

**EAA 2020**

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## **ANNUAL MEETING ATTENDANCE CONFIRMATION**

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This is to confirm that the below person participated at the 26th Virtual Annual Meeting of the European Association of Archaeologists (EAA), 24-30 August 2020.

Full name:

**ISKANDER GAINULLIN**

Contribution title:

**3D MODELING AS A TOOL FOR ANALYZING AND UNDERSTANDING CHANGES IN THE TERRITORY OF ARCHAEOLOGICAL SITES**

Contribution format:

**POSTER PRESENTATION**

**E**uropean  
**A**ssociation of  
**A**rchaeologists

Date: 16 September 2020

Signature: Sylvie Květinová (EAA Administrator)

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# **26th EAA Virtual Annual Meeting**

## **Abstract Book**

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# 26th EAA Virtual Annual Meeting

## Abstract Book

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Index of Authors includes all session organisers and only the main authors of contributions.

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### 26th EAA Virtual Annual Meeting - Abstract Book

**Technical editing:** Kateřina Kleinová (EAA)

**Design and layout:** Kateřina Kleinová (EAA)

**ISBN:** 978-80-907270-7-6

European Association of Archaeologists

Prague, August 2020

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able success, to match prints in an effort to understand ancient labor systems. Archaeologists worldwide have begun to ask questions, including the sex of the people whose prints they were, that require less specific print material. Problematically, most have focused on print size; however, shrinkage rates vary even for a single clay type, especially in cases where objects have been fired inadvertently (e.g. in a building fire rather than a kiln). Additionally, it is impossible to differentiate the prints of older juvenile males from those of adult females, since their sizes overlap substantially.

Fortunately, structured-light scanning allows us to build high-resolution 3D models of prints, akin to digital elevation maps, allowing us to examine a much wider range of sex-linked features. These include the ratio of ridge thickness to valley thickness (RTVTR), “secondary crease” frequencies (casually called “wrinkles”), and “incipient” lines. Robust statistical models based on these factors allow us to establish the probable sex of ancient producers based on their prints.

The current project establishes this methodology, using 3D scans of the prints of modern Greek adult potters of both sexes as a reference sample. Prints are taken from objects on which they were left inadvertently, because this format mimics what we see on ancient objects. Modern Greek ceramicists are both genetically and occupationally as close as we can get to their ancient predecessors. The technique will make it possible to rigorously evaluate longstanding archaeological questions, including the sexes (and as a result the genders) of producers of ceramic figurines, ceramic tablets, and ceramic sculpture.

## 10 SCHEMATA – 3D CLASSIFICATION AND CATEGORIZATION OF ANCIENT TERRACOTTA FIGURINES

**Abstract author(s):** Böttger, Lucie - Zeckey, Alexander (Institute for Digital Humanities, Georg-August-University Göttingen)

**Abstract format:** Oral

Three-dimensional objects with complex shapes are inadequately classified both in applied computer science and disciplines dealing with material artefacts. Archaeologists are confronted with the problem that resemblance in shape can be recognized and established, but is much harder to support with reasons and to describe adequately in language. Furthermore, archaeologists have yet to make sufficient use of automated 3D shape recognition to differentiate the mutual, formal dependency of similar figures.

Based on 200 terracottas from the 4th and 3rd century BC ancient Greece, a classification system will be elaborated with digital methods. We choose this object group because it is defined by its complexity in shape and the similarity between the objects.

The goal of the case-study is to develop procedures for automatically generating corpora using 3D pattern recognition, as well as to reflect on the associated schematizations and how they can be applied in computer science and visual sciences.

For this purpose, methods of object mining in 3D data are to be developed. In close cooperation between computer science and archaeology, this experimental process leads to a fundamental examination of the concept of pattern recognition as a humanities category.

The case study started in 12/2019. In the presentation we will present preliminary results.

## 11 LOST AND FOUND - VIRTUAL REDISCOVERY, DIGITIZATION AND INTERPRETATION OF AN ENIGMATIC FRAGMENT FROM THE TEMPLE OF ZEUS AT OLYMPIA

**Abstract author(s):** Patay-Horváth, András (ELKH Archaeological Institute) - Loucas, Nicolas (Cyprus Institute, STARC)

**Abstract format:** Oral

The author was trying to locate a small marble fragment, which was most probably belonging to the sculptural decoration of the temple of Zeus at Olympia, and was described and published with some drawings already during the 19th century. The research only led to the disappointing conclusion that the fragment has apparently disappeared during the past century and what is even more frustrating, there is absolutely no photographic documentation available either. Finally it turned out that a mould survives from which plaster casts were made during the 19th century and preserves the negative form of the fragment. This old mould was used to produce a fresh plaster cast, which was digitized immediately. In this way a virtual replica of the lost fragment is now available for research and the old controversy surrounding its interpretation can be rehearsed. Previous suggestions are discussed and a new reconstruction is proposed, accompanied by a 3D visualization.

## a. THE INFLUENCE OF MODERN TECHNOLOGIES ON OUR PERCEPTION OF HUMAN REMAINS. NEW TECHNOLOGIES/ NEW POSSIBILITIES/ NEW ETHICAL ISSUES

**Abstract author(s):** Tomczak, Sonia (Nicolaus Copernicus University in Toruń)

**Abstract format:** Poster

Should human remains be displayed? Is it ethical to present our ancestors' remains to the public? Does 3D visualisation replacing the remains solve the problem of current situation regarding ethical issues concerning presenting of a dead body? The debate about displaying human remains is not as dynamic in Poland as in other western countries in Europe, where there are arising new legal documents or guidelines on this matter. In Poland, one do not have at one's disposal clear-cut norms regarding presenting of human remains. In the light of this ensuing situation, is the use of modern new technologies, including 3D models of skeletons and graves, a solution for the discussion about this subject or it is quite the opposite, it is only an alternative which leaves the same ethical questions?

This is a complex issue which includes a lot of elements, among other status of a human after death. Can one say that a human is still

a human or does he/she become an artefact, which is made available for tourists at a museum? Museologists can look for a support in ICOM Code of Ethics for Museums, although it does not say much about human remains, describing them, together with material of sacred significance, as “culturally sensitive material”.

Besides the ethical issues one can not ignore the possibilities we gain by the use of modern technology such as 3D models that makes it easier to popularise knowledge and development of research by creating an easier access to the research materials. A lot of visualisations are generally available on the Internet platform e.g. SketchFab. Still, do we have the right to display the remains of our ancestors to the public? Are the new possibilities, which are given to us due to the technological development, against the ethics of displaying human remains?

## b. REVITALISATION OF VIKING AGE BOATHOUSES, WITH THE USE OF 3D TECHNOLOGY

**Abstract author(s):** Nytnun, Arve (Dept. of Culture heritage, Møre og Romsdal county)

**Abstract format:** Poster

In 2018, the Dept. of Culture heritage, in the county of Møre og Romsdal in Norway, initiated a project on digital dissemination. The main goal for this project is to revitalise three medieval localities that all is of great importance on the western coast, but also has national significance, as important centres in relation to early Christianity, urbanism and trade, and strategic military places.

Through scientific methods our goal is to collect as much knowledge about the sites as possible, but also general knowledge about the early medieval Nordic early towns (køpstadir), so that the visualising of the 3D models, in the best way possible resemble the data's; from both archaeological excavations and historical sources. The use of GIS-systems and analysis is an important method in the creation of a topographical map of the sites.

In the pre-project of the 3D-visualization, the case of revitalisation was two boathouses most likely related to the early regional levy organization, maybe related to the early christening under Haakon the Good (Norwegian Viking king from mid 1000th century).

LIDAR data along with visual effects used to visualize vegetation and geological features set the scene for the location. Then the knowledge, collected through specialised seminars about early towns in Northern Scandinavia, communication with museums with knowledge of traditional house-building were communicated with computer-engineers, specialised in game technology.

The result of the pre-project is a model of how two late Viking/age- medieval boathouses could have looked like, based on the best knowledge available.

Discussing: Through the work of visualising two prehistoric boathouses, several new problems appear. How do we handle the “black holes” that we suddenly have to address in the process of visualising the historical landscapes? Are the black holes maybe the most important investigations after all?

## c. 3D RECONSTRUCTION AS AN INTERPRETATION

**Abstract author(s):** Styk, Matej (Department of Archaeology Faculty of Arts Constantine the Philosopher University Nitra)

**Abstract format:** Poster

The poster presents a case study from the research of the Medieval castle of Peťuša (Zvolen). The main goal is to apply documentation and analytical procedures based on the application of 3D technologies. During the archaeological research of Peťuša castle, several methods were used to document the castle hill, archaeological contexts and artefacts. The aim of the paper is to point out the possibilities of 3D visualization, which serves not only for an interesting presentation of archaeological results to the general public but also for the work of archaeologists themselves. The primary goal is to use 3D technology in the analysis and subsequent interpretation of the phenomena examined in a form that is not common for archaeological procedures. These techniques are applied in interpreting the layout of the castle, castle grounds and the surrounding environment. The main contribution is the clarification of spatial relations, visualization of the examined structures and the opening of polemics within the interpretation levels.

## d. 3D MODELING AS A TOOL FOR ANALYZING AND UNDERSTANDING CHANGES IN THE TERRITORY OF ARCHAEOLOGICAL SITES

**Abstract author(s):** Gainullin, Iskander (Research Centre “Country of Cities”, Kazan) - Usmanov, Bulat (Institute of Environmental Sciences, Kazan Federal University)

**Abstract format:** Poster

This work is continuation of the research aimed at developing of a system for analysing of risks of destruction of archaeological objects of Volga-Bulgaria period (X–XIII centuries AD) on the territory of the Republic of Tatarstan (Russian Foundation for Basic Research project №18-09-40114). For a better understanding of the fortification system, river dynamics and negative exogenous and anthropogenic processes, a 3-D model was developed using UAV photos as a result of fieldwork in 2017-2019. Modern field survey with use of UAV and GNSS methods applied to study the relief of monument territory. Aerial photographs of the area were produced with a multi-rotor UAV. The GNSS survey of ground control points (GCP) was performed in Real Time Kinematics (RTK) regime in World Geodetic System 84 (WGS84) with real-time corrections by satellite reference stations for UAV data processing accuracy improvement. The model was created using AgiSoft Photoscan software. DEM analysis, mapping and calculations were conducted in Golden Software Surfer 13 software. A digital terrain model (DTM) with a step of 0.5 m showing the altitude characteristics of the settlement territory generated by the point cloud. Profiles, inclination and aspect maps described the morphometric characteristics of

settlement relief. The 3D visualization of fortified settlements helps to detect the changes caused by natural and human impacts, identify trends in monuments state and to quantify the risks of their destruction.

#### e. **MATTANZA TUNA FISHING VESSELS OF PORTOPALO, SICILY: PHOTOGRAMMETRY AND 3D MODELING**

**Abstract author(s):** Zak, Claire (Texas A&M University)

**Abstract format:** Poster

Tuna fishing has been a staple in the Sicilian economy from ancient times into the 20th century. Southern Sicily especially benefitted from the prosperity of the industry and built infrastructure known as tonnare for tuna processing and special mattanza vessels to exploit the fish during the warm summer months. Sicilians possessed a unique fishing method because of these boats, which contain distinctive construction features that specifically aid in the capture of tuna. Since the tuna fishing economy of Sicily has largely diminished, many of the now derelict boats have fallen into disrepair. It is necessary to record and study these cultural heritage objects to preserve their information for the members of the southern Sicilian community and for the research of future scholars. In June of 2019, three of these mattanza boats were digitally recorded using a newly developed combined method of photogrammetry and laser scanning, known as photogrammetric texture mapping (PTM), thus producing 3-D models. These digital recording methods are beneficial in a number of ways, including a user friendly platform for manipulation, great accuracy of details for measurements and analysis, and ease of data sharing and dissemination. One of the achieved goals of this project was to use the 3-D PTM models to produce sections and hull lines to study volumetrics, as well as an orthophotograph to create construction drawings. This research project serves not only as an evaluation of the PTM methodology for cultural heritage documentation, but also the preliminary data for the conservation of these vessels. Together, the lens of the tuna fishing mattanza vessels will supplement the greater goal of delving into the social and economic history of southern Sicily.

### 219 **ARCHAEOLOGY IN 3D – NEW TECHNOLOGIES FOR OLD QUESTIONS. PART 2**

**Theme:** 5. Theories and methods in archaeology: interactions between disciplines

**Organisers:** Jerem, Elizabeth (Archaeolingua Foundation) - Patay-Horváth, András (Archaeological Institute of the Hungarian Academy of Sciences) - Hermon, Sorin (Cyprus Institute, STARC)

**Format:** Regular session

The increasing availability of 3D datasets produced by photogrammetry, laser scanning, and procedural modelling in the last decades have offered new opportunities for the recording, documentation and scientific visualization of archaeological sites, environments and artefacts. Still debatable are their overall contribution to grand challenges in archaeology or the clarification of old puzzles which engaged generations of archaeologists so far. Analyses that would explicitly aim to do this remain few and far between, despite often producing promising but at the same time inconclusive results. Since the impact of the new technologies will largely depend on the long run on the successful combination of old problems and new methodologies, the proposed session would like to invite scholars with an interdisciplinary interest in archaeology, architecture, material culture, cultural heritage, computer graphics, morphometrics, machine learning etc. to present works that demonstrate how 3D datasets actually contribute to elucidate classical problems of archaeological research. We welcome presentations focusing on quantitative analysis of SFM and 3D models of archaeological artefacts and spaces, formal visibility, acoustic and lighting analysis of archaeological environments, analyses of immersive VR experiences (e.g. via the use of eye tracking devices etc.), 3D GIS analysis, volumetric, structural and statistical analysis of 3D data and scientific visualisation of sites, environments or artefacts, participants being encouraged to critically evaluate any methodological and theoretical issues related to these approaches.

### ABSTRACTS

#### 1 **UNCOVERING INVISIBLE: VISUAL ENHANCEMENT OF TOOLMARKS PRESERVED ON THE ROMAN TILES**

**Abstract author(s):** Janek, Tomáš (Institute of Classical Archaeology, Charles University, Prague)

**Abstract format:** Oral

3D technologies usually serve as a documentation method which allows to copy artefacts or whole archaeological situations and even sites in digital form. However, the preservation of archaeological data is not and should not be the only purpose. 3D technologies also present a tool for analysing the data, discovering and retrieving new information, information which could be previously invisible to the archaeologist.

This contribution focuses on the technological development of Roman military tile manufacture in ancient Vindobona. The aim of the research was to distinguish various production techniques and statistically evaluate them. Photogrammetry along with Reflectance Transformation Imaging (RTI) were chosen as the main research methods. The solid mesh of the 3D model enables examination of finds without disruptive elements such as colour or calcareous sinter. The simulation of various angle of lighting helps to enhance and to identify the cuts and other traces, left by the work tools or moulds. However, the quality of results is determined by the quality of detail of the 3D model. High quality 3D model requires substantial computing power and is also more time consuming. For the examination of a plane surface, RTI turned out to be more suitable. It provides more detailed visual enhancement and needs less computing power. Disadvantage of the method lays in the specific conditions required during the documentation.

With help of the both methods it was possible to successfully identify the various production techniques and connect them with unit which produced the material. It was also possible to document the development of certain techniques and their transfer between the different production centres.

#### 2 **SEE WHAT'S INSIDE: 3D IMAGING OF MEDIEVAL RUSSIAN PECTORAL CROSSES**

**Abstract author(s):** Zaytseva, Irina (Institute of Archaeology Russian Academy of Sciences) - Kovalenko, Ekaterina - Podurets, Konstantin - Murashev, Mikhail (National Research Center)

**Abstract format:** Oral

Pectoral crosses should be regarded as a meaningful phenomena of Medieval Rus' culture. A question that has been troubling the minds of scientists for the 150 years: what relics were worn by medieval people in these crosses? As a rule, archaeologists find separate leafs from these items. Finds of entire closed encolpions are quite rare and of great scientific interest. In recent years, as a result of legitimate archaeological research, about 20 closed pectoral crosses have been obtained. They originate from Novgorod, Moscow, Suzdal and rural settlements of the Suzdal district. The use of non-destructive methods of neutron and synchrotron imaging based on the interaction of penetrating radiation with matter allowed us to obtain information about the internal structure of encolpions, the presence of relics in them with their physical characteristics and their location inside the cavities.

The work used the equipment of the Kurchatov Institute located on two radiation sources: the IR-8 thermal neutrons reactor and the Kurchatov synchrotron radiation source. Neutron and synchrotron (x-ray) imaging are complementary methods due to the different nature of the interaction of radiation with matter. 11 encolpions have been studied. 3D models of their internal structure based on three-dimensional images of objects were created for 5 items. The paper presents methods and results of this work.

The surfaces of the leaves of some encolpions are decorated with niello. A 3D model for the niello decor of 1 pectoral cross was created. It allows to see its location and fit to the surface of the leaf in all details.

The built 3D models are able to work with archaeological and museum artifacts at the modern high-tech level: scientific analysis, creation of virtual and real copies, demonstration for the promotion of cultural heritage objects.

Research was supported by the Russian Foundation for Basic Research 17-29-04129.

#### 3 **DIGITIZING THE HERITAGE OF PALMYRA: OLD CHALLENGES AND NEW SOLUTIONS FOR DOCUMENTATION AND PRESENTATION OF WAR-ENDANGERED ARCHAEOLOGICAL SITES**

**Abstract author(s):** Blochin, Jegor - Solovieva, Natalia (Institute for the History of Material Culture, Russian Academy of Sciences) - Solovyev, Sergey (Institute for the History of Material Culture, Russian Academy of Sciences; State Hermitage Museum)

**Abstract format:** Oral

After the first liberation of Syrian Palmyra in March 2016 the 3D mapping of damaged sites has become one of the most important tasks for specialists in digital archaeology working in the region. The Institute for the History of Material Culture (Russian Academy of Sciences, Saint Petersburg) organized several survey expeditions in making an attempt to contribute to international efforts of digitizing Syrian heritage on a macro-level with a large-scale aerial survey of the entire territory of the ancient city of Palmyra.

During this survey we covered an area of ca. 14 sq.km and received more than 100000 aerial images (planar and oblique) with 2,5 to 7 cm/px resolution. The received photos were processed with Agisoft Photoscan and a detailed 3D model of ancient Palmyra was created. Based on this model we produced detailed geopositioned orthophotographs for the territory of the ancient city and nearby necropolis, as well as a detailed DEM. Currently we develop an online archaeological 3D GIS based on the imagery received – a multipurpose tool for damage assessment and cultural heritage management, for planning and conducting new research on the site and opening new insights in the understanding of the city infrastructure, topography and landscape development. The main purpose of these efforts is to give open access to all the collected data to the research community and to promote the knowledge about Syrian heritage in the world.

#### 4 **BUILDING EMPIRES– NEW RESEARCH ON CBM AND STAMPED TILES ON ROMAN FRONTIERS– INTRODUCING THE CLIR RESEARCH CENTER AND LIMES DATABASE**

**Abstract author(s):** Farkas, Gergo (CLIR Research Center – University of Pécs)

**Abstract format:** Oral

Presenting the preliminary results of the project aimed at documenting, evaluating and presenting the vast CBM material of the Danube Limes area in Hungary. A collaboration involves national and local museums and the recently established CLIR Research Center with the aims to extend research over the frontiers.

The project goal is to systematically complement and update former collections with both quantitative aspects (fabric, position of manufacturing features) and qualitative ones (paleography of stamps and surface markings, epigraphic digitalization). Recorded specimen are published in a publicly accessible online database. Documentation is complemented with methodological novities as 3D modelling and Highlight-Reflectance Transformation Imaging (H-HRTI) to interpret specimen which previous study has not been able to identify.

The results of the project are twofold: on one hand database answers questions of production modes, distribution, supply patterns.