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GLOBAL PRACTICES OF DIGITAL REPRESENTATION OF MUSEUM COLLECTIONS BASED ON CURRENT EXAMPLES

Digital representation of cultural artifacts has evolved from a simple archival practice into a multifaceted global phenomenon with far-reaching implications for various institutions and individual practitioners involved in preservation and study of nations' cultural heritage. Interestingly, such ideas are not driven solely by commercial interest nor the need for safeguarding artifacts themselves. This paper examines the likely motivations, methods, and outcomes of various efforts aimed at such digital representation. We focus on four key objectives. Firstly, the analysis of how digitization ensures the potential long-term preservation of historical artifacts by way of creating high-fidelity digital copies instead of physical lookalikes. Secondly, we explore current examples of how institutions leverage publicly accessible digital collections to grow the recognition of own brand image and expand their audience outreach. Thirdly, the paper investigates the role of digital archives in facilitating the promotion of regional history and culture, making this heritage accessible beyond physical boundaries of any given region and/or archive collection. Finally, taking a look at how practical application of digitization efforts has indirectly contributed to creation of a self-sustaining feedback loop, driving the evolution of both digitizing technologies and the philosophies governing their use and application. Demonstrated examples serve as actionable proof that digital representation is no longer treated merely as a technical process but a large-scale change in the relationship between humanity and its own cultural heritage. Despite this, we recognize that the largest and most influential impact of such initiatives is possible only when their results are freely accessible, with assured long-term existence of produced digital files in a similarly open-access format.

Key words: *cultural heritage, digitalization, immersive experiences, preservation, virtual gallery, virtual reality.*

Сосік Ольга. СВІТОВІ ПРАКТИКИ ЦИФРОВОЇ РЕПРЕЗЕНТАЦІЇ МУЗЕЙНИХ КОЛЕКЦІЙ НА ОСНОВІ СУЧАСНИХ ПРИКЛАДІВ

Цифрова репрезентація культурних артефактів еволюціонувала від простої музейної практики до багатогранного глобального явища, що має далекосяжні наслідки для різних установ та окремих фахівців, які займаються збереженням та вивченням культурної спадщини країн. Показово, що такі ідеї не обумовлені виключно комерційними інтересами чи необхідністю збереження самих артефактів. У цій статті розглядаються ймовірні мотиви, методи та результати цифрової репрезентації з акцентом на чотирьох ключових аспектах. По-перше, проаналізовано, як цифровізація забезпечує потенційне довгострокове збереження історичних артефактів шляхом створення високоякісних цифрових копій. По-друге, розглядається, використання установами загальнодоступних цифрових колекцій для підвищення впізнаваності їхнього бренду та розширення охопленої аудиторії. По-третє, у статті досліджується роль цифрових архівів у сприянні популяризації регіональної історії та культури, що робить цю спадщину доступною за межами фізичних кордонів будь-якого регіону та/або архівної колекції. Насамкінець, ми звертаємо увагу на ідею, що практичні зусилля з цифровізації опосередковано сприяють створенню самопідтримувального циклу зворотного зв'язку, що стимулює розвиток як самих технологій цифровізації, так і філософії, що регулює їх використання та застосування. Наведені приклади слугують реальним доказом того, що цифрове представництво більше не розглядається лише як технічний процес, а як масштабна зміна у відносинах між людством та його власною культурною спадщиною. Незважаючи на це, ми також усвідомлюємо, що найбільший і найвпливовіший ефект таких ініціатив можливий лише за умови вільного доступу до їхніх результатів та гарантованого довгострокового існування створених цифрових файлів у форматі, що також є відкритим для доступу.

Ключові слова: *культурна спадщина, оцифрування, імерсивні враження, консервація, віртуальна галерея, віртуальна реальність.*

Introduction. In an era defined by rapid technological advancement and increasing public demand for accessibility, the role of cultural heritage institutions (that being galleries, archives, museums and, crucially, libraries) is undergoing a profound transformation. Traditionally, they were tasked with physically safeguarding pieces of human history, keeping many artifacts in as good condition as possible, for the purposes of scholarly study and public display. However, the advent of sophisticated digital imaging techniques, such as 3D scanning and photogrammetry has ushered in a new paradigm of digital representation. Virtual reality in its turn, has partially taken on a role of providing a comfortable environment for interaction with digital copies of real-life items. The process involves a conversion of tangible, physical objects into high-fidelity models or images that can be stored, analyzed, and shared globally. In theory, it may lead to rethinking of how culture is preserved, managed, disseminated and what it means for it to be, actually, accessible for future generations. In practice, however, it has to be spearheaded and almost mandated for it to have such an impact on a global scale.

Motivations for such activity are often multifaceted and self-serving, as it may be any one or combination of the three underlying ideas: preservation, cultural promotion, brand recognition,. Impact on technological evolution is an indirect result, which, admittedly, sometimes becomes a cause by itself. In this paper we provide an overview of global practices of digital representation of museum collections based on existing real-world examples.

First Idea: The Imperative of Digital Preservation. The primary and most widely acknowledged motivation for the digital representation of museum collections is the preservation of historic artifacts. Physical objects are inherently susceptible to deterioration from environmental factors, natural or man-made disasters, and the simple passage of time. As custodians of these items, institutions face the constant challenge of ensuring their long-term survival. Borrowing language from marketing departments worldwide we could say that "digitization offers a powerful solution by creating a non-destructive, permanent record of an object in a virtual format", which is true to an extent. Any digital media exists precisely as long as the hosting provider keeps it accessible and even then the hard limit is set by the lifetime of physical media storage (questions of file corruption are outside of the scope of this paper).

Creating these digital files often involves performing high-resolution 3D scans using laser scanners and/or photogrammetry to capture an object's form, texture, and color. With added post-processing (texture and model cleaning, model repair, denoising, etc), this creates a "digital twin" that could be archived almost indefinitely, serving as a critical backup in case the original item is lost, damaged or destroyed. However, there is an obvious problem that may be overlooked more often than it is dealt with – such digital copies are frequently kept for internal use only, thus potentially compromising their long-term safety. There is an initiative called "Scan The World", that aims to create a large open-access collection of scanned artifacts. Additionally, every model is fully 3D-printable, meaning that any school, university or individual can create their own copy for educational, archival or artistic purposes (*Full Collection | Scan the World*, n.d.).

Second Idea: Promoting Regional History and Culture. While preservation alone is a good cause by itself, arguably as important is the aspect of cultural promotion. Such a task does not require high-fidelity copies required for academic study as it is satisfied by a faithful reproduction of the original. One of many examples is the "CC0" collection by Thomas Flynn (Flynn, n.d.), containing hundreds of public domain 3D models of cultural artifacts. After all, digitization of cultural artifacts is an incredibly effective tool for promoting regional history and cultural identity and sometimes instead of waiting for someone else to take first steps, citizens do it themselves. By creating virtual collections, museums and local repositories we all can share the unique heritage of the respective regions with a global audience, fostering cross-cultural understanding and a renewed interest in local history. This is

particularly impactful for smaller or lesser-known communities lacking resources for large international exhibitions.

A prime example of this is a project called "Virtual Museums of Małopolska". It is run by the Regional Digitalisation Lab, part of the Małopolska Institute of Culture in Kraków, Poland (Sketchfab, n.d.-c). This initiative aims to do more than just digitize random objects – it creates a curated collection telling a story of a specific place and its people. By making these collections accessible online, the project allows researchers, students, and enthusiasts from around the world to study and appreciate the cultural richness of the region. This in turn serves to both preserve the heritage and to promote cultural tourism and academic interest, turning otherwise unnoticed regional museums into a global resource.

The work of AD&D 4D (Association for the Documentation and Diffusion 4D) on the "Castellón Arqueológico" collection is another case worthy of our attention (AD&D 4D Association for the Documentation and Diffusion 4D, n.d.). This project focuses on the archaeological heritage of the Castellón region in Spain. By digitally documenting and disseminating these finds, the association partly ensures their preservation but also actively promotes the unique history of the area. Sketchfab being one of their chosen distribution / hosting channels is of great help particularly because of the website being much more common and widely known than the actual website supposedly made for the project itself (at the time of writing we had considerable connection issues as well) (*Yacimientos Arqueológicos En La Provincia De Castellón, Comunitat Valenciana, España, Europa*, n.d.). This is yet another demonstration that even a small, regional collection can hold immense value for the international community. This grassroots approach to cultural promotion, facilitated by digital tools, is a powerful force for democratization and inclusivity of the global cultural space regardless of the geography or time of origin. Besides, any institution concerned with the amount of visitors should see such publicly accessible collections as a free advertisement, since, for example, if not for the work of AD&D we almost assuredly would have not known about "Castellón Arqueológico" or Castellón region itself.

Third Idea: Strategic Brand Recognition and Public Accessibility. Beyond preservation or education, both of which are important in their own right, online presence of museum collections has become a strategic tool for institutions to expand their reach, grow brand recognition, and attract new audiences in an increasingly digital "online-enabled" world. A well-curated project acts as a digital extension of the physical facility, breaking down the geographical, financial, and physical barriers that have traditionally limited access to art and history. Not to mention the existence of institutions dedicated solely to the history of science and technology, which can not easily relocate parts of their archives for the purposes of out-of-state events.

The "Nationalmuseum" in Sweden, through its account on MyMiniFactory, demonstrates this principle effectively. By making high-quality scans of its collections available for download, the museum positions itself as a forward-thinking and publicly-minded institution (Nationalmuseum, n.d.). This act of openness not only serves its educational mission but also generates positive public relations and media attention. Gary Price in 2020 listed 20+ institutions that have uploaded parts of their collections to Sketchfab as public domain 3D models. As is the case with above mentioned AD&D work, if these online archives did not exist and/or were not listed in the article, we would have not known about some, many, most or all of them, or at the very least were oblivious about their digitizing efforts (Price, 2020).

"EMuseum" (Sketchfab, n.d.-a), a "project preserving the cultural heritage of Ukraine" leverages various platforms to create immersive, interactive experiences that go beyond static images. Users can explore artifacts from a variety of angles, developing a deeper connection with the object, which is not impossible to do in real life of course, so a virtual exhibit is not always a winning one in terms of engagement. This interactivity can later translate into increased foot traffic to the

physical location, as the digital experience serves as a tantalizing preview of what awaits prospective visitors. Essentially, the use of such platforms becomes a modern form of content marketing, where the content itself – the digital artifact – is the main draw, helping institutions to stand out in a crowded webway of online distractions and solidify their reputation as innovators. The "Public Domain Dedication" launched by Sketchfab further solidifies this as a beginning of a global movement, encouraging open access and collaboration (Sketchfab, 2020).

The Consequence: Feedback Loop of Technological Evolution. The relationship between museum digitization and technological development is a two-way street. While new technologies have enabled us to digitize singular items or entire collections and then present them by means of ready-to-download archives, Sketchfab or MyMiniFactory galleries, AR/VR/online exhibitions, the specific needs and challenges of cultural heritage projects have, in turn, spurred innovation in the field of digital representation. The pursuit of higher fidelity, greater efficiency, and more accessible software has created a dynamic feedback loop that continues to evolve the very tools and philosophies behind projects themselves.

"Misc Photogrammetry" by Shahriar Shahrabi (Sketchfab, n.d.-b), Smithsonian's efforts (Smithsonian 3D Digitization, n.d.) and the work of "AD&D 4D" are illustrative of this point. These individual and associative efforts represent the "hands-on" side where practitioners encounter real-world problems. For example, scanning a complex, ornate artifact or an object with a reflective surface requires specialized techniques and equipment. The need to overcome these challenges has led to the development of new photogrammetry workflows, refined 3D scanning hardware, and more sophisticated post-processing software. This practitioner-driven innovation, often shared through online communities and platforms, creates a rich ecosystem of knowledge that benefits not only cultural institutions but also other fields, such as archaeology, engineering, and video game development.

Furthermore, this practice has forced a philosophical shift within the field of cultural heritage. Physical-centric approach gave way to a hybrid physical-digital or entirely digital model. We consciously omit the multitude of questions about licensing and whether the "parlor" (closed, controlled use, unlikely derivatives) or "cathedral" (open, reasonably permissive use, derivatives generally allowed) model of society's cultural development is better for the present and future generations. Suffice to say that as of now, humanity has more tools for its own growth at its disposal than it ever had.

Discussion and Conclusion. The digital representation of museum collections is a complex and evolving topic and practice that serves multiple strategic purposes. As this paper argues, they are not isolated ideas but are deeply interconnected. The drive to preserve a fragile artifact (Goal A) provides the initial reason for a digitization project, but the resulting digital model quickly becomes a tool for outreach (Goal B). This new digital presence, in turn, helps create another way of sharing and promoting regional heritage (Goal C). Finally, the technical challenges encountered during these projects drive innovation and collaboration, indirectly contributing to the evolution of the entire field (Goal D). This in turn creates a cycle where results of one generation are then employed in another to greater extent: for example better post-processing practices (Goal D results) allow for more correct copies (Goal A), which are more useful for non-destructive studies or use of said artifact in media (movies, games, animation, art) without risk of damaging original item (Goal C).

While this movement offers immense benefits, it is not without its challenges. Issues like long-term digital preservation or data integrity remain critical areas for future research involving theoretical and practical work of specialists from multiple fields from IT/InfoSec to librarians, archeologists and artists. If future of cultural heritage lies not just in its physical form but in its accessible digital variant, we have to study current examples of how such is to be achieved. Moreover, we ought to create such a project ourselves for it to become more than a mere theoretical exercise.

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