REIMAGINING CULTURAL ENGAGEMENT: **THE DIGITAL TRANSFORMATION OF MUSEUMS**

Introduction

Thoughtful and imaginative uses of technology are reshaping the museum and art worlds, enhancing visitor engagement, streamlining operations, and redefining how collections are managed. This e-book explores key innovations, including immersive experiences, gamification strategies, technologies that enable digital storytelling, digital twins, AI, and collection management systems. Together, these advancements are enhancing accessibility and efficiency and shaping the future of cultural institutions.

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As we head into 2025, museums face a world shaped by rapid technological advances, shifting social priorities, and a growing focus on well-being. These changes are opportunities for museums to redefine their role in people's lives. From fostering creativity to combating loneliness, museums are stepping up to become more than places to visit — they're becoming places to belong."

Jim Richardson

Founder of MuseumNext

Technologies Transforming Museums

Immersive experiences and gamification are transforming museum engagement by making exhibits more interactive, educational, and memorable. Immersive experiences provide deeper emotional and intellectual connections, making content more accessible and appealing to diverse audiences. Combined with gamification elements, these technologies enhance visitor engagement and encourage visitor participation and learning in a fun and dynamic way.

In this section, you'll explore exciting examples of the use of gamification and extended reality in the cultural sector

Artificial Intelligence tools keep evolving, and it's nice to see how more museums are finding creative and truly engaging ways to incorporate AI into their offerings. AI-driven tools enable personalized recommendations, assist with art curation, and power interactive virtual guides that adapt to visitor preferences. AI also plays a role in analyzing visitor data to refine exhibit design and engagement strategies, making museum experiences more dynamic and inclusive.

In this section, you'll learn more about AI virtual assistants, how AI can enrich collections and experimenting with AI-curated exhibitions

Digital twins technology and 3D renderings play a significant role in monitoring heritage sites and artifacts, enhancing exhibition preparation, artifacts restoration, and reconstruction.

In this section, you'll discover cultural heritage use cases for digital twins

Technologies for managing fine and digital art collections, including digital cataloging systems and NFT/blockchain platforms, make it easier for curators, collectors, and institutions to track artworks, provenance, exhibition history, and maintain detailed artwork documentation. They allow museums to develop a more integrated approach to managing collections, leverage their value and enhance the overall efficiency of operations.

In this section, you'll learn about custom art collection management solutions, applying holographic and NFT technologies for digital art collections, and more

Immersive Experiences and Gamification

A 2023 study exploring the use of gamification and extended reality in the cultural sector found that virtual guides and gamified approaches, incorporating 3D and 2D technologies, appeared to be both effective and highly engaging for visitors.

Virtual Reality

Virtual reality (VR) is revolutionizing the way museums engage their visitors, offering immersive, interactive experiences that bring history, art, and science to life in ways never before possible.

By allowing users to explore distant cultures, intricate artifacts, and even abstract concepts, VR enhances accessibility and creates captivating narratives.

One example of how VR is reshaping the cultural sector's engagement strategies, particularly with younger audiences, is Holo-Museum, launched in 2021. Built using spatial reality technology, Holo-Museum helps young visitors understand collections better when they eventually get to see them in person, sparks their curiosity and gets them excited about learning new things.

A more budget-friendly XR museum experience involving the Meta Quest 2 is exemplified by the mixed reality project 'Victorian Reality', a collaboration between Powerhouse Museum and the iCinema Centre for Interactive Cinema Research in 2023. The experience used the hand-tracking functionality of the Meta Quest 2 to allow users to interact with scanned museum objects from the Powerhouse Museum's collection.

Another fascinating case of using VR technology for an important purpose is The Illinois Holocaust Museum's project. To protect and preserve the crucial eye-witness perspective of Holocaust survivors, the museum debuted three VR films featuring Marion Deichmann's experience in Nazi-occupied Paris, Doris Fogel's journey from Kristallnacht Berlin to wartime Shanghai, and Rodi Glass's return to Amsterdam and the sites of her survival.

The project taps advanced technologies, including 360-degree video, spatial sound, motion capture, and Unity — a game engine that creates three-dimensional, interactive environments. It also employs conventional techniques including set-building, animation and archival materials.

"What we have found, in particular over the past couple of years with the rise of hatred and extremism and antisemitism, is that visitors are coming to our museum looking for answers from our survivors. They are finding in the holographic technology or through the virtual-reality films this affirmation of, 'Okay, these courageous and resilient individuals were able to survive, were able to create these incredible lives after such darkness. I can be empowered by that. I can take strength from that."

"Our museum started having a lot of conversations about what we are going to do when our Holocaust survivors are no longer here to share their stories. Being able to ask a survivor, 'Do you have nightmares? Are you still angry? Do you forgive?' Those are really tough, intimate questions that young people now feel, because of this holographic technology, the freedom to be able to ask."

Kelley Szany

Senior Vice President of Education and Exhibitions
at Illinois Holocaust Museum & Education Center

Augmented Reality

Unlike virtual reality, which embodies users entirely in a different world, AR supplements and enhances the existing environment by displaying an altered version alongside reality. AR experiences are easily accessible with just a smartphone or tablet, making them versatile tools for annotating scenes, providing additional information, and placing objects or scenes in context within the user's current reality.

Since the pandemic, museums all over the world like Muséum national d'Histoire naturelle in France, The National Museum of Singapore, and The Art Gallery of Ontario, Toronto have implemented AR installations in one way or another.

An interesting recent example of how museums and cultural organizations can leverage AR to engage new audiences is the success of social, community-driven activities built around this technology, like Pokémon Go.

By embracing AR to foster interactive and social experiences much like Pokémon Go, museums can reinvent themselves as relevant and appealing spaces for today's diverse and digitally connected communities.

AR can provide more ways to connect to museum collections and put visitors at the center of an exhibition experience. A fascinating example that illustrates this benefit perfectly is the Fine Arts Museums of San Francisco with its exhibition Fashioning San Francisco: A Century of Style.

The museum offered their visitors the chance to "try on" classic dresses through the uncanny lens of augmented reality.

A playful experience allowed visitors to take pictures of themselves wearing digital versions of three different dresses and share them with their social networks. The experience incorporated a strong social component and a network effect dynamic. As a result, the museum saw 60% growth in engagement and 50% more outreach in their Instagram account. User feedback shows the experience has given visitors a more intimate connection with the art.

"For museums and cultural organizations, the headlines have changed. However, it doesn't have to mean doom and gloom, but rather, a chance to reinvent, reimagine, and reengage. We need to pay attention and hold space for conversation on what we can learn from, adopt, play with, and consider as part of the new way that we work within our organizations, in our online spaces, and in the community. It means experimentation, and now is a time that we should return to the idea that museums can be fun and places for play in a time when respite is so needed.

Adam Reed Rozan

Audience Development, Audience Research, Community Partnerships at Smithsonian Institution

This is a rare moment where the digital and physical worlds truly complement each other, creating an experience that is playful, meaningful, and memorable."

Patricia Buffa

Principal Product Marketing Manager at Adobe
previously Director of Digital Strategy at Fine Arts Museums of San Francisco

Augmented Reality and Gamification Elements

AR technology combined with gamification can be really powerful in terms of visitor engagement. A great example of how it can be implemented is a project made by the North Carolina Museum of Art and Proximal Design Labs. The essence of the project was rooted in the developing of virtual field trips into the ancient past allowing visitors to experience and interact with historical artifacts.

This project showed how virtual field trips that incorporate gamification elements have high engagement value, and they allow visitors to choose their own adventure, spark their own curiosity, and interact with other users on their journey, making the museum learning experience less didactic and more inquiry-based. It's another example of the benefits of placing the visitor rather than the object at the center of the experience.

Extended Reality

Immersive technologies are an exciting way for museums to display their collections online, reaching distant audiences all over the world, and to encourage their visitors to dive in deeper into the items in a collection.

Smartphone applications incorporating AR technologies is one more pivotal medium within the extended reality (XR) museum ecosystem.

These applications offer a range of experiences, from automated guides to augmented reality challenges, enhancing user experiences without burdening museums with excessive costs.

The use of Google AR-Core demonstrated the potential to exhibit materials in virtual museums that may be limited in physical spaces, providing curators with unprecedented flexibility.

Mobile Device-Based Engagement

The Migration Museum fantastically executed this strategy by offering their visitors a BYOD (Bring Your Own Device) solution.

The museum integrated a unique QR code system and invited visitors to submit migration stories via their personal devices.

The results were striking — 70% of submissions came from mobile devices, with lower abandonment rates compared to the interactive kiosk at the museum.

This approach, which was a part of the "All Our Stories" exhibition, spotlights how digital solutions can enhance participation and storytelling in museum experiences.

Digital Storytelling

Storytelling is a powerful tool to boost visitor engagement, facilitate learning and connection, inspire moments of wonder, and transform visitors into active participants. An interesting example of digital storytelling in action, shared during the MuseumNext's 2024 Digital Summit, involved creating "mood journeys" using map-based experiences and audio guides to animate the sense of being a story participant and encourage visitor exploration and engagement. This experience was available to visitors within the Getty Museum guide app and offered five pre-curated mood journeys to choose from — from "calm and serene" to "adventurous and brave." Such experiences offered visitors a non-linear type of exploration, emphasized and stirred up their emotional engagement, and provided a personal touch.

Digital Twins Technology

Digital twins serve a range of purposes in the cultural heritage space, such as monitoring the condition of heritage sites and artifacts, tracking changes in temperature, humidity, and other environmental factors that may impact heritage objects' stability, planning and conducting restoration and conservation work, simulating various restoration and conservation scenarios which enables conservators to select the best approach for a particular object or site.

Many historical landmarks and artifacts are at risk due to natural disasters, human activity, and conflict. Those dedicated to protecting and preserving these sites and artifacts often face dangerous or challenging conditions. Traditional methods of excavation and documentation can inadvertently damage these precious historical objects, risking further degradation of delicate materials.

To prevent the present from erasing the past, archaeologists worldwide are turning to 3D scanning technology for digital preservation. With 3D scanning, scientists can create detailed digital twins of priceless, unique artifacts. These digital replicas can be documented, distributed, preserved for posterity, examined by architects, historians, and scientists globally, and shared with audiences around the world.

Cultural Heritage Use Cases for Digital Twins

Monitoring Heritage Sites and Artifacts

One key application of 3D technology is monitoring heritage sites and artifacts. Digital twins can track changes in temperature, humidity, and other environmental factors that may affect the stability of heritage objects. This capability allows conservators to identify potential risks and implement preventative measures to protect these objects and sites.

Digital twins is invaluable in planning and conducting restoration and conservation work. Instead of relying on current estimations for conservation scheduling, cloud-based digital twins can simulate different restoration and conservation scenarios. This enables conservators to select the best approach for a particular object or site, ensuring more effective and precise preservation efforts.

Virtual Access to Sites and Artifacts

Virtual access to these sites and artifacts is another significant benefit of digital twins technology. Digital twins can open access to understudied but historically significant sites for researchers specializing in relevant fields. This virtual access allows experts to examine and provide insights into these sites, enriching the broader academic community's understanding. Furthermore, this remote accessibility can spark new collaborations and discoveries that would have been difficult to achieve through traditional means.

Enhancing Exhibition Planning and Preparation

By leveraging 3D renderings, exhibition curators and installers can test different layouts, ensuring artworks fit harmoniously within the exhibition space and optimizing visitor flow. Virtual models make it easy to assess how objects relate in size and placement before installation, preventing last-minute adjustments and allowing the team to experiment with configurations and lighting conditions, reducing the need for physical mock-ups.

Artifacts Restoration

Artifact restoration highlights another vital aspect of 3D technology — scanning data. The scanned data can produce a 3D digital archive for records, insurance, or restoration purposes. For example, if an original object is damaged or broken, the detailed digital model can be a reference to restore the artifact to its original state accurately. This capability ensures that even if physical damage occurs, the cultural and historical value of the artifact is not lost and can be meticulously reconstructed.

Reconstructions of Ancient Cities and Interiors

Digital reconstructions of ancient cities have begun to appear, showcasing the latest advances in digital twins technology. While initially limited to exteriors without realistic texturing, these reconstructions allow researchers and the public to interact with and study heritage sites and artifacts that have been damaged or lost.

A striking example of digital twins technology applied to this domain is The Smithsonian 3D team partnering with the Smithsonian's American Art Museum to 3D scan Hiram Powers's Greek Slave sculpture (1843). They used photogrammetry and a FARO laser arm scanner to capture the object in detail and made the data accessible online via the Smithsonian 3D viewer. The team also produced a life-sized 3D-printed replica displayed at the Renwick Gallery. Now, anyone with internet access can view and download the 3D scan data of the Greek Slave sculpture.

AI Technologies

Artificial Intelligence tools continue to evolve and widen horizons, and it's nice to see how more museums are finding creative and truly engaging ways to incorporate AI into their experiences. AI-driven tools enable personalized artwork recommendations, assist in curating art enhibitions, and power interactive virtual guides that can adapt to visitors' preferences. AI also plays a role in analyzing visitor data to refine exhibit design and engagement strategies, making museum experiences more dynamic and inclusive.

AI Virtual Assistants

An interesting example of using artificial intelligence in museums to enhance engagement with the help of AI virtual assistants is IRIS+, a project built with IBM's Watson services. IRIS+ was implemented at the Museum of Tomorrow in Rio de Janeiro, Brazil, to help analyze data collected through visitor interactions with museum exhibits and foster engagement with visitors through a conversational interface.

Unlike typical AI museum applications, IRIS+ takes an innovative approach, initiating conversations with visitors by posing thought-provoking questions about their concerns in today's world. The dialogue that ensues is facilitated by the application's interaction with the IBM cloud and its use of the Watson Conversation service to guide and extract meaning from the conversation.

IRIS+ considers the concerns visitors articulate during the conversation, together with personal information they submit, to suggest actionable initiatives, connecting individuals to social and environmental projects that contribute to building a more inclusive and equitable future for all.

Connecting and Enriching Collections

Recent experiments have demonstrated the value of AI in managing and enriching museum collections and to make undiscovered connections among them. The Henry Ford Museum of American Innovation has unveiled the AI Connections Table, a device designed to offer visitors a playful yet insightful glimpse into the intricate thought processes of museum curators.

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Museums are renowned for their vast and varied collections of objects and artifacts, spanning cultures, eras, and genres. Now, artificial intelligence (AI) is being employed to analyze these collections, identifying patterns and themes, and automating categorization. By drawing connections between seemingly disparate areas, visitors are able to gain a greater appreciation for the museum's overarching mission and brand"

Josh Goldblum

Founder of Bluecadet, Artwrld, Futurespaces

AI-Assisted Accessibility

By leveraging artificial intelligence, museums can also enhance accessibility, for instance, for visitors with low vision. One example of how it can be used is Be My AI, an AI-powered visual assistant that connects people in need of sighted support with volunteers and companies through live video around the world.

Be My AI uses OpenAI's GPT-4 vision model to generate descriptions of a photo the person has taken, like instructions for setting up a new computer or a product label. Through AI-based natural language conversations, the tool also provides contextual, advice-based guidance to help users through various issues.

Creative Collaboration

A novel application of artificial intelligence in the museum space is the co-creation of art. In September 2023, the MIT Museum introduced an exhibit called Collaborative Poetry, developed in partnership with Bluecadet and designed to educate visitors about AI through interactive poetry creation.

Bluecadet employed an AI trained specifically for writing poetry, enabling visitors to collaboratively compose verses with a neural network. Unlike many AI art generation tools, the focus of Collaborative Poetry was not to hand over control to the AI but to position it as a tool for unlocking creativity.

The exhibit encouraged visitors to reflect on issues of authorship and authenticity raised by popular AI art generators like Midjourney and Dall-E, emphasizing the value of AI as a collaborator in the creative process. By positioning AI as a collaborator rather than a primary creator, the exhibit prompted visitors to reconsider the role of AI in the creative process, emphasizing the fun, engaging, and occasionally moving aspects of interactive AI-generated poetry.

AI-Curated Exhibits

In 2023, the Nasher Museum of Art at Duke University embarked on an experiment to use AI to curate an exhibition from the museum's collection. Their team used ChatGPT to produce an AI-curated exhibition.

The team used OpenAI's text-embeddings model and worked with open-source tools to translate their collections database into the model and produce their own custom chatbot for this project. As part of the experiment, the team wanted to give the AI model as much agency as possible. For instance, they asked the bot to suggest a theme for the exhibition, to select appropriate works for this theme, and provide some introductory text for the exhibition.

Along the way, the team acquired some new and essential insights into their collection, such as the importance of having accurate and up to date descriptors, key words, and metadata built into their collection.

The experience affirmed that AI will not be taking over curatorial jobs anytime soon, due to the enduring need for human touch and empathy in the curatorial process and its fundamentally subjective nature.

> Some of my favorite interactions at museums have been when I somehow get talking to an exceptional docent, educator or security guard. As someone that has spent the last 20+ years in museum technology it makes me think people are actually the most under-leveraged technology in the experience design toolkit."

Josh Goldblum

Founder of Bluecadet, Artwrld, Futurespaces

Solutions for Managing Fine and Digital Art Collections

Technology solutions for managing art collections, like digital cataloging systems and NFT/blockchain platforms, make it easier for curators, collectors, and institutions to track artworks, provenance, exhibition history, and help museums to maximize and monetize the value of their collections digitally.

Customized Platforms for Museum Collections

If a museum has developed a clear vision of how they wish to maximize the value of their collections digitally, then they may consider building their own customized platform or leverage a solution from a technology software provider.

Some of the world's foremost museums have taken the former approach and developed their digital collections in-house, such as the Louvre's Collections database and the Whitney's collection of over 26,000 works.

Others leverage digital startups that offer numerous solutions in this space. Those now collaborating closely with museums and cultural institutions to build innovative and educational tools around their collections include Cuseum, whose "digital docent" self-guided, multilingual, multimedia-enhanced alternative to standalone museum audio guides has won awards.

Holographic Technologies Meet NFTs

An example of using holographical technologies to monetize art collections is the Morpheus Project, a blockchain-based platform that aims to create a new ecosystem for NFTs, which can be bought or sold like physical assets. The platform offers a range of features and tools for managing NFT collections.

Museums are following suit, experimenting with a range of cutting-edge digital channels, including alternative approaches to curation and exhibitions as well as new models for engaging their visitors and promoting art. The public appetite for virtual cultural content, which exploded during the pandemic, has stood strong even with the return to in-person life. .... What's clear is that technological innovation and the ethos and infrastructure that supports it are already shaping the future of museums."

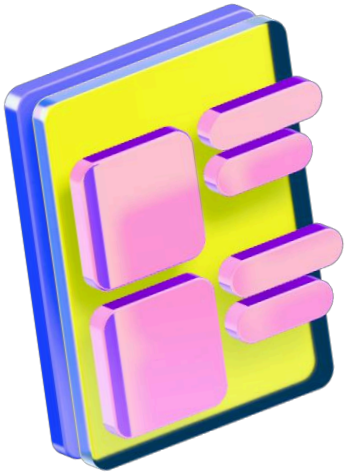
"It will be exciting to watch it all unfold and to look back on this moment decades from now as a tipping point in the mainstream adoption of digital art and culture."

Brendan Ciecko

Founder & CEO at Cuseum

How DataArt Can Help Museums to Make the Most from their Assets with Custom Collections Management Solutions

At DataArt we help to design, develop, implement and support inventory and collections management software to streamline the management of artworks, track provenance, maintain detailed artwork documentation and improve efficiency for museums.

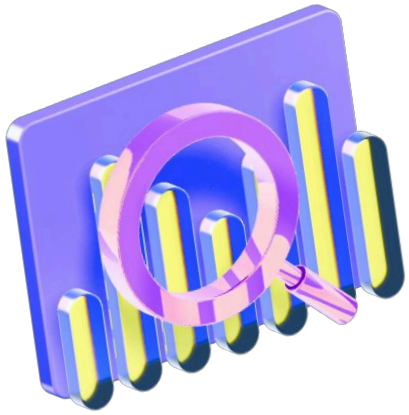


Inventory Management

Monitor the location, movement, and status of an artwork (e.g., on loan, in storage, on display) to facilitate efficient management of collections.

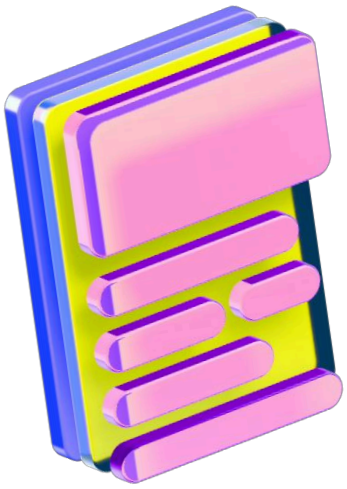
Data Consolidation & Accessibility

Catalog and manage artworks, artifacts, and collections digitally from a secure, centralized, cloud-hosted platform, quick and easy access to artwork information using rich search, sorting and filtering options, web and mobile app synchronization, multiplatform access.



Data Analytics and Reporting

Gain insights into your collections with reporting and analytics features that can analyze trends, track performance metrics, and make informed decisions about acquisitions, deaccessions, or conservation efforts.



Documentation and Tracking

Produce, customize, manage or access detailed documentation of each artwork, including its provenance, condition reports, exhibition history, invoices, loans, consignments and appraisals, provide intelligent customizable workflows and keep track of the full the lifecycle of the artwork.

Final Thoughts

As museums and art institutions continue to embrace digital solutions and adapt to rapid technological change, the contours of cultural engagement are evolving in unprecedented ways. Immersive experiences and gamification techniques are making exhibitions more interactive and engaging, digital twins are helping to preserve cultural heritage, AI is enhancing personalization and assisting in curation, while advanced collection management systems are improving the efficiency of museum operations.

The integration of these technologies is above all about ensuring that museums remain relevant and continue to provide social and cultural value through fun educational programs, community-driven activities and meaningful experiences. As an art and museum enthusiast, I'm excited to see how this sector is investing and experimenting with technological innovations to reimagine, reinvent and redefine their role in the modern cultural landscape.

Doron Fagelson

SVP at DataArt Media & Entertainment