

Commenced Publication in 1973

Founding and Former Series Editors:

Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Editorial Board

David Hutchison

Lancaster University, UK

Takeo Kanade

Carnegie Mellon University, Pittsburgh, PA, USA

Josef Kittler

University of Surrey, Guildford, UK

Jon M. Kleinberg

Cornell University, Ithaca, NY, USA

Alfred Kobsa

University of California, Irvine, CA, USA

Friedemann Mattern

ETH Zurich, Switzerland

John C. Mitchell

Stanford University, CA, USA

Moni Naor

Weizmann Institute of Science, Rehovot, Israel

Oscar Nierstrasz

University of Bern, Switzerland

C. Pandu Rangan

Indian Institute of Technology, Madras, India

Bernhard Steffen

TU Dortmund University, Germany

Madhu Sudan

Microsoft Research, Cambridge, MA, USA

Demetri Terzopoulos

University of California, Los Angeles, CA, USA

Doug Tygar

University of California, Berkeley, CA, USA

Gerhard Weikum

Max Planck Institute for Informatics, Saarbruecken, Germany

Marinos Ioannides Dieter Fritsch
Johanna Leissner Rob Davies
Fabio Remondino Rossella Caffo (Eds.)

Progress in Cultural Heritage Preservation

4th International Conference, EuroMed 2012
Limassol, Cyprus, October 29 – November 3, 2012
Proceedings

Volume Editors

Marinos Ioannides

Cyprus University of Technology, Archbishop Kyprianou 31, 3036 Limassol, Cyprus

E-mail: marinos.ioannides@cut.ac.cy

Dieter Fritsch

Universität Stuttgart, Geschwister-Scholl-Straße 24D, 70174 Stuttgart, Germany

E-mail: dieter.fritsch@ifp.uni-stuttgart.de

Johanna Leissner

Fraunhofer Brussels, Rue du Commerce 31, 1000 Brussels, Belgium

E-mail: johanna.leissner@zv.fraunhofer.de

Rob Davies

MDR Partners (Consulting) Ltd., 2B Fitzgerald Road, London SW14 8HA, UK

E-mail: rob.davies@mdrpartners.com

Fabio Remondino

Fondazione Bruno Kessler (FBK), Via Sommarive 18, 38123 Trento, Italy

E-mail: remondino@fbk.eu

Rossella Caffo

Istituto Centrale per il Catalogo Unico delle Biblioteche Italiane

Viale del Castro Pretorio 105, 185 Rome, Italy

E-mail: rosa.caffo@beniculturali.it

Cover illustration: All Rights reserved by Cultural Centre of the Archbishop Makarios III Foundation; <http://www.makariosfoundation.org.cy/>

ISSN 0302-9743

e-ISSN 1611-3349

ISBN 978-3-642-34233-2

e-ISBN 978-3-642-34234-9

DOI 10.1007/978-3-642-34234-9

Springer Heidelberg Dordrecht London New York

Library of Congress Control Number: 2012949188

CR Subject Classification (1998): H.5.1, H.3-5, I.3-4, C.2, K.4

LNCS Sublibrary: SL 3 – Information Systems and Application, incl. Internet/Web and HCI

© Springer-Verlag Berlin Heidelberg 2012

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer. Violations are liable to prosecution under the German Copyright Law.

The use of general descriptive names, registered names, trademarks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Description of the Cover Page

St. Euphemianos (Themonianos) Church at Lyssi Village

The church of St. Euphemianos is situated about 3 km southwest of Lyssi village in the Famagusta District in Cyprus and is a small single-aisled church with a dome. In accordance with the founders' inscription at the basis of the apse, which was destroyed by illicit dealers in antiquities, we know that the St. Themonianos Church was dedicated by priest-monk Lavrentios, abbot of the Monastery of St. Andronicos.

The church, which is only 7.5 X 3.5m (without the apse), was built on rough limestone, next to a clump of eucalyptus trees, which is like an oasis in the lonesome landscape. The church was adorned with frescoes, which have suffered the ravages of time because of humidity. Therefore, the Department of Antiquities undertook the conservation of the frescoes in 1973, a year before the Turkish invasion of 1974.

The Frescoes

The fresco from the dome of the church depicts the Pantocrator at its center, inscribed in a circle having a diameter of 1.94 cm. In a band of 0.83-cm height round the Pantocrator, the Preparation of the Throne is depicted, flanked by Virgin Mary and St. John the Baptist, followed by standing angels who are praying.

The other fresco comes from the apse and depicts Virgin Mary standing, painted in the Blachernitissa manner, with Christ in a medallion in front of her, and with her hands raised in supplication between Archangels Michael and Gabriel. A large part of Archangel Michael's torso was destroyed from humidity, but his face and the form of Archangel Gabriel are in very good condition.

The frescoes of St. Euphemianos, Lyssi, with the careful drawing, the correct proportions of the figures, the detailed rendition of the characteristics of the figures, the harmonious colors the strong calligraphic rendition of the beard and the hair of Jesus, the suppleness of the figures in the apse and the light colors, constitute the last echoes of the paintings of the mid-Byzantine era in Cyprus. These frescoes date to the third quarter of the thirteenth century and are classified among the characteristic works of *Maniera Cypria*, the comparative art which developed in Cyprus under Frankish rule during the thirteenth century.

The Cutting, Stealing, and Illegal Export of the Frescoes

In the mid-1980s, in addition to icons, the first frescoes and mosaics detached from church walls started to make their appearance in the international art

markets. The first discovery, after the Kanakaria mosaics, was the thirteenth-century frescoes from the apse and the dome of the church of St. Euphemianos at Lyssi, which the Menil Foundation in Texas, following consultations with the Government and the Church of Cyprus, bought in 1985 from Aydin Dikmen, a Turkish dealer in illicit antiquities. These frescoes dating to the thirteenth century ad were detached from the walls of the church and cut into 38 pieces in a professional manner by a group of thieves, headed by Aydin Dikmen, who was well-known from the Munich case. This attests to the brutal destruction of the cultural heritage of Cyprus by Turkish illicit antiquities dealers in the Turkish-held part of Cyprus and also to the participation and support of the Turkish occupation army in the looting, given that St. Euphemianos Church is situated in a military area. With the consent of Archbishop Chrysostomos A', the De Menil Foundation built a small chapel-museum in which the frescoes were placed following their conservation and piecing together that lasted from 1984 to 1988. Under an agreement signed in 1986 and amended in 1992 between the Church of Cyprus and the De Menil Foundation, the foundation took over the custody of the frescoes for a period of 20 years, in exchange for the costs of scientific conservation and restoration of the frescoes. The final agreement envisaged the return of the frescoes from Houston to Cyprus on expiry of the agreement in February 2012.

The Repatriation of the Frescoes

The frescoes were repatriated from the USA on March 16, 2012, following coordinated efforts by the Church of Cyprus and the authorities of the Republic of Cyprus and are temporarily exhibited at the Byzantine Museum of Archbishop Makarios III Foundation, until the day the Turkish-held township of Lyssi, where the looted St. Euphemianos church is situated, is liberated.

Dr. Ioannis A. Eliades,
Member of EuroMed2012 Organizing Committee,
Director
Byzantine Museum and Art Galleries,
Archbishop Makarios III Foundation,
Arch. Kyprianos sqr.,
1505 Nicosia, Cyprus
www.makariosfoundation.org.cy

Preface

Welcome to the island of Cyprus, which has been a bridge to three continents in the world going back to the origins of civilization. It is a place where the fingerprints of several ancient cultures and civilizations on earth can be found, with a wealth of historical sites recognized and protected by UNESCO.

It was an honor for Cyprus to be chosen as host for EuroMed 2012. Moreover, it is the first time that several organizations have decided to cooperate together in order to create an optimal environment for the discussion and explanation of new technologies, the exchange of modern innovative ideas, and in general to allow the transfer of knowledge between a large number of professionals and academics during one common time period.

This conference was held during the period of the Cypriot presidency of the European Union's Council and just before the final negotiations at the European Union on the European Regional Funds and the next Framework Programme, Horizon 2020, which will be the largest in the world in terms of financial support on research, innovation, technological development, and demonstration activities.

The government of the Republic of Cyprus has included the European Union Cultural Heritage policy and the Europe 2020/Innovation Union Initiative as important thematic priorities in the work programme of the presidency of the Council of the European Union (Decision 11447/11 of the EU Council from 17.6.2011). Consequently, the EuroMed 2012 agenda focused on themes aiming at contributing to the programme of the Cypriot Presidency in the area of cultural heritage. Moreover, EuroMed 2012 enhanced and strengthened international and regional cooperation and promoted awareness and tools for future innovative research, development, and applications to protect, preserve, and document the European and world cultural heritage. Our ambition was to host an exceptional conference by also mobilizing policy makers from different EU countries, institutions (European Commission, European Parliament, Council of Europe, UNESCO, International Committee for Monuments and Sites ICOMOS, the International Committee for Documentation of Cultural Heritage CIPA, the International Society for Photogrammetry and Remote Sensing ISPRS, the International Centre for the Study of the Preservation and Restoration of Cultural Property ICCROM, and the International Committee for Museums ICOM), professionals as well as participants from all over the world and from different scientific areas of cultural heritage.

Protecting, preserving, and presenting our cultural heritage are actions which are frequently interpreted as change management and/or change the behavior of the society. Joint European and international research has produced a scientific background and support for such a change. We are living in a period characterized by rapid and remarkable changes in the environment, in society, and

in technology. Natural changes, war conflicts, and man-made changes, including climate, as well as technological and societal changes form an ever-moving and colorful stage and a challenge for society. Close cooperation between professionals, policy makers, and authorities internationally is necessary for research, development, and technology in the field of cultural heritage.

Scientific projects in the area of cultural heritage have received national, European Union, or UNESCO funding for more than 30 years. Through financial support and cooperation, major results have been achieved and published in peer-reviewed journals and conference proceedings with the support of professionals from many countries. The European Conferences on Cultural Heritage research and development and in particular the biannual EuroMed conference have become regular milestones in the never-ending journey of discovery in the search for new knowledge of our common history and its protection and preservation for the generations to come. EuroMed also provides a unique opportunity to present and review results as well as to draw new inspiration.

To reach this ambitious goal, the topics covered at the conference include experiences in the use of innovative technologies and methods and how to best integrate the results obtained so as to build up new tools and/or experiences as well as to improve methodologies for documenting, managing, preserving, and communicating cultural heritage.

We present here 95 papers, selected from 392 submissions, which focus on interdisciplinary and multidisciplinary research concerning cutting-edge cultural heritage informatics, physics, chemistry and engineering and the use of technology for the representation, documentation, archiving, protection, preservation, and communication of cultural heritage knowledge.

Our keynote speakers Kishore Rao, Ben Kacyra, Michael T. Jones, Thomas R. Kline, Nadia Magnenat-Thalmann, Daniel Thalmann, Livio de Luca, Eleanor E. Fink, John Greaves, Stefan Gradmann, Christina Sabbioni, Salvatore Siano, and Werner Weber are not only experts in their fields but also visionaries for the future of cultural heritage protection and preservation. They promote the e-documentation and protection of the past in such a way for its preservation for the generations to come.

We extend our thanks to all authors, speakers, and those persons whose labor, financial support, and encouragement made the EuroMed 2012 event possible. The International Program Committee, whose members represent a cross-section of archaeology, physics, chemistry, civil engineering, computer science, graphics and design, library, archive and information science, architecture, surveying, history and museology, worked tenaciously and finished their work on time. The staff of the IT department at the Cyprus University of Technology helped with their local ICT and audio-visual support, especially Filippou Filippou and Stephanos Mallouris. We would also like to express our gratitude to all the organizations supporting this event and our co-organizers, UNESCO (especially the director general Irena Bokova for supporting the conference under her patronage), the European Commission (particularly Androula Vassiliou, Commissioner for Education, Culture, Multilingualism and Youth), the European Com-

mission scientific and policy officers Michel Chapuis, Astrid Brandt-Grau, Wim Jansen, Fredrik Olsson-Hector, Alessandra Luchetti, Martin Lange, Arya-Marie Ba-Trung, and Irmela Brach, the director general of Europeana, Jill Cousins, and Milena Popova, Europeana's marketing coordinator, the ESF/COST programme Thierry Goger, Inge DePrins, Matthias Haury, and Soula Louka, the Cyprus University of Technology, the Ministry of Education and Culture and particularly Minister George Demosthenous, the director of Cultural Services, Pavlos Paraskevas, Antonis Maratheftis, Demetris Nikolaou, and Zachos Polyviou, the Department of Antiquities in Cyprus, especially the director Maria Hadjicosti, all the members of the Cypriot National Committee for e-Documentation and e-Preservation in Cultural Heritage and, finally, Christos Lambrias from the Press and Information Office, our corporate sponsor, Cyprus Tourism Organization, and our official carrier, Cyprus Airways, who provided services and 'gifts of kind' that made the conference possible.

We express our thanks and appreciation to Ewald Quak from Estonia, Eleanor E. Fink, senior advisor at the World Bank Group in USA, Joris Pekel from the Open Knowledge Foundation, and Stefano Campana from Italy for their enthusiasm, commitment, and support for the success of this event. Most of all we would like to thank the organizations UNESCO, European Commission, CIPA, ISPRS, and ICOMOS that entrusted us with the task of organizing and undertaking this unique event.

Marinos Ioannides
Dieter Fritsch
Johanna Leissner
Rob Davies
Fabio Remondino
Rossella Caffo

Acknowledgement and Disclaimer

The EuroMed2012 Conference has been partly supported by the Republic of Cyprus, by the Cyprus University of Technology, by the Cyprus Tourism Organization, by CIPA (<http://cipa.icomos.org>), ISPRS and ICOMOS.

However, the content of this publication reflects only the authors' views and the UNESCO, European Commission, the Republic of Cyprus, the Cyprus Presidency of the EU Council, CIPA, ISPRS, ICOMOS, Cyprus University of Technology are not liable for any use that may be made of the information contained herein.

Organization

Conference Chairs

Marinos Ioannides	Cyprus
Dieter Fritsch	Germany
Johanna Leissner	Germany

Co-chairs

Fabio Remondino	Italy
Rob Davies	UK
Rossella Caffo	Italy

Paper Review Chair

Nikolas Doulamis	Greece
------------------	--------

Local Organizing Committee

Agapiou, Athos	Mallouris, Stefanos
Christodoulou, Andreas	Marangou, Anna
Eliades, Ioannis	Maratheftis, Antonis
Fillipou, Filippou	Michail, Harris
Hadjigavriel, Loukia L.	Nikolaou, Dimitris
Hadjigavriel, Stella	Polyviou, Zachos
Koukounidou, Sylvia	Themistokleous, Kyriakos
Lambrias, Christos	Tsimpoglou, Filippou
Lanitis, Andreas	Voskarides, Sotos
Loizou, Christos	Zervas, Marios
Louka, Andreas	

International Scientific Committee

Agapiou, Athos	Cyprus	Beacham, Richard	UK
Andia, Alfredo	USA	Beraldin, J-Angelo	Canada
Andreou, Andreas	Cyprus	Bernsen, Niels Ole	Denmark
Arnold, David	UK	Bertoncini, Massimo	Italy
Artusi, Alessandro	Italy	Blas, NicolettaDi	Italy
Baltsavias, Manos	Switzerland	Boehm, Jan	UK
Barcelo, Juan A.	Spain	Bourke, Paul	Australia

Brantl, Markus	Germany	Jabi, Wassim	USA
Bryan, Paul	UK	Jerem, Elizabeth	Hungary
Campana, Stefano	Italy	Kenderdine, Sarah	Australia
Catalano, Chiara Eva	Italy	Kolias, Stefanos	Greece
Chrysanthou, Yiorgos	Cyprus	Krizova, Romana	Czech Republic
Cignoni, Paolo	Italy	Kunkel, Timo	UK
Clayton, Chris	UK	Lanitis, Andreas	Cyprus
Coquillart, Sabine	France	León, Alfredo Grande	Spain
D' Andrea, Andrea	Italy	Lerma, Jose Luis	Spain
Dahari, Uzi	Israel	Loscós, Céline	Spain
Dallas, Costis	Canada	Louka, Soulla	Cyprus
Daria, Tsoupikova	USA	Madija, Lidiya	Russia
Day, Andy	UK	Malzbender, Tom	USA
De Masi, Alessandro	Italy	Mania, Katerina	Greece
Dikomitou, Maria	Cyprus	Markus, Brantl	Germany
Doerr, Martin	Greece	Martin, Kathi	USA
Doneus, Michael	Austria	May, Keith	UK
Doulamis, Anastasios	Greece	Michail, Harris	Cyprus
Duguet, Florent	France	Moropoulou, Antonia	Greece
Falcidieno, Bianca	Italy	Mullins, David	Ireland
Forte, Maurizio	USA	Niels Ole, Bernsen	Denmark
Fotakis, Costas	Greece	Oudenaren, JohnVan	USA
Gaitatzis, Sakis	Cyprus	Owen, John	
		Mackenzie	The Netherlands
Gebhardt, Andreas	Germany	Paliou, Eleftheria	Portugal
Georgiades, Marinos	Cyprus	Papagiannakis, George	Switzerland
Georgopoulos, Andreas	Germany	Pasquale, Savino	Italy
Gerasimou, Simos	Cyprus	Pattanaik, Sumanta	USA
Griffin, Stephen M.	USA	Pechlivanidou, A. Liakata	Greece
Grussenmeyer, Pierre	France	Philimis, Panayiotis	Cyprus
Guidi, Gabriele	Italy	Pitikakis, Marios	Greece
Haala, Norbert	Germany	Pletinckx, Daniel	Belgium
Hadijimitsis, Diofantos	Cyprus	Quak, Ewald	Estonia
Hagedorn-Saupe, Monika	Germany	Quintero, Mario	
Hanke, Klaus	Austria	Santana	Belgium
Havemann, Sven	Austria	Renaud, Christoph	France
Huggett, Jeremy	UK	Retalis, Adrianos	Greece
Ioannidis, Charalambos	Greece	Richards, Julian D.	UK
Ioannidis, Yiannis	Greece	Rinaudo, Fulvio	Italy
		Ross, Seamus	UK

Roussou, Maria	Greece	Thalmann, Nadia M.	Switzerland
Rushmeier, Holly	UK	Themistokleous, Kyriakos	Cyprus
Ryan, Nick	UK	Torres, Juan Carlos	Spain
Sablatnig, Robert	Austria	Troyer, Olga	Belgium
Saleh, Fathi	Egypt	Tsapatsoulis, Nicolas	Cyprus
Sanders, Donald H.	USA	Vavalis, Manolis	Greece
Sarris, Apostolos	Greece	Verdiani, Giorgio	Italy
Schlaumeier, Holly	UK	Walczak, Krzysztof	Poland
Segond, Frederique	France	Wehr, Aloysius	Germany
Skarlatos, Dimitrios	Cyprus	White, Martin	UK
Stylianou, Georgos	Cyprus	Zaphiris, Panayiotis	Cyprus
Tapinaki, Sevasti	Greece	Zervas, Marios	Cyprus

Table of Contents

Full Papers

Digital Data Acquisition Technologies and Data Processing in Cultural Heritage

Image-Based Low-Cost Systems for Automatic 3D Recording and Modelling of Archaeological Finds and Objects.....	1
<i>Thomas P. Kersten and Maren Lindstaedt</i>	
Photogrammetric Point Cloud Collection with Multi-camera Systems ...	11
<i>Dieter Fritsch, Mohammed Abdel-Wahab, Alessandro Cefalu, and Konrad Wenzel</i>	
Prospecting Archaeological Landscapes	21
<i>Immo Trinks, Wolfgang Neubauer, and Michael Doneus</i>	
Multispectral Image Acquisition of Ancient Manuscripts	30
<i>Fabian Hollaus, Melanie Gau, and Robert Sablatnig</i>	
Low-Cost and Open-Source Solutions for Automated Image Orientation – A Critical Overview.....	40
<i>Fabio Remondino, Silvio Del Pizzo, Thomas P. Kersten, and Salvatore Troisi</i>	

2D and 3D Data Capture Methodologies and Data Processing in Cultural Heritage

Automated Generation of an Historic 4D City Model of Hamburg and Its Visualisation with the GE Engine	55
<i>Thomas P. Kersten, Friedrich Keller, Jerome Saenger, and Jochen Schiewe</i>	
Alberti's Box: The Cultural Multimedia Project on the Architectures of Leon Battista Alberti	66
<i>Marcello Balzani, Carlo Bughi, Federico Ferrari, Luca Rossato, and Alessandra Tursi</i>	
Automatic Fusion of Digital Images and Laser Scanner Data for Heritage Preservation.....	76
<i>Wassim Moussa, Mohammed Abdel-Wahab, and Dieter Fritsch</i>	
Mapping of Defect Structural Micro-morphology in the Documentation of Conservation Approaches	86
<i>Eirini Bernikola, Elsa Tsiranidou, Vivi Tornari, Vincent Detalle, and Jean Luc Bodnar</i>	

Exploitation of Thermal Imagery for the Detection of Pathologies in Monuments	97
<i>Dafni Sidiropoulou-Velidou, Andreas Georgopoulos, and José Luis Lerma</i>	

2D and 3D GIS in Cultural Heritage

On-line Spectral Learning in Exploring 3D Large Scale Geo-Referred Scenes	109
<i>Nikolaos Doulamis, Christos Yiakoumettis, and George Miaoulis</i>	

An Information System for Medieval Archaeology Based on Photogrammetry and Archaeological Database: The <i>Shawbak Castle</i> <i>Project</i>	119
<i>Pierre Drap, Djamal Merad, Julien Seinturier, Jean-Marc Boï, Daniela Peloso, Guido Vannini, Michele Nucciotti, and Elisa Pruno</i>	

Towards an Archaeological Index: Identification of the Spectral Regions of Stress Vegetation due to Buried Archaeological Remains	129
<i>Athos Agapiou, Diofantos G. Hadjimitsis, Andreas Georgopoulos, Apostolos Sarris, and Dimitrios D. Alexakis</i>	

Historical Social Housing: Smart Analysis and Design for Conservation and Energy Regeneration	139
<i>Elena Gigliarelli, Donato Carlea, Angela Corcella, and Heleni Porfyriou</i>	

Virtual Reality in Archaeology and Historical Research

3D Heritage on Mobile Devices: Scenarios and Opportunities	149
<i>Karina Rodriguez Echavarria, Jaime Kaminski, and David Arnold</i>	

Reviving Ancient Rome: Virtual Reality at the Service of Cultural Heritage	159
<i>Philippe Fleury and Sophie Madeleine</i>	

Virtual Reconstructions in a Desktop Planetarium for Demonstrations in Cultural Astronomy	170
<i>Georg Zotti and Wolfgang Neubauer</i>	

Augmented Reality for Archaeological Finds	181
<i>Belén Jiménez Fernández-Palacios, Alessandro Rizzi, and Francesco Nex</i>	

Virtual Heritage: Exploring Photorealism	191
<i>Hafizur Rahaman, Rana Das, and Shehzad Zahir</i>	

Virtual Architectural 3D Model of the Imperial Cathedral (Kaiserdom) of Königslutter, Germany through Terrestrial Laser Scanning	201
<i>Thomas P. Kersten and Maren Lindstaedt</i>	

Standards, Metadata, Ontologies and Semantic Processing in Cultural Heritage

Integrated Documentation Protocols Enabling Decision Making in Cultural Heritage Protection	211
<i>Anastasia Kioussi, Maria Karoglou, Asterios Bakolas, and Antonia Moropoulou</i>	
Monument Damage Ontology	221
<i>Miroslav Blaško, Riccardo Cacciotti, Petr Křemen, and Zdeněk Kouba</i>	
A Generic Approach for Generating Cultural Heritage Metadata	231
<i>Martin Schröttner, Sven Havemann, Maria Theodoridou, Martin Doerr, and Dieter W. Fellner</i>	
Semantic Models for Architectural Heritage Documentation	241
<i>Erik Costamagna and Antonia Spanò</i>	

Data Management, Archiving and Presentation of Cultural Heritage Content

An Expert System for Quality Assurance of Document Image Collections	251
<i>Roman Graf, Reinhold Huber-Mörk, Alexander Schindler, and Sven Schlarb</i>	
Tactile Representation of Paintings: An Early Assessment of Possible Computer Based Strategies	261
<i>Monica Carfagni, Rocco Furferi, Lapo Governi, Yary Volpe, and Giovanna Tennirelli</i>	
Model-Based User Interface Design for the Encyclopedia of Islamic Architecture	271
<i>Osama Mohammad Alrawi</i>	
Mobile Devices for the Visit of “Anfiteatro Campano” in Santa Maria Capua Vetere	281
<i>Giuseppina Renda, Stefania Gigli, Alba Amato, Salvatore Venticinque, Beniamino Di Martino, and Francesca Romana Cappa</i>	

Evolution of the e-Museum Concept through Exploitation of Cryptographic Algorithms	291
<i>George S. Athanasiou, Harris E. Michail, Andreas Gregoriades, and Marinos Ioannides</i>	

ICT Assistance in Monitoring and Restoration

Completing Digital Cultural Heritage Objects by Sketching Subdivision Surfaces toward Restoration Planning	301
<i>Matthias Bein, Sebastian Peña Serna, André Stork, and Dieter W. Fellner</i>	

Collective Intelligence in Cultural Heritage Protection	310
<i>Anastasios Doulamis, Anastasia Kioussi, Maria Karoglou, Nikolaos Matsatsinis, and Antonia Moropoulou</i>	

An Automated Methodology for Assessing the Damage on Byzantine Icons	320
<i>Anastasios Maronidis and Andreas Lanitis</i>	

3D Information System for the Digital Documentation and the Monitoring of Stone Alteration	330
<i>Chiara Stefani, Xavier Brunetaud, Sarah Janvier-Badosa, Kevin Beck, Livio De Luca, and Muzahim Al-Mukhtar</i>	

Innovative Topics Related to the Current and Future Implementation, Use, Development and Exploitation of the EU CH

Identity Card of Cultural Heritage: How to Collect and Organize Data	340
<i>Roko Žarnić, Vlatka Rajčić, and Antonia Moropoulou</i>	

An Enhanced Distributed Repository for Working with 3D Assets in Cultural Heritage	349
<i>Xueming Pan, Thomas Schiffer, Martin Schröttner, René Berndt, Martin Hecher, Sven Havemann, and Dieter W. Fellner</i>	

A Contribution to a Unified Approach in Policy Making through Documenting Cultural Heritage	359
<i>Barbara Vodopivec, Rand Eppich, Ingval Maxwell, Alessandra Gandini, and Roko Žarnić</i>	

Innovative Technologies to Assess, Monitor and Adapt to Climate Change

Heritage-Led Eco-Regeneration: The Case of Zhejiang Water Towns Protection, Restoration and Preservation	369
<i>Luciano Cessari and Elena Gigliarelli</i>	
Flame Detection for Video-Based Early Fire Warning for the Protection of Cultural Heritage	378
<i>K. Dimitropoulos, O. Gunay, K. Kose, F. Erden, F. Chaabene, F. Tsalakanidou, N. Grammalidis, and E. Cetin</i>	

Project Papers

Digital Data Acquisition Technologies and Data Processing in Cultural Heritage

3D Multi-scale Scanning of the Archaeological Cave “Les Fraux” in Dordogne (France)	388
<i>Pierre Grussenmeyer, Albane Burens, Emmanuel Moisan, Samuel Guillemin, Laurent Carozza, Raphaëlle Bourrillon, and Stéphane Petrognani</i>	
The Catacombs of San Giovanni in Syracuse: Surveying, Digital Enhancement and Revitalization of an Archaeological Landmark	396
<i>Elisa Bonacini, Graziana D’Agostino, Mariateresa Galizia, Cettina Santagati, and Mariarita Sgarlata</i>	
Digitization of Cypriot Folk Dances	404
<i>Efstathios Stavrakis, Andreas Aristidou, Maria Savva, Stephanie Loizidou Himona, and Yiorgos Chrysanthou</i>	
Modeling the Past: Digital Technologies and Excavations in Polis, Cyprus	414
<i>Joanna S. Smith and Szymon M. Rusinkiewicz</i>	
Automated View Integration Techniques for Numerous 3D Clouds of Points	423
<i>Maciej Karaszewski, Elwira Holowko, Jerzy Wojsz, Robert Sitnik, and Eryk Bunsch</i>	

2D and 3D Data Capture Methodologies and Data Processing in Cultural Heritage

Protocols and Assisted Tools for Effective Image-Based Modeling of Architectural Elements	432
<i>Nicolas Nony, Livio De Luca, Aymeric Godet, Marc Pierrot-Deseilligny, Fabio Remondino, Alexandre Van Dongen, and Mauro Vincitore</i>	

Process Modeling and Photogrammetric Production for Structural Investigations Concerning to the Collapse of Palazzo Edilizia in Salerno (Italy)	440
<i>Domenica Costantino and Maria Giuseppa Angelini</i>	
Virtual Stonehenge Reconstruction	449
<i>Ertu Unver and Andrew Taylor</i>	
The Ancient Fragment Collection at the Museo Archeologico in Florence, Italy, a Digital Proposal to Allow Its Access	461
<i>Giorgio Verdiani and Andrea Braghiroli</i>	
The Geometry behind the “Fontana di Sala Grande” a Case Study of Reverse Modeling	469
<i>Giorgio Verdiani and Filippo Fantini</i>	

On-site and Remotely Sensed Data Collection

Architectural Photogrammetry by Non-Metric Cameras: CAD-Based 2D Drawing of Facades from Rectified Photos	477
<i>Elham Andaroodi and Zeinab Tagipour</i>	
Thesaurus Project: Design of New Autonomous Underwater Vehicles for Documentation and Protection of Underwater Archaeological Sites	486
<i>B. Allotta, S. Bargagliotti, L. Botarelli, A. Caiti, V. Calabrò, G. Casa, M. Cocco, S. Colantonio, C. Colombo, S. Costa, M. Fanfani, L. Franchi, P. Gambogi, L. Gualdesi, D. La Monica, M. Magrini, M. Martinelli, D. Moroni, A. Munafò, G. Pace, C. Papa, M.A. Pascali, G. Pieri, M. Reggiannini, M. Righi, O. Salvetti, and M. Tampucci</i>	
Development of a Low Altitude Airborne Imaging System for Supporting Remote Sensing and Photogrammetric Applications ‘The ICAROS Project’ Intended for Archaeological Applications in Cyprus	494
<i>Kyriacos Themistocleous, Diofantos G. Hadjimitsis, Andreas Georgopoulos, Athos Agapiou, and Dimitrios D. Alexakis</i>	

Reproduction Techniques and Rapid Prototyping in Cultural Heritage

From Real to Virtual Rapid Architectural Prototyping	505
<i>Mike Tato, Petros Papanikolaou, and George Papagiannakis</i>	

Reconstruction of Monumental Painting of the Church on Nereditsa Hill in the City Novgorod the Great: Methodology of Painting and Virtual Reconstruction Combination	513
<i>Tatyana V. Laska, Irina V. Tcymbal, Yulia A. Petrova, and Sergey V. Golubkov</i>	
Micrometer MultiResolution Laser Scanning of a Renaissance Medallion	525
<i>Emanuela Faresin, Adriano Baschiera, Giuseppe Salemi, Michele Asolati, and Cristina Crisafulli</i>	
Three-Dimensional Virtual Models for Better Comprehension of Architectural Heritage Construction Techniques and Its Maintenance over Time	533
<i>Daniela Oreni, Branka Cuca, and Raffaella Brumana</i>	
Digitization, Restoration and Visualization of Terracotta Figurines from the ‘House of Orpheus’, Nea Paphos, Cyprus	543
<i>G. Papantoniou, F. Loizides, Andreas Lanitis, and D. Michaelides</i>	
Virtual Reconstruction of the Ancient State of a Ruined Church	551
<i>Christina Gkintzou, Andreas Georgopoulos, José Manuel Valle Melón, and Álvaro Rodríguez Miranda</i>	
Reconstruction of Everyday Life in 19th Century Nicosia	568
<i>Panayiotis Charalambous, Hesperia Iliadou, Charalambos Apostolou, and Yiorgos Chrysanthou</i>	

2D and 3D GIS in Cultural Heritage

The Use of GIS in the National System for Cultural Heritage Management and Dissemination to the General Public in Norway: Case Study: The Heritage Management Database “Askeladden” and the System for Dissemination to the Public, “Kulturminnesøk”	578
<i>Evy Berg</i>	
The Reintegration of Urban Lacunas at Castelveccchio Calvisio (AQ) after the 2009 Earthquake: The Use of GIS 3D as a Project Monitoring Tool	586
<i>Carla Bartolomucci, Ilaria Trizio, and Daniele Bonzagni</i>	
An Integrated Management System for Historical Buildings: The Case Study of Dihua Historical Street Districts in Taiwan	594
<i>Wun-Bin Yang, Ya-Ning Yen, and Hung-Ming Cheng</i>	

Innovative Graphics Applications and Techniques

Macedonia from Fragments to Pixels: A Permanent Exhibition of Interactive Systems at the Archaeological Museum of Thessaloniki	602
<i>Dimitris Grammenos, Xenophon Zabulis, Damien Michel, Pashalis Paderis, Thomas Sarmis, Giannis Georgalis, Panagiotis Koutlemanis, Konstantinos Tzevanidis, Antonis A. Argyros, Michalis Sifakis, Polyxeni Adam-Veleni, and Constantine Stephanidis</i>	
Personalized Multimedia Experiences in Technology Museums	610
<i>Maria Teresa Linaza, Ander García, and Mikel Rodriguez</i>	
Solving the Centre–Periphery Problem in Cultural Heritage by Means of Situated Simulations	618
<i>Gunnar Liestøl</i>	
Interaction for a Shared Knowledge with Reperio: The Cardano Case . . .	628
<i>Damiana Luzzi and Marialuisa Baldi</i>	
Natural Lighting and Medieval Glass – Scientific Data Acquisition, Methodology and Physically Based Rendering	636
<i>Remi Cerise, Fernando da Graça, Frederic Magoulès, and Patrick Callet</i>	

Libraries and Archives in Cultural Heritage

Venus: A Unique Fast, Effective and Safe Publishing System for High-Resolution 3D Digital Models	644
<i>Charles Crable</i>	
The Europeana Newspapers – A Gateway to European Newspapers Online	654
<i>Aleš Pekárek and Marieke Willems</i>	
A Google Cloud Approach to Implement a Graphical Data Access Interface Binding Heterogeneous Cultural Repositories	660
<i>Antonella Coralini, Antonella Guidazzoli, Fiamma Lenzi, Micaela Spigarolo, Antonio Baglivo, and Maria Chiara Liguori</i>	
The CULTURA Project: Supporting Next Generation Interaction with Digital Cultural Heritage Collections	668
<i>Cormac Hampson, Maristella Agosti, Nicola Orio, Eoin Bailey, Seamus Lawless, Owen Conlan, and Vincent Wade</i>	
Cataloging Intangible Cultural Heritage on the Web	676
<i>Maria Teresa Artese and Isabella Gagliardi</i>	

Two Integrated Digital Libraries for Knowledge and Iconography of Orthodox Saints	684
<i>Desislava Paneva-Marinova, Radoslav Pavlov, and Maxim Goynov</i>	

Heritage-Oriented Spatial Data Infrastructures in Spain: Waiting on the World to Change	692
<i>César Parcerro-Oubiña</i>	

Tools for Education, Documentation and Training in CH

Preserving Monuments' Astronomical Orientation by Using Different Databases	701
<i>George Pantazis</i>	

The EUROMED 4 Project "ELAICH": e-Tools for a Teaching Environment on EU Mediterranean Cultural Heritage	710
<i>Anna Lobovikov-Katz, Agoritsa Konstanti, Kyriakos Labropoulos, Antonia Moropoulou, JoAnn Cassar, and Roberta De Angelis</i>	

A Proposal for Mobile Game Based Learning to Promote Knowledge of the A Famosa Fortress	720
<i>Mohamad Izani, Michael Grant, and Aishah Razak</i>	

Standards, Metadata, Ontologies and Semantic Processing in Cultural Heritage

Surveying Masonry Structures by Semantically Enriched 2.5D Textures: A New Approach	729
<i>Valeria Cappellini, Chiara Stefani, Nicolas Nony, and Livio De Luca</i>	

Identifying Semantic Relationships in Digital Libraries of Cultural Heritage	738
<i>Zoltán Harsányi, Viera Rozinajová, and Nadežda Andrejčková</i>	

Adaptive Augmented Reality for Cultural Heritage: ARtSENSE Project	746
<i>Areti Damala, Nenad Stojanovic, Tobias Schuchert, Jorge Moragues, Ana Cabrera, and Kiel Gilleade</i>	

Damage Assessment, Diagnosis and Monitoring for the Preventive Conservation and Maintenance of CH

The MEMORI Technology - An Innovative Tool for the Protection of Movable Cultural Assets	756
<i>Terje Grøntoft and Elin Dahlin</i>	

A Methodology to Monitor the Pollution Impact on Historic Buildings Surfaces: The TeACH Project	765
<i>Adriana Bernardi, Francesca Becherini, Alessandra Bonazza, Barbara Krupinska, Luc Pockelè, René Van Grieken, Sandro De Grandi, Izabela Ozga, Alejandro Jose Veiga Rico, Oihana Garcia Mercero, and Arianna Vivarelli</i>	
Characterizing Cracks in the Frescoes of <i>Sala degli Elementi</i> within Florence's <i>Palazzo Vecchio</i>	776
<i>Richard L. Wood, Tara C. Hutchinson, Christine E. Wittich, and Falko Kuester</i>	
IMAT Project: From Innovative Nanotechnology to Best Practices in Art Conservation	784
<i>Tomas Markevicius, Nina Olsson, Monica Carfagni, Rocco Furferi, Lapo Governi, and Luca Puggelli</i>	
PANNA Project – Plasma and Nano for New Age Soft Conservation. Development of a Full-Life Protocol for the Conservation of Cultural Heritage	793
<i>Alessandro Patelli, Monica Favaro, Stefan Simon, Patrick Storme, Paolo Scopece, Veska Kamenova, Zdravko Kamenarov, Andrea Lorenzon, and Frank De Voeght</i>	
Synthesis and Characterization of Nanostructured BaO Solutions: Application in Conservation of Wall Paintings	801
<i>Elisa Cordoncillo, T.R. Machado, Livio Ferrazza, and David Juanes</i>	
Information Management Systems in CH	
An Information System to Analyze Cultural Heritage Information	809
<i>J.C. Torres, L. López, C. Romo, and F. Soler</i>	
Arches: An Open Source GIS for the Inventory and Management of Immovable Cultural Heritage	817
<i>David Myers, Alison Dalgity, Ioannis Avramides, and Dennis Wuthrich</i>	
A Methodology for Integrative Documentation and Characterization of Culturally Important Statues to Support Seismic Analysis	825
<i>Christine E. Wittich, Tara C. Hutchinson, Richard L. Wood, and Falko Kuester</i>	
Historic Environment and INSPIRE – A View from Scotland	833
<i>Peter McKeague</i>	
A CH Based Integrative Management Framework on the Value Priority Aspect	841
<i>Ya-Ning Yen</i>	

European Research Networks in the Field of CH

EGI: An Open e-Infrastructure Ecosystem for the Digital European Research Area and the Humanities	849
<i>Steven J. Newhouse and Stephen Brewer</i>	
Contemporary Museums in an Age of Migrations: The Reinterpretation of European Cultural Heritage	857
<i>Luca Basso Peressut, Gennaro Postiglione, and Francesca Lanz</i>	
COSCH – Colour and Space in Cultural Heritage, A New COST Action Starts	865
<i>Frank Boochs</i>	

Non-destructive Diagnosis Technologies for the Safe Conservation and Traceability of Cultural Assets

Science in Aid of Expert Opinion: A Tell-Tale on Disputed Artworks . . .	874
<i>Fotini Koussiaki, Vivi Tornari, Eleni Kouloumpi, and Alkis Lembessis</i>	
Computed Tomography Studies Applied to Polychromed Sculpture: The Making Process in Three Different Times	884
<i>David Juanes and Livio Ferrazza</i>	

Erratum

Arches: An Open Source GIS for the Inventory and Management of Immovable Cultural Heritage	E1
<i>David Myers, Alison Dalgity, Ioannis Avramides, and Dennis Wuthrich</i>	
Author Index	895