

# CAA 2012



Computer Applications and Quantitative Methods in Archaeology

40<sup>TH</sup>

26-30 March 2012

Archaeological Computing  
Research Group

School of Humanities

UNIVERSITY OF  
Southampton

[www.CAA2012.org](http://www.CAA2012.org)

List of Workshops,  
Round-Tables and Sessions

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## Conference Themes

CAA2012 is organised around eight separate themes. These will run in parallel throughout the three days of presentations.

1. Simulating the Past
2. Spatial Analysis
3. Data Modelling & Sharing
4. Data Analysis, Management, Integration & Visualisation
5. Geospatial Technologies
6. Field & Lab Recording
7. Theoretical Approaches & Context of Archaeological Computing
8. Human Computer Interaction, Multimedia, Museums

## Workshops (Monday 26 March 2012)

### Introduction to Geophysics

One of a series of "Intro to ..." sessions for newcomers to CAA and computing in archaeology. This workshop will be an introduction to geophysical data capture, processing and visualisation

### ARK The Archaeological Recording Kit - an introductory workshop

ARK - the Archaeological Recording Kit ([ark.lparchaeology.com](http://ark.lparchaeology.com)) - is a highly flexible system that you can use to put your archaeological data on the web so that you can work on it collaboratively and share it with a wider audience.

ARK is currently in use on a large number of different archaeological and non-archaeological projects around the world and has been available for download for a several years.

Version 1.0 of the system was released in 2011 and we thought that CAA 2012 would be a great opportunity for people to get a hands-on introduction to the latest version of the system, its installation, customisation and setup. Bring a computer to take part in the installation tutorial.

### Nikon "iSpace for Archaeology"

A hands-on workshop with a new 3D data-acquisition system from the Metrology division of the Nikon Corporation.

### Semantic Technologies and Linked Data Workshop

The purpose of this workshop is to explain the technologies and demonstrate new tools for non-specialist users to map and extract their own archaeological datasets into RDF/XML conforming to the CIDOC CRM and the CRM-EH archaeological extension of that ontology. The RDF/XML output is produced in a form that allows subsequent expression as Linked Open Data. We will demonstrate this using both pre-defined STELLAR project templates and other user-defined templates that can be found at:

<http://hypermedia.research.glam.ac.uk/resources/STELLAR-applications/>

The STELLAR (Semantic Technologies Enhancing Links and Linked data for Archaeological Resources) project <http://hypermedia.research.glam.ac.uk/kos/STELLAR/> was an AHRC funded project that followed on from STAR (Semantic Technologies for Archaeological Resources) which employed semantic and knowledge-based technologies to link excavation databases, vocabularies and associated grey literature. STELLAR has generalised the data mapping/extraction tools to facilitate their use by third party data providers. Excavation and analysis databases can be intellectually mapped to the CIDOC CRM conceptual model and extracted as RDF triples conforming to standard CRM patterns. The aim is to make it easier for data owners who are not ontology specialists to express their excavation data in terms of the CRM and to generate semantic and/or **linked data representations**.

In particular at the workshop we will demonstrate the STELLAR mapping/extraction tools and report on various experiences with using them. This will include input from the Archaeology Data Service (ADS) about their work on the implementation of their Linked Data triple store at <http://data.archaeologydataservice.ac.uk> along with development of the front end to the linked data, the ingest procedures and **metadata requirements**.

It will also be an opportunity to update people on the latest work carried out at English Heritage to develop templates and procedures for outputting Linked Data from the Intrasis excavation recording system to be deposited in and accessed from the ADS triple store. Other work looks at generating RDF/XML versions of the glossaries and thesauri connected with the datasets to be expressed in SKOS W3C standard format, which allows controlled data items and vocabularies to be connected using Linked Data technologies.

We will discuss mapping and extraction issues and there will be opportunities to try the tools, using examples of excavation datasets with finds, contexts, samples, etc. We would also welcome feedback and experiences from participants who have either used the STELLAR tools or who are carrying out similar work.

### **Open Source Hands-on GIS workshop for Archaeologists using QGIS and GRASS**

This workshop will introduce the use of Free and Open Source (FOSS) GIS software for archaeological applications. Both Quantum GIS (QGIS) and the Geographical Resources Analysis Support System (GRASS) will be used. There are no prerequisites, and no previous GIS experience is required. The workshop will present an overview of some applications of GIS for archaeologists, and will provide a basic introduction to QGIS and its GRASS plug-in. Participants will learn how to download the software (Windows, Mac or Linux), where to find help and various online resources for archaeology GIS, and will be provided with specific examples of the use of these for archaeology. The hands-on activities will center on learning the basic use and capabilities of QGIS for the display and analysis of spatial data. The GRASS plug-in will be used to conduct more comprehensive vector, raster, and voxel data display and analysis. A brief introduction to how these tools fit into the 'open source stack' together with other capabilities including python, WGS, R, and Postgis will also be presented. The goal is to have each participant capable of downloading the current version of the code and mastering the basics of using QGIS and GRASS for their own archaeological work.

### **Hands-on Archaeological Conceptual Modelling**

#### **Workshop Main Theme and Goals**

Research and practice in archaeology often generates and needs to manage a large amount of information, which exhibits complex relationships and categorisation phenomena. The quality of the conceptual models that we use when gathering, organising, processing and reporting this information determines, to a large extent, the quality of the results. Creating explicit, high-quality conceptual models is a crucial task in any information-intensive endeavour, and especially in those where the complexity of the information means that intuition alone is not sufficient.

This workshop aims to introduce the discipline of conceptual modelling, often seen as pertaining to the engineering world, to archaeologists and related professionals. This introduction will be achieved by doing and experimenting rather than through theoretical explanations. The authors have extensive experience in using conceptual modelling in archaeological domains for over 15 years, and will use ConML ([www.conml.org](http://www.conml.org)) as a vehicle. ConML is a simple, high-level, affordable, powerful modelling language specifically designed with the humanities and social sciences in mind. In addition to supporting most of the object-oriented structural modelling constructs, ConML extends them with concerns that are rarely seen in industry-standard approaches but which are extremely important in archaeology, such as the ability to express temporality and subjectivity in conceptual models.

The workshop will assume no previous knowledge of conceptual modelling, although it will assume familiarity with archaeological concepts and practice. It will begin by teaching the basic tenets of



object-oriented structural modelling, followed by more advanced concepts and situations. Participants will be asked to undertake an extensive array of exercises and practical cases in the archaeological domain, either or and in small groups, throughout the workshop. The number of 20 participants is considered maximum.

Similar experiences have been carried out internally at Incipit and also in the form of a postgraduate course at CSIC, with excellent results in both cases; archaeologists, historians and architects with no previous exposure to conceptual modelling were capable of creating good-quality models after a few hours of practice.

### **Other Related Events**

A related workshop, "Creating Conceptual Models in Archaeology", was run by the same co-chairs at CAA 2011 in Beijing with excellent results. The session "Archaeological Information Modelling", proposed also at CAA 2012, co-chaired by Cesar Gonzalez-Perez and Patricia Martín-Rodilla, is aimed to attract submissions describing the application of theories and methods to create and use information models in archaeology; in this regard, the workshop proposed here would work as the applied counterpart to the more theoretical-oriented session, and participants attending both would benefit from a richer perspective on the issue of information modelling in archaeology.

### **Joining the pots: linking and publishing excavation data using Heurist**

Heurist is a flexible, web-based collaborative Open Source database with a wide variety of applications, from archaeological data to historical encyclopaedias and text annotation. It has recently become the platform for a major legacy excavation data publication project for the site of Zagora. This had led to the development of models for complex interlinked excavation data and connectivity to ArcGIS (in addition to built-in mapping).

In this half day workshop we will introduce participants to the use of Heurist for heterogeneous archaeological data, illustrated with the Zagora database. Since it is web based, anyone with an internet connected computer will be able to follow along and spawn their own live database on our server, import the models from Zagora and import some trial datasets which we will provide.

The workshop will proceed from database creation and definition, through data import, online data entry and linking of data, to generation of online published output. At the end of the workshop participants should have the confidence to tackle a new database, either for a site or for other types of data collection.

The workshop will not require any special hardware or technical skills. Trial data will be made available via the web.

### **CARARE – Archaeology in Europeana Workshop**

Funded by the European Commission, Europeana (<http://www.europeana.eu/>) was launched in 2008, with the goal of making Europe's cultural and scientific heritage accessible to the public. It is a hugely significant and ambitious project which enables people to explore the digital resources of Europe's museums, libraries, archives and audio-visual collections through a single multi-lingual portal. The concentration to date has been on content from national libraries, archives and galleries and as such Europe's rich archaeological resources are currently underrepresented. CARARE is a Best Practice Network, funded under the European Commission's ICT Policy Support Programme, which started on 1 February 2010 and which will run for three years. CARARE engages and supports Europe's network of heritage agencies and organisations, archaeological museums and research institutions, and specialist digital archives in:



- making the digital content for the archaeology and architectural heritage that they hold available through Europeana,
- aggregating content and delivering services,
- and enabling access to 3D and Virtual Reality content through Europeana.

CARARE plays an important role in drawing together Europe's network of organisations responsible for investigating, protecting, informing and promoting unique archaeological monuments, architecturally important buildings, historic town centres and industrial monuments.

Lead by CARARE project partners the ADS from York, UK and the DCU based in Athens, Greece, this workshop will offer an opportunity for the international archaeological community to explore the work of the CARARE project and its relationship with Europeana. The workshop will consist of demonstrations of Europeana, the CARARE tools for data ingestion, the CARARE metadata repository, and CARARE data standards. This will be followed by a wide-ranging question and answer session with the CARARE team covering international data aggregation projects and the future directions that Europeana and CARARE might follow.

CARARE is an important opportunity for archaeologists, data holders, and data creators to engage with the European Commissions vision for making rich cultural heritage material available to all its citizens. This workshop will be of interest to everyone who consumes archaeological content online is concerned with public engagement, data management, data sharing and data standards, especially those who hold digital archaeological content, including 3D, and would like to make it more broadly available both to the specialist archaeological community and public at large.

### ArchCamp 8 ('Eahta')

ArchCamp is a regular meeting of minds and idea swapping session held by the Antiquist Cultural Heritage and IT online community. ArchCamp is intended as an open forum within which to demonstrate and to discuss ongoing, interesting and innovative projects and ideas. The session will take a round table format with all attendees welcome to comment and interact on an equal footing. In order to keep things interesting we ask that participants bring a topic or topics with them that they would be interested in presenting. These will be listed during a round of introductions after which we will agree upon a loose thematic agenda according to the interests of those present.

Generally speaking, presentations will last 5-10 minutes followed by a further 5-10 minutes of interactive demonstration of the relevant tools and technologies. Time will be set aside at the end to pass on and discuss any web discoveries or matters of common interest that participants may have stumbled upon prior to our session. The session lasts generally lasts for around 3 hours and is traditionally followed by drinks, food and sparkling conversation at a local watering hole.

For details of past ArchCamps, see:

<http://www.antiquist.org/wiki/index.php?title=Archcamp>

### Computational photography

This workshop will consist of presentations, discussion and hands-on demonstration. We will present advances in robust new conservation tools from the emerging science known as Computational Photography. The common feature of the computational photography imaging family is the purpose-driven, selective extraction of information from sequences of digital photographs. The information is extracted from the photographic sequences by computer algorithms. The extracted information is

then integrated into new digital representations containing information not present in the original photographs, examined either alone or sequentially.

We will describe robust photography-based digital techniques for use within conservation and associated research. We will show how the stories of conservators using these tools and the disclosed insights about the art works they care for can be leveraged and digitally presented to their colleagues, visitors to the collections, and the interested public.

The most mature and widely adopted technique for collections conservation and research is Reflectance Transformation Imaging. RTI creates digital representations from image sequences where light is projected from different directions. The lighting information from this image set is mathematically synthesized into an RTI image, enabling a user to interactively re-light and enhance the subject's surface in incredible detail. An IMLS sponsored training program is bringing a four day RTI training to all six masters programs in art conservation in North America, as well as four regional museum trainings open to museum professionals. As a result of this program over 150 museum professionals and pre-professionals will be fully trained in RTI technology, in addition to the many institutions that are adopting RTI outside of this program.

The workshop will present the latest developments in RTI. We will examine multi-spectral RTI and the hidden topological landscapes disclosing under-painting and drawings in the infra-red and the fine surface information disclosed in ultra-violet wavelengths. We will discuss RTI of subjects under magnification using macro and microscopic optics as well as updates in viewing technology.

New developments in the related technology Algorithmic Rendering (AR), which uses the same data sets as RTI, will also be presented. The development of new AR technology by Princeton University and Cultural Heritage Imaging is supported by a significant grant from the National Science Foundation. The end-product will be an open-source tool which will extract and merge visual information available only under certain lighting conditions, certain wavelengths, or certain imaging modalities. Conservators will be able to generate high quality, comprehensible illustrations for documentation, scientific study, and sharing with colleagues, collection visitors, and the public.

New software tools to better collect and manage the metadata surrounding the creation of RTI and AR will also be discussed. This “digital lab notebook” is a critical element in the generation of scientifically reliable digital representations that enable future reuse for novel purposes, assist the long-term digital preservation of the virtual representations, and aid the physical conservation of the digitally represented museum materials.

Computational photography is a rapidly expanding field generating new tools and methods that can aide conservators in the documentation, study, and widespread understanding of the art works under their care. Note: this workshop is designed to complement the paper session “Advances in computational photography techniques for conservation, research, and public access”.

### **MeshLab as a tool for archaeological studies**

In the last few years 3D technologies have found in the archaeological studies an important application field and, from niche experimentations, have become a standard tool for the documentation, investigation and presentation of sites, artefacts and excavations.

The aim of this half-day workshop is to present to the archaeological community the various tools offered by MeshLab for the manipulation and use of 3D data in the archaeology field.

MeshLab is an Open Source tool for the visualization and processing of large, unstructured 3D models, developed by the Visual Computing Lab (ISTI-CNR). Born as a university project, MeshLab has steadily grown in features and usability, reaching more than 100.000 downloads in the last year. MeshLab is used by hundreds of research groups and industries, and by thousands of 3D hobbyists. Featuring various state-of-the art 3D processing algorithms (often implemented by their academic authors), it represents a solid and free alternative to commercial tools for 3D scanning data management.

The workshop will cover the various stages of the use of a 3D model, from its creation to its complete exploitation, focusing on the functionalities more interesting from a CH and Archaeological point of view

- 3D Model creation from raw data: the tools needed to process raw 3D data coming from 3D scanners (triangulation, structured light or time of flight) and 3d-from-images reconstruction tools (like Arc3D, PhotoFly or PhotoScan). Scan alignment and merging. Photographic alignment, color mapping and texture generation.
- 3D model manipulation: model cleaning and filtering. Smoothing, simplification and format conversion.
- Measurement and data extraction: taking measures on a 3D geometry, point picking, model annotation, numerical comparison between 3D geometries.
- Visualization and documentation: advanced shading, rendering, image generation.

#### **V-MusT.net Thematic Cluster Meeting**

V-MusT is a EU FP7-funded network of excellence that aims to provide the heritage sector with the tools and support to develop virtual museums that are educational, enjoyable, long-lasting and easy to maintain. This meeting will bring together those CAA2012 delegates involved in the project.

## Sessions (Tuesday 27, Wednesday 28 and Thursday 29 March 2012)

### Theme One: Simulating the Past

This theme includes sessions and round-table discussions that focus on the simulation of both dynamic past processes and past environments. Session Sim4 includes papers that aim to illustrate the new applications in archaeological simulation modelling that high-performance computing and large digital datasets allow for. The papers in session SimG, on the other hand, reveal new approaches and original case-studies in archaeological virtual reconstruction. Sim6 moves the emphasis firmly towards the analysis of simulated environments by exploring theoretical and practical considerations surrounding structural analysis of built and non-built environments. Session Sim1 includes papers that introduce a wide range of archaeological theories, methods and applications of 3D modelling. Sim7 focuses more specifically on applications of 3D modelling to engage public audiences, through papers discussing practical experiences with new digital techniques for public engagement. Session Sim2 includes papers that apply simulation approaches to understanding a diverse range of past dynamics. The round-table Sim3 will feature discussions of existing applications of interactive visualisations in archaeology and how to build on the experiences gained in developing them.

The papers presented in this theme are indicative of the growing number of original applications of simulation techniques in archaeology. They also promise to illustrate an awareness of the largely practical issues surrounding these applications as well as the new opportunities provided by recent hardware and software development.

### Archaeological Simulation Modelling as Computational Social Science: Next Steps Forward

#### *Session Code: Sim4*

Simulation modelling and 'Artificial Societies' have given social scientists a new and productive means for the study of social interactions. These same tools have been extended to archaeological contexts through numerous simulation models and applications of social and social-ecological interactions over both short and long periods.

The core components of simulation in social science contexts, especially agent-based modelling (ABM), have begun to be considered under a broader heading of 'Computational Social Science.' This shift reflects new currents in the larger domain of computational science, where dramatic changes, such as a shift to 'cloud' computing, are being seen. Computational Social Science includes an array of approaches, including social network analyses and the mining and modeling of large-scale data sets. Broadly, these are all related by virtue of being based on two components that have become available only recently: the increased processing power needed to carry out the extensive computation required and the availability of novel (and often very large-scale) datasets. For the moment, the pendulum has swung toward the latter of these, as new, immense datasets become available and researchers pursue the wide array of opportunities they offer. Computational power, conversely, continues to expand, but to use it social scientists must overcome the technical challenges that arise because the platforms for the most powerful systems for high-performance computing (HPC) require parallel rather than serial computation; systems with tens of thousands of processors can solve very large problems, but only if those problems are parsed into units that can be executed in parallel, a task that is especially challenging for problems in the social sciences. Both

the increasing use of large datasets and the move toward high-performance, parallel computing will continue for the foreseeable future.

Archaeological simulation modelling is also being shaped by these trends. The platforms and architecture available for archaeological simulations grow ever more powerful; meanwhile, existing datasets are being expanded and translated into computationally manipulable forms, and are further complemented by datasets that are newly available and are of previously unimaginable kinds and very large scales. These not only allow new ways to approach our original questions, but make possible previously unconsidered ways of understanding the archaeological record.

This session will bring together examples of archaeological simulation models and related computational approaches that are at the fore of these issues. The emphases will be: large-scale simulation models, especially those that feature HPC/parallel computing environments or 'cloud-based' simulations; models that integrate and employ datasets that are novel or that are especially challenging in their content, structure, or scale; new and innovative ways to use these large datasets; and models or modelling efforts that reflect archaeology as a computational social science and the broader changes being seen in this and similar computational fields. The purpose is to present the current state of the art in the field, to reflect on the new technical and theoretical challenges these models offer and the ways these are being overcome, and to discuss the next directions that archaeological simulations and related problems will take.

**Papers in this session:**

Inside an Artificial Society. Beyond Science Fiction Tales

*Juan A Barceló, Florencia Del Castillo*

Evaluating Prehistoric Population Events in Finland: A Simulation Approach

*Tarja Sundell, Juhana Kammonen, Martin Heger, Jukka Palo, Päivi Onkamo*

Pandora's box: the challenge of exploring social simulation models with supercomputers

*Xavier Rubio-Campillo, Alexis Torrano, Jose María Cela, Bernardo Rondelli, Andrea Balbo, Miquel Ramírez, Carla Lancelotti, Matthieu Salpeteur, Victoria Reyes-García, Marco Madella*

A High-Performance Computing Simulation of an Irrigation Management System: The Hohokam Water Management Simulation II

*John T. Murphy*

Applying Parallel and Distributed Computational Methodology to Modelling Irrigation Agriculture

Mark Altaweel

**Virtual Reconstructions: Theory and Practice (General Papers)**

**Session Code: SimG**

**Papers in this session:**

Handling transparency in 3d reconstructed on line environments: Aquae Patavinae VR case study

*Sofia Pescarin, Daniele Ferdani, Bruno Fanini, Ivana Cerato, Guido Lucci Baldassari*

Combining diverse modeling techniques to produce high-fidelity reconstructions

*Peter Anthony Inker, Taylor Baldwin*

Deconstructing Photorealism: Art or Science?

*Grant Bryan Jeffrey Cox*

VIRTUAL ENVIRONMENTS AS AN INTERPRETATIVE TOOL: THE EXAMPLE OF THE TEMPLE OF

HERCULES IN CELJE, SLOVENIA*Maja Jerala*VR of a 1st century AD Roman city. Pollentia: architecture, topography, geography*Bartomeu Vallori-Márquez, Miguel Ángel Cau Ontiveros*Restitutions of architectural hypotheses in an archaeological 3D GIS*Eric Desjardin, Olivier Nocent, Dominique Pargny, Cyril de Runz*Modeling Stonehenge: visualisation, auralisation, apps and films*Rupert Till*Digital Models – Associative Geometry: the peculiarity of monuments in extension. The eighteenth-Century Lisbon Aqueduct as a case study*Maria Helena Rua, Ana Cristina Chalaça Gil*The medieval settlement of Montieri, from archaeological excavation to 3D reconstruction*Daniele Ferdani, Giovanna Bianchi*The Invisible Museum*Suzanne-Marie Psaila*3D Laser Scanning and Virtual Reconstructions, their integration as research tools for representing the past. Case of study: the Virtual Roman Baths of Edeta.*Vito PORCELLI, Fernando COTINO VILLA, Josep BLASCO I SENABRE, Vicent ESCRIVÁ TORRES, Carmen MARTÍNEZ CAMPS, Xavier VIDAL FERRÚS, Julián ESTEBAN CHAPAPRÍA*Pompei revived Scanning Mission- insula V 1*Nicolo' Dell'Unto, Matteo Dellepiane, Marco Callieri, Anne-Marie Leander, Stefan Lindgren, Carolina Larsson***Standing structurally stable on the common grounds of archaeology****Session Code: Sim6**

Structural analysis is widely used to determine static, dynamic, and thermal behaviour of physical systems and their components. Several methods can be employed to analyse building and non-building structures. The main purpose of structural analysis is to ensure the adequacy of the design from the view point of safety and serviceability of the structure and to check stability of an existing system. Although it plays an important role within many different disciplines, it is rarely applied within archaeology.

This session wishes to promote structural analysis within archaeological modelling and interpretation and aims to take the first step in bringing together the existing diverse and interdisciplinary applications of structural analysis. As a result, identification of methodological and theoretical common grounds can be used within all aspects of archaeological studies.

This session invites inter-disciplinary studies which combine structural analysis considerations of historic structures and/or their components with the techniques used in archaeology. The key point for this session is the collaborative working towards a shared set of computational techniques that can be used within various aspects of archaeological data, recording and subsequent interpretation.

**Papers in this session:**

The application of finite element method to the structural study of vaulted monumental buildings in Opus Caementicium

*Renato Perucchio*

Structural analysis of earthworks and wooden systems: a support to restore the neolithic monumental architecture

*PILLOT Lucile*

Theoretical Structural Archaeology

*Geoff Carter*

Reconstruction of Ruined Archaeological Structures Using Structural Analysis Methods

*James Miles, Aykut Erkal*

Structural assessment of ancient building components

*Georg Herdt, Aykut Erkal, Dina D'Ayala, Mark Wilson Jones*

### **3D technologies for archaeological research: theory and methodologies**

#### **Session Code: Sim1**

3D technologies are around us for more than two dozens of years and yet their full implementation as a research tool in archaeology has not been exploited. The session is looking at gathering papers that will show success and failure case-studies of 3D technologies involved in the archaeological research process - in other words, how 3D technologies helped answering an old (unanswered) archaeological research question, or helped defining a new question (and also answering it).

#### **Papers in this session:**

Groovy hardware on my wish list

*geoff carver*

Methodological contest between high-end hardware and low-cost equipment for archaeological documentation

*Undine Lieberwirth, Bernhard Fritsch, Markus Neteler, Markus Metz*

Making visible: 3D voxel representations of 'sites without features'. The case study of Hoge Vaart, the Netherlands

*Stefania Merlo, Hans Peeters*

Image-Based 3D Documentation of Archaeological Trenches Considering Spatial, Temporal and Semantic Aspects

*Robert Wulff, Reinhard Koch*

Three dimensional modular construction system for interpretation and visualization of archaeological urban environments

*Paul Johnson, Michael Klein, Nicola Schiavottiello*

The archaeologist perspective on the use of procedural modeling

*Nicola Amico, Sorin Hermon*

3D Documentation for the assessment of underwater archaeological remains

*Barbara Davide, Gabriele Gomez de Ayala, Roberto Petriaggi*

A Proposed 3-D Imaging Technique for Recording a Submerged Cultural Resource

*Brian Seymour*

3D documentation and exploratory data analysis of excavation data using GIS

*Markos Katsianis, Spyros Tsipidis*



## Connecting to Cultural Heritage: Using 3D Visualization to Engage Public Audiences

### *Session Code: Sim7*

One of the primary beneficiaries of archaeological research is the public, but distilling complex datasets into understandable information about the past for non-specialists is essential for reaching this audience. Virtual reconstructions of cultural heritage sites have tremendous benefits for research and scholarship, but archaeologists can also use them to translate archaeological findings into a format that is more accessible for a lay audience. 3D models can be presented online to reach diverse and distant web users or they can be used onsite to enhance the guest experience as part of a visit to a cultural heritage destination. Virtual reconstructions can be used not only to help public audiences visualize historical sites, but they can also serve as portals connected to additional digital media for further learning. In an interactive virtual environment, the user is no longer a passive consumer of information but can assume a much more active role in exploring a historical site. At the same time, it is important to situate the virtual world within its greater historical context so that the participant can make informed decisions to guide their experiences and thus to learn about the past.

We would like to bring together a wide-range of papers focusing on innovative approaches to presenting 3D models to the public, either online or onsite. How are projects moving beyond rendered images of virtual reconstructions to present engaging experiences for a non-specialist audience and what technologies are being used? Some examples might include the use of gaming engines or other software to create interactive experiences, such as games, simulations, or 3D data portals; the development of mobile applications; and the creation of immersive environments. What are the benefits and challenges of creating these virtual environments for a public audience? Can a virtual reconstruction be engaging and educational if it is "uninhabited" or is it important to add people through avatars, video, or other means? What are the explicit or implicit educational goals of these presentation formats and is it possible to determine whether those goals are being met?

In this session, we will explore the presentation of 3D virtual reconstructions for a public audience as part of a discussion about the strengths and limitations of different approaches, not only in terms of the technology but also from the end user perspective. We welcome papers not only on projects that have been completed, but also those that might still be in the early stages of development to create a dialogue about future directions for connecting to cultural heritage.

### *Papers in this session:*

#### Virtual Reality Simulations in Cultural Heritage

*Ioanneta Vergi*

#### Teaching Cultural Heritage and 3D Modelling through a Virtual Reconstruction of a late Middle-Age Church

*Andres Bustillo, Lena Saladina Iglesias, Ana Maria Peña, Laura Martinez*

#### Virtually Visiting Williamsburg: The Use of 3D Modeling to Enrich the Museum Guest Experience

*Lisa E. Fischer*

#### Hands-Off: Using Kinect to virtually query the ancient Maya city of Copan, Honduras

*Heather Richards-Risetto, Jim Robertsson, Jennifer von Schwerin, Giorgio Agugiaro, Fabio Remondino, Maurizio Forte*

#### Three-dimensional tour into the mysterious world of Ancient Egyptian Mummies. A stereo 3D film in the Museum of Fine Arts, Budapest

*Máté Petrik, Miklós Kázmér, Zsófia Végvári*

Using ConML to visualize the main historical monuments of Crete

*Panagiotis Parthenios*

A real-time exploration of the virtual reconstruction of the “Pórtico de la Gloria” instruments

*Roi Méndez Fernández*

Taking excavation to a virtual world: importing archaeological spatial data to Second Life and OpenSim

*Isto Huvila, Kari Uotila*

The role of heritage education in the development of 3D virtual models

*M.Carmen Rojo, Tània Martínez, Mireia Romero*

ICON – A Content Exchange Mechanism for 3D Cultural Heritage Models

*James Miles, Richard Beales, Ajay Chakravarthy, Ken Meacham, Michael Selway, Mike Stapleton, Sam Kuhn, James Stevenson, Carlos Jimenez, Steve Luther*

### 3D technologies for archaeological research: applications

#### **Session Code: Sim1**

3D technologies are around us for more than two dozens of years and yet their full implementation as a research tool in archaeology has not been exploited. The session is looking at gathering papers that will show success and failure case-studies of 3D technologies involved in the archaeological research process - in other words, how 3D technologies helped answering an old (unanswered) archaeological research question, or helped defining a new question (and also answering it).

#### **Papers in this session:**

Calibrating an Illumination Dome for Archaeological Metrology

*Lindsay MacDonald, Mona Hess, Ali Hosseinaveh Ahmadabadian, Stuart Robson*

Extracting Scars and Ridges Features from 3D-scanned Lithic Artifacts

*Eitan Richardson, Leore Grosman, Michael Werman, Uzy Smilansky*

The Restoration of Ceramics from Torre de Palma in Virtual and Augmented Reality, and the Implementation of CAD/CAM Technologies

*Maria Helena Rua, Maia Langley*

Exploring the perception of epigraphy: Analysis of visualisations through eye tracking

*Adam Frost*

Instruments and methods for the survey and analysis of amphitheatres

*Martina Ballarin*

The Digital Hadrian's Villa Project: Virtual World Technology as an Aid to Finding Alignments between Built and Celestial Features

*Bernard Frischer*

Towards an interactive procedural reconstruction of the Louvre

*Sven Havemann, Ulrich Krispel, Wolfgang Thaller, Rene Zmugg, Martin Pszeida, Dieter Fellner*

Post-excavation analysis in archaeology using technology

*Kostas Anastasiades, Nicola Amico, Giancarlo Iannone, Sorin Hermon, Karin Nys*

## Artificial Societies in Prehistory and Ancient Times

### **Session Code: Sim2**

The idea of this session is to integrate different papers about the computer simulation of social mechanisms in prehistory and ancient times. Any computer simulation technique will be welcomed, from agent-based simulation to discrete event simulation, differential equations or neural networks. In the same way, all subjects within archaeology are also welcomed, from hunter-gatherer dynamics to ancient states.

### **Papers in this session:**

#### Applying the ODD protocol in agent-based modeling of past socio-ecological dynamics

*Bernardo Rondelli, Xavier Rubio, Alexis Torrano, Andrea Balbo, Miguel Ramirez, Carla Lancelotti, Matthieu Salpeteur, Victoria Reyes-García, Marco Madella*

#### Modeling Anthropic Ecosystems: a framework to understanding the whole before modeling the parts

*Andreas Angourakis*

#### SteppingIn – modern humans moving into Europe

*Fulco Scherjon*

#### Why Hunter and Gatherers did not die more often? Simulating prehistoric decision making

*Florencia del Castillo, Juan A. Barcelo*

## Round-Table: New Interactive 3D Solutions for Cultural Heritage Visualization

### **Session Code: Sim3**

As computational capabilities in real-time Computer Graphics have continued their relentless advance in recent years and as prices for 3D data capture and modeling have been greatly reduced, many new tools for interactive visualization have become available. This round table will explore the latest applications of interactive and real-time 3D graphics technology across the spectrum of cultural heritage applications, including modeling of intricate objects such as sculpture, conversion of 3D environmental models to virtual worlds, serious gaming, remote and web rendering, and augmented reality simulations.

We will highlight the work of IDIA Lab (John Fillwalk, Ball State, USA), the Virtual World Heritage Laboratory (Bernie Frischer, University of Virginia, USA), the Center for Digital Initiatives (Alyson Gill and Kim Dylla, Arkansas State University, USA), the Experiential Technologies Center (Chris Johanson, UCLA, USA), and Gunnar Liestøl (University of Oslo, Norway). Frischer and Fillwalk will discuss their collaboration on creating a virtual world of Hadrian's Villa, the World Heritage Site near Tivoli, Italy. The project is based on a scientific 3D model of the villa authored in 3D Studio Max and converted to Unity 3D, a virtual world platform. The purpose of the virtual world is to test recent scholarly theories about the utilitas of the villa proposed in two recent monographs by Chiappetta and Ytterberg. Frischer will also discuss his work using Autodesk's freeware Photo Scene Editor for 3D data capture of sculpture. Gill and Dylla will illustrate the use of non-playing characters in Unity 3D in the virtual heritage site, the Lakeport Plantation, as well as a few other American Heritage visualization projects in virtual environments such as Second Life, including a reconstruction of the boyhood home of Johnny Cash. Liestøl will discuss his work involving iPhone applications for augmented reality solutions for on-site observation of Viking archaeology sites, and Johanson will discuss recent work in the "Humanities Virtual Worlds Consortium." The roundtable will also include

other colleagues from across North America and Europe whose work involves real-time walkthroughs of archaeological sites, or remote rendering online simulations.

The aim of this roundtable is to provide a forum in which to both showcase existing uses of this technology in the realms of archaeology and cultural heritage, as well as to brainstorm about possible collaborations and advancements in the way that interactive visualizations further the exploration of and access to projects of this nature.

***Papers in this session:***

Round Table Discussion

*Alyson Gill et al.*

Reconstructing the Baths of Caracalla

*Taylor Oetelaar*

## Theme Two: Spatial Analysis

Spatial analysis is well represented at CAA2012, with sessions and papers covering a wide range of both theoretical and methodological concerns. Session Geo6, which aims to stimulate integrative spatial approaches in archaeology, promises to do just that. It includes papers that address the issues involved in integrating diverse scales of spatial and temporal analysis, illustrated by a number of applied case studies. Papers in session Geo10 also focus on integrated geospatial approaches with a particular focus on survey and remote sensing datasets. Session Geo1 addresses the key archaeological issue of detecting and understanding change in light of new data gathering techniques and advances in spatio-temporal modelling and analysis. Session Theory2 addresses the common criticism of archaeological GIS applications being technologically deterministic and showing a lack of theoretical engagement. With session Theory6 we return to questions of change, but this time the focus lies on change through movement. Papers include reflections on motion capturing techniques, least-cost path analysis and theoretical considerations on movement and flows through the landscape. Session Geo5 argues that Advanced geomorphometric analysis techniques, which deal with characterizing surface features through DEM's, have not attracted much interest in archaeology and the papers in this session promise address this concern.

All of these sessions attest of a critical awareness of theoretical issues as well as of the research and commercial opportunities new geospatial technologies allow for. The research papers that will feature in this 40<sup>th</sup> edition of CAA promise to build on the strong tradition of spatial analysis in archaeology and will push the boundaries of current applications to open up new and exciting research avenues.

### Reviewing spatial analyst in archaeological context, from disconnected components to a congruence way of integration: Archaeological Spatial Information Perspective

#### *Session Code: Geo6*

This session aims to discuss epistemological and operational functions in recent advances (theory, methodology and archaeological issues) in spatial technologies applied to archaeology. At present, the process of capturing, managing and analysing spatial data in archaeological contexts has been a real revolution in our discipline. Despite this innovative setting, one of the main risks that archaeologists are facing is repeating the same kind of questions from past decades about the analysis and representation of archaeological entities in a spatial dimension, while technology is far beyond the capability of formulating and solving our (archaeological) spatial questions.

There are many new possibilities for analyses and understanding spatial (and temporal) variability in the archaeological record. Advances in the Heuristic Approach as a way to solve certain archaeological spatial problems seem to be well addressed, e.g. Geo-statistical approach, Spatial Simulation Process, Analytical Visualization, etc. Nevertheless, the software solutions are extensive and they have a vast range of applications, from capturing data to interpretative representation of spatial variability. Thus, having a high-degree of knowledge in the design and implementation of tools for spatial analysis has become essential.

Within this framework, the relationship between different aspects like: data type, visualization, analysis and interpretation are often disconnected. This situation has give rise to an integrating tendency commonly referred to as Archaeological Information Science (AISc) (Llobera 2011;

McManamon&Kitigh 2010).It is an integrative perspective where capturing data, representing, analysing and modelling archaeological events has an interdisciplinary focus, anything that, in the words of Llobera: “goes beyond mere technical skills” (2011:193.)

This is an interesting point of view, since in other disciplines it is common to solve spatial problems under this perspective. AISC is probably a better way to integrate particular conditions in archaeological spatial problems, analytical toolkits and interpretation. Archaeology, like other domains of Science, has an important spatial-temporal component, but is it ready to implement these kinds of solutions?

Of course scalar questions are a key factor in any archaeological spatial problematic. For example at intrasite level the opportunity of AISC may be related with the idea of real innovation at archaeological sites converting it in an interactive laboratory (e.g. quantifying spatial variations in real-time, making spatial predictions,..). On the other hand, at a landscape level it can suppose an opportunity for designing new ways of representing meaningful relationships between artefacts, sites and landscapes’ features in a critical way.

For instance, in this session we are interested in contributions oriented on discussion how to engage the methodological scope with epistemology by discussing study cases where integrative approaches have been applied to analyse and represent complex spatial data.

### **Papers in this session:**

Approaching spatial context from a new perspective. What can we wait from “Archaeological Information Science”?

*Alfredo Maximiano Castillejo, Enrique Cerrillo Cuenca*

Landscape networks. The spatial reflection of human practices.

*Luis Antonio Sevillano Perea*

The Distribution Map – One step beyond

*Gary Nobles*

From space to graphs for understanding the spatial changes with the medieval and modern fiscal sources

*Mélanie Le Couédic, Xavier Rodier, Samuel Leturcq, Florent Hautefeuille, Bertrand Jouve, Etienne Fieux*

Open source geostatistics for archaeology: the fauna of Fumane cave

*Enzo Cocca, Enrico Guastaldi, Marco Peresani, Matteo Romandini*

Zooming patterns among the scales

*Alessio Palmisano*

Ecological and social space in the high mountains in South Norway 8500 – 2000 BP

*Espen Uleberg, Ellen Anne Pedersen*

Integrating spatial analyses into foraging societies land use strategies. A case study from the Nalón basin (Asturias, North of Spain).

*Miguel Angel Fano, Alejandro Garcia*

GIS & Statistical Methods applied on the ager Tarraconensis.

*José Ignacio Fiz*

Bootstrapped Correspondence Analysis in Practice

*Kris Lockyear*

## Integrated geospatial approaches to the interpretation of archaeological environments

### Session Code: Geo10

In recent years advances in archaeological survey and remote sensing technologies (archaeological geophysics, aerial photography, satellite imagery, LiDAR etc.) have offered new possibilities for the recording, visualisation and analysis of archaeological environments. In parallel with the technological and methodological developments observed in individual fields of research there has been a growing awareness of the benefits of integrating different survey and remote sensing methods, so as to produce enriched archaeological analyses and interpretations. This trend has mainly been expressed in the increasing number of multi-method approaches to the study of archaeological remains and works that examine the benefits of various data fusion techniques. Furthermore, integrated geospatial approaches have been a main focus for discussion within international multidisciplinary research groups and networks of co-operation (e.g. ArchaeoLandscapes Europe, <http://www.archaeolandscapes.eu/> and Radio-Past projects, <http://www.radiopast.eu/>).

Contributions to this session will discuss the use of integrated approaches to geospatial analysis in archaeology, highlight their benefits for archaeological practice and interpretation, and examine the potential problems associated with their application. Papers discussing the integration and coupling of different survey and remote sensing methods (geophysical survey (e.g. magnetometry, electrical resistance, and GPR survey etc), satellite imagery, airborne remote sensing techniques, aerial photography, topographic survey, geoarchaeological survey) for the interpretation of archaeological remains are particularly encouraged. Furthermore, we invite contributions that explore how the above methods can be best combined with other computational approaches and analyses in archaeology (GIS-based analysis, ancient terrain reconstruction, 3D urban reconstructions, space syntax etc). Finally, works that cover advanced data analysis and fusion techniques, and discuss the currently available commercial and open source software solutions for the integrated analysis of surveying and remote sensing data are also very welcome.

### Papers in this session:

Pursuing the past: Current approaches to integrated geophysical surveys of Roman urban landscapes in the Mediterranean

*Stephen Kay, Sophie Hay, Nicholas Crabb, Elizabeth Richley*

"The whole is more than the sum of its parts"- Geospatial data integration and analysis at the Roman site of Ammaia (Marvão, Portugal)

*Eleftheria Paliou, Cristina Corsi, Frank Vermeulen*

Dionysias Archaeological Project: the discovery of a new town in Egypt through Remote Sensing and GIS

*Gabriella Carpentiero*

Rural Life in Protohistoric Italy: using integrated spatial data to explore protohistoric settlement in the Sibaritide

*Kayt Armstrong, Martijn van Leusen*

Multi+ or Manifold Geophysical Prospection?

*Apostolis Sarris*

Multi-method archaeological prospection in the Brú na Bóinne WHS, Co. Meath, Ireland.

*Stephen Davis, Conor Brady, Kevin Barton*

Above and below: an integrated approach to the analysis and visualisation of data from



topographic and geophysical surveys

*John Pouncett, Christine Markussen*

Integrated survey, mapping and interpretation of abandoned Roman towns in Adriatic Italy

*Frank Vermeulen, Geert Verhoeven, Francesca Carboni*

**Detection and analysis of change****Session Code: Geo1**

Archaeologists have many sources of information to investigate changes in rural and urban in detail. Moreover, the development of data acquisition techniques increases significantly our ability to detect and interpret historic features within landscapes. Rural and urban areas have therefore a time depth which is sometimes difficult to sort out; their study now require a more contextualized approach to the use of various datasets (e.g. field walking, archival, geophysics or remote sensing data – optical, radar or lidar) through sophisticated data management, visualization and/or modelling paradigms.

In this session we would like to gather a broad overview of methods and techniques used to perceive and analyze spatial dynamics in Archaeology. The multiple approaches in Archaeology provide various analytical and theoretical frameworks to better understand chronological change and interconnections between different states. Besides, new data acquisition techniques do not only provide evidence (features) and input data for analysis and modelling over large time span, they also offer specific concepts and techniques (e.g. image processing or geostatistics) for analysis of change. Papers that cover new approaches to spatio-temporal modelling and analysis, and data integration are encouraged. Papers that review the current status of spatio-temporal approaches and their application in archaeological domain are also invited to participate. In addition, papers that address the use of aerial and remote sensing techniques as a tool for detection and analysis of change are welcome.

The purpose of the session is to encourage innovative thought, discussion and transfer of approaches, methods and tools to capture, visually illustrate and analyse change or changes. The group ISA (Information Spatiale et Archéologie) hopes that this session will generate exchanges of ideas among specialists from different horizons and different fields, and perhaps stimulate new collaborations.

Topics of interest include, but are not limited to:

- practical examples of change detection, spatio-temporal GIS or visualization,
- integration of various sources of information to detect changes in archaeological features and landscapes,
- integration of spatial and temporal data for the analysis of dynamics, presentation of explanatory and representational tools to model both spatial and temporal changes.

**Papers in this session:**Surface artifact survey and analysis of ceramic concentrations

*Ondřej Malina, Jakub Šilhavý*

Neolithic and Chalcolithic territorial patterns in Moldavia (Romania). Remarks on Neamt and Iasi regions.

*Andrei Asandulesei, Robin Brigand, Vasile Cotiuga, Olivier Weller*

Landscape change at Metaponto: a tale of two DEMs

*Jessica Trelogan, Alessandro Rizzo, Esmeralda Moscatelli*

Seeing the unseen: Archaeological detection outside the visible spectrum

*David Stott, Doreen Boyd, Anthony Beck, Anthony Cohn*

Long-term change detection from the Mediterranean context: the case study of Menorca (Balearic Islands, Spain).

*monica de cet, simón gornés hachero, joana gual cerdó, elena sintes olives, bianca willié, rainer duttmann, roberto risch, johannes müller*

Using GIS and the analysis of published and unpublished urban excavations

*Gareth Dean*

Can Infovis tools support the analysis of spatio-temporal diffusion patterns in historic architecture?

*Jean-Yves BLAISE, Iwona DUDEK*

Interpreting time – representing chronology

*Katalin Tolnai*

## Spatial Thinking in Archaeology

### Session Code: Theory2

Spatial thinking entails knowing about: 1) Concepts of space – the conceptual and analytical framework within which data can be integrated, related and structured into a whole; 2) Tools of representation – the forms within which structured information can be stored, analysed, comprehended and communicated, and; 3) Processes of reasoning - the means of manipulating, interpreting and explaining the structured information (The US National Academies, 2006). Most, if not all, archaeological data has a spatial component and, as such, it is not surprising that spatial thinking has been central to archaeological endeavour since the beginnings of the discipline. Specific forms of spatial thinking have changed with developing theory and methods and with changing analytical and technological opportunities resulting in the rich variety of approaches available to us today.

Within this development, the rapid adoption of Geographic Information Systems (GIS) since the early 1990s has had a major impact on archaeological research and its use is now almost taken for granted. Although the use of GIS in archaeology is contentious at the theoretical level, the attractions of the technology are usually seen to outweigh any restrictions or disadvantages. It is important to recognise that use of GIS in itself does not constitute an advance in spatial thinking. Without a nuanced understanding of concepts of space and detailed justification of processes of reasoning, the role of GIS is reduced to that of a new tool of representation. One consequence of this is the danger that the use of GIS stifles archaeological creativity to conform to the functionality provided by the technology rather than enabling that creativity to flourish.

Archaeological applications of GIS have long been subject to criticisms of technological determinism and a lack of theoretical engagement. Many of these criticisms can be addressed by thinking critically about concepts of space, tools of representation and processes of reasoning, placing the emphasis back on archaeological questions rather than technological solutions. This session seeks to situate the use of GIS within the wider arena of spatial thinking in archaeology in an attempt to

assess the impact that this technology has had on how we think spatially. Papers are welcome which explore a wide range of themes, including: the tension between subjectivity and objectivity; the implications of scale, and; understandings of place and landscape.

### **Papers in this session:**

Concepts for Studying the Built Environment: A framework of socio-spatial reasoning for identifying and operationalising comparative analytical units in GIS

*Benjamin N. Vis*

Formalization of scientific process and conceptual modelling for the study of territorial and products distribution dynamics (ArchaeDyn II programme)

*Xavier Rodier, Laure Saligny, Frédérique Bertoncello, François Favory, Elise Fovet, Christina Gandini, Estelle Gauthier, Murielle Leroy, Laure Nuninger, Nicolas Poirier, Olivier Weller*

Can points, polygons, and lines represent dynamic and differing spatial landscapes of hunter-gatherers, pastoralists, and fisher-folk? An example of the role of GIS in understanding Holocene archaeology in the Lake Turkana basin in Northern Kenya

*Loretta Dibble*

Detecting the causal action, mapping the spatial distribution consequence: Geostatistic approach in chemical residues at intra-site level.

*Alfredo Maximiano Castillejo*

Exploring the effects of curvature and refraction on GIS-based visibility studies

*Mariza Kormann, Gary Lock*

Spatial Configuration and the Roman House: A Visibility Graph Analysis Approach

*Adlai Lang*

“There’s an App for that”: How can smartphones improve the ergonomics of landscape study, analysis and interpretation?

*Lawrence Shaw*

Diffusion of Raw Materials and Manufactured Objects. A challenge for spatial analysis?

*Estelle Gauthier, Olivier Weller, Jessica Giraud, Robin Brigand*

### **Loc(i) Motion: Current technologies and computational methodologies for exploring human movement in the past and present**

#### **Session Code: Theory6**

Human movement and mobility has always been a challenging topic in the field of archaeology – involving research both in past and contemporary settings- due to the static nature of material culture which usually conditions both its interpretation and reception. In addition, research on movement features in a variety of discourses pertinent to spatial perception, wayfinding and embodied experience providing thus, an ideal ground for interdisciplinary research.

Mobility in past societies can be considered a scalar phenomenon whose study requires the consideration of diverse temporal and spatial scales. In order to understand how people travelled and moved during the past, it is necessary to delve into a series of theoretical and practical issues that range from the basic variables and factors that affect human movement such as physiology, perception, and social relationships, to the specific conditions of the environment in which the studied society lived. In the past decade, a wide range of computational approaches in different disciplines has been developed helping us to shed light onto a variety of hypotheses related to

human movement.

Similarly, current technological advances in motion capture, tracking systems and simulation techniques enable the study of human movement and the experience of moving both in real and virtual spaces; and to extrapolate from one to the other. This has unlocked a variety of new territories for research and practice-led work which informs the computer-mediated fields of heritage such as site and visitor management, fieldwork, serious games in cultural heritage, museology and visitor experience studies. It also allows us to (re) consider some of the assumptions that lie behind the capture and presentation of 3D imagery of archaeological features and environments.

The purpose of this session is to bring together the various technologies and computational methodologies used by archaeologists and other specialists that explore past and present human movement. We also welcome papers that examine potential lines of collaboration on this topic between a diversity of fields like physiology, psychology, archaeology, heritage management, design and computer science.

#### **Papers in this session:**

Markers, visibility and the structuration of past landscapes. Analysing the role of megalithic monuments as waypoints during Iberian Late Prehistory.

*Patricia Murrieta-Flores*

Bronze age pathways? Past populations mobility in prehistoric landscapes.

*Maria Yubero-Gomez, Xavier Esteve, Xavier Rubio-Campillo, F.Javier López-Cachero*

Hydrodynamic and flow modelling as a diachronic approach to prehistoric seafaring.

*Rodrigo Pacheco-Ruiz*

Everything flows: a computational approach to fluid landscapes

*Dimitrij Mlekuž*

Calculating Accessibility

*Irmela Herzog*

Archaeology, mobility and the lived experience

*Jim Leary*

Material Motion: A case study in quantitative motion analysis

*Kirk Woolford, Stuart Dunn*

#### **Geomorphometric approaches in archaeology**

##### **Session Code: Geo5**

Geomorphometry is a branch of the geo-sciences that is relatively young. It uses quantitative methods and techniques to characterize the earth's surface from digital elevation models. It is especially concerned with the quantification of land-surface parameters and the extraction of landscape features from DEMs. Geomorphometric methods are attractive to many disciplines, including soil science, hydrology, and ecology (see [www.geomorphometry.org](http://www.geomorphometry.org)).

Archaeologists have used DEMs for a long time to analyse the landscape and the position of archaeological sites in it. They are probably among the most avid users of the high-resolution LiDAR-based elevation models that are increasingly available in many parts of the world. The level of detail

available in DEMs nowadays allows archaeologists to use elevation models as tools for prospection: individual archaeological sites and features may be detected directly from the images, as if they were aerial photographs. Archaeologists will usually try to identify and delineate objects of interest (archaeological features and/or landform units) by means of visual inspection and manual digitizing. Hillshading and colour manipulation will be the major analytical tools used for this. Filtering techniques to better recognize the micro-relief typical of archaeological features have been applied with reasonable success, especially in forested areas.

Advanced geomorphometric analysis techniques however have not attracted much interest in archaeology. The multi-scalar landform classification routines available in LandSerf have been used as additional parameters to analyse and predict archaeological site location. The rate of success of geomorphometric approaches in automatically identifying archaeological features however seems to be limited to specific cases such as round barrows. Only limited successes with regard to the automatic recognition and delimitation of specific landforms containing archaeological sites have been reported. It therefore seems to be difficult to automate the process of landform recognition in a way that is useful for archaeologists. The question is why: are archaeological landform 'objects' more difficult to recognize, and therefore more difficult to translate into formal, quantitative rules? Are we perhaps interested in different scale levels than geomorphologists or soil scientists? Does the available software provide us with the right kind of information?

This session invites papers that explore the wider potential of geomorphometric approaches for archaeology, both from the point of view of detecting individual archaeological features, as well as for analysing landform for purposes of predictive mapping and landscape archaeological studies.

***Papers in this session:***

[A Digital Terrain Analysis and Multi-Criteria Evaluation of Higher Archaeological Potential Landforms in Northern Alaska.](#)

*Sarah Kessick*

[Identifying landforms of archaeological interest in Alberta's oil sands region: a geomorphometric approach](#)

*Robin Woywitka*

[Spatial characterization and prediction of Neanderthal sites based on stochastic environmental modelling](#)

*Michael Märker, Michael Bolus*

## Theme Three: Data Modelling & Sharing

The archaeological record is made up from incredibly diverse data as the result of site specific fieldwork, artefact analysis, Geographical Analysis and Interpretation. The resulting data is spread across a wide range of sources which vary in accessibility, quality and storage medium. This theme on Data Modelling and Sharing brings together sessions exploring how we can make data more interoperable: using Linked Open Data (LOD) approach, through ontologies: The Semantic Web. It also examines how we can use the data we are collecting to model the past specifically looking at the less tangible aspects of the archaeological record: such as temporality and subjectivity. It also examines the less applied uses of Data Modelling: how we can use networks to further develop GIS technologies methods of exploring topographical and geographic space. The theme aims to highlight issues encountered in data modelling, storage and sharing and communicate developments in each of the sessions application both practically and theoretically.

### Linked Open Data for the Ancient World

#### *Session Code: Data1*

The study of the Ancient World is by nature a rich soil for the adoption and exploitation of the Linked Open Data (LOD) approach. Indeed its long tradition, the diversity of materials and resources as well as the high level of disciplinary specialisation lead to a situation where silos of knowledge, even when available online and under open access licenses, are isolated from each other. This situation is also reflected by the segmentation that the study of the Ancient World has reached with the inevitable tendency to favour one single perspective in despite of others. On the contrary, the LOD approach allows us to integrate heterogeneous sources of information by means of links and persistent identifiers while preserving the disciplinary specificity of data.

The recent adoption of the LOD principles by projects such as Pelagios [1], SQPR [2] and the British Museum [3], in acceptance of the CIDOC-CRM's Linked Open Data Recommendation for Museums [4], are important steps towards a future of interoperable data in archaeology and classics. There is a variety of ways in which different resources are related to each other: an inscribed stone, for instance, will be linked to the edition of the text, to the building and location it belonged to, to different photographs of the object, to a record in the museum catalog and to related literature. Having those different pieces of information interconnected would allow us to overcome to some degree the mentioned fragmented view on antiquity by rendering a more wholistic image of the past.

In this session we shall discuss the advantages and disadvantages of LOD for the study of the Ancient World, look at available data, existing tools and live applications (beyond the status of being testbeds) and question which steps should be taken to overcome existing obstacles to increase the amount of LOD. Furthermore we welcome reflections on the opportunities, challenges and methodological consequences for the disciplines involved. In continuity with past sessions of the conference on related topics, this section addresses issues including but not limited to:

- URIs for Cultural Heritage objects
- methodological reflections on consequences of LOD
- experiences of projects publishing their data as LOD
- discussion of relevant tools and live applications based on LOD

- digital libraries and their content in relation to Ancient World objects
- other approaches of making data interoperable and interlinked

[1] <http://pelagios-project.blogspot.com/>

[2] <http://spqr.cerch.kcl.ac.uk/>

[3] <http://collection.britishmuseum.org/About>

[4] [http://www.cidoc-crm.org/URIs\\_and\\_Linked\\_Open\\_Data.html](http://www.cidoc-crm.org/URIs_and_Linked_Open_Data.html)

### ***Papers in this session:***

#### A Semantically Linked Ontology of Aterian Lithic Reduction

*Eleanor Scerri, John Goodwin*

#### Data sharing in archaeology: vision, nightmare or reality?

*Anja Masur, Christian Ansorge*

#### Sea++: Connecting the Ancient World with Pelagios Project

*Leif Isaksen, Elton Barker, Rainer Simon*

#### Archaeology and the Semantic Webs

*Leif Isaksen, Kirk Martinez, Graeme Earl*

#### Linking Roman Coins: Current Work at the American Numismatic Society

*Ethan Gruber, Gilles Bransbourg, Sebastian Heath, Andrew Meadows*

### **Joined-Up Data: What are the new research questions?**

#### ***Session Code: Data3***

Since the first CIDOC-CRM workshop in 2002 at the meeting in Heraklion, interoperability of data using ontologies has been a subject of formal discussion at CAA. This has grown apace, with papers presenting the CIDOC-CRM in use starting from the 2004 meeting in Prato. The 2008 meeting at Budapest saw the first session dedicated to projects using the CRM, entitled CIDOC-CRM in Data Management and Data Sharing, but other solutions were also offered in the session Alternative Ontologies and Approaches to Data Management and Data Sharing. All of this shows the growing consensus that sharing data is important to archaeologists, irrespective of which tools are deemed most appropriate. As the Semantic Web has matured alongside these other important components in data sharing, it was not surprising when exploratory papers on this topic began to appear at CAA as well.

The first paper to incorporate Semantic Web concepts and technologies was also presented in 2008 at Budapest. Such was the interest bubbling under however, a dedicated session with 11 papers called The Semantic Web: Second Generation Applications was held the following year at Williamsburg. This session bridged the theoretical and practical, as Semantic Web technologies were continuing to develop, but some practical applications were presented. This was followed by two further years of general Semantic Web sessions at Granada and Beijing, maintaining similar levels of activity, but with work that had now moved well into the practical realm.

The Semantic Web and the use of ontologies is a complex topic, with technologies that are still evolving. After three years of general Semantic Web sessions however, and now that practical work



is well underway, perhaps it is time to step back from the technology somewhat and shift the focus towards the new archaeological research questions we had planned to ask in the first place, once we were able to make our data interoperable.

What are we able to do now, that we could not do before? What new research questions can we expect to be able to answer? Can we now re-formulate previous questions and expect to get more complex answers? How do we illustrate the new research capabilities and interface with the data and present answers? How do we communicate the potential to non-specialist archaeologists? How do we then incorporate their feedback?

This session invites papers presenting exemplars of the Semantic Web in use, and in particular papers demonstrating ways of answering new questions archaeologists can now ask of their data when it is 'joined-up'. This could include papers about practical applications, or examples of projects that communicate with archaeologists about what 'semantic' data can do. It is hoped that by sharing these projects with each other, we can then do a better job of communicating to non-specialist researchers and funders of the usefulness of linking data, and using the shared data of others. This in turn will allow us to create better tools for sharing, linking, archiving and answering the research questions that our fellow archaeologists really want answering.

***Papers in this session:***

When, what, where, how and who?

*Sarah May*

Exploring Semantic Web-based research questions for the spatio-temporal relationships at Catalhöyük

*Holly Wright, James Stuart Taylor*

Comparing the informatics of text and Cultural Heritage: the SAWS project

*Stuart Dunn, Anna Jordanous, Mark Hedges, Christoph Storz*

From the Slope of Enlightenment to the Plateau of Productivity

*Michael Charno, Stuart Jeffrey, Doug Tudhope, Keith May, Ceri Binding*

Linking data to explore Landscape and Identity in England

*John Pybus, Xin Xiong, Chris Gosden, Zena Kamash, Chris Green, Letty Ten Harkel*

ArcheoInf, the CIDOC-CRM and STELLAR: workflow, bottlenecks, and where we go from here?

*Geoff Carver*

@OccupyWatlingStreet: Can we find out Who was occupying What, Where and When in the past?

*Keith May*

**Modelling & Sharing Cultural Heritage Data (General Papers)**

***Session Code: DataG***

***Papers in this session:***

A DATABASE FOR RADIOCARBON DATES. Some methodological and theoretical issues about its implementation

*Igor Bogdanovic, Giacomo Capuzzo, Glauco Mantegari, Juan A. Barceló*

Constraining flexibility: moving entity relationships from structure to data*Ian Johnson, Stephen A White*Information Models as Representations of Paradox of Change and Control in Digital Infrastructures*Teija Tuulia Oikarinen, Helena Karasti*'The metadata is the message': communicate knowledge through metadata*Paola Ronzino, Valentina Vassallo, Sorin Hermon, Franco Niccolucci*Ontology-enabled community annotations in Archaeology*Manuella Kadar, Maria Muntean*Connecting Archaeology and Architecture in Europeana: the Iberian digital collections*Ana Martinez, Francisco Gómez Cabeza, Arturo Ruiz Rodríguez, Alberto Sánchez Vizcaino***Archaeological Information Modelling****Session Code: Data6**

The information that we use to represent the elements in the archaeological record is not neutral; its shape, depth and quality affects the descriptive and interpretive processes that are part of the archaeological practice. For this reason, attention must be paid to the ways in which we construct information models and the ways in which we employ them.

Data modelling has been used in archaeology for decades (e.g. CIDOC CRM). However, there is much more to information modelling than merely thinking of data. Issues such as abstraction, semantics, scoping and intentionality must be considered if a valuable information model is to be obtained. In addition, some "soft" aspects of information modelling in archaeology have been especially difficult to tackle, such as subjectivity, multivocality, temporality and uncertainty.

This session aims to address all these issues by questioning the state of the art about the theories and methods that are usually employed to create and use information models in archaeology.

Major areas that will be welcome in the session include (but are not limited to):

- Do we, as archaeologists, actually create information models as an a priori step? Or is information described without pre-existing models in mind?
- How can we combine flexibility and interoperability when designing archaeological information models?
- What features are necessary in information modelling languages so that models can interoperate while staying information-rich?
- How can we document and communicate information models to colleagues, partners and other organisations?
- How can we manage subjective points of view and multi-vocality within information models and data sets?
- How can time be captured and expressed in information models and data sets?
- What mechanisms can we use to express vagueness and uncertainty with regard to archaeological data?
- Is it appropriate or feasible to extend or adapt industry-standard modelling languages and/or best practices (such as those in engineering, i.e. UML, or ontologies) to archaeology?
- Please bear in mind that the session is intended to focus on the theory and methods of information modelling in archaeology, rather than on specific case studies of particular

archaeological problems.

The session will be of interest to people who:

- Are concerned about conceptualisation and/or terminology issues in archaeology.
- Are involved in the development of policies, processes or standards for the management of, or research on, archaeological collections, artefacts or monuments.
- Have an inclination to theorise about the world that surrounds us, but are not happy with the existing representational approaches.
- Are having problems to conceptualise, express or communicate a particular area of inquiry in archaeology.
- Design forms, templates and tables to record archaeological information.
- Need to integrate or otherwise inter-relate two or more repositories or data sets of archaeological information.
- Create databases or other software-intensive archaeological tools.

#### Other Related Events

A related roundtable session, “Conceptual Modelling for Archaeology”, was run by the same co-chairs at CAA 2011 in Beijing, where an exciting debate took place and priming material for this one was collected. This time, we are narrowing down the focus of the session in order to target a more specific audience and participation.

The workshop “Hands-on Archaeological Conceptual Modelling”, proposed also at CAA 2012, co-chaired by Cesar Gonzalez-Perez and Charlotte Hug, will introduce the discipline of conceptual modelling to archaeologists and related professionals.

#### ***Papers in this session:***

Data-oriented approach versus process-oriented approach : from Computing to Archaeology

*Djindjian François*

The AIS Matrix: Beyond Harris and the CIDOC-CRM

*geoff carver*

Places, People, Events and Stuff; building blocks for archaeological information systems

*Paul J Cripps*

Linking with legacy: Modelling spatio-temporal distribution patterns of 40 year old excavation data from the settlement site of Zagora

*Ian Johnson, Beatrice McLoughlin, Matthew McCallum, Andrew Wilson, Steven Hayes*

Imperfect temporal information in data sets

*Koen Van Daele*

Through an Archaeological Urban Data Model Handling Data Imperfection

*Cyril de Runz, Asma Zoghlam, Dominique Pargny, Eric Desjardin, Herman Akdag*

## Geography and-or-not Topology: Spatial Network Approaches in Archaeology

### **Session Code: Geo2**

Archaeologists' attempts to explore geographical structure through spatial networks date back to at least the late 1960s. Pioneering studies introduced some of the core principles of graph theory which underpin network analysis, principles which are fundamental but yet seldom acknowledged in many recent applications. The introduction of GIS-based network techniques has allowed for easier analysis of the characteristics of spatial structure, particularly with regard to large or complex network datasets, but at the same time has severely limited the diversity and scope of archaeological applications of network analysis. Commercially available GIS-based network software is often limited to a few applications with clear modern-day relevance like the calculation of least-cost pathways and the analysis of hydrological networks. Archaeologists have been forced to adapt these popular tools and have been successful in doing so, but have left a wealth of alternative applications largely unexplored.

It has been argued that the interpretative potential of GIS-based network techniques can be realised by incorporating new views of networks developed in physics and by drawing upon complexity. By doing so it is possible to both move beyond the confines of traditional definitions of space structure and explore the realm of network growth and evolution. A number of archaeologists have taken their work on spatial networks along this route, exploring the dynamics between physical and relational space. Complex network models and methods are ever more frequently used for exploring the complexity of past spatial networks. Dynamic network models, for example, have been developed to explore the hypothetical processes underlying the interactions between past regional communities. Agent-based techniques have been coupled with complex network models or applied to archaeologically attested spatial networks.

These developments do not seem to have influenced GIS technologies, at least not in the discipline of archaeology. In fact, the archaeological use of GIS seems to suggest that formal methods for exploring past topological and geographical spaces are mutually exclusive.

This session aims to disprove the apparent divide between geographical and network-based methods by providing a discussion platform for archaeological research at the intersection of physical and relational space. This session will welcome contributions addressing the following or related topics: network analysis in GIS, past spatial networks, spatial network evolution, complex networks and spatial models, exploratory network analysis, network-based definitions of spatial structure, agent-based modelling and networks, and space syntax.

### ***Papers in this session:***

The long and winding road: Combining Least Cost Paths and Network Analysis techniques for settlement location analysis and predictive modelling

*Philip Verhagen, Tom Brughmans, Laure Nuninger, Frédérique Bertonecello*

Least-cost networks

*Irmela Herzog*

Navigating the Network: a Network Analysis of Roman Transport Routes

*David Andrew Potts*

The Shape of the Ancient World Project

*Jonathan Allan Weiland*

The Spatial Construct of Social Relations: human interaction and modelling agency

*Mu-Chun Wu*

Toward a Spatial Grammar of Pompeii

*David Charles Fredrick, Keenan Cole, Jackson Cothren, Russell Deaton, Jasmine Merced, Matthew Tenney*

Re-contextualising inter-visibility networks with artefact networks for understanding urban connectivity in Iron Age and Roman Southern Spain

*Tom Brughmans, Graeme Earl, Simon Keay, Leif Isaksen, Catriona Cooper*

Graves and graphs: relational approach to mortuary analysis

*Daniel Sosna, Patrik Galeta, Ladislav Šmejda*

A new method of spatial analysis based on the extraction of proximity graphs

*Diego Jimenez*

A network-based approach to the analysis of the spatial distribution of artefacts from surface contexts

*John Pouncett*

## Theme Four: Data Analysis, Management, Integration & Visualisation

The analysis, integration and visualisation of data has sat at the heart of archaeological computing since the inception of the discipline. However, despite being an area of constant interest it has also proven one of the most dynamic and responsive sectors of archaeological computing. The increasing size of data sets, the development of the web and rapid increases in processing power and storage capacity have ensured that the subjects covered by this theme have remained central to archaeological computing discourse.

The sessions which fall within this theme represent a global response by archaeologists to issues which have come to characterise contemporary computing. Large Databases and Datasets (Data5) is a session dedicated to coping with the 'big data' sets which have come to characterise archaeological computing. Similarly, To Posterity and Beyond: Bridging the gap between data creation and sustainability (Data4) and The use of Standardized Vocabularies in Archaeology (Data2) deal with the challenges of ensuring that these data remain accessible and of use beyond their immediate life.

The other three sessions within this theme; Quantitative Studies in Italian Archaeology: new approaches to old problems (Data7), Ancient Italian Landscapes: New Insights from GIS, Network and Statistical Approaches (Data8) and Spatial Data Infrastructures (SDIs), Archaeology and Cultural Heritage. Achievements, problems and perspectives (GEO7) all deal with the challenges of extracting new meaning and insights out of large and complex data sets.

### **Spatial Data Infrastructures (SDIs), Archaeology and Cultural Heritage. Achievements, problems and perspectives**

#### ***Session Code: Geo7***

Spatial Data Infrastructures (SDIs) are an increasingly visible and extended means to publish and share any kind of digital data with a spatial component. Archaeology, being about material culture, is extremely concerned about space and spatial relations. In fact, the recording and analysis of archaeological data has incorporated spatial dimensions, and is been common established practice in archaeology. However, SDIs emerged and evolved with no direct relation to Archaeology, or the wider field of Cultural Heritage. In fact, major efforts have been put in the development of standards and procedures for data, metadata and services in many fields (INSPIRE directive being the best example) that don't consider archaeological, or heritage, information at almost any extent.

In spite of that, a number of efforts exist worldwide for the publication and reuse of archaeological (and cultural heritage) data that tell informative stories of achievements, benefits, drawbacks and problems. The aim of this session is to bring together some of those questions, in order to compose an up to date picture of what is going on in this field and to discuss about benefits, issues to be addressed and perspectives.

Expected contributions to this session will cover a series of questions, ranging from theoretical to practical applications. Some specific topics are encouraged, as:

- Theoretical issues about representation of archaeological data and SDI technology. Is archaeological data naturally ready for inclusion in a SDI? Compatibility between archaeological data and existing data models. Can, for instance, INSPIRE be extended or

complemented to fulfil archaeological information?

- What's going on? Examples of SDI using archaeological data, or cultural heritage information more in general. Developments in other GI which can be used as best practice and point way forward.
- Implications of the SDI field for archaeological practice. Are SDIs going to change anything in archaeology? Specific issues about archaeology: Implications in terms of ethics and differences in legislation.
- Data, metadata and/or services developed for archaeology. Extending and adapting INSPIRE for use in CH. Questions on practical implementation: open source and proprietary software (benefits and drawbacks).

This session will be supported by the Archaeolandscapes Europe project ([www.archaeolandscapes.eu](http://www.archaeolandscapes.eu))

### ***Papers in this session:***

From system to society and safety: Twelve months of Consortium for the Earthquake-Damaged Cultural Heritage of Japan

*Yasuhisa Kondo, Takayuki Ako, Yu Fujimoto, Yoichi Seino, Hiroshi Yamaguchi, Tomokatsu Uozu, Akihiro Kaneda*

The visualization of the archaeological information through web servers: from data records on the ground to web publication by means of Web Map Services (WMS)

*Jose-Julio Zancajo-Jimeno, Teresa Mostaza-Perez, Mercedes Farjas-Abadia*

Beyond INSPIRE: towards delivering richer heritage data in Scotland.

*Peter McKeague, Mike Middleton*

Cultural Heritage Application Schema: a SDI framework within the Protected Sites INSPIRE Spatial Data Theme

*Carlos Fernández Freire, Isabel del Bosque González, Pastor Fábrega Álvarez, Alfonso Fraguas Bravo, César Parceró Oubiña, Esther Pérez Asensio, Antonio Uriarte González, Juan Manuel Vicent García*

(Not) Integrating cultural heritage in the National Spatial Data Infrastructure of Botswana. Some considerations and challenges.

*Stefania Merlo*

SDI: A perspective from a UK archaeological unit

*Paul J Cripps*

### **Quantitative studies in Italian archaeology: new approaches to old problems**

#### ***Session Code: Data7***

We propose a session that focuses on quantitative analyses in Italian archaeology. The Italian archaeological tradition remains primarily culture-historical: typological chronologies are established and often continue in use without independent scientific corroboration through, for example, radiocarbon dating. However, there are researchers – both Italian and non-Italian – who are committed to the application of quantitative and computer-based approaches to understanding the past.

These approaches include, but are not limited to: GIS-based approaches to settlement, landscape and taskscape; Bayesian approaches to radiocarbon dating; OSL dating; isotope analyses (carbon,



nitrogen, oxygen, strontium, lead, sulphur, etc.); LIDAR; topological approaches to rock-art (a variant of the Harris Matrix); DNA sequence analysis; and geophysical analyses. All of these approaches are characterised by a reliance on computing power and, often, advanced statistical methodologies.

By moving beyond the typological chronologies so prevalent in Italian archaeology such quantitative and scientific approaches offer to open up significant new understandings of the past.

Our focus is prehistory but we also welcome contributions relating to the Classical and Medieval periods.

***Papers in this session:***

Quantitative methods in Italian archaeology: a review

*Alessandro Guidi*

Two heads are better than one - New approaches to identifying the origins of agriculture in Italy with DNA and C14

*Keri A. Brown*

Analysis of complex overlapping rock art sequences using topological tools: the case of two fragments from Piancogno (Valcamonica, BS, Italy)

*Alberto Marretta, Angelo Martinotti, Mauro Colella*

Dating Back Historical Rock Art on Marble Surfaces By means of a Mathematical Model for the Natural Erosion Processes.

*Paolo Emilio BAGNOLI*

The Use of CFD to Understand Thermal Environments Inside Roman Baths: A Transdisciplinary Approach

*Taylor Oetelaar, Clifton Johnston, David Wood, Lisa Hughes, John Humphrey*

Aqueduct Travertine: A High-Resolution, Stratigraphic Record of the Timing, Chemistry, Flow Dynamics and Management of Aqueduct Water

*Duncan Keenan-Jones, Bruce Fouke, Glenn Fried, Mayandi Sivaguru, Julia Waldsmith*

Open source software and quantitative archaeology: converging trajectories?

*Stefano Costa, Luca Bianconi*

**The Big Digital Archaeology Digital Humanities Venn Diagram Show (Round-Table)**

***Session Code: Theory 5***

In this session we will explore the intersection between digital archaeology and the digital humanities. The session should consist of short papers of 10 minutes beginning with a definition for one or other of the above, a description of a relevant research project by the author in this domain, and thoughts on its intersections with the other. We will attempt to populate and critique a Venn diagram of digital archaeology and digital humanities theory and method during the session and propose novel means for interaction in the future.

***Papers in this session:***

Guerilla Foursquare: A digital archaeological appropriation of commercial location-based social networking.

*Andrew Dufton, Stuart Eve*

## The use of standardized vocabularies in archaeology

### *Session Code: Data2*

Institutions world wide aware of the need to standardize their vocabularies in order to make their data re-usable by a wider audience. The Semantic Web and Linked Open Data sessions at the CAA conferences from 2009-2011 were seminal in introducing the new challenge with the accompanying new methodologies and techniques to archaeologists.

Several central Cultural Heritage agencies and archaeological departments have taken up the challenge and are translating their thesauri in SKOS-XML, which offers a way to structure vocabularies in a standardized format, with expectations that many of the more locally (in space or specialisation) oriented institutes will follow this initial phase.

SKOSifying thesauri is neither a self-explanatory nor a common-sense type of activity. Making decisions on design the structure and filling that structure with content are a continuous process, which requires both technical and theoretical domain knowledge.

Our session and workshop are directed towards explaining the need for using SKOS and how to use it. The final objective is that we try to standardize the standardization process in such a way that use of each other's solutions and content (thesauri) will be facilitated.

The full Session:

- 1) an introduction presentation explaining what it is all about
- 2) several presentations of successfully SKOSified thesauri (German, Italian, English, Flemish, Dutch)
- 3) presentation of tools (STAR/CLAROS, TUSaurus, Italian)
- 4) panel discussing the possibilities for the interconnection of different thesauri.

Followed by a Workshop:

- 4) a 'hands on' workshop for members to bring in their own thesauri related issues and see if we as a group can discuss and solve these.

### *Papers in this session:*

[PICO thesaurus, a semantic solution for CulturalItalia project](#)

*Matteo Lorenzini*

[On Implementing and using SKOS in simple databases](#)

*Matthias Lang*

[Experiences with SKOS from the STAR and STELLAR Projects](#)

*Douglas Tudhope, Ceri Binding, Phil Carlisle, Keith May, Andreas Vlachidis*

**To posterity and beyond! - Bridging the gap between data creation and sustainability.**

### *Session Code: Data4*

There is now a near universal acceptance amongst archaeologists that the long term preservation of

their digital outputs is not only desirable, but is a fundamental responsibility of the data creator. As a direct consequence of this growing awareness, archaeologists in the research, commercial and government sectors are looking for suitable, sustainable repositories for their outputs such that they remain both discoverable and usable in the long term. Repositories exist in a number of forms, as institutional repositories based in Universities, subject specific repositories such as the Archaeology Data Service in the UK and tDAR in the USA and even commercial data archiving services. Each of these approaches to sustainable preservation can be said to have a role to play in the future, particularly as the range, format and scale of digital outputs are so diverse, but how are they working together to provide archaeologists with clear, straight forward and practical digital archiving solutions?

This session is an opportunity for archaeological data managers, from both creation and preservation perspectives, to present the results of recent developments in the long term preservation and on line presentation of their outputs, aggregation of resource discovery data, and automated ingest procedures. It is expected that papers presented here will cover a broad range of work under these general topics, but the session is likely to focus on the impact on archaeological practice resulting from both preservation activities and the availability of wider range of research resources, and also the avenues of collaboration that exists between repositories and between repositories and their depositors.

### ***Papers in this session:***

The new Research Data Centre for Archaeology and Historical Studies in Germany

*Ortwin Prof. Dr. Dally, Florian Fischer, Felix Dr. Schäfer*

Old places, New ideas: new routes into Canmore, the National Inventory of Scotland.

*Peter McKeague, Susan Casey, Rebecca Jones*

Why the SWORD is mightier than the pen: automated ingest and the SWORD-ARM project.

*Ray Moore, Catherine Hardman, Jen Mitcham, Michael Charno, Lei Xia, Julian Richards*

SEAD - The Strategic Environmental Archaeology Database. Inter-linking multiproxy environmental data with archaeological investigations and ecology.

*Philipp Iain Buckland, Erik J Eriksson, Fredrik Palm*

Marine Digital Data Archiving with MEDIN : Measure once, use many times

*Tom Dommett*

SVG Pottery: upgrading pottery publications to the Web age

*Stefano Costa*

JISC DataPool

*Graeme Earl*

Incentivising data publication: the REWARD project and the Journal of Open Archaeology Data

*Brian Hole, Anastasia Sakellariadi*

### **Large Databases and Datasets**

#### ***Session Code: Data5***

Large databases and datasets can now be accessed by researchers and the general public to an extent that no one would imagine just a few years ago. Several museum collections can be found on the internet. Excavation documentation can be found at several sites. There are on many levels

initiatives to make databases from several institutions accessible over the internet.

This availability will change the way results are shared. The large datasets will make it possible to carry out research in new ways. On the other hand, with more and more information available on the net, all other information tends to vanish. It is easy and tempting to relate only to what is found electronically.

The quality of the information in the large datasets will vary. Several of the large museum collections have a long history, starting in the early 19th century or even earlier. The early catalogue texts will necessarily differ from the latter. The precision of the provenience is often variable. We will have to relate to the fact that the quality varies. When the databases are used in research, the museums could benefit from feedback that updates the information.

Large datasets freely available give the researcher the possibility to try out look many different combinations of data, but will no less have to address the question of completeness and data quality before publishing.

The session would like to invite papers that present large databases and datasets. It will also welcome papers that present research that have used such large datasets.

***Papers in this session:***

Archaeology in broad strokes: collating data for England from 1500 BC to AD 1086

*Chris Green, Chris Gosden, Zena Kamash, Letty Ten Harkel, Xin Xiong, John Pybus*

Data journey - excavation data goes to large dataset

*Karin Lund*

Material Culture Living Conditions: a digital platform for the publication of large artifact assemblage's datasets

*Jesús Bermejo Tirado, Irene Mañas*

ARCA: creating and integrating archaeological databases.

*Maria del Carmen Moreno Escobar*

Semantics and thesauri for the study of Ancient Curse Tablets

*Achille Felicetti*

Database of Estonian Archaeological Collections – development, problems, perspectives

*Priit Lätti*

«Askeladden» - the Norwegian database system for cultural heritage: From closed system for professionals to open access and interaction with “everyone”

*Evy Berg*

OpenInfRA – Storing and retrieving information in a heterogeneous documentation system (Long Paper)

*Felix Falko Schäfer*

ROAD - A Portal and Platform for Research on Early Humans

*Michael Märker, Zara Kanaeva, Geraldine Quénehervé, Volker Hochschild*

## Ancient Italian Landscapes: New Insights from GIS, Network and Statistical Approaches

### *Session Code: Data8*

This session brings together inclusive approaches to ancient Italian landscapes: approaches that combine GIS, demographic reconstruction, network analysis, geophysics, and other formal mathematical and statistical approaches, along with, at times, more experiential/phenomenological insights. The organisers do not privilege any one approach but, rather, believe that the broadest integrated approach to analysis is most likely to yield insights of value. We anticipate bringing together scholars working in similar and complementary traditions in various countries in such a way as to foster creative dialogue and to advance research and understanding.

### *Papers in this session:*

Rock-art in the taskscape: a GIS-based approach to understanding the role of Iron Age rock-art in the lived landscape of Valcamonica (BS), Italy

*Craig Alexander*

Shepherds or farmers? GIS-based approaches to understand the pre-Roman transhumance and land exploitation in Umbrian region (Central Italy)

*Paolo Camerieri , Tommaso Mattioli*

Pastoral Strategies, Settlement Patterns and Environment in the Uplands of Val di Fiemme (Trentino, Italy): the application of logistic regression analysis and the importance of spatial autocorrelation.

*Francesco Carrer*

Scaling Etruscan expansion

*Letizia Ceccarelli, David Redhouse, Simon Kenneth Stoddart*

SOCIAL NETWORK ANALYSIS CENTRALITY INDEXES AND CENTRAL PLACES: A CASE STUDY FROM EARLY IRON AGE CENTRAL ITALY

*Francesca Fulminante*

Reconstructing the ancient cultural landscape around Pompeii in 2D and 3D

*Michael Märker, Sebastian Vogel, Florian Seiler*

The application of GIS to the study of Roman centuriated landscape in the low Padua Plain (Italy)

*Michele Matteazzi*

Historic and archaeological itineraries for the discovery of Friuli during the Lombard period

*Sara Gonizzi Barsanti, Davide Gherdevich, Donata Degrassi*

## Theme Five: Geospatial Technologies

The archaeological record is made up from incredibly diverse data as the result of site specific fieldwork, artefact analysis, Geographical Analysis and Interpretation. The resulting data is spread across a wide range of sources which vary in accessibility, quality and storage medium. This theme on Data Modelling and Sharing brings together sessions exploring how we can make data more interoperable: using Linked Open Data (LOD) approach, through ontologies: The Semantic Web. It also examines how we can use the data we are collecting to model the past specifically looking at the less tangible aspects of the archaeological record: such as temporality and subjectivity. It also examines the less applied uses of Data Modelling: how we can use networks to further develop GIS technologies methods of exploring topographical and geographic space. The theme aims to highlight issues encountered in data modelling, storage and sharing and communicate developments in each of the sessions application both practically and theoretically.

### Round-table: Problems, methods and solutions in archaeological prospection

#### *Session Code: Geo8*

We would like to propose a round-table discussion to be supported by ISAP (<http://www.bradford.ac.uk/archsci/archprospection/menu.php?1>). The aim of the discussion will be to exchange ideas and practice between practitioners in the fields of archaeological prospection (including near-surface geophysics and remote sensing), data management / information architecture, and archaeological visualisation. Our aims for the discussion are to generate cross-disciplinary contacts and foster co-operation and the adoption of innovative practice.

Technological advances in instrumentation and data processing and storage capacities have meant that archaeological prospection is able to generate exponentially larger data sets, covering large tracts of the landscape. In particular, the arrival of '3D' radar acquisition at very high sampling densities (0.08 x 0.08m cells) has created challenges for storing, interpreting and visualising the data. It is now entirely feasible to study whole landscapes by geophysical means, supported by remote sensing techniques such as Airborne Laser Surveys, Hyperspectral Mapping and Terrestrial Laser Scanning. In the last two years, major projects in the UK (DART- <http://dartproject.info/WPBlog/>) and Austria (The ArchPro programme at the LBI- <http://archpro.lbg.ac.at/>) have started. These projects all intersect with GIS, data management, spatial and landscape archaeology, and areas around the visualisation of archaeological interpretations and their presentation to the public. Areas of overlap with the airborne research groups also occur, for example in the field of developing automatic or human-assisted computer based anomaly recognition. At the 9th International conference on Archaeological Prospection in September 2011, it was agreed that CAA was a good opportunity for dialogue across these fields and exchange of ideas, theories and practice. Whilst the focus has fallen on large scale landscape surveys, there are good examples of data management and dissemination strategies for geophysical data using webmapping approaches from other studies, in particular the work in the Vale of Pickering by the Landscape Research Centre (<http://www.landscape-researchcentre.org/index.html>), which was largely collected over a long period of time largely using the traditional 'hand held' manner. We strongly feel that the sub-discipline of archaeological prospection would both be enriched by, and contribute to the enrichment of, the disciplines mentioned above. We would welcome the participation of anyone who feels their research falls into these categories and could potentially be of use, or who has a geophysical problem (question?) to solve. We would aim for a relatively informal discussion and

presentation of problems, solutions and areas of agreement. Ideally, we would hope that such a discussion would feed into 'best practice' documentation by way of groups like the GEOSIG (<http://www.archaeologists.net/groups/geophysics>), MAPSIG (<http://www.archaeolandscapes.eu/index.php/news-a-events/news/138-qmethods-in-archaeological-prospectionq-caa-sig.html>) and the open methods store ([http://methods.okfn.org/wiki/Main\\_Page](http://methods.okfn.org/wiki/Main_Page)).

There are some great things happening across a number of disciplines. It would be good to listen and debate with those who have similar data and interpretational challenges.

#### **Round Table Discussion by:**

*Kayt Armstrong, Chris Gaffney, Anthony Beck, Steve Davis, Klaus Locker, Karolin Kastowsky, Geert Verhoeven, Benjamin Vis, Jimmy Adcock, Jessica Ogden, Sophie Hay, Stephen Kay, Kris Strutt*

### **Acquisition and processing of marine geophysical data**

#### **Session Code: Geo11**

This session will look at developments in the acquisition and processing of marine geophysical data for archaeological purposes. Surveys are currently undertaken for both focused investigation of individual sites and large scale area surveys. These may include wreck surveys or investigations of submerged palaeo-landscapes.

There are a range survey methods which only just starting to become commonly used. These include bathymetric lidar, use of bathymetric water column data and parametric sonar systems. It is hoped that the reliability, logistical ease of use and interpretation of the resulting datasets of some of these systems can be addressed.

This session will address how multiple datasets can be used to develop a coherent understanding of submerged archaeological material. Geophysical surveys often require interdisciplinary collaboration for ground truthing and integration of these datasets will also be discussed. Other relevant topics may include how large datasets created by surveys can be handled and associated archiving issues.

#### **Papers in this session:**

##### Data acquisition, processing and integration: A submerged Middle Palaeolithic site case study

*Louise Tizzard*

##### Acoustic Data in Underwater Archaeology

*Sašo Poglajen*

##### Trials and tribulations of wreck visualisation using Multi-Beam Echo Sounder data.

*Patrick Dresch, Paul Baggaley Baggaley*

##### Managing data from multiple sensors in an interdisciplinary research cruise

*Øyvind Ødegård*



## Terrestrial Geophysics (General Papers)

### Session Code: GeophG

#### Papers in this session:

The Hinterland of Portus. Integrated Analysis of Geophysical Survey Data and Remotely Sensed Imagery in the Tiber Delta

*Kristian David Strutt, Simon Keay, Martin Millett*

Integration of the new Ohmmapper Resistivity-Meter and GPR investigation in Lixus ancient town (Morocco)

*Marta Caterina Bottacchi, Giulio Bigliardi, Sara Cappelli, Enzo Cocca, Stefano Camporeale, Emanuele Papi*

The effects of seasonal variation on archaeological detection using earth resistance: Preliminary results from an ongoing study

*Robert Fry, Anthony Beck, Chris Gaffney, David Stott*

Using Time Domain Reflectometry to monitor the geophysical properties of archaeological residues

*Daniel Boddice, Laura Pring, Nicole Metje, David Chapman*

Higher precision at higher speed: Geomagnetic prospection near the threshold of sensitivity with the digitiser LEA D2

*Cornelius Meyer, Henning Zöllner, Rudolf Kniess, Burkart Ullrich*

## Archaeological Predictive Modelling: Old applications to New environments and New applications to Old environments

### Session Code: Geo3

Archaeological predictive modelling is breaking new ground in site predictive modelling. The two areas of focus for this session are (1) how researchers are applying techniques that have become common practice to environments and situations that are unique, new, and/or different; and (2) how researchers are finding new methods, techniques, and tools to apply predictive modelling to environments and situations that have been studied in the past.

As underwater archaeology expands, predictive models will be instrumental in keeping surveys within a reasonable budget. However, these submerged landscapes provide new challenges to traditional predictive modeling, including locating paleo-river channels. Also, snow patches in high latitude and altitude environments are producing organic artifacts dating back to the beginning of the Holocene. Researchers are starting to quantify the variables to predict where productive (i.e. producing artifacts) patches could be found. Here predictive modeling is applying old techniques to new environments.

New advances and techniques in predictive modeling are being sought. As more government agencies strive to use predictive modeling to help with cultural resource management, new techniques and methods arise. As archaeological predictive modeling catches up with technology, the application of remote sensing and 3-D modeling can provide novel, and possibly improved means to analyze environments that have been previously studied.

This session is meant to show a full scope of predictive modeling uses and methods from around the world. The goal of this session is to introduce the problems faced by applying old techniques to new

environments including submerged landscapes and snow patches and the new techniques, such as remote sensing and 3-D modeling, being developed for old environments.

***Papers in this session:***

Introducing the human factor in Predictive Modelling

*Philip Verhagen, Laure Nuninger, François-Pierre Tourneux, Frédérique Bertoncello, Karen Jeneson*

The landscape of central places

*Bo Ejstrud*

Mathematical models for the determination of archaeological potential

*Gabriele Gattiglia, Nevio Dubbini*

Ecological niche modelling for archaeological prediction: Case studies from the Pleistocene Levant and Holocene East Japan

*Yasuhisa Kondo, Takashi Oguchi*

Transparency, testing and standards for Archaeological Predictive Modelling

*Bill Wilcox*

A Paleoeconomic Approach to Predictive Modeling in the Lower Mississippi River Region (Southern Arkansas, Northern Louisiana, and Western Mississippi, USA).

*Thomas G. Whitley, Inna Burns*

Predictive Models and Advanced Hydrology Systems- A New Route to Improving Predictive Models

*Doug Rocks-Macqueen*

**Archaeological Predictive Modelling II: Applications**

***Session Code: Geo12***

***Papers in this session:***

Familiar road, unfamiliar ground: Archaeological Predictive Modelling in Hungary

*Gergely Padányi-Gulyás, Máté Stibrányi, Gábor Mesterházy*

Landscape reconstruction and archaeological prediction in the Lake Manyara area, Northern Tanzania

*Michael Märker, Geraldine Quénéhervé, Felix Bachofer, Christine Hertler, Liane Giemsch*

Lost Worlds: A predictive model to locate submerged archaeological sites in SE Alaska, USA

*Kelly R Monteleone, E. James Dixon*

Predicting Macedonian tombs' locations using GIS, predictive modeling and fuzzy logic

*Aikaterini Balla, Gerasimos Pavlogeorgatos, Despoina Tsiafakis, George Pavlidis*

Predictive Modelling in Rock Art Research Without Absence Data

*Michelle Lynn Wienhold*

Modeling Ice Patch Location via GIS Analysis of Topography - Short Paper

*Nicholas Levi Jarman, Kelly R Monteleone, E James Dixon, Michael Claude Grooms*

## Texturing remote sensing data processing for archaeological research: innovation and experimentation

### *Session Code: Geo4*

The proposed session will investigate emerging and newly established or tested data processing techniques performed on LIDAR, multispectral and hyperspectral data obtained from satellite and airborne instruments with a view of locating as-yet unidentified archaeological features.

As well known, the possibility of detecting anthropogenic or palaeo-environmental features by LIDAR and spectral recognition is an extraordinarily valuable addition to ground survey methods and feature recognition achieved with traditional aerial imagery. By subjecting spectral imagery or LIDAR data to carefully designed processing, the outcomes obtainable through simple visual analysis of the original data can be greatly enhanced. Processed remotely sensed data can thus facilitate the identification of archaeological and palaeo-environmental traces that could not necessarily be observed by simple visual analysis or by using other prospecting methods.

Despite the clear possibilities offered by processing remote sensing data, there is still a lack of a strategy for the development of a customised set of processing techniques to serve particular aspects of the archaeological research and a tendency to use standard procedures adopted from other disciplines that do not always fulfil the need of the archaeological research. In multispectral and hyperspectral analysis, successful image processing techniques -for example Vegetation Indices, Principal transformations (PCA), Tasseled Cap Transformation (TCT), Supervised and Unsupervised Classifications-, are well known and established procedures adopted from environmental studies by a over three decades of application, but scholars tend to apply these standard procedures without either testing or defining and developing new, tailored applications. With LIDAR data, large part of the processing is limited to the use of the Hillshade analysis, although other processing procedures have demonstrated to have the potential to maximise the obtainable results.

With this in mind, the papers accepted in this session should focus on innovative remote sensing data processing techniques for LIDAR, multi and hyperspectral data that push the envelope in the archaeological feature detection by mean of remote sensing data. Ideally, within their papers the scholars will define the capabilities, potentials and -eventually- deficiencies of these original techniques and will showcase results that have been already verified through ground truthing activities, such as archaeological excavations, geophysical prospecting or ground surveys. Contributions relating to successful applications of data processing focusing on solving well defined issues are encouraged.

The final discussion on the presented papers will hopefully lead to a definition of a specific set of remote sensing data processing techniques to be applied whenever appropriate situations occur. The session, which is very methodologically oriented, is specifically designed to promote discussion and exchange between RS archaeologists and RS experts.

### *Papers in this session:*

First steps towards detection of archaeological objects in high-resolution remotely sensed images of the Silvretta Alps

*Karsten Lambers, Igor Zingman*

New advances in the detection of centuriated field systems

*Hèctor A. Orengo, Josep Maria Palet*

## GIS Methodologies, Applications and Case Studies (General Papers)

### Session Code: GeoG

#### Papers in this session:

Recycling Roberts and Wrathmell: Building and Analysing the Atlas of Rural Settlement in England GIS

*Andrew George Lowerre*

Testing for Nonlinear Settlement Patterns with Fractal Geometry: A Case Study from the Yalahau Region, Northern Quintana Roo, Mexico

*Jennifer U. Weber, Jeffrey B. Glover*

Analysis of relationship between archaeological site distribution and multiple environmental factors in the Jomon Period of Japan using GIS

*Susumu Kato*

INTERPRETING THE BRAIN SIZE VARIABILITY IN THE LATE PLEISTOCENE HOMININS BY THE USE OF QUANTITATIVE AND GIS APPROACHES

*Alexia Serrano Ramos, Juan Manuel Jiménez-Arenas, José Antonio Esquivel Guerrero*

Open source GIS for archaeological data: two case studies from British and Egyptian Archaeology

*Anna Kathrin Hodgkinson, Stefano Costa, Luca Bianconi*

Speeding up Georeferencing with subpixel accuracy

*Gianluca Cantoro*

PyArchinit: Database Management System and Archaeological GIS

*Enzo Cocca, Luca Mandolesi, Simona Gugnali, Manuela Battaglia, Chiara Cesaretti, Valeria Casicci, Alessandra Peroni, Chiara Di Fronzo*

The SICAC: an information system for the Conjunto Arqueológico de Carmona (Seville, Spain)

*Daniel González-Acuña, Alejandro Jiménez-Hernández, José Manuel López-Sánchez, Ignacio Rodríguez-Temiño, José Idelfonso Ruiz-Cecilia*

The Application of GIS in Ethnic and Folk Cultural Resource of China: Digitalization Types and Spatio-temporal Presentation

*Xianfu Liu, Song Li, Gang Zhang, Ming Li*

Spatio-temporal analysis of radiocarbon dated archaeological artefacts from eastern Fennoscandia – a Bayesian computing approach using a Poisson point process model

*Juhana Kammonen, Petro Pesonen, Markku Oinonen, Tarja Sundell, Päivi Onkamo*

Is It Really The "GOOD" Place? -The spatial analysis about the distribution of the Japanese Ancient Local government office "Gunga".

*Yoichi Seino*

A new approach for a peculiar Palaeolithic site: Spatial analysis at La Garna (Spain)

*Alfredo Maximiano Castillejo, Pablo Arias Cabal, Roberto Ontañón Peredo*

Soil Erosion Risk Assessment near Archaeological Sites in Grevena, Northwestern Greece using the Revised Universal Soil Loss Equation (RUSLE) and GIS

*Miki A Beavis*

GIS IMPLEMENTATION IN PREVENTIVE ARCHAEOLOGY : PROCESS FOR AN EPIPALEOLITHIC SITE (LYON, F), METHODS AND RESULTS

*Bertrand Moulin, Frederic Jallet, Najla Touati*

Mapping Spanish Republican Airfields: Using GIS for interpreting Air Warfare

*Maria Carmen Rojo-Ariza, Xavier Rubio-Campillo, Francesc Xavier Hernández-Cardona*

Study of Mont Bego's engravings with a Geographic Information System

*Thomas Huet*

Exploring Archaeological Methods: Using Quantitative and Qualitative Techniques to Examine the Distribution of Amateur Collected Finds

*Katherine Robbins*

## Theme Six: Field & Lab Recording

Field & Lab Recording (Theme Six) will gather together sessions that aim to examine how archaeology and related sub-fields conceptualize, process and analyse data in the two primary settings of data collection: the laboratory and the field.

The theme includes sessions dedicated to exploring the analytical potential of techniques that are relatively novel, such as three-dimensional recording and advanced laser scanning tools (Rec2). Furthermore, the large and complex datasets produced by such intensive recording of archaeological material present their own challenges. Calls for a critical evaluation of appropriate database management and integration promise a look to the future of the discipline (Rec 3). A core focus in this regard is the modelling of data in three dimensions (Rec6). In a similar vein, the potential, as well as the limits of, computational photography will be explored in the contexts of heritage and public engagement (Rec1). In order to encourage a deeper connection between archaeologists and the question they ask of data, sessions will make a necessary examination of the benefits of choosing new versus old techniques, for instance in laser scanning and photogrammetry (Rec5).

In summary, this theme will provide a thoroughly stimulating array of sessions and workshops that are geared towards best practice and innovation in archaeological data collection.

### Recording & processing 3D data in archaeological practice

#### *Session Code: RecG*

#### *Papers in this session:*

3D modelling of cultural objects in the V&A Museum. An aid to scholars.

*James Stevenson, Bernd Breuckmann*

Photogrammetry contribution to the study of early Middle Ages sarcophagi quarries of Panzoult (Indre-et-Loire, France)

*Daniel Morleghem*

Social Spreading of Geometric, Recorded Data from a Range of Types 3D Scanners via a Web Data Server.

*Jorge Angas, Paula Uribe, Alfredo Serreta*

Combining Terrestrial Laser Scanning and techniques of digital image processing in "Archaeological of the Architecture" analysis, in the Walls of the Andalusian Site of Vascos (Navalmaralejo, Toledo-Spain)

*María J. Iniesto-Alba, Miguel Bru, Estela Paradelo, Ricardo Izquierdo*

### MeshLab

#### *Session Code: RecML*

#### *Papers in this session:*

MeshLab as a complete open tool for the integration of photos and color with high-resolution 3D geometry data

*Marco Callieri, Matteo Dellepiane, Guido Ranzuglia, Paolo Cignoni, Roberto Scopigno*

Enhancing surface features with the Radiance Scaling Meshlab Plugin

*Xavier Granier*

A methodology for the digitization of ancient buildings using open source software tools: the case of the Castle of Bouvignes

*Daniel Pletinckx, Massimiliano Corsini*

**Advances in computational photography techniques for conservation, research, and public access*****Session Code: Rec1***

This session will explore advances in Computational Photography. The common feature of the computational photography imaging family is the purpose-driven, selective extraction of information from sequences of digital photographs. The information is extracted from the photographic sequences by computer algorithms. The extracted information is then integrated into new digital representations containing information not present in the original photographs, examined either alone or sequentially.

Potential topics include:

- Reflectance Transformation Imaging
- Algorithmic Rendering
- Multispectral computational photography
- Provenance and documentation
- Annotation
- Archiving and dissemination
- Novel applications
- Integrated approaches

***Papers in this session:***3D Representations from Reflectance Transformation Image Datasets: A case study from early Egypt

*Kathryn E. Piquette, Lindsay W. MacDonald*

Re-reading the British Memorial: RTI and memorial inscriptions in British churches

*Gareth Beale, Nicole Beale*

Multispectral Image Analysis of a Censored Postcard from 1942

*Florian Kleber, Fabian Hollaus, Robert Sablatnig*

Multi-spectral imaging of historic handwritings

*Fabian Hollaus, Florian Kleber, Robert Sablatnig*

RTI and Graphical Visualisation

*Graeme Earl, Gareth Beale, Hembo Pagi, Grant Cox*

Advances in the computational photography tools: Reflectance Transformation Imaging (RTI) and Algorithmic Rendering (AR)

*Carla Schroer, Mark Mudge*

An improved algorithm of artifact restoration based on image reassembly (long paper)

*wuyang shui, mingquan zhou, zhongke wu*

## Computer-Aided Coin Archiving and Processing

### *Session Code: Rec3*

Nowadays, numismatics is at a point where it can benefit greatly from the application of computer-aided archiving and processing methods. The broad use of digital cameras has led to an exploding number of digitally recorded coins, either contained in museum databases or online archives. Due to the large number of items stored in these databases (e.g. over 400.000 coins on [www.coinarchives.com](http://www.coinarchives.com)), automatic processing methods are essential to allow a proper database creation and data handling. For this purpose, database entries of any type – ranging from textual descriptions, coin type reference numbers, technical values like diameter and weight up to the available photos of the coins – can be exploited. A promising research direction in this area is the use of image information to automatically recognize coins. In the past groundwork for this research has been achieved (e.g. in the European COINS project) but further scientific challenges have to be tackled in the future, like the automatic classification of coins in large scale databases or die analyses on coin hoards.

In summary, the use of computer-aided processing methods bears great potential for the numismatic world and opens up new and currently unthought-of possibilities. As the goals for the future have to be achieved in an interdisciplinary manner, the purpose of this session is to bring together specialists from different fields (e.g. numismatists, visual computing researchers, database experts) to present and discuss their work and review future research activities.

Areas of interest in this session include (but are not limited to):

- Coin Acquisition (2D and 3D)
- 3D coin modelling and analysis
- Image-based coin recognition
- Coin database management
- Coin web search tools

### *Papers in this session:*

#### Semantic Web Technologies Applied to Numismatic Collections

*Ethan Gruber, Sebastian Heath, Andrew Meadows, Daniel Pett, Karsten Tolle, David Wigg-Wolf*

#### Different online coin databases for different use: two examples

*Mario Schlapke*

#### Digitalization of the Collection of Roman Republican Coins in the Kunsthistorisches Museum, Vienna, Austria

*Klaus Vondrovec*

#### Using Image Analysis to Match a Coin to a Database

*Sebastian Zambanini*

#### Automatically Recognizing the Legends of Ancient Roman Imperial Coins

*Albert Kavelar, Sebastian Zambanini, Martin Kampel*

#### Automatic coin classification and identification

*Reinhold Huber-Mörk, Michael Nölle, Michael Rubik, Michael Hödlmoser, Martin Kampel, Sebastian Zambanini*

#### IBISA 3D: Image-Based Identification/Search for Archaeology Using a Three-dimensional Coin Model



*Sylvain Marchand*

The use of computed tomography within the study of archaeological coins

*James Miles, Graeme Earl, David Hinton, Ian Sinclair, Mark Mavrogordato*

Telling the story of ancient coins by means of interactive RTI images visualization

*Gianpaolo Palma, Roberto Scopigno, Eliana Siotto, Sabrina Batino, Monica Baldassarri, Marc Proesmans*

Dies Studies Online

*Robert Bracey*

## On a Smaller Scale: 3D Modelling and Analysis of Findings

**Session Code: Rec6**

**Papers in this session:**

Reverse Engineering Archaeological Artefacts

*Vera Moitinho de Almeida, Juan Anton Barceló*

3D imaging at the microscale: Feature visualisation and wear analysis applied to artefacts

*Adrian Evans*

Old stones & new technologies

*Claire Rebecca Fisher, Richard Abel, Craig Williams, Nick Mark Ashton*

## Three-dimensional archaeology: Recording, Analysis and Visualisation

**Session Code: Rec2**

Over the last decade, new digital spatial technologies have become widely available for the capture, processing, analysis and visualisation of 3D data. Often originating in other disciplines, these technologies have been adopted by archaeologists for a range of purposes, with some groundbreaking results.

Terrestrial Laser Scanning (TLS) is now routinely deployed to record archaeological sites, monuments, earthworks, buildings and other structures. Close Range Laser Scanning (CRLS) is used to record artefacts and structures. Airborne Laser Scanning (ALS) is used to record large areas of countryside and even see through tree cover. English Heritage have now produced guidance on the use of TLS and ALS in archaeology, demonstrating that these are now established technologies within the heritage sector. Metrology systems are also being used to record features and fine surface detail at a range of scales whilst novel approaches using photographic techniques are being used to produce Digital Surface Models (DSMs) at scales from microns to tens of metres, suitable for use with individual artefacts through to entire landscapes. Photographic techniques alone or combined with TLS are also being used to produce 3D models in some cases equivalent to photogrammetric output but without the for complex site photography arrangements.

Combined with these data capture technologies, visualisation and analysis techniques such as Polynomial Texture Mapping (PTM) or Reflectance Transformation Imaging (RTI) are being used to visualise and investigate real-world objects and structures in addition to virtual objects, structures and landscapes at any scale. Laser scanning software now facilitates working with massive point clouds from TLS, CRLS, ALS or even submarine bathymetric datasets and provides means of

integrating colour and photographic information. Automated or semi-automated vector extraction allows models to be created from these rich datasets for use in traditional workflows or integrated with Google Earth, CAD, 3D modelling packages or GIS. Orthographic views of 3D datasets, particularly those with colour data present, allow for the rapid creation of scaled, almost photographic like images which can be used in conjunction with or in place of traditional drawn plans and elevations. GIS, whilst being inherently two-dimensional, is being used in novel ways to analyse and interpret ALS data.

This session aims to showcase innovative and exemplary, current and emerging digital spatial technologies and applications of them in heritage contexts. With numerous potential approaches to recording, visualisation and analysis, bringing together the various techniques to be compared and contrasted will promote cross-fertilisation of ideas through qualitative assessment; critical appraisal of the technologies and their current and potential applications is an essential part of this and it is anticipated that through active discussion and sharing of experiences, best practice regarding such applications can be promoted and further developed.

Papers should focus on one or more of the following subject areas:

- Photographic and photogrammetric data capture technologies
- High resolution (sub-millimetre) data capture technologies
- Mid-resolution (millimetric-centimetric) data capture technologies
- Large scale (metric and above) data capture technologies
- Process, workflow and data integration
- Analytical techniques and methodologies
- Visualisation techniques and methodologies

### ***Papers in this session:***

#### Virtual RTI of Three Dimensional Datasets

*James Miles*

#### Low-cost, rapid, mid-resolution 3D data capture using miniature, automatic Unmanned Aerial Vehicles and modern computer vision algorithms

*Hartmut Tschauner*

#### 3D model of Lugo's Roman Walls (Galicia-Spain) using a Terrestrial Laser Scanner and Unmanned Aerial Vehicle.

*María J. Iniesto-Alba, Alicia Cañizares, David Miranda, Rafael Crecente*

#### Recording on Commercial Excavations with the Nikon Archaeology iSpace System.

*Maarten Smeets, Geoff Avern*

#### Multi-scalar, multi-sensor, three-dimensional documentation: two case studies exploring the utility of various methods in different environments

*Rachel Opitz, Katie Simon, Geoff Avern, Thann Baker, Christine Markussen*

#### Archiving Three-Dimensional Archaeology: New Technologies, New Solutions?

*Kieron Niven*

#### Capturing and working with 3D data in heritage contexts

*Paul J Cripps*

## *La Question du Jour: Laser Scanning or Photogrammetry*

### *Session Code: Rec5*

#### *Papers in this session:*

3D laser scanning for site documentation: Worth the price?

*Philip Sapirstein, Katie Simon, Thann Baker, Rachel Opitz, Christine Markussen*

3D Laser Scan of Stonehenge, Wiltshire.

*Andrew James Dodson, Cory D Hope*

Revealing hidden realities in archaeology through laser scanner technologies. A critical analysis.

*Mercedes Farjas, Jose Julio Zancajo, Teresa Mostaza, Juan Gregorio Rejas*

Virtual Reconstruction of a Maya Temple Using Total Station and Photo Modelling

*Cornelis Stal*

Site recording using automatic image based three dimensional reconstruction techniques

*Victor Ferreira*

A new photogrammetric method applied to mining archaeology

*Adrien Arles, Patrick Clerc, Florian Téreygeol, Jürgen Heckes*

Intra-site analysis and photogrammetry: the case study of the “Buca di Spaccasasso” (Gr, Italy) an Eneolithic funerary site.

*Daniele Pirisino, Giovanna Pizziolo, Carlo Tessaro, Nicoletta Volante*

3D Documentation in Archaeology: Recording Las Cuevas Site, Chiquibul Reserve, Belize

*Fabrizio Galeazzi, Holley Moyes*

## Theme Seven: Theoretical Approaches & Context of Archaeological Computing

The level of interest in theoretical approaches in archaeological computing –reflected both in the proposed sessions and the submitted papers- was unprecedented and justified the creation of the ‘Theoretical Approaches & Context of Archaeological Computing’ theme as well as the distribution of theoretically oriented sessions elsewhere.

This theme addresses significant theoretical issues in archaeological computing free from the need to discuss methodological or technical considerations. It includes a collection of papers discussing open content in Archaeology, digital applications for the public and the issues of uncertainty and realism in archaeology. Additionally, a collection of papers oriented in theory and archaeological practice initially submitted at the general papers were organised under this theme.

### Archaeological methods and theory

#### Session Code: AMT

#### Papers in this session:

Detection, recording and analysis of post-depositional transformations to the archaeological record

*geoff carver*

Crafting Archaeological Methodologies: Suggesting Method Engineering for the Humanities and Social Sciences

*Cesar Gonzalez-Perez, Charlotte Hug*

Visualising time with multiple granularities: a generic framework.

*Jean-Yves BLAISE, Iwona DUDEK*

Reconstructing Fragments: Shape Grammars and Archaeological Research

*Myrsini Mamoli, Terry Knight*

The evolution of territorial occupation: Exploratory Spatial Data Analysis applied to different case studies.

*Laure Saligny, Lucile Pillot*

Handling Notes and Sketches. Management of Different Levels of Archaeological Resolution.

*Stefano Rossi, Chiara Panelli, Roberto Maggi*

15 more years of computer applications in archaeology

*Tom Frankland*

### The Shoulders of Giants: Open Content in Archaeology

#### Session Code: Theory10

Open Content, while by no means a new concept, is increasingly being seen as having a transformative impact on the Research and Higher Education Communities.[1] Distinct from the Open Source and Open Standards initiatives, Open Content is the online provision of actionable research material under licenses that permit its reuse. It facilitates public learning, the interconnection of resources, economic efficiency, and gives rise to new lines of research.

A number of pioneering archaeological schemes (including the ADS,[2] Arachne[3] and

OpenContext[4]) have begun to make headway in this area, and commercial units (especially in the UK) are playing an important role as well. The evolving suite of Creative Commons licenses is also slowly addressing important concerns related to copyright, IPR and Data Protection. Nevertheless, Archaeology as a global discipline has woefully inadequate provision of openly available data with the vast majority of data kept technically, legally (and frequently physically) out of the hands of those who could do something unanticipated and useful with it.

This session is intended to be a showcase and forum for projects and theory related to the subject of Open Content in Archaeology. Topics of interests include, but are not limited to:

#### Showcase

- \* New Open Content repositories and data sets
- \* Interconnections between online data (including 'Linked Open Data')
- \* Projects applying new analysis techniques to legacy data sets

#### Theory

- \* Legal issues (licensing, national and international legal requirements)
- \* Practical issues (acquisition, hosting, formatting, nighthawking, etc.)
- \* Lessons learned (case studies)

Papers will be followed by a discussion of future action within this important area of activity.

Note: This session is unrelated to this year's CAA Open Content Prize which will consider any viable paper submitted for consideration, regardless of the session in which it is presented.

[1] <http://www.nmc.org/pdf/2011-Technology-Outlook-UK.pdf>

[2] <http://archaeologydataservice.ac.uk/>

[3] <http://www.arachne.uni-koeln.de/>

[4] <http://opencontext.org/>

#### *Papers in this session:*

Re-introducing FASTI Online: FASTI and Furious

*Jessica Ogden*

Half open or half shut? Can digital archiving and Linked Data resource discovery provide the best of both worlds?

*Keith May, Ceri Binding, Doug Tudhope*

Reflections on the rocky road to E-Archaeology

*geoff carver*

Web Services, XML and Ancient Documents

*Henriette Roued-Cunliffe*

What does the Holy Grail look like? Defining open data in archaeology and the related issues

*Stefano Costa, Andrew Bevan*

[OpenAccessArchaeology.org](http://OpenAccessArchaeology.org)- A Case Study in Facilitating Open Access in Archaeology

*Doug Rocks-Macqueen*

## Embracing Uncertainty in Archaeology

### Session Code: Theory1

This session aims to develop greater awareness of approaches to uncertainty in archaeology by bringing together both established experts and young researchers from a range of different fields. Its ultimate goal is to generate broader discussion about how we confront uncertainty in the recovery of archaeological datasets, how we treat it analytically and computationally, and how we incorporate it into our inference building, interpretations and narratives.

Uncertainty is at the core of long-standing debate in a wide variety of modern scientific domains, as testified by the recent inclusion of the topic among the twelve most relevant scientific endeavours listed by the Royal Society ([url:http://royalsociety.org/further](http://royalsociety.org/further)). Critical debates concerning the assessment, representation and public understanding of uncertainty are also of widespread interest in the social and political sciences.

The increasing availability of tools capable to solve large computational problems has provided a suitable environment for tackling this issue. Examples of such approaches can be widely found in different realms of our discipline. These include the use of advanced techniques in chronometry (Buck et al 1996), predictive modelling (Ducke et al 2009), spatial analysis (Crema et al 2010) remote sensing (Menze and Ur 2011), phylogenetic analysis (Nicholls and Gray 2006), typology and classification (Hermon and Nicolucci 2002), stratigraphy (De Runz et al 2007) and data visualisation (Zuk et al. 2005).

Despite some explicit, epistemologically-oriented contributions (Wylie, 2008; Lake, 2011) a debate encompassing both practical and theoretical aspects has never emerged nor it has determined direction and priorities of mainstream archaeology.

### Themes

Isolated discussions within single subfields (e.g. radiocarbon dating or spatial modelling) can certainly provide grounds for theoretical and methodological advancement, but we need to develop more integrated approaches to uncertainty across all the aspects of the discipline.

We invite original contributions to the following themes:

- a) the role of uncertainty in archaeological narratives;
- b) methodological debates about different probabilistic approaches;
- c) measurement and integration of uncertainty into archaeological analysis;
- d) appropriate sampling strategies and missing data problems;
- e) cultural resource management, risk assessment and decision making;
- f) public understanding and data visualisation.

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### *Papers in this session:*

#### Uncertainty in sampling and interpretation: can ethnoarcheology help us?

*Carla Lancelotti, Bernardo Rondelli, Alessandra Pecci, Fernanda Inserra, Andrea Luca Balbo, Javier Ruiz Perez, Victoria Yannitto, Charusmita Gadekar, Marco Madella, P Ajithprasad, Miguel Angel Cau Ontiveros*

#### Handling Uncertain Information on Archaeological Sites - Lesson from the 3.11 Shock in Japan-

*Yu Fujimoto*

#### Two techniques for the assessment of the positional uncertainty derived from the polygon-to-point collapse operation

*Fernando Sanchez-Trigueros, Antoni Canals*

#### Map Digitisations: Methodological Foundations, Uncertainties, and Error Margins at the example of the Gough Map

*Catja Pafort*

#### Reliability of the representation of a distribution: a case-study on Middle Bronze Age metal finds in the Seine valley.

*Estelle Gauthier, Maréva Gabillot*

#### Temporal Uncertainty and Artefact Chronologies

*Andrew Bevan*

#### Exploring probable histories: applying Monte-Carlo methods for uncertainties in spatial and

temporal analysis.

*Enrico R. Crema*

Quantifying the Obvious: communicating uncertainty in the geochemical provenance of archaeological ceramics

*Alice Hunt*

Embracing Uncertainty and The London Charter: Case Studies with the 3D Restoration of Ancient Sculpture

*Bernard Frischer*

Shape grammar modelling and the visualisation of an uncertain past

*Matthew James Harrison*

## From the scientist to the citizen - communicating digital archaeology

### Session Code: Theory7

The session aims to discuss how we communicate archaeological research - in other words, is there an optimal pipeline, good practices, charters, etc. which deal with this process of communicating archaeological research? How a traditional archaeological research pipeline can/should integrate issues related to the communication step (both scientific and public).

Papers to be presented in this session should address this issue and present examples, methodologies, theories, etc. which eventually will enable us to achieve a clearer picture of communicating archaeological research.

### Papers in this session:

Matera Città Narrata project: a multimedia and multiplatform guide for mobile systems

*Eva Pietroni*

History in 3D: New Virtualization Techniques for Innovative Architectural and Archeological Scholarship and Education

*Krupali Krusche, Paul Turner, Christopher Sweet*

A tangible chronology ?

*Jean-Yves BLAISE, Iwona DUDEK*

Human guinea pigs and casual collaborators: Crowdsourcing archaeological data

*Anthony Masinton*

A new online platform for archaeological and cultural heritage dissemination and discussion

*Nicola Schiavottello, Sharjil Nawed*

GeoDia: or, Navigating archaeological time and space in an American college classroom

*Adam Rabinowitz, Stuart Ross, Adrienne Witzel, Nick Rabinowitz*

Public Archaeology Online - Top Down, Bottoms Up

*Lorna Richardson*

An Architect in Contemporary Archaeology, Museum of the Second World War in Gdansk

*JACEK GZOWSKI*



## Round-table: Realism & Archaeology

### Session Code: Theory9

The nature of realism and its role in archaeological research has been the subject of much discussion. Amongst other things, realism has been used to refer to physical accuracy, to a sense of perceptual faithfulness and to that which is compellingly realistic or believable. Due perhaps to these associations, discussions of realism have characterised discourse relating to the representation of archaeology using computer graphics.

Often realism is considered synonymous to reality and this contradiction becomes apparent when talking about authenticity in all aspects of archaeological research. This is also the case for any computational approaches, including data acquisition and recording, modelling, representation, analysis and so forth. However, all these aspects and the understanding of realism, have their roots in other disciplines such as literature, film studies, sociology, philosophy etc. In archaeology, the question of how, or indeed if, we are able to usefully reconcile a sense of the real with readings of an archaeological record which is inherently incomplete and fragmentary remains unanswered.

This round-table will bring together researchers from several disciplines in order to discuss the nature of realism and the real and the value of these and significance of these concepts to archaeological research. Participants will be encouraged to discuss the ways in which different conceptions of realism and the real might assist or challenge existing or future archaeological enquiry.

Subjects for discussion may include the following:

- Envisioning the Real
- Realism and Objectivity
- Realism, Romance and the Archaeological Narrative.
- Realism VS reality & Authenticity

### *Papers in this session:*

The Web as a Space for Interpretation of the Real in Archaeology

*Nicole Beale*

Terrestrial Laser Scanning and Realism: Decisions Made for Effective Communication

*Amy Nettley*

(Augmented) Reality and Cultural Heritage Sites

*Angeliki Chrysanthi*

Physically Accurate Computer Graphics: A New Visual Medium for Archaeology

*Gareth Beale*

The Paradox of Translating Reality into Photorealism: From Fieldwork and Recording to Computer Graphic Interpretations

*Constantinos Papadopoulos*

STONE LANDSCAPES | a fine art route through landscape visualisation

*Rose Ferraby*

## Theme Eight: Human Computer Interaction, Multimedia, Museums

The changing landscape of available applications for use in the dissemination and interpretation of archaeological data within the cultural heritage sector has never been so rich in opportunities. Human Computer Interaction, Multimedia and Museums brings together some key approaches to utilising those new tools, platforms and approaches, to provide an excellent overview of the current climate in the professional and academic worlds of museums and data sharing.

Overviews of issues encountered and overcome by projects are covered in this theme, such as The Portus Visualisation Project, using mixed reality installations for interpretation of large, complex archaeological excavation sites, iConText, an application that makes possible the broadcasting of exhibit histories to museum visitors, and Augmenting Stone Worlds, using mixed reality to enhance interpretations from Bender et al.'s phenomenologically based reflexive practice experiments at Leskernick Hill (Bender et al., 2007).

Covered also within Human Computer Interaction, Multimedia, Museums is the possibilities for adapting and reusing novel and new technologies for the support of archaeological fieldwork. This includes descriptions of a project experimenting with RFID tags to trace archaeological materials from excavation, to storage, to museum display, as well as an innovative project aiming to improve knowledge sharing around object data, using free open source software ArcheOS and an open source Universal Aerial Video Platform prototype for aerial archaeology and remote sensing. A notable project involves the use of ethnographic field studies, using human computer interaction methodologies to attempt to better understand the relationships between technology, actors, and the archaeology on excavation sites. The project is an augmented reality breaching experiment, using low-tech interventions to stage interactions within fieldwork activities to explore technology design and implementation possibilities.

This theme also provides an opportunity to debate the extent to which virtual reality can support museums' and heritage projects' work. Etruscanning3D is an example of a project using a VR application and 3D reconstructions to improve audiences' experiences of data, extending the experience beyond a basic image. The Pleistocenic Museum of Casal Dè Pazzi's plans for a large-scale multi-projector system for recreating virtual spaces using high quality rendered photorealistic terrain generator software explores the potential for bringing the past back to life for museum audiences. Whereas the project for user interface search development for the Israel Museum describes an approach focussed more on the minutiae of the user experience of large complex datasets.

Topics such as the use of smartphone applications to engage visitors with hidden cultural heritage, using digital storytelling for storytelling in museum exhibition spaces, and using combinations of methods such as photogrammetry alongside iPads, geophysics and GIS for field recording are also included.

Encouraging conversation around topics such as these are essential, not only will it enable us to share experiences and improve future developments for the good of all of Archaeology, but these conversations will also ensure that the relevance of artefacts, maps, and the huge variety of archaeological data formats that are now being produced, will continue to be integral to the role of the museum and similar institutions as a place of learning and sharing of cultural heritage knowledge, tied into society's notions of community, identity and the future.

## References

Barbara Bender, Sue Hamilton, and Christopher Tilley, *Stone Worlds: Narrative and Reflexivity in Landscape Archaeology (Publications of the Institute of Archaeology, University College London)*, illustrated edition. (Left Coast Press Inc, 2007).

## The Virtuality-Reality Blender. Mediated and Mixed Reality applications in archaeology and cultural heritage

### *Session Code: HCI4*

Virtual environments constitute the main digital platform for inquiring and disseminating aspects of the past. Yet at the beginning of the 21st century, a change of focus in research agendas and media strategies towards the physical spurred an ever-growing body of research on mediated and mixed reality (MR) environments. The fields of archaeology and cultural heritage have provided stimulating grounds for the development of enabling technologies which promise to push the boundaries of interpretation beyond solely virtual or real spaces. Whether such technologies are used as research assisting, interpretive or knowledge dissemination tools, the main idea is to enhance the environment in which the user operates with additional information. To name a few, audio and video, digital annotations and three-dimensional imagery embedded in physical spaces or gestural input in virtual environments.

Already, a significant number of collaborative projects are exploiting how the potential of mixed reality technologies and new methodologies are applied in fieldwork, interpretive archaeology, cultural heritage sites, and museums. More recently, the advancements in Information and Communication Technologies (ICT), the advent of smartphone and PC tablet devices which are equipped with more powerful operating systems have increased the development of mobile applications. In terms of Augmented Reality (AR), substantial change is also witnessed at the level of real time and dynamic generated content. Issues of sustainability and affordability of the systems are also on the agenda. Apart from the enabling technologies per se, research focuses on interaction design and visitor experience evaluations. These developments provide technological foundation for revisiting theoretical discussions about phenomenology and the perception of the environment, embodiment, and visual cognition.

The purpose of this session is to assemble researchers from a variety of disciplines who currently work on mediated and mixed reality applications in archaeology and cultural heritage and initiate discussions around the affordances and limitations of such systems in our discipline as well as the theoretical issues concerned.

### *Papers in this session:*

[Installation for Interpretation of Archaeological Sites. The Portus Visualisation Project](#)

*Javier Pereda*

[Virtual Hands Free Interaction with 3D Objects and Environments](#)

*Dante Abate, Graziano Furini, Silvio Migliori, Samuele Pierattini*

[iConText – an App for Conveying Archaeological Contexts and Reception Histories of Exhibits to Museum Visitors](#)

*Marco Klindt, Daniel Baum, Steffen Prohaska, Hans-Christian Hege*

Personalizing interactive digital storytelling in archaeological museums: the CHES project*Maria Roussou, Laia Pujol-Tost, Olivier Balet, Stavrina Poulou, Niki Dollis*'Tangible Pasts': User-Centred Design of a Mixed Reality Application for Cultural Heritage*Angeliki Chrysanthi, Constantinos Papadopoulos, Tom Frankland*Augmenting 'Stone Worlds' – A Mixed-Reality approach to Phenomenological Analysis*Stuart Eve*Reconstructing Victorian Newcastle through Augmented Reality and Mobile Technology*Ning Gu, Tessa Morrison*AUGMENTED REALITY FOR THE STRUCTURAL CONSERVATION OF ARCHAEOLOGICAL MONUMENTS*Renato Perucchio, Jannick Rolland, Elizabeth Colantoni***Virtual Museums and Virtual Heritage****Session Code: HCI3**

The session will be focused on research aspects regarding the entire digital workflow that lead to the creation of a Virtual Museum: Communication, Acquisition and Modelling of Multimedia Assets, Archiving, Exploitation and quality evaluation, Visual Presentation, Concatenation of data into story (transmedia authoring)

**Papers in this session:**Etruscanning 3D: an innovative project about Etruscans*Eva Pietroni, Daniel Pletinckx, Wim Hupperetz, Claudio Rufa*Etruscanning 3D project. The 3D reconstruction of the Regolini Galassi Tomb as a research tool and a new approach in storytelling*Daniel Pletinckx, Raffaele Carlani, Irene Carpanese, Augusto Palombini, Christie Ray, Eva Pietroni*Evaluating Virtual Museums: archeovirtual test-case*Sofia Pescarin, Wim Hupperetz, Alfonsina Pagano, Christie Ray, Mattias Wallergård*Sandstone Pointcloud Smartphone Footfall: using TLS data to engage visitors with hidden cultural heritage*David Strange-Walker, Julia E Clarke*Back into Pleistocene waters*Augusto Palombini, Antonia Arnoldus Huyzendveld, Marco Di Ioia, Patrizia Gioia, Carlo Persiani, Sofia Pescarin*The Virtual Museum*Laia Pujol, Anna Lorente*Mapping the museum: artefacts to hand - A 3D tablet interactive visualisation, reaching from the museum into the showcases*Maria Dorigana De Padova*Interactive workspace for exploring heterogeneous data*Uros Damjanovic, Sorin Hermon*Ways of Seeing the English Domestic Interior, 1500-1700: the case of digital decorative textiles*Catherine Richardson, Tara Hamling, Graeme Earl, Maria Hayward*

## Novel technologies for supporting archaeological fieldwork

### *Session Code: HCI1*

This session explores how consumer grade technologies, such as smartphones or tablets, or custom-built technologies are currently being used to support archaeological fieldwork. We welcome papers relating to any aspect of fieldwork technology, however we are particularly interested by technologies that promote new forms of interaction, either between the user and the technological device(s) or between archaeologists, and technologies that disrupt or revolutionise current work practices. Excavations present a challenging environment for deploying technology, and therefore papers relating to how these difficulties have been overcome are also of interest.#

### *Papers in this session:*

[A Free and Open Source Platform for remote sensing and 3D data acquisition.](#)

*Alessandro Bezzi, Luca Bezzi, Rupert Gietl*

[Identifying and tracing archaeological material with RFID tags.](#)

*Ana María López, Ana María Salinas, Eduardo Pascual, Guillermo Azuara, Gloria Fernández, Elena Gallego, Francisco Burillo*

[Archaeology and Technology: Towards Collaborative Decipherment of Non-Verbal Markings](#)

*Barbara Rita Barricelli, Stefano Valtolina*

[ARCH \(Archaeological Recovering for Cultural Heritage\) and its application to the roman forum of Cástulo](#)

*Ana Martínez, Francisco Arias de Haro, Marcelo Lopez Castro*

[Principles of human-computer interaction in fieldwork software. Study of the archaeologist as a user and its implications](#)

*Patricia Martín-Rodilla*

[Using technology to explore issues of communication and disruption in archaeological fieldwork](#)

*Tom Frankland*

[Can you hack \(the\) communication?](#)

*Hugh Corley*

[Learning Sites, free open source communication and data-exchange tools for archaeological fieldwork and education](#)

*Jitte Waagen*

## Using tablet PCs to support field documentation

### *Session Code: HCI5*

This session examines how tablet PCs and other off-the-shelf portable devices are being used by archaeologists for data recording and analysis in the field. Submissions will explore how portable devices and mobile applications have been used to improve existing workflows and implement paperless recording systems. The session aims to identify the advantages that using tablet devices present over traditional recording methods and considers the future for the use of these devices in the field. It will also offer audience members who are possibly unsure whether tablet PCs could benefit their practice the chance to direct questions to archaeologists who have successfully implemented digital and paperless workflows.

***Papers in this session:***

The recording of rescue archaeology data from rural test trenching by the French National Institute for Preventive Archaeological Research (INRAP - France) in the Rhône Alpes area : elements of archaeological metrology

*Bertrand Moulin, Ellebore Segain, Véronique Vachon, Pierre Jacquet*

Paperless Recording at the Sangro Valley Project

*Christopher F Motz, Sam Crowe Carrier*

Tablet computer as a documentation tool for excavating an archaeological site: practical employment in the field and future possibilities

*Eva Butina*

EXTREMAL RECORDING SOLUTION – USING E-READERS FOR FIELD DOCUMENTATION ON GDANSK EXCAVATIONS IN WINTER, POLAND

*Bogdan Marek Bobowski*

Comprehensive Digital Recording and Analysis: iPads, Photogrammetry, Geophysics and GIS.

*Eric E. Poehler*

Pompeii and the iPad: an update

*Steven Ellis, John Wallrodt*

## General

### General paper session

**Session Code: GEN**

### Personal Histories of CAA

**Session Code: PH**

The 2012 edition at Southampton will be the 40th anniversary of Computer applications and quantitative methods in archaeology conference (CAA). This great occasion deserves some attention, which is why the organizers of the 40th CAA conference decided to host a 'Personal Histories of CAA' session. Over the last forty years CAA has grown from an annual event at the University of Birmingham to a national and now worldwide conference attracting over 300 participants every year. It also lived through major changes in the role computing played in academia and people's personal lives, through the availability of computers at academic institutions, the introduction of GIS, the affordability of computers for private use, the rise of user friendly operating systems, and last but not least the emergence and extreme impact of the world wide web. These events have strongly influenced the way archaeologists have used computing and quantitative techniques, and no organisation is a better reflection of this than CAA. The 'Personal histories of CAA' session aims to make the current generation of archaeologists aware of such dramatic shifts, and to provide personal perspectives for charting fascinating future research avenues.

### Poster Session

**Session Code: Post**

#### Posters:

Visitor movement and tracking techniques. A methodological approach.

*Angeliki Chrysanthi*

An integrated remote sensing approach for regional geoarchaeology in northwestern India

*Francesc Cecilia Conesa, Andrea Luca Balbo, Bernardo Rondelli, Marco Madella, P Ajithprasad*

3D Macrowear Analysis of Sculpture techniques in the Manufacture of the Neolithic Stelae with Horns of the Serra de Mas Bonet (Vilafant, Catalonia)

*Vera Moitinho de Almeida, Rafel Rosillo, Antoni Palomo*

LOW-COST PHOTOGRAMETRY AND 3D SCANNING: THE CASE OF EL NIÑO CAVE'S PALEOLITHIC ROCKWALL PAINTINGS DOCUMENTATION.

*Alejandro Garcia, Diego Garate*

A survey on archaeological Web Gis: interoperability, usability, interface from the beginning to the future development

*anna maria marras*

Modelling Neolithic site location with MaxEnt

*Claira Lietar*

The use of GIS for comprehensive analysis of heterogeneous data collected at the Preobragenka-6 burial ground

*Olga Pozdnyakova, Elena Rybina*

Simulated paths, real paths? The study case of the Iberian Cessetania (iron age society). POSTER

*Joan Canela Gràcia*

From 3D GIS to ArcheoGIS: First Steps towards a Timeless Conceptual Model

*Berdien De Roo, Ruben Maddens, Ann Vanclooster, Jean Bourgeois, Philippe De Maeyer*

Reconstructing the Gokstad Mound and its landscape

*Rebecca J S Cannell*

GOOGLE EARTH, GIS AND STONE WALLED STRUCTURES IN SOUTHERN GAUTENG, SOUTH AFRICA

*karim sadr*

Preparing High Resolution DTM to Prospect Ancient Roads in Saxony (Poster)

*Reiner Goeldner*

Integrating remote sensing techniques: the Penedes-Garraf (North-Eastern Spain) landscape case study

*Irene Cruz, Hector A. Orengo, Josep M. Palet*

No more pencils, no more field books... Archaeological drawing from total station data and digital photography

*Celia Goncalves, Joao Cascalheira, Alexandrina Amorim, Nuno Bicho*

Mapping the Late Iron Age of the Vredefort Dome, South Africa

*Patrick Joseph Byrne*

Intrasite spatial analysis of the cemeteries with dispersed cremations

*Marge Konsa*

VR as a tool for Ancient architecture. Examining some buildings in the eastern side of the forum of Pollentia (Alcúdia, Mallorca, Spain)

*Bartomeu Vallori-Márquez, Catalina Mas-Florit, Miguel Ángel Cau Ontiveros*

(Re)seeing the engraved block of El Mirón Cave (Ramales de la Victoria, Cantabria, Spain)

*Vera Moitinho de Almeida, Luis Teira, Manuel González-Morales, Lawrence G. Straus, Millán Mozota, Ana Blasco*

Interpreting the evolution of the Roman villa of Sa Mesquida (Mallorca, Balearic Islands) through VR and DEM models

*Bartomeu Vallori-Márquez, Catalina Mas-Florit, Patricia A. Murrieta-Flores, Miguel Ángel Cau Ontiveros*

Investigations at Roman Maryport. Integrated use of Geophysical Survey Methods to investigate the Extra-Mural area of a Roman fort.

*John Alan Biggins, Kristian Strutt, David Taylor*

Settlement patterns in Drahaný Highlands: GIS and quantitative methods based approach

*Lucie Culikova, Lukáš Holata*

Ontology-based Collaborative Image Annotation

*Yi Hong*

Application of RTI in Conservation

*ELENI KOTOULA*

Photographic rectification and photogrammetric methodology applied to the study of construction process of the Provincial Forum of Tarraco (Spain)

*Maria Serena Vinci*

Paris and its urban area at the intersection of history and geography (9th-19th century)

*COSTA Laurent*



ADeX for Protected Sites - Steps towards Standardisation in German Heritage (Poster)

*Reiner Goeldner*

Rock Art on the Cloud: Spatial Data Infrastructure about Horn of Africa rock art

*Alfonso Fraguas-Bravo*

QueryArch3D: A 3D WebGIS System linking 3D Visualizations to Archaeological Data

*Jennifer von Schwerin, Heather Richards-Rissetto, Giorgio Agugiaro, Fabio Remondino, Gabrio Girardi*

Across the river. Spatial analysis in the middle basin of Ripoll river (Catalonia, Spain)

*Maria Yubero-Gomez, Xavier Carlús*

The ideal bedfellows: How the Social Web and Archaeology became friends

*Nicole Beale*

Royalty and Rust: Tidgrove Key Reconstructions

*Grant Bryan Jeffrey Cox, David Hinton, kristian Strutt*

Photo-realistic Reality: The Level V 'Shrine of the Hunters' at Catalhöyük

*Grant Cox, Graeme Earl, Ian Hodder, Shahina Farid, Stephanie Moser*

The Portus Project: Simulating the Ship-sheds

*Grant Bryan Jeffrey Cox, Simon Keay, Christina Triantaphyllou, Graeme Earl*

RENDERING 3D ARCHAEOLOGICAL VISUALISATIONS IN AVAYA'S WEB.ALIVE

*Joe Rigby*

Prehistoric settlements, burial sites, ritual places reprocessed by GIS

*Karin Göbel*

Distribution analysis of bone findings in the prehistoric site of Mondeval de Sora (Belluno - Italy): issues and proposals

*Maria Chiara Turrini, Giulia Rinaldi, Federica Fontana, Antonio Guerreschi, Ursula Thun Hohenstein*

Visualizing History: Visualization of Archeological and Architectural Sites

*Paul Turner, Krupali Uplekar Krusche, Christopher Sweet, Benjamin Keller*

Deconstructing the present

*Suzanne-Marie Psaila*

Enemy at the Gates – Prediction models of the siege tactics at the castles in the 15th century

*Petr Koscelník*

Exploring the Future Roles for Archaeological Photography - Poster

*Alex Jansen*

Geophysical survey in North Africa: Archaeological research by the British School at Rome and Archaeological Propection Services of the University of Southampton

*Sophie Hay, Stephen Kay*

Pursuing the Past: Geophysical prospection services in the Mediterranean

*Sophie Hay, Stephen Kay, Kristian Strutt, Nicholas Crabb, Elizabeth Richley, Alice James*

LiDAR data evaluation for archaeological purposes in Northwest Iberia

*João Fonte, Luis Gonçalves Seco*

The application of the modern recording standards in the Romania's museums

*Felix Marcu*

The Journal of Open Archaeology Data (JOAD)

*Brian Hole*

Visualisation and the Interpretive Process: An Investigation into the Practice of Archaeological Reconstruction*Alice Elizabeth Watterson*The Scottish Ten project*Adam Matthew Frost*The Musawwarat Graffiti Archive: a workbench environment for the publication of large image collections and related complex data sets*Cornelia Kleinitz, Robert Casties*From concept to practice – experimental archaeology and cultural education*Angelica Balos, Paul Chepstea, Marius Barbu, Andrei Mihai*Illuminating Africa's past: using Reflectance Transformation Imaging techniques in documenting ancient graffiti at Musawwarat es Sufra*Cornelia Kleinitz, Hembo Pagi*The Art of Making project: Capturing the Meaning of Ancient Roman Sculpture*Michele Pasin, John Bradley, Will Wootton, Benjamin Russell***Demo:**"TOMOBIKI Night" a Japanese Archaeo-GIS Ustream programme*Yasuhisa Kondo, Takayuki Ako***People seeking collaborators****Session Code: COLLAB**

This session is designed to bring together experts with particular research questions and problems, and other experts providing potential computational and/or quantitative solutions. It is also a vehicle for like-minded researchers to join forces. The session will be organised around short papers so we look forward to a broad range of open-ended topics.

**Talks:**Developing tools for semi-automatic classification of phytoliths: a plea for help with image processing*Carla Lancelotti, Alessandro Mosca, Michelangelo Diligenti, Bernardo Rondelli, Marco Madella*FKI - A New Research Institute for Culture and Computer Science in Berlin, Germany*Elisabeth Lindinger*21st Century Archaeology- How Do We Make an Archaeology Curriculum that Involves Digital Devices Beyond Token Programs?*Doug Rocks-Macqueen***Session Code: FILM**

We also hope to be able to run these animations on the touch-screens and standard video screens distributed around the venue.

**Breakfast in Australia: a linkup with Digital Humanities Australasia 2012**

The Australasian Association for Digital Humanities (aaDH) will hold its inaugural conference "Digital Humanities Australasia 2012: Building, Mapping, Connecting" at the same time (28-30 March) as CAA2012 and will contribute to CAA2013 in Perth. Join us for breakfast to link up with colleagues attending the aaDH meeting in Canberra. Our aim is to explore opportunities for research visits and collaboration in conjunction with travel to CAA2013. Note: this session will take place on 28th or 29<sup>th</sup> March, starting at 8am

**CAA Speed dating**

This session will enable participants to network with fellow delegates. Each pair of delegates will have two minutes to get to know each other.