

# The Three Dimensions of Archaeology – Introduction

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This volume brings together presentations from two sessions organized for the XVII World UISPP Conference that was held from 1-7 September 2014 in Burgos (Spain). The sessions are: *The scientific value of 3D archaeology*, organised by Hans Kamermans, Chiara Piccoli and Roberto Scopigno, and *Detecting the Landscape(s) – Remote Sensing Techniques from Research to Heritage Management*, organised by Axel Posluschny and Wieke de Neef. The common thread amongst the papers presented here is the application of digital recording techniques to enhance the documentation and analysis of the spatial component intrinsically present in archaeological data. For a long time the capturing of the third dimension, the depth, the height or z-coordinate, was problematic. Traditionally, excavation plans and sections were documented in two dimensions. Objects were also recorded in two dimensions, often from different angles. Remote sensing images like aerial photographs were represented as flat surfaces. Although depth could be visualized with techniques such as stereoscopes, analysis of relief was troublesome. All this changed at the end of the last century with the introduction of computer-based digitization technologies, 3D software, and digital near-surface sampling devices. The spatial properties of the multi-scale archaeological dataset can now be accurately recorded, analysed and presented. Relationships between artefacts can be clarified by visualizing the records in a three-dimensional space, computer-based simulations can be made to test hypotheses on the past use of space, remote sensing techniques help in detecting previously hidden features of landscapes, thus shedding light on bygone land uses.

The methods and techniques that fall under the broad definition of 3D archaeology have now reached a mature state, where the advance in technology is at the service of archaeological research.

The session on *The scientific value of 3D archaeology* was dedicated to the presentation of methods, techniques and applications within the broad topic of 3D archaeology, with a specific focus on their scientific relevance. The papers selected for publication give a good overview of the application of digital 3D methodologies in archaeology, discussing how the use of 3D models has helped in the analysis and interpretation of archaeological evidence in a way that could not have been achieved by traditional documentation. The volume opens with the paper by Tjmm Lanjouw, which considers the application of 3D visualizations in archaeology from a theoretical perspective, focussing especially on digital reconstructions and virtual reality applications. Dominic Powlesland discusses the benefits of 3D imaging to accurately document the excavation process and enhance its interpretation, drawing on the experience accumulated by the Landscape Research Centre in Yorkshire. Martijn van Leusen and Serge van Gessel take into consideration the archaeological requirements of a 'true' 3D GIS,



which were discussed in the related session at the 2012 CAA Dutch-German chapter meeting. On the same subject, the paper by Victor Klinkenberg shows the usefulness of a 3D GIS for the interpretation of the 3D distribution of burials and artefacts at the site of Tell Sabi Abyad in Syria. Delphine Lacannette, Catherine Ferrier, Jean-Christophe Mindeguia, Evelyne Debard and Bertrand Kervazo present their research on a three-dimensional fire simulation in the Chauvet-Pont-d'Arc cave (France). Their study aimed to identify the zones that were suitable for occupation within the cave, by simulating temperature, smoke and the distribution of toxic gases of the fires that were lit inside. Next, the paper by Jose L Caro, Víctor Jiménez-Jáimez and José Enrique Márquez-Romero presents the result of digital photogrammetry applied to the prehistoric ditched enclosures of Perdigões (Portugal). Dealing with the application of photogrammetric techniques is also the paper by Lioudmila Iakovieva, François Djindjian and Yves Egels, which focusses on the 3D documentation of the Palaeolithic mammoth bone dwelling at Gontsy (Ukraine). Elias López-Romero, Patricia Mañana-Borrazás, Alejandro Güimil-Fariña and Marie Yvane Daire discuss the benefit of a 3D documentation of coastal heritage sites, which are threatened by erosion, focussing on selected case study areas in Galicia (Spain), Brittany (Western France) and Isles of Scilly (Britain). Finally, Patricia Mañana-Borrazás, Rebeca Blanco-Rotea and José Carlos Sánchez-Pardo present the methodology they have adopted for the 3D documentation of early medieval churches in Galicia (Spain), which enables stratigraphic analysis of the structures and an easy dissemination of their results.

The second part of this volume collects the papers that were selected for publication among those that were presented at the session *Detecting the Landscape(s)*. Techniques such as aerial reconnaissance, Airborne Laser Scanning (LiDAR), Geophysics, UAVs etc. have become major sources of archaeological information, especially for large areas and landscapes as a whole. Each of these techniques adds to the integration of the third dimension in archaeological research. The aim of this session was to highlight the great potential of these techniques for all aspects of landscape archaeology, including but not restricted to site detection, landscape research, heritage management, site and landscape preservation. Speakers were invited to place special focus on national and regional survey strategies and to discuss different research scales, from broad-brush to site specific approaches.

The participants in this session highlighted the application of non-invasive or remote sensing techniques, but also the complex interactions between these digital techniques and “traditional” archaeological recording methods such as field walking and excavation. The papers collected in this volume include four very different approaches to remote sensing for archaeology. First of all, Rebeca Blanco-Rotea, João Fonte, Alejandro Güimil-Fariña and Patricia Mañana-Borrazás discuss the use of airborne laser scanning and aerial photography for the detection of Modern Age fortification structures in the poorly accessible landscape of the Minho Valley (Portugal / Spain). On a site-specific scale, Wieke de Neef and Martijn van Leusen focus on the potential of the integration of surface distributions, geophysical data, and subsurface remains for the reconstruction of Late Bronze Age rural settlement in Calabria (Italy). Eduardo Carmona Ballester, Cristina Vega Maeso, Oscar López Jiménez and Victoria Martínez Calvo show how electro-magnetic induction survey can be applied to mitigate archaeological detection biases in the heavily vegetated landscape of Cantabria (Spain). Finally, Lucia Bermejo, A. I. Ortega, R. Guérin, A. Benito-Calvo, J. M. Parés, M. A. Martín, E. Aracil, U. Maruri and J. A. Porres discuss the application of electric resistivity surveys for the identification of possibly anthropogenic deposits and natural infill processes in a karstic cave system in the province of Burgos (Spain). These contributions show that remote sensing techniques have a great potential for archaeological research in otherwise poorly investigated areas, which adds a further dimension to our knowledge of land use in the past.

