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Contents

Human Computer Interaction, Multimedia, Museums

15 Towards Collaborative Decipherment of Non-Verbal Markings in Archaeology
Barbara Rita Barricelli, Stefano Valtolina, Giovanna Bagnasco Gianni and Alessandra Gobbi

21 Archaeological Documentation in the Field: the Case of the Roman Forum of Cástulo
Ana Martínez Carrillo, Marcelo Castro, Francisco Arias de Haro and Manuel Serrano

30 Implications for the Design of Novel Technologies for Archaeological Fieldwork
Tom Frankland and Graeme Earl

37 OpenArchaeoSurvey, or ‘Being Educated by the Digital Fieldwork Assistant’
Jitte Waagen, Nils de Reus and Rogier Kalkers

48 The Use of iPad as a Documenting Tool on an Archaeological Excavation on Govêe 2011 Project in North - Eastern Slovenia
Eva Butina

57 Back into Pleistocene Waters. The Narrative Museum of Casal de’ Pazzi (Rome)
Augusto Palombini, Patrizia Gioia, Antonia Arnoldus-Huyzendveld, Marco Di Ioia and Sofia Pescarin

66 Etruscanning 3D: an Innovative Project about Etruscans
Eva Pietroni, Daniel Pletinckx, Wim Hupperetz and Claudio Rufo

77 Personalizing Interactive Digital Storytelling in Archaeological Museums: the CHESS Project
Laia Pujol-Tost, Maria Roussou, Olivier Balet and Stavroula Poulou

91 Installation for Interpretation of Archaeological Sites. The Portus Visualisation Project
Javier Pereda

102 Material Motion: Motion Analysis for Virtual Heritage Reconstruction
Kirk Woolford and Stuart Dunn

110 Interactive Workspace for Exploring Heterogeneous Data
Uros Damnjanovic and Sorin Hermon

Simulating the Past

120 The Use of CFD to Understand Thermal Environments Inside Roman Baths: A Transdisciplinary Approach
Taylor Oetelaar, Clifton Johnston, David Wood, Lisa Hughes and John Humphrey
130 Structural Assessment of Ancient Building Components, the Temple of Artemis at Corfu  
Georg Herdt, Aykut Erkal, Dina D’Ayala and Mark Wilson Jones

138 Final Results of the Virtual 3D Reconstruction of the East Pediment of the Temple of Zeus at Olympia  
András Patay-Horváth

146 Teaching Cultural Heritage and 3D Modelling through a Virtual Reconstruction of a Medieval Charterhouse  
Andres Bustillo, Ines Miguel, Lena Saladina Iglesias and Ana Maria Peña

156 3D Reconstruction in Archaeological Analysis of Medieval Settlements  
Daniele Ferdani and Giovanna Bianchi

165 Handling Transparency in 3D Reconstructed Online Environments: Aquae Patavinae VR Case Study  
Daniele Ferdani, Bruno Panini, Guido Lucci Baldassari, Ivana Cerato, Sofia Pescarin

174 3D Documentation for the Assessment of Underwater Archaeological Remains  
Barbara Davidde Petriaggi, Roberto Petriaggi, Gabriele Gomes de Ayala

181 Post-Excavation Analysis in Archaeology Using 3D-Technology: the Case Study of Hala Sultan Tekke  
Kostas Anastasiades, Sorin Hermon, Nicola Amico and Giancarlo Iannone, Karin Nys

190 A New Approach for Interactive Procedural Modelling in Cultural Heritage  
René Zmugg, Ulrich Krispel, Wolfgang Thaller, Sven Havemann, Martin Pszeida and Dieter W. Fellner

205 Virtual Reality Simulations in Cultural Heritage  
Ioanneta Vergi

214 Taking Excavation to a Virtual World: Importing Archaeological Spatial Data to Second Life and OpenSim  
Isto Huvila and Kari Uotila

221 Using ConML to Visualize the Main Historical Monuments of Crete  
Panagiotis Parthenios

225 A High-Performance Computing Simulation of an Irrigation Management System: The Hohokam Water Management Simulation II  
John T. Murphy

Field and Lab Recording

232 Application of RTI in Museum Conservation  
Eleni Kotoula

241 Automatically Recognizing the Legends of Ancient Roman Republican Coins  
Albert Kavelar, Sebastian Zambanini and Martin Kampel
250 Multispectral Imaging of Historic Handwritings
Fabian Hollaus

258 Multispectral Image Analysis of a Censored Postcard from 1942
Florian Kleber, Fabian Hollaus and Robert Sablatnig

264 Semantic Web Technologies Applied to Numismatic Collections
Ethan Gruber, Sebastian Heath, Andrew Meadows, Daniel Pett, Karsten Tolle and David Wigg-Wolf

275 Automatic Coin Classification and Identification
Reinhold Huber-Mörk

289 Archiving Three-Dimensional Archaeology: New Technologies, New Solutions?
Kieron Niven, Stuart Jeffrey and Julian D. Richards

295 Intra-Site Analysis and Photogrammetry: the Case Study of the ‘Buca Di Spaccasasso’ (Grosseto, Italy) an Eneolithic Funerary Site
Gioanna Pizziolo, Daniele Pirisino, Carlo Tessaro and Nicoletta Volante

308 Site Recording Using Automatic Image Based Three Dimensional Reconstruction Techniques
Victor Ferreira, Luís Mateus and José Aguiar

316 Photographic Rectification and Photogrammetric Methodology Applied to the Study of Construction Process of Provincial Forum of Tarraco
M. Serena Vinci

324 Image-Based 3D Documentation of Archaeological Trenches Considering Spatial, Temporal and Semantic Aspects
Robert Wulff and Reinhard Koch

337 Digital Photogrammetry: a Contribution to the Study of Early Middle Ages Sarcophagi Quarries of Panzoult (Indre-et-Loire, France)
Daniel Morleghem

344 Low-Cost Photogrammetry and 3D Scanning: the Documentation of Palaeolithic Parietal Art in El Niño Cave
Alejandro García Moreno and Diego Garate

350 3D Documentation in Archaeology: Recording Las Cuevas Site, Chiquibul Reserve, Belize
Fabrizio Galeazzi, Holley Moyes and Mark Aldenderfer

363 Social Spreading of Geometric, Recorded Data from a Range of Types of 3D Scanners via a Web Data Server
Jorge Angas and Paula Uribe

376 Combining Terrestrial Laser Scanning and Techniques of Digital Image Processing in “Archaeology of the Architecture” Analysis in the Walls of the Andalusian Site of Vascos (Navalmoralejo, Toledo-Spain)
María J. Iniesto-Alba, Miguel A. Bru Castro, Estela Paradelo Fernández and Pablo Carballo Cruz
386 3D Model of the Roman Walls of Lugo (Galicia, Spain) Using a Terrestrial Laser Scanner and an Unmanned Aerial Vehicle

María J. Iniesto-Alba, Alicia Canizares-Sánchez, David Miranda and Rafael Crecente

398 (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 and Ana Blasco

406 Meshlab as a Complete Open Tool for the Integration of Photos and Colour with High-Resolution 3D Geometry Data

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

417 Enhancing Surface Features with the Radiance Scaling Meshlab Plugin

Xavier Granier, Romain Vergne, Romain Pacanowski, Pascal Barla and Patrick Reuter

422 OpeninfRA – Storing and Retrieving Information in a Heterogeneous Documentation System

Alexander Schulze, Frank Henze, Felix F. Schäfer, Philipp Gerth and Frank Schwarzbach

432 Towards Reverse Engineering Archaeological Artefacts

Vera Moitinho de Almeida and Juan Anton Barceló

Data Analysis, Modelling and Sharing

444 ARCA: Creating and Integrating Archaeological Databases

Maria del Carmen Moreno Escobar

457 A Database for Radiocarbon Dates. Some Methodological and Theoretical Issues about its Implementation

Igor Bogdanović, Juan Antonio Barceló and Giacomo Capuzzo

468 Standardised Vocabulary in Archaeological Databases

Matthias Lang, Geoff Carver and Stefan Printz

474 Modelling Imperfect Time in Datasets

Koen Van Daele

480 Distribution Analysis of Bone Remains in the Prehistoric Site of Mondeval De Sora (Belluno - Italy): Issues and Proposals

Maria Chiara Turrini, Federica Fontana, Antonio Guerreschi and Ursula Thun Hohenstein

487 Places, People, Events and Stuff; Building Blocks for Archaeological Information Systems

Paul J. Cripps

498 ArcheoInf, the CIDOC-CRM and STELLAR: Workflow, Bottlenecks, and Where do we Go from Here?

Geoff Carver

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

Keith May
Connecting Archaeology and Architecture in Europeana: the Iberian Digital Collections
Ana Martínez Carrillo, Arturo Ruiz and Alberto Sánchez

Open Access Journals in Archaeology and OpenAccessArchaeology.org
Doug Rocks-Macqueen

SVG Pottery: Upgrading Pottery Publications to the Web Age
Stefano Costa

Through an Urban Archaeological Data Model Handling Data Imperfection
Asma Zoghlami, Cyril de Runz, Dominique Pargny, Eric Desjardin and Herman Akdag

Guerrilla Foursquare: a Digital Archaeological Appropriation of Commercial Location-Based Social Networking
Andrew Dufton and Stuart Eve

Conceptualising eScience for Archaeology with Digital Infrastructures and Socio-Technical Dynamics
Teija Oikarinen and Helena Karasti

Geospatial Technologies and Analysis

Intrasite Spatial Analysis of the Cemeteries with Dispersed Cremation Burials
Marge Konsa

A Specific Approach for a Peculiar Site: New Spatial Technologies for Recording and Analysing a Palaeolithic Site (the Cave of La Garma, Northern Spain)
Alfredo Maximiano, Pablo Arias and Roberto Ontañón

Use of Quantitative Methods to Study an Alpine Rock Art Site: the Mont Bego Region
Thomas Huet

“The Whole is More than the Sum of its Parts”- Geospatial Data Integration, Visualisation and Analysis at the Roman Site of Ammaia (Marvão, Portugal)
Eleftheria Paliou and Cristina Corsi

Scattered Chronology - Surface Artefact Survey and Spatial Analysis of Ceramic Concentrations
Ondrej Malina and Jakub Silhavy

Ecological and Social Space in the High Mountains in South Norway 8500 – 2000 BP
Espen Uleberg and Ellen Anne Pedersen

Chalcolithic Territorial Patterns in Central Moldavia (Iaşi County, Romania)
Robin Brigand, Andrei Asândulesei, Olivier Weller and Vasile Cotiugă

Settlement Patterns in Drahany Uplands (Czech Republic): GIS and Quantitative Methods Based Approach
Lukáš Holata
Rural Life in Protohistoric Italy: Using Integrated Spatial Data to Explore Protohistoric Settlement in the Sibaritide
Kayt Armstrong and Martijn van Leusen

Reconstructing the Ancient Cultural Landscape Around Pompeii in 2D and 3D: from Scientific Data to a Computer Animated Museum Exhibit
Sebastian Vogel, David Strebel, Michael Märker and Florian Seiler

Using GIS to Reconstruct the Roman Centuriated Landscape in the Low Padua Plain (Italy)
Michele Matteazzi

Integrating Spatial Analyses into Foraging Societies Land Use Strategies. A Case Study from the Nalón River Basin (Asturias, North of Spain)
Alejandro García, Miguel Angel Fano and Diego Garate

Lost Worlds: A Predictive Model to Locate Submerged Archaeological Sites in SE Alaska, USA
Kelly R. Monteleone, E. James Dixon and Andrew D. Wickert

Familiar Road, Unfamiliar Ground. Archaeological Predictive Modelling in Hungary
Gergely Padányi-Gulyás, Máté Stibrányi, Gábor Mesterházy and Márton Deák

Mathematical Models for the Determination of Archaeological Potential
Nevio Dubbini and Gabriele Gattiglia

Calculating Accessibility
Irmela Herzog

Simulated Paths, Real Paths? A Case Study of Iberian Cessetania (Iron Age Society)
Joan Canela Gràcia

Open Source GIS for Archaeological Data: Two Case Studies from British and Egyptian Archaeology
Anna Kathrin Hodgkinson, Luca Bianconi and Stefano Costa

Speeding up Georeferencing with Subpixel Accuracy
Gianluca Cantoro

Multi+ or Manifold Geophysical Prospection?
Apostolos Sarris

Managing Data from Multiple Sensors in an Interdisciplinary Research Cruise
Øyvind Ødegård, Martin Ludvigsen, Geir Johnsen, Asgeir J. Sørensen, Stefan Ekehaug and Fredrik Dukan and Mark Moline

Towards Detection of Archaeological Objects in High-Resolution Remotely Sensed Images: the Silvretta Case Study
Karsten Lambers and Igor Zingman
ArcheOS and UAVP, a Free and Open Source Platform for Remote Sensing: the Case Study of Monte S. Martino ai Campi of Riva del Garda (Italy)
Alessandro Bezzi, Luca Bezzi, Rupert Gietl and Nicoletta Pisu

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)
Julio Zancajo, Teresa Mostaza and Mercedes Farjas

Theoretical Approaches and Context of Archaeological Computing

Crafting Archaeological Methodologies: Suggesting Situational Method Engineering for the Humanities and Social Sciences
César Gonzalez-Perez and Charlotte Hug

Boundary Concepts For Studying the Built Environment. A Framework of Socio-Spatial Reasoning for Identifying and Operationalising Comparative Analytical Units in GIS
Benjamin Vis

Everything Flows: Computational Approaches To Fluid Landscapes
Dimitrij Mlekuž

Reliability of the Representation of a Distribution: a Case Study on Middle Bronze Age Metal Finds in the Seine Valley
Estelle Gauthier and Maréva Gabillot

Assessing Positional Uncertainty due to Polygon-to-Point Collapse in the Cartographic Modelling of Archaeological Scatters
Fernando Sanchez and Antoni Canals

Theoretical Space-Time Modelling of the Diffusion of Raw Materials and Manufactured Objects
Estelle Gauthier, Olivier Weller, Jessica Giraud, Robin Brigand, in collaboration with: Pierre Pêtrequin and Maréva Gabillot

A Tangible Chronology
Jean-Yves Blaise and Iwona Dudek

Reconstructing Fragments: Shape Grammars and Archaeological Research
Myrsini Mamoli and Terry Knight

Grammar Modelling and the Visualisation of an Uncertain Past: the Case of Building 5 at Portus
Matthew Harrison, Simon Keay and Graeme Earl

Can Infovis Tools Support the Analysis of Spatio-Temporal Diffusion Patterns in Historic Architecture?
Jean-Yves Blaise and Iwona Dudek
History in 3D: New Virtualization Techniques for Innovative Architectural and Archaeological Scholarship and Education
James C. Sweet, Krupali Krusche, Christopher R. Sweet, and Paul Turner

Investigating the Effectiveness of Problem-Based Learning in 3D Virtual Worlds. A Preliminary Report on the Digital Hadrian’s Villa Project
Lee Taylor-Nelms, Lynne A. Kvapil, John Fillwalk and Bernard Frischer

Building Blocks of the Lost Past: Game Engines and Inaccessible Archaeological Sites
Anna Maria Kotarba-Morley, Joe Sarsfield, Joe Hastings, John Bradshaw and Peter Nicholas Fiske

Re-reading the British Memorial: A Collaborative Documentation Project
Nicole Beale and Gareth Beale
3D Documentation in Archaeology: Recording Las Cuevas Site, Chiquibul Reserve, Belize

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Abstract:
This research aims to define new methodologies for the 3D documentation and preservation of archaeological sites. In this paper we will show one approach to document completely aspects of an archaeological site using different 3D survey technologies and find the most appropriate methods, based on diverse environmental conditions and light exposures, and with varied surfaces. During the summer 2011 fieldwork campaign a test was conducted in the Las Cuevas’s site (Chiquibul Reserve, western Belize). Thanks to this test was possible to demonstrate the reliability of the triangulation laser scanner technique in terms of accuracy in cave environment. This kind of technology allowed the high resolution data capture of the excavation process in 3D. The final result was the 3D models of the units’ levels (meshes and textures applied). Moreover the comparison between triangulation laser scanner and dense stereo matching techniques showed pros and cons of the two recording methods.

Keywords:
Digital Archaeology, 3D Documentation, Dense Stereo Reconstruction, Triangulation Laser Scanner, Digital 3D Models

1. Introduction

The research described in this paper aims to define new methodologies for the 3D documentation and preservation of archaeological sites. 3D archaeological surveys are becoming more common in archaeology, but this can become problematic because researchers have yet to integrate these technologies to develop a complete and coherent methodology for 3D documentation of sites. The proposed work is intended to completely document aspects of an archaeological site using different 3D survey technologies to find the most appropriate methods based on diverse environmental conditions and light exposures, and with varied surfaces. The final product will be the creation of a 3D application that will be used for both scientific research and the creation of models and digital objects for heritage preservation and outreach activities. In the month of June 2011 the 3D documentation methodology was tested in the Las Cuevas site, located at the Las Cuevas Research Station in the Chiquibul Reserve in western Belize (Fig. 1). This site, originally referred as “Awe Caves”, is a medium-sized Maya ceremonial center located approximately 14 km east of Caracol. It is of particular interest because a large cave with an extensive dark zone tunnel system resides directly beneath the largest temple in the site core. This archaeological site is a perfect case study to test the different 3D documentation techniques and to integrate them in a precise working plan. The most interesting aspect of this site, for the 3D documentation, is the heterogeneity in its parts. It consists, in fact, of a number of buildings including temples, range structures, a ballcourt, and what appear to be sacbes and causeways. These characteristics represent a perfect test for the understanding of which 3D survey technologies are more appropriate for each structure category and how they can be integrated. Because of the complexity of the site, it has a wide range of environmental conditions – dark recesses of caves, areas in shaded sunlight under the jungle canopy, and areas of more direct sunlight in areas that have been cleared of brush or exposed by treefall. Thus, we have structures, variability in lighting, and other kinds of features in close proximity.
Two areas of the cave were dug and surveyed using two different approaches, the triangulation laser scanner (Minolta Vivid 910) and the photogrammetry technique (dense stereo matching). Two units have been excavated inside the cave, one in the entrance chamber, another in chamber one. The entire excavation process was acquired (9 strata in the entrance chamber and 8 strata in chamber one).

The goal of this test is the understanding if it is possible to plan the 3D documentation of an archaeological site using the cheaper and more portable photogrammetry, instead of the more expensive laser scanner technology. Can photogrammetry technique give the same result of the laser scanner in term of level of detail, or is the gap that exists between these technologies not filled yet? Aligning all the strata of the unit, it was possible to obtain the complete documentation of the excavation process in 3D. This project aims to demonstrate how these technologies can be a powerful tool for the site survey and data analysis. They give the possibility to preserve the information digitally through time. In this way archaeology can be revisited over the long-term and, thanks to the following of new discoveries, analyzed by multiple experts and subjected to new analytical techniques.

2. Related Work

In the past ten years the use of new technologies for the 3D documentation and reconstruction of cultural heritage has changed how we approach archaeological research. Archaeology, becoming even more ‘digital’, is officially part of the digital village described by Zubrow (2006: 12). The use of 3D laser scanners and photogrammetric methods is now well established in the field. One of the main reasons for this development is the possibilities that these techniques give to preserve digitally information through time.

Up to now the efforts in the 3D laser scanner documentation have been mainly focused on two aspects: the first is the 3D analysis of archaeological sites and monuments after the excavation process. Here it is possible to obtain only the static representation of a site or monument. An example is the 3D survey of Livia’s Villa (30–25 BC, Rome, Italy). A laser scanner (Cyrax 2005) was used for the 3D acquisition of the site. Thanks to this technology it was possible to obtain a detailed 3D data capture of point clouds, and, after the post-processing, a mesh characterized by a millimetric precision of the entire archaeological site (Dell’Unto et al. 2008: 121-122). The main goal of this project was not the 3D documentation of the excavation process, but rather the representation of the site after the dig.

The 3D documentation of the archaeological excavation process in real-time is one of the most challenging aspects of this research. What, in fact, this work is intended to understand is if it is possible to develop a
methodology that allows the three dimensional survey of archaeological stratigraphy during the excavation process. For the achievement of so ambitious a goal, different technologies must be tested in order to integrate and use them according to their characteristics and potential.

2.1 Time of Flight Laser Scanner vs Triangulation Laser Scanner

In the past ten years the time of flight laser scanner technology has demonstrated to be very powerful in the 3D documentation of general archaeological contexts, but cannot produce sub-centimeter precision, which is often required for high quality site documentation (Galeazzi et al. 2010: 102; Koch and Kaehler 2009: 1).

For this reason in the summer of 2010 a triangulation light laser scanner, the Konica Minolta VIVID 910, was used to scan the stratigraphic units of Building 86, a mud-brick house, in Çatalhöyük, Turkey.

During the fieldwork was possible to scan 27 stratigraphic layers (Fig. 2). This first test represents a very good starting point in the analysis of the effectiveness of this new methodology.

The stratigraphy was acquired using two different laser scanners: the Konica Minolta Vivid 910 and the Trimble CX. The first one is a triangulation light laser scanner able to reach a level of detail within to a millimeter (TELE X: ± 0.22 mm, Y: ± 0.16 mm, Z: ± 0.10 mm), with a scan range of 0.6 to 2.5 m. The second is a time of flight laser scanner that can reach a detail between 8 mm and 1 cm (considering the post-processing phase), with a scan range of 0.5-350 m. Both the scanners have pros and cons.

The data recording obtained through the Minolta is not as fast as that obtained by the Trimble, which can acquire large areas in a few minutes of work. However, the data post-processing is faster; in fact the Minolta is able to acquire textures (under good light conditions) and surfaces, while the Trimble is not. The latter, in fact, can just acquire point clouds that have to be triangulated and texturized in the post-processing phase. Unfortunately, the Konica Minolta Vivid 910 cannot work in direct light conditions. For this reason we were forced to cover the excavation area in order to scan the layers. Since the team was not prepared for this kind of situation it was not possible to have a perfect distribution of the light with the cover. So the textures acquired by the scanner were not homogeneous enough to be used in the 3D models of the layers. The textures of the layers were acquired through a high resolution digital camera in the attempt to georeference them to the 3D surfaces of the layers during the post-processing. There are two negative aspects in this kind of texturing procedure: the first one is that the alignment of the map to the 3D model is made manually through control points, and for this reason the accuracy of their matching is not always guaranteed. The second is that it is more time consuming.

The fieldwork proved that using Minolta it is possible to obtain very detailed 3D meshes in the acquisition of stratigraphic layers, and confirmed that the time of flight laser scanner cannot produce sub-centimeter precision, which is often required for high quality site documentation (Koch and Kaehler 2009: 1).

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2.2 From Photogrammetry to Dense Stereo Reconstruction Tools

The use of photogrammetry techniques for the 3D documentation of archaeological sites was tested in different digital archaeology projects. One of the most successful is the 3D documentation and reconstruction of the medieval monastery of “Santa Maria di Tergu” (X-XII century AC, Sardinia, Italy). In this project some excavation areas were 3D recorded using the photo-modelling technique (Galeazzi et al. 2007).

These techniques are used to create simplified 3D metric models with a photorealistic aspect. Photo-modelling is a photogrammetric technique that provides image-based modelling. Using it, it is possible to calculate measurements and build 3D models through digital pictures, and is used for the creation of simplified 3D metric models with photorealistic aspect.

The comparison between laser scanner and photo-modelling techniques were developed in the 3D survey of the Livia’s Villa archaeological site. In this case the high irregularity of the structures did not allow the acquisition of a good 3D resolution model through photo-modelling technique. The difference in term of level of detail between the laser scanner and the photo-modelling 3D models was considerable (Dell’Unto et al. 2006).

The use of dense stereo reconstruction tools for the 3D documentation of the archaeological stratigraphy is not anymore a new technique in archaeology. Thanks to this technique the camera calibration that was mandatory with photogrammetric software like PhotoModeler, is not necessary anymore. Dense stereo reconstruction tools, in fact, allow the 3D data generation starting from a series of un-calibrated images. The different steps of the process of 3D reconstruction are image matching, camera parameters estimation, dense matching, and the results of this computation may be similar to a series of range map, associated to each input image (Callieri et al. 2011). The processing of image sets usually takes some hours.

The main problems in the use of this technique are the lack of scale information and the absence of a convincing comparison between this documentation method and 3D scanning. Nonetheless some attempts have been made in this direction (Doneus et al. 2011; Guerra 2011), the definition of a coherent methodology is still far to come.

3. Case Study: Las Cuevas, Chiquibul Reserve, Belize

3.1 The Site

The Las Cuevas Archaeological Reconnaissance (LCAR) began investigations of the ancient Maya archaeological site of Las Cuevas, located in the Chiquibul Reserve in western Belize, Central America (Fig. 1) during a four-week summer field season in 2011. Originally referred to as “Awe Caves,” Las Cuevas has received little investigation, with the exception of one notable project. In 1957, working for the British Museum, Adrian Digby (1958) and then Commissioner of the Belize Department of Archaeology A. H. Anderson conducted excavations at the site and produced a sketch map. Digby wrote a brief article for the London News describing the site and reporting his excavations, and Anderson mentions a 1938 visit to Las Cuevas in his 1962 paper for the Americanists’ Congress, but no other reports have been found. The current investigations by the LCAR address cultural dynamics during the Late to Terminal Classic periods, a time of severe stress in the ancient Maya world, by examining the ritual life of a Maya community on the eve of collapse.

Recent studies (Aimers 2007; Demarest et al. 2004:546) question the usage of terms such as “collapse” or “fall” because they are
colorful but misleading, but Demarest and his colleagues suggest that the events of the late 9th century do represent changing political systems and ideologies. In other words, instead of representing the total failure of an entire civilization, the “collapse” has been redefined as the decline of the elite class and the abandonment of the institution of kingship in the Maya Lowlands. Most Mayanists agree that there was in fact a major change in both population and social organization, and it is clear that many sites were abandoned during the mid to late 9th century.

Las Cuevas offers an excellent venue for exploring this issue. It is a medium-sized minor administrative/ceremonial center whose nearest neighbor is the mammoth site of Caracol, located approximately 14km to the east as the crow flies. On the surface Cuevas seems to be typical of many Late Classic sites found in Belize such as Baking Pot, Floral Park, Blackman Eddy or Minanha (Iannone 2004). However, this site has something that these other sites do not—a large cave system that runs directly beneath the main plaza. The cave entrance is situated below the eastern pyramid or “shrine,” that as noted at both Caracol and Tikal, are the foci of ancestral burials (Chase 1994:53, Becker 2003:258-262). The cave entrance itself is massive, cathedral-like, and architecturally modified, suggesting that it was used for large public performances. The LCAR aims to articulate constructions in the cave with those of the surface site to produce a picture of the ritual life of the community, and contextualize ritual practice within the sociopolitical as well as the natural environments.

A large cave with an extensive dark zone tunnel system resides directly beneath Structure 1, and runs directly beneath Plaza A. The opening of the cave is at the base of the cenote located in the center of the site. While it is not unusual for Maya sites to be associated with caves, we rarely see such a direct connection or such an extensive tunnel system beneath a site core (Moyes and Brady 2012). Not only this, but located directly inside the cave’s cathedral-like entrance is an additional cenote with a natural spring at its base (Fig. 3). Test excavations both in surface contexts and within the cave were conducted to begin to establish the site’s chronology. The plan is to investigate connectivity between Las Cuevas and Caracol by comparing architectural layouts, ceramic assemblages, chronology, ritual practices and settlement patterning between the sites (Moyes et al. 2011).

3.2 Mapping the Site

The first field season of the LCAR focused on mapping the site and conducting test excavations for chronology building. The site was surveyed by Rafael Guerra, Erin Ray, and
Mark Kile, using a Sokkia 650X 6” reflectorless total station on loan from the University of California, Merced and a Topcon 3” total station on loan from Lisa Lucero. Data were displayed and organized using a Geographic Information System. Maps were produced by Justine Issavi, Lauren Phillips, Rafael Guerra, and Holley Moyes. A digital elevation model (DEM) of the site, a plan view map of the constructions in the site core and plazuela group (Fig. 4), and a partial map of the cave were created (Fig. 3; Moyes et al. 2011).

4. 3D Scanning vs Dense Stereo Reconstruction Tools

Concerning the stratigraphy data acquisition, the tests were conducted in four different areas of the site, characterized by diverse environmental conditions and light exposures, and with varied surfaces:

Test 1 – Caves Chamber 1 (no natural light/compact and muddy soil). The test in the second chamber of the cave allowed testing the data acquisition techniques (dense stereo matching or triangulation laser scanner) in an area characterized by the total absence of natural light. Moreover testing this part of the cave was of extreme importance to put in evidence the performances of the different documentation technologies in high level of humidity and compact and muddy soil’s condition.

Test 2 – Caves Entrance Chamber (medium natural light/compact and medium wet soil). The first chamber is at the entrance of the cave for this reason it presents a medium exposition to natural light. The soil is less compact and muddy respect to the second chamber.

Test 3 – Ballcourt (areas in shaded sunlight under the jungle canopy/wet soil). The test in this part of the site showed the limits and potentialities of the different methods in no direct natural light conditions. The jungle canopy, in fact, permits a homogeneous distribution of the sunlight all day long.

Test 4 - Open area of the research station (direct sunlight in areas that have been cleared of brush or exposed by treefall). The test in this area was, probably, the most challenging because exposed to direct sunlight.

The tests conducted in the ballcourt (3) and in the open area of the research station (4), showed the limits of the triangulation laser scanner technique in these environmental conditions. The test 4 confirmed the results obtained in the Çatalhöyük project, the triangulation laser scanner (Konica Minolta Vivid 910) cannot work in a direct light condition. The test 3 gave the same results. In fact, also if the canopy partially filters the direct sunlight, it is still very difficult to obtain good results in these light conditions. The acquisition in these kinds of environments (3 and 4) is possible just covering the area that has to be scanned. But this procedure is not always possible during the archaeological fieldwork; moreover the textures acquired by the scanner are not homogeneous enough to be used in the 3D models of the layers. Since the triangulation laser scanner technique showed its limits in these two areas of the sites, in the summer 2012 fieldwork campaign the survey will be conducted comparing the photo dense tools techniques to a phase shift variation laser scanner, the FARO Laser Scanner Focus3D, to understand if these technologies may work better in these environmental and lighting conditions.

4.1 Cave Investigation

The triangulation laser scanner techniques showed its limits in the outdoor environment of the site (tests 3 and 4). The result was totally different in cave environment (tests 1 and 3). The FARO Laser Scanner Focus3D uses Phase Shift technology to measure the distance to a surface. An infrared laser is sent out and reflected back to the system. The distance is measured by analyzing the shift in the wavelength of the return beam: http://www.faro.com/site/resources/download?ReturnUrl=/site/resources/download/1772/.
Two test units were placed in the cave. Cave investigations were supervised by Barbara Voorhies. Laura Kosakowsky analyzed the ceramics for chronology using standard type: variety designations largely in line with the Belize Valley (Gifford 1976). All of the units datable material and all contained ceramics dating to the Late Classic Spanish Lookout/Tepeu II complex (Moyes et al. 2011).

Unit 1 (Test 2 - Cave Entrance Chamber, medium natural light/compact and medium wet soil)

Unit 1 was of particular interest. This unit was placed in the Entrance Chamber into a partially eroded platform with a plaster floor. A second floor was encountered below suggesting that there was more than one phase of construction within the cave. Initially we thought that this earlier construction may have been quite old, but ceramic analysis clearly demonstrated that this was not the case and that the cave was modified on more than one occasion in the Late Classic period. A total of 316 sherds were excavated within the unit, of which 62 were identifiable to type. Although there were redeposited sherds from the Late Preclassic (Sierra Red Group) and Early Classic period Petén Glosswares, both constructions primarily contained sherds dating to the Spanish Lookout/Tepeu II complex. Additional artifacts encountered including chert flakes, a chert biface, and animal bone, bolster our argument that, rather than representing a unique cave assemblage, the artifacts in the fill of the platform are typical of mixed fills from surface site excavations elsewhere (Moyes et al. 2011: 17-19).

The excavation process of this unit was completely recorded in 3D using the two techniques: triangulation laser scanner, Minolta Vivid 910; and dense stereo matching. The quality of the data coming from the Minolta acquisition was very good. The characteristics of the cave environment (medium and no natural light conditions) allowed a better control on the lighting of the excavation area. Artificial lights, in fact, were used to give a more homogenous distribution of the light on the area to be scanned. The first positive aspect in the use of the triangulation laser scanner technique was the extreme detail of the meshes acquired (Fig. 6). The second benefit consists in the possibility to acquire meshes and not point clouds. This allowed, during the post-processing phase, to avoid the point clouds filtering, alignment and triangulation, saving almost the half of the post-processing work time. One of the negative aspects in the use of this technique is the low resolution of the textures. The camera integrated in the scanner, in fact, is a low resolution camera (number of output pixels: 307,000/FINE mode, 76,800/FAST mode). Moreover this technique is not recommended for scanning big areas for two...
main reasons: first of all because the post-processing and alignment of the different meshes obtained from the scans will be extremely time-consuming. The Minolta, in fact, allows acquiring just a small area at a time. The optimal 3D measurement range (0.6-1.2 m) consents to record a surface of about 80x80 cm. Secondly the fieldwork experience showed that the cave environment, because the high level of humidity, remarkably affects the laser scanner performances. After about an hour and an half the hardware stopped working properly. Since in this amount of time it is possible to estimate an acquisition of a surface of about six square meters, the acquisition of a bigger area would slow down too much the excavation process.

The same unit was acquired using dense stereo reconstruction tools. The purpose of this paper is not to give an overview and comparison of the different dense stereo matching software. Some evaluations have already been done between three tools: Arc3D webservice, Photosynth/Bundler+PMVS2 and AutoDesk PhotoFly. The comparison showed that it is possible to obtain the same numerical results from one system to another. The differences between them are in terms of data density, resilience to non-optima photo dataset, visual quality of data and tools flexibility (Callieri et al. 2011). Photosynth/Bundler+PMVS2 seemed to be the best choice between the three different tools tested, because the only one that can be executed on a local machine. This represents a fundamental characteristic in archaeology, because during the on-site 3D documentation the probability to be connected to a webserver is not so common, especially in very remote site like Las Cuevas.

A different dense stereo matching software was used for the 3D documentation of the Las Cuevas stratigraphy, PhotoScan, Agisoft. This software uses the same algorithm adopted by Photosynth/Bundler+PMVS2, but it was preferred because it is the only dense stereo matching software that allows complete 3D model restitution (alignment, creation of the geometry and texture). Moreover, thanks to the graphic interface, it is possible to separately manage the geometry and texture creation from the alignment. In the last years, because of logistics issues connected to the fieldwork in remote environments, archaeologists have started to test this technique as a possible alternative to laser scanner technology. Also the site subject of this study, Las Cuevas, is located in a very remote area of the Chiquibul Reserve in western Belize. The site is four hour driving from the closest town, San Ignacio. In this kind of environment it is very difficult to bring heavy equipment like laser scanners, therefore the possibility to acquire 3D models just taking picture makes the dense stereo reconstruction tools technique extremely more flexible.

Another positive aspect in the use of this technique consists in the possibility to reduce consistently the acquisition and post-processing time. The acquisition time with the Minolta laser scanner of a surface of 2x2 meters was about twenty minutes, while the pictures capture for the dense stereo matching took around five minutes. The post-processing of the same surface with the Minolta took about an hours of work (meshes optimization and alignment), while with PhotoScan the data processing was about four hours, but the real work time, the data loading, took just about 15 minutes, the rest was of machine processing.
The final 3D models of the unit, result of the acquisition with the two techniques, have been aligned to permit their comparison. Nonetheless the Dense Stereo Tools technique gave good results in term of meshes’ details, the difference between this technique and the triangulation laser scanner technology was still relevant. The comparison of the 3D models obtained from the two techniques, in fact, showed that just the triangulation laser scanner technology allowed the preservation of the details of all the features contained in the strata (Fig. 7).

The preservation of the unit textures’ quality was problematic for both the 3D recording methods. The use of external lights remarkably affected the texture color in the Minolta data acquisition. Lighting issues, pretty common in cave environments, were evident also in the integrated camera of the laser scanner (Fig. 8). The camera flash was used instead of external lights for the dense stereo matching data acquisition in the attempt to avoid the mentioned effects on the textures’ color, but the result was exactly the same, the textures’ color of the unit was altered (Fig. 9).

Unit 2 (Test 1 – Caves Chamber 1, no natural light/compact and muddy soil)

This unit is located in an alcove that has a large imposing stalagmite positioned in front of the narrow passageway that leads into the alcove from the direction of the cave’s entrance. Unit 2 (1 x 1m) was located on the east side of a protruding rock that was surrounded by abundant flat-lying sherds. The diagnostics ceramics belong to the Spanish Lookout Ceramic Complex pertaining to the Late Classic Period (A.D. 700-900; Moyes et al. 2011: 19-21).

The two techniques (dense stereo tools and triangulation laser scanner) were tested also on this unit (Fig. 10), and the comparison gave exactly the same results obtained in the 3D documentation of unit 1.
5. Conclusions

The interest in archaeological 3D documentation has greatly accelerated over the past decade (e.g. Addison 2008; Bobowski et al. 2008; Dell’Unto et al. 2008; Galeazzi et al. 2007; Koch and Kaehler 2009; Zubrow 2006). Nonetheless today 3D technologies are being used more commonly in archaeology, and the use of technologies is well established for the documentation of archaeological sites (e.g. Callieri et al. 2011; Dell’Unto et al. 2008; Craig et al. 2006; Neubauer et al. 2005; Galeazzi et al. 2007), there are only a handful of scholars who compared different techniques on site, and usually this evaluations take in consideration just two technologies per time (Dell’Unto et al. 2006; Doneus et al. 2011; Koch and Kaehler 2009). This research compared the two main types of 3D laser scanner technologies (the triangulation and the time of flight) with dense stereo matching technique. The analysis of all those techniques on site is fundamental to have a complete and comprehensive test of their potentialities, and to verify the possibilities to integrate them effectively in the 3D documentation process.

The results obtained in the first Las Cuevas 3D documentation campaign showed the extreme flexibility of the dense stereo reconstruction tools technique for logistics, data acquisition and post-processing time. This technique allowed saving 15 minutes for the data acquisition (5 minutes vs 20 minutes), and 45 minutes for the data processing (15 minutes vs 60 minutes), without considering the machine processing in this estimation (about three hours and a half), respect to the triangulation laser scanner technology. For this reason it is possible to state that in this particular environment the acquisition through triangulation laser scanner technology slows down the excavation process more than the dense stereo reconstruction data recording, especially for area bigger than six square meters.

The improvement of dense stereo matching technique in term of detail, in the last years, is evident; it allowed a good reliability in the metric representation of the unit information. But it does not consent the preservation of the details of all the features in the unit. The triangulation laser scanner technique seemed more indicated for the 3D reproduction of the unit’s micro-stratigraphy in cave environment. However more tests will be done in the second Las Cuevas fieldwork campaign, in summer 2012, to understand if the camera flash light, used during the dense stereo matching acquisition, has affected the detail and quality of the 3D model’s meshes. Since the triangulation and time of flight laser scanners showed some limits for the 3D documentation of archaeological stratigraphy, the first for the impossibility to work in direct light conditions and the second for lack of details of the strata’s features acquired in the 3D models, in summer 2012 the dense stereo reconstruction tools technique will be compared with a phase shift variation laser scanner to understand if this technology could serve better the scope.

This project is a work in progress; the next fieldwork campaigns will allow its completion. But the preliminary results coming from the summer 2011 fieldwork season clearly showed the potentiality of this research, and gave the first answers on the comparison of two of the four techniques that will be analyzed (triangulation laser scanner - Minolta Vivid 910, and the dense stereo reconstruction tools, PhotoScan). At the conclusion of the project it will probably possible to understand if the cheaper and more portable dense stereo reconstruction technique can give the same results of the more expensive laser scanner technologies. This aspect is one of the most debated in archaeology today. The possibility to record in 3D the site just taking picture can represent a revolutionary change in the discipline, raising an unprecedented dissemination of 3D representation in the archaeological documentation. This discovery can also increase the use of 3D documentation methods between students that want to
understand the discipline and personally test these technologies. So the extreme flexibility and portability of the photogrammetric method can promote teaching, training and learning, giving the possibility to students that cannot have access to the more expensive 3D laser scanner technologies, to experience some of the tools used during the documentation of an archaeological site. In this way they can understand the archaeological documentation process from classes and be trained for the real fieldwork (Di Giuseppantonio Di Franco et al. 2012).

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