

ArcheoVerso: a cultural metaverse for enhancement, technologies, communities, services

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Abstract – In December 2022, DigiLab of Sapienza University, Rome, partnered with Società Cooperativa Culture to potentially develop a metaverse prototype, ArcheoVerso, dedicated to cultural heritage. ArcheoVerso aims to leverage digital universes to enhance both tangible and intangible Cultural Heritage, creating an ecosystem for best practices in immersive and augmented reality and economically sustainable metaverse solutions. With an estimated market value of \$758.60 billion by 2026, a significant subscription rate for Meta, and hefty investments by leading companies in engaging systems, the metaverse presents an immense opportunity. Like social media, it serves as an excellent communication and enhancement tool for cultural heritage, driving unprecedented public involvement and economic impact. Platforms like Facebook, WhatsApp, Instagram are merging digital and physical reality, reflecting philosopher Luciano Floridi's concept of 'onlife' in a 'phygital' world. This transformation is evident in recent cultural studies.

I. INTRODUCTION

In December 2022, the centre of research DigiLab - Sapienza University of Rome, collaborated with the Società Cooperativa Culture to investigate possibly developing a meta-versal prototype entirely dedicated to cultural heritage. The ArcheoVerso project was born from this collaboration. ArcheoVerso aims to explore the potential of digital universes for the enhancement of material and immaterial Cultural Heritage, developing a methodological and technological ecosystem aimed at identifying and expressing the best practices for the creation, use, and interaction in immersive and augmented reality, as well as for the formulation of solutions of economic sustainability for projects focused on metaverses. With a market growth prospect that is estimated to reach 758.60 billion dollars in 2026, a subscription rate - for the Meta solution - which sees the registration of over three hundred thousand users in the first six months of life, and the conspicuous investment

(over 50 billion dollars) by leading companies in the sector for the development, over ten years, of increasingly engaging and pervasive systems, that of the metaverse represents an area that cannot be ignored or underestimated. Just as with social media, a relational infrastructure of this type represents an excellent vehicle for communication and enhancement of cultural heritage, capable of expressing itself in its complexity and generating a factor of public involvement like never before. now, with the relative economic impact that these actions entail.

Platforms such as Facebook, WhatsApp, Instagram, in fact, merge the digital world with reality, of which they are in all respects an extension and not a mere replica or simple one, so much to make concrete the concept of onlife coined by the philosopher Luciano Floridi, inside of an increasingly fluid and osmotic context, to the point of requiring another neologism: phygital, portmanteau of physic and digital. This distinction also emerges from studies conducted in the cultural field..

II. STATE OF ART

Although the concept of the metaverse has existed for thirty years, it is only since last year that attention on digital universes has focused on such a level as to leave the videogame or niche social platforms, to establish itself on a broader and more stratified level. As a 3D digital world, there is no shortage of virtualization experiments in archaeological, museum or more generally cultural contexts, nor applications of immersion and the possibility of interaction with the environment, albeit very limited. But it is the complexity of the actions, relationships, reactions within realities that go beyond the simple environment, to also provide a complete context, that makes the metaverse so potentially interesting. It is not a question of a single or a series of virtual spaces proposed to the user, but of an articulated complex of ecosystems constantly connected and synergistically interacting with reality.

Therefore, while studies on the more strictly technological aspects of the metaverse are constantly increasing, in the wake of developments related to three-dimensional modeling in the cultural sphere, to the use of virtual and augmented reality to expand the visitor's on-site experience, to the use of sensors to quickly obtain information and contextual content, the impact of the metaverse – understood in its complexity as a system, and not as an instrumental set of technologies – on the cultural world, and on the potential and problems that this relationship entails, is different; if the set of services is considered, with the consequent aspect relating to economic sustainability, the relationship between the two entities appears even more inscrutable, since at the time of this proposal, no analysis work has been carried out in this direction.

In the field of research, a certain confusion still seems to dominate regarding digital environments and universes. The former are the direct derivation of an application of virtual reality methodologies and technologies, even better if immersive, even if not exclusively; applications in augmented reality are rarer, although the hybridization between reality and digital is focusing on the metaversal platform of Microsoft, with the emblematic name of "Mesh". This typology includes those solutions that make the three-dimensional reconstruction or restitution of a real context their operational focus: it is a method that is now known and widely spread in the cultural world: as users become more familiar with the use of experiences. In fact, museums and other cultural organizations have had the opportunity to make virtual reality available to them to bring their collections and exhibitions to life. The studies and publications of various research groups that, at an international level, have explored the possibilities of digital technology in the cultural field are part of this trend [1].

With regard to the digital universes, on the other hand, especially in the current year, the possible connections with tourist use and school training were taken into consideration - also in consideration of the restrictions adopted to counter COVID-19 and the consequent limitations on travel and face-to-face activities – while remaining along the lines of a dated vision of the digital medium, almost a three-dimensional offer of contents that were previously usable through digital but two-dimensional platforms or catalogues. Likewise, an analysis of the quality of the use of environmental and social interactions within the metaversal spaces is missing, focusing more on the construction of the numerical space than on the effectiveness of the solutions created.

Even less attention has been paid to the relational aspects and the possible economic impact of the presence of

cultural entities in the metaverse. It is a market that is estimated to reach 758.60 billion dollars in 2026 (https://www.reportlinker.com/p06233177/Global-Metaverse-Industry.html?utm_source=GNW), between technological implementations and related activities from virtual activities – primarily videogames – where the cultural element is not currently represented, despite being a factor of considerable impact in the market of VR apps and installations.

In 2020, the date of the last available ISTAT census, in Italy there are a total of 4,265 museums and cultural sites open or partially open, between public and private entities, distributed as follows: 3,337 museums, 295 archaeological areas and 633 monuments or monumental complexes. Most archaeological sites are concentrated in the south (51.5%), while 49.4% of the museums and 40% of the monuments are in northern Italy. In general, the presence of museums on the national territory is widespread and capillary, even in neighbouring areas: 32.2% of museums are located in small municipalities with less than 5,000 inhabitants (some of which count up to 4 – 5 structures), 33% in cities of medium demographic size (between 5,000 and 30,000 inhabitants). Almost two-thirds of museums and similar exhibition structures are public institutions (67.9%); 2,000 institutions (69% of the publicly owned subset) depend on local authorities, while 444 are state institutions (15.3%) and 4.7% are regional institutions. Among the private institutes open or partially open in 2020, 33.3% belong to associations, 21.3% to foundations, 19.2% to ecclesiastical and religious bodies (262 structures), while in 8.4% some cases are private citizens [2].

III. METHODS

Having ascertained the absence of an in-depth and systemic study of the metaverse-culture relationship, ArcheoVerso intends to carry out the analysis of the potential and the formulation of a methodological and technological ecosystem which, taking into account the possibilities offered by the digital universes, knows how to combine them to respond to the needs of cultural institutions and at the same time help to design new formulas for valorisation and involvement. To this end, three phases of the investigation are envisaged, which are set out below:

Technology infrastructure

The project involves different technologies related to computer science, networking and user experience. Some principles should be focused for better understanding the reasons of specific selections:

- The environment is multi-user, with real-time interactions and voice streaming;
- Any type of content could be shown, reproduced

- or shared;
- It should be possible to combine Virtual and Real worlds elements (Extended Reality - XR);
- It could be possible to integrate the system with external services;
- Everything should be user-friendly to allow different user segments to easily interact with the environment.
- Based on these assumptions, the proposal exploits the following technologies:
- Virtual/Augmented/Mixed reality (VR, AR, MR) head mounted displays to allow immersion and presence effect in virtual or augmented environments;
- Touchless controllers, usually handsfree-driven, that do not require any documentation for usage knowledge;
- Machine/Deep learning algorithms for improving the quality of the system in multiple contexts (e.g., user's hands tracking, gesture recognition, and virtual locomotion redirection or reorientation);
- High-speed network for low latency interactions with the environment and among users;
- Interconnectivity with external services (e.g., API, libraries, and payment gateways);
- Scalability and modularization, for offering possible future improvements.

Thus, the complexity of the platform is mainly related to its wideness in terms of different programming skills required. In fact, the development of virtual environments should be combined with networking principles, user-centred designs, multi-user contexts and specific language knowledge for each third party service involved.

The system should create an avatar of the user based on its features (e.g., body details or favourite interests); then, the ArcheoVerso platform is accessible, allowing the user to choose the activity to perform. The design principle is based on well-known multiplayer games structures, where a lobby room is firstly accessed and from that location the others can be explored. The lobby is the returning place of the user after and before each activity. The profile information of the user and the data that can be retrieved from his/her interaction inside the application could be relevant data for aimed news, offers or announcements [3].

The interaction system is based on hand gestures without any joystick or joypad. This technique is considered more effective than using a controller thanks to its faster learning curve for novice users (cf. <https://www.mdpi.com/2571-9408/6/5/217>). The contents should be specifically designed for XR applications, always taking into account the proposed interaction

system and a multi-user environment. The latter should also deal with other problems such as concurrency management, spatial audio design and role-based contents access issues.

Finally, the integration with external services could provide a relevant improvement in terms of "ecosystem" concept: the system without this feature is standalone life living, like a multiplayer game expanded with different contents. On the other hand, an external service could allow the user to improve the immersion experience and the feeling of a real ecosystem interconnected with the world (e.g., the connection with a personal cryptocurrency wallet allows the user to buy services or products directly into ArcheoVerso).

Community activation

The methodological approach to the interaction between territorial communities and the metaverse was defined following an analysis that aimed to trace the current state of progress at the national and international level on the interest that the virtual trinomial tool - citizen - territory arouses on the part of stakeholders such as companies and Public Administration, who has been experimenting with metaverse systems in the social sphere for some time. From the analyses carried out, three main areas of adherence of the metaverse to social issues emerge:

- Vocational training and school education
- The health and socio-welfare sphere
- The leisure time sphere, with particular reference to the gamification sector

Several cases of metaverse development aimed at providing services to citizens by public administrations were also mapped; some still need to find positive feedback and actual operational products.

With a view to market positioning towards civil society, it was thus decided to integrate ArcheoVerso within two main market areas: the provision of services and that related to activities and leisure.

As a matter of fact, from an initial survey, compared to the case studies analysed, the two sectors mentioned above are identified as preferable precisely because, to date, there is a void of territorial expertise and experience (and at times interest) in these areas, if not for marginal contingencies that move away from the centrality of Cultural Heritage as a primary theme. The chosen methodology has always been a top-down tool administration in all the European cases analysed. Apart from ordinary comparative analyses and contingent evaluations before the product's release for marketing purposes, the product's construction and development towards the beneficiary stakeholders have never involved them actively [4].

ArcheoVerso intends to reverse this arrangement with co-creation processes in Community Activation, which will complement the part of pre-constituted development linked to the mere asset of Cultural Heritage. The social innovation process to be created will thus be developed in five sub-phases:

- 1) Census and mapping of businesses, communities and the third sector (ex-ante)
- 2) Community audit and community representation (ongoing)
- 3) Focus groups (ongoing)
- 4) Co-creation activities (ongoing)
- 5) Impact assessment ex-ante and ex-post (ongoing)

This process will last one year and conclude with the dedicated area's first release, which will undergo further experimental benchmarking. The testing area to be released will be based on the relationship for the time being of only three subjects: No-profit organisations, corporations and public administrations.

At the end of the fifth phase, the value chain will be created for each stakeholder, including the outcomes and the outputs generated by and for each.

Thanks to the social research strand developed by the DigiLab Research Centre, this will be developed through an analytical-experimental methodology that will lead to three main outputs:

- 1) Social impact assessment, according to a hybrid methodology between several models developed by the Research Centre DigiLab.
- 2) The co-creation project developed by communities, facilitators and researchers.
- 3) The final contingent evaluation of the experience that will provide information on the impact of social research on digital cultural heritage.

The area of community activation will have its theoretical (and consequently applicative) references in social science. Only after analysing the answers of the audit phase will it be possible to rework the draft social impact assessment developed in its chosen indicators and define the correct impact model. Therefore, the specific project-related indicators will be elaborated at the end of the audit phase, validating and integrating, or not, the general hands. In particular, the onus will be placed on the stakeholders themselves, albeit mediated by facilitated activities, to articulate the social need on which the change model and related framework will be developed.

IV. PERSPECTIVES

ArcheoVerso is currently still in the execution phase; anyway, the scalability feature is instead in the international scope of ArcheoVerso. The multilevel

platform will accommodate learning platforms of universities, schools and research institutions from several participating countries. The open-source vocation will also allow the platform to be augmented with contributions from all institutions interested in using ArcheoVerso, according to models with international standards.

As a methodological and technological ecosystem, ArcheoVerso will involve different areas in the field of Cultural Heritage innovation, such as:

Role of public institutions: ArcheoVerso encourages an awareness of the growing role of cultural institutions as creators and publishers of digital content - be it videos, clips, video/audio podcasts, virtual exhibitions, apps, gamification elements, and so on - capable of demanding and guaranteeing quality in digitization, sore point of the metaverses, and at the same time offering new possibilities for using cultural contents, not excluding progressive payment methods (based on specific services) or even organizing new fruition and subscription formulas - in the case of exhibitions, live performances, virtual tours, digital classes, operational meetings, and so on.

Cultural heritage preservation and conservation: ArcheoVerso will allow cultural institutions or individuals owning Cultural Heritage to exhibit all those artwork or artefacts that need specific conservation conditions that are fundamental for their preservation through time. In this way, the much-discussed topic of archives, which are undervalued by the current national and international cultural system, becomes an opportunity for the general public to enjoy them without compromising the preservation of the Heritage. Furthermore, this will also allow access to catalogues of goods in private places (for example, historical residences) that are inaccessible today.

Cultural Heritage enhancement: ArcheoVerso aims to formulate a different concept of preservation and transmission of cultural memory broadly, redesigning the relationships between objects and interactions with the subject. Through the development of new digital fruition methodologies, with the use of open source software and with the study of the user experience within the digital universes, it will be possible to rethink new ways of using and creating training content, capable not only of providing, in a digital key, elements of traditional teaching, but rethinking them in an experiential and laboratory key, according to the logic of mixed reality, straddling the real and the virtual;

Audience development: ArcheoVerso will bring new audiences who are more familiar with the environments,

uses and processes deriving from immersive, interactive, and multi-user digital ecosystems, with a strong interacting element, as occurs with the so-called "Generation Z". This will be possible thanks to the reformulation of new ways of using and creating training content, capable not only of providing, in a digital key, elements of traditional teaching but rethinking them in an experiential and laboratory key, according to the logic of mixed reality, straddling the real and the virtual. In this way, it will be possible to ensure the acquisition of new audiences, according to standard audience development methodologies, from the engagement to the outreach phase. In this last phase, the Cultural Heritage steps out of its usual zone by intersecting with the everyday life of the public [5].

Accessibility: ArcheoVerso will also be guaranteed for people with mental/physical handicaps. Through everyday technological tools (PC and smartphones), archaeological or monumental sites that would be difficult to access will become accessible for everyone. ArcheoVerso also aims to establish direct contact with institutions, such as hospitals or shelters, to make the experience more immersive through specially formulated technological devices.

Economic model: in addition to the economic model linked to rewards that will be described in the text, ArcheoVerso aims an optimization of investments and structural funds linked to the digitization of cultural assets, such as to guarantee a wider use of cultural heritage - tangible and intangible - with innovative digital combinations and with a substantial impact on the community. This will enliven the discussion on the documentary replicability of objects of cultural interest, on usage licenses, on the ability of open licenses to generate new forms of content and economic impact.

Considering the social impact activities, ArcheoVerso utilising the centrality of the two Stakeholders mentioned above, the structure to be validated and for which the experimentation will begin will be a structure comprising a sub-set of guidelines.

In this direction and perspective, at the end of the first three-year period of experimentation, it is intended to support the creation of community cooperatives that systematise the most revenue-generating services tested during this initial analysis phase. This cluster will have three strands; for the first experimentation phase, one action will be implemented from among them.

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