁸Bauer, Alexander, Martin Kocur, and Josef Hagler, 'Augmenting Murals: Creating Playful AR Experiences for Wall Art Exhibitions', *8th IEEE VR Internal Workshop on Animation in Virtual and Augmented Environments*, IEEE, 2025.

¹⁹Soto-Martin, Ovidia, et al.,2020, p.3.

Beyond content, structural issues of digital equity must be addressed. Although commercial entities often promote AR as an engine for tourism, the expense of professional infrastructure and reliance on proprietary platforms create significant barriers for developing nations²⁰. Exclusive corporate projects risk widening digital divides and marginalising local voices in governance.

Consequently, exclusive corporate projects risk widening digital divides and actively marginalising local voices in governance. A further threat to sustainability is platform obsolescence: dependence on proprietary platforms (e.g., Meta's Spark AR, Adobe Aero) creates a critical vulnerability where their discontinuation²¹ results in the loss of AR experiences and their data. Since big tech companies often retain ownership of user content, this structural reality raises concerns over cultural sovereignty, necessitating that practitioners favour open-source or locally hosted solutions and advocate for protective regulations. Finally, ethical implementation requires strict moderation and contextual respect to prevent excessive, entertainment-driven overlays from transforming historic sites into themed environments, which would fundamentally undermine their cultural significance²².

Conclusion

AR murals offer an innovative fusion of visual art and digital storytelling for heritage preservation, enabling the visualisation of marginalised narratives and the creation of digital surrogates. To harness this potential, practitioners must couple technical ingenuity with ethical sensitivity, requiring them to center local voices, ensure accuracy and transparency, plan for platform obsolescence, and advocate for supportive legal frameworks.

This methodology respects the theoretical understanding that heritage is lived, not merely preserved in stone²³, as rituals and memories provide monuments with their meaning, allowing AR murals to weave narrative threads between physical and digital spaces.

Future development must therefore commit to addressing pressing issues: resolving technological challenges by implementing hybrid AR models in dense districts²⁴, assessing and mitigating the

²⁰BrandXR, 'AR Murals in Historic Preservation: Bringing the Past to Life', April 2025,

<https://www.brandxr.io/ar-murals-in-historic-preservation-bringing-the-past-to-life>.

²¹<https://spark.meta.com/blog/meta-spark-announcement/#:~:text=Following%20a%20thorough%20assessment%2C%20we,effective%20Tuesday%2C%20January%2014%2C%202025>

<https://helpx.adobe.com/aero/aero-end-of-support-faq.html#:~:text=Adobe%20Aero%20will%20be%20discontinued,content%20until%20December%203%2C%202025>.

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²²Soto-Martin, Ovidia, et al., 2020, p.3.

²³Scholars such as Laurajane Smith argue that heritage is a cultural process involving negotiation and interpretation rather than a fixed set of objects, emphasising that tangible and intangible elements are inseparable: rituals, songs, and memories give meaning to monuments and public spaces, while built environments provide context for social practices.

Smith, Laurajane, *Uses of Heritage*, 1st ed. (Routledge, 2006) <https://doi.org/10.4324/9780203602263>.

²⁴As an example, an AR project displaying Islamic patterns in Imam el Shafei Mausoleum was initiated in 2021 but was abandoned due to weak internet and GPS.

environmental footprint of AR infrastructure, and conducting empirical studies to ensure accessibility for diverse demographic groups, including seniors and the disabled. Thoughtfully implemented, AR murals serve as powerful tools for equitable and integrated heritage management, moving decisively beyond mere digital spectacle.

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