

Advanced 3D Archaeological Documentation and Linked Open Data

17-18 APRIL 2024 | DEPARTMENT OF ARCHAEOLOGY AND ANCIENT HISTORY



Workshop aims

The workshop aims to promote discussions and investigations into the transformative potential of 3D-based documentation tools for archaeological data structuring and web exposition. The key objectives include recognising the needs of archaeologists (and all the potential stakeholders and data users) and identifying the requirements for long-term data preservation, accessibility and reusability.

The workshop intends to provide a unique venue for experts from various disciplines to converge and discuss the latest advancements in 3D documentation techniques and open data principles in archaeology. It represents a unique opportunity to explore the intersection of archaeology, 3D modelling, and data sharing from various perspectives.

The workshop will draw on different project experiences to define the shared needs and aspirations, consider the imperatives to meet current open data requirements, and outline the way forward in archaeological data management. To achieve this, it is organised around three sessions, where invited participants will present their experiences, current challenges, and possible solutions. These presentations will pave the way for the closing session, where participants will be able to define a concrete agenda for the design and development of state-of-the-art archaeological data curation.

Session 1. The current landscape of archaeological documentation and data management: Sharing experiences and hurdles

This session introduces the focus of the workshop: the documentation and data management of archaeological investigations in light of technological advances and the widespread use of 3D models as a common medium for representing archaeological features and artefacts.

Experiences from projects based in Sweden, Greece and Sardinia (IT) will provide a broad overview of the different strategies adopted, based on the characteristics of the sites, the research questions and the available logistics.

The choices made and the current limitations highlighted by practice will be presented to identify common needs and requirements (such as open science, fairness, or simply the best dissemination of information).

MARKOS KATSIANIS

Markos Katsianis is Assistant Professor at the Department of History and Archaeology at the University of Patras. He has studied History and Archaeology at the Aristotle University of Thessaloniki and received an MSc in GIS and Spatial Analysis in Archaeology at the Institute of Archaeology, University College London. He holds a PhD in Archaeology from the Aristotle University of Thessaloniki. His research approaches the application of digital technology in Archaeology with a focus on 3D documentation, semantic modelling, data preservation and re-use. He has worked for the Acropolis Restoration Service and the Dipylon Society for the Study of Ancient Topography. He is a member of the organising committee of the CAA SIG in 3D Spatial Analysis and a participant in the SHADE (SHaring Archaeological Data Effectively).



Evolving workflows, data migration processes and usability questions

Curating 3D digital archives can be a challenging process. Within the ARIADNEplus project (2018-2022) the data archive from the excavation of trench 01 of the Paliambela Kolindros archaeological project, compiled between 2000-2008, was re-examined for deposition as a finalized 3D spatial dataset that captures the entire spectrum of the data cycle, from initial fieldwork recording to post-ex stratigraphic analysis and the formulation of an aggregated archaeological narrative. Many questions have risen in the process, including suitable long-term data preservation strategies, data upcycling problems, data standardisation issues, semantic mapping procedures, documentation of digital argumentation processes and of course the practical facets of data curation. The presentation will touch upon these issues to highlight lessons learned and open issues in the long-term handling of 3D GIS data, with a view to inform current efforts in consolidating 3D data infrastructures.

JAMES TAYLOR

Dr. James Taylor is a Lecturer in the Department of Archaeology, at the University of York. His research currently centres on Neolithic Archaeology of Greece and the Eastern Mediterranean, North Africa and the Near East and he is currently Co-Director of the Toumba Serron Research Project, an archaeological investigation centred on a Neolithic village in Greek Macedonia. He also has a longstanding research interest in Archaeological Theory and Method and in particular the application of Digital Methods in Archaeology and has published on the impact of the 'Digital Turn' on archaeological practice.



From Digital Fields to Inclusive Futures: Towards Ethical and Participatory Approaches in Archaeological Data Acquisition and Management

This presentation will explore a transformative journey from the digitalisation of the Çatalhöyük Research Project to the current efforts of the Toumba Serron Research Project (TSRP) in Northern Greece, to integrate cutting-edge digital field recording methods. Using a recording workflow that incorporates drone technology and 3D modelling, with a comprehensive Geographic Information System, the TSRP exemplifies increasingly common hybrid approaches to primary archaeological documentation. Central to this discourse will be the project's commitment to developing an inclusive digital research environment, rooted in the principles of an 'Archaeology of Care' as proposed by William Caraher (2019) under the banner of the Transforming Data Re-use in Archaeology (TETRARCHs) project. This approach not only acknowledges the human consequences of archaeological methods but also strives for the co-creation of knowledge through participatory design and the active involvement of local communities, despite facing significant challenges in doing so. It is hoped that the TSRP's methodological framework, characterised by its focus on accessibility, reusability, and ethical stewardship of digital data, will serve as a model for addressing the challenges of digital archaeology. By reflecting on the tensions between technological advancements and the need for multivocality in archaeological narratives, this talk invites a critical examination of how digital tools can foster an equitable, inclusive, and collaborative archaeological practice. We ask: what is the potential for digital methodologies to transform archaeological data into a shared resource, enhancing the visibility of diverse perspectives within the archaeological record and ensuring equitable access and control over this data by all stakeholders?

STEVEN ELLIS

Dr Steven Ellis (PhD Sydney, 2005) is a Roman archaeologist whose research activities and publications spring from his interests in ancient cities and urban life. He has conducted fieldwork principally throughout Italy and Greece, but with other field activities in Spain, Portugal, France, Morocco, and Algeria. Steven directs the University of Cincinnati's excavations at both Pompeii (the Pompeii Archaeological Research Project: Porta Stabia) and Tharros, Sardinia (the Tharros Archaeological Research Project); and co-directs (with Eric Poehler) the Pompeii Quadriporticus Project and (with Timothy Gregory) the 'East Isthmia Archaeological Project' in Greece.



ERIC POEHLER

Dr Eric Poehler is a classical archaeologist with sixteen consecutive years of experience in the field at Pompeii, Italy. Poehler co-directs the Pompeii Quadriporticus Project, an archaeological investigation of one of the largest monumental structures at Pompeii that employs non-invasive methodologies and cutting-edge research technologies. He is the author of ten articles on the infrastructure of the ancient city and co-editor of a recent volume. Poehler's involvement in the digital humanities began in 2001 as part of The Pompeii Forum Project's work with the Institute for Advanced Technology in the Humanities at the University of Virginia. In 2006 he founded Pompeiana.org as a central, online location for digital information about Pompeii. Most recently, Poehler has founded the Pompeii Bibliography and Mapping Project, an online resource for Pompeian scholarship..



The “Imagination Gap” in Deploying 3D Models

Since 2019, the Tharros Archaeological Research Project (TARP) has been producing a photogrammetric model of each stratigraphic unit (SU) excavated, including its wider context. Although TARP continues to produce traditional 2D plans of each SU, we believe that the creation of 3D models must now be considered best practice in archaeological field recording. More than merely objects for the archive, however, 3D models have a number of unique affordances for interpreting and sharing contextual information.

With the goal of exploring these affordances in mind, the 2024 field season of TARP will seek to 1.) decrease lag between 3D model capture and 3D model production to within twenty-four to forty-eight hours and 2.) share every model (as appropriate) along with its basic contextual information on publicly available online platforms. The purpose of efficiently generating models (1.) is to return each model to the field while excavation is still underway so that this dynamic record of the previous day's work can be deployed for interpretation and planning, as well as providing a shared environment for discussion, rather than relying on memory and photographs alone.

The purpose of publicly sharing these models (2.) is to provide the best immediate information for scholars and institutions, but also to invite the possibility of a close-to-real-time “broadcast” of our investigations for public-facing projects to present to other stakeholders and the wider community.

We argue that there is an “imagination gap” in how these powerful instruments can be used while still in the field and how they can be used to educate beyond academia. We are underutilizing the potential of 3D.

Therefore, the 2024 season will implement these accelerated modeling and sharing procedures to test if the forced experience of time in the trench with the models can begin to bridge the imagination gap and find novel uses for 3D models within otherwise traditional excavation and publication workflows. Finally, we are excited to participate in Advanced 3D Archaeological Documentation and Linked Open Data Workshop, where we anticipate receiving feedback on our plans, and especially to learn more about LOD practices for 3D in field archaeology.

PAOLA DERUDAS

Dr Paola Derudas is researcher who completed her PhD in Archaeology at Lund University, focusing on the application of 3D-based and digital technologies in archaeological practice. Her research, bolstered by a solid international network, focuses on using web 3D visualization and semantic technologies to improve archaeological practice. By integrating these tools, she aims to create a comprehensive understanding and use of archaeological data while following FAIR principles and supporting open science.



Between the trench and the platform. Common and project-specific needs in current archaeological documentation

The adoption of digital tools by archaeologists has revolutionized excavation practices, but challenges remain in effectively integrating 3D capabilities into data management processes. While the archaeological community generally follows common procedures rooted in single-context methodologies, documentation practices vary widely across research projects. These variations stem from established practices, nuanced national and heritage regulations, and inherent logistical considerations unique to each excavation site. This presentation will explore the complexities observed and captured in the trench and with the digital platform when dealing with documentation and data management from different research projects across Europe. It examines how differences in documentation procedures can be traced back to established traditions of practice, specific national and heritage regulations, and logistical constraints inherent in the context of each project. The study of these common and project-specific needs allowed to identify future goals and to highlight the importance of developing flexible solutions that seamlessly accommodate ad hoc tools while facilitating accessible and versatile data reuse.

Session 2 Modelling the data. Experiences & Tools

Each project models the data to meet specific needs, using standard formats and models to avoid extreme subjectivity while allowing researchers to describe the archaeological information freely. In this session, different experiences and methods of data modelling will be presented as a basis for reflection on the interoperability of archaeological data.

FEDERICO NURRA

Federico Nurra is the Head of the Digital Research Service at the French National Institute of Art History (INHA, Paris).

He holds a PhD in "Architecture and Planning" and worked at the French National Institute for Preventive Archaeological Research (Inrap), where he was in charge of the scientific mediation of the NEARCH project and the development of the ARIADNE project. Before, he was research fellow at the Department of Architecture, Design and Urban Planning (DADU) at the University of Sassari. His main research topics are digital development and database management applied to the protection and valorisation of cultural heritage. He is author or co-author of several publications related to his research topics.



Drawing the shape of AIR: from molecules to skyscape.

How is archaeological evidence represented? Since their inception, the disciplines of antiquarianism before and archaeology after have produced multiple forms of representation of archaeological evidence, whether it be a landscape with ruins by Piranesi, a stratigraphic section from a 20th century scientific publication, or an inventory of stratigraphic units in tabular form. In the digital age, archaeological information can be deconstructed down to the smallest component. But how far should we go in deconstructing, and how can we then reassemble the pieces of this puzzle to get an overall view of the "archaeological evidence"? These are the questions we asked ourselves as we defined the conceptual model for the Archaeological Interactive Report (AIR). This contribution is intended to be like a journey from the archaeological site to its documentary deconstruction (site, trench, context, artefact, etc.) and back, building a new landscape of knowledge based on the semantic interaction of minimal elements (archaeological report, narrative, etc.).

DOMINIK LUKAS

Dominik Lukas studied prehistoric archaeology and philosophy at the University of Leipzig (Germany) and at Université-Marc-Bloch (Strasbourg, France). In 2008 he completed his master's thesis on the archaeological concept of the Late Iron Age "Oppidum". From March 2008 to March 2015 he worked in Berlin, at the German Archaeological Institute (DAI) and the Excellence Cluster Topoi as coordinator for research databases. In April 2015 he started a position as Database Developer of the Çatalhöyük Research Project at Stanford University. In parallel I began developing the next stage of the Living Archive of Çatalhöyük. Since 2019 he is a Doctoral Student at the Department of Anthropology.



Accommodating differing ontological commitments by building information systems from scratch

Archaeological Information Systems have to be considered as conceptualized knowledge systems and similarly to ontologies, they need to be understood as reflections or even materializations of epistemic cultures (Knorr-Cetina 1999). Within these cultures researchers interact either in accord with a shared conceptualization or in tension with the constraints of conflicting ideas or the inherent structures of the systems. As researcher's positionalities change over time, their expectations change as well. In consequence conceptions and knowledge systems evolve, continuously prompting modifications that can either be accommodated or need to be relegated in regards to considerations for data consistency and coherence with the already recorded information. In order to determine which knowledge system is most suitable for a given situation or social context, it is necessary to clarify the decision-making processes for each entity structuring the data. Either a group comes to an informed decision to employ a pre-existing conceptualization (e.g. CIDOC-CRM as reference model), or by establishing their own structure and defining the groups' ideas of how knowledge should be formed within their domain. Taking seriously the need for interoperability either at the time of development and usage of a field recording system, or at least at the end of a project and the transfer of data into repositories for long term preservation, in this paper I will present an approach to repeatedly start the development process from scratch in order to accommodate differing conceptualizations of archaeological knowledge. Making use of a tried and true set of frameworks, programming libraries and tools, it is possible to streamline the development process by retaining the prospect of implementing differing data models. I understand this as a compatible or at least complementary approach to the AIR ecosystem, building data logics at once inspired by the CIDOC-CRM as reference model but still allowing for additional conceptions.

HALLVARD INDGJERD

Dr Hallvard Ingjerd currently works as a data curator on building and implementing workflows that facilitates collection and retention of clean, structured, and accessible data, both in digitisation of existing material, and in the creation of born-digital data. His research is centred on survey, archaeology, and ceramic studies (including petrography) in the Mediterranean, where I have taken part in a range of survey and excavation projects (Italy, Greece, Turkey, Cyprus, Tunisia, Morocco), with research foci spanning from the Early Bronze Age to the Medieval period.



From field to web in one click: Automated workflows for SfM 3D modelling

The current contribution presents a working prototype for a fully automated photogrammetry workflow using the python API of Agisoft Metashape, and will discuss the integration of this system with standardised metadata recording for FAIR compatible publication and archiving.

The manual processing steps involved required at different stages of the workflow of SfM software is a major obstacle to achieving large scale photogrammetric recording in the field. The aim of the current project is to create a solution where field personnel can upload imagery and order a model in a single step, and later be able to access the resulting data online. This opens for a much wider adoption of photogrammetric workflows in our field projects. Currently the use of 3d modelling relies on the presence of skilled and interested individuals, and is often not prioritised under the strict budget and time limitations of rescue archaeology.

While tweaking of the settings by skilled professionals can bring out impressive results from even mediocre datasets, this is a challenge to repeatable and standardised data creation. In the proposed automated workflow we try to balance the needs of flexibility and repeatability by recording all settings used in a database, and allowing for easy reuse of those stored parameters.

The computational processing may be local or server based, and has been tested on an HPC cluster at the University of Oslo.

MARKUS GYLLING

Markus Gylling is currently a Solutions Architect at Riksanstikvarieäm-betet, bringing experience from previous roles at 1EdTech (formerly IMS Global), IMS Global Learning Consortium and Skolverket. Markus Gylling holds a 1991 - 1994 BSc in sociology @ Stockholm University. With a robust skill set that includes HTML, Accessibility, XML, Ebooks, Project Management and more, Markus Gylling contributes valuable insights to the industry.

Next generation Swedish cultural heritage aggregator

The Swedish National Heritage Board is currently building a new version of K-Samsök, the national-level aggregator of cultural heritage data. One focus area of this update is to increase information interoperability between actors in the domain. This presentation will focus on describing the design of the data model used in the aggregator, and how we intend to use it as a lingua franca, representing a wide variety of information spanning from basic records to advanced research data sets.

Session 3. Effective data management for long-term preservation and reuse

This session will offer the participants a broad view of national (Swedish) and international initiatives regarding the long-term preservation, accessibility, openness and reuse of archaeological data. The K-SOCH at Riksantikvarieämbetet will be presented, providing the reasons behind and the objectives of such archaeological infrastructure. A contribution will illustrate how Lund University is expected to contribute to the upcoming Open Science mandate. The European project TETRARCHs will offer the possibility to reflect on the importance of the reuse of archaeological data by multiple stakeholders, bringing some examples of how to make it possible.

NICOLÓ DELL'UNTO

Nicolò Dell'Unto is a Professor of Archaeology at the Department of Archaeology and Ancient History at Lund University. His research focuses on archaeological practice, specifically on how spatial technology and 3D visualisation affect our ability to perceive the past. He is currently the director of Lund University's Digital Archaeology Laboratory (DARKLab), a national infrastructure for digital archaeology and 3D visualisation. He is also responsible for the undergraduate and postgraduate courses in digital archaeology offered by the Department of Archaeology and Ancient History at Lund University.



Navigating the Future: Strategies for the Long-Term Preservation and Reuse of 3D Models in Heritage Documentation

The integration of 3D models into the field of cultural heritage documentation and material studies has made significant progress. Despite this advance, the cultural heritage field faces a critical challenge: the establishment of effective strategies for the long-term preservation and reuse of these digital assets. This presentation explores the underlying issues that hinder the development of a coherent plan for the management of 3D models, arguing that the dilemma stems not from a deficit of technical expertise, but from a lack of deep engagement with the intrinsic qualities and potential uses of this form of data. By examining case studies from current projects and discussions about the nature of digital infrastructure, this talk argues that the success of long-term preservation efforts is closely linked to how well these data become part of and shape our research practices. The aim is to stimulate a reflective discourse on the true nature and affordances of 3D models, and to advocate a paradigm shift in how we perceive and manage digital data for the benefit of future generations.

ÅSA LARSSON

Dr Åsa Larsson is the Head of Unit for Technology and Digital Mediation at the Swedish National Heritage Board. She has worked with digitalisation and digital infrastructures since 2015, from implementing a digital archaeological process in Sweden, to preserving digitally born archaeological documentation. Within the frame of Swedigarch, she works on developing a national research infrastructure for digital archaeology using FAIR data practices, linked data and semantic web and exploring how these resources can be used to create new knowledge and new ways of public outreach.



Why don't we do right? Lessons from dealing with messy data in archaeology and heritage science.

Archaeologists have generally been quick to adopt new methods and technologies, and digital documentation is no exception. But proficiency in executing a technology is not the same as understanding the underlying principles it is built upon, or how to make the best use of it. Ironically, one of main areas where archaeologists have been failing is in preservation and reusability of the materials they themselves create. Awareness of this fact has increased a lot in the last decade, as have the demands by research funders for data to be made FAIR, yet change is still moving at a very slow pace. Why is that? What is the problem? Drawing upon examples from years of working with messy archaeological documentation data, as well as working with implementing good data practices in archaeology and heritage science, I will highlight some of the challenges faced both on individual and systemic levels. I will also present suggestions for what is needed to overcome these, which includes collaborative efforts from Academia, Government agencies and field archaeologists.

SARA PERRY

Dr Sara Perry is Director of Research and Engagement at MOLA (Museum of London Archaeology), leading a team of 120 specialists, and overseeing MOLA's award-winning community initiatives and its extensive post-excavation programmes and grant-funded research. Sara was previously Senior Lecturer in Cultural Heritage Management at the University of York, where she honed her research specialism in the development, circulation and evaluation of media and interpretive resources for archaeology and heritage sites and their audiences.



Data managers as storytellers: Possible futures for archaeological data reuse.

In this presentation I make the case for reorienting approaches to the archaeological data life cycle, including the roles and responsibilities of data stakeholders (e.g., data creators, curators, depositors, managers, users, etc.), around storytelling. Evidenced through the work of the EU-funded Transforming Data Reuse in Archaeology project (www.tetrarchs.org) and related research, the reuse of archaeological data is highly circumscribed, enabling the circulation of stripped down records which facilitate worrisome, denuded narratives about the past. A more concerted approach to archaeological data management that overtly embraces storytelling at all stages in the data life cycle has the potential to constructively impact not only wider public engagements with the data, but also archaeologists' own professional interpretations and working experiences.

Final Keynote

The final keynote will showcase semantic modeling based on various conceptual approaches and provide guidance for developing best practices.

NICOLA CARBONI

Nicola Carboni is a Lecturer at the University of Geneva, where he teaches courses in Digital Images, Data Curation and Knowledge Graphs. Previously Fellow at the Swiss Art Research Infrastructure - University of Zurich and Digital Humanities Fellow at the Harvard Center for Italian Renaissance Studies. He completed his PhD on the topic of Visual Heritage and Knowledge Graphs at NTUA (National Technical University of Athens) and CNRS (National Research Center of France), where he was also previously appointed Marie Curie Fellow. He works on the intersection between knowledge graphs, big visual data, and cultural interpretation..



From Context to Annotation: Using Linked Data to Document Cultural Artefacts.

The presentation investigates the application of linked data for documenting our heritage, exploring possibilities and challenges associated with modelling, linking, and analyzing historical and cultural information. The contribution begins with a brief panorama of current scholarly work in the field, highlighting the diverse conceptual and technological approaches for representing knowledge about diverse types of cultural artefacts. Following this introductory overview, the discussion shifts to present examples of the use of linked data for the description of cultural objects.

This investigation delves into the (i) framing of different levels of knowledge, (ii) recording of documentation processes through provenance and (iii) the spatialisation of information in 2D/3D digital objects. Through selected case studies, the presentation underlines the possibilities for documentation and analysis opened up by linked data, as well as the necessity to pursue novel research and standards for the annotation of 3D information.

Advanced 3D Archaeological Documentation

The Workshop on Advanced 3D Archaeological Documentation and Linked Open Data represents an exciting opportunity to explore the intersection of archaeology, 3D modelling, and data sharing; it is an interdisciplinary event designed to bridge the gap between cutting-edge 3D documentation techniques and open data principles in archaeology.

The workshop aims to promote discussions and investigations into the transformative potential of 3D-based documentation tools for archaeological data structuring and web exposition. The key objectives include identifying accessible and easy-to-use tools, promoting interoperability and data comparability, ensuring data export in standard formats, and designing user-oriented interfaces with scientific integrity.

