

OPHERA WORKSHOP 2021

17-21
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2021



OPHERA

ICOMOS
international council on monuments and sites

**Digital technologies for knowledge and promotion
of cultural heritage during the restoration & reconstruction
process**

CYPRUS WORKSHOP

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Segretariato Regionale
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per le Marche

Università
degli Studi
di Ferrara

University of Ljubljana
Faculty of Civil and
Geotechnical Engineering

Université de Minho

United Nations
Educational, Scientific and
Cultural Organization

UNESCO Chair on
Digital Cultural Heritage at
the Cyprus University of Technology

Cyprus
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STUDY ON QUALITY IN 3D
DIGITISATION OF TANGIBLE
CULTURAL HERITAGE

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“People over the world are creating memories in forms that are less and less permanent - be it sound recordings, film, videotape, newsprint, photographs, computer-based documents, or buildings/constructions. It must be said that the output of the present century alone is probably greater than the total output of all previous centuries put together; and ironically and tragically, it is being lost faster than ever before. It is a tragedy indeed, for what is at stake is the recorded memory of mankind...”

*Dato’ Habibah Zon, Director-General of the National Archives of Malaysia, introduction from UNESCO
MEMORY OF THE WORLD PROGRAMME: The Asia-Pacific Strategy, 17 April 1999*

WORKSHOP

1st OPHERA WORKSHOP: Digital technologies for knowledge and promotion of cultural heritage during the restoration & reconstruction process

This event will focus on:

1st OPHERA Workshop is organized and carried out by Cyprus University of Technology – Digital Heritage Research LAB (DHRLab), the UNESCO Chair on Digital Culture Heritage and ERA Chair Mnemosyne.



Objectives:



- Provide participants with a general overview and a clear state-of the art of the available digital methods, technologies and tools applied to cultural heritage knowledge and communication, particularly to the objects under restoration process in the post-earthquake scenario
- Training on the method of communication and visualization of complex technical data in order to reach and increase the awareness of a wider audience




OPHERA project aims to reveal, as a cultural expression, the cultural heritage restoration process currently ongoing in the territories affected by Central-Italy 2016 earthquake, in Marche Region. The project assumption is the awareness about the need to allow citizens participation and ensure transparency all along the restoration process.



The cultural values embedded in the restoration activities are characterized by a wide range of skills and sometimes by creative acts, normally visible only to operators. Through OPHERA project the partnership aims to foster the cultural exchange between restoration professionals and a wider audience, sharing at European level the reconstruction experiences developed in Central – Italy regions.

The project envisages the selection of a multidisciplinary team of operators through a public call for applications. In the first phase the team will be trained by means of three workshops to be held in Cyprus, Portugal and Italy, dedicated to the strategic domains of heritage risk prevention - monitoring methods and to the digital technologies applied to cultural heritage; during the second phase the multidisciplinary team will be involved in the organization of two “open-days” of some key restoration sites located in the most impacted Marche region towns.

 1st OPHERA WORKSHOP: Digital technologies for knowledge and promotion of cultural heritage during the restoration & reconstruction process 		
Eastern European Time EET (CY Time)	Monday 17/05/2021	
10:00-10:35	Greetings Mr. Marinos Ioannides UNESCO Chair on Digital Cultural Heritage , Cyprus Mr. Chrysanthos Pissarides – ICOMOS Cyprus Mr. Panayiotis Zaphiris , Rector - Cyprus University of Technology , Mr. Stelios Himonas Permanent Secretary at Deputy Ministry Research, Innovation and Digital Agenda, Cyprus Mrs. Alessandra Luchetti - EACEA Head of Department 'Creativity, Citizenship and Joint Operations' - European Commission H.E. Andrea Cavallari - Ambasciatore d'Italia a Nicosia Mr. Paolo Verdone - Italian Ministry of Culture - International Affairs Manager Mrs. Anna Conticello - Project Manager – Desk Italia Europa Creativa - Cultura	
10:35-12:00	Prof. Roko Žarnić, University of Ljubljana, Slovenia Prof. Vlatka Rajcic, University of Zagreb, Croatia	<i>Lessons learned from the recent earthquakes in Croatia and resilience of Cultural Heritage assets.</i>
12:00-12:15	Coffee Break	
12:15-13:15	Panel Round Table Discussion Mrs. Riin Alatalu – Vice President, ICOMOS International Mrs. Zeynep Gül Ünal – Vice President, ICOMOS International Mr. Maurizio Di Stefano – ICOMOS Italy Mrs. Ifko Sonja – ICOMOS Slovenia Mr. Chrysanthos Pissarides – ICOMOS Cyprus	
13:15-14:15	Lunch	
14:15-15:15	Giovanni Issini Ministry of Culture, Italy – Marche regional branch, Italy	<i>OPHERA project mission. Social and urban challenges embedded in the process of post-earthquake cultural heritage reconstruction for the Marche region cultural rebirth</i>
15:15-15:30	Coffee Break	
15:30-16:30	Prof. Petros Patias, Aristotle University of Thessaloniki, Greece	<i>Understanding Complexity and Quality in 3D digitization of Tangible Cultural Heritage</i>
16:30-17:00	Discussion	
17:00	End of Day 1	

 <p><u>1st OPHERA WORKSHOP: Digital technologies for knowledge and promotion of cultural heritage during the restoration & reconstruction process</u></p> 		
Eastern European Time (CY Time)	Tuesday 18/05/2021	
10:00-12:00	Marinos Ioannides, George Tryfonos Cyprus University of Technology/UNESCO Chair on Digital Cultural Heritage	<i>Digitisation, Preservation and Protection of Cultural Heritage in Cyprus</i> <i>An approach for preventing conservation</i> <i>Interreg VA Greece – Cyprus, DigiArc</i>
12:00-12:15	Coffee Break	
12:15-12:45	Nicholas Kyriakides Cyprus University of Technology	<i>Numerical simulations of the response of the Asinou church to seismic excitations using finite element modelling</i>
12:45-13:15	Kyriakos Efstathiou ERA Chair on Digital Cultural Heritage - Mnemosyne, Cyprus	<i>Holistic approach to record the memory of cultural heritage</i> <i>The case study of the Paphos castle</i>
13:15-14:15	Lunch	
14:15-14:45	Alex, Ya-Ning Yen, Nick, Wun-Bin Yang China University of Technology, Taiwan	<i>Digital techniques on Conservation of CH in Taiwan</i>
14:45-15:15	Siao Syun KE National Science and Technology Center for Disaster Reduction (NCDR), Taiwan	<i>Development and application of the Integrated Platform on Information of Disaster for Cultural Heritage</i>
15:15-15:30	Coffee Break	
15:30-17:00	Discussion & Exercises	
17:00 – 17:30	Scott McAvoy Digital Media Lab – UC San Diego Library, USA	<i>Big 3D - Archiving and Streaming Lidar and Photogrammetry</i>
17:30	End of Day 2	

 <p><u>1st OPHERA WORKSHOP: Digital technologies for knowledge and promotion of cultural heritage during the restoration & reconstruction process</u></p>  		
Eastern European Time (CY Time)	Wednesday 19/05/2021	
10:00-10:35	Jürgen Frick Materials Testing Institute – University of Stuttgart, Germany	<i>Rehabilitation of the Blue tower in Bad Wimpfen, Germany by the use of digital technologies and structural health monitoring</i>
10:35-12:00	Kyriacos Themistocleous Eratosthenes Centre of Excellence, Cyprus Incl. discussion	<i>Using Copernicus for Monitoring Cultural Heritage</i>
12:00-12:15	Coffee Break	
12:15-13:15	Michael Klein 7reasons – Medien GmbH, Austria	<i>The power of digital technologies, XR experience</i>
13:15-14:15	Lunch	
14:15-15:15	Discussion with the audience	
15:15-15:30	Coffee Break	
15:30-16:30	Discussion & Exercises	
17:00-17:30	David Myers Getty Conservation Institute, USA	<i>The Arches Open Source Software Platform: Heritage Management Use Cases</i>
17:30	End of Day 3	

 <u>1st OPHERA WORKSHOP: Digital technologies for knowledge and promotion of cultural heritage during the restoration & reconstruction process</u> 		
Eastern European Time (CY Time)	Thursday 20/05/2021	
10:00-10:35	Antonia Moropoulou National Technical University of Athens, Greece	<i>Digital Solutions and Innovations in Multi Layer Big Data in the Rehabilitation of the Holy Aedicule of the Holy Sepulchre in Jerusalem</i>
10:35-12:00	Rand Eppich Heritage Development, Spain Incl. discussion	<i>Digital Technologies for Informed Conservation of Cultural Heritage: diverse pragmatic examples</i>
12:00-12:15	Coffee Break	
12:15-13:15	Lyn Wilson Historic Environment Scotland, UK	<i>Digital Documentation to Support Disaster Management Response: Glasgow School of Art Mackintosh Building Case Study</i>
13:15-14:15	Lunch	
14:15-15:15	Raffaella Brumana Politecnico di Milano, Italy	<i>Quality and complexity of 3D informative content models (HBIM) for preservation, re-use of Object Libraries, and communication within CDE</i>
15:15-15:30	Coffee Break	
15:30-16:30	João Martins CTS/UNINOVA, Portugal	<i>Intelligent management of Heritage Buildings: a COST Action</i>
16:30-17:00	Discussion	
17:00	End of Day 4	



1st OPHERA WORKSHOP: Digital technologies for knowledge and promotion of cultural heritage during the restoration & reconstruction process



Eastern European Time (CY Time)	Friday 21/05/2021	
10:00-10:35	Tony Cassar Heritage Malta	<i>Digitising the National Collection</i>
10:35-12:00	Themos Demetriou Bi-Communal Technical Committee on Cultural Heritage in Cyprus Incl. discussion	<i>Cultural Heritage in conflict: Monument's conservation in Cyprus</i>
12:00-12:15	Coffee Break	
12:15-13:15	Discussion & Exercises	
13:15-14:15	Lunch	
14:15-15:15	Gunnar Liestøl, Anna Insa Vermehren Connected Culture and Natural Heritage in a Northern Environment (CINE), Norway	<i>CINE see the past – imagine the future: lessons learned</i>
15:15-15:30	Coffee Break	
15:30-16:30	Presentations of Fellow's results	
16:30-17:00	Discussion	
17:00	End of Day 5	

SPEAKERS



Roko Žarnić is professor of building materials at the University of Ljubljana, who has dedicated most of his research career to the problems of assessment and retrofitting of earthquake-damaged buildings including experimentally based development of retrofit techniques. In 1999, he was a guest lecturer for six months at the University of Colorado at Boulder, CO, as part of the Fulbright program. In 2006, a six-month national separate expert at the EU JRC laboratory in Ispra, Italy, oversaw preparing the foundations of the new European standard for glass structures EUROCODE 11. From 2010 to 2012, he was the Minister of the Environment and Spatial Planning of the Republic of Slovenia.

Vlatka Rajčić is Professor of structural engineering at University of Zagreb, Faculty for Civil Engineering (GFUNIZG), since 1992. Her research background is in structural engineering with a particular interest for built heritage preservation, lightweight structures, innovative hybrid structural elements, various computational models for design of structures and use of AI techniques in structural design. She is a licensed structural designer, licensed auditor of structural projects as well as scientific advisor and director of company Bene Construere Ltd., Zagreb, Croatia. She has done numerous designs of retrofitting and sanation projects for immovable tangible heritage. She has done also numerous auditing of the sanation projects in last 20 years. She participated in the development of semantic platforms as a background of the 3D digitization of immovable and movable, tangible cultural heritage; digital data based assessment and Heritage BIM development taking part as beneficiary in projects dealing with digital cultural heritage: H2020 INCEPTION, FP 7 Marie Curie ITN-DCH; as well as in FP7 project Climate for Culture and Smart Monitoring of Historic Structures contributing the projects in the topics of assessment of the structural elements using Non-destructive techniques, drones and by numerical modelling of heritage structures on the influence of climatic loads. She participates in development of the next generation of Eurocode 5 - related to strengthening and retrofitting, of immovable timber cultural heritage; organizes scientific and professional events (e.g. Days of licensed engineers from 2012 till now every year in Croatia). Currently she is a Head of Structural department at the University of Zagreb. She is a Professor, teaching at undergraduate, graduate and postgraduate level courses in Constructive Aspects of Cultural Monuments Protection and Special Chapters in Assessment of Cultural Heritage objects at the postgraduate study, courses in Timber Structures I and II at the university undergraduate study and Structural glass, Aluminum and Membrane, structures as well as the courses Artificial Intelligence in Structural Design and Wood Composites at the postgraduate scientific study. She is the leader of a domestic scientific project, VETROLIGNUM, - a multipurpose CLT-glass hybrid panel, participant and responsible person for the implementation of the 4 FP7 project, 2 Horizont2020 project, 1 FP7 Marie-Curie project and many ERASMUS projects. In European Construction Technology Platform (ECTP) she coordinated group Education and Ethics in Focus Area Cultural Heritage (2006-2010) and was individual expert working as evaluator for many FP7 and Horizon 2020 calls (2010-2020). She took part in twelve COST Actions and 6 FP projects since FP6 till H2020. She also coordinated bilateral projects.

PRESENTATION TITLE: LESSONS LEARNED FROM THE RECENT EARTHQUAKES IN CROATIA AND RESILIENCE OF CULTURAL HERITAGE ASSETS

ABSTRACT:

The lecture is divided in two parts. The first discusses the consequences of earthquakes that hit Zagreb and Petrinja areas in Croatia in March and December 2020 especially emphasizing the cultural heritage assets and role of tools in assessment and analysis of structural response. In presentation several cases of heritage monuments and traditional houses are analysed and recommendations on the retrofitting measures as well as on preventive conservation are given.

The second part is about the resilience of cultural heritage assets presenting the idea of resilience model applicable to them. The basis of model is identification of specific significances of heritage assets that need to be identified before occurrence of a disastrous event and after used in rehabilitation or reconstruction processes. The explained approach is illustrated with analysis of pre-earthquake reconstruction and assessment of post-earthquake conditions of important sacral monument located near by the epicentre of Petrinja 29.12.2020 earthquake.



Giovanni Issini,

Ministry of Culture – Marche regional branch, Italy

Architect-building engineer at Ministry of Culture, Marche regional branch, since 2018. PhD on advanced methods for communication of cultural heritage values (2008). He is coordinator of several conservation works of cultural heritage sites located in Marche region, damaged by 2016 earthquake, such as Palazzo Priori (Visso). In 2010 he was appointed by UNESCO as consultant for advanced teaching services on historical architecture knowledge and valorisation. He was Visiting Professor at Beijing University of Civil Engineering and Architecture, China and he is currently 3D modeling professor at Università Politecnica delle Marche. His field of activity covers the advanced methods and tools for cultural heritage knowledge and communication, sustainable strategies for cultural heritage site development and the analysis of traditional architecture construction technologies.

PRESENTATION TITLE: OPHERA project mission. Social and urban challenges embedded in the process of post-earthquake cultural heritage reconstruction for the Marche region cultural rebirth

ABSTRACT:

It is common knowledge that the central-southern inland of Marche region is the area that was most affected by the earthquake events, which occurred from August 2016. The Italian Ministry of Culture was on the front line in the emergency response actions addressed to the cultural heritage safeguard, both through a widespread assessment of the damages and through the coordination of several securing works. As a consequence of the extensive knowledge gathered through their activity, it was clear how cultural heritage conservation and reconstruction processes would have been wide and deep in the following decades. OPHERA project is based on the assumption that involving local people and opening to a wider European cultural community can make the conservation process a unique chance for local cultural rebirth.



Petros Patias,

Aristotle University of Thessaloniki, Greece

Petros Patias is a Professor, Director of Laboratory of Photogrammetry & Remote Sensing and ex-chairman at the School of Rural and Surveying Engineering (2003-2007), The Aristotle University of Thessaloniki (AUTH), board member of the Department of Urban Planning, AUTH (2004-2012) and Vice Rector at the University of Western Macedonia (2010-2015), Greece.

Eng. (1981) The Aristotle University, MSc (1985) and PhD (1987) both from the Dept. of Geodetic Science and Surveying, The Ohio State University, USA.

Chairman of various ISPRS (International Society of Photogrammetry and Remote Sensing) WGs from 1992 onwards, ISPRS Commission V President (2000-2004), CIPA (international Committee for Architectural Photogrammetry) President (2003-2007) and Honorary President (2013-for life), ISPRS Fellow (2016-for life), President of the Hellenic Society of Photogrammetry and Remote Sensing (1992-1996). Visiting Professor at various European universities (TU Delft, ETH Zurich, Universidad del País Vasco).

Editor-in-chief of the “South-Eastern European Journal of Earth Observation and Geomatics” e-Journal (<http://ejournals.lib.auth.gr/seejeog>), Scientific reviewer to 51 Journals.

Reviewer/evaluation to numerous promotions/elections to all Greek universities. In addition, internationally, he served as evaluator to promotions at National Research Council, Canada (2004), State University of New York, USA (2011), University of Haifa, Israel (2012), Politecnico di Torino, Italy (2015, 2016).

Evaluator to research proposals (besides Greece) to NSERC Discovery Grant Applications, Canada (2013), Research Promotion Foundation Grants, Cyprus (2013), External Evaluation of Higher Education Institutions, Cyprus (2013), Israeli Ministry of Science, Technology and Space Grants, Israel (2014, 2016), Italian Research and University Evaluation Agency (ANVUR) Grants, Italy (2004-2016), Italian Ministry of Education, University and Research (MIUR) Grants, Italy (2015-2016), Ministry of Education, science and Technological Development Grants, Serbia (2016).

Supervised 101 undergraduate Diploma Theses, 73 MSc Theses and 38 PhD Dissertations.

Published work includes 6 books, 11 chapters in international books and 259 papers in journals and proceedings.

Scientific Responsible, Principal Researcher or member of Research Group to a total of 91 Research Projects funded by European or National Organizations.

PRESENTATION TITLE: Understanding Complexity and Quality in 3D digitization of Tangible Cultural Heritage

ABSTRACT:

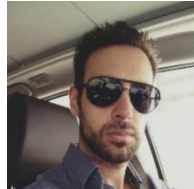
Object Complexity is of course very important since it has a high impact on various aspects of 3D digitization: it suggests different technologies to be used, it reflects on the required or achievable quality, it may put limits on the intended purpose of use and impacts on the time and budget of survey. Therefore, it is not surprising that the term “Complexity” is quite often used in CH documentation literature and practice.

What is not expected though, is the fact that it always remained a vague term with no clear definition, no subjective methodology of calculating, and no clear connection to Quality, Purpose-of-use, or other imposed restrictions. In other words, the tooling of “Object Complexity” as a decision-support tool has always remained a gap.

The major function and usefulness of a definition is to clear up concepts and to lead to a fruitful decision-making workflow. However, currently, we discuss the object complexity as a value of its own, which cannot be estimated subjectively, it can be defined only AFTER we make all the measurements on the object (making it useless for 3D

digitization planning and decision-making) and it is neutral to intended use (making it useless for choosing the best technology, or setting up the technical specifications for the 3D digitization).

We propose to shift our attention from the “Object complexity” to “Model complexity”. This means that our focus is not the complexity of the real object per se (which is connected to the data capture phase), but the complexity of the produced model (which is connected to the data processing phase). This may look like a conceptual compromise, but the alternatives are worse. Either we ignore this fact, or we make subjective guesses.



Marinos Ioannides,

George Tryfonos

Cyprus University of Technology/UNESCO Chair on Digital Cultural Heritage

Dr. Ioannides is, since 2013, the director of the Digital Heritage lab of the Cyprus University of Technology in Limassol. The lab is the fastest growing research Centre on the island and has been awarded several EU projects within its seven years' existence (total budget for CUT: 8.5 MEuro). After receiving his MSc in CS at the University of Stuttgart, Germany where his thesis was undertaken at the HP European Headquarters in safety and security of Multitasking Repository-systems, he gained his PhD (Dr.-Eng) at the same university. where he participated in more than 68 EU and national research projects. His pioneering work on the 3D Volumetric Reconstruction of objects from digitised scattered data during his PhD gained him the important IBM Award in 1993. In 1994, he received for his achievements from the European Commission, the EU KIT award and in 2010 he was awarded from the Spanish and European Association of Virtual Archaeology the prestigious Tartessos prize for his successes in 3D-documentation in Cultural Heritage. In 2017 his Lab became the UNESCO Chair on Digital Cultural Heritage, which is the only Chair in the World in this area of Education, Science and Technology, together with, in 2018, the EU Innovation Award at the Innovators in Cultural Heritage Fair in Brussels. The EU ERA Chair on Digital Heritage was gained in 2018 under the H2020 Widening Programme, with 2.5 MEuro financial support in order to establish with his team in Cyprus as a regional centre of Excellence. In 2019 the European Commission/Research Executive Agency declared his project MSCA ITN-DCH as one of the best five projects under the category: “Life Changing innovation project” in the last decade (2009-2019). He was the chairman of the joint international conferences CIPA /VAST2006 (www.cipavast2006.org) and VSMM2008 (www.vsmm2008.org) in Cyprus and the permanent chair of the biannual EuroMed conference dedicated in Digital Heritage. He was the Coordinator of the Marie Curie (MSCA) Fellowship Project FP7-PEOPLE ITN2013 ITN-DCH project on Digital Heritage (www.itn-dch.eu) with a budget of 3,7 MEuro and the coordinator of the H2020 ViMM (Virtual Multimodal Museum – www.vi-mm.eu) with a budget of 1,3 MEuro. Marinos was also the Chair of Europeana's 1st Task Force Group on Advances in 3D documentation of CH assets.

George Tryfonos, PhD is a Research Associate at the UNESCO Chair on Digital Cultural Heritage of Cyprus University of Technology (CUT). He holds a B.Sc. in Architecture (2011) and a Diploma of Architect – Engineer (2012), both degrees obtained by the University of Cyprus (UCY). He received his PhD in January 2019 from the Department of Architecture, UCY.

His research activities at CUT focus on managing the digitization of cultural heritage in Building Information Modelling (BIM) using data from 3D laser scanning and photogrammetry. George has over than 6 years of teaching experience and research, including teaching architecture design media methodologies such as BIM, parametric design and digital

fabrication. In addition, he is a member of Cyprus Scientific Technical Chamber and a professional training instructor of Human Resource Development Authority of Cyprus (HRDA) at the area of BIM.

His research area focuses on material simulation in BIM, CAD, CAM and industrial robotics fabrication programming tools. Using advanced design tools for BIM, parametric design, automation systems, real time robot control, CNC programming, 3D printing and optimization has conducted collaborations, tutorials and research on digitization and advance fabrication.

PRESENTATION TITLE: Digitisation, Preservation and Protection of Cultural Heritage in Cyprus. An approach for preventing conservation - Interreg VA Greece – Cyprus, DigiArc

ABSTRACT:

The presentation shows a holistic documentation methodology for the digitization and modelling of eight medieval monuments. The holistic approach includes data acquisition technologies such as terrestrial 3D laser scanning, UAV photogrammetry and thermal image processing. The data have been used for the creation of 3D modelling using Heritage Building Information Modelling (H-BIM) and advanced 3D modelling in order to capture the current stage of the monuments and to implement architecture, engineering and construction (AEC) parameters. Subsequently, the results of highly detailed geometric documentation of the monuments offer new possibilities for completed 2D and 3D repositories, allowing future studies and long-term monitoring and preservation strategies from the multidisciplinary community of experts.



Nicholas Kyriakides,
Cyprus University of Technology

Nicholas Kyriakides is an Assistant Professor at the Civil Engineering and Geomatics Department of the Cyprus University of Technology and a member of the Executive Committee of the Eratosthenes Centre of Excellence. His main areas of research interest include the damage propagation and risk assessment of existing buildings and monuments subjected to seismic loading

before and after retrofitting, and the simulation of experimental and health monitoring results using numerical FE analysis. He has also examined the correlation of damage condition mapped in underground sepulchral monuments with historical seismic activity in the area of Cyprus using non-linear FE analysis on a simulation 3D model of a case study tomb, which provided valuable and new evidence regarding the seismic activity and risk in Cyprus.

PRESENTATION TITLE: Numerical simulations of the response of the Asinou church to seismic excitations using finite element modelling.

ABSTRACT:

In order to numerically examine the structural response of the Asinou church (UNESCO WH monument) in Cyprus, a Finite Element (FE) model was developed in Abaqus/CAE. For the simulation of the masonry, the stone-mortar composite was treated as a homogenous continuum whose mechanical properties average the effects of the two interacting materials. The response of the homogenized masonry medium was modelled using an isotropic elasticity constitutive model. The mechanical characteristics assigned to the medium were derived from calculation models and experimental data reported in the literature. All load-bearing masonry components (i.e. walls, arches, vaults) were modelled using shell elements based. According to the outcomes of the analysis, damage of the structure's masonry sections is primarily due tensile cracking, rather than shearing. At the level of seismic loading examined, structural response is characterized by

the development of localized damage, rather than the propagation of extensive damage which can result to instability at the global level.



Kyriakos Efstathiou,

ERA Chair Mnemosyne – Cyprus University of Technology

Kyriakos Efstathiou, a Cypriot citizen, is the holder of the ERA Chair on Digital Cultural Heritage, Cyprus University of Technology. Kyriakos holds a PhD Degree from the Department of Mechanical Engineering at the Aristotle University, Thessaloniki (Greece) and was for 37 years a researcher and Professor there, serving as Director of the Laboratory for Machine Tools and Manufacturing Engineering, and Director of the Design and Construction Department. He was the Leader of the Aristotle University research team, which investigated the Antikythera Mechanism, the first analogue computer in the human history. He has published more than 100 papers in international Scientific Journals and Conference proceedings and has a long experience on the investigation of archaeological objects and reproduction of accurate replicas, rapid prototyping, reverse engineering, X-ray and neutron tomography, Machine tools, manufacturing technology, CNC technology, CAD/ CAM systems, CIM systems. He investigated and manufactured exact replicas of archaeological findings such as the vaginal speculum of Dion, digitized the West Freeze of the Parthenon etc., and has organized related exhibitions.

PRESENTATION TITLE: Holistic approach to record the memory of cultural heritage: The case study of Paphos castle (UNESCO WH Site in Cyprus)

ABSTRACT:

The EU ERA Chair Mnemosyne project is focusing on the holistic documentation of the Digital Cultural Heritage lifecycle, including both the tangible and the intangible aspects of Cultural Heritage assets.

The 3D documentation is the beginning of the holistic presentation in which the story and memory are hidden in the intangible aspect, in books, documents, photos etc. Collecting, recording and processing of this information is a step forward to create the holistic record of a building transferring so that can be presented as a monument. This approach will be presented in a special case study of MNEMOSYNE which is the UNESCO WH listed monument, the Paphos castle.



CHINA UNIVERSITY
of TECHNOLOGY

Alex, Ya-Ning Yen, Nick, Wun-Bin Yang

China University of Technology, Taiwan

Alex, Ya-Ning Yen is an Associate Professor at the Department of Architecture of China University of Technology as well as the Director of Cultural Properties Research Center. He is a member of the advisory committee of the Ministry of Culture in Taiwan and a member of the Executive Committee of ICOMOS CIPA.

Nick, Wun-Bin Yang is a Lecturer at the China University of Technology and an Associate Fellow at the Cultural Properties Research Center. He is also a member of ICOMOS/CIPA.

PRESENTATION TITLE: Digital techniques on Conservation of Cultural Heritage in Taiwan

ABSTRACT:

This presentation is focused on the introduction and development of Taiwan Heritage, Conceptual Framework and Strategy, as well as on the current trends on digital technologies and future developments.



Siao Syun KE

**National Science and Technology Center for
Disaster Reduction (NCDR), Taiwan**

Dr. Siao Syun KE is a researcher at the National Science and Technology Center for Disaster Reduction (NCDR), an Associate researcher at the Earthquake and Man-made Disaster Division and an expert member in Disaster Management Society of Taiwan.

PRESENTATION TITLE: Development and application of the Integrated Platform on Information of Disaster for Cultural Heritage

ABSTRACT:

Since 2017, NCDR and Bureau of Cultural Heritage (BOCH) worked jointly with interdisciplinary collaboration, to establish the Integrated Platform on Information of Disaster for Cultural Heritage. On the Platform, there are three key features of natural disaster management: potential map for disaster prevention, monitoring the environment during the disaster-response stage, and the last, 3D visualization of cultural heritage for disaster recovery stage. This year, the hazard monitoring list has been set up in order to quicken the disaster alert message.



Scott McAvoy

**Department of Anthropology –
Center for Cyber – Archaeology &
Sustainability, University of California, USA**

Scott McAvoy manages the Digital Media Lab at UC San Diego Library and acts as a 3D data researcher with the Scripps Center for Marine Archaeology. He is the 2021 Data Scientist in residence at Cyark, researching digital documentation and visualization.

PRESENTATION TITLE: Big 3D - Archiving and Streaming Lidar and Photogrammetry

ABSTRACT:

We spend untold hours to acquire and clean incredibly detailed models, which end up having very limited utility. In sharing our work we often rely on 2 dimensional derivative products, losing much in the process. How do we enable collaborators across the world to utilize hundred gigabyte lidar files? How can we link this data to important documentation and literature? Web-based Multi-resolution 3D model viewers like Potree and Cesium.js offer a new model for 3D visualization which promise simple integration with our university archives.



Jürgen Frick,

**Materials Testing Institute University of Stuttgart,
Germany**

Dr. Jürgen Frick is an expert for non-destructive test methods in civil engineering at the Institute of Material Testing (MPA). He was member of the coordinating team of the SMooHS project (Smart Monitoring of Historic Structures), coordinator of the CETIEB project (Cost-Effective Tools for Better Indoor Environment in Retrofitted Energy Efficient Buildings) and WP-Leader in the HomeSkin project. Actual he is WP-Leader in the SensMat project (Preventive solutions for Sensitive Materials of Cultural Heritage) and is partner in a new DFRG project for NMR-measurements in cultural heritage. His professional position is vice-head of department “Building Preservation”, and head of unit “Climate, Comfort, Pollution”. He manages the participation of USTUTT in the European Construction Technology Platform and coordinates the Focus Area Cultural Heritage within the German Construction Technology Platform (GCTP-FACH). He is active in the Advanced Material and Nanotechnology Cluster AMANAC for EeB projects and member of the WTA Technical commission “Damage Monitoring”.

PRESENTATION TITLE: Rehabilitation of the Blue tower in Bad Wimpfen, Germany by the use of digital technologies and structural health monitoring

ABSTRACT:

The Blue tower in Bad Wimpfen showed severe structural damage after the last building phase in the 19th century. Several rehabilitations in the late 20th century couldn't stop the structural disintegration. Starting in 2012, the causes of the

damage were systematically investigated by an interdisciplinary team. Archive research, a fundamental examination of the existing masonry structure, various material investigations and many static model calculations of the masonry and its stresses were combined with a complex test program to form the currently implemented repair concept. An instrumented structural health monitoring, which has been installed since the beginning of the investigations, is used to record external influences and changes in the geometry of the tower during the repair measures and thereafter.



Kyriacos Themistocleous,

Eratosthenes Centre of Excellence, Cyprus

Dr. Kyriacos Themistocleous is an Architect with 30 years of experience in architecture, urban design & planning, Earth observation, remote sensing, GIS and cultural heritage. He is the External Affairs & Business Development Director of the Eratosthenes Centre of Excellence. Dr. Themistocleous has collaborated in over 35 national and European research projects and has over 280 publications in prestigious international scientific journals, book chapters and conference proceedings. He is the national representative for the Copernicus User Forum, the Copernicus Cultural Heritage Task Force, the Copernicus Relay Network and the Copernicus Academy, as well as a member of the Leadership committee of the EU Framework Partnership Agreement on Copernicus User Uptake. Dr. Themistocleous is President of the Cyprus Remote Sensing Society, Executive Council member of the Technical Chamber of Cyprus (ETEK) and treasurer of the Cyprus branch of the International Council on Monuments and Sites (ICOMOS).

PRESENTATION TITLE: Using Copernicus for Monitoring Cultural Heritage

ABSTRACT:

Copernicus, which is the European Union's Earth observation programme, can be used to provide valuable information to monitor cultural heritage. Based on satellite and in situ observations, the Copernicus program deliver near-real-time data on a global level. Earth observation techniques can be used to provide the necessary information for the monitoring, preservation, conservation and restoration for cultural heritage sites. Examples of how Copernicus can be used to monitor cultural heritage sites will be presented.



Michael Klein,

7reasons Medien GmbH, Austria

Michael Klein has been active as CEO of 7 Reasons in the fields of virtual archaeology and digital cultural heritage for over two decades with a special interest to disseminate scientific knowledge to a broader audience.

PRESENTATION TITLE: The power of digital technologies, XR experience in Cultural Heritage

ABSTRACT:

The media agency 7reasons is specialized in producing multimedia content for print and films, interactive applications as well as mobile applications and a broad range of other digital productions. While covering a wide field in terms of techniques applied and services offered, the company has specialised thematically in dealing with projects connected to cultural heritage and within this range especially historical, archaeological and musicological research, reconstruction and education issues. 7reasons objective is not only to produce the final media in terms of a well-researched and scientifically backed animation, interactive application or representative short film, but also to aid scientific personnel during research with new methods and possibilities offered by computerized tools and simulations. In this presentation we will showcase some highlights of the recent production in context with virtual cultural Heritage using XR and VR Technologies.



David Myers

Getty Conservation Institute, USA

David Myers is a member of the GCI's Arches project team, having worked on the implementation of Arches with the City of Los Angeles, and with government authorities in England and China. He has worked on GCI projects in Jordan, Egypt, Southern Africa, Iraq, and Myanmar. He holds an M.S. in historic preservation and an advanced certificate in architectural conservation and site management from the University of Pennsylvania, and an M.A in geography from the University of Kansas.

PRESENTATION TITLE: The Arches Open Source Software Platform: Heritage Management Use Cases

ABSTRACT:

The [Arches heritage data management platform](#) has been developed by the Getty Conservation Institute to support informed decision making for effective heritage management. This presentation will review how Arches has been designed to address the needs of cultural heritage policy makers and managers and review a variety of use cases from around the world showing how Arches is being used for heritage protection and management.



Antonia Moropoulou

National Technical University of Athens, Greece

Antonia Moropoulou is currently Professor at the National Technical University of Athens, Greece and Vice President of the Technical Chamber of Greece. She is a Chemical Engineer, PhD, Full Professor at the Section of Materials Science and Engineering of the School of Chemical Engineering. She was elected as Contracted Professor in IUAV University of Venice (1993), Visiting Professor at Princeton University (1995-1996) and has served as Vice Rector of Academic Affairs of NTUA (2010-2014). She is a world class expert in building materials and the preservation of monuments that comprise the World's Cultural Heritage (Hagia Sophia in Istanbul, Medieval City of Rhodes, Holy Sepulchre in Jerusalem, et al.) scientific coordinator of more than 80 National, European and International research competitive programs and author of 1 book, 2 monographies, 16 chapters in books and more than 450 scientific publications. In 2012 she was awarded the 'YPATIA' Award by the 'Association of Hellenic Women Scientists'.

PRESENTATION TITLE: Digital Solutions and Innovations in Multi Layer Big Data in the Rehabilitation of the Holy Aedicule of the Holy Sepulchre in Jerusalem

ABSTRACT:

The need for the immediate rehabilitation of the Holy Aedicule of the Holy Sepulchre involved the collaborative efforts done by the religious communities, scientific experts, and policy makers with the aim to secure the structural integrity and sustainable rehabilitation of the monument, which stands as a par excellence landmark of spiritual renewal and worshipping for the generations to come. Using best practices and integrating specific disciplinary expertise knowledge, the rehabilitation project has been throughout relevant and extrovert to the society, engaging the public in order to share problematic as well as scientific findings, to understand and promote its cultural resources. In order to achieve this, an innovative scientific method was developed by the National Technical University of Athens Interdisciplinary Team involving methods and perspectives from different disciplines, namely, from the scientific fields of architecture, civil engineering, surveying engineering, materials science and engineering, information technology, archaeometry and archaeology in dialogue with the religious communities. Reference is made to the cultural policy, highlighting the benefit of the interaction between ideas, institutions, and the common interest for the protection of monuments. The aforementioned, along with the organization programming, the integrated governance of the project, based on management functions, such as planning, budgeting, fundraising, evaluation and quality control, designed a prolific interdisciplinary agenda. This paper presents practical and theoretical work in heritage protection management, communicates the tools involved in master scientific issues, while it seeks to engage the interest of the public in order to interact actively, participate in its protection and add constructively on its future life.



HERITAGE DEVELOPMENT

Rand Eppich,

Heritage Development, Spain

Rand Eppich is a conservation architect who believes that the protection of our built historic environment is essential because it has a profound impact on the quality of our lives and shapes our identities. He holds Master Degrees in both Architecture and Business Administration (MBA) from UCLA- the University of California, Los Angeles (USA), and a Bachelors Degree in Architecture from LSU. He received his Ph.D. from the Universidad Politécnica de Madrid, International Mention, with a focus on economic and social development utilizing cultural heritage. His current projects are in Uganda, Tajikistan, Albania, and Cyprus for various clients that include the World Bank, IDB, UNDP, and ICCROM.

PRESENTATION TITLE: Digital Technologies for Informed Conservation of Cultural Heritage: diverse pragmatic examples

ABSTRACT:

Information is essential to make informed decisions concerning the conservation of cultural heritage. Never before have professionals been faced with such a dazzling array of new digital technologies. This makes awareness of the principles, methodology, and strategy important. This presentation will cover several pragmatic approaches to the documentation of recent and ongoing international conservation projects highlighting a number of tools and techniques.



HISTORIC
ENVIRONMENT
SCOTLAND

Lyn Wilson,

Historic Environment Scotland, UK

Dr Lyn Wilson is a heritage scientist with over 20 years' experience in digital documentation practice and conservation/archaeological science. She has a BSc in Archaeology, MA and PhD in Archaeological Science. As Head of Programme for Technical Research and Science at Historic Environment Scotland, the lead public body established to investigate, care for and promote Scotland's historic environment, Lyn has operational oversight of digital documentation, digital innovation, conservation science, technical research and climate change activities. Lyn is a Specialist Assessor on digital documentation to the British Council's Cultural Protection Fund, an Expert Member of CIPA and a Board Member of the ICOMOS-UK Scientific Committee on Digital Heritage Technologies.

PRESENTATION TITLE: Digital Documentation to Support Disaster Management Response: Glasgow School of Art Mackintosh Building Case Study

ABSTRACT:

A serious fire broke out at The Glasgow School of Art Mackintosh building on 23rd May 2014. Our team immediately began a programme of emergency 3D digital documentation in the fire-affected areas. This paper outlines how and why 3D digital documentation was carried out, highlighting the immediate benefits for disaster management and real-time decision making in an emergency situation, plus the ongoing research benefits for the longer-term conservation and restoration of the Mackintosh.



Raffaella Brumana, Politecnico di Milano, Italy

Dr. Raffaella Brumana, Full Professor of Geomatics at the Politecnico di Milano, Head of dABCLab Gicarur Classic High School.

Master Degree in Architecture at the Politecnico di Milano with honours (1989). Ph.D. in Geodetic and Topographic Sciences. Since 07/01/2016 Full Professor (Geomatics), Politecnico di Milano, Dept. of Architecture, Built Environment and Construction Engineering (dABC). Head of DABCLab Gicarur (4D BIM-GIS-SDI), Geospatial Information@Content modelling: Architectural heritage & Built environment & EUrbanAtl@s Surveying. She teaches Innovative Advanced Surveying techniques, Surveying&Modelling Techniques within the Preservation Studio Lab at the M.Sc.Arch (AUIC School, 7th position in the Int. QS University Ranking 2020).

Research activities: Digitization, Surveying, modelling and monitoring of Architectural Heritage and Built Environment, Archaeological site. Lidar, TLS, MMS and Photogrammetry, multi-spectral RGB, IRT/NIR images, UAV and satellite data. Geospatial information: informative models, SCANToBIM, 4D HBIM (Historical Building Information Model & management), VR/AR/MR, Architectural Object Library (vaults, masonry, ceilings) within Common Data Environment. WEB GIS, BIM-GIS, OpenData, Virtual Hub APP, Climate change landscape pressures and mitigation using EO (Copernicus programme). EU 7FP and H2020 funded research projects (EASEE, GE20, ENERGIC-OD, ALDREN), EU FESR (HOMEBIM liveAPP).

Consulence contracts (Royal Villa of Monza, Milan, Basilica di San Marco, Venice, Basilica di S.Ambrogio, Milan, Milan Cathedral, Arquata del Tronto Earth-quaked hamlet). Basilica di Collemaggio L'Aquila (awarded by Europa Nostra 2020). 2009-2020 Member of the Scientific Board of the POLIMI School of DABC Doctoral Studies and 2001-2009 Department DIIAR.

Chair/co-Chair on conferences: Arqueológica 2.0 and GEORES GEOMatics and pREServation', 2021 Valencia, Spain (Co-chair); GEORES2019 (CIPA-ICOMOS, ISPRS event), Chair; EUROMED2018 (Co-chair), 2017 CIPA Ottawa (ICOMOS and ISPRS).

Editor /Associate Editor/ Guest Editor Activities and Special issues. More than 200 peer review scientific publications.

Associations: PB ECTP EEB PPP Private Public Partnership; E2BA (Energy Efficient Building Association) Steering Committee; SB of UNESCO-OPEN FORUM Mesopotam (Albania). AB ERACHAIR, CUT Cyprus. ICOMOS, CIPA, Copernicus Academy Member.

Internship programmes: 2016-2020 Executive Committee of Partnered Research Training Initiative 'New Paradigm / New Tools', Canada SSHRC (Social Sciences and Humanities Research Council, Canadian Government). 2011-2020 ARCHDOC Architectural Heritage Documentation for Conservation, RLICC (Unesco Chair on Preventive conservation and monitoring of monuments and Sites, KUL, Be). FORMAT-EO ERASMUS IP, UK.

Traineeship Supervisor, Thesis Supervisor, PhD supervisor and co-supervisor: NTUA (Athens, GR), Kul Leuven, CUT (CY) and others.

PRESENTATION TITLE: Quality and complexity of 3D informative content models (HBIM) for preservation, re-use of Object Libraries, and communication within CDE

ABSTRACT:

HBIM (Heritage Building Information Modeling) need to address new functionalities, new paradigm and new tools shifting from BIM domain - mainly born to manage new building assets - to the heritage unicity and richness. 3D digitisation of tangible cultural heritage supports massive laser scanning and photogrammetric data acquisition (LIDAR, TLS, MMS) able to generate reliable 3D quality models with different Grade of Accuracy for different purposes and uses.

HBIM represents an opportunity to matching BIM enabled complex Models (geometry) with all the different related Information spanning from radiometric multispectral information (i.e. imaging), materials, construction techniques, skilled workers traditions, together with indirect data sources (i.e. archives, catalogues, map registry), but also environmental data (i.e. Earth Observation, Open Data), contribution to knowledge creation and addressing the different 'BIM-uses' to maximize the preservation (i.e. decay mapping, BIMtoFEA, conservation plan, WBS), reducing reconstruction/replacement, supporting design and energy-efficiency analysis new sustainable solutions.

Object Libraries, Common Data Environment and Geospatial Virtual Hubs will support the re-use and circulation of the different nodes, including extended Reality through cloud platform where to share models and information among multi-actors till to citizens and communities. Case studies as the Basilica di Santa Maria di Collemaggio will be presented (Europa NOSTRA2020 award).

João Martins



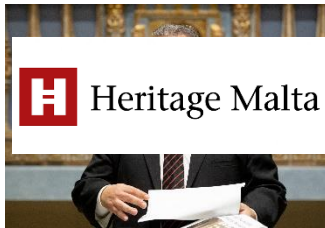
INNOVA Instituto de Desenvolvimento de Novas
Tecnologias (UNINOVA), Portugal

João Martins is a senior researcher at CTS/UNINOVA, Portugal and the head of the Electrical and Computer Engineering Department (NOVA School of Sciences and Technology, NOVA University of Lisbon). He has published more than 70 scientific articles in refereed journals and books and more than 180 articles in refereed conference proceedings. Amongst others, he took part in 4 INTERREG projects, 5 COST Actions (coordinating one) and 11 H2020 projects coordinating. Currently he is the coordinator of H2020 IMPACTOUR. His research interests are mainly in energy efficiency and heritage buildings.

PRESENTATION TITLE: Intelligent management of Heritage Buildings: a COST Action

ABSTRACT:

Europe is also one of the World's regions presenting the richest cultural heritage. Within this cultural heritage, Heritage Buildings play a major role in the richest cultural heritage that Europe holds as one of the World's finest regions. Furthermore, those Heritage Buildings play a key role in harnessing economic activities and job creating, strengthening the Europe social cohesion. Therefore, the management and conservation of these historical constructions is of extreme importance to preserve the cultural references of Europe's communities.



Tony Cassar,
Heritage Malta

A firm believer of contemporary museology as means of engaging more visitors in physical and virtual museums. I am responsible for developing and implementing the digital strategy for - Heritage Malta - the national agency for cultural heritage. This is aimed at preserving, documenting, interpreting, and making accessible Malta's tangible and intangible cultural heritage.

Digital tools and technology have made great advances, placing the agency at an important milestone in its existence. Technology provides the tools to allow us to enlarge our reach to a broader audience, now more than ever before. Digitisation opens up our collections to foreign audiences outside too, allowing more opportunities for collaboration and research with heritage institutions and experts. Barriers to access are broken down by technology.

PRESENTATION TITLE: Digitising the National Collection

ABSTRACT:

By implementing its strategic digital policy, Heritage Malta is endorsing and harnessing the power of digital technology and new approaches in museology to increase access, improve interpretation and create visitor-centric experiences



Themis Demetriou,
Bi-Communal Technical Committee on Cultural Heritage in Cyprus

Themis Demetriou is a Civil Engineer and member of the advisory board at the Cyprus bi-Communal Technical Committee on Cultural Heritage.

PRESENTATION TITLE: Cultural Heritage in conflict: Monument's conservation in Cyprus

The Agreement of 21 March 2008 reached between Greek Cypriots and Turkish Cypriots under the auspices of the United Nations (UN), paved the way for the establishment of the Technical Committee on Cultural Heritage, dedicated to the recognition, promotion and protection of the rich and diverse cultural heritage of Cyprus. The Committee is supported in its work by an Advisory Board composed of archaeologists, architects, art historians and town planners from both communities. All its programmatic decisions are taken in line with the agreed principles and the task attributed to them by the two Leaders.

The Technical Committee on Cultural Heritage works to provide a mutually acceptable mechanism for the implementation of practical measures for the proper preservation, physical protection and restoration (including research, study and survey) of the cultural heritage of Cyprus. The Committee believes that the protection of cultural heritage is an integral part of the ongoing process of broadening areas of cooperation between Greek Cypriots and Turkish

Cypriots, which can most effectively be achieved through joint efforts. The protection of cultural heritage also stimulates sustainable development and mutual understanding.

An initial list of 40 sites in need of emergency care and conservation was approved by the Leaders. Additional monuments of great historical value or notable size have been added to this list. Particular attention was given to the archaeological importance of the monuments, reflecting their uniqueness, historical significance and role in society as well as their future educational role.

Since 2012 approximately €14.7 million of European Union funds have been provided by the European Commission to implement the priorities of the Technical Committee on Cultural Heritage, for the islandwide preservation of Cyprus' cultural heritage. This makes the EU the biggest contributor to the work of the Committee.

UNDP's SUPPORT

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Anna Insa Vermehren, Museum Nord, Norway

Gunnar Liestøl, University of Oslo, Norway



UiO

Department of Media and Communication

Anna Vermehren is Head of Research and Development at Museum Nord, Norway. Her portfolio includes managing the digital heritage project *Connected Culture and Natural Heritage in the Northern Environment* (CINE) which spans a collaboration of 9 Project Partners and 10 Associated Partners in Norway, Scotland, Iceland, Ireland and Northern Ireland; the *SKREI Convention* project which tells the European history of stockfish; and the development of a new national museum in Storvågan, Lofoten, dedicated to Arctic cod - *SKREI*.

Gunnar Liestøl is professor at the Department of media and Communication, University of Oslo. He has conducted research and development in digital media for more than 25 years, starting with hypermedia designs for The Kon-Tiki Museum and The Viking Ship Museum. He has authored and edited numerous books and articles on rhetoric, narrativity and digital media design, among them *Digital Media Revisited* (MIT Press). Liestøl has spent the last decade exploring the potential of location-based media, especially Augmented Reality (AR). He is particularly interested in AR storytelling *on location* at Cultural Heritage sites. Recent experiments include AR applications for use at Ancient Phalasarna in Crete, on Omaha Beach in Normandy, the Calmecac Museum in Mexico City, and *Old Narva* in Estonia (the latter won a GLAMi-award at MW2019).

PRESENTATION TITLE: CINE see the past – imagine the future: lessons learned

ABSTRACT:

On the example of the CINE-project we will demonstrate the importance of making changes in landscapes visible. We present the models and digital tools we used to reconstruct a medieval archaeological site in Northern Norway through different time layers – ice age, medieval town, C20 and a climate changed future. Our presentation ends on considerations about identity of place and on curatorial practices that bring heritage sites to life with the help of digital technologies.

SHARED MEMORY INITIATIVE

Shared Memory initiative is an action triggered by the UNESCO Chair on Digital Cultural Heritage on the 18th of April 2020 (International day celebrating historical Monuments and Sites). The action encourages kids of all ages to download our already made plans of Panagia Asinou church (UNESCO World Heritage Site) and the Kolossi medieval Castle and start creating their own creations, colorizing the monuments with their favorite colors and at the same time being educated on the architectural structure of the monument.

Please find below an informative video with all the guidelines on how to start playing with the magnificent monuments of Cyprus.



Shared Memory 2021

Link: <https://youtu.be/B1usVuRr9go>

Plans of the monuments are available in the video description.

#OPHERAPRO

COORDINATED BY:



Segretariato Regionale
del
Ministero della Cultura
per le Marche



ICOMOS

international council on monuments and sites

ORGANISED BY:

UNESCO CHAIR ON DIGITAL CULTURAL HERITAGE
ERA CHAIR ON DIGITAL CULTURAL HERITAGE
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