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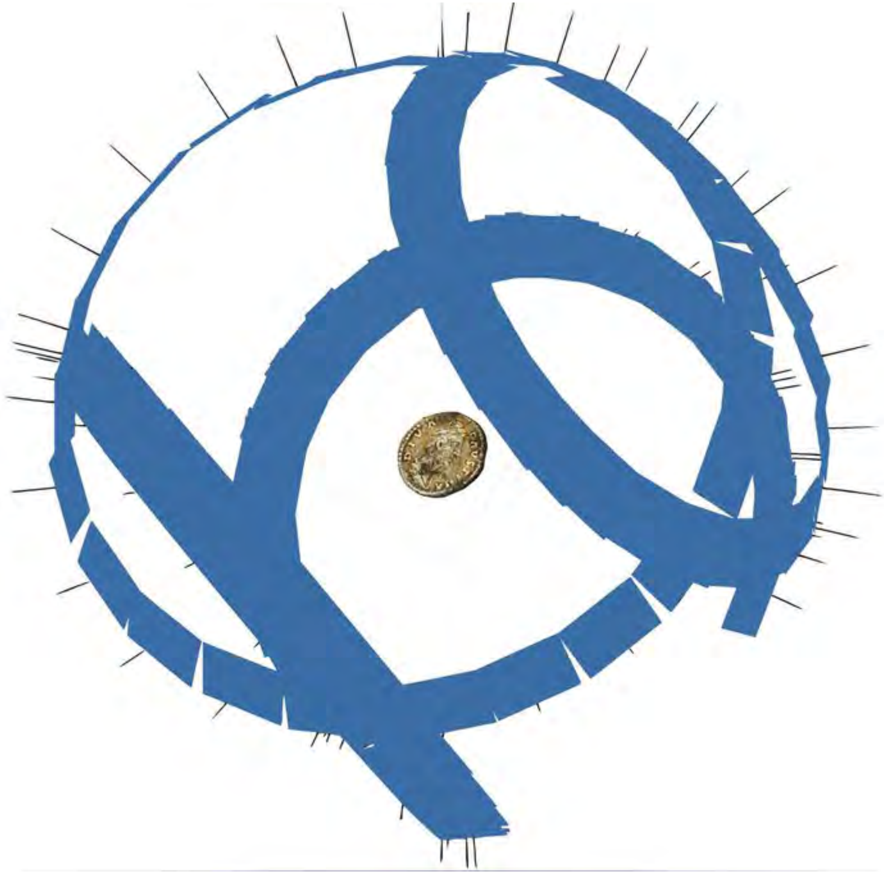

DIGITAL TECHNIQUES FOR DOCUMENTING AND PRESERVING CULTURAL HERITAGE

Edited by ANNA BENTKOWSKA-KAFEL and LINDSAY MacDONALD

COSCH
COLOUR & SPACE IN CULTURAL HERITAGE

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CONTENTS

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LIST OF ILLUSTRATIONS

Figures

Tables

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LIST OF ACRONYMS AND ABBREVIATIONS

3D	Three-dimensional
4D	Four-dimensional
AAT	*Art & Architecture Thesaurus® Online*, Getty Vocabulary Program, J. Paul Getty Trust, USA
ACM	Association for Computing Machinery, USA
AHRC	Arts and Humanities Research Council, UK
AOTF	Acousto-Optical Tunable Filter
AR	Augmented Reality
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing Materials
ATR	Attenuated Total Reflectance
BHRT	Bosnia Herzegovina Radio Television
BIM	Building Information Modelling
CAD	Computer-Aided Design
CBIR	Content-based Image Retrieval
CCD	Charge-Coupled Device
CD-ROM	Compact Disc-Read Only Memory
CH	Cultural Heritage
CIDOC	International Committee for Documentation (within ICOM)
CIE	Commission Internationale de l'Éclairage
CIPA	Comité International de Photogrammétrie Architecturale (within ICOMOS)
CMM	Coordinate Measurement Machine
CMOS	Complementary Metal-Oxide-Semiconductor
CMS	Collection Management System
COSCH	Colour and Space in Cultural Heritage, COST Action TD1205, 2012–16
COST	European Cooperation in Science and Technology
CPU	Central Processing Unit
CRISATEL	Conservation Restoration Innovation Systems for image capture and digital Archiving to enhance Training, Education and lifelong Learning (EU FP5-IST-1999-20163 project 2001–4)
CRM	Conceptual Reference Model
CT	Computed Tomography
DEM	Digital Elevation Map

DOI	Digital Object Identifier
DSLR	Digital Single Lens Reflex (camera)
ECCO	European Confederation of Conservator-Restorers' Organisations
ECI	Early Career Investigator
EDM	Electronic Distance Measurement/Meter
EDS	Energy Dispersive Spectroscopy
EDX	Energy Dispersive X-ray Spectroscopy
EPSRC	Engineering and Physical Sciences Research Council, UK
ERA	European Research Area
ESR	Early Stage Researcher
EU	European Union
FADGI	Federal Agencies Digitization Guidelines Initiative, USA
FTIR	Fourier Transformed Infrared Spectroscopy
FWHM	Full Width Half Maximum
GFC	Goodness-of-Fit Coefficient
GIS	Geographic Information System
GPS	Global Positioning System
GSD	Ground Sampling Distance
HBIM	Heritage Building Information Modelling
HD	High Definition
H-RTI	Highlight Reflectance Transformation Imaging
HSI	Hyperspectral Imaging
HTML	Hypertext Markup Language
ICCROM	International Centre for the Study of the Preservation and Restoration of Cultural Property
ICOM	International Council of Museums
ICOM-CC	International Council of Museums-Committee for Conservation
ICOMOS	International Council on Monuments and Sites
ICP	Iterative Closest Point (algorithm)
ICT	Information Communication Technology
IEEE	Institute of Electrical and Electronics Engineers, USA
IET	The Institution of Engineering and Technology, UK
IFAC-CNR	Istituto di Fisica Applicata Nello Carrara, The Nello Carrara Institute of Applied Physics in Sesto Fiorentino, Italy, part of the National Research Council (CNR)

IS	Imaging Spectroscopy
ISO	International Organization for Standardization
ISPRS	International Society for Photogrammetry and Remote Sensing
IVE	Interactive Virtual Environment
JCGM	Joint Committee for Guides in Metrology
Laser	Light Amplification by Stimulated Emission of Radiation
LCTF	Liquid Crystal Tunable Filter
LED	Light-Emitting Diode
LIBS	Laser-Induced Breakdown Spectroscopy
LIDAR	Light Detection and Ranging (remote sensing)
LS	Laser Scanning
MARC	Methodology for Art Reproduction in Colour (EU FP3-ESPRIT 6937 project 1992–95)
MoU	Memorandum of Understanding
MSI	Multispectral Imaging
MVS	Multiple View Stereovision
n/a	not applicable
NEH	National Endowment for the Humanities, USA
NIR	Near Infrared
OBJ	Computer file format for 3D geometry definition
OIML	International Organization of Legal Metrology
OWL	Web Ontology Language
PEG	Polyethylene Glycol
PGP	Prism-Grating-Prism
PLY	Polygon File (computer file 3D format)
PS	Photometric Stereo
PTFE	Polytetrafluoroethylene
PTM	Polynomial Texture Mapping
PXRF	Portable X-ray Fluorescence (Spectroscopy)
R&D	Research and Development
RDFa	Resource Description Framework in Attributes
RGB	Red Green Blue
RIC	*The Roman Imperial Coinage* (see Mattingly and Sydenham 1923)
RMSE	Root-Mean-Square Error
ROV	Remotely Operated Vehicle

RRT	Round Robin Test
RS	Recommender System
RTI	Reflectance Transformation Imaging
SEM	Scanning Electron Microscopy
SfM	Structure from Motion
SIVT	Spatial Image analysis and Viewing Tool
SLI	Structured Light Imaging
SLR	Single Lens Reflex (camera)
SLS	Structured Light Scanning
SOP	Standard Operating Procedure
SPD	Spectral Power Distribution
SPIE	Society of Photographic Instrumentation Engineers
STSM	Short-Term Scientific Mission
SWIR	Short-Wave Infrared
TIN	Triangulated Irregular Network
TLS	Terrestrial Laser Scanner
TOF	Time of Flight
UAV	Unmanned Aerial Vehicle
UNESCO	United Nations Educational, Scientific and Cultural Organization
URL	Uniform Resource Locator
USB	Universal Serial Bus
UV	Ultraviolet
VASARI	Visual Art System for Archiving and Retrieval of Images (EU FP2-ESPRIT 2 project 1989–92)
VDI/VDE	Verein Deutscher Ingenieure / Verband der Elektrotechnik Elektronik Informationstechnik
Vis	Visible
VNIR	Visible and Near Infrared
VR	Virtual Reality
VRML	Virtual Reality Modelling Language
WG	Working Group
XML	eXtensible Markup Language
XRF	X-ray Fluorescence Spectroscopy

FOREWORD

COSCH stands for Colour and Space in Cultural Heritage and represents four years of networking activities of scientists and researchers from other disciplines from twenty-eight European countries. They share a dedication to improving the understanding of optical measurement techniques, applied to various tasks in documentation of material cultural heritage. The COSCH network benefited from the support and funding of the European Cooperation in Science and Technology, commonly known as COST. COST was founded in 1971 as an intergovernmental framework for cooperation in science and technology and is one of the oldest European bodies funding networking in these areas. Cooperation is implemented through the so-called Actions, such as COSCH. A COST Action provides a platform for dialogue and exchange of interdisciplinary knowledge amongst researchers from different academic disciplines, as well as industry and commercial research laboratories.

COST Actions have a funding period of four years. The funding covers networking activities, mainly the cost of organizing and travelling to meetings, conferences, and workshops. Financial support is also available for research exchange visits (so-called Short-term Scientific Missions, or STSMs), training schools, publications, and other dissemination activities. Personnel costs cannot be funded, which distinguishes COST Actions from research projects supported through the framework programmes of the European Union, such as Horizon 2020 and the earlier 7th Framework Programme (FP7) for Research and Technological Development. The networking character of COST Actions is paramount. Despite the lack of research funding, COST Actions have nonetheless a clear scientific focus that guides work conducted in the course of all activities. COST takes a bottom-up approach to the selection of proposals for funding: any kind of scientific objectives held by an international group of researchers may compete for support, if it fits within the COST implementation rules. When accepted, a proposal is transformed into a Memorandum of Understanding (MoU) and is signed by all participating countries. This document defines the objectives, programme of work, its milestones and measures to be implemented by the Action. The summary of the COSCH MoU (2012, p. 3) reads:

> True, precise and complete documentation of artefacts is essential for conservation and preservation of our cultural heritage (CH). By ensuring access to the best possible documentation of artefacts we are contributing to the enhanced understanding of material CH and help its long-term preservation. We are all responsible for ensuring that this heritage is

> passed on to future generations. Documentation of CH involves researchers, scientists and professionals from multiple disciplines and industries. There is a need to promote research, development and application of non-contact optical measurement techniques (spectral and spatial) adapted to the needs of heritage documentation on a concerted European level, in order to protect, preserve, analyse, understand, model, virtually reproduce, document and publish important CH in Europe and beyond. Research in this field typically relies on nationally-funded projects with little interaction between stakeholders. This Action will provide a stimulating framework for articulating and clarifying problems, sharing solutions and skills, standardising methodologies and protocols, encouraging a common understanding, widening applications and dissemination. The Action will foster open standards for state-of-the-art documentation of CH. It will simplify the usage of high-resolution optical techniques in CH and define good practice and stimulate research.

COSCH represents four years of intense interdisciplinary work, to the benefit of our common cultural heritage, aimed at optimizing its documentation through a better understanding of technology, and its dependencies on the questions and requirements of specific applications. Exemplary case studies in applied technology, in accordance with identified guiding research questions, are the main subject of this book. They represent the practical work which has been conducted in order to meet the COSCH objectives.

Frank Boochs
COSCH Chairman