

Digital archaeological projects and their influence on the perception of cultural identities in different regions

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Abstract. The digitalisation of archaeological heritage was transforming the methods of storing, visualising, and interpreting archaeological data, whilst also influencing the perception of cultural identities across various regional and institutional contexts. The aim of this study was to determine how the application of computational tools in the study of archaeological heritage alters conceptions of collective memory, historical belonging, and modes of interpreting the past in colonial and postcolonial societies. The research methodology was grounded in a theoretical-analytical approach and encompassed qualitative content analysis, comparison and systematisation, the logical-analytical method, and theoretical generalisation. Data analysis identified the principal forms of digital archaeological projects: three-dimensional documentation of archaeological sites and digital twins; three-dimensional reconstructions; digital archives; integrated research infrastructures; geoinformation projects; virtual museums and interactive exhibitions; and digital repatriation. It was established that digital repositories, three-dimensional models, and integrated research infrastructures broaden access to archaeological materials beyond their physical storage locations. It was determined that three-dimensional reconstructions construct a spatial image of the past but necessitate a demarcation between verified and hypothetical elements. Regional analysis enabled the identification of infrastructural, documentary, landscape-analytical, reconstructive-managerial, and archival-epigraphic models of digital archaeological heritage. Consequently, it was revealed that the decolonisation of the digital archaeological narrative depends on the transparency of object provenance, the participation of source communities in the description of materials, and the possibility of updating metadata. The findings of this research can be utilised by researchers, museum specialists, digital archive developers, and educational institutions when creating digital projects related to archaeological heritage and cultural identity.

Keywords: three-dimensional documentation; heritage; virtual museums; geoinformation projects; postcolonial rethinking; metadata

INTRODUCTION

The digital transformation of archaeology was changing the methods of recording, storing, analysing, and publicly presenting archaeological heritage. Three-dimensional (3D) documentation, digital twins, online repositories, geoinformation systems, algorithmic data processing, and virtual forms of exhibition were expanding the formats for working with archaeological materials. In the digital environment, an archaeological object was represented not only as a material artefact or a museum exhibit but also as a dataset, a visual model, an element of a digital collection, or part of an online narrative. In this regard, it was necessary to determine how computational tools participate in shaping conceptions of cultural memory, historical belonging,

object provenance, and the right of different groups to interpret heritage. Colonial and postcolonial contexts require particular consideration, where digital description, open access, and the re-cataloguing of archaeological collections may reproduce previous classification schemes or create conditions for the inclusion of local knowledge, alternative descriptions, and the participation of source communities.

In the work of C. Bonacchi (2021), digital heritage was presented as a changing form of cultural memory linked to big data, platform communication, and user participation in engaging with the past. The authors' findings demonstrated that digitalisation was not confined to expanding access to objects but transforms the modes of production,

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dissemination, and discussion of cultural meaning. This approach allows for a shift from a general understanding of digitalisation as a technical process to the consideration of digital heritage as an environment in which the relationships between data, memory, cultural meanings, and participants in interpretation were altered. The development of this issue was traced in the study by J. Huggett (2021), which documents the increasing role of algorithmic procedures in archaeological practice. Algorithms, software environments, and digital models participate in the selection, processing, and presentation of data; therefore, the results of digital analysis depend not only on the source materials but also on the logic of the tools employed. In a later work, J. Huggett (2024) links the digital turn in archaeology to changes in methodological approaches, professional norms, and modes of interpreting archaeological data. Taken together, these findings demonstrated that digital archaeology affects not only research tools but also the conditions under which archaeological knowledge was formed. If the works of C. Bonacchi and J. Huggett focus on changes in digital heritage and archaeological practice overall, T. Zoldoske (2024) specifies this issue through the role of metadata. In his work, metadata were defined as a prerequisite for the discovery, linking, and reuse of archaeological materials. Standardised descriptions, vocabularies, and information links transform a digital archive not merely into a repository but into a research network through which objects, collections, territories, and historical contexts can be juxtaposed. For the analysis of cultural identity, this holds methodological significance, as it was metadata that record an object's provenance, the conditions of its description, and its connection to a specific classification system.

The question of digital procedures acquired an additional dimension in the work of M. Tenzer *et al.* (2024), where the application of artificial intelligence in archaeology was associated with the processing of large volumes of information, pattern recognition, automated classification, and the ethical issues of using algorithms. The authors' findings point to the necessity of considering algorithmic transparency, data bias, and researcher accountability when shaping interpretive outcomes. This correlates with the problem of the digital representation of cultural heritage, since algorithmic classification can influence which features of an object become visible and which remain outside the description. A similar logic manifests in the work of D. Belteki *et al.* (2025), where the datafication of cultural collections was presented as a process altering documentation, cataloguing, and data exchange within cultural heritage institutions. Digital infrastructures provide new forms of disseminating museum and archival descriptions, yet they retain a connection with previous classification systems, terminology, and the administrative history of collections. In a postcolonial context, this means that placing a collection online does not in itself resolve questions of object provenance, the right to description, and the participation of source communities in refining metadata.

The transition from data and metadata analysis to the institutional and user environment was presented in the work of J. Pereda *et al.* (2025). Online cultural heritage was described as a socio-technical system in which digital infrastructures, users, institutions, data, and mechanisms of co-production of knowledge interact. Such a conclusion enables the consideration of digital archaeological projects not merely as platforms for storage or material demonstration but as environments where relationships were formed between researchers, museums, educational audiences, local communities, and users of digital heritage. At the level of archaeological data production, this issue was elaborated in the work of S. Perry *et al.* (2025). The authors' findings were linked to a critique of uniform models of describing the past and to the necessity of reconsidering archaenormativity through storytelling and alternative forms of data presentation. In this approach, archaeological information was understood not solely as the result of recording facts but also as a product of choices regarding language, narrative structure, material accessibility, and the mode of interpretation. This allows digital archaeology to be linked to the question of which groups gain the opportunity to participate in the creation of descriptions of the past. This line of enquiry continued in the work of F. Dolcetti (2025), where human-centred and participatory approaches were presented as conditions for creating a digital archaeological experience. The findings of this work showed that digital archaeological products can perform not only a demonstrative function but also be used for the collaborative description, discussion, and rethinking of cultural material.

Thus, the studies enumerated above delineate several trajectories of analysis within digital archaeology: the transformation of heritage in the context of big data, algorithmic agency, the development of digital infrastructures, the role of metadata, the application of artificial intelligence, the datafication of museum collections, the socio-technical organisation of online heritage, alternative forms of archaeological narrative, and user participation in the creation of digital experience. Notably, these trajectories were predominantly presented as discrete lines of inquiry. The question of how they collectively reshape the perception of cultural memory, historical belonging, and the postcolonial rethinking of archaeological heritage remains insufficiently synthesised. The aim of the study was to ascertain how the use of digital methods in the study of archaeological heritage influences the conceptualisation of cultural memory, historical continuity, and the right to interpret the past in colonial and postcolonial societies. The research objectives were: to systematise the principal digital methods for studying archaeological heritage and determine their role in the preservation, visualisation, and interpretation of cultural materials; and to reveal how digital archives, three-dimensional reconstructions, metadata, and the participation of source communities affect the conceptualisation of cultural memory and the postcolonial rethinking of the past.

MATERIALS AND METHODS

The study was carried out as a theoretical-analytical inquiry. It comprised qualitative content analysis, as well as the comparison and systematisation of scholarly publications, digital platforms, museum catalogues, professional reports, and project materials dedicated to digital archaeology and its influence on the perception of cultural identities. The source base of the study consisted of materials examining 3D documentation of archaeological sites, digital twins, 3D reconstructions, archaeological repositories, geoinformation mapping, virtual museums, digital collections, online catalogues, and the digital repatriation of cultural heritage.

Qualitative content analysis was employed to identify the principal thematic and functional trajectories of digital archaeology. The purpose of applying this method was to determine which forms of the digitisation of archaeological heritage were represented in scholarly publications, digital platforms, museum catalogues, professional reports, and project materials. On the basis of this method, materials devoted to the 3D documentation of archaeological sites, digital twins, 3D reconstructions, archaeological repositories, geoinformation mapping, virtual museums, digital collections, online catalogues, and the digital repatriation of cultural heritage were examined. Materials from CyArk (n.d.a) and CyArk (n.d.b) were used to examine the 3D documentation of monuments, the digital recording of the condition of heritage objects, and the creation of digital models of objects accessible for remote study. The issues of digital twins, virtual reconstruction, and the management of archaeological sites were examined on the basis of the works of M. Hostettler *et al.* (2024) and W. Liu *et al.* (2024). The problematic of 3D reconstructions and the virtual presentation of archaeological heritage was explored through the studies of E. Champion & H. Rahman (2020), I. Liritzis & P. Volonakis (2021) and R. Spallone *et al.* (2022). Materials from the Archaeology Data Service (n.d.), The Digital Archaeological Record (n.d.), and re3data.org (n.d.) were used for the analysis of digital archaeological archives, repositories, and the reuse of research data. The integration of archaeological databases, the handling of metadata, and cross-archive material connectivity were examined on the basis of the S. Basset (2020) and ARIADNEplus (2023) infrastructures. Museum online catalogues and the digital representation of collections were analysed using materials from the British Museum (n.d.) and the Pixelated Realities (2025). Geoinformation mapping and spatial analysis of archaeological landscapes were examined on the basis of the study by M.A. Canuto *et al.* (2018). Emergency digital documentation of heritage objects under conditions of risk was studied through the example of ICOMOS (2019) materials. The systematisation of epigraphic heritage and the creation of a digital repository of inscriptions were examined using materials from Archaeological Survey of India (n.d.) and the Press Information Bureau, Government of India (2023). Issues of digital repatriation, the participation of source communities, the postcolonial rethinking of heritage, and

control over digital copies were analysed on the basis of the works of C. Poske (2024) and A. Mohammed (2025).

The comparative method was applied to juxtapose digital archaeological projects in different regional and institutional contexts. The purpose of the method was to identify differences between projects in terms of their technological format, research function, and significance for the perception of cultural identity. Examples from the United Kingdom, Ukraine and the European Union, Syria, Guatemala and Mexico, China, and India were selected for comparison. The selection of these countries and regions was conditioned by the fact that they reflect different institutional and functional models of digital archaeology: the infrastructural model of data access, the digital recording of heritage under conditions of risk, landscape-analytical mapping, the reconstructive-managerial use of digital twins, and the archival-epigraphic systematisation of written monuments. The comparison was conducted according to the following criteria: country or region of project implementation, project or platform, digital format, data corroborated by sources, and the project's significance for the perception of identity.

The method of systematisation was used to organise the source materials into the main analytical blocks of the study. Its purpose was to group information according to the trajectories of digital archaeology and to determine their role in the representation of archaeological heritage. On the basis of this method, the materials were distributed across the following blocks: types of digital archaeological projects, forms of expanding access to heritage, the participation of local communities in the interpretation of digital materials, the influence of 3D reconstructions on the perception of the historical past, the role of digital archives in the analysis of colonial collections, the educational use of digital projects, the conditions for the decolonisation of the historical narrative, and the risks of digital archaeology for cultural identity. Systematisation was applied to scholarly publications, digital repositories, museum online catalogues, project materials, and institutional platforms dealing with the recording and preservation of data, visualisation and reconstruction, archival storage, spatial analysis, museum and educational interpretation, as well as the digital return of cultural materials to countries and communities of origin.

The logical-analytical method was applied to establish the connection between digital technologies, modes of representing archaeological data, and changes in the perception of cultural identity. The purpose of the method was to explain how digital repositories alter the regime of access to archaeological materials, how 3D reconstructions shape a spatial image of the past, how geoinformation projects reveal territorial connections and cultural contacts, and how digital repatriation correlates with issues of object provenance, the right to interpretation, and cultural sovereignty. This method was applied to materials that reveal the technological basis of digital archaeological projects, the forms of representing archaeological data, the regime of access

to materials, and the connection between digitisation and questions of cultural memory, local identity, and the post-colonial rethinking of heritage.

The method of theoretical generalisation was employed to develop a final model of digital archaeology's influence on cultural identity. On the basis of this method, four levels of digital archaeology's influence were distinguished: access, visualisation, interpretation, and identification. The material for generalisation comprised the results of the examination of digital repositories, 3D models, virtual exhibitions, geoinformation projects, digital archives, regional case studies, and digital repatriation projects.

RESULTS AND DISCUSSION

Digital archaeological projects differ not only in the technologies employed but also in their research function. Digitisation was represented by seven principal forms: 3D documentation and digital twins, 3D reconstruction of lost architectural elements, the creation of digital archaeological archives of field and museum materials, integrated research infrastructures, geoinformation projects, virtual museums and interactive exhibitions, and digital repatriation projects. Digital archaeological projects were considered as tools that transform the modes of presenting archaeological data and influence the perception of cultural identity (Table 1).

Table 1. Principal types of contemporary digital archaeological projects

Group of digital archaeological projects	Technological basis	Primary function	Significance for the perception of cultural identity
3D Documentation and digital twins	Laser scanning, photogrammetry, digital modelling, digital twins	Precise recording of a monument's condition, monitoring, preservation, and object management	Enable the perception of a monument as a spatially integral object, rather than merely a ruin or museum fragment
3D reconstructions	Reconstructive modelling, architectural analogies, virtual restoration	Recreation of lost or partially destroyed architectural elements and historical context	Form a visually complete image of the past, yet require a clear distinction between proven and hypothetical elements
Digital archaeological archives	Digital repositories, databases, metadata, digitised reports and images	Long-term storage, description, and reuse of archaeological materials	Broaden access to data and create conditions for the re-analysis of archaeological collections
Integrated research infrastructures	Common description standards, cross-archive integration, semantic data linkage	Unification of archaeological data from diverse collections, countries, and research systems	Allow for the comparison of materials from different regions and the identification of cross-cultural connections
Geoinformation projects	Geographic Information Systems, digital cartography, spatio-temporal analysis	Analysis of the distribution of monuments, historical landscapes, routes, and zones of cultural exchange	Portray identity as a result of territorial connections, migrations, and interactions
Virtual museums and interactive exhibitions	Virtual and augmented reality, 3D visualisation, interactive museum environments	Public presentation of archaeological objects and educational interpretation of heritage	Render archaeological heritage accessible to a broad audience and influence public representation of the past
Digital repatriation projects	Digital copies, online access, virtual collections, collaborative digital archives	Restoration of access for source communities to cultural objects and data	Linked to the reconsideration of ownership, cultural sovereignty, and postcolonial justice

Source: compiled by the author based on data from Archaeology Data Service (n.d.), CyArk (n.d.a, n.d.b), The Digital Archaeological Record (n.d.), re3data.org (n.d.), E. Champion & H. Rahaman (2020), S. Basset (2020), R. Spallone *et al.* (2022), ARIADNEplus (2023), M. Hostettler *et al.* (2024), W. Liu *et al.* (2024), A. Mohammed (2025)

The typology presented has enabled the identification of several levels of digital transformation of archaeological heritage. The first level was associated with the recording and preservation of data. It encompasses 3D documentation, digital twins, archaeological archives, and integrated research infrastructures. These projects ensure more accurate registration of objects, long-term preservation of materials, and the possibility of their subsequent scientific re-analysis. The second level was associated with the spatial and visual interpretation of archaeological data. It was constituted by 3D reconstructions, geoinformation projects, virtual museums, and interactive exhibitions. In this instance, digitisation was not limited to the preservation of information but shapes a particular mode of representing the past. An archaeological object was embedded within

a reconstructed environment, a cartographic context, or a museum narrative, which influences the perception of its historical and cultural significance. The third level was associated with the socio-cultural reconceptualisation of heritage. It was most distinctly manifested in digital repatriation projects, where digital copies, archives, and models were employed to restore access for source communities to objects of cultural memory. Within a postcolonial context, such projects acquire particular significance, as they engage with issues of the right to interpretation, cultural sovereignty, and the revision of previous museum classifications. Thus, the typology presented demonstrates that digital archaeological projects perform not only a technical but also an epistemological function. They alter the conditions of the production, storage, and dissemination of

knowledge about archaeological heritage. For the study of cultural identities, this signifies that digitisation becomes a factor not only in the preservation of the past but also in its reinterpretation within contemporary historical, educational, and postcolonial contexts.

In the current study, digital archaeological projects were systematised according to their technological basis and research function: 3D documentation, digital twins, 3D reconstructions, digital archives, geoinformation projects, virtual museums, and digital repatriation. This corresponds with the findings of G. Bitelli *et al.* (2025), where high-precision 3D surveying and data post-processing were applied to museum archaeological objects. In contrast to the aforementioned work, where the emphasis was placed on the technical recording and digital presentation of museum materials, the current study considers three-dimensional documentation as one element of a broader typology of digital archaeology. The results of the study also align with the work of S. Barzaghi *et al.* (2024), where the management of 3D cultural heritage data was examined through FAIR principles, the Aldrovandi digital twin, object provenance, and metadata provenance. In contrast to that approach, which was oriented towards the organisation, preservation, and reuse of 3D data, the current study incorporates digital twins and 3D repositories into a system influencing access, visualisation, and interpretation of archaeological heritage. The delineation of virtual museums and interactive exhibitions in the study corresponds with the work of O. Jamil & A. Brennan (2025), where Gaussian Splatting and generative artificial intelligence 3D models were linked to the creation of immersive virtual environments for presenting architectural heritage. In contrast to that work, where attention was focused on visual aesthetics and the technical capabilities of immersive representation, the current study examines virtual and interactive formats through their connection to the educational perception of culture, the public representation of the past, and digital access to archaeological materials.

Digitisation expands access to archaeological heritage through remote engagement with materials, the reuse of research data, interaction with digital spatial models, and the provision of digital copies to countries and communities of origin (Archaeology Data Service, n.d.). Digital repositories reduce dependence on the physical location of archaeological materials: field reports, images, artefact descriptions, drawings, and datasets can be utilised by researchers and educational institutions irrespective of the location of the museum, archive, or excavation site (The Digital Archaeological Record, n.d.). The Archaeology Data Service (n.d.) was oriented towards the preservation and dissemination of archaeological data, while tDAR (The Digital Archaeological Record, n.d.) accumulates documents, images, datasets, and other materials from archaeological investigations. A distinct direction was constituted by 3D repositories and digital models, which provide access to objects that were difficult to study directly. This pertains to monuments in

remote locations, objects with restricted museum display regimes, destroyed fragments, and artefacts requiring delicate handling. Such a format allows engagement not only with an object's description but also with its digital spatial representation, including its form, scale, and structure (Champion & Rahaman, 2020).

Integrated infrastructures expand access not to a single object, but to interconnected bodies of archaeological data. ARIADNE (Basset, 2020) aggregates archaeological data and metadata according to thematic, spatial, and temporal criteria, thereby enabling the comparison of materials from different collections, regions, and research projects. For the analysis of cultural identity, this mode of access makes it possible to examine heritage through connections between territories, migrations, exchanges, and cultural contacts, rather than solely within the bounds of a single collection or national archive. Separately, digital access was examined in relation to societies whose heritage has been displaced, removed, or described by external research traditions. Digital repatriation provides countries and communities of origin with digital copies, descriptions, and archival materials related to their cultural heritage. Crucially, such access does not substitute for the physical return of objects, but creates an additional channel for engaging with heritage, memory, and historical descriptions (Poske, 2024; Mohammed, 2025). Thus, the broadening of access renders archaeological materials available beyond their place of storage, enables the re-analysis of data within new scholarly contexts, and involves a wider circle of participants in the interpretation of heritage. In the context of cultural identity, this means that the past ceases to be represented solely through museological or academic selection and becomes accessible to local and postcolonial interpretations.

Digital projects alter not only access to archaeological materials, but also the distribution of interpretative authority. If a digital archive was created solely by a museum or a research institution, the local community remains an external user of a ready-made description. A different outcome arises when representatives of communities of origin were involved in refining names, describing the cultural functions of objects, adding oral histories, and determining the conditions of access to materials. Scholarship on digital repatriation emphasises that the return of digital copies and descriptions concerns not only access, but also questions of ownership, cultural sovereignty, and the right to interpret heritage (Poske, 2024; Mohammed, 2025). The participation of local communities may take a consultative, collaborative, or community-driven form. In the consultative model, the community comments on an already prepared project; in the collaborative model, museums, researchers, and community representatives shape the digital description together; in the community-driven model, the initiative originates from the bearers of cultural memory. For the analysis of cultural identity, the collaborative and community-driven models allow for the integration of local knowledge, language,

memory, and the cultural meanings of objects alongside academic classification (Poske, 2024).

Analysis of the sources has demonstrated that 3D reconstructions perform not only a visualisation function, but also an interpretative one. They transform fragmentary archaeological data into a model of the presumed historical appearance of an object, an architectural environment, or a museological context (Spallone *et al.*, 2022; Liu *et al.*, 2024). The primary effect of 3D reconstructions was associated with a shift in the scale of perception. The archaeological object was presented not as an isolated fragment, but as part of a spatial structure: a building, a complex, a settlement, a ritual space, or a landscape. This makes it possible to analyse not only the form of the object, but also its potential connections with the surrounding environment, function, and cultural context (Spallone *et al.*, 2022). At the same time, a 3D reconstruction was not a direct reproduction of the past. It depends on the state of preservation of the object, the composition of the sources, the analogies selected, and the researchers' assumptions. Therefore, the reconstructed model captures a particular scholarly version of the object, rather than its definitive historical appearance (Hostettler *et al.*, 2024). For the perception of cultural identity, this means that a 3D reconstruction can establish a visual image of a past society: its architecture, technologies, spatial organisation, and symbolic practices. However, the extent of this influence was determined by the transparency of the reconstruction: it was essential to distinguish between elements corroborated by archaeological data and those restored hypothetically. Consequently, 3D reconstructions should be regarded as a tool of scholarly visualisation with a pronounced interpretative component. Their efficacy depends not only on the technical quality of the model, but also on the methodical documentation of sources, assumptions, and the level of reliability of the restored elements.

Digital archives allow archaeological collections to be considered not merely as an assemblage of objects, but as data with a history of provenance, movement, description, and institutional custody. For collections assembled during the colonial period, this was significant, since museum classifications often reflected an external research optic and did not incorporate local ways of understanding heritage. A digital archive records not only the image or description of an object, but also the metadata associated

with it: place of discovery, date of acquisition, institutional affiliation, research history, previous names, and classification variants. This enables the tracing of artefacts' provenance, the identification of gaps in documentation, and the comparison of museum descriptions with the territorial and cultural context of the object (Archaeology Data Service, n.d.; The Digital Archaeological Record, n.d.). In a postcolonial context, digital archives create the conditions for the re-examination of collections. One and the same object may be represented as a museum exhibit, an archaeological source, and an element of the memory of a community of origin. Therefore, the significance of a digital archive was determined not only by the volume of digitised materials, but also by whether it permits the refinement of metadata, the inclusion of alternative descriptions, and the linking of the object to local knowledge (Poske, 2024). Digital repatriation projects advance this approach by providing countries and communities of origin with access to digital copies, descriptions, and archival materials. However, the digital form does not eliminate the question of the physical return of objects or of control over cultural data. Research emphasises that digital repatriation should be considered not as a technical substitute for restitution, but as one of the mechanisms of access, collaboration, and the revision of colonial regimes of heritage description (Poske, 2024; Mohammed, 2025). Consequently, digital archives participate in the rethinking of colonial collections when they do not confine themselves to the publication of images and brief descriptions. Their analytical role manifests itself in the disclosure of objects' provenance, the revision of metadata, the accommodation of local interpretations, and the creation of conditions for collaborative work among museums, researchers, and communities of origin.

Regional analysis has shown that digital archaeological projects were shaped in accordance with a country's historical experience, the state of preservation of monuments, the structure of museum collections, and the objectives of cultural policy. In some instances, digitisation was aimed at organising access to archaeological data and museum holdings; in others, at recording objects under threat of destruction, reconstructing archaeological complexes, or systematising epigraphic heritage. Therefore, the influence of digital projects on the perception of cultural identity does not manifest itself universally, but through specific national and institutional contexts (Table 2).

Table 2. Regional models of digital archaeological heritage

Country/ region	Project / platform	Digital format	Sources corroborating	This significance for identity perception
Great Britain	Archaeology Data Service (ADS); British Museum Collection Online	Digital archaeological repository; online database of museum collections	ADS ensures long-term professional curation of archaeological data and its accessibility for reuse; the British Museum Collection Online provides access to nearly 5 million objects in over 2 million records, and also documents research into the history and provenance of museum items	Digitisation was linked to institutional access to archaeological data and museum collections. Within the context of colonial heritage, the availability of online descriptions and provenance data creates a foundation for analysing the history of object acquisition and their museological interpretation

Table 2. Continued

Country/ region	Project / platform	Digital format	Sources corroborating	This significance for identity perception
Ukraine / EU	Europeana; 3D-4CH; Ukrainian 3D models of cultural heritage	Pan-European digital platform; 3D models of heritage objects	The first Ukrainian 3D models were published on Europeana via the 3D-4CH project; the European Commission links this to the preservation of heritage under threat	Digitisation inscribes national heritage within a pan-European digital space. 3D models allow objects to be presented not merely as local monuments, but as part of a transnational system of cultural heritage preservation
Syria	Project Anqa, Damascus	3D scanning, photogrammetry, panoramic photography, web platform	Project Anqa created 3D records of endangered heritage objects in Damascus, archived the data, and made the images and materials accessible via a web platform; the project was focused on the emergency documentation of heritage in the Middle East and North Africa	Digitisation was associated with the documentation of objects under risk of destruction. Here, the perception of heritage was shaped through the preservation of a digital image of the urban and architectural environment, available for further analysis and public presentation
Guatemala / Mexico	PACUNAM LiDAR Initiative; research on the Maya lowlands	LiDAR-mapping; spatial analysis of the archaeological landscape	LiDAR survey of the Maya lowlands revealed ancient settlements and structures hidden beneath the forest canopy; research by M.A. Canuto <i>et al.</i> demonstrated the significance of airborne laser scanning for studying the complexity of the ancient Maya landscape	Digital archaeology changes the scale of perception of the pre-Columbian past: heritage was viewed not as an assemblage of individual monuments, but as a spatially organised system of settlements, infrastructure, and landscape interconnections
China	Digital twin of the Pishan archaeological site, Zhejiang Province	Digital twin; virtual reconstruction of an archaeological site	Application of a digital twin to the Pishan archaeological site and its use for the virtual reconstruction of an object preserved primarily at the foundation level	Digitisation was employed for the reconstruction and management of an archaeological site. This makes it possible to a local monument as part of a historical environment suitable for research, museum display, and educational use
India	Bharat Shared Repository of Inscriptions, BharatSHRI	Digital repository of inscriptions; digital epigraphic museum	BharatSHRI was posited as a national repository and virtual museum of ancient Indian inscriptions; the initial phase envisages the digitisation of 100,000 inscriptions	Digitisation was linked to the systematisation of epigraphic heritage. Access to inscriptions, transcriptions, and metadata makes it possible to connect archaeological data with language, territories, dynasties, and historical memory

Source: compiled by the author based on data from Archaeology Data Service (n.d.), Archaeological Survey of India (n.d.), British Museum (n.d.), M.A. Canuto *et al.* (2018), ICOMOS (2019), Press Information Bureau, Government of India (2023), W. Liu *et al.* (2024), Pixelated Realities (2025)

The data presented in the table reflect the differences in regional models of archaeological heritage digitisation according to the predominant objectives and institutional conditions of project implementation. In Great Britain and EU countries, digital initiatives were primarily associated with the establishment of a sustainable infrastructure for accessing archaeological and museum data. In the British case, this was manifested through the development of professional repositories and open museum catalogues, which enable the study of collection provenance, the history of their acquisition, and methods of museological description. In the European and Ukrainian example, the emphasis was shifted towards the 3D documentation of at-risk objects and their integration into the pan-European digital space. The Syrian example demonstrates a documentation model of digital archaeology. In this instance, digital technologies were applied to record architectural heritage susceptible to damage or loss. In Guatemala and Mexico, conversely, digitisation was linked to expanding the scale of archaeological

analysis: LiDAR mapping allows pre-Columbian heritage to be considered not as an assemblage of individual monuments, but as a spatially organised system of settlements, infrastructure, and landscape interconnections. The Chinese and Indian examples reflect different forms of institutional utilisation of digital data. In China, a digital twin was employed for the reconstruction and management of a specific archaeological site. In India, the digital repository of inscriptions was oriented towards the systematisation of epigraphic heritage and the creation of a unified database of written testimonies. In both cases, digital projects connect archaeological materials with research, educational, and museological practices. Consequently, regional differences were manifested in the dominant function of the digital project. Characteristic of Great Britain and the EU was an infrastructural model of access; of Syria – a documentation model for heritage preservation under risk; of Guatemala and Mexico – a landscape-analytical model; of China – a reconstructive-managerial model; and of India – an

archival-epigraphic model. This differentiation demonstrates that digital archaeological heritage influences the perception of identity through diverse mechanisms: access to collections, the documentation of vulnerable objects, the spatial re-conceptualisation of the past, the reconstruction of local monuments, and the systematisation of written sources.

The study identifies regional models of digital archaeological heritage: infrastructural, documentational, landscape-analytical, reconstructive-managerial, and archival-epigraphic. This aligns with the findings of G. Chen *et al.* (2025), where the reconstruction of cultural heritage in virtual space was linked to preserving the image of heritage lost or damaged after catastrophes, as well as to engaging with the cultural memory of displaced groups. In contrast to that work, which focuses on virtual reconstruction following destruction and on user perception of the digital environment, the study examines regional models through the lens of differing institutional objectives, technological formats, and modes of representing cultural identity. The use of photogrammetry, temporal data integration, semantic documentation, and virtual reconstruction enabled the recording of the stratigraphic context within an active urban infrastructure setting. Unlike that research, where the analysis centres on a single urban archaeological case and the methodological process of its digital recording, the study juxtaposes the reconstructive-managerial model with other regional formats of digital archaeology. The postcolonial dimension of the regional models aligns with the work of J. Eyssette (2025), where AI-assisted museums in Morocco and Egypt were linked to algorithmic heritage, museum representation, coloniality, and techno-cultural empowerment. This finding corresponds with the study, wherein digital archaeological heritage was regarded not only as technological infrastructure but also as a medium for re-examining museum descriptions, access to cultural data, and the

participation of diverse groups in interpreting the past. In contrast to that work, which was oriented towards North African museums and the application of artificial intelligence (AI) in the museum sphere, the study incorporates the postcolonial aspect into a comparative framework of regional models of digital archaeology.

Digital archaeological projects transform the educational perception of culture by facilitating a shift from textual description to the visual and interactive study of heritage. 3D reconstructions, virtual museums, and digital collections allow an archaeological object to be examined through its form, scale, spatial positioning, and relationship with the historical setting (Liritzis & Volonakis, 2021). In educational environments, such projects afford the opportunity to study inaccessible, damaged, or fragmentarily preserved objects without direct contact. This broadens the approaches to working with archaeological material and enables its integration into teaching scenarios related to regional history, the origins of cultural forms, and intercultural connections. At the same time, the educational value of a digital project depends on its scholarly support. A 3D model or virtual exhibition must include information on sources, the degree of reconstruction, and hypothetical elements, for without such explanatory detail, the visual image may be perceived as the definitive version of the past (Liritzis & Volonakis, 2021).

The digitisation of archaeological data can contribute to the decolonisation of the historical narrative; however, this effect does not arise automatically. The mere fact of making a collection available online does not alter the interpretive framework if previous museum descriptions, colonial terminology, and a unidirectional logic of object classification persist. In this case, the digital archive reproduces the pre-existing knowledge model, merely in a new technological form (Mohammed, 2025). The analysis identified two opposing scenarios (Fig. 1).

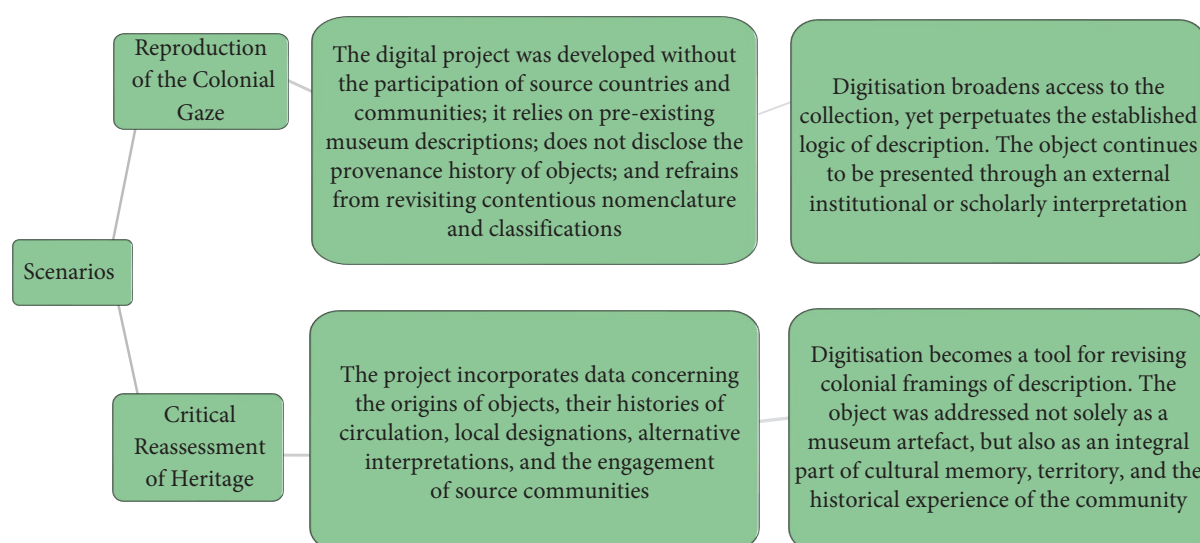


Figure 1. Scenarios of digitisation impact on the decolonisation of the archaeological narrative

Source: compiled by the author based on C. Poske (2024), A. Mohammed (2025)

Three conditions were fundamental to the decolonisation of the archaeological narrative: transparency of object provenance, participation of source communities in the description of materials, and the possibility of updating metadata. When these conditions were met, digitisation allows an object to be presented not merely as a museum exhibit, but as part of the cultural memory, territory, language, and historical experience of a specific community (Poske, 2024; Mohammed, 2025). Consequently, digital archaeological projects influence the decolonisation of the historical narrative not through technology per se, but through a change in the regime of data description and interpretation. Their analytical role manifests itself when the digital environment reveals not

only the object but also the history of its study, movement, classification, and incorporation into museum or scholarly knowledge systems.

The analysis of digital archaeological projects demonstrates that their influence on cultural identity was not confined to expanding access and visualising heritage. The digital environment simultaneously creates new risks associated with data selection, methods of reconstruction, control over digital copies, and the conditions for source community participation. Therefore, the assessment of digital archaeology must consider not only technological capacities but also the methodological, ethical, and post-colonial constraints that may affect the interpretation of cultural heritage (Table 3).

Table 3. Risks of digital archaeology for cultural identity

Risk	Manifestation in digital archaeology	Potential impact on identity perception
Technological simplification of culture	An archaeological object was presented through a 3D model, virtual tour, or brief digital description	A complex historical, social, and ritual context may be reduced to a visually convenient form
Illusion of complete authenticity	A 3D reconstruction may incorporate confirmed, hypothetical, and analogically restored elements	The user may perceive the reconstruction as the definitive historical appearance of the object
Unequal access to digital infrastructure	The creation of repositories, digital twins, and virtual exhibitions requires equipment, funding, and specialists	Source communities may become dependent on external institutions that control digitisation, storage, and data access
Shift in emphasis towards visual appeal	A virtual exhibition or 3D model was used primarily as a museum-communication or tourism product	The cultural significance of the object may be presented in a fragmentary manner, without disclosure of sources and the degree of hypotheticality
Control over digital copies and metadata	A digital copy may be stored, distributed, and described by external organisations	Issues of ownership, the right to describe, conditions of access, and cultural sovereignty persist

Source: compiled by the author based on R. Spallone et al. (2022), M. Hostettler et al. (2024), C. Poske (2024), A. Mohammed (2025)

The data presented demonstrate that the principal risks of digital archaeology were linked not to the use of technologies as such, but to the conditions of their deployment. The most significant were methodological non-transparency of reconstructions, unequal access to digital infrastructure, and control over digital copies and metadata. These factors can restrict the participation of source communities and entrench unidirectional modes of cultural heritage interpretation.

In the study, the risks of digital archaeology for cultural identity were linked to the technological simplification of culture, the perception of reconstruction as a definitive version of the past, unequal access to digital infrastructure, a shift in emphasis towards visual form, and control over digital copies and metadata. This aligns with the results of L. Stacchio et al. (2024), where neural rendering in the field of cultural heritage and creative industries was examined through the ethical principles of trust, transparency, authenticity, authorship, intellectual property, and the accountability of participants in the digital process. In contrast to that work, which focuses on the ethical regulation of neural network visualisation, the study considers the risks of digital representation through their impact on the perception of cultural identity and the interpretation of the archaeological past. The

issue of control over digital copies and data corresponds with the work of I. Spano & Y. Zhang (2025), where the digitisation of intangible cultural heritage was linked to Indigenous data sovereignty, the protection of traditional knowledge, languages, and cultural practices, as well as the risk of data colonialism in corporate digitisation projects. The authors indicate that existing legal mechanisms do not always ensure the protection of the intangible heritage of Indigenous communities in the digital environment. In contrast to that work, which was oriented towards intangible heritage and traditional knowledge, the study transposes the issue of data control into the sphere of digital archaeology, where digital copies, metadata, and conditions of access can likewise affect the participation of source communities in the description and interpretation of heritage.

Based on the results of the analysis, a generalised model was developed, reflecting how digital archaeological projects influence the perception of cultural identity. The model comprises four levels: access, visualisation, interpretation, and identification. These levels demonstrate a sequential transition from the technical placement of archaeological data in a digital environment to its incorporation into cultural memory, educational practices, and the postcolonial reinterpretation of heritage (Table 4).

Table 4. Model of the influence of digital archaeology on identity

Level of influence	Manifestation in digital archaeology	Criterion of influence	Outcome for the perception of cultural identity
Access	Online archives, digital repositories, open museum catalogues, 3D models	The possibility of accessing archaeological data outside its physical storage location	Heritage becomes accessible to a wider range of participants: researchers, educational institutions, local communities, and diasporas
Visualisation	3D reconstructions, digital twins, virtual museums, interactive exhibitions	The presentation of an object in a spatial and visual form	The archaeological object was perceived not only as a fragment or exhibit, but as part of a historical environment
Interpretation	Metadata, provenance information, alternative descriptions, local commentaries	The possibility of juxtaposing academic, museum, local, and postcolonial explanations	Heritage receives multiple descriptions, which creates conditions for revising previous classifications and colonial narratives
Identification	Educational projects, digital repatriation, participation of source communities	The connection of archaeological data with the memory, territory, language, and historical experience of a community	Archaeological heritage was incorporated into processes of cultural self-understanding and public discussion of the past

Source: compiled by the author based on a synthesis of the research results

As this model demonstrates, the influence of digital archaeological projects was formed in stages. Access to digital materials becomes the initial condition for the further apprehension of archaeological heritage, as it reduces dependence on the physical location of the object, museum, or archive. On this basis, visualisation expands the modes of perceiving the material: the archaeological object was presented not only as a description or fragment, but also as a spatial model linked to a specific historical environment. Subsequently, digital data moves into the interpretative plane, where the possibility arises to juxtapose academic, museum, local, and postcolonial versions of heritage description. As a result, digital projects connect archaeological objects with contemporary notions of origin, cultural memory, and historical continuity. Thus, the model shows that digital archaeology influences cultural identity not through a single technology, but through a set of interconnected mechanisms: the expansion of access to data, the alteration of the visual image of the past, the revision of descriptions, the participation of source communities, the digital return of cultural memory, and the educational reinterpretation of heritage.

The data analysis has established that digital archaeological projects exert a significant influence on the perception of cultural identities across different regions. Their significance lies not only in the preservation and visualisation of archaeological data, but also in changing the ways the past was interpreted. 3D reconstructions, digital archives, virtual museums, and geoinformation platforms allow cultural heritage to be presented as a multi-layered historical process connected to local memory, colonial experience, postcolonial reinterpretation, and contemporary forms of cultural self-identification. In countries with a colonial legacy, digital archaeology can perform a significant function. It creates conditions for restoring access to cultural objects, revising museum descriptions, incorporating the voices of local communities, and critically analysing previous historical narratives. However, digitalisation by itself does not guarantee the decolonisation of archaeological knowledge. Its outcome depends on research ethics, transparency of interpretation, community participation, and equitable

distribution of control over digital data. Consequently, digital archaeological projects modernise the understanding of cultural identities, as they transfer archaeological heritage from the status of a closed scientific or museum object into a space of open, visual, and polyphonic cultural dialogue.

CONCLUSIONS

The conducted research has made it possible to determine that digital archaeological projects were changing the methods of recording, storing, visualising, and interpreting archaeological heritage. The analysis identified 3D documentation and digital twins, 3D reconstructions, digital archaeological archives, integrated research infrastructures, geoinformation projects, virtual museums, and digital repatriation projects. These forms of digitalisation correlate with different modes of handling archaeological data: preserving the condition of monuments, reconstructing lost elements, archival storage, spatial analysis, museum visualisation, and providing digital access to countries and communities of origin. Digitalisation expands access to archaeological materials through online repositories, digital models, cross-archive infrastructures, and digital copies of heritage objects. Field reports, images, find descriptions, 3D models, and metadata become accessible outside the physical storage location of the object. In the context of studying cultural identity, this creates conditions for comparing materials from different regions and analysing territorial connections, migrations, exchanges, and cultural contacts. A distinct place was occupied by the participation of local communities in the interpretation of digital heritage. Such participation may take a consultative, collaborative, or community-led form. In these models, local knowledge, language, memory, and the cultural meanings of objects were incorporated into the description of heritage alongside academic and museum classifications. 3D reconstructions form a spatial image of the past; however, their use requires a demarcation between confirmed and hypothetical elements. Digital archives allow archaeological collections to be examined through the history of their origin, movement, descriptions, and institutional custody. In a postcolonial context, this was linked

to the revision of museum classifications, the inclusion of local interpretations, and discussions regarding the rights to describe cultural objects.

The regional analysis revealed differences in models of digital archaeology. In the UK and the EU, digital projects were linked to access infrastructure; in Syria, to the documentation of heritage under conditions of risk; in Guatemala and Mexico, to the landscape-analytical study of archaeological spaces; in China, to reconstruction and site management; and in India, to the systematisation of epigraphic heritage. Digital archaeological projects also participate in the educational perception of culture through 3D reconstructions, virtual museums, and digital collections. At the same time, the digitalisation of archaeological data does not automatically lead to the decolonisation of the historical narrative. This process depends on the transparency of object provenance, the participation of source communities in describing the materials, and the possibility of updating metadata. Based on a synthesis of the results, a model of the influence of digital archaeology on cultural identity was proposed, comprising four levels: access,

visualisation, interpretation, and identification. Concurrently, the limitations of digital archaeological projects were identified: the technological simplification of culture, the perception of reconstructions as the definitive version of the past, unequal access to digital infrastructure, and control over digital copies and metadata. A limitation of this research was its theoretical-analytical nature, as the work does not include an empirical assessment of the perception of digital heritage by users and source communities. Further research may be directed towards interviews, questionnaires, and comparative analysis of user experience in different regional and museum contexts.

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