Digital Heritage 2015

3D in knowledge production

Moesgaard Museum and Aarhus University, Denmark

ABSTRACTS

3D and the body as a hyper intelligent navigator
Jette Gejl, Aarhus University

As an artist I am concerned with the possibilities for creating new, bodily immersed experiences and meanings through the means of virtual reality and 3D. In my experiments with 3D virtual reality, I employ the digital medium as an artistic material in order to challenge our bodily experiences of space and the construction of space through time. By using digital programs, screens, projectors, 3D glasses, sound and interactive installations, the artworks invite the visitor to participate – thereby initiating bodily engaged sensual experiences in the individual visitor.

I claim that the body needs to be conceived of as a constantly vibrating, fluid, producing organism, which is radically open to the world. The body receives and creates events, and it enables us to navigate in a hyper intelligent way. The body experiences and perceives parallel to our cognitive faculties. In my work I explore this interrelation between body and mind by staging a confrontation between a bodily embedded experience of materials and the socio-historical and culturally inscribed meaning that applies to all materials, systems and phenomena. It is precisely in this zone of mutual dependency between these two epistemological conditions – the body and the cognitive faculty – that my work operates.

3D Auralisation and Virtual Reality Technology in Digital Heritage
Damian Murphy, Jude Brereton, Andrew Chadwick, Helena Daffern, Gavin Kearney, William Smith & Alex Southern, University of York

Auralisation enables us to audition virtual acoustic environments that once existed, will exist or that are purely fictional, and is based on obtaining the acoustic impulse response of a space, through measurement if the site already exists, or simulation using computational modelling. The result is a 3D acoustic rendering of any sound we wish to hear within the auralised environment.In digital heritage, auralistion is beginning to take its place alongside the more established discipline of visualisation, for interpretation, understanding and research. This paper presents two ongoing projects making use of Oculus Rift virtual reality technology to deliver immersive, interactive, 3D audio-visual heritage experiences. St Margaret's Church, York, UK, was founded in the 11th century and in 2000 was reopened as The National Centre for Early Music, a state of the art venue for music performance. There has been a working theatre on the site of York Theatre Royal since 1744 and it is about to undergo significant refurbishment giving a unique opportunity to expose the archaeology of the site. Both have been acoustically surveyed and software has been developed to enable the Oculus Rift to be integrated with Unity (for 3D visualisation) and MAX/MSP (for 3D headphone auralisation) to provide ease of access to this technology for researchers interested in the multi-modal experience of heritage sites.

Challenging Surfaces: The use of customised terrestrial laser scan rigs to provide more comprehensive surface coverage
Douglas Pritchard, Heriot-Watt University

Contemporary terrestrial laser scanning systems can provide a quick and dimensionally verifiable way of three-dimensionally recording a object, as-built structure or physical environment. The issue with terrestrial scanners though, is that as an optical capture system, the laser scanners can only record information in a line-of-site manner. If an object or surface is obstructed, the view unattainable, too oblique, or beyond the reach of the laser, the area will not be effectively recorded by the laser scanner. To acquire as much dimensional information as possible on a recent project, a custom-designed adjustable extension rig was fabricated and successfully employed at a large heritage site. The extension rig provided considerably more surface detail than if the scanner remained on the

tripod and on the ground. This paper has two aims. For context, it will describe the use of the latest 3D survey and imaging technology recently used at a heritage site as a case-study. The paper will also address the rationale, design and effectiveness behind the use of the custom-designed scanning systems.

Motion Control for Remote Archaeological Presentations
Erik Champion, Curtain University

Displaying research data between archaeologists or to the general public is usually through linear presentations, timed or stepped through by a presenter. Through the use of motion tracking and gestures being tracked by a camera sensor, presenters can provide a more engaging experience to their audience, as they won't have to rely on prepared static media, timing, or a mouse. While low-cost camera tracking allow participants to have their gestures, movements, and group behaviour fed into the virtual environment, either directly (the presenter is streamed) or indirectly (a character represents the presenter). Using an 8 metre wide curved display (Figure 1) that can feature several on-screen panes at once, the audience can view the presenter next to a digital environment, with slides or movies other presentation media triggered by the presenter's hand or arm pointing at specific objects (Figure 2). An alternative is for a character inside the digital environment mirroring the body gestures of the presenter; where the virtual character points will trigger slides or other media that relates to the highlighted 3D objects in the digital scene.

In-Situ 3D Olfactorisation or How to explore archaeological sites by following your nose
Stuart Eve, University College London

3D *visualisation*, by its very definition, privileges vision over the other senses. This occularcentrism is inherent not just in post-Renaissance literature, but also in the way we describe and reconstruct an archaeological site. A digital reconstruction almost always involves building a 3D model of a past building or object and this is almost always confined to the computer screen. Some steps are being taken to rectify this, and technology such as Augmented Reality can take these 3D reconstructions and present them *in-situ* within the landscape via a smartphone or tablet. However, even the technology of AR currently privileges the visual - we 'see' the reconstructions through our smartphone camera, overlaid on the landscape. This paper seeks to challenge this dominance of the visual and instead concentrates on reconstructing and presenting the smells of the past *in-situ*. By using the emerging concept of embodied GIS and a small bit of technical wizardry, this paper will present an experiment that allows a smell-enabled journey to be undertaken through the prehistoric landscape of Moesgaard. This results of this experiment go a long way to highlighting the necessity for archaeologists to consider all of the senses when reconstructing or representing a landscape.

Playful Pasts: Some Considerations Regarding 3D Representations and Knowledge Production of Digital-Heritage Through Video-Games.
Tara Copplestone, University of York & Aarhus University

In recent years the video-game industry has come to leverage heritage elements extensively as integral aspects of their products, whilst simultaneously digital-heritage practices have increasingly begun to engage with video-games for their own ends - however, even with this increasing ubiquity several methodological and theoretical issues have prevented digital heritage video-games from reaching their full potential, with most applications being limited to visualisation or dissemination spheres. Many of these significant issues stem from a lack of qualitative or quantitative data regarding the roles and relationships between the variety of stakeholders involved in the production and consumption of heritage video-games, a lack of effective communication between the various stakeholders, and also a lack of effective documentation or standards to assist in production,

assessment and analysis. This paper, based on the author's MSc and preliminary PhD research, will draw from 156 interviews of stakeholders from the heritage, video-game and consumer sectors to establish a baseline of qualitative data, and through analysis of this data, present preliminary theoretical and methodological suggestions which will assist in developing better representation and knowledge forming practices for digital-heritage through the video-game media.

Digital data management and issues of knowledge production I

The subtle difference between knowledge and 3D knowledge
Isto Huvila, Uppsala University

In spite of the relatively long history of the use of digital 3D technologies in archaeology and heritage contexts, only rather recently, after the introduction of affordable easy-to-use tools and their (relative) mass-adaption by subject (rather than technology) specialists have began to unveil some of the broader outcomes and shape quotidian expectations of how the different methods of producing and using 3D representations might influence the broad patterns of practices in archaeology and cultural heritage fields. In addition to explicit and planned implications, the wider adaption of the technologies has made it possible to begin to understand the byproducts and unplanned consequences of embracing the new means of representing the past and knowledge about it. This presentation discusses the implications of the current state-of-the-art in digital 3D representation to knowledge production in archaeology with a reference to capture, algorithmic and reconstruction based approaches. The talk addresses the questions of how specific technologies influence on what is knowable and known about the past, and what could be the critical success factors of using 3D representations for reaching specific knowledge goals. The discussion is based on an analysis of three case studies on using 3D representations in archaeological fieldwork, research and communication.

3D Documentation and Community Archaeology: Considering Ownership and the Formation of the Digital Object
Gareth Beale, University of York

The increased availability of 3D data capture technology has helped to ensure that the generation and manipulation of 3D data has moved from the specialist into the public domain. The generation of 3D data using ubiquitous capture devices such as mobile phones has occurred alongside the popularization of technologies for sharing and engaging with 3D data such as 3D printing and immersive gaming. As yet, the routine capture and exploitation of 3D data is in its infancy. It is however, important to consider the impact which these technologies and the forms of practice which they afford might have upon the management and ownership of cultural heritage.

Using case studies from Britain and Canada this paper will consider the cultural, social and political impact which ubiquitous 3D data capture has begun to have upon the management of cultural heritage. Reflecting upon lessons learned within a range of community archaeology projects it will consider some of the responses which archaeologists can make in order to ensure that the potential value of these technologies (social, political and economic) is more fully realised by community groups.

3D data and information ecologies in archaeology: The impact of 3D models on archaeological practice
Matteo Pilati, Aarhus University

The presentation sketches a theorization of how 3D data, as collected through a documentation strategy based on image-based 3D reconstruction of archaeological contexts, have relevance for archaeological practice and bring forward the traits of a peculiar information ecology. This contribution builds upon the charting of principles and assumptions inherent to the employment of excavation methods, 3D data capture technologies, and 3D representational visualizations, seeking to make explicit how information, technologies, evidence, and archaeologists are interlaced elements of a new methodology. This endeavor responds to a need to establish a middle ground where theoretical paradigms and the requirements of archaeological practice can meet in a sustainable and beneficial methodological layout.

Digital data management and issues of knowledge production II

The State of Virtual Heritage in Ireland
Frank Lynam, Trinity College Dublin/ Hugh Denard, Trinity College Dublin

The paper would aim to characterise and showcase the state of Virtual Heritage in Ireland, with particular attention to the creation of a new Virtual Heritage Network (VHN), which aims to "connect and support members of the *academic*, *business*, *education*, *cultural heritage*, *policy* and *tourism* sectors who have an active interest in virtual cultural heritage". By the time of the Aarhus event, VHN (which I currently chair) will just have held its first annual conference (in the Long Room Hub, Trinity College Dublin, April 30th and May 1st, 2015), which grows out of a successful pilot event in February 2014. The paper will cross-reference virtual heritage work in Ireland to international consensus on best practice as represented by "The London Charter for the Computer-based Visualisation of Cultural Heritage" (www.londoncharter.org) and will offer examples of the Charter's implementation in Irish virtual heritage projects.

From research archives to web-based visualization: the ADS 3D viewer
Fabrizio Galeazzi, Marco Callieri, Matteo Dellepiane, Michael Charno, Julian D. Richards & Roberto Scopigno, University of York & ISTI-CNR Pisa

The 3DHOP viewer, developed by the Visual Computing Lab of CNR-ISTI, is a web-based dynamic working environment for 3D data on the web. This viewer is being used by the Archaeology Data Service (ADS), a UK-based digital archive hosted at the University of York, to enhance the web-based browsing of 3D data within ADS archives. The ADS implementation of the viewer allows the user to browse 3D geometry directly in the webpage, and contains all the information related to the digital model without the need for plugins. We plan to develop the viewer to allow the visualization and analysis of a very specific kind of “aggregated” data such as archaeological stratigraphy. The ADS 3D viewer will allow exploration and interaction with the different stratigraphic layers and associated information. Increasing the accessibility of 3D metric reproductions of the excavation process and the interpretations made by different scholars, this new tool will promote the use of 3D representations for analysis, interpretation and knowledge production in Digital Heritage research.

Archaeological 3D documentation as a new conceptual layer of objectivism. The role of interpretation and reflection in modern archaeology
Peter Jensen, Aarhus University

Recent advances in archaeological field documentation show a considerable increase in the use of 3D. This calls for a revision of not only the general workflow of excavations, but re-evaluating the inherent dichotomy of interpretation and observation in archaeology. For years archaeologists have been addressing the concept of authenticity as a matter of documentation quality - how open to interpretation are our observations? This paper presents research into the augmentation of the scientific quality of data through evaluating authenticity - both as a concept and as a tool in the archaeological documentation workflow. 3D documentation advocates for a new workflow with a more 3-dimensional reasoning, allowing for the utilisation of 3D as a tool for continuous progress-planning and evaluation of an excavation and its results. Just like the general use of models to form hypotheses, it is possible to use 3D models as spatial hypotheses of an ongoing excavation. This allows us to visually realise or spatially conceptualise our hypothesis as a virtual reconstruction and to combine it with our observational data. In combining 'reality data' with 'model data', evaluating the level of authenticity becomes paramount to the quality of excavation documentation, but also integrates as a level of measure, that allows for evaluating the excavation process. The aim of this paper is to present an approach to integrating this new level of documentation detail into excavations through conceptualising levels of generalisation and authenticity, and in addition demonstrate practical approaches to managing 3D observation data alongside reconstructions and visualisations.

3D in virtual heritage and data acquisition

CultLab3D – digitization for cost-effective and fast scanning, documentation and archiving of heritage artifacts
Pedro Santos & Constanze Fuhrmann, Frauenhofer IGD

Innovative documentation methods for cultural heritage artefacts are becoming increasingly important. This heightened relevance results from both the desire to provide better access to unique objects, e.g. to make museum collections easily available to a wider audience, and the looming threat of losing them due to disasters. 3D digitization has proved to be a promising approach to enable automated and precise reconstructions of heritage objects. With this focus, the Fraunhofer IGD Competence Center for Cultural Heritage Digitization has been founded to develop fast and economic digitization technologies for an accurate virtual reproduction of heritage objects. The used reconstruction techniques digitize objects by using a variety of sensors and light-sources under controlled environmental conditions for comparable results of the highest quality.

CultLab3D (www.cultlab3d.de) is the world's first automatic modular 3D digitization pipeline developed by the Competence Center for Cultural Heritage Digitization. It combines state-of-the-art scanning and lighting technologies to capture the exact geometry, texture, and optical material properties such as reflection and absorption characteristics of heritage objects to allow for a photo-realistic representation. By automating the scanning process, *CultLab3D* greatly reduces the time needed for object digitization. Special scanning arcs on a conveyor belt and scanners mounted to robotic methods. *CultLab3D* was recognized with an award at the 2013 Digital Heritage conference in Marseille, France. At this stage, the CultLab3D pipeline is undergoing evaluation.

Ruthwell Kirk and Cross 3D.0: Building the Platform for a Digital Humanities-based 3D Social Network
James Graham, University of Lethbridge

The Ruthwell Kirk and Cross 3D.0 Project is a highly-realistic 3D virtual heritage site currently being developed by our DH-based research team. Using the Unreal Engine 4 game engine in combination with laser scan data, collected in situ by the researchers at the Ruthwell Kirk site in Dumfriesshire, Scotland, our team has recently completed the first major stage of this project and will be demonstrating its advanced capabilities for delivering rich media interactivity spatially. We will also discuss the design considerations currently being implemented in current and future builds of the project, using current and anticipated HTML5/WebGl capabilities. Finally, we will discuss our research into the potential for how this 3D virtual heritage environment can be made to function as a framework upon which to build a new type of social network – a 3D.0 network – of communities and individuals. This project is part of a larger integrated critical edition heteromedial objects that are part of the Anglo-Saxon Visionary Cross tradition. Our international research team, The Visionary Cross, is building this critical edition around five texts and objects, which include: the Ruthwell and Bewcastle Standing Crosses, the Brussels Reliquary Cross, and the Vercelli Book Dream of the Rood and Elene poems.

The well in the Holy Cross Church in Dalby - an investigation of its position and function through 3D technology
Martina Polig, Lund University

One of the many unanswered questions regarding the Holy Cross Church in Dalby (Skåne, Sweden), the oldest standing stone church in Scandinavia, is related to the well situated in the crypt of the church. Its appearance and position suggest that it belonged to the original western part of the church, which was replaced by the crypt in the 12th century. The outline of this part is still being discussions. This paper analyses the relationship between the well and the original church by comparing a 3D model of the church obtained in a complete laser scanning acquisition campaign by Lund University in 2013 and three 3D reconstructions resulting from a cross match between existing interpretations and excavation maps. The plausibility of each reconstruction was investigated by looking at whether they give rise to any structural issues during modelling, whether they match the 3D scan, and whether they reflect the function of the well. Using 3D technology, it was possible to assess the likelihood of the interpretations with a level of precision and completeness that would not have been possible with 2D.

New insights from the historical events in Nydam by 3D visualisation
Karin Göbel, Landesmuseen Schloss Gottorf

The excavations in Nydam/ Denmark conducted by the National State Museum during the years from 1989 to 1999 are a good example of how helpful the utilization of a Geographic Information System (GIS) could be. The excavation area was only about 500m², but the documentation includes 134 different excavation plans with more than 10.000 objects, a database with 13.387 items and countless photos and drawings. In a GIS all this information is gathered in one single system. The fact, that one is able to show how the different features are arranged in combination with the profiles within a 3D animation, is a considerable support for analysing the historical events in Nydam during the Iron Age. But one has to proceed carefully, because height values in a bog are a difficult thing to deal with. Depending on the water content or the soil pressure the height can change within hours. Moreover, the form and weight of the items, how they got into the lake or bog and the consistency of the mud has influenced their position in the bog. Older items are not always necessarily found beneath the younger ones. Nevertheless the position in which the finds were discovered contains a lot of useful information and facilitates the discovery of coherences/ relationships between the different elements.

3D Laser scanning of Hammershus prior to the restoration work
Trine Skovbo, Kulturstyrelsen

In 2012 the Danish Nature Agency received a donation of 28 million dk. by AP Møller and Chastine Mc-Kinney Møller Foundation for General Purposes, earmarked for an extensive restoration of Hammershus castle ruins. The project is limited to a 3 year period, which means that we have to pursue new and untried methods and techniques in regard to the archaeological documentation of the castle, prior to the restoration work. Our goal is to exclusively work with digital building archeology, developing new techniques and methods as well as using cloud based communication between the project participants.

The castle ruins are laser scanned and subsequently processed digitally. The collected data is prepared as the fundamental base for architects to assess and analyze the ruin before restauration work is accepted and can be carried out. We work in "Cloud-based" Autodesk solutions where everyone involved in the process, the project manager, architects, entrepreneurs and the workmen can access relevant information and data digitally, directly from the construction site from their I-pad or smartphone. Therefore, there is only one version of a dataset. In our presentation, we aim to show examples of data collection, workflow and data processing, as well as our end result in the documentation process. There are always challenges and drawbacks associated with 3D laser scanning and digitally documentation, which we will also try to demonstrate in our presentation.

Aesthetically acceptable statically preservation of ruin parts, using composites
Kim Elif Pedersen, Naturstyrelsen

In 2012 the Danish Nature Agency received a donation of 28 million dk. by AP Møller and Chastine Mc-Kinney Møller Foundation for General Purposes, earmarked for an extensive restoration of Hammershus castle ruins. Our goal is to exclusively work with digital building archeology, developing new techniques and methods as well as using cloud based communication between the project participants. We aim to develop a concept for long lasting static support of smaller individual building elements, and exploring the possibility of employing composite materials defined by 3D laser scanning. This technique has not yet been used in the very narrow academic environment which constitutes the physical maintenance of ancient monuments (ruins) in Denmark.

The Danish Nature Agency and Danish Technical University has initiated a collaboration which aims to develop and demonstrate (prof. of concept) the usability of composite materials, in the restauration of Hammershus. The project defines alternative materials and methods which replaces traditional massive and sometime bulky and visually dominant metal or wooden structures.

The project will consist of a number of elements:
- 3D laser scanning and documentation of the selected building elements will be carried out, including photogrammetry.
- Construction of a digital model (mesh) of the building component.
- Defining a load case for the structure and extracting mechanical design criteria for a support bracket.
- Choice of suitable material for support bracket.
- 3D print of the building element (negative mould).
- Casting of support brackets in composite material. Selection of method for installing the support bracket.

The success criteria, is a support bracket designed with minimal interference to the ruin, providing a solution that is aesthetically acceptable and which appears visually insignificant and will not dominate the affected structure.

Reconstructing the ancient site of Tebtunis: dislocated knowledge production
Andrea Gasparini & Federico Aurora, University of Oslo

In this presentation we describe the first phase of an ongoing international project, Virtual Tebtunis, were archeological items, papyri, maps, photos, pictures, journals articles and excavation data are all part of the reconstruction of the ancient Egyptian city Tebtunis. The innovative aspect of this project is the use of Design Thinking to envision how technology and humanities can cooperate to rethink the way knowledge is produced. As an approach, Design Thinking may help innovation, using a combination of empathy for the users, applying rapid prototyping, and finally using abductive reasoning to foster educated guesses. From a technological perspective, our project may use innovative artifacts like 3D-printer, google glass, low-energy Bluetooth (Beacons), Kinect interfaces (Leap Motion), and more, to enrich the experience researchers have in situ or in other locations. Giving researchers the possibility to access a holistic view of deeply contextualized data and combine available textual, tactile and visual information, the construction of knowledge is closer to the researcher perspectives than the usual one, where the it-experts dictate the possibilities and constrains. Our presentation will argue for the establishment of a designerly perspective on knowledge creation, where technology and humanities are more integrated.

Reasoning in 3D - Formal knowledge representation for the 3D virtual reconstruction of the Santa Cristina (Sardegan, Italy) sanctuary site
Sorin Hermon, Lola Vico & Franco Niccolucci, The Cyprus Institute

The paper will discuss the possible impact of social / cultural / religious constraints on the architecture and interior space organisation at the Santa Cristina (Sardegna, Italy) well sanctuary, as reflected in a 3D virtual reconstruction of the site. In particular, the paper will present the decision-making process and scientific analyses performed that led to a proposed 3D shape of the site and how such reasoning can be formally expressed within a digital repository. Key elements taken into consideration are data transparency, the possibility to virtually de-construct the final 3D model and the visual and quantitative representation of 3D shape uncertainty.

Advances in Shipwreck Survey Data Acquisition and 3D Visualisation
Martin Dean, ADUS DeepOcean (cancelled)

Digital models of shipwrecks are proving to be increasingly useful to specialists as data acquisition and visualisation techniques develop and resolution is improved. Equally important, the general public, non-specialist professionals and organisations responsible for financing such projects can be presented with information that is easier for them to comprehend compared to numerous sheets of archaeological site plans and section drawings that have been a mainstay of wreck site recording in the past. The new technology can be used to enthuse people and so it makes sense to exploit these recent advances as a method of making shipwrecks on the seabed visible to the public.

3-D data can be collected in many different ways underwater including by divers with tape measures, static and dynamic sonar and laser systems, and photogrammetry. ADUS DeepOcean, active in both the academic and commercial worlds, has access to the full range of techniques and chooses the most appropriate for each project. All systems and methodologies have advantages and disadvantages but we mostly rely on high-resolution multibeam sonar -supported by underwater lasers and photogrammetry when the water is sufficiently clear.

3D in knowledge production: Reconstruction of a badly damaged medieval castle with no historical graphical representation (Poster)
Kaspar Lund, InnoPro Aps

The ruin of the medieval castle of Kaloe called "Kalø Slotsruin" is located 32 km from Aarhus, Denmark and 40 km from the conference area. The focus of this poster is to report how the team of researchers and developers in the absence of any historical paintings or drawings created a trustworthy 3D-representation of a very damaged site like the castle of Kaloe. We will discuss how an incremental and iterative process can integrate the available sources of 3D-documentation including written and archaeological documentation, traces of the castle onsite and research knowledge of medieval castles. 3D-dissemination of the reconstruction on mobile devices and other platforms is not the focus of the poster but will be available at the conference area.

3D Laser Scanning as a Tool for Viking Age Studies
Michael Neiß, Department of Archaeology and Ancient History, Uppsala University,

Three dimensional (3D) laser scanners are becoming increasingly more affordable and user friendly, making 3D modelling tools more widely available to researchers in various countries and disciplines. In archaeology, 3D modelling has the particular advantages of facilitating the documentation and analysis of objects that are fragile, rare, and often difficult to access. To test the usefulness of 3D-modeling when analyzing artefacts with a very complex morphology, we chose to digitize highly ornate brooches from Scandinavia and Russia with NextEngine laser scanners. The resulting 3D models were used in different case studies. Through this, we gained new insights about Viking Age dress ornaments and their cultural significance. At the same time, our pilot study revealed both strengths and limitations of the portable laser scanner technology employed. 3D-modeling was very well suited for artefact reconstruction, but less so for tool mark analysis, due to the resolution limits of our particular laser scanner brand. It was also a very useful technique for stylistic and motif analysis (cf. fig. 2b). Overall, 3D-model-based analysis appears to be useful for answering traditional questions in Viking Age artefact studies, and may also inspire methodological innovations. As 3D technology keeps improving, novel findings are likely to result from 3D model-based analysis. However, our study shows that 3D-modeling cannot completely replace traditional artefact autopsies. Instead, the two approaches appear to be best used in combination.

3D documentation of an archaeological object, what kind of information we could obtain?
Marta Bura, Warsaw University

The development of technology and its wider availability, result in an increased quality of the possibilities of documentation. The 3D Scan Lab of the Archaeological Institute at the University of Warsaw specialises in holistic 3D documentation of finds/objects for archaeological needs. Archaeological investigations are inherently linked with the acquisition of finds, which in turn have to be documented. The following example of find documentation is part of my doctoral thesis, which includes the scanning of a specific type of a roman vessel, exported beyond the frontiers of the Empire, the so-called obliquely fluted cauldrons Eggers 44-49. These finds are kept in many European museums, and are therefore hard to access for scientists interested in investigating this topic holistically. Documenting all available cauldrons preserved to the present day, allowed us to carry out a number of analyses in order to reconstruct the production process of these vessels and investigate their shape, size and capacity. Printing in 3D will create a unique collection of those items in one place.

Seeking knowledge in an immersive virtual environment

Alexandra Angletaki, University of Trondheim

Mubil is a 3D lab established in 2012 as a learning space by the NTNU University library of Trondheim. The library is looking for new dissemination paths and solutions to reach a wider public. Mubil presents a new approach in transposing old books and manuscripts using 3D technology and gaming design. Mubil is an interdisciplinary collaboration initiated by the NTNU University library of Trondheim and PERCRO at Scuola Santa Anna in Pisa. The books are presented 3D objects enriched with additional 3D content, pictures, drawings, videos, audios and the original text in both Norwegian and English, in oculs rift technology where users can interact in a gaming environment with an experiment of Alchemy from 1590. This experimental setting isis connected directly to an Alchemist`s lab with content from the book of medicine by Adam Lonicer written in 1590. The project is still under development and here we present some preliminary observations done during a visit of 40 school children from a local school in our 3D lab. The overall aim of the project is to explore innovative technology applications in disseminating knowledge from the past to a wider younger audience.