

CAA 2021 – “DIGITAL CROSSROADS”

June, 14-18 2021
Limassol, Cyprus Online Event

DRAFT PROGRAMME: June 03, 2021



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Condensed Programme

CAA 2021 "Digital Crossroads" June 3rd, 2021



CAA 2021
Digital
Crossroads
gone virtual...
14-18 June, Limassol, Cyprus



Time	Monday, June 14th	Tuesday, June 15th						Wednesday, June 16th						Thursday, June 17th					
	Workshops	Sessions						Sessions						Sessions					
		Rooms						Rooms						Rooms					
		A	K	P	S	Ch	T	A	K	P	S	Ch	T	A	K	P	S	Ch	T
09:45-10:00		Welcome Notes																	
10:00-10:30	S31	S6	S2	S7	S25			Networking Event						Keynote					
10:30-11:00														S19		S22			
11:00-11:30																			
11:30-11:50	Coffee Break	Coffee Break						Coffee Break						Coffee Break					
11:50-12:20	S31																		
12:20-12:50								S4	S11	S13	S17	S20	S28	S10	S16	S24	S22	S28	S35
12:50-13:20																			
13:20-13:50																			
13:50-14:20																			
14:20-15:00	Lunch Break	Lunch Break						Lunch Break						Lunch Break					
15:00-15:30	Posters																		
15:30-16:00	Nick Ryan Bursary	S6	S2	S9	S25	S26		S5	S8		S32	S20	S28	S15	S14	S18	S23	S32	S1
16:00-16:30																			
16:30-16:50		Coffee Break						Coffee Break						Coffee Break					
16:50-17:20		Keynote						CAA Annual General Assembly						S15 S5 S18 S23 S32					
17:20-17:50																			
17:50-18:20																			
18:20-18:30		Break												Closing Notes					
18:30-19:00																			
19:00-19:30		S21			S8	S19	S26												
19:30-20:00																			
20:00-20:30																			

A: Amathous, K: Kourion, P: Palaepaphos, S: Salamis, Ch: Chirokoitia, T: Tombs of the Kings

POSTER SESSION & NICK RYAN BURSARY WILL BE ACCESSIBLE TO THE PARTICIPANTS THROUGHOUT THE WHOLE CONFERENCE PERIOD

*Networking Event:

On Wednesday, June 16th (10:00-11:30 EET) we will be hosting on conference's online platform a networking event, where participants will chat randomly with other conference attendees, get to know better and exchange ideas. Multiple chat rooms of 4 will be available during this event so one may join another room and connect with more people!

Workshop

S31. Developing R packages (Other)

Convenor(s):

Sophie C. Schmidt, German Archaeological Institute

Petr Pajdla, Masaryk University

Clemens Schmid, Max Planck Institute for the Science of Human History, CAA-SIG SSLA

Monday, June 14, Room to be announced

10:00 – 11:30, 11:50 – 14:20

A growing number of researchers use the scripting language R (R Core Team 2020) for scientific data analysis. Many organise their code in scripts and functions to perform sequences of data manipulation, statistics and visualisation. Sometimes these workflows gain in complexity and it becomes feasible to outsource core components into a dedicated R package. Packages are one of the best ways to make R code reproducible as they provide a well-established structure to share functions, data and their documentation with other R-users. The vast numbers of packages by diverse developers on the Comprehensive R Archive Network (CRAN) indicate their popularity in the scientific community and they could very well become a pillar of scientific progress in archaeology (Schmidt and Marwick 2020). Indeed more and more packages are also being developed by and for archaeologists (e.g. <http://open-archaeo.info>).

For CAA2021 we would like to offer a workshop to teach R-users how to develop R packages from their scripts. We believe that many archaeological R-users do not engage in package development as they lack training and the learning curve seems steep. We will try to fill this gap and offer a low-level introduction to R package development for users with basic R-skills.

This workshop is designed in tandem with the session “Tools for the Revolution: developing packages for scientific programming in archaeology” by the SIG SSLA.

Therefore:

- Do you use the scientific scripting language R for your analyses?
- Do you, too, now have a number of script files flying about and don't know how to organise them?

Join us and learn how to create an R-package!

In this workshop we will focus on the main points in Hadley Wickham's book on package development (Wickham 2020, <https://r-pkgs.org>) and create an example application together. Workshop attendees will get to know a structured workflow, which will aid them in organizing their personal scripts afterwards.

Basic topics will include: Package setup, function documentation and development cycle. As every package should come with example data, we will show how to implement these into a package, as

well as more detailed function explanations within a vignette. Testing routines and licensing for publication, e.g. using git (Github, Gitlab or similar) will enable attendees to share their work safely.

Basic R knowledge is strongly recommended for the workshop. Software requirements will be announced to registered attendees later.

References

R Core Team. 2020. R: A Language and Environment for Statistical Computing. Vienna, Austria: R Foundation for Statistical Computing. <https://www.R-project.org/>.

Schmidt, Sophie C, and Ben Marwick. 2020. "Tool-Driven Revolutions in Archaeological Science." *Journal of Computer Applications in Archaeology* 3 (1): 18–32. doi:10.5334/jcaa.29.

Wickham, Hadley. 2020. R Packages. Organize, Test, Document and Share Your Code. 2nd ed. O'Reilly. <https://r-pkgs.org/>.

Keynotes

Barbara J. Mills

Regents Professor

School of Anthropology

University of Arizona

Tucson, AZ, USA

Andrew Bevan

Professor of Spatial and Comparative Archaeology

Institute of Archaeology, UCL, UK

Sessions CAA 2021

- S1.** Paradata to the people! Documenting documentation and more (Roundtable)
- S2.** Hic sunt dracones – Improving knowledge exchange in the Semantic Web with Linked Open and FAIR data (Standard)
- S4.** Archaeological practices and knowledge work in the digital environment (Roundtable)
- S5.** From CAD to GIS. Implications of a fundamental change in documenting excavations (Standard)
- S6.** The archaeological perspective on the use of satellite data (Standard)
- S7.** Conceptualising, Processing and Visualising Vagueness in Archaeological Data (Standard)
- S8.** New challenges in archaeological network research (Standard)
- S9.** Digital fieldwork: technologies, methods and good practices (Standard)
- S10.** Modelling socio-ecological dynamics of past societies: recent advancements and new perspectives (Standard)
- S11.** Advances in Digital and Computational Archaeology in Taiwan and Neighboring Regions (Standard)
- S12.** Digital Infrastructures and New (and Evolving) Technologies in Archaeology (Roundtable)
- S13.** Our little minions, part 3: small tools with major impact (Other)
- S14.** Bayesian Approaches to Archaeological Questions (Standard)
- S15.** Archaeological Exploration of Digital Spaces (Standard)
- S16.** Problem and Project-based learning in Digital Archaeology Pedagogy (Standard)
- S17.** Tools for the Revolution: developing packages for scientific programming in archaeology (Standard)
- S18.** Urban Complexity in Settlements and Settlement Systems of the Mediterranean (Standard)
- S19.** Challenging the axiom that “absence of evidence is not evidence of absence” (Standard)
- S20.** European Union Study on quality in 3D digitisation of tangible cultural heritage (Roundtable)
- S21.** Archaeology-related online community practices (Standard)
- S22.** From surface distributions to settlement patterns: field survey during COVID-19 (Other)
- S23.** 3D Scholarly Editions: Potential, Limitations, and Challenges (Standard)

- S24.** Ghosts in the machine: Reflections on traditions of survey practice at the eve of automation (Other)
- S25.** Exploring the possibilities of 3D Spatial Analysis (Standard)
- S26.** Moving Over Seas: Modeling Seafaring Routes to Analyze Past Connections (Standard)
- S28.** Computational modelling in archaeology: methods, challenges and applications (Standard)
- S32.** From artificial intelligence to stratigraphic reality. Dynamics of an inverse process for AI applications in archaeology (Standard)
- S35.** Round Table proposals for EU ERA Chair Mnemosyne (Roundtable)

S1. Paradata to the people! Documenting documentation and more (Roundtable)

Convenor(s):

Isto Huvila, Uppsala University

Thursday, June 17, Tombs of the Kings

15:00 – 16:30

A key obstacle to using and understanding archaeological legacy data is seldom the lack of general information about the data, but that there is not enough contextual knowledge of its origins and earlier use. A lack of proper understanding of how data, models, visualisations and other carriers of archaeological knowledge make it difficult or impossible to interpret them properly. The issue is accentuated in the contemporary digital contexts where documentation needs to be more explicit than ever to ensure that the traces of its making and use become and remain visible and are preserved.

The data that documents the processes relating to data and information in different forms is conventionally referred to as paradata in the literature. Even if its importance has been acknowledged already a long time and especially in field archaeology, the documentation of not only observations but the documentation processes is a common practice and requirement, the systematic capturing, understanding and use of paradata is still at its infancy.

This roundtable session hosted by the CAPturing Paradata for document- ing data creation and Use for the REsearch of the future (CAPTURE) project (www.uu.se/en/research/capture) invites short lightning talks describing evidence-based and theoretical work, positions statements and perspectives relating to archaeological paradata i.e. data about processes of, for instance, creating, using, manipulating and managing archaeological data and information in different forms (e.g. digital measurement and observation data, spatial data, visualisations, texts physical collections and features). This can include data about the making of 3D visualisations or digital or non-digital paradata about the provenance of digital or non-digital field observations. The contributions should focus on identifying theoretical and practical opportunities, challenges and gaps in how paradata is understood at the moment, how these issues should be solved and what aspects require more research.

JUNE 17th

15:00 – 15:20

Paradata beyond the field: creating legacy from legacy data

Ian Johnson

15:20 – 15:40

Reassessing reflexive digital archaeology - a modest proposal

Mike Kelly

15:40 – 16:00

Documenting the shift in meaning over long-term archaeological project

Adela Sobotkova

S2. Hic sunt dracones – Improving knowledge exchange in the Semantic Web with Linked Open and FAIR data (Standard)

Convenor(s):

Florian Thiery, Römisch-Germanisches Zentralmuseum

Martina Trognitz, Austrian Centre for Digital Humanities at Austrian Academy of Sciences

Ethan Gruber, American Numismatic Society

Tuesday, June 15, Kourion
10:00 – 11:35, 11:50 – 14:25, 15:00 – 16:30

In historical maps, the phrase Hic sunt dracones (engl. here be dragons) is used to describe areas which were unknown to the map creator [UW19]. Today the WWW gives researchers the possibility of sharing their research (data) and enables the community to participate in the scientific discourse to create previously unknown knowledge. But much of this shared data are not findable or accessible, thus resulting in modern ‘unknown data dragons’. Often these ‘data dragons’ lack connections to other datasets, i. e. they are not interoperable and in some cases even lack usefulness or usability. To overcome these shortcomings, a set of techniques, standards and recommendations can be used: Semantic Web and Linked Open Data, the FAIR principles and LOUD data.

Tim Berners-Lee introduced the concept of Semantic Web, where he suggested using the ideas of Open Data, semantically described resources and links, as well as usable (machine readable) interfaces and applications for creating a Giant Global Graph. In 2016 the FAIR principles were introduced [MW16]: Research data and its metadata have to be Findable, Accessible, Interoperable and Reusable. Linked Data is an essential part of the FAIR principles: “The Semantic Web isn’t just about putting data on the web. It is about making links, so that a person or machine can explore the web of data. [TBL06].” Publishing research data as HTTP URIs with RDF content containing links to other resources makes data FAIR!

On top of that, these data should be open for access, re-use and universal participation [ODH19]. A five star rating system of openness [MH12] was introduced to rate Linked Data, i. e. “Linked Open Data (LOD) is Linked Data which is released under an open licence. [TBL06].” Furthermore, LOD have to be usable for scientists and programmers to take advantage of all the LOD power. Following the LOUD principles [RS18] will make LOD even more FAIR.

Merging all these principles to create FAIR and LOUD research data results in the Sphere 7 Data Model [FT19], which enables a wide array of digital humanities and archaeological (web-)applications using LOUD and FAIR data.

The Linked Data Cloud already offers research data repositories for certain archaeological and humanities domains. Popular examples of FAIR LOUD providers are: Nomisma.org [EG18], Kerameikos.org [GS15], Pelagios [ISBS14], OpenContext [EC07], Portable Antiquities Scheme [EH18], ARIADNE [AN17] and there are more to come, e.g. NAVIS [TM18b], ARS3D [TKR19] and ARIADNEplus [AP19].

The development of more and more repositories poses challenges in handling the complex facets of data quality and completeness. This is especially valid for archaeological data, which are based on a complicated network of concepts from different knowledge domains. Moreover, it is necessary to

include means of conveying knowledge about uncertainty in the data models to produce and publish transparent FAIR and LOUD data that can also describe specific stratigraphies or the (archaeological) context of objects. In order to be able to connect different data resources, exchange standards also have to be developed, published and applied.

To enable non-experts in engaging with FAIR, and especially LOUD data, small tools – minions – were created for different purposes, such as modelling a relative chronology (Alligator [DS18]), modelling and reasoning on vague edges in graph data (Academic Meta Tool [TM18]), creating annotated texts and images (Recogito [SBIS17]), and creating controlled vocabularies (Labeling System [TE16]). Furthermore, Wikidata [EGKMV14] not only offers community-driven data, but also provides a vast set of tools for using and interacting with it.

The goal of our session is to bring together experts on LOD and FAIR data, as well as anybody interested in learning about FAIR and LOUD data-driven publishing, applications and research projects based on this kind of data. We would like to discuss ideas for FAIR and LOUD data models as a basis for reproducible research and exchange in the Semantic Web.

This session is intended as a starting point for the CAA SIG on Semantics and LOUD in Archaeology. The core aim of this SIG is to use the CAA's SIG format to raise awareness for Linked Data in archaeology by creating a friendly and open platform to discuss the role of LOUD and FAIR Data in archaeology, and to enable the CAA community to learn about LOD basics. If you wish to join the SIG, feel free to contact us to be an active part of the discussion [SIG19] and help us to navigate archaeology away from the data dragons.

The success of the sessions on data quality in Linked Data at CAA 2017 and 2018 has raised awareness of the many challenges related to FAIR and LOUD data, and encourages pursuing the debate. For this session we invite contributions that address part or all of the following issues:

- application of semantic web technologies, such as ontologies or RDF, to the archaeological domain
- modelling archaeological artefacts as FAIR and LOUD data
- modelling archaeological context, including the specificity of stratigraphy, uncertainty, and vagueness as FAIR and LOUD data
- proposals for FAIR and LOUD data exchange standards
- development of research tools producing or using FAIR and LOUD data
- identifying sources and dangers of incorrect or ambiguous LOD
- identifying duplicates across different LOD sources
- keeping track of the provenance of data as a means of solving errors and identifying their source
- setting up methodologies and tools in order to label or assess datasets based on their quality
- dealing with ambiguities resulting from multiple links in the LOD cloud
- computer vision or machine learning applications built upon controlled, semantic data

We encourage presenters to derive the problems from real-world datasets and to formulate proposals for solutions, preferably demonstrating (prototypes of) realised data-driven web

applications. Since we target a broad and diverse audience because of the thematic relevance, the challenges described should also be integrated into the archaeological context (excavation, museum, archive, etc.).

References

[AN17] Aloia, N, Binding, C, Cuy, S, Doerr, M, Fanini, B, Felicetti, A, Fihn, J, Gavrillis, D, Geser, G, Hollander, H, Meghini, C, Niccolucci, F, Nurra, F, Papatheodorou, C, Richards, J, Ronzino, P, Scopigno, R, Theodoridou, M, Tudhope, D, Vlachidis, A, and Wright, H, 2017 Enabling European Archaeological Research: The ARIADNE E-Infrastructure, *Internet Archaeology* 43. DOI: <https://doi.org/10.11141/ia.43.11>

[AP19] ARIADNEplus 2019 ARIADNEplus: Advanced Research Infrastructure for Archaeological Data Networking in Europe Available at https://ariadne-infrastructure.eu/wp-content/uploads/2019/02/ariadne-plus_A4_researcher_web.pdf [Last accessed 18 July 2019]

[EC07] Kansa, E C 2007 Publishing Primary Data on the World Wide Web: Opencontext.org and an Open Future for the Past. *Technical Briefs in Historical Archaeology*, 2(1):1-11. Available at http://www.sha.org/publications/technical_briefs/volume02/article_01.pdf [Last accessed 18 July 2019]

[EG18] Gruber, E 2018 Linked Open Data for Numismatic Library, Archive and Museum Integration. In: Matsumoto, M. and Uleberg, E. (eds.) CAA2016. Oceans of Data. Proceedings of the 44th Conference on Computer Applications and Quantitative Methods in Archaeology. 2018 Oxford: Archaeopress. pp. 55–62.

[EGKMV14] Erleben, F, Günther, M, Krötzsch, M, Mendez, J and Vrandečić, D 2014 Introducing Wikidata to the Linked Data Web. In: Mika, P., Tudorache, T., Bernstein, A., Welty, C., Knoblock, C., Vrandečić, D., Groth, P., Noy, N., Janowicz, K., and Goble, C. (eds.) *The Semantic Web – ISWC 2014*. Cham: Springer International Publishing. pp. 50–65. DOI: https://doi.org/10.1007/978-3-319-11964-9_4.

[EH18] Harper, E 2018 Toys and the Portable Antiquities Scheme: A Source for Exploring Later Medieval Childhood in England and Wales, *Childhood in the Past*, 11(2): 85–99. DOI: <https://doi.org/10.1080/17585716.2017.1348647>.

[FT19] Thiery, F 2019 Sphere 7 Data: LOUD and FAIR Data for the Research Community DOI: <https://doi.org/10.5281/zenodo.2643469>.

[GS15] Gruber, E and Smith, T J 2015 Linked Open Greek Pottery. In: Giligny, F., Costa, L., Moscati, P., and Robert, S. (eds.) CAA2014. 21st Century Archaeology. Concepts, methods and tools. Proceedings of the 42nd Annual Conference on Computer Applications and Quantitative Methods in Archaeology. 2015 Oxford: Archaeopress. pp. 205–214.

[ISBS14] Isaksen, L, Simon, R, Barker, E T E and de Soto Cañamares, P 2014 Pelagios and the emerging graph of ancient world data. In: Proceedings of the 2014 ACM conference on Web science – WebSci’14. 2014 Bloomington, Indiana, USA: ACM Press. pp. 197–201. DOI: <https://doi.org/10.1145/2615569.2615693>.

[MH12] Hausenblas, M 2012 5-star OPEN DATA. Available at <https://5stardata.info/en/> [Last accessed 18 July 2019].

[MW16] Wilkinson, M D, Dumontier, M, Aalbersberg, I J, Appleton, G, Axton, M, Baak, A, Blomberg, N, Boiten, J-W, da Silva Santos, L B, Bourne, P E, Bouwman, J, Brookes, A J, Clark, T, Crosas, M, Dillo, I, Dumon, O, Edmunds, S, Evelo, C T, Finkers, R, Gonzalez-Beltran, A, Gray, A J G, Groth, P, Goble, C, Grethe, J S, Heringa, J, 't Hoen, P A., Hooft, R, Kuhn, T, Kok, R, Kok, J, Lusher, S J, Martone, M E, Mons, A, Packer, A L, Persson, B, Rocca-Serra, P, Roos, M, van Schaik, R, Sansone, S-A, Schultes, E, Sengstag, T, Slater, T, Strawn, G, Swertz, M A, Thompson, M, van der Lei, J, van Mulligen, E, Velterop, J, Waagmeester, A, Wittenburg, P, Wolstencroft, K, Zhao, J and Mons, B 2016 The FAIR Guiding Principles for scientific data management and stewardship, *Scientific Data*, 3: 160018.

[ODH19] Open Data Handbook 2019 What is Open Data?. Available at <http://opendatahandbook.org/guide/en/what-is-open-data/> [Last accessed 18 July 2019].

[RS18] Sanderson, R 2019 LOUD: Linked Open Usable Data. 28 May 2019. Available at <https://linked.art/loud/> [Last accessed 18 July 2019].

[SBIS17] Simon, R, Barker, E, Isaksen, L and De Soto Cañamares, P 2017 Linked Data Annotation Without the Pointy Brackets: Introducing Recogito 2, *Journal of Map & Geography Libraries*, 13(1): 111–132. DOI: <https://doi.org/10.1080/15420353.2017.1307303>.

[SIG19] Thiery, F, Trognitz, M, Gruber, E, Tolle, K, Wigg-Wolf, D 2019 CAA SIG on “Semantics and LOUD in Archaeology” DOI: <https://doi.org/10.5281/zenodo.3337979>.

[STMS18] Seidensticker, D, Thiery, F, Mees, A and Schmid, C 2018 Rdf Based Modeling Of Relative And Absolute Chronological Data: Examples From The Central African Rainforest And Roman Periodisation DOI: <https://doi.org/10.5281/zenodo.1410516>.

[TBL06] Berners-Lee, T 2006 Linked Data. 27 July 2006. Available at <https://www.w3.org/DesignIssues/LinkedData.html> [Last accessed 18 July 2019].

[TE16] Thiery, F and Engel, T 2016 The Labeling System: The Labelling System: A Bottom-up Approach for Enriched Vocabularies in the Humanities. In: Campana, S., Scopigno, R., Carpentiero, G., and Cirillo, M. (eds.) CAA2015. Keep the Revolution Going. Proceedings of the 43rd Annual Conference on Computer Applications and Quantitative Methods in Archaeology. 2016 Oxford: Archaeopress. pp. 259–268.

[TKR19] Thiery, F, Karmacharya, A and Rokohl, L 2019 ARS3D – Documenting facts and interpretations of African Red Slip Ware DOI: <https://doi.org/10.5281/zenodo.2648210>.

[TM18] Thiery, F and Mees, A 2018 Taming the chronology of South Gaulish Samian found at Hadrian’s Wall and the German Limes using Linked Open Data DOI: <https://doi.org/10.5281/zenodo.1469298>.

[TM18b] Thiery, F and Mees, A 2018 Taming Ambiguity – Dealing With Doubts In Archaeological Datasets Using Lod DOI: <https://doi.org/10.5281/zenodo.1200111>.

[UW19] Wuttke, U 2019 “Here be dragons”: Open Access to Research Data in the Humanities. [ulrikewuttke](https://ulrikewuttke.wordpress.com/2019/04/09/open-data-humanities/). Available at <https://ulrikewuttke.wordpress.com/2019/04/09/open-data-humanities/> [Last accessed 17 April 2019]

JUNE 15th

10:00 – 10:20

Linked Open Usable Data for Archaeology Including Modeling of Interpretations

Brigit Danthine, Daniel Brandner, Gert Goldenberg, Caroline Grutsch, Gerald Hiebel, Manuel Scherer-Windisch, Markus Staudt

10:20 – 10:40

Hic sunt dracones – How to make modern data dragons LOUD and FAIR

Florian Thiery, Allard Mees

10:40 – 11:00

The Metsemegologolo African urbanisms project: Experiences developing a database of archaeological material with a geospatial focus

Anton S Coetzee, Stefania Merlo, Justine Wintjes

11:00 – 11:20

Linked Open Data – Problems encountered and approaches to solving them in the numismatic domain

Karsten Tolle, David Wigg-Wolf

11:20 – 11:35

Making Practical Use of Linked Open Data

Ceri Binding, Douglas Tudhope

COFFEE BREAK

11:50 – 12:10

Historic maps as a multifaceted LOUD resource

Junaid Abdul Jabbar, Rebecca C Roberts, Huw Jones, Marco Madella, Hector Orengo, Cameron Petrie

12:10 – 12:30

Linked Open Data Vocabularies and Recognizing Intellectual Contributions via ORCID

Ethan Gruber, Tyler Jo Smith, Renee Gondek, Abigail Bradford

12:30 – 12:50

Linked Art for Archaeological Data Exchange

Ethan Gruber, Tyler Jo Smith, Renee Gondek

12:50 – 13:10

Reflections of history: An approach to enhanced documentation of cultural heritage

Myrto Koukouli, Akrivi Katifori, Maria Boile, Dimitra Petousi, Yannis Ioannidis

13:10 – 13:30

The Living Archive of Çatalhöyük: investigating the in-/transparencies of archaeological knowledge production

Dominik A Lukas

13:30 – 13:50

An Open and Shut case? Towards Shared Standards for Stratigraphic Data and Heritage Linked Data or LOD

Keith May, James Taylor, Ceri Binding

13:50 – 14:10

On using the CIDOC CRM to model archaeological datasets

Marlet Olivier, Roulet Théo, Hivert Florian, Markhoff Béatrice, Rodier Xavier, Simon Gaël

14:10 – 14:25

Routes to Linked Open Data: Modelling FAIR ceramics based on CIDOC CRM and a regional data acquisition system

Sophie C. Schmidt

LUNCH BREAK

15:00 – 15:20

Linking datasets in Norway

Espen Uleberg, Mieko Matsumoto, Christian-Emil Ore, Jakob Kile-Vesik

S4. Archaeological practices and knowledge work in the digital environment (Roundtable)

Convenor(s):

Isto Huvila, Uppsala University

Costis Dallas, University of Toronto

Suzie Thomas, University of Helsinki

Eleftheria Paliou, University of Cologne

Rimvydas Laužikas, Vilnius University

Wednesday, June 16, Amathous

11:50 – 14:20

At the time of rapid development of novel computer applications for archaeology, there is an increasing need to critical understanding of their implications to the practices of knowledge production in and about archaeology (cf. Lambourne et al., 2014; Selhofer & Geser, 2015; Geser & Selhofer, 2014; Geser & Niccolucci, 2016; Huvila & Huggett, 2018). In-depth insights into how digital tools and methods impact the making and use of archaeological knowledge are a key to a better understanding of how the use of digital technologies influence archaeological work and thinking and of being able to steer the use of computer applications to improve the quality of archaeological work.

There is an emerging body of work in the field ranging from the studies of field practices (e.g. Dell'Unto et al., 2017) to collections based research (e.g. Khazraee, 2019; Faniel et al., 2018), and use of digital archaeological tools and information in different branches of the society from education and public presentation to community archaeology and land development (e.g. Laužikas et al., 2018; Foka et al., 2017; Huvila, 2017) in the context of individual research projects, national initiatives, as well as EU funded projects and frameworks such as CARARE, Europeana Cloud, ARIADNEplus, ARKWORK, SEADDA and DARIAH and other multi-national efforts like in the work of the European Archaeological Council.

The session organised under the auspices of the COST Action Archaeological practices and knowledge work in the digital environment (ARKWORK) invites paper proposals on evidence-based and reflective studies of digital practices and knowledge work in archaeology relating but not limited to how material cultural heritage is being digitised, preserved and made available, how archaeological remains are documented, how the documentation and archaeological collections are used to create knowledge on archaeology and the human past, and how the knowledge the broad range of stakeholders from land development and academia to tourism and education to do their work from complementary disciplinary perspectives. The session is open for proposals and participation by archaeologists working with digital tools reflecting their use of technologies, developers of digital applications conducting user studies and evaluations and a broad range of scholars from fields including but not limited to museum studies, sociology, ethnography, information studies, science and technology studies and beyond conducting evidence-based studies of digital archaeological practices and knowledge work,

References

- Dell'Unto, N., Landeschi, G., Apel, J., & Poggi, G. (2017). 4D recording at the trowel's edge: Using three-dimensional simulation platforms to support field interpretation. *Journal of Archaeological Science: Reports*, 12, 632–645.
- Faniel, I. M., Austin, A., Kansa, E., Kansa, S. W., France, P., Jacobs, J., Boytner, R., & Yakel, E. (2018). Beyond the archive: Bridging data creation and reuse in archaeology. *Advances in Archaeological Practice*, 6(2), 105–116.
- Foka, A., Katerelou, A., Kelaidis, K., & Xekalaki, G. (2017). Digital archaeology? greece on focustools, methodologies and trends. *Archaeology & Arts*.
<http://www.archaeology.wiki/blog/2017/09/19/digital-archaeology-greece-on-focus/>
- Geser, G., & Niccolucci, F. (2016). D2.4: Final Innovation Agenda and Action Plan. ARIADNE.
- Geser, G., & Selhofer, H. (2014). D2.1 First Report on Users' Needs. Prato: ARIADNE.
- Huvila, I. (2017). Land developers and archaeological information. *Open Information Science*, 1(1), 71–90.
- Huvila, I., & Huggett, J. (2018). Archaeological practices, knowledge work and digitalisation. *Journal of Computer Applications in Archaeology*, 1(1), 88–100.
- Khazraee, E. (2019). Assembling narratives: Tensions in collaborative construction of knowledge. *JASIST*, 70(4), 325–337.
- Lambourne, G., Stoakes, L., Cassar, M., Balen, K. V., Rhisiart, M., Thomas, M., Miller, R., & Burnell, L. (2014). Strategic Research Agenda. Tech. rep., JPI Cultural Heritage and Global Change, Rome.
<http://www.jpi-culturalheritage.eu/wp-content/uploads/SRA-2014-06.pdf>
- Laužikas, R., Dallas, C., Thomas, S., Kelpšienė, I., Huvila, I., Luengo, P., Nobre, H., Toumpouri, M., & Vaitkevičius, V. (2018). Archaeological knowledge production and global communities: Boundaries and structure of the field. *Open Archaeology*, 4(1), 350–364.
- Selhofer, H., & Geser, G. (2015). D2.2 Second Report on Users' Needs. Salzburg: ARIADNE.

JUNE 16th

11:50 – 12:10

A little knowledge is a dangerous thing: Analogue practices with digital tools

Åsa M. Larsson, Daniel Lowenborg, Maria Jonsson, Marcus Smith, Gísli Pálsson

12:10 – 12:30

Critical Digital Archaeology. A postphenomenological approach to AI applications in Archaeology

Gabriele Gattiglia

12:30 – 12:50

Technologies and archaeological site inscription (knowledge claim) mutation

Yashaswini Jayadevaiah, Koumudi Patil

12:50 – 13:10

Creating a Digital Data Story, Proof-of-Concept and Early Lessons

Meghan Dennis

13:10 – 13:30

Tales from Two River Banks? Is there an increasing digital divide between Development Funded archaeological practice and Research Funded archaeological practice?

Keith May

13:30 – 13:50

Undergraduate Education Towards Digital Archaeological Practice

Nimet Pinar, Ozguner Gulhan

S5. From CAD to GIS. Implications of a fundamental change in documenting excavations (Standard)

Convenor(s):

Axel G. Posluschny, Research Centre of the Keltenwelt am Glauberg

Reiner Göldner, Saxon Archaeological Heritage Office

David Bibby, Regierungspräsidium Stuttgart

Wednesday, June 16, Amathous

15:00-16:30

Thursday, June 17, Kourion

16:50-18:20

Documentation of excavations in recent years has undergone fundamental changes. After digital documentation methods have become standard with CAD tools, GIS are more and more taking over for a number of reasons:

- GIS offer database options to be combined with graphical elements
- GIS are usually used anyway to analyse excavation data
- GIS software is available as FOSS (free and open source software) in a greater variety than CAD software

However, the move from CAD to GIS has a number of implications for documenting, storing and analysing excavation data, including problems with documenting 3D structures, changing the philosophy of recording elements in the field etc. Various tools offer different approaches:

- survey2GIS (<https://www.survey-tools.org/>) uses recorded data from total stations and transfers these into shape files for further use.
- Tachy2GIS (<https://github.com/Archaeological-Museum-Hamburg/Tachy2GIS>) on the other hand uses incoming data from total stations to directly 'draw' features on an attached computer. The choice for one of these approaches of course also has an impact on the documentation strategy.

GIS may also be advantageous for archiving purposes. There are highly standardized geodata formats (e.g. based on ISO 19125 Simple Features). So it would be interesting to discuss specific archaeological geodata structures with regard to preservation, archiving and re-use, preferably based on experiences from real life geodata.

We invite contributions that deal with practical aspects of the tools in use, that offer new and exciting solutions or that show case studies, where GIS has been used, solving problems or creating problems. We would also very much welcome contributions that tackle the theoretical aspects of digital tools for documenting excavations in general and the change from CAD to GIS in special.

JUNE 16th

15:00 – 15:20

From CAD to GIS to BIM to where? Archaeological documentation in 3D

Markos Katsianis, Kostas Kotsakis

15:20 – 15:40

TachyGIS – Support to Change from CAD to GIS

Reiner Göldner

15:40 – 16:00

Steps towards database driven excavations in lakeside settlements

Niels K. Bleicher, Tim Wehrle, Claire Ries

16:00 – 16:20

Open data and closed lines. Reflections on the management of CAD drawings and RDBMS from the open datasets of Massaciucoli Romana excavations

Gabriele Gattiglia, Francesca Anichini, Filippo Sala

JUNE 17th

16:50 – 17:10

A report of failure and understanding: The introduction of GIS and Open-Data as a standard for documentation and archiving in rescue excavations

Marco MS Schrickel, David Bibby

17:10 – 17:30

New tools dealing with old issues: from graphical elements to semantic objects

Andrea D'Andrea, Alexia Pavan, Roberta Giunta

17:30 – 17:50

25 years of trends in digital data deposition at the ADS

Teagan K Zoldoske, Olivia Foster, Kieron Niven

S6. The archaeological perspective on the use of satellite data (Standard)

Convenor(s):

Deodato Tapete, Italian Space Agency (ASI)

Francesca Cigna, National Research Council (CNR) – Institute of Atmospheric Sciences and Climate (ISAC), Italy

Arianna Traviglia, Italian Institute of Technology (IIT) – Centre for Cultural Heritage Technology

Tuesday, June 15, Amathous
10:00 – 11:35, 11:50 – 14:20, 15:00 – 16:35

It is undisputable that satellite data are valuable to support different types of archaeological activities such as prospection, surveying, regional mapping, condition and damage assessment. The ever-growing scientific literature provides evidence of numerous cases of successful implementation (Agapiou & Lysandrou, 2015). Online visualisation platforms such as Google Earth and Bing Maps have massively contributed to make satellite images a resource for archaeologists (Luo et al., 2018), and cloud computing facilities such as Google Earth Engine are increasingly exploited by archaeologists to analyse multi-temporal datasets (Agapiou, 2017; Orengo & Petrie, 2017).

However, the use of satellite data is not yet an established practice across the whole international community of archaeologists. Image processing expertise is mostly clustered around multi-disciplinary teams (Tapete, 2018; 2019), and some teams of field archaeologists still do not utilise satellite images in daily practice, and show limited enthusiasm in these technologies for everyday use (Ruciński et al., 2015; Rączkowski & Mickiewicz, 2019) privileging ad hoc aerial imagery.

The evidence gathered from the literature suggests that archaeologists have so far mostly exploited optical satellite images collected at high to very high spatial resolution (from 5 to less than 1 m). Less frequent is, instead, the use of other data types, such as Synthetic Aperture Radar (SAR) and multispectral imagery at lower resolution (> 5 m), e.g. Sentinel-2. Some recent studies attempted to demonstrate the value of these data (e.g., Tapete & Cigna, 2018). However, users have paid little attention to these space-borne sensors (as highlighted, e.g., in Opitz & Hermann, 2018), despite the costless accessibility, global spatial coverage, high temporal revisit and ease of data handling. Training and multi-disciplinary collaboration were proved to be effective gap-bridging actions to promote the use of new, or long-existing but yet-to-exploit, space technologies by non-experts and beginners (Tapete & Cigna, 2016). Training is also the best way to build capacity and disseminate standard methodologies (e.g., Rayne et al., 2017).

This also aligns with the efforts currently made by space agencies (e.g., the European Space Agency – ESA) to make users more acquainted with satellite data. Nevertheless, in the end it is up to the users to perceive such particular technology as useful to their scopes, and make it work in the daily practice.

To capture these divergent trends across the community, we propose to hold this standard session to understand the directions in which the use of satellite data in computer applications for archaeology is heading, based on the direct feedback from archaeologists.

The overall aim is to bring together archaeologists who already work with satellite data and scholars who can demonstrate the spectrum of archaeological challenges and unsolved problems to which satellite data can try to provide a solution.

We will select a range of papers including, but not limited to, the following topics and open questions:

- Which archaeological domains already benefit from the use of satellite data?
- Which barriers currently prevent further exploitation or make some types of data more used than others (e.g., optical vs. SAR)?
- Which requirements and expectations archaeologists have and would like to see addressed by current and future satellite data, so they can use these images as a resource for their daily practice?
- How pure observations from satellite images can be fed in to archaeological interpretation and understanding of anthropogenic processes (e.g., settlement patterns or damage mapping into causal relationships between social and political organisation and environmental conditions)?
- What are the lessons learnt and best practices in the use of large amounts of satellite images for archaeological and cultural heritage recording and creation of databases?
- Which role automation can play to solve technical challenges in big data handling?

and we will welcome examples of capacity building initiatives contributing to make satellite data and standard processing routines more accessible to users.

In addition to the open call, we will solicit the submission of papers from scholars who can provide the evidence base to hold this discussion. We expect that this session will attract a diverse audience, not limited to scholars and researchers who are highly skilled in processing satellite data, but also encompassing archaeologists, heritage practitioners and younger generations. The latter may not be already familiar or aware of these technologies, but could help to target the areas where satellite data can be better used and disseminated, and offer real use-cases with clear archaeological research questions to address. The interaction with this cross-section of the community will allow us to collect user needs and feedback in the context of the current scenario of satellite missions (e.g., EC Copernicus programme) and future developments.

References

- Agapiou, A. & Lysandrou, V. (2015) Remote sensing archaeology: tracking and mapping evolution in European scientific literature from 1999 to 2015. *J. Archaeol. Sci. Rep.*, 4, 192-200.
- Agapiou, A. (2017) Remote sensing heritage in a petabyte-scale: satellite data and heritage Earth Engine© applications. *International Journal of Digital Earth* 10, 85–102.
- Luo, L., Wang, X., Guo, H., Lasaponara, R., Shi, P., Bachagha, N., Li, L., Yao, Y., Masini, N., Chen, F., Ji, W., Cao, H., Li, C., Hu, N. (2018) Google Earth as a Powerful Tool for Archaeological and Cultural Heritage Applications: A Review. *Remote Sens.*, 10, 1558.
- Opitz, R. & Herrmann, J. (2018) Recent trends and long-standing problems in archaeological remote sensing. *Journal of Computer Applications in Archaeology*, 1(1): 19-41.
- Orengo, H.A. & Petrie, C.A. (2017) Large-Scale, Multi-Temporal Remote Sensing of Palaeo-River Networks: A Case Study from Northwest India and its Implications for the Indus Civilisation. *Remote Sens.*, 9, 735.
- Rączkowski, W. & Ruciński, D. (2019) Cooling down enthusiasm: potential vs. practice in application of EO techniques in archaeological research and heritage management – have lessons been learned? ESA Living Planet Symposium, Milan, 17 May 2019.
- Rayne, L., Bradbury, J., Mattingly, D., Philip, G., Bewley, R., Wilson, A. (2017) From Above and on the Ground: Geospatial Methods for Recording Endangered Archaeology in the Middle East and North Africa. *Geosciences*, 7, 100.
- Ruciński D., Rączkowski W., Niedzielko J. (2015) A Polish perspective on optical satellite data and methods for archaeological sites prospection. *Proc. SPIE 9535, Third International Conference on Remote Sensing and Geoinformation of the Environment (RSCy2015)*, id. 95350U.
- Tapete, D. (2018) Remote Sensing and Geosciences for Archaeology. *Geosciences*, 8, 41.
- Tapete, D. (2019) Earth Observation, Remote Sensing, and Geoscientific Ground Investigations for Archaeological and Heritage Research. *Geosciences*, 9, 161.
- Tapete, D. & Cigna, F. (2017) Trends and perspectives of space-borne SAR remote sensing for archaeological landscape and cultural heritage applications. *J. Archaeol. Sci. Rep.* 14, 716–726.
- Tapete, D. & Cigna, F. (2018) Appraisal of Opportunities and Perspectives for the Systematic Condition Assessment of Heritage Sites with Copernicus Sentinel-2 High-Resolution Multispectral Imagery. *Remote Sens.*, 10, 561.

JUNE 15th

10:00 – 10:20

High-resolution or long wavelength? What is the right SAR sensor for archaeological applications

Timo Balz, Gino Caspari

10:20 – 10:40

The concept of human-trace SAR satellite initiated from past investigations of SAR in archaeology

Fulong Chen

10:40 – 11:00

Listening to archaeologists and practitioners: analysis of the user feedback on the use of Copernicus data

Deodato Tapete, Francesca Cigna, Branka Cuca, Cristian Moise, Iulia Dana Negula

11:00 – 11:20

How many hectares? Combining remote sensing, historical cartography, and survey data to rapidly categorize and assess the size of archaeological sites in South Asia

Adam S Green, Hector Orengo, Aftab Alam, Francesc Conesa, Arnau Garcia-Molsosa, Joanna Walker, Ravindra Nath Singh, Cameron Petrie

11:20 – 11:35

Satellite remote sensing for the reconstruction and mapping of archaeological resources in alluvial environments

Nicholas L Crabb, Chris Carey, Andy Howard, Robin Jackson, Matthew Brolly, Niall Burnside

COFFEE BREAK

11:50 – 12:10

The European Union's Copernicus Programme in Support of Cultural Heritage

Benjamin Ducke

12:10 – 12:30

Potential of satellite imagery analysis for archaeological heritage studies and management in the suburbs of Khartoum (Sudan)

Mariusz Drzewiecki

12:30 – 12:50

Detecting Change at Archaeological Sites in North Africa using Open-Source Satellite Imagery

Louise Rayne, Nichole Sheldrick

12:50 – 13:10

Towards Big Earth Data: cloud-computing workflows for the automated detection and monitoring of endangered archaeological sites

Francesc Conesa, Hector Orengo, Agustin Lobo, Arnau Garcia-Molsosa, Adam S Green, Cameron Petrie

13:10 – 13:30

Prospecting archaeological archives in South Africa through hyperspectral image processing and field spectroscopy

Christian Sommer, Volker Hochschild

13:30 – 13:50

Medieval urban sites of Iraq in the sphere of archaeological remote sensing

Lenka Starkova

13:50 – 14:10

Documenting and monitoring the impact of dams to cultural heritage from space. Tuning satellite data collection to meet archaeologists' needs

Federico Zaina, Deodato Tapete

14:10 – 14:25

Copernicus Earth Observation and Big Data for Cultural Heritage Management

Athos Agapiou, Vasiliki Lysandrou

LUNCH BREAK

15:00 – 15:20

Assessment of soil erosion processes on archaeological sites using the SIMWE Model and GRASS GIS: The Case Study of Amathous, Cyprus

Nikoletta Papageorgiou, Rosa Lasaponara, Athos Agapiou, Diofantos Hadjimitsis, Chris Danezis

15:20 – 15:40

Challenges and Opportunities in Cultural Heritage from the development of a Digital Innovation Hub (DIH) for Earth Observation and Geospatial Information in the Eastern Mediterranean, Middle East and North Africa (EMMENA) through Eratosthenes Centre of Excellence

Georgios Leventis, Diofantos Hadjimitsis, Phaedon Kyriakidis, Kyriakos Themistocleous, Gunter Schreier, Harris Kontoes, George Komodromos

15:40 – 16:00

**Uses of Sentinel-1 and -2 imagery in heritage protection and management strategies. A case study
from Ostrów Lednicki (Poland)**

Lidia Zuk, Sławomir Królewicz

COFFEE BREAK

BREAK

S7. Conceptualising, Processing and Visualising Vagueness in Archaeological Data (Standard)

Convenor(s):

Cesar Gonzalez-Perez, Incipit CSIC

Patricia Martín-Rodilla, University of A Coruña

Martín Pereira-Fariña, University of Santiago de Compostela

Maria Elena Castiello, University of Bern

Leticia Tobalina, Université de Pau et des Pays de l'Adour

Tuesday, June 15, Palaepaphos
10:00 – 11:30

Background

Vagueness has always been a difficult topic in science; information that is uncertain, or entities with unclear borders, for example, are especially difficult to treat. Over the past few years, for archaeology, and for the humanities in general, vagueness has started to be considered as a rich source of knowledge when it is adequately managed. Mechanisms to record, represent and communicate vagueness have been proposed, and CAA as well as other conferences has had some very good sessions on this topic in recent years. This complements a long tradition of trying to cope with vagueness; works such as [2] and, more recently, [6], have paved the way for more recent research.

The aim of this line of research can be summarised as follows: instead of treating vagueness as an undesirable and annoying aspect of archaeological information, we should start seeing it as a valuable resource that must be recorded, processed and visualised for richer interpretations and more nuanced conclusions.

Current Research

Recently, approaches have been proposed to classify vagueness in different types (such as ontological vs. epistemic [3]), capture vague information about archaeological entities [5], or visualise vagueness in 3D archaeological reconstructions [1]. The Digital Humanities community has also paid significant attention to this, with specific projects (such as PROVIDEDH, <http://www.chistera.eu/projects/providedh>) and some specific workshops and tracks focusing on vagueness, such as “Complexity And Uncertainty In DH Projects: A Co-design Approach Around Data Visualization” within Digital Humanities (DH) 2019, or “Uncertainty in Digital Humanities” in the International Conference on Technological Ecosystems for Enhancing Multiculturality (TEEM) 2019. Information science and computing are also starting to work on this field, as exemplified by the ongoing special issue of Information on vagueness [4].

Most of these works, however, are extremely data-oriented, focussing on how to capture vagueness in databases or how to express it in datasets. Although this is very interesting, it only constitutes part of the necessary work; in order to treat vagueness as a valuable asset, we must **start by being aware**

of its existence and impact in our data models, and include the explicit treatment of vagueness as one factor in the decision-making processes of model building in archaeology. In addition, we need tools to build and process vagueness as one dimension of the archaeological data from the field to the final report.

So far, there are no tools like these, and drawing conclusions that incorporate vague knowledge or evaluating the impact of vagueness in research outcomes is practically impossible.

Expected Contributions

In this manner, research is necessary to contribute sound philosophical arguments to the treatment of vagueness in archaeology; to provide a good conceptualisation of related ontological and epistemic issues such as precision, exactitude, accuracy, perfection, error, ambiguity, generalisation, or reliability; and to suggest notational and visual devices to convey vagueness in 3D reconstructions, maps, charts and other forms of representations. Only when a solid theoretical foundation has been set will we be able to develop computer systems that can store, process and represent vagueness as appropriate.

This is especially so in relation to space and time. Objects with fuzzy spatial boundaries (such as many archaeological sites or areas) are difficult to manage, study and preserve, and events or phases with uncertain or unclear temporal boundaries are equally hard to treat. This session aims to advance contributions to fulfil these needs.

Expected Themes

Papers are welcome in this session about the following topics, among others:

- Philosophical accounts of vagueness, including ontological and epistemic aspects.
- Relationships between linguistic, spatial, and temporal vagueness.
- Theories, ontologies and conceptual models of data vagueness in archaeology.
- Use of different computational approaches such as fuzzy logic, many-valued logics, machine learning or other quantitative approaches to the description of vagueness in archaeological data.
- Incorporating vagueness to the recording of data in the field or the lab using databases and other information systems.
- Visualisation of vagueness in final outputs of computer-aided archaeological products, including datasets, maps, timelines, sketches, 3D reconstructions and other visual representations of the archaeological record.
- Case reports of archaeological sites or areas that have been affected (positively or negatively) by the treatment of vague information.

Audience

The session will be of interest to:

- Archaeologists concerned with a richer and more nuanced representation of spatial and temporal vagueness.
- Cultural heritage managers that must make decisions on, and deal with, information that is intrinsically imprecise and uncertain.
- Developers of information systems that are aiming to capture vagueness in their data.

Session Format

This will be a standard session including an introductory invited keynote talk (20 minutes) plus a number of 20-minute papers. Time for discussion will be available.

References

- [1] L. Brunke, "Uncertainty in archaeological 3D reconstructions," University of Leiden, Leiden, The Netherlands, 2017.
- [2] P. A. Burrough, I. Masser, and F. Salgé, "Natural Objects with Indeterminate Boundaries," in *Geographic Objects with Indeterminate Boundaries*, no. 2, P. A. Burrough and A. U. Frank, Eds. London: Taylor & Francis, 1996, pp. 3–28.
- [3] C. Gonzalez-Perez, *Information Modelling for Archaeology and Anthropology*. Springer, 2018.
- [4] C. Gonzalez-Perez, M. Pereira-Fariña, and L. Tobalina-Pulido, "Information Vagueness." *MDPI*, 2020, [Online]. Available: https://www.mdpi.com/journal/information/special_issues/information_vagueness.
- [5] P. Martín-Rodilla, C. Gonzalez-Perez, P. Martín-Rodilla, and C. Gonzalez-Perez, "Conceptualization and Non-Relational Implementation of Ontological and Epistemic Vagueness of Information in Digital Humanities," *Informatics*, vol. 6, no. 2, 2019, doi: 10.3390/informatics6020020.
- [6] B. Smith and A. C. Varzi, "Fiat and bona fide boundaries: Towards an ontology of spatially extended objects," in *Spatial Information Theory: A Theoretical Basis for GIS*, no. 1329, S. C. Hirtle and A. U. Frank, Eds. Springer, 2005, pp. 103–119.

JUNE 15th

10:00 – 10:20

Dating mechanisms: possibilities and limitations of dealing with time intervals of the Roman Limes. Vagueness in the case of terra sigillata (samian) chronology

Allard Mees (RGZM), Florian Thiery

10:20 – 10:40

On the Emerging Supremacy of Structured Digital Data in Archaeology

Piraye Hacıgüzeller, James Taylor, Sara Perry

10:40 – 11:00

The ambiguity of the classification process in the digital environment. Typologies and quantification of shape similarity in the analysis of pottery

Agnieszka E. Kaliszewska, Rafał Bieńkowski

11:00 – 11:20

A fuzzy approach to type formulation, definition and description

Danai Kafetzaki, Jeroen Poblome, Jan Aerts

S8. New challenges in archaeological network research (Standard)

Convenor(s):

Philip Verhagen, Vrije Universiteit Amsterdam

Tom Brughmans, Aarhus University

Grégoire Van Havre, Universidade Federal do Piauí

Aline Deicke, Akademie der Wissenschaften und der Literatur Mainz

Natasa Conrad, Zuse Institut Berlin

Phil Riris, Bournemouth University

Tuesday, June 15, Salamis

18:30 – 20:30

Wednesday, June 16, Kourion

15:00 – 16:30

New challenges emerge as network research becomes ever more common in archaeology: can we develop new network methods for dealing with archaeological data, and how can cross-disciplinary collaborations be leveraged to make original contributions to both archaeology and network science? In this session, we aim to explore some of the core issues in current network research that need cross-disciplinary collaboration, in particular dealing with data uncertainty in archaeology, and integrating archaeological spatial and temporal analysis in network research. This session welcomes papers on archaeological network research including but not exclusive to these new challenges.

Although a range of techniques exist in both archaeology and network science for dealing with missing data and data uncertainty, the fragmentation of the material record presents a challenge – made more explicit through the use of formal methods – that is hard to tackle. Much of the task of identifying network science equivalents of archaeological missing data techniques remains to be done, and there is a real need for identifying how archaeological approaches could lead to the development of new network mathematical and statistical techniques. But by far most pressing is the need to formally express data uncertainty and absence in our archaeological network research.

A second challenge is the inclusion of spatial and temporal archaeological analysis into network research. Archaeology as a discipline has a long tradition of spatial analysis and of exploring long-term change in datasets and past phenomena. These are two areas where archaeologists did not look towards mathematicians, physicists and sociologists for inspiration, but rather developed original network methods based on a purely archaeological tradition. As such, they are some of the most promising research topics for archaeologists to make unique contributions to network science.

The spatial phenomena archaeologists address in their network research are rather narrow and can be grouped into three broad categories: movement-, visibility- and interaction-related phenomena. The aim of network techniques in space syntax focus on exploring movement through urban space, whereas least-cost path networks tend to be used on landscape scales. Neither of these approaches have equivalents in network science (Verhagen et al. 2019). Archaeology has a strong tradition in visibility studies and is also pioneering its more diverse use in network research (Brughmans and Brandes 2017). Most visibility network analyses tend to explore theorised visual signalling networks or visual control over cultural and natural features. Most network methods used for exploring

interaction potential between past communities or other cultural features belong to either absolute or relative distance approaches: such as maximum distance network, K-nearest neighbours (sometimes referred to in archaeology as proximal point analysis (PPA)), beta-skeletons, relative neighbourhood network or Gabriel graph. These, however, are derived from computational geometry and have a long tradition in network research and computer science. Moreover, this is not a field in which archaeologists seem to push the boundaries of network science (with perhaps a few exceptions; Knappett et al. 2008).

There are a few commonalities between the archaeological applications of these movement, visibility and interaction networks. They tend to be network data representations of traditional archaeological research approaches (e.g. viewsheds, least-cost paths, urban settlement structure, community interaction), and they tend to be applied on spatially large scales with the exception of space syntax (inter-island connectivity, landscape archaeology, regional visual signalling systems). How can we diversify spatial archaeological network research? How can we go beyond making network copies of what archaeologists have done before and rather draw on the unique feature of network data (the ability to formally represent dependencies) to develop even more original spatial network techniques? This seems to us like an eminently possible task for archaeologists.

Despite being at the core of archaeological research, the use of temporal (or longitudinal) network data is common but incredibly narrow in archaeological network research. By far the most common application is to consider dating evidence for nodes or edges and to chop up the resulting networks into predefined categories that could have a typological, culture historical or chronological logic (e.g. artefact type A; Roman Republican; 400-300 BC). This process results in subnetworks sometimes referred to as snapshots, the structure of which are explored in chronological order like a film strip. A significantly less common approach is to represent processes of network structural change as dynamic network models (e.g. Bentley et al. 2005), or to represent dynamic processes taking place on top of network structures (e.g. Graham 2006).

This research focus of temporal archaeological network research is not at all representative of the diverse and critical ways archaeologists study temporal change. How can the archaeological research tradition inspire new temporal network approaches? How can the use of dynamic network models become more commonly applied? What temporal approaches from network science have archaeologists neglected to adopt? How can, for example, studies modeling the evolution of networks suggest explanations for the levels of complexity observed in past networks?

Recognition of these contributions outside archaeology has still to materialise due to a number of challenges. How can we ensure these archaeology-inspired approaches become known, explored and applied in other disciplines? How precisely do these spatial and temporal archaeological approaches differ from existing network methods? What existing spatial and temporal approaches in archaeology show equal potential for inspiring new network research?

Like many other aspects of archaeological network research, this challenge should be faced through cross-disciplinary collaboration with mathematicians, statisticians and physicists. Archaeological network research has a great track record of such collaborations, but not all of them have been successful and not all archaeologists find it equally easy to identify collaborators in other disciplines. How can we facilitate the communication between scholars with different disciplinary backgrounds? How can we foster archaeological network research that holds potential contributions to archaeology as well as other disciplines? What events and resources should be developed to provide a platform for cross-disciplinary contact and collaboration?

References

Bentley, R., Lake, M., & Shennan, S. (2005). Specialisation and wealth inequality in a model of a clustered economic network. *Journal of Archaeological Science*, 32(9), 1346–1356. <https://doi.org/10.1016/j.jas.2005.03.008>

Brughmans, T., & Brandes, U. (2017). Visibility network patterns and methods for studying visual relational phenomena in archaeology. *Frontiers in Digital Humanities: Digital Archaeology*, 4(17). <https://doi.org/doi.org/10.3389/fdigh.2017.00017>

Graham, S. (2006). Networks, Agent-Based Models and the Antonine Itineraries: Implications for Roman Archaeology. *Journal of Mediterranean Archaeology*, 19(1), 45–64. <https://doi.org/10.1558/jmea.2006.19.1.45>

Knappett, C., Evans, T., & Rivers, R. (2008). Modelling maritime interaction in the Aegean Bronze Age. *Antiquity*, 82(318), 1009–1024. Retrieved from <http://antiquity.ac.uk/Ant/082/1009/ant0821009.pdf>

Verhagen, P., Nuninger, L. & Groenhuijzen, M. R. (2019). Modelling of pathways and movement networks in archaeology: an overview of current approaches. In: Verhagen, P., J. Joyce & M.R. Groenhuijzen (eds.) *Finding the Limits of the Limes: Modelling Demography, Economy and Transport on the Edge of the Roman Empire*. Cham: Springer, p. 217-249. https://doi.org/10.1007/978-3-030-04576-0_11

JUNE 15th

18:30 – 18:50

The antiquities in Phocis and Boeotia described by Gell and Dodwell

Zafeirios Avgeris

18:50 – 19:10

A methodological approach for Intra - Site Analysis of Spatial Organization of Thessalian Neolithic Settlements

Maria Cristina Manzetti, Apostolos Sarris

19:10 – 19:30

Fuzzy chronologies in longitudinal network studies

Daniela Greger

19:30 – 19:50

Exploring visual signalling networks of Medieval strongholds in Garhwal Himalaya, India

Tom Brughmans, Nagendra Singh Rawat, Vinod Nautiyal

16th JUNE

15:00 – 15:20

On the calibration of least cost path models: a large-scale simulation of boat and wagon transport in late Iron Age Gaul

Fabrice Rossi, Clara Filet

15:20 – 15:40

Evaluating the Effects of Randomness on Missing Data in Archaeological Networks

Robert Bischoff, Claudine Gravel-Miguel, Cecilia Padilla

15:40 – 16:00

Mathematical modeling of spreading processes on archaeological networks

Natasa Djurdjevac Conrad

16:00 – 16:20

Roads and rivers. The importance of regional transportation networks for early urbanization in central Italy (1000-500 BC)

Francesca Fulminante, Luce Prignano

S9. Digital fieldwork: technologies, methods and good practices (Standard)

Convenor(s):

Łukasz Misk, Jagiellonian University in Kraków

Wojciech Ostrowski, Warsaw University of Technology

Tuesday, June 15, Palaepaphos

11:50 – 14:20, 15:00 – 16:30

The present digital revolution and its applications in archaeology have fundamentally changed the ways in which we conduct archaeological work. We encounter these changes in many aspects of practice (Tspidis et al. 2011; Forte et al. 2012; Berggren et al. 2015. Katsianis et al. 2015):

Technological aspect: using constantly upgraded hardware and software, Spatial aspect: broad implementation of a wide range of geodetic tools, e.g. GNSS technology, enabling the global georeferencing of various spatial data, has already become almost as popular as the use of local site coordinates, Methodological aspect: the use of diverse recognized methods of archaeological science has a huge impact on the field work, including processes of data acquisition and further data processing (sampling, documenting), The 'big data' aspect: concerns archaeological data management in the context of its rapid growth, as well as diversification of data formats and electronic data carriers, Logistic aspect: connected i.a. with the necessity to possess the appropriate human resources (qualified professionals) and fitting digital solutions (information-storage capacity), as well as funding applications and planning project finances.

Among the achievements of contemporary technology, modern digital methods of 3D stratigraphic documentation, enabling the registering of excavation as it progresses, through the implementation of 3D reality modelling solutions, e.g. photogrammetry, laser scanning (Forte et al. 2012; Dell'Unto 2014; Berggren et al. 2015; Opitz 2015), seem to have the biggest impact on how we conduct the whole process of archaeological work across all aspects noted above. These methods influence the equipment used during the fieldwork, dictate the necessary software, and lead to constructing custom-tailored archaeological databases for the projects. Documenting the excavation by means of photogrammetry or with the application of GIS databases is slowly becoming a standard. That is why 3D documentation experiences have repeatedly been presented and discussed during CAA meetings. However, the majority of papers given so far on the topic have focused only on the technical aspects of this change in practice. We emphasize that the presented modern technology solutions are mainly focused on the possibilities of photogrammetry itself, and many times these seem non-complementary to the whole archaeological research process, which should be digitally enabled, as well as, including basic documentation procedures.

Therefore, for this session, we invite papers focusing on further steps of modern digital fieldwork rather than on simple data acquisition or processing. The presented papers should respond to the following questions: How does data acquisition influence fieldwork? How are 3D stratigraphic data stored and combined with other data (concerning architecture, movable finds, archaeometric analyses etc.)? How are 3D and all other data visualized, analysed and shared? What are the results of these analyses? How are these results disseminated between the research team members?

The proposed session would welcome:

Papers presenting complete photogrammetric (or other reality modelling technology) solutions which have already been practically tested during archaeological fieldwork; examples of methods application on a big scale, i.e. on vast excavation areas, for teams composed of many people etc., would be especially interesting and most welcome.

Papers presenting holistic solutions of acquiring archaeological data and data management afterwards (such as examples of various custom-tailored databases, as well as technological solutions applied within them), and also ways of data post-processing and analysing.

Papers concerning various practical aspects of human resources challenges encountered within archaeological team work, such as human work organisation during the whole project, securing of appropriately qualified staff, as well as, enabling smooth cooperation and data exchange within the team.

Presentations of specific projects with their goals, challenges and solutions applied would be most welcome.

References

- Barcelo J.A., De Castro O., Travet D. and Vicente O. 2003. A 3D Model of an Archaeological Excavation. In M. Doerr and A. Sarris (ed.), *The Digital Heritage of Archaeology. Computer Applications and Quantitative Methods in Archaeology. Conference on Computer Applications and Quantitative Methods in Archaeology, Greece: Archive of Monuments and Publications, Hellenic Ministry of Culture*
- Berggren Å., Dell'Unto N., Forte M., Haddow, S. Hodder I., Issavi, J., Lercari N., Mazzucato C., Mickel A. and Taylor, J. 2015. Revisiting reflexive archaeology at Çatalhöyük: Integrating digital and 3D technologies at the trowel's edge. *Antiquity*, 89/344, 433-448.
- Dell'Unto N. 2014. The Use of 3D Models for Intra-Site Investigation in Archaeology. In S. Campana, F. Remondino, *3D Recording and Modelling in Archaeology and Cultural Heritage, BAR IS*, 151-158.
- Forte M., Dell'Unto N., Issavi J., Onsurez L., Lercari N. 2012. 3D Archaeology at Çatalhöyük. *Journal International Journal of Heritage in the Digital Era*, 1.
- Katsianis M., Tspidis S. and Kalisperakis I. 2015. Enhancing Excavation Archives Using 3D Spatial Technologies. In C. Papadopoulos, E. Paliou, A. Chrysanthi, E. Kotoula and A. Sarris (eds) 2015, *Archaeological Research in the Digital Age. Proceedings of the 1st Conference on Computer Applications and Quantitative Methods in Archaeology Greek Chapter (CAA-GR)*, 46-54.
- Opitz R. 2015. Three Dimensional Field Recording in Archaeology: An Example from Gabii, In: B. R. Olsen and W. R. Caraher (eds), *Visions of Substance: 3D Imaging in Mediterranean Archaeology*, 73-87.
- Tspidis S., Koussoulakou A. and Kotsakis K., 2011. Geovisualization and Archaeology: supporting excavation site research. In A. Ruas (ed.) *Advances in Cartography and GIScience. Volume 2: Selection from ICC 2011*, 85 – 107.

JUNE 15th

11:50 – 12:10

AtticPOT: a borderless approach for studying Attic painted pottery in ancient Thrace

Natasa Michailidou, Despoina Tsiafaki, Kostas Stavroglou, Ioannis Mourthos, Melpomeni Karta, Markos Dimitzas

12:10 – 12:30

The Aide Memoire Project: Drawing and Archaeological Knowledge Production

Colleen Morgan, James Taylor, Holly Wright, Helen Petrie

12:30 – 12:50

The deep end of the FAIR principles – making legacy GIS documentation from excavations interoperable and reusable

Daniel Lowenborg, Gísli Pálsson, Åsa M Larsson, Maria Jonsson, Marcus Smith

12:50 – 13:10

Developing an efficient and “sustainable” method for 3D stratigraphic documentation: issues and advantages of a digital process. The case study of the medieval site of Vetricella, Italy

Giulio Poggi, Fabrizio Falchi, Luisa Russo, Mirko Buono, Lorenzo Marasco

13:10 – 13:30

LiDAR and RGB airborne orthophotos coverage and visualization and automatic recognition of archeological findings in Kephissos /Phokis

Geosystems Hellas

13:30 – 13:50

Archeometry, Science and Technology Applied to the study of rupestrian architecture. New Conclusions About The rupestrian monastery of St Pedro of Rocas in the Ribeira Sacra (Galicia, Spain)

Jorge López Quiroga, Natalia Figueiras Pimentel

13:50 – 14:10

Between two worlds. Implementation of various survey methods and their impact on the research process on both sides of the Vistula river in Lesser Poland

Jan Bulas, Magdalena Okońska-Bulas, Marcin Przybyła

14:10 – 14:30

Reconstructing Bell Beaker funerary practices and burial taphonomy: applying digital 3D tools in the re-analysis of old field documentation from the site of Oostwoud-Tuithoorn, West-Frisia

Hayley L Mickleburgh, Harry Fokkens

LUNCH BREAK

15:10 – 15:30

Digital photogrammetric capture of the IS looters' tunnels under the Nebi Yunus Mausoleum, Mosul: its challenges, benefits, and further potential
Juan Aguilar, Stéphane Bordas

15:30 – 15:50

Digital Data Curation Model: Designing a Unified Framework for Archaeology
Tugce Karatas

15:50 – 16:10

Invisible Heritage - Analysis and Technology Platform. A multi-sensors documentation of the UNESCO listed churches in Troodos (Cyprus)
Dante Abate, Kyriakos Toumbas, Marina Faka

16:10 – 16:30

The Byzantine City of Mystras: The South West Gate to Hagia Sophia Monastery
Vayia V. Panagiotidis, Nikolaos Zacharias

S10. Modelling socio-ecological dynamics of past societies: recent advancements and new perspectives (Standard)

Convenor(s):

Marta Krzyzanska, University of Cambridge

Leah Brainerd, University of Cambridge

Thursday, June 17, Amathous

11:50 – 14:20

This session aims to explore the diversity of computational methods used to model the relationship between environmental factors, subsistence systems and the socio-economic organisation of past societies. Ranging from studies focused on the impact of landscape characteristics and resources availability on mobile and semi-mobile societies, to those concerned with the resilience of agricultural strategies and the rise and collapse of complex socio-political systems in the context of changing environmental conditions: human-environmental interactions and the responses and adaptations to environmental change have been major themes in archaeology across different time periods and geographic locations.

Computational modelling and statistical analysis have been commonly applied in these contexts and provide major contributions to their research. For example, agent-based modelling helps to explore the dynamics of human socioecological systems while models correlating paleoenvironmental and archaeological data provide insight into the relationship between cultural and environmental change and populations dynamics. The increasing availability and improved spatial and temporal resolution of paleoenvironmental reconstructions also enables a more widespread use of models derived from ecology, such as ecological niche models, which stimulates further methodological developments.

We are looking to bring together papers that showcase the advances in the modelling of dynamics between human societies and the environment either through specific archaeological case studies or broader methodological reflection. This may include papers that integrate archaeological and paleoenvironmental records to reveal the patterns of correlation between the two or model the availability of resources in the landscape, or papers that explicitly model the dynamics of human socioecological systems and the effects of environmental change on the organisational structure of past societies and their subsistence strategies.

We also invite studies concerned with the methodological developments, either through the critical reflection on, and the improvement of existing methods of analysis, or via new modelling approaches and the novel applications of computational methods used in the context of human-environmental interactions. We also welcome papers concerned with the quality of available environmental and archaeological data, which explore its impact on performance and the results of existing models, for example through the sensitivity analysis or by explicitly modelling uncertainty in the data.

JUNE 17th

11:50 – 12:10

The application of Neyman-Scott Cluster Process in landscape archaeology

Filippo Brandolini, Stefano Costanzo, Andrea Zerboni, Habab Idriss Ahmed, Andrea Manzo

12:10 – 12:30

Using Supervised Machine Learning for Modelling Early Neolithic Survival Probability: a Bayesian Networks approach

Olga Palacios, Juan Antonio Barceló, Rosario Delgado

12:30 – 12:50

IndusVillage. Modelling cropping strategies and climate change in rural settlements of the Indus Civilisation

Andreas Angourakis, Jennifer Bates, Jean-Philippe Baudouin, Alena Giesche, Joanna Walker, M. Cemre Ustunkaya, Nathan Wright, Ravindra Nath Singh, Cameron Petrie

12:50 – 13:10

Modelling cooperative gathering behavior of early hominins, using comparative recent hunter-gatherer behavior

Jan-Olaf Reschke, Christine Hertler, Ericson Hoelzchen

13:10 – 13:30

Productive Paddies: Understanding the Spread of Rice Farming during the Yayoi Period in Japan through Modelling of Productivity and Habitat Suitability

Leah Brainerd, Enrico R Crema, Marco Madella, Akihiro Yoshida

13:30 – 13:50

Nonequilibrium dynamics in models of human palaeoecology

Joe Roe

S11. Advances in Digital and Computational Archaeology in Taiwan and Neighboring Regions (Standard)

Convenor(s):

Li-Ying Wang, University of Washington

Mu-Chun Wu, National Taiwan University

Wednesday, June 16, Kourion

11:50 – 14:20

The application of digital and computational methods in Taiwan archaeology is experiencing an impressive expansion. As the potential origin of the Austronesians spreading across the Pacific Ocean, and a marine transit point from continental Asia into Japan, Taiwan archaeology is at the heart of understanding maritime trade, cultural diffusion and prototypes. Recent developments in digital archaeology and cultural heritage, as well as advances in spatial analysis and network sciences in Taiwan have all proven fruitful.

With the prospect to build bridges in order to facilitate dialogue with colleagues focusing research in and around Taiwan, this session aims to promote the advances in digital and computational archaeology in Taiwan and its neighboring regions.

This session is open to studies dealing with all periods of archaeological interest that relates to Taiwan and its neighboring regions, as well as theoretic and methodological contributions towards digital heritage, GIS, network science, ABM in this region. The presentation of in progress projects, experimental proposals, and theoretical explanations are also welcome.

JUNE 16th

11:50 – 12:10

From Ritual Landscape to Ritual Practice: Integrating Multi-Technique Recording in a Complex Landscape

Muchun Wu, Karl Smith, John Pouncett

12:10 – 12:30

Dynamic Social Structure of Old-Kucapungane: New Approach of Space Syntax with Network Analysis for Taiwan Abandoned Settlement, Kucapungane

Chung Yu Liu

12:30 – 12:50

A GIS-based approach with data visualization to reconstruct a historical district: A case study of Chikan Tower in southwestern Taiwan

Albert Liu

12:50 – 13:10

A Bayesian network modeling approach to examine social changes using burial data

Liyang Wang, Ben Marwick

13:10 – 13:30

A southern-route model of modern human migrations to the Japanese Archipelago using GIS approaches

Atsushi Noguchi

13:30 – 13:50

3D Restores the Lost — Application of 3D Digital Restoration in Taiwan Archaeology

Chang-keng Yeh

13:50 – 14:10

The problems of chronological uncertainty: Using Bayesian approaches to investigate the demography and settlement patterns of the Jomon Period of Japan

Charles Simmons, Erik Gjesfjeld, Simon Kaner, Enrico R Crema

S12. Digital Infrastructures and New (and Evolving) Technologies in Archaeology (Roundtable)

Convenor(s):

Holly Wright, University of York

Achille Felicetti, University of Florence, PIN

Ceri Binding, University of South Wales

Tuesday, June 15, Tombs of the Kings

11:50 – 14:20

Following on from the successful Digital Infrastructures for Archaeology: Past, Present and Future directions session in Krakow, the ARIADNEplus project invites participants to present and discuss the role of new technologies in digital infrastructures. Investment in new and evolving technologies within persistent digital infrastructures represents significant investment, and requires a firm understanding of the potential risks and rewards. This roundtable will consist of 10-minute presentations about the pros and cons of a technology already in use within an archaeological data infrastructure, or the introduction of a new technology that has potential for use within infrastructures.

Technologies may include, but are not limited to, Linked Data, Natural Language Processing, Image Recognition and other types of machine/deep learning. This will be followed by discussion around the challenges and potential usefulness of these technologies within archaeological data infrastructures, as we chart a course for current and future best practice.

Details will follow soon...

S13. Our little minions, part 3: small tools with major impact (Other)

Convenor(s):

Ronald Visser, Saxion University of Applied Sciences

Moritz Mennenga, Lower Saxony Institute of Historical Coastal Research

Florian Thiery, Römisch-Germanisches Zentralmuseum

Wednesday, June 16, Palaepaphos

11:50 – 14:30

In our daily work, small self-made scripts, home-grown small applications and small hardware devices significantly help us to get work done. These little helpers – “little minions” – often reduce our workload or optimise our workflows, although they are not often presented to the outside world and the research community. Instead, we generally focus on presenting the results of our research and silently use our small tools during our research, without even pointing to them, and especially not to the source code or building instructions.

This session will focus on these small helpers – “little minions” – and we invite researchers to share their tools, so that the scientific community may benefit and – perhaps – create spontaneously “special minion interest groups”.

As we have seen in the last year’s “minion talks” there is a wide range of tools to be shared. These may be perfect examples for your own minion creation. A constantly expanding list of little minions can be found at <https://github.com/caa-minions/minions>.

At CAA international 2018 in Tübingen, a normal session (see S6 [LH18]) spontaneously became a “Stand-up-Minion” lightning talk with a lot of nice pieces of source code, small tools and open/free software extensions for proprietary products. In 2018 we saw a tool for photogrammetric rectification of profile images of archaeological excavations, digital tools behind Bonify, and database solutions for excavations.

In Krakow at CAA international 2019, a lot of little minions of various research domains were published to the research community (see O29 [JUK19]). Martina Trognitz gave a deeper insight into Wikidata as a LOD minion addressing a “Linked and Open Bibliography for Aegean Glyptic in the Bronze Age”. In terms of text mining, Ronald Visser showed his “little text mining minion”. Florian Thiery and Allard Mees presented two small time minions to tame relative chronology and vague information in graph modelling using “Taming Time Tools: Alligator and Academic Meta Tool”. A minion to do “serial, fast and low cost 3D pottery on site documentation” was presented by Fanet Göttlich. Furthermore, Bart Vissers presented the minion “CpyPst3D: a tool for direct exchange of 3D features with attributes between GIS, 3D-modeling environment and CAD”. Spontaneous minions were additions to profileAAR by Moritz Mennenga, the use of Heurist for collecting minions by Ian Johnson and a little minion by Gary Nobles to create a 3D volume object from point clouds of laser scans of excavation trenches.

This session invites short presentations, lightning talks – aka “minion talks” (max. 10 minutes including very short discussion) – of small coding pieces, software or hardware solutions, not only focusing on field work or excavation technology, associated evaluation or methodical approaches in data driven

archaeology. Each “minion talk” should explain the innovative character and mode of operation of the digital tool. The only restriction is that the software, source code and/or building instructions are open and are or will be freely available (e.g. GitHub, GitLab, etc.). Proprietary products cannot be presented, but only open and freely available tools designed for them.

We invite speakers to submit a short abstract including an introduction into the tool, the link to the repository to get access to the source code and an explanation which group of researchers could benefit from the little minion and how. The tools may address the following issues, but are not limited to, data processing tools and algorithms, measuring tools, digital documentation tools, GIS-Plugins, hands-on digital inventions (for excavations) and data driven tools (e.g. Linked Data, CSV, Big Data). After previous years’ (pt.1 at CAA 2017 Tübingen and pt.2 at CAA 2018 Krakow) spontaneous success of “Stand-up-Science”, you will also have the opportunity to spontaneously participate and demonstrate what you have on your stick or laptop. If you want to participate without an abstract in the spontaneous section of the session, please send an email to us (even shortly before the conference). Please come and spontaneously introduce your little minion!

The minion session is designed for technically interested researchers of all domains who want to present their small minions with the focus on the technical domain and also for researchers who want to get ideas about what kinds of little minions are available to help in their own research questions, with the possibility to create spontaneously little minion special interest groups. All of us use minions in our daily work, and often tools for the same task are built multiple times. The reason for this reproduction is often that the focus in talks are on the projects and not on the technical details. This session gives these tools that are considered too unimportant to be presented in the normal talks, but take important and extensive steps in our research, a slot.

As an outcome of the session, all presented tools and links to code repositories will be available for the CAA research community. We will also collect all little minions in a “CAA little minion catalogue” (<http://littleminions.link>) available for the public and extended in the future on a GitHub repository at <https://github.com/caa-minions/minions>.

References

[JUK19] Institute of Archaeology of Jagiellonian University in Kraków 2019 CAA 2019 Kraków. Check Object Integrity. Book of Abstracts. Available at https://2019.caaconference.org/wpcontent/uploads/sites/25/2019/04/CAA2019_programabstracts_v20190423.pdf [Last accessed 18 July 2019].

[LH18] Lang, M., Hochschild, V. 2018 Abstracts CAA Tübingen 2018. Available at <https://2018.caaconference.org/wp-content/uploads/sites/22/2018/03/AbstractBook.pdf> [Last accessed 18 July 2019].

JUNE 16th

11:50 – 12:10

Democratization of Knowledge from Small Museums Online Digital Collections Reusable Human and Machine-Readable Content Models

Avgoustinos Avgousti, Georgios Papaioannou, Nikolas Bakirtzis, Sorin Hermon

12:10 – 12:30

ChronochRt –make chronological charts with R

Thomas Rose, Chiara G. M. Girotto

12:30 – 12:50

re3dragon – REsearch REsource REgistry for DataDragons

Florian Thiery, Allard Mees

12:50 – 13:10

geoCore - A QGIS plugin to create graphical representations of drillings

Moritz Mennenga, Gerrit Bette

13:10 – 13:30

APE – ArboDat Pangaea Export

Moritz Mennenga

13:30 – 13:50

Grading minion to the rescue

Ronald Visser

13:50 – 14:10

My little Linked Open Data Ogham Minion: visualising graph data connections using SPARQL endpoints

Florian Thiery

14:10 – 14:30

Introducing a stature estimation tool for human skeletal material to the public

Mariana Koukli, Vasileios Sevetlidis, Frank Siegmund, Christina Papageorgopoulou, George P Pavlidis

S14. Bayesian Approaches to Archaeological Questions (Standard)

Convenor(s):

Martin Hinz, Institut für Archäologische Wissenschaften, Universität Bern

Caroline Heitz, Institut für Archäologische Wissenschaften, Universität Bern

Mirco Brunner, Institut für Archäologische Wissenschaften, Universität Bern

Nils Müller-Scheeßel, Institut für Ur- und Frühgeschichte, Christian-Albrechts-Universität Kiel

Thursday, June 17, Kourion

15:00 – 16:40

It is now about 30 years since Bayesian techniques triggered a revolution in 14C calibration (Buck et al. 1991), and at about the same time the first Bayesian approaches were applied beyond pure dating questions. The methodology for archaeology was then introduced to the archaeological public 25 years ago by Buck et al. (1996) in a comprehensive textbook. It may be time now, and since we have two anniversaries to celebrate, also a good opportunity to sum up the current state and new developments in this field and to discuss future developments.

Which of the high-flying expectations of the pioneering days has been confirmed, which developments have led to dead ends? What does Bayesian statistics do today in archaeology, what is its significance in relation to chronological questions, but above all, where is it otherwise applied besides this field? Where are there still development potentials, and how can Bayesian thinking fertilize archaeological discussions? What are new, exciting and innovative fields in which Bayesian approaches can prove themselves in the future?

For this session, we invite presentations that explore the limits and possibilities of Bayesian statistics in and outwith the context of chronological questions, emphasizing those that involve these procedures beyond the scope of dating archaeological objects, features or sites (e.g. analysis of satellite, bioarchaeological, demographic and spatial data, hypothesis testing, and in material culture studies). We would like to explore how the methods from this field of statistics, the influence of which in general is growing in scientific research, and the thinking associated with it can enrich the archaeological sciences in general, and where the potential for the next revolution lies.

References

Buck, C.E., Kenworthy, J.B., Litton, C.D., Smith, A.F.M., 1991. Combining archaeological and radiocarbon information: a Bayesian approach to calibration. *Antiquity* 65, 808–821.

<https://doi.org/10.1017/S0003598X00080534>

Buck, C.E., Cavanagh, W.G., Litton, C.D., 1996. Bayesian approach to interpreting archaeological data, *Statistics in practice* J. Wiley and Sons. John Wiley, Chichester [etc.].

JUNE 17th

15:00 – 15:20

nimbleCarbon: An R package for fitting and comparing demographic Bayesian growth models of radiocarbon dates

Enrico R Crema

15:20 – 15:40

Reversing Bayesian Forecasting: developing a tool for prehistoric population estimates

Martin Hinz, Caroline Heitz

15:40 – 16:00

Estimating the Age and Sex Composition of Zooarchaeological Assemblages with Bayesian Mixture Models

Jesse L. Wolfhagen

16:00 – 16:20

Patterns of Trauma - A proof of concept using AI to distinguish interpersonal violence from accidental injury

Chiara G. M. Giroto, Henry C. W. Price, Martin Trautmann

16:20 – 16:40

Bayesian models of compositional data: the case of pre-Hispanic goldwork in Colombia
Jasmine Vieri, Enrico R Crema, María Alicia Uribe-Villegas, Juanita Sáenz-Samper, Marcos Martín-Torres

S15. Archaeological Exploration of Digital Spaces (Standard)

Convenor(s):

Lauren Herckis, Carnegie Mellon University

Thursday, June 17, Amathous

15:00 – 15:30

16:50 – 18:20

The lives people live in digital environments has been a topic of fascination for decades and a focus of analysis for nearly as long. A meaningful “place” where people interact might not always correspond to a specific physical space. Relationships are shaped, power is deployed, and culture unfolds in places that are imbued with cultural value through human activity. Anthropologists now incorporate digital ethnographies, online tracing, and other methods for understanding behavior in digital environments. In the field of social computing, the notion that meaningful places may exist without a corresponding physical space instigated a paradigm shift away from spatial models more than twenty years ago (Harrison and Dourish 1996). In these and other disciplines, new methods of understanding our lives online have rapidly proliferated. The translation of archaeological methods for use in spaceless places is a vital step for the advancement of archaeological science, and a promising new avenue of exploration.

Archaeological methods encompass the many ways that we derive meaning from the traces that people leave behind. These include the footprints, the rubbish, the spent tools and broken bits. Ours is the science of learning about people who have left the room, using any reliable means we can imagine. Anthropological archaeology is uniquely positioned to expand our understanding of ancient cultures by analyzing the residues of past behavior and explicating the relationships between sweeping social structures and an individual’s daily practice. Archaeological methods enable us to describe the cultural, biological, and technological constraints on daily lives, and to detail the myriad ways that human beings exercise their agency despite these constraints. When we want to understand how and why technologies or social organization have changed over centuries, or how these parallel processes are in fact manifestations of the same cultural developments, we turn to archaeological methods. For the past four decades, archaeology has been used to contextualize contemporary practices with regards to larger social systems and historic processes. Behavioral archaeology explains how cultural and economic forces led to the early 20th century dominance of the combustion engine. Garbagology provides a window into the relationship between consumption of perishable goods and economic stress in the United States today.

As a field, archaeology rests on a foundation of potsherds and lithic fragments. Archaeological methods derive from the analysis of physical artifacts. Their power is evident in the inferences we draw from analyzing these assemblages. Archaeological theory explores the nature of relationships between humans and the places and things that matter to us, sometimes waxing philosophical about the very thingness of things and the placeness of places (Hodder 2012). In the twenty-first century, people use immaterial objects in their daily lives. In the next hour, I might coordinate family dinner plans using a group chat, work with a colleague on another continent to collaboratively edit an academic paper, or visit an in-game “location” to see if friends are “around” so that I can “spend time with” them. These metaphorical places offer opportunities to experience meaningful encounters with

people who play important roles in my life. Cultural anthropologists readily understand them to be culturally significant second and third places. Activities that take place in spaceless places include relationship building, information sharing, teaching, learning, participating in local and global economies, politics of all sorts, factionalism of many kinds, planning and other collaboration, actual construction of digital artifacts, and identity-crafting. The traces of these activities are largely intangible. Archaeology has only begun to account for some of these new ways of living. These new spaceless archaeological sites require that we translate our methods and extend our theory to understand behavior in the contemporary world. We can imagine a distinction between two different kinds of digital archaeological sites. Some digital places look like three-dimensional spaces. Many videogames, for example, require navigating apparent landscapes and encountering landmarks, participating in social encounters, and engaging with digital objects. Other digital places have no apparent landscape. Chat rooms, for example, may have a spatial metaphor without a visual component: individuals enter, interact, and leave. Meaningful interactions take place here, but there is no illusion of space.

Digital landscapes that are designed to resemble the natural world invite archaeologists to imagine virtual excavations, survey projects, and other traditional archaeological field methods, rendered in virtual archaeological sites. The place can be mapped, the activities that take place “within” the “site” can be located (eg, Reinhard 2018). But the distinction between these two kinds of digital environments is only a difference in the metaphors we can use to describe them. A long trek toward a distant in-game horizon may lead, inexorably, to the place where it began. A doorway in a virtual room may open into the room it also exits. Bodies may not decay. Objects may disappear. No digital environment is governed by the same physics, or bound by the same depositional processes, as the sites for which archaeological methods were developed. Analysis of archaeological sites has always depended on our understanding of geology and ecology, but analysis of intangible artifacts and dimensionless archaeological sites requires us to trade these sciences for a new set of rules imagined and instantiated by other contemporary people.

Cultural processes, however, do extend into spaceless places. Archaeology is uniquely positioned to make sense of human culture and to contextualize the use of these new kinds of places within larger social systems and long-term change. For example, *chaîne opératoire* is used to reconstruct technique, power differentials, and collaborative labor through the analysis of debitage and other physical artifacts. *Chaîne opératoire* can be effectively applied to collaborative writing by quantifying, classifying, and carefully analyzing editorial changes and other artifacts of labor in an Overleaf or Google document. An archaeology of spaceless places is necessary to make sense of the relationships of power and trajectories of technological change in the recent past. Archaeology of digital environments is a developing body of method and theory that will open new avenues for applied and collaborative archaeological inquiry, especially in emerging domains such as the design of virtual worlds.

References

Harrison, Steve R., and Paul Dourish. “Re-place-ing space: The roles of place and space in collaborative systems.” In *CSCW*, vol. 96, pp. 67-76. 1996.

Hodder, Ian. *Entangled: an archaeology of the relationships between humans and things*. John Wiley & Sons, 2012.

Reinhard, Andrew. *Archaeogaming: An introduction to archaeology in and of video games*. Berghahn Books, 2018.

JUNE 17th

15:00 – 15:20

Exploring 'humAI'n' correspondences with digital spaces through archaeological theory and creative practice

Eloise Govier

15:20 – 15:40

Digital space: archaeological reflections upon the myELeusis project

Despoina Tsiafaki, Ioannis Mourthos, Chairi Kiourt, Akrivi Katifori, Natasa Michailidou, Paraskevi Motsiou, Anestis Koutsoudis, Katerina Servi

15:40 – 16:00

Videogames as what kind of artefact? Establishing effective methodologies for a solid practice of archeogaming

Benjamin Hanussek

16:00 – 16:20

Teaching Archaeology Through Digital Games: The Last Banquet in Herculaneum

Amanda Pina, Alex da Silva Martire, Maria Isabel D' Agostino Fleming

COFFEE BREAK

16:50 – 17:10

Archaeology of Spaceless Places

Lauren Herckis

17:10 – 17:30

Crafting Past Places: Reimagining archaeology as usual through Minecraft

Angus Mol, Manda Forster, Aris Politopoulos, Sybille Lammes

17:30 – 17:50

Geospatial archaeological information visualization and Mixed Reality: Enhancing visitors' meaningful engagement with archaeological sites

Stella Sylaiou, Nikos Trivyzadakis, Nikos Evangelidis, Theofilos Papadopoulos

S16. Problem and Project-based learning in Digital Archaeology Pedagogy (Standard)

Convenor(s):

Costas Papadopoulos, Maastricht University

Ronald Visser, Saxion University of Applied Sciences

Thursday, June 17, Kourion

11:50 – 14:20

Teaching Digital Archaeology (DA) as a subject as well as teaching archaeology-related subjects using digital approaches has the potential to empower students with the skills and competencies required to become producers rather than passive consumers of knowledge (Cocco 2006). Despite the fact that much DA teaching utilises real-world examples, artefacts, and documentary sources, we argue that the full pedagogic potential of experiential learning (Kolb 1984; Wurdinger 2005) within a DA classroom (or a traditional archaeology classroom employing a DA ethos) can be achieved within a problem/project-based learning (PBL) environment.

PBL constructs a framework through which students engage with authentic challenges (Bell 2010; Herrington & Herrington 2007; Stein 1998) in a student-led, collaborative, engaged, and reflective environment. Teaching this way can be challenging, with student projects potentially collapsing due to a variety of managerial, technological, or interpersonal issues. As Wurdinger (2005, 69) states: 'outcomes of the learning process are varied and often unpredictable'. Yet, despite the potential pitfalls, providing situated and experiential learning opportunities which make students responsible for their own learning (Chapman et al. 1995) has the potential for their weaknesses to become strengths hence improving their practice (Ertmer & Simons 2005).

While Digital Humanities (DH) has embraced the ethos of the Maker Culture, there is little consensus (Whitson 2015) regarding how learning by making and doing can empower students to become critical thinkers and makers (Ratto 2011) through self-reflexivity and problem solving. Creating a collaborative and experiential learning environment, on the other hand, through PBL, in which students work together to complete an end product that materialises their knowledge and understanding (Helle et al. 2006) is designed to achieve this. Finally, the process of co-creation and the management challenges (above and beyond the technical skills being imparted) that collaborative projects pose, provide students with new mechanisms to critically respond to different situations as well as with the necessary competencies for careers in academia and the private sector (Cain & Cocco 2014).

Teaching DA or DH within a PBL environment changes the role of a traditional teacher: from an instructor to a facilitator and coaching expert. This poses different challenges for the teachers, since they have to rethink their role within the classroom and adapt their teaching practices. Instead of teaching a traditional course, teachers need to (learn to) select problems/projects that are suited to the Intended Learning Outcomes of the curriculum. PBL can also better address the challenge of teaching digital natives (Visser et al. 2016); as students are at the center of the pedagogical process, they can develop a learning trajectory that suits their skills, needs, and experiences.

This session builds on the discussions carried out in CAA2019 as part of S08: Teaching Digital Archaeology in which speakers and participants reflected on issues related to traditional classes, different modalities of teaching, the evolving role of instructors as coaches and facilitators, the value of exposing students to real-world problems, successes and failures of experimental approaches to teaching, digital natives and digital immigrants, and students as owners and producers.

This session invites all teachers in DA or DH who employ or have employed problem- and project-based learning approaches in their teaching, as well as students who have experienced such teaching and learning methods. Speakers are welcome to present specific class problems and projects, however, the focus should be on the lessons learnt and the pedagogical dimension of using such approaches in undergraduate/postgraduate teaching programmes and training sessions (e.g. workshops, masterclasses, hackathons etc.). It would be an important addition if speakers would not only show successes, but also instances where PBL failed. Session organisers envision short, 10-minute reflexive presentations and an informed discussion on the potential and challenges of problem- and project-based approaches to teaching digital archaeology.

References

Bell, S. (2010). Project-based learning for the 21st Century: Skills for the Future. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, 83(2): 39-43.

Cain, K. & Cocco, S. (2014). Leadership Development through Project Based Learning. In *Proceedings of the Canadian Engineering Education Association Conference - École Polytechnique de Montréal June 2013*.

Chapman, S., McPhee, P., & Proudman, B. (1995). What is Experiential Education?. In Warren, K. (Ed.), *The Theory of Experiential Education* (pp. 235-248). Dubuque: Kendall/Hunt Publishing Company.

Cocco, S. (2006). *Student Leadership Development: The Contribution of project-based learning*. Thesis, Royal Roads University, Canada.

Ertmer, P.A. & Simons, K.D. (2005). Scaffolding Teachers' Efforts to Implement Problem-based Learning. *International Journal of Learning*, 12(4): 319-328.

Helle, L., Tynjälä, P. & Olkinuora, E. (2006). Project-Based Learning in Post-Secondary Education – Theory, Practice and Rubber Sling Shots. *Higher Education*, 51(2): 287-314.

Herrington, A. J. & Herrington, J. A. (2006). What is an authentic learning environment?. In A. J. Herrington & J. A. Herrington (Eds.), *Authentic learning environments in higher education* (pp. 1-13). Hershey, PA: Information Science Publishing.

Kolb, D.A. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. Financial Times/Prentice Hall, New Jersey.

Ratto, M. (2011). Critical Making: Conceptual and Material Studies in Technology and Social Life, *The Information Society*, 27(4), 252-260, <https://doi.org/10.1080/01972243.2011.583819>

Stein, D. (1998). Situated learning in adult education. <http://www.ericdigests.org/1998-3/adult-education.html>

Visser, R.M., van Zijverden, W.K., Alders, P.G. (2016). Teaching digital archaeology digitally, In S. Campana, R. Scopigno, G. Carpentiero, M. Ciollo (Eds), CAA2015. Keep the Revolution Going. Proceedings of the 43rd Annual Conference on Computer Applications and Quantitative Methods in Archaeology. Archaeopress, Oxford, 11–15.

Whitson, R. (2015). “Critical Making in the Digital Humanities”, In J. Wolfreys (Ed). *Introducing Criticism in the Twenty-First Century*. Edinburgh: Edinburgh University Press. 157-177.

Wurdinger, S.D. (2005). *Using Experiential Learning in the Classroom*. Lanham: Scarecrow Education

JUNE 17th

11:50 – 12:10

Digital archaeology: Where should we start from?

Emeri Farinetti, Francesca Chelazzi

12:10 – 12:30

Challenging Students and Teachers with Interdisciplinary Projects

Ronald Visser

12:30 – 12:50

Digital Iron Age: Data Analysis Using Mysql, QGIS, And R

Caroline von Nicolai, Stephan Luecke

12:50 – 13:10

XRchaeology: The Pros and Cons of AR/VR/XR Learning Tools in Archaeology Education

Kayeleigh Sharp, Grant Miller, Bijay Raj Paudel, Upesh Nepal, Salvador Orozco Gonzalez

13:10 – 13:30

Digitizing Delphi: A Case Study in Virtual Reality Pedagogy

Robert P. Stephan

13:30 – 13:50

Integrating digital and on-field activities in archaeological training

Paola Derudas

S17. Tools for the Revolution: developing packages for scientific programming in archaeology (Standard)

Convenor(s):

Joe Roe, University of Copenhagen

Martin Hinz, University of Bern

Clemens Schmid, MPI-SHH

Wednesday, June 16, Salamis

11:50 – 14:20

Organised on behalf of the CAA ‘Scientific Scripting Languages in Archaeology’ special interest group (SIG-SSLA)

The increasing use of scientific programming languages (e.g. R or Python) is transforming the practice of quantitative archaeology. This “tool-driven revolution” (Schmidt and Marwick 2020) promises to greatly improve the accessibility, power, and reproducibility of computational analyses. It is a core component of the “Third Science Revolution” (Kristiansen 2014), which has major theoretical and practical implications for the discipline of archaeology as a whole.

That said, a tool-driven revolution dies without robust and versatile tools. As inveterate methodological borrowers, we can frequently rely on implementations in other fields, but the adoption of scripted analysis also reiterates the long-established need for methods designed specifically for archaeological data and archaeological problems (Kintigh 1987; Aldenderfer 1998).

Recent years have seen a proliferation in packages developed by and for archaeologists (e.g. <http://open-archaeo.info/>). An increasing number of computational archaeologists therefore find themselves not only in the role of analyst, but also that of a ‘research software engineer’ (Baxter et al. 2012); not just using tools, but making them.

The distinct set of skills and practices this role demands has not yet been widely discussed within the field, but establishing what constitutes ‘good’ software engineering in archaeology is vital if we are to ensure that our new tools do what they say they do, work together, can be maintained over the long term, and are accessible to the broadest possible community of archaeological practitioners.

This session, organised on behalf of the CAA-SIG “Scientific Scripting Languages in Archaeology”, will survey the state of the art in archaeological packages for R, Python, and other scientific programming languages.

We invite technical or theoretical papers on:

- critical reviews of software support for specific domains of analysis
- discussions of future priorities for package development in archaeology
- general concepts in package development as applied to archaeology (e.g. user interface design, unit testing, continuous integration, software peer review)
- new packages or significant updates to existing ones

The session is aimed at both developers, users, and prospective users of scientific programming languages in archaeology.

A companion workshop on package development for beginners is also planned.

References

Aldenderfer, Mark. 1998. "Quantitative Methods in Archaeology: A Review of Recent Trends and Developments." *Journal of Archaeological Research* 6 (2): 91–120.

Baxter, Rob, N Chue Hong, Dirk Gorissen, James Hetherington, and Ilian Todorov. 2012. "The Research Software Engineer." In *Digital Research 2012*, Oxford.

Kintigh, Keith W. 1987. "Quantitative Methods Designed for Archaeological Problems." In *Quantitative Research in Archaeology: Progress and Prospects*, edited by Mark S Aldenderfer, 126–34. Newbury Park, CA: Sage.

Kristiansen, Kristian. 2014. "Towards a New Paradigm: The Third Science Revolution and Its Possible Consequences in Archaeology." *Current Swedish Archaeology* 22 (4): 11–34.

Schmidt, Sophie C, and Ben Marwick. 2020. "Tool-Driven Revolutions in Archaeological Science." *Journal of Computer Applications in Archaeology* 3 (1): 18–32. <https://doi.org/10.5334/jcaa.29>.

JUNE 16th

11:50 – 12:10

Poseidon - A toolbox for archaeogenetic data management

Clemens Schmid, Ayshin Ghalichi, Wolfgang Haak, Stephan Schiffels

12:10 – 12:30

CHRONOLOG: a tool for computer-assisted chronological research

Eythan Levy, Gilles Geeraerts, Frédéric Pluquet

12:30 – 12:50

**Digital Ecosystems in Archaeological Science: A History and Taxonomy of R packages in
Archaeology**

Ben Marwick

12:50 – 13:10

outlineR: An R package to derive outline shapes from (multiple) artefacts on JPEG images

David N Matzig, Felix Riede

13:10 – 13:30

**An open-source approach for the vulnerability assessment of archaeological deposits using GPR
data in QGIS environment**

Philip K Fayad, Matteo Serpetti, Stefano De Angeli

13:30 – 13:50

Managing and analysing pictorial documentation with GIS and graphs

Craig Alexander, Jose Pozo, Thomas Huet

13:50 – 14:10

Open archaeology: a survey of collaborative software engineering in archaeological research

Zachary Batist, Joe Roe

S18. Urban Complexity in Settlements and Settlement Systems of the Mediterranean (Standard)

Convenor(s):

Katherine A. Crawford, Arizona State University

Georgios Artopoulos, The Cyprus Institute

Eleftheria Paliou, University of Cologne

Iza Romanowska, Aarhus University

Thursday, June 17, Palaepaphos

15:00 – 16:30, 16:50 – 18:20

The application of quantitative methods to the study of ancient cities and settlement networks has seen increased interest in recent years. Advances in data collection, the use of and integration of diverse big datasets, data analytics including network analysis, computation and the application of digital and quantitative methods have resulted in an increasingly diverse number of studies looking at past cities from new perspectives (e.g. Palmisano et al. 2017; Kaya and Bölen 2017; Fulminante 2019-21). This barrage of new methods, many grounded in population-level systemic thinking, but also some coming from the individual, agent-based perspective enabled researchers to investigate the structural properties and mechanisms driving complex socio-natural systems, such as past cities and towns (e.g. MISMAS; The CRANE Project; Carrignon et al. 2020). These advances have recently opened new possibilities for the study of cities and settlement systems of the Mediterranean, an area with some of the longest known records of urban occupation that could be key for studying a wide range of urban complexity topics (e.g. Lawrence et al. 2020).

This session invites papers that deal with the applications of computational and digital methodologies, including agent-based modelling, network analysis, urban scaling, gravity and spatial interaction models, space syntax, GIS, and data mining. We look for a diverse range of studies on the interactions between cities, complex meshworks of information flow, simulations of social and socio-natural activities, as well as analyses of groups of cities and their environment (the ecosystem of resources) in the Mediterranean basin. We are especially interested in papers that use agent-based modelling to adopt a comparative and diachronic perspective to studying transformations and transitions of urban and settlement systems and works that focus on the area of Eastern Mediterranean, in particular.

Potential topics of consideration include but are not limited to:

- Settlement persistence,
- Multi-scale spatial patterns within urban complexes and across settlements,
- Inter and/or intra urban settlement dynamics & interactions,
- Transitions and diachronic transformations of urban/settlement patterns,
- Urban network interactions and modelling,
- Urban-environmental processes; the impact of climate disturbances on cities and their resources,
- Formal analysis of cities development of time,
- Processes involved in urban centres formation and abandonment.

References

- S. Carrignon, T. Brughmans, I. Romanowska, (2020). Tableware trade in the Roman East: Exploring cultural and economic transmission with agent-based modelling and approximate Bayesian computation. *PLoS ONE*, 15, (11), e0240414. DOI: 10.1371/journal.pone.0240414
- F. Fulminante (ed), (2019-21). Research Topic: Where Do Cities Come From and Where Are They Going To? Modelling Past and Present Agglomerations to Understand Urban Ways of Life. *Frontiers in Digital Humanities* <https://www.frontiersin.org/research-topics/7460/where-do-cities-come-from-and-where-are-they-going-to-modelling-past-and-present-agglomerations-to-u#overview>
- H. Serdar Kaya and Fulin Bölen, (2017). 'Urban DNA: Morphogenetic Analysis of Urban Pattern', *International Journal of Architecture & Planning*, (5), 1, 10-41. DOI: 10.15320/ICONARP.2017.15
- D. Lawrence, M. Altaweel, and G. Philip, (2020). *New Agendas in Remote Sensing and Landscape Archaeology in the Near East: Studies in Honour of Tony J. Wilkinson*. Oxford: Archaeopress.
- A Palmisano, A. Bevan, and S. Shennan, (2017). Comparing archaeological proxies for long-term population patterns: An example from central Italy. *Journal of Archaeological Science*, (87), 59-72. DOI: 10.1016/j.jas.2017.10.001
- Saad Twaissi, (2017). 'The Source Of Inspiration Of The Plan Of The Nabataean Mansion At Az-Zantur Iv In Petra: A Space Syntax Approach', *Mediterranean Archaeology and Archaeometry*, (17), 3, 97-119. DOI: 10.5281/zenodo.1005494
- MISAMS (Modelling Inhabited Spaces of the Ancient Mediterranean Sea), <https://cordis.europa.eu/project/rcn/108224/en>
- The CRANE Project (Computational Research on the Ancient Near East) <https://www.crane.utoronto.ca/>

JUNE 17th

15:00 – 15:20

Comparing Time and Energy in Urban Spatial Networks: A Least-Cost Analysis of Water Fetching in Pompeii

Matthew Notarian

15:20 – 15:40

PolisABM: Modelling polis formation, urban systems and social complexity in the eastern Mediterranean from Iron Age to Hellenistic times

Dries Daems

15:40 – 16:00

GIS-based landform classification of settlements in the Pantelis Valley (Sitia, Crete) to assess water management, from the Classical to the Venetian periods

Nadia Coutsinas, Athanasios Argyriou, Marianna Katifori

16:00 – 16:20

SNA and ANT in the study of local identities: central Italian centres and their cemeteries

Ulla M. Rajala

COFFEE BREAK

16:50 – 17:10

Towards discovering the similarities of regular Mediterranean cities using network analysis
Anna Fijałkowska, Paulina Konarzewska, Anna Kubicka, Wojciech Ostrowski, Artur Nowicki, Łukasz Misk, Ewdoksia Papuci-Władyka

17:10 – 17:30

Reshaping a Roman city with GIS analyses and rescue archaeology. Palma (Mallorca, Balearic Islands)

Bartomeu Vallori-Márquez

S19. Challenging the axiom that “absence of evidence is not evidence of absence” (Standard)

Convenor(s):

Stephen Stead, Paveprime Ltd – University of the Arts London (UAL)

George Bruseker, Getty

Athanasios Velios, University of the Arts London (UAL)

Tuesday, June 15, Chirokitia

18:30 – 20:30

Cultural Heritage documentation generally only shows things that have been identified in the field or secondary documents. However, this means that absences are rarely explicitly documented and thus there is a generally held belief that the lack of documentation of presence fails to prove the absence of something. This is a solid assumption where it is likely that our knowledge is incomplete (Romans in Tywi Forest in Wales) but becomes more of an issue where it is either very unlikely (Romans in Venezuela) or where comprehensive research shows no evidence (Blind-tooled decoration on a book with well-preserved covers). How then do we record the cases where we have good reason to believe that there actually is an absence?

This session is intended to provide an opportunity for practitioners grappling with documenting absence to talk about their approaches. Papers are invited to discuss:

- a) how researchers establish complete knowledge in specific areas of their domain to argue with certainty that there is absence of a feature,
- b) how researchers evaluate conclusions in their domain while being uncertain whether lack of documentation means absence of a feature,
- c) how researchers come up with criteria to help them choose which features to document as absent,
- d) what is the kind of automatic reasoning that researchers can compute based on knowledge of absence of a feature.

So, if you are wrestling with recording sterile deposits or areas that show no remains after intensive field survey or missing features during finds conservation we want to hear from you!

The session will include invited papers about initiatives from the CIDOC Conceptual Reference Model Special Interest Group (CIDOC CRM-SIG) to help make data about documented absence interoperable and reusable.

JUNE 15th

18:30 – 18:50

The Linked Conservation Data semantic test data set

Stephen Stead

18:50 – 19:10

The application of CRMInf to documenting negative conclusions

Stephen Stead

19:10 – 19:30

Negative placeholders: Knowing when nothing is more significant than something

Jennifer A. Loughmiller-Cardinal

19:30 – 19:50

No Dragons Here: recording the absence of archaeological remains during field survey

Martijn van Leusen

19:50 – 20:10

Documenting types and absence of types using the CIDOC CRM

Athanasios Velios

20:10 – 20:30

Settlement dynamics and blank areas: the case study of the Ager Pisanus

Antonio Campus

S20. European Union Study on quality in 3D digitisation of tangible cultural heritage (Roundtable)

Convenor(s):

Thomas Rigauts, UNESCO Chair on Digital Cultural Heritage

Francesco Ripanti, UNESCO Chair on Digital Cultural Heritage

Douglas Pritchard, UNESCO Chair on Digital Cultural Heritage

Robert Davies, UNESCO Chair on Digital Cultural Heritage

Dr. Marinos Ioannides, Director of UNESCO Chair on Digital Culture Heritage, Cyprus University of Technology

Wednesday, June 16, Choirokoitia

11:50 – 14:20

15:00 – 16:40

Today, tangible cultural heritage may be irreversibly damaged or destroyed due to diverse natural and human-derived threats, ranging from pollution and earthquakes to improper maintenance or deliberate destruction. High quality 3D replicas of cultural heritage sites, monuments and artefacts can contribute greatly to the protection of our world's shared heritage. 3D digitisation thus has a significant potential value in the field of cultural heritage.

By signing the Declaration of Cooperation on advancing the digitisation of cultural heritage in Europe at the 2019 Digital Day, 27 EU Member States have acknowledged the importance of 3D digitisation and information technologies for cultural heritage and the urgent need to use them to their full potential. The declaration also endorses a call for common standards, methodologies and guidelines for the holistic 3D documentation of 3D cultural heritage assets in Europe and beyond.

Beyond being crucial to preserve the memory of our world, tangible cultural heritage digitised in 3D can also be a significant source of new knowledge, in particular with respect to contemporary challenges such as climate-related impacts and resilience. Digitised cultural heritage likewise has great re-use potential in many sectors, including the creative and cultural sectors, and also in education and tourism. The innovative re-use of digitised cultural heritage can be a valuable contribution to a European sense of belonging and to European integration.

The UNESCO Chair on Digital Cultural Heritage at Digital Heritage Research Lab / Cyprus University of Technology is coordinating a consortium of key organisations from across Europe to conduct the first of its kind study on quality in 3D digitisation of tangible cultural heritage, fully funded by the European Commission.

The study aims to identify all the relevant elements for 3D digitisation of tangible cultural heritage, classifying them by degree of complexity and purpose or use. It will also cover the specific types of equipment used throughout the different stages of the 3D digitisation process, and all the types of relevant data, including geometry, colour, texture and materials.

This unique study focuses on the quality of the data as well as of the methodologies and system used for the survey. Its main objective is to map parameters, formats, standards, benchmarks, methodologies and guidelines relating to the 3D digitisation of immovable and movable tangible cultural heritage assets, considering the different potential uses, general-purpose visualisations and

degree of complexity. The results of the study will enable cultural heritage professionals, institutions, content-developers and academics to define and produce high-quality digitisation standards and protocols for 3D data acquisition of tangible heritage.

To summarize, this initiative will identify and compile:

- the technical parameters that determine the level of quality of 3D digitisation depending on different degrees of complexity;
- existing digital formats, standards, benchmarks, methodologies and guidelines for 3D digitisation; and
- past or ongoing 3D digitisation projects and existing 3D models and data sets that can serve as benchmarks for 3D digitisation of tangible cultural heritage.

Our proposed round table session will bring together outstanding professionals from the domain of the 3D data acquisition in Cultural Heritage to present the results of the study in 15 minute presentations and discuss with the audience the impact and added value in the European sector of Cultural Heritage.

Details will follow soon...

S21. Archaeology-related online community practices (Standard)

Convenor(s):

Rimvydas Laužikas, Vilnius University

Costis Dallas, University of Toronto

Ingrida Kelpšienė, Vilnius University

Suzie Thomas, University of Helsinki

Tuesday, June 15, Amathous

18:30 – 20:30

The increasing recognition of the need for openness in archaeological research, communication and resource management, as well as the broader availability and uptake of Web 2.0 / Web 3.0 technologies and approaches across the whole spectrum of archaeological work is contributing to the rising use of online social media platforms by academic archaeologists, archaeological heritage management and communication professionals, amateurs and members of communities engaged with archaeology.

In this context archaeological heritage and archaeological scholarly knowledge has often enjoyed a particular status as a form of sharing heritage/sharing knowledge that, capturing the public imagination, has become the locus for the new different archaeology-related digital community practices. The session brings together researchers and research projects studying archaeology-related practices in social media platforms. It aims to present and highlight the ongoing work on the topic, including theoretical and empirical research on archaeological work, knowledge production and use by professional archaeologists and non-professional archaeology-engaged communities, operating across different social media platforms.

JUNE 15th

18:30 – 18:50

Digital technologies applied to Antarctic Archaeology
Alex da Silva Martire, Andrés Zarankin, Fernanda Codevilla

18:50 – 19:10

Impact of the Digital Archaeology Practices on the Regulatory Framework Design and eCommunities
Vladislav V. Fomin, Rimvydas Lauzikas, Tadas Ziziunas

19:10 – 19:30

Using Spatial Storytelling Platforms for Public Archaeology, Open Data, and Scholarly Publishing
Matthew Howland, Brady Liss, Mohammad Najjar, Thomas Levy

19:30 – 19:50

CAA-GR online community practices during the pandemic: Outcomes of the first series of online roundtable sessions
Athos Agapiou, Markos Katsianis, George Pavlidis, Dorina Moullou, Tuna Kalayci, Stella Sylaiou

S22. From surface distributions to settlement patterns: field survey during COVID-19 (Other)

Convenor(s):

Buławka Nazarij, University of Warsaw, Faculty of Archaeology, Department of Near Eastern Archaeology

Chyla Julia Maria, University of Warsaw, Antiquity of Southern Europe Research Centre, Faculty of Archaeology

Cirigliano Giuseppe Prospero, University of Siena, Department of History and Cultural Heritage
Sobotkova Adéla, Aarhus University, School of Culture and Society

Thursday, June 17, Salamis
11:00 – 11:40, 11:50 – 14:20

Archaeological field surveys, even the most intensive and systematic ones, cannot be considered flawless methods of acquiring data. Archaeological landscapes' state of preservation, surface collection methods and agenda, visibility and personal preferences can affect the final results. It is not simply just the registration of observations, but a process of continuous interpretation starting from where to survey, what to collect, and how.

Research conducted in the 1990s and early 2000s found increasing precision in mapping and in the resolution of surveys to be a solution to the most pressing problems in settlement pattern studies and landscape archaeology. Today, mapping precision does not seem to be a problem thanks to widely available portable GNSS equipment and specialized software dedicated to field data acquisition (Mobile GIS). Or is it? Reflection is needed on the technological advances of the past decades. What have archaeological studies gained thanks to these technological achievements, and what are the implications of new, higher resolution data for crucial topics in scientific debate, such as complex societies?

Currently, it is difficult to conduct field research because of the COVID-19 pandemic, but it is possible to step back and reflect on its theoretical and technical aspects of this methodology. The aim of this session is to continue the discussion of the changes that are happening in archaeological field prospection today, which we have been pursuing since CAA 2017 in Atlanta, through the Mobile GIS sessions.

This session invites papers discussing broad interpretive and methodological aspects of landscape archaeology, settlement pattern studies, field survey (micro and macro scale) and Mobile GIS, theoretical or technical papers, and case studies from around the world. When submitting please specify if you want to present a long (15 minutes) or short (10 minutes) paper.

This session will conclude with a roundtable discussion.

JUNE 17th

11:00 – 11:20

Treasured hunters? The application of amateur archaeological datasets from North-Western Europe in spatial analysis

Linda Bjerketvedt

11:20 – 11:40

Integrating legacy data for archaeological and remote survey at the 7th-15th century site of Unguja Ukuu, Zanzibar

Tom Fitton, Stephanie Wynne-Jones

COFFEE BREAK

11:50 – 12:10

Mobile GIS survey in Mustis

Tomasz Waliszewski, Monika Rekowska, Krzysztof Misiewicz, Jamal Hajji, Chokri Touihri, Julia M. Chyla, Jerzy Oleksiak

12:10 – 12:30

Southern Latium (Italy) in Roman Republican and Imperial Times – Considerations on Legacy Data and Site Location Modelling

Michael Teichmann

12:30 – 12:50

Model-led survey with mobile GIS: the prediction and survey of karstic caves and rockshelters in Kazakhstan

Patrick Cuthbertson, Tobias Ullmann, Christian Büdel, Aristeidis Varis, Abay Namen, Reimar Seltmann, Denné Reed, Zhaken Taimagambetov, Radu Iovita

12:50 – 13:10

But why here? Deciphering the past choices with the use of GIS methods. The Orońsko flint mining area case study

Nazarij Bulawka, Katarzyna Kerner-Gubała

13:10 – 13:30

Good digital tools do not make or break field survey - but they sure help!

Adela Sobotkova, Petra Hermankova

13:30 – 13:50

**Evaluating an Ancient Landscape Using Remote Sensing: The Kotroni Archaeological Survey Project
(KASP)**

Anastasia Dakouri-Hild, Athos Agapiou, Stephen Davis, Will Rourk

13:50 – 14:10

**ArchaeoCosmos. Historical Geography of the Mediterranean and the Near East from the Prehistory
to Late Antiquity**

Konstantinos Kopanias

S23. 3D Scholarly Editions: Potential, Limitations, and Challenges (Standard)

Convenor(s):

Costas Papadopoulos, Maastricht University

Susan Schreibman, Maastricht University

Thursday, June 17, Palaepaphos

15:00 – 16:30

16:50 – 18:20

Three-dimensional models and reconstructions have been used in the last thirty years across many fields in the humanities and social sciences to bridge time and space; to become immersed in the past through virtual worlds; to explore physical artefacts from multiple angles; to allow interactive close-ups and see features not visible with the naked eye; and to analyse sociocultural phenomena and simulate the experience and perception of objects and spaces. Despite this plethora of research, 3D digitisation initiatives by cultural institutions, and a growing number of higher education institutions teaching 3D skills, methods, and theories, 3D scholarship is still faced with scepticism and hesitation. This is not only because of the constant technological shifts and exigencies and the fragile ecosystem within which 3D projects are being developed, but also due to their non-conventional nature that does not adhere to established academic practices. In addition, no stable infrastructure exists to support this form of knowledge production and therefore, bespoke solutions only serve the needs of individuals projects and do not provide long-term and sustainable solutions.

As a result, 3D scholarship exists in a fragmented information space: the knowledge generated from the models is published in articles, while the models themselves rarely become part of scholarly record. When interactive 3D artefacts are included in online publications they function as illustrative figures without making visible the scholarship that has gone into their creation (e.g. sources, decision-making, and methodologies). The reproducibility of such models remains rather limited; decisions, sources, and variables stay with the team which means that their validity cannot be checked and the whole process of creation (including both the decisions of the researcher but also the technology itself) remains blackboxed and thus inaccessible to other audiences. Without a concerted undertaking, 3D – along with other ephemeral born-digital data is at the most risk of disappearing from the scholarly record.

This session explores a new conceptual model/framework for 3D scholarship; that of a 3D scholarly Edition that can function as a knowledge site that provides a framework for 3D scholarship and the communication of the results of that scholarship within a single spatio-temporal environment that is immersive and multisensorial (Papadopoulos & Schreibman 2019; Schreibman and Papadopoulos 2019). 3D Scholarly Editions can operate as a forum for scholarly argument and/or critical debate, for scholars to test out and critique the intent and meaning of those who formed/used/acted within those historic objects or environments. This framework differs from that of a digital monograph (e.g. Stanford University Press' digital monographs; Michigan University Press' Gabii Project) that largely uses narrative with 3D models having an illustrative function. The model of the 3DSE is annotative, utilising the model itself to embed contextual information.

This session welcomes researchers who have been thinking about their 3D work along the lines of 3D Scholarly Editions and who find that available publication models are insufficient for communicating the value and meaning of 3D as well as the decision-making and argumentation that goes into and/or

is developed from 3D scholarship. Session speakers are encouraged to submit paper proposals that a) discuss conceptual and methodological frameworks to capture and make available the process of knowledge production in 3D projects; and, b) problematise the conceptual and technical limitations of 3D scholarship, especially in relation to peer-review, archiving and 3D FAIR Data, annotation, and 3D infrastructures. Representatives from cultural heritage institutions embarking on 3D digitisation or from those which are already 3D digitising their collections (works of art, archaeological objects, etc.) and are using proprietary or bespoke solutions to contextualise them are also encouraged to share their views and experiences. Case studies as well as theoretical, conceptual, and methodological problematisations are equally welcome.

References

- Champion, E. (2017). The role of 3D models in virtual heritage infrastructures, in Benardou, A., Champion, E., Dallas, C., & Hughes, L. (Eds.). *Cultural heritage infrastructures in digital humanities*, pp. 15-35. Routledge.
- Papadopoulos, C. Schreibman, S. 2019. Towards 3D Scholarly Editions: The Battle of Mount Street Bridge. *Digital Humanities Quarterly* 13, no. 1.
<http://www.digitalhumanities.org/dhq/vol/13/1/000415/000415.html>
- Schreibman, S., Papadopoulos, C. 2019. Textuality in 3D: three-dimensional (re)constructions as digital scholarly editions. *Int J Digit Humanities* 1, 221–233. <https://doi.org/10.1007/s42803-019-00024-6>

JUNE 17th

15:00 – 15:20

ART3mis: Ray-based textual annotation on 3D cultural objects

Vasileios Arampatzakis, Vasileios Sevetlidis, Fotis Arnaoutoglou, Athanasios Kalogeras, Christos Koulamas, Aris Lalos, Chairi Kiourt, George Ioannakis, Anestis Koutsoudis, George P. Pavlidis

15:20 – 15:40

The presentation of XRF assay data on 3D objects

Joshua Emmitt, Jeremy Armstrong

15:40 – 16:00

Publication of a PhD in 3D: An interactive VR library of Dutch merchant ships

John McCarthy

16:00 – 16:20

What's in store? Normalized Artifact Databases from 3D-Acquisition Campaigns

Hubert Mara, Bartosz Bogacz

COFFEE BREAK

16:50 – 17:10

Integrating 3D modelling and publication for archaeological and historical research: a 3D modelling archaeologist's perspective

Tijm Lanjouw

17:10 – 17:30

Making Meaningful Models as a Digital Novice: Modelling Bronze Age Food Vessels from Archeological Illustrations in Maya and Mudbox

Rosemary M Hanson

17:30 – 17:50

Defining a new paradigm for knowledge production and management within digital archaeology

Paola Derudas

17:50 – 18:10

Standardized output or standardized workflow? Discussion approaches to 3D mini- and micro photogrammetry of archaeological artefacts and their scientific usability

Łukasz A. Czyżewski

S24. Ghosts in the machine: Reflections on traditions of survey practice at the eve of automation (Other)

Convenor(s):

Lucy Killoran, University of Glasgow & Historic Environment Scotland

George Geddes, Historic Environment Scotland

Thursday, June 17, Palaepaphos

11:50 – 14:20

This session aims to capture discussion at the interface of traditional archaeological survey practices and emerging computational approaches to survey, specifically the application of Artificial Intelligence (AI) and Computer Vision (CV) based processes of analysis to remote sensing data sets. These approaches require decisions to be made on survey methodology which are then built into the automated system. However, the essential questions of classification ('what is it') and detection ('where is it') have been addressed in many different ways over the development of survey practice. A key takeaway of this session is to encourage the critical consideration of manual survey practices as an important stage in the ethical design of automated survey systems.

The development of survey practice has been both interdisciplinary—for instance, the interconnection of archaeological, geographical and anthropological methodologies in the context of the twentieth-century evolution of mapping and field survey (Wickstead, 2019)—and intradisciplinary—for comparison: observational on-the-ground field survey; eye-in-the-sky remote sensing; human-ecological or environmental analyses; psychogeographical contemporary-archaeological *dérives*. It is also widely recognised that contemporary survey practices, and their stated or implicit objectives, vary substantially between individual practitioners, different regional and geographic traditions, between ascribed intradisciplinary labels, and across distinct disciplinary shifts over time (Fleming, 2007; Johnson, 2007, 2012; David and Thomas, 2008; Halliday, 2013; Cowley, 2015).

For instance, in the UK, after more than three centuries of use and development, field-based earthwork survey is identified as an indispensable archaeological craft with the capacity to teach foundational skills in seeing and understanding (Historic England, 2017, 2018; Poller, 2018); encompassing an entanglement of observation, interpretation, depiction and classification. Aerial photography and remote sensing may give the impression of distance from the object of observation, but this in itself does not equal objectivity (Wickstead and Barber, 2012; Palmer, 2013). In such a framework, vision and interpretation occurs inside the human 'black box' and is still being untangled from conceptions of vision dating back to the nineteenth century (Wickstead and Barber, 2012).

Accordingly, this multiplicity of inflections upon the essential inquiries of 'what' and 'where' shows that archaeological survey practices cannot be easily articulated under one set of rules. Furthermore, both ground-level and aerial survey practices have been augmented by digital processes providing varying levels of input by machine or automation since the 1970s (Wheatley and Gillings, 2002), affecting both survey practices and their products. The revolutionary impact of technologies such as Airborne Laser Scanning on archaeological practice since the late 1990s has seen data sets for archaeological survey proliferate rapidly, alongside an extending suite of data collection, analysis and

management practices (Hesse, 2013; Kokalj, Zakšek and Oštir, 2013; Opitz, 2013, 2016; Banaszek, Cowley and Middleton, 2018; Opitz and Herrmann, 2018).

Discourse around 'automation', as the term is understood today, has a definable focus on the potential existential ramifications of this emerging technology (Frey, 2019; Moradi and Levy, 2020; Ponce, 2020; Spaulding, 2020). It is not new to posit that these proliferating data sets present a vital opportunity for large-scale heritage management (Challis et al., 2008; Cowley et al., 2020), or, to this end, to advocate for a critically-examined integration of AI with long-standing traditions of practice (Cowley, 2012; Bennett, Cowley and De Laet, 2014; Ball, Anderson and Chan, 2017; Trier, Cowley and Waldeland, 2019), but many issues raised by the latest generation of technological changes remain unresolved.

Ethical approaches to the design of automated systems require a rigorous consideration of and accountability for exactly how the system reaches its results, as well as a proactive approach to understanding and mitigating the human biases which can be uncritically included within the system (Samek et al., 2019; The Royal Society, 2019; Centre for Data Ethics and Innovation, 2020; Kroll, 2020; Vilone and Longo, 2020). In the context of archaeological survey practice, these biases are complex (Cowley, 2016)—so long as they remain implicit, unwritten, or otherwise un-interrogated. Scholarship within the computing sphere of archaeology refers to the missing element as paradata, or data about how the data were collected (the sister of metadata, the data about data) (Huggett, 2020; Huvila 2021).

In more philosophical areas of the discipline this may be referred to as capturing the experiential or phenomenological element to landscape practices (Millican, 2012). So, how are we to assess this missing paradata, this experiential aspect of survey—an interconnected web of complex, subjective, idiosyncratic, expert, but mostly unwritten approaches to visual observation and perception—when designing vitally-needed automated approaches to landscape survey? AI and CV are fundamentally new tools in archaeology and represent a compelling nexus between observer-led and remote sensing survey practices. This session invites papers that reflect upon the miscellany of approaches that influence contemporary archaeological topographic and aerial survey practices, at this particular moment in the early stages of survey automation by AI. The format of the session will be a mix of 10-minute papers and roundtable discussion, with an expected outcome of presenting a wide range of intradisciplinary traditions and exploring how survey practitioners think about their own practice. Contributions should reflect upon the development of different practices and traditions, identify how they have fully, partially or not-quite intersected with one another, and locate them in the collective trajectory of survey practice, both past and future.

This session will be of interest to researchers and practitioners working across the broad sphere of survey, from observer-led and remote sensing to those working on AI and CV approaches, but participation is also encouraged from those concerned with other approaches to landscape and landscape analysis, heritage management, digital archaeology, disciplinary theory, methods and history, interpretive practices or other related fields. Contributions to this session will inform the PhD 'Automation in the practice of archaeological survey – integrating Machine Learning, Computer Vision, People, and Practice', a Collaborative Doctoral Award supervised between the University of Glasgow and Historic Environment Scotland.

References

Frey, C. (2019). *The Technology Trap: Capital, Labor, and Power in the Age of Automation*. Princeton: Princeton University Press.

Ball, J. E., Anderson, D. T. and Chan, C. S. (2017) 'Comprehensive survey of deep learning in remote sensing: theories, tools, and challenges for the community', *Journal of Applied Remote Sensing*, 11(04), p. 1. doi: 10.1117/1.JRS.11.042609.

Banaszek, Ł., Cowley, D. and Middleton, M. (2018) 'Towards National Archaeological Mapping. Assessing Source Data and Methodology — A Case Study from Scotland', *Geosciences*, 8(8), p. 272. doi: 10.3390/geosciences8080272.

Bennett, R., Cowley, D. and De Laet, V. (2014) 'The data explosion: tackling the taboo of automatic feature recognition in airborne survey data', *Antiquity*, 88(341), pp. 896–905. doi: 10.1017/S0003598X00050766.

Centre for Data Ethics and Innovation (2020) *Review into bias in algorithmic decision-making*. London: UK Government, Department for Digital, Culture, Media & Sport, p. 151. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/939109/CDEI_review_into_bias_in_algorithmic_decision-making.pdf.

Challis, K. et al. (2008) 'Airborne lidar and historic environment records', *Antiquity*, 82(318), pp. 1055–1064. doi: 10.1017/S0003598X00097775.

Cowley, D. (2012) 'In with the new out with the old? Digital workflows and auto-extraction in remote sensing archaeology', in *The First International Conference*, State Hermitage Museum.

Cowley, D. et al. (2020) 'Making LiGHT Work of Large Area Survey? Developing Approaches to Rapid Archaeological Mapping and the Creation of Systematic National-scaled Heritage Data', *Journal of Computer Applications in Archaeology*, 3(1), pp. 109–121. doi: 10.5334/jcaa.49.

Cowley, D. C. (2015) 'Aerial photographs and aerial reconnaissance for landscape studies', p. 30.

Cowley, D. C. (2016) 'What Do the Patterns Mean? Archaeological Distributions and Bias in Survey Data', in Forte, M. and Campana, S. (eds) *Digital Methods and Remote Sensing in Archaeology: Archaeology in the Age of Sensing*. Switzerland: Springer International Publishing, p. 27.

David, B. and Thomas, J. (2008) 'Landscape Archaeology: Introduction', in *Handbook of Landscape Archaeology*. 1st Edition. New York: Routledge, p. 17.

Fleming, A. (2007) 'Don't Bin Your Boots!', *Landscapes*, 8(1), pp. 85–99. doi: 10.1179/lan.2007.8.1.85.

Halliday, S. (2013) 'I Walked, I Saw, I Surveyed, but what did I see?...and what did I survey?', in Opitz, R.S. and Cowley, D. C. (eds) *Interpreting Archaeological Topography*. Oxbow Books (3D Data, Visualisation and Observation), pp. 63–75.

Hesse, R. (2013) 'The changing picture of archaeological landscapes:: lidar prospection over very large areas as part of a cultural heritage strategy', in Opitz, R. S. and Cowley, D. C. (eds) *Interpreting Archaeological Topography*. Oxbow Books (3D Data, Visualisation and Observation), pp. 171–183.

Historic England (2017) *Understanding the Archaeology of Landscapes*. 2nd edition. Swindon: Historic England.

Historic England (2018) 'Graphical and Plane Table Survey of Archaeological Earthworks'. Historic England.

Huggett, J. (2020) 'Is Big Digital Data Different? Towards a New Archaeological Paradigm', *Journal of Field Archaeology*, 45(sup1), pp. S8–S17. doi: 10.1080/00934690.2020.1713281.

Huvila, I. (2021) 'Paradata to the people! Documenting documentation and more', session at Computer Applications in Archaeology International Conference, Virtual, 14-18 June 2021, accessed 8 December 2020, <<https://2020.caaconference.org/sessions/>>.

Johnson, M. (2007) 'Don't Bin Your Brain!', *Landscapes*, 8(2), pp. 126–128. doi: 10.1179/lan.2007.8.2.126.

Johnson, M. (2012) 'Landscape studies:: The future of the field', in Kluiving, S. J. and Guttman-Bond, E. B. (eds) *Landscape Archaeology between Art and Science*. Amsterdam University Press (From a Multitudo an Interdisciplinary Approach), pp. 515–526.

Kokalj, Ž., Zakšek, K. and Oštir, K. (2013) 'Visualizations of lidar derived relief models', in Opitz, R. S. and Cowley, D. C. (eds) *Interpreting Archaeological Topography*. Oxbow Books (3D Data, Visualisation and Observation), pp. 100–114.

Kroll, J. A. (2020) 'Accountability in Computer Systems', in Kroll, J. A., *The Oxford Handbook of Ethics of AI*. Edited by M. D. Dubber, F. Pasquale, and S. Das. Oxford University Press, pp. 179–196. doi: 10.1093/oxfordhb/9780190067397.013.10.

Millican, K. (2012) 'The Outside Inside: Combining Aerial Photographs, Cropmarks and Landscape Experience', *Journal of Archaeological Method and Theory*, 19(4), pp. 548–563.

Moradi, P. and Levy, K. (2020) 'The Future of Work in the Age of AI: Displacement or Risk-Shifting?', in Moradi, P. and Levy, K., *The Oxford Handbook of Ethics of AI*. Edited by M. D. Dubber, F. Pasquale, and S. Das. Oxford University Press, pp. 269–288. doi: 10.1093/oxfordhb/9780190067397.013.17.

Opitz, R. (2016) 'Airborne Laserscanning in Archaeology: Maturing Methods and Democratizing Applications', in Forte, M. and Campana, S. (eds) *Digital Methods and Remote Sensing in Archaeology*. Cham: Springer International Publishing (Quantitative Methods in the Humanities and Social Sciences), pp. 35–50. doi: 10.1007/978-3-319-40658-9_2.

Opitz, R. and Herrmann, J. (2018) 'Recent Trends and Long-standing Problems in Archaeological Remote Sensing', *Journal of Computer Applications in Archaeology*, 1(1), pp. 19–41. doi: 10.5334/jcaa.11.

Opitz, R. S. (2013) 'An overview of airborne and terrestrial laser scanning in archaeology', in Opitz, R. S. and Cowley, D. C. (eds) *Interpreting Archaeological Topography*. Oxbow Books (3D Data, Visualisation and Observation), pp. 13–31. Available at: <https://www.jstor.org/stable/j.ctvh1dqdz.7> (Accessed: 2 November 2020).

Palmer, R. (2013) 'Reading aerial images', in Opitz, R. S. and Cowley, D. C. (eds) *Interpreting Archaeological Topography*. Oxbow Books (3D Data, Visualisation and Observation), pp. 76–87.

Poller, T. (2018) 'The craft of earthwork survey', in *Re-Mapping Archaeology Critical Perspectives, Alternative Mappings*. London: Routledge, p. 24.

- Ponce, A. (2020) 'Labour in the Age of AI: Why Regulation is Needed to Protect Workers', SSRN Electronic Journal. doi: 10.2139/ssrn.3541002.
- Samek, W. et al. (eds) (2019) *Explainable AI: Interpreting, Explaining and Visualizing Deep Learning*. Cham: Springer International Publishing (Lecture Notes in Computer Science). doi: 10.1007/978-3-030-28954-6.
- Spaulding, N. W. (2020) 'Is Human Judgment Necessary?: Artificial Intelligence, Algorithmic Governance, and the Law', in Spaulding, N. W., *The Oxford Handbook of Ethics of AI*. Edited by M. D. Dubber, F. Pasquale, and S. Das. Oxford University Press, pp. 374–402. doi: 10.1093/oxfordhb/9780190067397.013.25.
- The Royal Society (2019) *Explainable AI: the basics*, Policy briefing, p. 32.
- Trier, Ø. D., Cowley, D. C. and Waldeland, A. U. (2019) 'Using deep neural networks on airborne laser scanning data: Results from a case study of semi-automatic mapping of archaeological topography on Arran, Scotland', *Archaeological Prospection*, 26(2), pp. 165–175. doi: 10.1002/arp.1731.
- Vilone, G. and Longo, L. (2020) 'Explainable Artificial Intelligence: a Systematic Review', arXiv:2006.00093 [cs]. Available at: <http://arxiv.org/abs/2006.00093> (Accessed: 27 October 2020).
- Wheatley, D. and Gillings, M. (2002) *Spatial Technology and Archaeology: The Archaeological Applications of GIS*. London, UNITED STATES: Taylor & Francis Group.
- Wickstead, H. (2019) 'Cults of the distribution map: Geography, utopia and the making of modern archaeology', in Gillings, M., Hacıgüzeller, P., and Lock, G. (eds) *Re-Mapping Archaeology Critical Perspectives, Alternative Mappings*. Abingdon: Routledge, p. 37.
- Wickstead, H. and Barber, M. (2012) 'A Spectacular History of Survey by Flying Machine!', *Cambridge Archaeological Journal*, 22(1), pp. 71–88. doi: 10.1017/S0959774312000054.

JUNE 17th

11:50 – 12:10

Find 'em all: Large-scale automation to detect complex archaeological sites with Deep Learning – A case study on English hillforts

Jürgen Landauer, Wouter B. Verschoof-van der Vaart

12:10 – 12:30

Applying automated object detection in archaeological practice: a case study from the southern Netherlands

Wouter B. Verschoof-van der Vaart, Karsten Lambers

12:30 – 12:50

Surveying with non-humans: challenges and opportunities

Dimitrij Mlekuz Vrhovnik

12:50 – 13:10

iSEGMound – a Reproducible Workflow for Mound Detection in LiDAR-derived DTMs

Agnes Schneider

S25. Exploring the possibilities of 3D Spatial Analysis (Standard)

Convenor(s):

Alexander C.Q. Jansen, Faculty of Archaeology, Leiden University

Gary Nobles, Oxford Archaeology

James Taylor, Department of Archaeology, University of York

Marina Gavryushkina, Faculty of Archaeology, Leiden University

Tuesday, June 15, Salamis

10:00 – 10:35, 11:50 – 14:25, 15:00 – 16:30

With the steadily increasing use of 3D spatial analysis as a methodology in the broad field of archaeology, the CAA Special Interest Group 3D Spatial Analysis welcomes papers which are oriented towards the analysis of 3D space.

Innovation in 3D spatial analysis is the next 'big thing'. As archaeologists, what does 3D afford us that 2D and 2.5D approaches do not? What added complexities does working in 3D bring and how do we resolve or theorise around those complexities? As archaeologists first and foremost, aside from the restrictions of technological limitations, why do we want to apply 3D spatial analysis, how would we apply it and what questions would it help answer? Papers are invited which cover any form of 3D spatial data: recorded geospatial data (GIS/CAD), interpretive 3D modelled data (procedural modelling/Archaeological BIM/Heritage BIM (ABIM/HBIM)), semantic analysis, and even imagined spaces and their physical manifestations (e.g., 3D printing). Crucially papers should go beyond the presentation of purely 3D recording/modelling methods and processes. What insights can we achieve which are not possible from visual inspection alone? While we would like presentations, which push the boundaries (theoretically/technologically), we also welcome position papers. Presenters may want to consider how their research fits within archaeological workflows (established or burgeoning) and broader Spatial Data Infrastructures; what does the integration of associated data bring and what analytical capabilities does or could this create? How do we use these 3D digital objects, datasets and results once they are created? What purpose do they serve, what will their legacy be? Presenters are urged to discuss how the results of 3D spatial analysis are communicated. What are the merits of staying in 3D space against reducing or simplifying it to 2.5D and 2D presentation formats and vice versa?

Submissions from young researchers/early career researchers are particularly welcome. We want to enable researchers to discuss ideas, whether or not you have access to the best data, funding for big computer systems, or underlying technical knowledge. Such positional papers should focus on what we want to get out of 3D spatial analysis. In this aspect we encourage 'blue-sky thinking' particularly if the tools and capabilities are not yet in existence.

Presenters can select one of two formats for their paper: papers which are more exploratory and 'blue-sky' in nature can be presented as a 10-minute lightning talk, while those with a more traditional structure may be better suited for a 20-minute standard format. The author should specify their preference when submitting their proposal. If in doubt, contact one of the session organisers well before the paper deadline. The session will conclude with a discussion bringing together the principal themes which emerge from the presented papers. Facilitated through the 3D Spatial Analysis CAA SIG, we endeavour to keep these discussions continuing beyond the meetings at CAA International. The session will begin with 20-minute case study presentations, followed by 10-minute position papers/lightning talks, and ending with the discussion.

JUNE 15th

10:00 – 10:20

FundUS – an Interactive 3D Visualization Software for Palaeolithic Excavation Data
Selina Andrews, Stefan Rudolf Radicke

10:20 – 10:40

Position, Privilege and Potential - 10-minute lightning talk
Meagan Mangum

10:40 – 11:00

3D G[EYE]S: Integrating Eye Tracking and 3D Geographical Information Systems
Danilo Marco Campanaro, Giacomo Landeschi

11:00 – 11:20

Intersite analysis based on intrasite contexts in the museum database
Espen Uleberg, Mieko Matsumoto, Steinar Kristensen, Judyta Zawalska

11:20 – 11:35

Pompeii within Ancient Virtual Skies: From Urban Orientations to 3-D Visualisation
Ilaria Cristofaro, Michele Silani, Georg Zotti

COFFEE BREAK

11:50 – 12:10

Using VR to analyse GeoPhysics data - a case study
Paul Harwood, Mark Harwood

12:10 – 12:30

Towards a workflow for documenting, processing and archiving large excavation contexts on-the-fly. Challenges and lessons learnt at The Palace of Nestor Project, Pylos
Cristiano Putzolu, Michael Loy, John Wallrodt, Sharon Stocker, Jack Davis

12:30 – 12:50

3D shape of past human activities: the paradigmatic example of mining landscape
Alexander Maass, Angela Celauro, Maria Marsella

12:50 – 13:10

Experimental archaeology in immersive Virtual Reality: a 3D reconstruction of a mortuary structure of Tomb 21, a Bronze Age mortuary structure from Ayios Vasileios, Greece
Yannick de Raaff, Gary R. Nobles

13:10 – 13:30

Exploring the possibilities of 3D Spatial Analysis: Discussion

Gary R Nobles, Alexander Jansen, Marina Gavryushkina, James Taylor

13:30 – 13:50

Medieval urban sites of Iraq in the sphere of archaeological remote sensing

Lenka Starkova

13:50 – 14:10

Documenting and monitoring the impact of dams to cultural heritage from space. Tuning satellite data collection to meet archaeologists' needs

Federico Zaina, Deodato Tapete

14:10 – 14:25

Multiscalar Approaches to Digital Documentation of Archaeological Sites. The case studies of Flavian Amphitheater, Temple of the Divine Claudius and the Theater of Marcellus in Rome

Martina Attenni, Marika Griffio, Carlo Bianchini, Carlo Inglese, Alfonso Ippolito

LUNCH BREAK

15:00 – 15:20

From 2D documentation to parametric reconstruction of archaeological structures and procedural modelling of an ancient town

Anna Kubicka, Łukasz Misk, Artur Nowicki, Wojciech Ostrowski, Anna Fijałkowska, Paulina Konarzewska, Ewdoksia Papuci-Władyka

15:20 – 15:40

Challenges and Opportunities in Cultural Heritage from the development of a Digital Innovation Hub (DIH) for Earth Observation and Geospatial Information in the Eastern Mediterranean, Middle East and North Africa (EMMENA) through Eratosthenes Centre of Excellence

Anna Kubicka, Łukasz Misk, Artur Nowicki, Wojciech Ostrowski, Anna Fijałkowska, Paulina Konarzewska, Ewdoksia Papuci-Władyka

15:40 – 16:00

Evaluating Two Methods of 3D Spatial Analysis (UAV-based Photogrammetry and Ground-Based LiDAR) for Quantifying Erosion

Kelsey A. Pennanen

16:00 – 16:20

From the material culture to the lived space. A virtual reconstruction of a Minoan workshop

Bastien Rueff, Alexandre Pinto, Katerina Messini, Haris Procopiou

S26. Moving Over Seas: Modeling Seafaring Routes to Analyze Past Connections (Standard)

Convenor(s):

Emma Slayton, Carnegie Mellon University

Karl Smith, University of Oxford

Tuesday, June 15, Chirokitia

15:00 – 16:30

Tombs of the Kings

18:30 – 20:50

Understanding human mobility is a key factor in being able to read the past, as many past communities were oriented around their place in the world, their relationships with their neighbors, and the resources around them. In many cases the archaeological record supports the existence of sea travel without capturing evidence of the corridors or specifics of this movement. Computer-based analysis can be used to fill in these gaps. With the increasing availability of large datasets, more detailed and accurate weather records, and forecasted models of past conditions, as well as advances in GIS applications and simulations, our understanding of seascapes, coastal landscapes, and navigation is expanding. As digital archaeology is crucial to the investigation of these spaces, this session will focus on individual or groups who have used modeling or computation to analyze the key question of seafaring sharing their processes and expertise.

Over the past 30-odd years there has been increasing interest in understanding the difficulties faced by seafarers in moving across the waves, resulting more recently in a push to develop models that address this practice in greater detail. More researchers are evaluating both the use of the water's surface and the interaction between seascapes and adjoining land-based sites, which is essential for understanding the use and meaning of maritime spaces in the past. Over the past several years, the community focused on this area has grown, due in part to sessions like this at large international conferences (ex. Slayton and Safadi 2017, Slayton 2019), as well as numerous research projects and papers shared by individual archaeologists or labs (for lists of efforts to model water-based movement in the field of archaeology see Davies and Bickler 2015: Table 1 and Slayton 2018: Table 1).

Though the community is coming together, and indeed edited volumes (ex. Ducruet 2017) are being produced, there are still conversations on data, methods, and theories needed to showcase these efforts and broaden the general knowledge for our community of practice. Despite the presence of these sessions, presentations, and published works, there are still those just starting in this work who are unaware of our developing community, or researchers who are deeply involved in this type of modeling who are not connected with other corners of the community due to a difference in the focus of region or time period. These include researchers focused on broader themes facing computational archaeology as a whole, such as using big data to answer questions around seafaring modeling (Ducruet 2017; Napolitano et al. 2019), the impacts on research of findings from experimental archaeology (Dixon 2018; Pomey and Poveda 2018), or the influence computer gaming / XR experiences may have on our interpretation of the past (Blakely 2018; Poullis et al. 2019). This session will also seek to encourage active discussion between participants as a way to foster new ideas, collaborations, and building blocks on which future modeling can be run.

This virtual conference session is an opportunity to further develop this community, encouraging wider participation from our colleagues working in this area, and focusing on various aspects of modeling movement across water including (but not limited) to:

- Computational case studies exploring seafaring and voyaging
- Computational case studies exploring coastal landscapes, and interaction in the context of movement between sea and land
- Discussion of maritime cultural landscapes
- Discussion of experimental archaeological studies of seafaring
- Discussion of various methodologies used to evaluate sea-based movement
- Issues facing the field of water movement modeling
- Use of water modeling as outreach (e.g. computer games, VR experiences)
- Use of big data (emerging climate data sets) as a base for modeling seafaring

Through this session we aim to explore and highlight different approaches to analyzing maritime spaces, within the context of a broader sub discipline of computational archaeology, and bring together researchers who participate in maritime digital archaeology.

In tandem with this session, the authors plan to propose a new CAA International interest group to continue to foster the water-based movement modeling community. If you have any questions or would like to join the special interest group, contact eslayton@andrew.cmu.edu.

References

Blakely, S. (2018). Sailing with the Gods: serious games in an ancient sea. *thersites. Journal for Transcultural Presences & Diachronic Identities from Antiquity to Date*, 7.

Davies, B., Bickler, S. H., & Traviglia, A. (2015). Sailing the simulated seas: A new simulation for evaluating prehistoric seafaring. In *Across Space and Time: Papers from the 41st Conference on Computer Applications and Quantitative Methods in Archaeology, Perth, 25–28 March 2013* (pp. 215-223). Amsterdam: Amsterdam University Press.

Dixon, Charlotte (2018) *Sailing the monsoon winds in miniature: model boats as evidence for boat building technologies, cultures and collecting*. University of Southampton, Doctoral Thesis, 385pp.

Ducruet, C. (Ed.). (2017). *Advances in shipping data analysis and modeling: tracking and mapping maritime flows in the age of big data*. Routledge.

Napolitano, M. F., DiNapoli, R. J., Stone, J. H., Levin, M. J., Jew, N. P., Lane, B. G., ... & Fitzpatrick, S. M. (2019). Reevaluating human colonization of the Caribbean using chronometric hygiene and Bayesian modeling. *Science advances*, 5(12), eaar7806.

Pomey, P., & Poveda, P. (2018). Gyptis: Sailing Replica of a 6th-century-BC Archaic Greek Sewn Boat. *International Journal of Nautical Archaeology*, 47(1), 45-56.

Poullis, C., Kersten-Oertel, M., Benjamin, J. P., Philbin-Briscoe, O., Simon, B., Perissiou, D., ... & Rizvic, S. (2019). Evaluation of "The Seafarers": A serious game on seaborne trade in the Mediterranean Sea during the Classical period. *Digital Applications in Archaeology and Cultural Heritage*, 12, e00090.

Smith, K. (2020). *Modelling Seafaring in Iron Age Atlantic Europe*. PhD Dissertation, University of Oxford: Oxford.

Slayton, E. R. & Safadi, C. (2017, August 31). S343 Putting Seafaring on the Map: The application of computer models to maritime spaces and communication networks. *European Association of Archaeologists 2017*. Maastricht, Netherlands.

Slayton, E. R. (2018). *Seascape corridors: modeling routes to connect communities across the Caribbean Sea*. Leiden: Sidestone Press.

Slayton, E. R. (2019) S378 Modeling Mobility Across Waterbodies. *Society of American Archaeologists 2019*. Albuquerque, New Mexico, USA.

JUNE 15th

15:00 – 15:20

Cretan ports and harbors from Late Antiquity to the Byzantine Early Middle Ages (4th – early 9th c. AD)

Konstantinos Roussos

15:20 – 15:40

Digital Navigator on the Seas of the Selden Map of China: Sequential Least-Cost Path Analysis Using Dynamic Wind Data in the Early 17th Century South China Sea

Wesa Perttola

15:40 – 16:00

Between land and sea: modelling terrestrial mobility and maritime interaction on Crete during the Late Bronze Age

Paula Gheorghiade, Henry C. W. Price, Ray Rivers, Tim Evans

16:00 – 16:20

Navigating Seaways, Datasets, and Methods: Integrating Environmental and Archaeological Data into an Agent-Based Navigation Model for the Iron Age English Channel

Karl J. Smith

COFFEE BREAK

BREAK

18:30 – 18:50

Maritime mobility across the Neolithic seaways of North West Europe

Crystal Safadi, Fraser Sturt

18:50 – 19:10

Virtual Vaka: A Computational Tool for Thinking About Seafaring

Ben Davies, Simon Bickler

19:10 – 19:30

A Web-service for dynamic least-cost-maritime-path analysis and visualization within the context of seafaring in the Eastern Mediterranean during the Classical period

Georgios Leventis, Elias Frentzos, Phaedon Kyriakidis, Dimitrios Skarlatos, Dimitra Perissiou, Stella Demesticha, Evangeline Markou, Glafkos Cariolou

19:30 – 19:50

Technologies of Resilience, Climate Disaster, and Maritime Networks: A Case Study of Cycladic Small Worlds

Katherine Jarriel

19:50 – 20:10

Insular Interconnectivity in the Viking Age: A View from Norse Jarlshof, Shetland Islands, UK

Trent M. Carney

20:10 – 20:30

Four Ways to Paddle a Canoe: Comparing the successes and failures of four different seafaring computational models to capture pre-Columbian movement in the Caribbean

Emma Slayton

20:30 – 20:50

A null model of drift-induced maritime connectivity between Cyprus and its surrounding coastal areas at the onset of the Holocene

Phaedon Kyriakidis

S28. Computational modelling in archaeology: methods, challenges and applications (Standard)

Convenor(s):

Iza Romanowska, Aarhus University

Colin D. Wren, University of Colorado

Stefani A. Crabtree, Utah State University

Sebastian Fajardo, Department of Materials Science and Engineering, Delft University of Technology

Wednesday, June 16, Tombs of the Kings

11:50 – 14:20

15:00 – 16:40

Thursday, June 17, Choirkoitia

11:50 – 14:20

The steady stream of publications involving archaeological computational models is a clear sign of the discipline's dedication to the epistemological turn towards formal theory building and testing. Where hypotheses used to be generated verbally in natural language as possible explanations, they are now increasingly often expressed as GIS, agent-based modelling (ABM) or statistical models and meticulously tested against data. The session will showcase the breadth of applications, the ingenuity of researchers deploying new or adapted methods and the depth of insight gained thanks to computational modelling.

With increasing numbers of archaeologists becoming proficient in computer programming it seems that some of the technical and training-related hurdles are being overcome. In general, while some methods in archaeological computational modelling are well established and widely deployed, others (e.g., ABM) are still an emerging subfield with many exciting and fresh applications.

We will structure the session upon the three major questions:

- **The current landscape of computational modelling:** what are the strong versus the weak areas? Are certain topics, time periods, types of questions more often modelled than others? If so, why is that?
- **Potential areas for growth:** what are the obvious methodological and archaeological directions for computational modelling? Are technical skills still an impediment for a wider adoption?
- **Disciplinary best practice:** the need for open science is well recognised among computational archaeologists, but are there other ways in which we can make it easier for members of other branches of archaeology to engage with the computational modelling?

We invite archaeological modellers to present their current case studies, discuss new methods and issues they have encountered as well as their thoughts on the role of computational modelling in general archaeological practice. Computational modelling is meant broadly here as any digital technologies that enable the researcher to represent a real-world system to test hypotheses regarding past human behaviour.

JUNE 16th

11:50 – 12:10

The Toyah Phase Paradox

Bonnie L. Etter

12:10 – 12:30

Using difference-modelling and computational fluid dynamics to investigate site formation processes at shipwreck sites

Jan Majcher, Rory Quinn, Ruth Plets, Chris McGonigle, Thomas Smyth, Fabio Sacchetti

12:30 – 12:50

Estimating Sex from Calcaneus Measurements in a 19th Century Dutch Population: A Machine Learning Approach

Anne C. Dijkstra

12:50 – 13:10

Computational modelling of Neolithic spread: archaeology and genetics

Joaquim Fort, Joaquim Pérez-Losada

13:10 – 13:30

A multiscale approach to landscape connectivity using circuit theory

Xavier Rubio-Campillo

13:30 – 13:50

Agent-based modelling to assess hominin role in creating and maintaining vegetation openness during the Last Interglacial and the Early – Middle Holocene in Europe: overview of a planned simulation

Anastasia Nikulina, Fulco Scherjon, Katharine MacDonald, Anhelina Zapolska, Frank Artur, Maria Antonia Serge, Elena Pearce, Marco Davoli, Jan Kolen, Wil Roebroeks

13:50 – 14:10

Was Asclepius more popular in times of the Antonine plague? Answers from temporal modeling of epigraphic and numismatic evidence

Tomas Glomb

LUNCH BREAK

15:00 – 15:20

Replication of Results from Village, an Agent-Based Model of Socio-Ecological Dynamics in the North American Southwest

James R. Allison

15:20 – 15:40

Automated Segmentation of Hieratic on Papyri

Bartosz Bogacz, Tobias Konrad, Svenja A. Gülden, Hubert Mara

15:40 – 16:00

Modelling future developments of historic landscape character: challenges and pitfalls

Francesco Carrer, Nurdan Erdogan, Sam Turner

16:00 – 16:20

Teaching archaeological agent-based modelling through replication

Colin Wren, Stefani Crabtree, Iza Romanowska

16:20 – 16:40

Ontological behavior modeling and reasoning to capture tool use among primates and hominins

Pierre R Mercuriali, Geeske Langejans, Carlos Hernández Corbato

JUNE 17th

11:50 – 12:10

Stable results from spatial interaction models: was this settlement really popular?

Fabrice Rossi, Clara Filet

12:10 – 12:30

Virtual Knapping with Neural Networks: A Proof of Concept

Jordy D Orellana Figueroa, Jonathan Reeves, Shannon McPherron, Claudio Tennie

12:30 – 12:50

Multiproxies modeling to support new insights in landscape archaeology: the case studies of Pecora and Cornia valleys in Southern Tuscany, Central Italy

Giulio Poggi, Luisa Dallai, Vanessa Volpi, Steven Arthur Loiselle, Giuseppe Rino Stricchi

12:50 – 13:10

Computer Vision Understanding of Narrative Strategies on Greek Vases

Torsten S. Bendschus, Prathmesh Madhu, Ronak Kosti, Corinna Reinhardt

13:10 – 13:30

Petri nets for modeling non-linear dynamics of ancient adhesive technology systems

Sebastian Fajardo, Paul Kozowyk, Geeske Langejans

13:30 – 13:50

Modeling the material performance of ceramic vessels in view of their function and utilization

Anno Hein, Vassilis Kilikoglou

13:50 – 14:10

Strategy, tactics, supply and logistics of a Roman military intervention as a dynamic system: Middle Danube region during the Marcomannic wars

Marek Vlach, Balázs Komoróczy

S32. From artificial intelligence to stratigraphic reality. Dynamics of an inverse process for AI applications in archaeology (Standard)

Convenor(s):

Luigi Magnini, University of Sassari

Cinzia Bettineschi, University of Padova

Wednesday, June 16, Salamis

15:00 – 16:30

Thursday, June 17, Choirokoitia

15:00 – 16:30

16:50 – 18:20

Recently, artificial intelligence (AI) has become increasingly important in many archaeological fields, as testified by the growing number of publications, dedicated workshops, and sessions at international conferences (Schneider et alii 2015; Sevara et alii 2016; Ortengo, Garcia-Molsosa 2019; Davis 2019; Caspari, Crespo 2019; Dolejš et alii 2019; Fiorucci et alii 2020). Object-Pattern-Scenery Recognition, Machine Learning, Convolutional Neural Networks and ArchaeOBIA constitute some of the most widespread methods. These approaches are driving renewed innovation and experimentation in archaeological image analysis at the multi-scale level, further encouraging the shift from qualitative classification and interpretation to a truly quantitative and reproducible approach (Bennet, Cowley, De Laet 2014).

The initial burst of blind enthusiasm for AI derived from its numerous accomplishments is now being followed by a more reasoned reflection on the limits imposed by the very nature of archaeological sites and materials. In fact, the intrinsic incompleteness of the available data, especially the problems of equifinality and multifinality, rarely allow for a comprehensive and univocal classification of the archaeological objects even within the same or very similar case studies (Magnini, Bettineschi 2019; Casana 2020).

This session welcomes theoretical reflections, but also successful and not-so-successful case studies which highlight the synergy between artificial intelligence and the study of formation/ transformation/ postdepositional processes. The focus is multi-scalar, encompassing landscape-level, but also object-level and microscopic-level applications and their peculiar issues (e.g. partial obliteration, fragmentation, alteration, weathering and so on). This session is particularly interested in contributions focused on special assessment methods, from remote cross-validation to classic fieldwork, to statistical and mathematical approaches.

Our aim is to stimulate a profitable discussion on the limits, potential, and the future directions of automated image analysis in archaeology, stressing possible new directions for overcoming the uniqueness and incompleteness of the archaeological record. Ideally, the session aims to bridge the gap between the shovelless computer-archaeologists working from their couches and the 'old trowels', who claim the primacy of fieldwork and look with suspicion at new practices involving a fully digital, analytical protocol.

We particularly encourage authors to submit papers related to the following research questions:

- What are the strengths and weaknesses the different AI methods (OPSR/CNN/ML/OBIA) in coping with the incompleteness of the archaeological record?
- What can we learn from a theoretical reflection on stratigraphy, formation processes and objects biographies in order to improve (semi)automated classifications?
- How can we integrate the diachronic evolution of materials and landscapes into automated classification protocols?
- What can we learn from modeling and comparing the efficiency of digital and field-based assessment strategies?
- Is a real integration of field archaeology and automated detection possible? And if so, which is the expected impact of this interaction?

References

Bennett R., Cowley D., De Laet V., 2014, "The data explosion: Tackling the taboo of automatic feature recognition in airborne survey data", in *Antiquity*, 88(341), pp. 896–905. DOI: <https://doi.org/10.1017/S0003598X00050766>

Casana J., 2020, "Global-Scale Archaeological Prospection using CORONA Satellite Imagery: Automated, Crowd-Sourced, and Expert-led Approaches", in *Journal of Field Archaeology*, 45:1, S89-S100, DOI: 10.1080/00934690.2020.1713285

Caspari G., Crespo P., 2019, "Convolutional neural networks for archaeological site detection – Finding "princely" tombs", in *Journal of Archaeological Science* 110, 104998. <https://doi.org/10.1016/j.jas.2019.104998>.

Davis D.S., 2019, "Object-based image analysis: a review of developments and future directions of automated feature detection in landscape archaeology" in *Archaeological Prospection* 26, pp. 155-163. <https://doi.org/10.1002/arp.1730>

Dolejš M., Pacina J., Veselý M., Brétt D., 2019, "Aerial Bombing Crater Identification: Exploitation of Precise Digital Terrain Models", in *ISPRS International Journal of Geo-Information* 9, 713.

Fiorucci M., Khoroshiltseva M., Pontil M., Traviglia A., Del Bue A., James S., 2020, "Machine learning for cultural heritage: A survey", in *Pattern Recognition Letters* 133, pp. 102-108.

Magnini L., Bettineschi C., 2019, "Theory and practice for an object-based approach in archaeological remote sensing", in *Journal of Archaeological Science* 107, pp. 10-22, DOI: <https://doi.org/10.1016/j.jas.2019.04.005>

Orengo H., Garcia-Molsosa A., 2019, "A brave new world for archaeological survey: automated machine learning-based potsherd detection using high-resolution drone imagery", in *Journal of Archaeological Science* 112, 105013. <https://doi.org/10.1016/j.jas.2019.105013>.

Schneider A., Takla M., Nicolay A., Raab A., Raab T., 2015, "A template-matching approach combining morphometric variables for automated mapping of charcoal kiln sites: automated mapping of charcoal kiln sites", in *Archaeological Prospection* 22, pp. 45–62. <https://doi.org/10.1002/arp.1497>.

Sevara C., Pregesbauer M., Doneus M., Verhoeven G., Trinks I., 2016, "Pixel versus object—a comparison of strategies for the semi-automated mapping of archaeological features using airborne laser scanning data", in *Journal of Archaeological Science* 5, pp. 485-498. <https://doi.org/10.1016/j.jasrep.2015.12.023>.

Trier Ø.D., Cowley D.C., Waldeland A.U., 2019, "Using deep neural networks on airborne laser scanning data: Results from a case study of semi-automatic mapping of archaeological topography on Arran, Scotland", in *Archaeological Prospection* 26, pp. 165-175.

Verschoof-van der Vaart W.B., Lambers K., 2019, "Learning to look at LiDAR: the use of R-CNN in the automated detection of archaeological objects in LiDAR data from The Netherlands", in *Journal of Computer Application in Archaeology* 2, pp. 31-40. <https://doi.org/10.5334/jcaa.32>

JUNE 16th

15:00 – 15:20

Using machine intelligence to locate ephemeral archaeological landscape modifications: A case from Madagascar

Dylan Davis

15:20 – 15:40

Bridging the gap between Archaeology, Remote Sensing, and Artificial Intelligence through Explainable AI (XAI)

Hassan el-Hajj, Metoda Persin

15:40 – 16:00

Ceramic Fabric Classification of Petrographic Thin Sections Using Convolution Neural Networks

Mike Lyons

16:00 – 16:20

Objectives and Information: Mutual information, composite probabilities, and partitioning of archaeological sets

James S. Cardinal

JUNE 17th

15:00 – 15:20

Autonomous Archaeological Survey in the Southern Peruvian Andes

James Zimmer-Dauphinee, Steven Wernke

15:20 – 15:40

Application of machine learning to stone artefact identification

Rebecca Phillipps, Joshua Emmitt, Sina Masoud-Ansari, Stacey Middleton, Simon Holdaway

15:40 – 16:00

From field drawings to artifact data extraction using an object-oriented methodology

Floriane Peudon, Eric Masson, Agnès Lamotte

16:00 – 16:20

Dealing with an unbalanced dataset in Archaeology: a case study in the rock art archaeological sites of the Pajéu Watershed, Pernambuco/Brazil

Lucas B. Souza, Demétrio Mutzenberg, Eduardo Krempser

COFFEE BREAK

16:50 – 17:10

Clearing the clearance cairns: an object/pattern/scenery recognition case-study from the Highland of Asiago (Eastern Pre-Alpine area-Italy)

Armando De Guio

17:10 – 17:30

Mapping World War I heritage from historical aerial photography using Convolutional Neural Network approaches

Giovanni Azzalin

17:30 – 17:50

Convolutional Neural Networks for Ground-Penetrating Radar

Katie M Simon, Christopher Angel, William Johnston

S35. Round Table proposals for EU ERA Chair Mnemosyne (Roundtable)

Convenor(s):

Francesco Ripanti, Cyprus University of Technology

Harriet Clifflen, Cyprus University of Technology

Nenad Joncic, Cyprus University of Technology

Marina Toumpouri, Cyprus University of Technology

Giulia Osti, Cyprus University of Technology

Douglas Pritchard, Cyprus University of Technology

Eleanna Avouri, Cyprus University of Technology

Kyriakos Efstathiou, Cyprus University of Technology

Marinos Ioannides, Cyprus University of Technology

Thursday, June 17, Tombs of the Kings

11:50 – 14:20

The contemporary fast-paced evolution of tools and technologies that can be applied to facilitate Digital Cultural Heritage (DCH), from storytelling within museum exhibitions to e-archives, has enabled brand new scenarios in terms of human-machine interaction. The diversification of mobile devices and the ease of access to digital resources can now allow Cultural Heritage (CH) stakeholders – or better prosumers – to customise their interactions with the past and the present, even in real time. As the group of CH stakeholders is growing larger and more diverse, the conventional categorisations that included mostly traditional CH professionals are out-of-date and too limited: therefore, current and potential end users of DCH remain largely unidentified.

The development of methodologies and tools in order to address and understand their needs, motivations, degree of CH knowledge and technical expertise, has emerged as a critically important step in efforts towards the creation and implementation of guidelines on User Centred Design (UCD) for DCH. Therefore, this pioneering roundtable offers the opportunity to experts and/or practitioners from any field of DCH, to exchange and provide insights from the perspective of their sector about UCD. The participants can contribute as DCH users, as well as representatives of their institutions, which make CH digital assets available for use and re-use. Existing personalisation practices and tools will be discussed, along with specific methodological gaps in the area and proposals that will enrich current knowledge concerning use and reuse of DCH assets. The roundtable also considers the impact of the current pandemic on the needs of the users, and on how DCH is accessed, preserved and shared.

This session is organised by the European Research Area (ERA) Chair Mnemosyne on Digital Cultural Heritage (DCH), a research programme centred on the holistic documentation of the DCH lifecycle in support of existing and potential user needs. Contributions are not limited to researchers related to the project but are open for the wider DCH community. Participants are called to submit position papers that must not exceed 8 pages in total (references included), based on which they will be required to prepare a presentation with the duration of 10 or 15 minutes. We believe that a multidisciplinary approach is necessary in order to tackle UCD in DCH; contributions from any sector addressing global and post-pandemic UCD challenges are welcome, especially those covering topics such as:

- Personas, stakeholder analysis and other approaches to user categorisation in DCH,

- UI for specialised audiences in Knowledge Management in DCH (the story, memory and identity to be used by the audience, beyond concerns around 3D objects and environments),
- Crowdsourcing and user needs in long term digital preservation, e-archiving and DCH repositories,
- Interoperability, compatibility and standards in DCH Knowledge Management systems, for long-term preservation and e-archiving,
- UX design in relation to Virtual Archaeology, -Museums, immersive technologies and serious games.

JUNE 17th

11:50 – 12:10

Reflecting on the use of facilitated dialogue to support user centered design in digital heritage

Dimitra Petousi, Akrivi Katifori

12:10 – 12:30

From archaeological to digital data: a holistic reflection on the design of a serious game for users' engagement

Samanta Mariotti

12:30 – 12:50

User-centered design for digital applications on Underwater Cultural Heritage

Alexandros C. Tourtas, Anastasia Chourmouziadi

12:50 – 13:10

What can human-centred design achieve? Openness and inclusivity for enabling participatory digital heritage

Angeliki Tzouganatou

13:10 – 13:30

User Experience Design of Full-Immersive Serious Games for improvement of Cultural Heritage Communication and Understanding

Eleftherios Anastasovitis, Christina Tsita, Maya Satratzemi, Manos Roumeliotis

Posters

The Use of Sequential Spectral Filtering in Digital Multispectral Imaging for Identifying Pigments on Ancient Sculpture

Orestis Kourakis, Dimitrios Karolidis, Elissavet Dotsika, Angeliki Koukouvou, Dimitrios Tzetzis

Near Presence Analysis: A New Technique for Analyzing the Spatial Distribution of Material in Irregularly Distributed Surface Survey Data

Eli Weaverdyck

The French National 3D Data Repository for Humanities: Features, Feedback and Open Questions

Sarah Tournon-Valiente, Vincent Baillet, Chayani Mehdi, Xavier Granier, Bruno Dutailly, Valentin Grimaud

3D visualisation - a form of exploring, studying and experiencing the past. Reconstructions of the Early Iron Age settlements discovered at the sites of Stary Śleszów 17 and Milejowice 19

Małgorzata Markiewicz

Pedestrian surface survey nowadays with Covid-19: an example of QField application

Alessia Mandorlo

From Major Tom to Ground Control and back again: an almost circular argument

Gail Higginbottom, Vincent Mom

Three Approaches to the Sharing and Re-use of Survey Data

Martijn van Leusen, Tymon de Haas, Niels Wouda

Integrating legacy archaeological data into an ontology based on Human Ecodynamics: the case of the NABO archaeological reports in the DataARC Project

Pablo Barruezo Vaquero

Data augmentation of iberian pottery collections for DeepLearning based classification

José M. Fuertes, Manuel Lucena, Celia Cintas, Pablo Navarro

The study of the Christian origins of the Ribeira Sacra (Galicia, Spain) through New Technologies. Geophysical Prospecting and Photogrammetric Survey

Natalia Figueiras Pimentel, Jorge López Quiroga

An exploration of NLP and NER for enhanced search in osteoarchaeological and palaeopathological textual resources

Alphaeus G. W. Talks

Politia II: a Virtual Tour Management System

Vasileios Sevetlidis, Cristina Manzetti, Gianluca Cantoro, Nikolaos Papadopoulos, Ilias Fiotakis, George P Pavlidis, Apostolos Sarris

Laser Scanning for supporting the three-dimensional topographic footprints of monuments

Josefina Kountouri

Do water soil erosion phenomena threat cultural heritage sites? The case study of Chania, Crete, Greece

Christos Polykretis, Dimitrios D Alexakis, Manolis Grillakis, Athos Agapiou, Branka Cuca, Nikos Papadopoulos, Apostolos Sarris

Digitally Re-creating the Assembly Church: Using 3D Modeling to Enhance Archaeological Research

Cynthia Deuell, Lisa E. Fischer

Monitoring, Protection, and Valorization of Eastern Mediterranean Cultural Heritage: A role for the ERATOSTHENES Centre of Excellence

Georgios Leventis, Diofantos Hadjimitsis, Phaedon Kyriakidis, Kyriakos Themistocleous, Gunter Schreier, Harris Kontoes, George Komodromos

How to review research software in archaeology?

Timo Homburg, Anne Klammt, Hubert Mara, Clemens Schmid, Sophie C. Schmidt, Florian Thiery, Martina Trognitz

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