CDH annual meeting 2017, Leiden, June 15-16

Abstracts

Session 1 "3D Recording and Modelling of Heritage"

Curious Travellers – developing web scraping tools and social media APIs for 3D visualisation of heritage under threat. Andrew S. Wilson (School of Archaeological Sciences, University of Bradford), Vince Gaffney, Eugene Ch'ng, Chris Gaffney, Tom Sparrow, Andrew Murgatroyd, Yuhan Luo, Edward Faber, Richard Bates, Richard Cuttler, Gareth Sears.

The AHRC-funded Curious Travellers project (www.visualisingheritage.org) is a data-mining and crowd sourced infrastructure enabling accurate digital reconstruction and 3D visualisation of archaeological sites, monuments and heritage at risk. The project provides a practical response for the heritage community to help record sites that have been destroyed or are under immediate threat from natural disasters, neglect, conflict and cultural vandalism. This abstract focusses on the methods being developed to scrape publically available image data drawn from resources such as travel blogs, picture galleries and other social media. These images are combined with donated content to recreate 3D models of endangered and lost monuments and heritage sites. Furthermore, with the development of Social Media APIs (Application Programming Interfaces) for image data we are able to query contextual information, helping to place and interrogate structures in context by linking with relevant site and landscape data for the surrounding environment. The project blends datasets where appropriate, using geospatial records such as aerial imagery and 3D laser scan data where they exist. These serve as a framework for adding new content and in preserving time-event records as a basis for heritage management. The scale of this undertaking will be represented using a historic environment record structure for sustainable longterm utility. Case examples to be discussed will include Palmyra, Syria; Cyrene, Libya; Diocletian's Palace, Split, Croatia and Fountains Abbey, Yorkshire.

An embarrassment of riches? Hanna Stöger (Leiden University/Universität Augsburg), Mark Locicero (Leiden University) and Alexander Jansen (Leiden University).

Given the endangered heritage situations arising from dramatic contemporary conflicts, we tend to forget about well-known familiar archaeological sites closer to home. Key sites of urban culture such as Pompeii and Ostia occasionally appear in the news when buildings collapse or the sites are completely closed off due to flooding. Slow, on-going processes of deterioration resulting from exposure to the elements and everyday wear and tear caused by an endless stream of visitors hardly ever make the news. Most Mediterranean countries are blessed with high densities of archaeological sites and finds. Yet, these cultural assets turn from a blessing to a curse when budget-cuts occur and local or regional administration can no longer assure sufficient protection and sustainable site management. A case study of a city block from Ostia (Insula V, ii), and examples from other parts of the city will be used to address a number of problems the site is confronted with. This city block is one of the best researched in the Roman world, and its original model, from the 1970s (published in

1984), has recently been reassessed by several researchers from Leiden's Faculty of Archaeology (H. Stöger, M. Locicero and A. Jansen). This research brings together the pressing challenges of climate change, archaeological conservation, and sustainable heritage management, while presenting opportunities at all scales of research (including 3D modelling, space syntax analysis, building information modelling (BIM), as well as the assessment of the block's water infrastructure). Although it doesn't often make newspaper headlines, the wealth of urban archaeological data within Europe continues to require new forms of research, assessment, and management, in our increasingly urbanized world.

3D monitoring for assessing structural threats to cultural heritage. Roderik Lindenbergh (Dept. of Geoscience and Remote Sensing, Delft University of Technology).

Many structures that belong to our cultural heritage have in common that they are special, not only from a cultural but also from a structural viewpoint. Both building materials and building constructions are often ancient and atypical. This makes it even more challenging to assess the structural state of such buildings. 3D surface sampling techniques like photogrammetry and laser scanning are nowadays common tools for rapid 3D digital documentation of single monuments or even complete sites. Often a digital reconstruction that appears faithful to a human operator is accepted as a valid end product. To assess the structural state of a building it is typically required to consider the absolute and/or relative metric properties of available 3D data, that may be acquired at a single moment or at two or several epochs in time. Metric properties are however difficult to assess, as both laser scanners and photogrammetry extract 3D positions of apparent arbitrary locations on a construction.
In the proposed presentation, different methodology is discussed, by means of examples, aiming at assessing the state of a structure. It is shown how local deviations to geometric primitives, like planes or cylinders, may indicate perturbations in walls due to pressure. Recent techniques also allow to extract and assess individual bricks in brick walls, and, cracks in walls and wooden beams. All though 3D sample techniques measure apparent arbitrary points, it is often possible to reliable estimate the position of assignable key points, by exploiting the large number of available 3D points. It is also shown how to estimate deformations from repeated 3D acquisitions: in an absolute way, by comparing the same 3D key point though time, but also in relative ways: First by considering changes between epochs in deviations from an ideal model, and second, by comparing an epoch-wise virtual network of distances between suitable 3D key points.

Replicating lost heritage: 3D digital reconstructions, social recovery, and the sense of place. Paola Di Giuseppantonio Di Franco (McDonald Institute for Archaeological Research, University of Cambridge).

The past few years have seen increasing number of projects incorporating 3D digital and printed reconstructions of heritage that has been lost due to conflicts or natural disasters. Although scholars and institutions such as UNESCO and the ICCROM recognise the value of such reconstructions, some scholars suggest that these models only reproduce the surface authenticity of a place, lacking the essential emotional and material engagement that can only be obtained through physical interaction

with the environment. This opens up a question about the significance of digital reconstructions in the context of traumatic loss of heritage. Studies demonstrate, in fact, that we do think with objects and that interaction with the environment is a key element that defines people's sense and ownership of a place.
In this paper I discuss these issues and show, through the analysis of a series of case studies, how digital models can bring short-term solutions for social recovery after the traumatic loss of heritage. In fact, the process of reconstruction is a performance that can enhance a cathartic effect through the affective bodily interaction involved in crafting the replica. In the paper I also examine what role 3D digital reconstructions might have a few years after the traumatic event happened, when long-term material reconstructions have most likely taken place, resulting in new mechanisms of ownership and sense of place.

Pilot project Scanning for Syria. Olivier Nieuwenhuijse (Leiden Erasmus Delft Centre for Global Heritage and Development/ Leiden University, Faculty of Archaeology), Dominique Ngan-Tillard (TU Delft, Faculty of Civil Engineering and Geosciences, Department of Geoscience and Engineering), Jouke Verlinden (TU Delft, Faculty of Industrial Design Engineering, Department of Advanced Manufacturing).

The relentless civil war in Syria is having disastrous effects on the people of Syria and their rich cultural heritage. Initiatives are taken across the world to preserve the archaeological materials or at least the scientific information they contain.
Our project focuses on casts of Assyrian clay tablets (ca. 1200 BC) with cuneiform script from the site of Tell Sabi Abyad (northern Syria) excavated by archaeologists from the National Museum of Antiquities and Leiden University between 1996 and 2006. After the excavations, the archaeologists made silicone rubber casts of the objects for detailed studies in Europe. Cuneiform, i.e., wedge-shaped writing was invented in the later fourth millennium BCE and remained in use in the Middle East until the 2nd century CE. Dated to the 12th century BCE, the Tell Sabi Abyad texts are an important historical source on the organization of the Middle Assyrian Empire. They provide unique insights in the daily scores of Assyrian officials managing a rural settlement on the western outskirts of their empire, levying taxes, and pacifying local tribes. In 2012 the original tablets were stolen from the archaeological museum of Raqqa when Raqqa became the capital of ISIS. The original objects gone, the moulds are the closest we can get to the originals. Assyriologists stress the importance of continued access to the objects to facilitate ongoing interpretation and re-translation. The short life expectancy (30 years) of the moulds necessitates measures for long-term preservation.
We are developing a new method for safeguarding information from the lost artefacts: making high-resolution three-dimensional scans of the plastic moulds and subsequently physical replicas of the original objects by 3D printing. Leiden Assyriologists have confirmed the validity of a pilot reproduction. Nevertheless, several issues have aroused during this trial. First, the moulds are not free of imperfections and irregularities. For example, they contain air bubbles that have to be filtered out from the digital model of the surface of the clay tablet, especially when bubbles are lodged inside wedges. Second, the surface mesh size has to be optimized to preserve all information contained in the tablets without rendering the 3D printing too time consuming. Third, attention has to be paid to the colour, lustre and illumination of the 3D prints to facilitate deciphering. Preliminary results aiming to render the digital models and physical replicas even more real than the first reproduction

are exposed. The use of the replicas by multiple stake holders (field archaeologists, assyriologists, museums, game industry) is envisaged.

Digitalization of architectural heritage: recording, processing, archiving. Marina Đurovka (Institute for Architecture and Media, Graz University of Technology).

The aim of the ongoing FWF research project: "Nagara Architecture of Himachal: Form, Geometry, Construction" is to document, analyse and digitally reconstruct Nagara temples of the Himachal Pradesh. One focus of the project is also, digital preservation and presentation. The Nagara stone temples are a specific form of sacral architecture, characterised by distinctive shikhara tower. Himachal Pradesh is a state of India, located in the foothills of the western Himalayas. The largest district is formed by the two formerly separate sub-districts of Lahaul and Spiti and it is bordering Buddhist Ladakh and Tibet. One of the most significant and probably the oldest monument of the district is Triloknath temple, situated on the left bank of the Chandrabhaga River in Lahaul. An interesting fact is that the temple is equally visited by Buddhist and Hindu pilgrims. At the same time, Triloknath is last Buddhist outpost, and the only Nagara style temple in the district. Next to the main temple, there is a small shrine that shares the same features, which have not been found elsewhere among the other Nagara shrines. Therefore the two structures form a unique set. After one severe landslide - landslides and avalanches have been a regular threat to the site over the centuries - Triloknath was almost completely buried underneath tonnes of rock. After excavation, locals tried to reassemble the temple, but only a few parts were salvageable and therefore today only parts of the temple are original. Fortunately, those sections include the portal and the porch, which constitute the most important part, the side niches on the outside of the main chamber and part of the small shrine. Otherwise, the facade of the sanctum was covered with new marble and a new corridor for circumambulation built around it. Proposed paper will be based on the fieldwork in Himachal Pradesh in September 2016, conducted within the framework of the above mentioned research project. It will present a complete documentation of the Triloknath temple portal and the small ruined shrine. In addition, the paper will include a discussion of the entire workflow, regarding the photogrammetric processing of digital images and videos in order to generate 3D spatial data, additional manual modelling due to possible incompleteness of input information, UV mapping and texturing, and the possibility of archiving, in the aspect of digital preservation and presentation of one such historical architecture.

Documenting Himalayan Landscapes: Material Art and Its Meta-Networks. Gerald Kozicz (Institute for Architecture and Media, Graz University of Technology).

The Nubra Valley, now in modern India, was once a major corridor of trade and communication between Northwestern India, Central Asia and Tibet and its archaeological and architectural heritage includes iron age tombs, early Buddhist shrines (as early as the 11th century), Buddhist temples (17th century) and ruined fortifications. Among the Buddhist shrines are a significant number of so-called lhathos (lha=god and tho=seat; i.e. seat of a god) usually referred to as manifestations of territorial spiritual entities or protective deities. This type of shrine is of archaic form and presumably originates from pre-Buddhist cults. Lhathos can literally be found everywhere: On house shrines, on temples,

but most prominently at topographic landmarks. Lhathos occasionaly form groups of seven. Members of such groups may exist within one village i.e. within a rather confined area, but may also be situated across a larger region and „interact“ over distances of more than 100 km.
A similar group of seven sacral monuments - albeit of a completely different kind - was documented last year in the course of field research. That was a group of stupas (i.e. monuments of the classical Buddhist tradition) all with a specific mandala cycle depicted in their cult chambers. As a group those stupas are unique so far and they are affiliated with the activities of a particular Buddhist doctrinal tradition.
Lhathos in general and these particular stupas not only represent a physical network of artefacts in topographic and socio-cultural context. They also determine a spiritual and meta-physical layer beyond the material art. The scenarios of threat are manifold: the danger of war as the Nubra Valley has been invaded twice by Pakistani forces since the separation of the two nations; growing social tensions as the Nubra Valley is half populated by Muslims and by Buddhists; general neglect of cultural heritage preservation strategies; but most of all by tourism to which significant parts of the Valley were opened in 2010 and which indirectly caused the loss of more than 50% of the cultural heritage of Hunder, the former economic, political and religious center of the Nubra Valley within the last three years only.
The paper will focus on the methods of documentation, the digitalisation of the collected data using the mandalas in architectural context in as case studies. The paper will also address the interdisciplinary approach in the process of documentation, i.e. (landscape) architectural, art historical and ethnological, and in the analytic process, as well as the potential for further interdisciplinary research in order to digitally reconstruct the lost cultural landscape.

Session 2 “Monitoring Heritage Sites and Monuments”

Recording and Monitoring of Cultural Heritage Places in Syria. Azadeh Vadafari (Dept. of Archaeology, Durham University), Graham Philip (Dept. of Archaeology, Durham University), Richard Jennings (School of Natural Sciences and Psychology, Liverpool John Moores University).

In Syria since 2011, thousands of cultural heritage places[1], have suffered significant damage from conflict, looting, and the interruption of official monitoring and development controls. While various organizations are seeking to monitor and record the extent of damage through satellite imagery and media reports, it is also essential to have tools and methods in place for on-the-ground condition assessment and systematic recording of data. These tools will be essential in meeting post-war challenges.
To work effectively the authorities must have access to a dataset which will inform them on the number, location, type, period, nature, and importance (in multiple senses) of heritage places as well as the level of associated damage and risk. This paper presents the approaches used in the development of a Historic Environment Record (HER) for Syria[2]. It describes the methodologies used

[1] The term Place in this paper is used as defined in Burra Charter: “ Place means site means site, area, land, landscape, building or other work, group of buildings or other works, and may include components, contents, spaces and views” (ICOMOS, 1999, Article 1.1).
[2] The HER for Syria is a modified and customized version of the Arches Heritage Inventory Package database developed by the Getty Conservation Institute and World Monument Fund (http://archesproject.org/) and is

for emergency recording, assessing, as well as identifying level and category of heritage place significance. Syria HER is being developed at Durham University and it incorporates information and data from archaeological surveys undertaken in Syria by research projects in recent decades. The focus of this project is to provide a tool not only for the recording and inventory of sites and monuments, but also to record damage and threats, their causes, and assess their magnitude in order to be able to prioritize emergency and preservation responses. The database aims to set procedures for carrying out systematic rapid condition assessment (to record damage) and risk assessment (to record threat and level of risk) of heritage places, on the basis of both on the ground and remote assessment.
Given the large number of heritage properties damaged by conflict, the implementation of rapid assessment methods to quickly identify and record level of damage and condition is essential, as it will provide the evidence to support effective prioritization of efforts and resources, and decisions on the appropriate levels of intervention and methods of treatment. Given the general lack of appropriate emergency response and assessment databases, this system could also be applied in other locations facing similar threats and damage from conflict or natural disasters.

How can we measure the threat of archaeological sites in Upper Egypt? Julia M. Chyla (Antiquity of Southeastern Europe Research Centre, University of Warsaw).

Analysis of contemporary and archival satellite images and archaeological documentations give the possibility to monitor the state of archaeological sites in the Near East (for example Palmyra in Syria). As it has been proven in the case of Upper Egyptian sites, the rapid growth of agricultural lands and settlements can create a great threat for sites localized on the border of the fields and the desert.
As a case study for the problem, the Luxor and Quena districts were chosen, regions significant to the history of ancient Egypt. To trace the expansion of agriculture and the development of the modern settlements a synthesis of archival maps from the last 200 years, archival and contemporary satellite images (Landstat and Google Earth) was created. Satellite images from 1976 and 2013 were classified into 3 classes: Nile, desert and agricultural lands. With the use of map algebra one received an area which in 1976 was not a agricultural field but it is now. This area was marked as a "hazard zone" for archaeological sites.
Additionally, archaeological data was gathered from field prospection with the use of a mobile GNSS device with a Geographic Information System application. The detailed research on the sites was made with the use of a new method "Comprehensive Field Survey", which was tested at Gebelein. This method gave the possibility of fast and accurate data gathering from the field, and combined the analysis of it with information from different sources.
The analysis helps to trace the expansion of the agriculture areas during the last 200 years and the influence of both - ancient Egyptians and the Nile - on the local landscape. Additionally, it is possible to find archaeological sites, now invisible on the surface, which were marked on old maps.

being developed as part of the EAMENA (Endangered Archaeology in the Middle east and North Africa) project (http://eamena.arch.ox.ac.uk/)

Archaeological remote sensing for risk monitoring of Roman military sites in Northwest Iberia. José Manuel Costa-García (Universidade de Santiago de Compostela / Vrije Universiteit Amsterdam), João Fonte (Institute of Heritage Sciences (Incipit), Spanish National Research Council (CSIC) / Department of Archaeology, University of Exeter), David González Álvarez Institute of Heritage Sciences (Incipit), Spanish National Research Council (CSIC) / Durham University); Rebeca Blanco-Rotea (Universidade de Santiago de Compostela / Universidade do Minho).

The number of archaeological sites related with the Roman military presence in Northwest Iberia has exponentially grown since the beginning of the 21th century. This phenomenon can be largely related to the increasing popularity of remote sensing techniques such as aerial photography, satellite imagery and, more recently, the use of airborne LiDAR datasets to obtain high resolution DEMs. However, Roman military settlements are frequently characterised by the perishable nature of their structures and the scarcity of the material culture in these sites. The marching camps (*castra aestiva*) constitute the best example of this situation. Since these sites are almost invisible in the modern landscape, the utilisation of remote sensing techniques and data for their detection and analysis has become vital for their study. In this paper, we will broaden the use of these tools and resources to retrospectively monitor the changes in the landscape which could have affected the preservation of these sites. Even if we can detect some natural processes in this development, the number of anthropogenic agents (ploughing, forestation, building of infrastructures…) has grown in the last decades. The use of different series of aerial and satellite ortophotographs, *ad hoc* photogrammetry and LiDAR coverage can help us to trace those factors and to better assess the degree of preservation of this sites from a diachronic perspective. Moreover, the handling of these datasets as risk estimation tools also contributes to the development of more comprehensive Cultural Heritage management policies, mitigation and prevention measures.

Monitoring heritage at risk through community archaeology. Pau Olmos Benlloch (Institut Català d'Arqueologia Clàssica, Tarragona).

Between 2013 and 2015 we have been working in the ALERT project about coastal erosion and the destruction of archaeological heritage in western France, in collaboration with regional authorities and local stakeholders. In this area, publicity about the effects of recent extreme weather events on cultural heritage has led to a growing interest in public archaeology. Public response to coastal heritage loss has been very positive, and this has resulted in the development of a coastal monitoring network, consisting of professional archaeologists and local volunteers.
Thanks to the collaboration with amateur archaeologists some sites in danger have been identified and depending on its risk of destruction and its scientific potential, some deepened actions have been carried out (non-destructive techniques of prospection and rescue excavations) in order to mitigate its destruction.
On the other hand, public response has not always been positive to our research project. The two key criticisms to us were the difficulty of using our mobile applications in the field and the threat of looting of sites if they communicate their discoveries. This demonstrates the need for further training of using this technology and for increasing awareness campaigns.
From 2016 we have started a similar project of heritage loss in high-mountain areas. Our aim is to point out the existence and importance of the archaeological sites within this natural space and raise

social awareness of this fragile heritage. In this on-going project we have already noticed a huge interest of local communities in the conservation of this heritage and a complete lack of knowledge about this archaeological heritage.
In this presentation we would like to share our experience in participative heritage management. We want to share with the audience what we have learnt working with volunteers, their needs, what they expect from us (professional archaeologists) and how we integrated local communities in the role of decision of heritage management strategies.

Session 3 "Making Heritage Data FAIR"

Swedish National Data Service (SND); the Findability principle of FAIR. Ulf Jakobsson (Swedish National Data Service - SND).

The mission of the Swedish National Data Service is to facilitate access to and preservation of high quality research data. Through training, user support and advanced technical and standardized development of metadata, SND provides the tools for the Swedish research community to store research data so that they can be found by and shared with Swedish and international researchers within the framework of existing legislation.
The SND has considerable expertise in making data accessible in accordance with the OAIS reference model , was recently certified as a Trusted Digital Repository (DSA) and added to the list of recommended repositories at Plos Journals. SND's service has ensured that data are findable, accessible, interoperable and reusable according to the FAIR Guiding Principles.
For a researcher (or any other person) who is looking for a specific kind of data that he/she can use, finding those data can be problematic. The problem is not always due to the lack of existing data, but that data is not always described in such way and on an enough detailed level that the search engines used can find it. Here, correct and rich metadata is essential and the best way to achieve that is to let the researcher/-s behind the data participate in the documentation of the data. After all, the researcher/-s are the ones that best know their data. The documentation has to be of high quality, sufficiently rich and machine-readable. Even though the humans are better on interpreting information, we lack the speed and capability of searching information of the magnitude that exist online and thus we rely on the computational aid that these search engines can provide. If using controlled vocabularies, community adopted and public terminology systems to describe the data, the chance of finding the useful data for secondary use will increase.
At SND, data is provided in datasets; each dataset is composed of one or several data files that are closely connected, metadata that describes the data in such way that the data is findable and understandable, and each data set has its unique persistent identifier (DOI). This package is compliant with the Data Object definition of the FAIR principles. The data in the data set is in most cases machine readable (apart from a few datasets containing images) and can therefore be considered as FAIR data.
During this presentation, the concept "Findability" will be further elaborated, but also what we (SND) as a repository in cooperation with the researcher can do to increase the findability of the data.

Being FAIR when archaeological information is MEAN: Miscellaneous, Exceptional, Arbitrary, Nonconformist. Isto Huvila (Uppsala University).

The importance of increasing findability, accessibility, interoperability and reusability of archaeological information has been acknowledged widely in the literature and the professional archaeological community. At the same time, there seems to be an almost equally widespread conviction that this cannot be done because archaeology is distinct from other disciplines within which the contemporary principles of data management and reuse have been developed. Archaeological information is so miscellaneous, exceptional, arbitrary and nonconformist that it is impossible to make available in similar terms than information in other disciplines.
Based on the findings of empirical research on archaeological information work, the presentation shows that there are indeed major differences in how information is used and knowledge is made in contemporary archaeology and, for instance, many science, technology and medical disciplines but that it does not necessarily mean that archaeology could not be FAIR in its own terms. The presentation argues that focus of contemporary information practices in archaeology is not in discipline-wide naming of entities and following a shared agenda of explicating interactions between these named entities, the FAIRness of archaeological information repositories is more focused and acted out in the interactions between the specific makers and users of archaeological information.

Discovering England's Burial Spaces. A community led documentation project. Gareth Beale, Nicole Beale, Julian Richards (University of York).

The DEBS project enables local communities to be involved in recording, sharing and telling stories about burial space. Burial spaces have been classified by Historic England as being 'at risk' and are under pressure from a range of social and environmental factors including pollution, neglect and vandalism. Our project seeks to provide support to community groups to record burial spaces; enabling groups to interpret and present the history of their community in their own way. So far the project has trained more than 300 people across 21 groups in England to use digital recording technologies including Reflectance Transformation Imaging in their own work. The project has enabled community groups, often excluded from academic research practice, to make use of open source digital imaging technology. Access to these tools has transformed the practice of these groups, enabling them to better analyse and interpret local burial spaces and also to share these digital skills within the community.
The project is now moving into a second phase in which we will support community groups in the management, archiving and publication of their data. This presentation will discuss the lessons learned during the first phase of the project, will discuss our ongoing work and will share our aspirations for the future. We will describe some of the challenges of incorporating data management tools and practices into community led research and will discuss the importance of participatory design in building sustainable data management solutions for heritage.

Session 4 "Heritage as Games – Games as Heritage"

Persistent game worlds as a sustainable tool for the interpretation of endangered and lost tangible Heritage. Nicola Schiavottiello (CIDEHUS - Centro Interdisciplinar de História, Culturas e Sociedades da Universidade de Évora).

In Cultural Heritage 3D visualization and communication there are many projects that rely on their visual and narrative spectacularization. These two factors remain probably the most important when developing 3D rendered or real-time environments for museum visits or other cultural communication purposes. However, some unresolved logistic problems, such as initial costs, maintenance and technology outdating issues, remains. For these reasons visualization projects, when outdated, are often not reusable. The objective of this research is to investigate how the online persistency of virtual worlds can potentially solve these problems and contribute to the digital conservation of lost and endangered site for a longer period. In fact, tangible Cultural Heritage (as well as intangible) is inevitably subjected to the passage of time, and endangered by several destructive factors such as conflicts, natural disasters or simply by progress. Virtual reconstruction of a Cultural Heritage environment is one way to preserve it and rebuild it (if already disappeared) in a digital form. However, rather than creating multiple copies exploited by different projects over time it would be advisable to create one consistent version always accessible by the researcher for content creation and modification, and by the public for its fruition. A persistent state world (PSW) is a feature of open-world multiplayer games. These are certain types of video games that exist and continue to develop their environment even when the game is not been played. In fact, it is possible to maintain on a server an instance state of the game world, this will be shared by all users that will be viewing it in real-time. The scope of this paper is to describe how we can apply the concept of persistency, used in some game environments, to the production of 3D real-time visualization for Cultural Heritage. This will be exploited with a review of examples of how persistent techniques have been used in old and more recent games with focus on historical video-games, in order to show possible solutions on how it can be applied to CH visualisation in general. In this case, we will look specifically at the world and data persistency rather than the game state. Although the gamification factor is often an effective communication method in 3D visualization for Cultural Heritage, at this stage, we will focus only on the importance of the persistency of the explorable virtual environment and of its contents. We will see how these contents, being of textual, imagery and of sound nature, can be generated in a simple manner by the interpreters which are usually non-technical users. These contents, which remain persistent as much as desired, can then be explored by the final "player" at his/her own pace and will. Finally it will be show a practical example of a personal ongoing research that aims to create a new open-world platform. This platform tries to incorporate three important features(as well as many other) necessary to fulfil some important requirements of Digital Heritage visualization projects such as being sustainable, upgradable and easy accessible.

The Archaeological Museum Gregorio Aguilar Barea meets the Unreal Engine: A Virtual Reality experience from Nicaragua. Juan Aguilar (Heidelberg University), Alexander Geurds (University of Oxford/ Leiden University).

It was the passion of 16-year-old Nicaraguan-born Gregorio Aguilar Barea, who in 1949 started looking for precolonial artefacts in the region surrounding the city of Juigalpa in central Nicaragua, which has led to an impressive and remarkable museum collection today: In a collective effort, he gathered large numbers of ancient ceramics and dozens of stone idols measuring up to five metres in height. In 1962, the then-mayor of Juigalpa, Aguilar Barea, founded a museum to shelter all these unknown relics, which allegedly tell the story of Nicaragua when Nahuatl-speaking peoples from Central Mexico found a new home near its large lakes and numerous volcanoes. Unfortunately, hardly any accurate data on the context of the igneous rock sculptures was recorded. This lacunae led to some of the research questions of the Central Nicaragua Archaeological Project ('PACEN'), directed by Dr. Alexander Geurds.
During the 2015 field season, photogrammetric acquisition of all 52 idols on display at the museum was done to create digital three-dimensional copies. Using computer vision, the goal is now to analyse and compare the idols and make new or complementary observations on ancient clothing, jewellery, weapons, and possible post-funerary customs and sculpting technology traces. In addition to that, the approach of PACEN incorporates contributions to Aguilar Barea's vision and collaborates with the museum for purposes of knowledge exchange and exhibit improvement: A digital version of the original museum to be enjoyed and fully explored online. To realise this, all 3D models were imported into the freely available Unreal Editor, a computer game engine tool to design virtual walkable worlds and tell new stories. The possibility to rearrange the heavy anchored-in-the-ground idols and redesign the museum also opened the door for new ways to disseminate the work of Aguilar Barea.
This presentation provides insights into this part of PACEN's recent investigations and efforts to preserve pre-Columbian artefacts as well as into the different processes of virtual museum reconstruction, from data collection to data presentation, to eventually show a new role for archaeology in the world.

Wonders of Civilization: Heritage Preservation and Presentation in Sid Meier's Civilization Series.
Angus A.A. Mol, Csilla E. Ariese-Vandemeulebroucke, Krijn H.J. Boom & Aris Politopoulos (VALUE project, Faculty of Archaeology, Leiden University).

While cultural and archaeological heritages are increasingly threatened by looting, destruction and (urban) development, virtual media techniques are gradually being utilized to create digital copies and blueprints for preservation and presentation purposes. Although there are ample examples of 3D virtual reconstructions or photogrammetric cultural preservation projects, the value of video games in this sense is still under-researched. Video games are one of the present's quintessential virtual media and cultural forms, but also have a surprising and many-sided relation with the past. This certainly holds true for Sid Meier's Civilization (1991-2016), which is a series of turn-based, strategy video games in which you lead a historic culture from "the dawn of civilization to the space age." Civilization, often simply referred to as Civ, allows players to engage with past and present technological advances, social systems, and built heritage in a playful history that is closely analogous but always different to our own. Since its 1991 debut, Civ has sold more than 37 million copies worldwide. With 2 million copies sold in the first two weeks after publication and changing many of the previous games mechanics, the newest iteration Civ VI (2016) is the fastest selling game in the series yet.

In short, Civ is an enduring and massive commercial and critical success. Yet at the same time it also has a complex, and sometimes problematic, relation with its subject matter: world heritage, and history. This paper will discuss Civ not only as a collection of interactive media with a specific perspective on the past and a massive impact on popular knowledge of it, but also as an assemblage of artefacts that reflects 25 years of change in the field of video games, archaeology, and heritage. In particular, this paper will delve into the function and changing representations of 'Wonders,' a group of unique buildings that are closely analogous to World Heritage sites. These wonders have existed in every iteration of the Civ series and form a 25-year record of the gaming industry's perception of heritage. By researching the occurrence of wonders per game, we will show how certain types of wonders have been introduced recently, whereas others have fallen out of grace. The paper will tie these changes in the Civ series to changing perceptions in the field of heritage studies, such as the criticisms addressed to the World Heritage List for being culturally and regionally biased. The paper will also discuss Civ wonders in relation to threats to actual-world heritage.

Poster session

3D reconstruction of the fortified entrance of the Citadel of Aleppo from a few sightseeing photos.
Jean-Baptiste Barreau (CNRS/ INSA de Rennes), Emmanuel Lanoë (INRAP, Rennes), Ronan Gaugne (Université de Rennes).

Built at the beginning of the 16th century by the final Mamluk sultan Al-Achraf Qânsûh Al-Ghûrî, the entrance to the Citadel of Aleppo was particularly affected by an earthquake in 1822, bombings during the Battle of Aleppo in August 2012, and a collapse of ramparts due to an explosion in July 2015. Even if compared to other Syrian sites, there are still enough vestiges to grasp the initial architecture, the civil war situation makes extremely difficult any "classic" process of digitization by photogrammetry or laser scanning. On this basis, we propose a process to produce a 3D model "as relevant as possible" only from a few sightseeing photographs. This process combines fast 3D sketching by photogrammetry, 3D modeling and texture mapping and relies on a corpus based on pictures available on the net. Furthermore, it has the advantage to be applicable to destroyed monuments if sufficient pictures are available.
Five photos taken in 2005 by a tourist archaeologist around the entrance were first used to generate a partial and poor quality point cloud with photogrammetry. The main elements of the inner gate and a part of the arched bridge are distinguishable on the point (Fig. 1). Because the architecture is fairly rectilinear and symmetrical, it has been possible to redraw in 3D most of the outlines by constantly comparing with what is visible on these first photos. The next step is the enrichment of the 3D model from the initial geometric basis and thanks to a corpus of photos available on the internet. This corpus was constituted from selection of pictures obtained with a search on Google Web Search and the keywords "Citadel" and "Aleppo". The selection took into account both the resolution of the images and the coverage of the items of interest and gathered 66 pictures.
The enrichment of the 3D model is performed through an iterative process made up of four main steps: (i) orthophoto extraction from some photos of the corpus (ii) 3D modeling from these orthophotos (iii) seamless texture extraction (iv) texture mapping.
The resulting 3D textured model is presented in Fig. 2. There are still some uncovered lateral areas, unreadable engraved wall writings, and some details are reconstructed naively, but the essential

items, allowing to visually characterize the fortified entrance as a whole, have been reconstituted. The 3D model was first used to produce some renderings intended to obtain first reviews from archaeologists and architecture specialists, photos and complementary documents allowing correcting and filling the gaps. We wish to set a collaborative process to improve the model, based on an exchange with experts of the domain. The resulting model aims at feeding an interactive website dedicated to 3D display of heritage under threats. Other rendering of the model such as virtual reality or 3D printing could also be considered to share this testimony of our heritage. The application of this methodology to other sites deserves further studies that would depend on the possibilities of photogrammetry, the architectural complexities and human means for 3D modeling.

Ancient Mesopotamian Heritage in the Event of Armed Conflict, documentation, assessment and solution. Anas Al Khabour (Department of Historical Studies, University of Gothenburg).

In this paper I would like to shed light on the situation of the cultural heritage sites in Syria and Iraq, in the territory occupied by ISIS in general, and on the patrimony sites well documented in the northeastern part of Syria; in the provinces of, the provinces of Hasake, Deir ez-Zor and Raqqa (the capital de facto of Islamic State). The documentation system I applied during my Postdoctoral research at the University of Santiago de Compostela in Spain 2014-2015, employing the available satellite image system, and the maps offered by Google Earth, and the assessment of the damaged sites confirmed by a reliable resource, the General Directorate of Antiquities and Museums in this case. Similarly I will display the latest international effort in documentation and assessment of the damaged patrimony, UNESCO regulations, the latest projects focused on the documentation and applying the technology to reconstruct a 3-D models or scanning the threatened sites in Syria and Iraq, on the other hand using the successful experiences in recovery of the post-war Cultural Heritage like the Spanish experience after the Civil War 1938.
In brief, I will display some suggestions and ideas to safeguard the patrimony in the Middle East, highlighting that struggling against the radical people isn't the tentative solution; fighting must be against the radical ideas and ideology. Repeating the message that dealing with looted items from the conflict area and purchasing the archaeological artifacts is increasing the loss of the patrimony of the region.

Damage assessment of Syrian heritage with TerraSAR-X radar images. Deodato Tapete (formerly at British Geological Survey), Francesca Cigna (Italian Space Agency).

In the last two years the TSX-New-Modes-2013 grant LAN2377: 'TerraSAR-X Staring Spotlight mode for damage assessment, looting monitoring and prospection of archaeological features in semi-arid environment'(Principal Investigator: Dr D. Tapete; Co-Investigator: Dr F. Cigna) has measured the impact of illegal excavations and war on Syrian cultural heritage, by exploiting time series of satellite Synthetic Aperture Radar (SAR) images of the German Aerospace Center (DLR)'s TerraSAR-X constellation. This paper showcases the capabilities of repeated SAR acquisitions at high to very high spatial resolution to undertake consistent digital recording and quantitative damage assessment in areas of conflict, via a selection of examples including urban and rural Syrian sites. The city of Homs and the sites in the nearby countryside provide an interesting test-bed to: (i) prove the importance of

creating digital archives; (ii) discuss at what extent the lack of digital records prior to the event can constrain the multi-temporal analysis; (iii) demonstrate the potential of SAR to complement aerial photography and satellite optical images; and (iv) compare benefits and limitations of semi-automated processing. The results obtained during this project contribute to the knowledge of the current conservation status of the Syrian heritage that the research and practitioner communities are also trying to gather via national and international parallel projects based on satellite-based damage assessment, such as those undertaken by the American School of Oriental Research, EAMENA project and UNITAR-UNOSAT.

FAIR RE-USE: Furthering data re-use at the Archaeology Data Service. Katie Green & Julian Richards (Archaeology Data Service, University of York).

The long-term preservation of archaeological data underpins the concept that the loss of a heritage asset via excavation can be counterbalanced by the benefit realized through the increased understanding provided by thorough investigation and recording. Without a secure, durable, accessible and well-ordered archive, that increased understanding is threatened. The Archaeology Data Service (ADS) has long been aware that while preserving digital data in the long term is essential, the preservation value can be significantly negated if the archive is not accessible for re-use. However, despite the considerable effort the ADS has invested in creating open online visualization data interrogation tools to facilitate access to its archived datasets, evidence for re-use of data is often something we struggle to capture.
The values embodied by the FAIR principles have always been at the forefront of the ADS's remit to 'provide users with freely available, high quality and dependable digital resources'. This paper will provide an overview of how the ADS strives to provide FAIR datasets with an emphasis on the complexities and issues that surround the re-use of archaeological data. This paper will broach the questions: are we busily archiving data when few people choose to reuse it? Can FAIR can help aid and encourage the reuse of datasets, raise awareness of available data and encourage the interoperability of datasets produced by different projects, methodologies and technologies.