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# Visual Heritage in the Digital Age

 Springer

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# Foreword

## Digital Heritage: Agora and Agility

Subject disciplines are the building blocks of the academy. From the orderings of the trivium and quadrivium in classical antiquity, to the presence of divinity, natural philosophy, physick and law in the pre-modern era, and from the emergence of the classical sciences in the enlightenment, to the explosion of professional disciplines and the diversification of the humanities and social sciences in the twentieth century it is disciplinary communities—subject disciplines—that have been one of the most visible constituents of scholarship. Today, many of the academy’s university curricula, library classifications, research council panels and learned societies retain and perpetuate the differentiations and demarcations of these individual subject disciplines. And, at their centre, each of these disciplines typically preserve their own canon of key works, their own common grammar of research questions, as well as core sets of methodologies and even shared protocols of publishing. Offering identity, community and intellectual equipment to their member scholars, academic disciplines remain, in effect, the tribes of scholarship.

So where does that leave a subject such as digital heritage, as well as the scholars who see themselves working within it? Is digital heritage a discipline? Does it need to be? And does it matter if it is not? There are, after all, no core sets of methodologies at the centre of digital heritage, no routine forms of evidence or data. Digital heritage scholars (most of the time) are not found in one place, and, in fact, are invariably located in an array of other subject disciplines across the arts and sciences. Similarly, with its investigations and investigators so varied, the outputs and publications of digital heritage (both in style and medium) are, likewise, eclectic. Moreover, as a young subject, relative to the rest of the academy, digital heritage has not built (many) organisational norms—be they formal institutions, honours, canonical reference points, pre-eminent journals or even textbooks. Consequently, we might think digital heritage does not satisfactorily meet the usual criteria of an academic discipline as commonly understood—at least not according to orthodox benchmarks. Instead, rather than being a discipline, digital heritage presents itself to us (progressively and excitingly) as something else. What we see instead is Digital heritage as a gathering of many different academics from many different fields. It occupies the space at the confluence of a number of different research trajectories and lines of thought. Instead of a ‘discipline’ digital heritage is, rather, an ‘agora’.

Today, the agora of digital heritage has many notable characteristics. First, there is a fluidity to its shape. As technological invention changes (and with it, responsively, the professional agendas, government policies and funding opportunities) so the spotlight of interest and activity within digital heritage likewise shifts; the last 15 years alone have been testimony to some substantial alterations to the main headline discourse within the subject—from digitisation, to social media, to linked data, to mobile, to gameification, to augmented reality, to 3D printing, to the internet of things... One consequence of this moving story of digital heritage is the ebbing and flowing of the particular expertise drawn into its domain; rather than being permanently resident, experts might only pass through the agora of digital heritage, as and when their expertise becomes relevant.

Another characteristic of digital heritage is its openness to collaboration. Populated by multiple disciplines, and being as much about critical reflection as about practical and technical operation, the research partnerships between academics, as well as between academics and non-academic actors, have become a distinguishing mark of digital heritage activity. These are frequently partnerships not just between academic and heritage organisations, but also with commercial companies—if not the triple helix of all three. This culture of collaboration has also cultivated within the agora an extended definition of expertise. With no single centre to the subject area, and without the hierarchies that characterise some other academic disciplines, digital heritage projects operate in a professional landscape in which the principle of the ensemble thrives, in which (holistically) research and development relies upon mutual support and respect to achieve its goals. And it is digital heritage's culture of intellectual generosity that, in turn, allows approaches such as open publishing, open innovation and open data to flourish within it.

And yet, today, digital heritage (plastic, collaborative and open; an agora rather than a discipline) has the potential to develop further—in two areas in particular. First, digital heritage has the opportunity to be even more localised within its global community of research and practice. It can resist framing universal conclusions on technology and heritage, and instead acknowledge how much place, geography and cultural context matter. After all, the cultures of media usage vary internationally, as does (still) access to technology, and (not least) the relative position of heritage organisations around the world in their respective digital journeys. Research and practice in this area can display a sensibility to these contextual differences, being prepared—if necessary—to write a local theory of digital heritage.

Secondly, digital heritage has the opportunity to harness its own inherent agility. With no disciplinary etiquette to observe, no canonical practice to revere, no orthodox methodologies to reuse, digital heritage can respond, expand and (if necessary) contract to its world accordingly. With a confidence to be agile, digital heritage should be able to challenge itself, and even question its own function and role—especially as we enter a postdigital condition where technology is becoming more naturalised within our heritage organisation, to the point where it may even become inappropriate to reflect at all on something called 'digital'.

But whatever shape it takes next, whichever issues and ideas dominate its discourse, and whoever chooses to offer their expertise and disciplinary perspective to its activity, digital heritage offers a vision of the future of scholarship in the twenty-first century. Its intellectual agility and its place as an agora (rather than as closed discipline) position digital heritage as a maquette of what the wider academy can become.

Leicester, 2013

Dr. Ross Parry

**Dr. Ross Parry** is a Senior Lecturer in the School of Museum Studies and Academic Director for College of Arts, Humanities, and Law at the University of Leicester. From 2008 to 2011, he was elected Chair of the National Museums Computer Group, and in 2009 was made a Tate Research Fellow. He is currently Chair of Trustees for the Jodi Mattes Trust (for accessible digital culture), and sits on the national JISC Content Advisory Group. In 2012, he was Visiting Professor at the Danish Research Centre on Education and Advanced Media Materials at the University of Southern Denmark. He is the author of 'Recoding the Museum' (Routledge 2007), the first major history of museum computing, and in 2010 published 'Museums in a Digital Age' (Routledge).

## Editors' Note

Heritage in the digital age is frequently a visual domain and access to visual interfaces, at a variety of sizes and scales, is often required to support the work and research of heritage practitioners. In this context, there is not surprisingly, a focus on visualisation in many of the contributions within the present volume. Whilst the collection of chapters presented here provides a rich source of visual materials for study, extra materials including videos or supporting imagery that could not be included within the printed text can be accessed through the SpringerExtras portal.

The chapter “Resolving the Carving: The Application of Laser-scanning in Reconstructing a Viking Cross from Neston, Cheshire” has associated images of the 3D scan of the Neston Cross from various positions, detailing the joining fragments, details of the damage to the stone fragments, cable moulding of the edges, a digitally decimated 3D model that demonstrate how the angling of light on the scanned surface changes the visible detail on the stone.

The chapter “Simulation and Visualisation of Agent Survival and Settlement Behaviours in the Hunter-Gatherer Colonisation of Mesolithic Landscapes” is accompanied by a video that demonstrates some of the agent behaviours outlined in the chapter. The video capture of the simulation and visualisation shows multiple views of agents roaming the landscape, leaving resource markers behind which indicates the availability of food and potential settlement areas based on the resource and settlement equations formulated in the text. In the latter part of the video, agents build houses after a settlement map has been constructed (within the ‘memory’ of the agents) at an area that has the highest score (safety, food and resources): they then collect resources from within the area. The second part of the video shows an interactive version of the software adapted from the simulation for The Royal Society Summer Science Exhibition at Carlton House Terrace, London, 3–8 July 2012.

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The establishment of the Digital Humanities Hub and the associated research at Birmingham, supported by the European Regional Development Fund, Michael Chowen, Mark Glatman, the Garfield Weston Foundation, Carol Kennedy, and The Leverhulme Trust provided the infrastructure and framework underpinning the world-class, cross-disciplinary research that made much of this book possible. The debt to these individuals and Institutions is gratefully acknowledged.

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## Contributors

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computer engineering, and is a reviewer for the IEEE Transactions on Geoscience and Remote Sensing. He is employed at the Scientific Research Centre of the Slovenian Academy of Sciences and Arts, Centre of Excellence for Space Sciences and Technologies, and as an associate Professor at the University of Ljubljana, where he teaches several courses on remote sensing and satellite image processing. He is the president of the Scientific Council of the Institute of Anthropological and Spatial Studies at the ZRC SAZU.

**Dr. Deborah Maxwell** is a member of the design team on the SerenA project (based at Duncan of Jordanstone College of Art and Design, University of Dundee) and a research fellow on the AHRC-funded Design in Action Knowledge Exchange Hub, Edinburgh College of Art, University of Edinburgh. Deborah is interested in the ways people interact with and reshape technology, and is investigating the ways in which interface design, storytelling and data visualisation can impact users' perceptions of quality, relevance and sense of engagement with content. Her research background includes work with rural communities and traditional storytellers, where digital technology is applied, but not viewed as a panacea.

**Dr. Aron Mazel** is a Senior Lecturer and Director of the International Centre for Cultural and Heritage Studies, Newcastle University, UK. Aron was the principle investigator on the Rock Art on Mobile Phones project (2010–2011). Before moving to the UK in 2002, Aron had a 25-year career in archaeological research and heritage and museum management in South Africa. Posts he held in South Africa included Assistant Director of the Natal Museum (1994–1997) and Director of the South African Cultural History Museum (1998–2002). Between 2002 and 2004, Aron undertook the Beckensall Northumberland Rock Art Website Project, which won the 2006 Channel 4 ICT British Archaeological Award. Aron's research interests include the management and interpretation of tangible and intangible heritage; museum history; the construction of the hunter-gatherer past; dating of rock art; and Northumberland rock art. Recent book publications include *Tracks in a Mountain Range: exploring of the history of the uKhahlamba-Drakensberg* (2007, with John Wright), *Art as Metaphor: The Prehistoric Rock-Art of Britain* (2007, co-edited with George Nash and Clive Waddington), and *uKhahlamba: Umlando wezintaba zoKhahlamba/History of the uKhahlamba* (2012, with John Wright).

**Dr. Ante Milosević** Born and raised in Sinj, Croatia. Milosević studied Archaeology and the History of Art at the Faculty of Philosophy in the University of Split. Graduating in 1976 he also undertook postgraduate studies in the Department and was awarded a doctorate in 2005. From 1977 he was the Director of the Museum of the Cetina region in Sinj and then, from 1994 to 2005, was Director of the Museum of Croatian Archaeological Monuments in Split where he now works as a senior keeper. During this time he has published extensively in Croatian and international journals with much of his work being dedicated early medieval archaeology and art history. Milosević has published several books and

has edited journals including *Zbornika Cetinske krajine* (1979–1989) i *Starohrvatske prosvjete* (1994–2004.), and organized or led more than 40 national and international symposia and two international projects. Most notable is his exhibition “Croatsians and Carolingians” (2000) as part of the international project “Charles the Great—Creation of Europe”.

**Helen Moulden** is a Research Associate in Artefact Scanning, Modeling and Reconstruction for IBM VISTA at the University of Birmingham. She specialises in the application of 3D scanning technologies (both object and terrestrial), with particular focus on the convergence of 3D object representations and digital archiving as a means to enhance accessibility and research practices. Her project portfolio includes the Eton Myers Virtual Museum Project, the Jewel of Muscat Comparative Analysis Project and the Stabiaen Graffiti Project. Recent work involves the large scale 3D digitisation of Chedworth Roman Villa to inform research into site phasing.

**Dr. Philip Murgatroyd** is a Research Associate at the University of Birmingham, currently visualising large geophysical datasets as part of the GG-Top project. His Ph.D. was completed in 2012 as part of the Medieval Warfare on the Grid project and focussed on the use of agent-based modeling in the study of medieval military logistics, using the march of the Byzantine army to the Battle of Manzikert as a case study. He has previously excavated in, and produced 3D models of, Pompeiiian houses as part of the Anglo-American Project in Pompeii and studied at the universities of York and Bradford. Prior to that he did almost every conceivable job within the computer industry. His research interests include simulation within archaeology, military logistics, 3D modeling, Roman domestic archaeology and data visualisation.

**Kieron Niven** is a Digital Archivist at the Archaeology Data Service. He has recently worked on a two-year project revising the ADS Guides to Good Practice and is editor of a forthcoming introduction to digital archiving in archaeology. He was the convenor of the Forum for Information Standards in Heritage (FISH) for several years.

**Peter Pehani** holds a B.Sc. in Physics and is employed at the Scientific Research Centre of the Slovenian Academy of Sciences and Arts. He was primarily developer of Web mapping applications based on the Internet GIS technology. He has prepared a publicly accessible Interactive map of Slovenia presenting the ZRC SAZU databases, interactive map of Karst region (in Slovene language only) as a part of Fabrica project, and a summary of archaeological reconnaissance in southeastern Campeche, Mexico. Other Web GIS-based applications he develops for specific needs of particular institutes or projects. Lately, he is involved in various phases of satellite data processing, from orthorectification to products development for the fields: disaster management, classification and visualization.

**Eleanor Ramsey** is a Research Associate at the IBM VISTA Centre in the Institute of Archaeology and Antiquity, specialising in GIS analysis and marine

geophysical interpretation. She has a background in commercial archaeology, and her recent project portfolio includes the Humber Regional Environmental Characterisation, the West Coast Palaeolandscapes Project and the Southern North Sea/ Qatar project funded by NOAA. Current projects include the Adriatic Islands Project and the Royal Society Summer Science Exhibition. Personal research interests include the use of GIS to analyse documentary and cartographic sources from the 19th century to explore urban development and industrial change.

**Professor Julian Richards** is Professor of Archaeology and Director of the Centre for Digital Heritage at the University of York. His direct involvement in archaeological computing began in 1980 when he started his Ph.D. research studying pre-Christian Anglo-Saxon burial ritual using the computing power of an ICL mainframe and an early Z80 micro-computer. In 1985, he co-authored the first textbook in archaeological computing for Cambridge University Press, and has subsequently written numerous papers and edited a number of books on the applications of information technology in archaeology. Since 1996, he has been Director of the Archaeology Data Service and Co-Director of the e-journal *Internet Archaeology*. He is a member of the Board of Directors of Digital Antiquity, in the United States. Apart from computer applications his research interests focus on Anglo-Saxons and Vikings. He has directed excavations of Anglo-Saxon and Viking settlements at Wharram Percy and Cottam, and of the Viking cemetery at Heath Wood, Ingleby, and he is currently co-directing a project to investigate the site of the winter camp of the Viking Great Army at Torksey. He is author of *Viking Age England*, now in its third edition, and of OUP's *Very Short Introduction to Vikings*.

**Dr. Cettina Santagati** is Building Engineer (1997, University of Catania). In 2003, she got her Ph.D. degree in "Drawing and Survey of architectural heritage" at University of Rome "La Sapienza". Since 1999 she collaborates to the research's activities of the Laboratory of Architectural Photogrammetry and Survey "Luigi Andreozzi" at University of Catania. In the 2012–2013 academic years she is lecturer at Faculty of Architecture (University of Catania, site Syracuse) and at Faculty of Engineering (University of Catania). From 2010 to 2011 she holds a post Ph.D. research grant at Faculty of Engineering of University of Catania. Her research focuses on: Architectural and archaeological survey aimed at the knowledge, representation and preservation of built heritage; Graphical analysis of architecture; Survey of historic urban fabric and studies of historical and present maps; CAD and Descriptive Geometry. Since July 2012 she is the head of the Section "Innovative technologies for surveying and 3D reconstruction" of the Department of Communication, Interactive Graphics and Augmented Reality of IEMEST (Euro Mediterranean Institute of Science and Technology), Palermo. She is author and co-author of 60 scientific publications (books, book chapters, article in Journals and International proceedings) for the most part presented at International Conferences.

**John Sear** is both the co-founder of wallFour and Senior Technical Developer at University of Birmingham's Digital Cultural Heritage Demonstrator (DHD) Project. wallFour are internationally acclaimed for bringing technology from the videogame sector to live events. Their largest world to data Renga, a feature length 100 player experience for cinema, lies on the convergence between film and games and has been featured at South by Southwest, New York International Film Festival and the Toronto International film festival. DHD works with key heritage organisations and aims to demonstrate how collaborative projects exploring the use of digital technology with the Cultural and Heritage sector can develop new markets for business. Both of these roles require John to work with new technology in order to design and develop unique collaborative crowd experiences. John started his professional academic career at the University of Manchester where he combined teaching with research. He was a member of the High Performance Computing group studying for a Ph.D. in Computer Vision while also teaching at undergraduate level. From here he joined Codemasters where he worked on Massively Multiplayer Online Role-Play games. He returned to academia, combining both his industrial and academic backgrounds to develop a ground breaking degree course, specialising in the advanced software engineering required for large-scale triple-A game development. The course received recognition from industry for its focused approach to industry and employability. During his 7 years as Programme Leader, John also ran his own digital download games studio specialising in games for iOS devices.

**Dr. Gareth Sears** is Senior Lecturer in Roman History at the University of Birmingham. He works on Roman urbanism, particularly in North Africa, and the Christianisation of the city and society. He is the author of *The Cities of Roman Africa* and *The City in the Roman West* with Ray Laurence and Simon Esmonde Cleary. Most recently he has edited *Written Space in the Latin West* with Peter Keegan and Ray Laurence. He has co-directed projects in Cyrene, Libya and Dalmatia, Croatia.

**Dr. Armin Schmidt** is an Archaeological Geophysicist and IT pioneer, initially trained as a physicist. He has applied novel methods of geophysical prospection worldwide from Ecuador to Iran, Nepal and Japan, working as a researcher and UNESCO consultant. He is Founder of the International Society for Archaeological Prospection (ISAP), as well as co-founder of the Archaeology Data Service (ADS) and of the Bradford Centre for Archaeological Prospection (B-CAP). His specialisations are in near-surface geophysics for archaeological prospection and geoarchaeology; geodata processing; and computer applications in archaeology. He has written books on geophysical data in archaeology, and on magnetometer and earth resistance surveys for archaeologists. After obtaining a physics Ph.D. from the RWTH Aachen, Germany, he worked in the Department of Archaeological Sciences, University of Bradford (UK) from 1993 to 2010 as a Senior Lecturer. In 2010 he founded the company GeodataWIZ Ltd, which specialises in the advanced processing and visualisation of geodata. He holds honorary

appointments with the archaeology departments of University of Bradford and Durham University.

**Dr. Kate Sharpe** is a Research Associate at Durham University, England. Her research focuses on prehistoric rock-art in the British landscape. She has also led community recording projects, resulting in the England's Rock Art database, and co-edited 'Carving a Future for British Rock Art. New directions for research, management, and presentation' (Oxbow Books, 2010).

**Lawrence Shaw** is the Heritage Mapping and Data Officer of the New Forest National Park Authority. Although heavily focused on the use of remote sensing to identify and manage archaeological monuments found in the National Park, Lawrence has always been interested in looking at landscapes as a whole and has been involved in a number of leading landscape projects including the Stonehenge Riverside Project and the Rapa Nui; Landscapes of Construction Project. His interest in modern technology, in particular that of mobile devices, led to his undertaking of master's dissertation at the University of Birmingham, the results of which can be seen in this book. To date he is currently looking at the use of tablet devices to aid with survey and LiDAR interpretation whilst undertaking ground verification work.

**Joseph Sivell** is a digital experience designer who has worked in museums and the heritage sector for many years. He specialises in creative concepts, digital storytelling and e-learning. His background covers both the technical and design side of digital media. He read engineering at Cambridge University and design and production of interactive multimedia cultural databases at Portsmouth school of design. After several years of working for digital media agencies in the tourism and heritage sector Joseph moved to the British Museum where he led the Educational Multimedia Unit for nine years. This multi disciplinary team was set up to devise innovative uses of new media for museum collections and to explore its potential for learning and audience engagement. Joseph subsequently set up The Field Unit, an umbrella for a group of digital creatives and consultants who work together in the wider heritage and education sectors. He is now Creative Director on the Digital Heritage Demonstrator project at the University of Birmingham. Current projects include touch tables for the Staffordshire hoard, Birmingham History Galleries and the Hive, Worcester.

**Tom Sparrow** is currently a research assistant at the University of Bradford working on the 'Digitised Diseases', a JISC funded project digitising human remains and 'Visualising Animal Hard Tissues', an AHRC funded project digitising animal hard tissues. He has worked in a variety of archaeological jobs both in the research and commercial sectors. He works as a data capture and processing specialist, working on many types of landscape and object-based data from many research fields ranging from geophysical data to CT data. He also designs and builds bespoke hardware and software set-ups for use in the capture of data and imagery.

**Dr. Caroline Sturdy Colls** is a Lecturer in Forensic Investigation at Staffordshire University and practicing Forensic Archaeological Specialist for various Police Forces across the UK. Her research focuses on the application of interdisciplinary approaches to the investigation of Holocaust landscapes and the establishment of a sub-discipline of Archaeology that solely examines this period of history. In particular, Caroline has developed a non-invasive methodology which allows the scientific, ethical and religious aspects associated with studies of this period to be upheld whilst allowing fieldwork, education, visualisation and dissemination to take place. Caroline has worked across Europe, including completing the first archaeological survey at the former extermination camp at Treblinka, Poland, as well as Alderney in the Channel Islands and the former Semlin Judenlager and Anhaltelager in Belgrade, Serbia. Caroline is also a member of the Scientific Advisory Council for Kamp Westerbork Archaeological Project in The Netherlands and an active member of a number of research groups in Holocaust and forensic archaeology, including Buried War Pasts, the Atlantic Wall Research Group and the Burial Research Group at Staffordshire University.

**Professor Harold Thwaites** is currently Consultant Professor at University of Malaya and Director of the Centre for Creative Content and Digital Innovation. Originally from Canada, he was a tenured Associate Professor of the Communication Studies Department at Concordia University in Montreal for 31 years and Dean of the Faculty of Creative Multimedia at Multimedia University, Malaysia from 2006 to 2012. He is now Adjunct Associate Professor. Thwaites has served as a government and industry consultant, while his research and teaching comprised media production, information design, digital heritage, biocybernetic research, and 3-D spatial media. He was the first overseas researcher at NHK Science and Technical Research Labs in Tokyo specializing in 3D HDTV, in addition to being the recipient of a Fellowship from the Telecommunications Advancement Organization of Japan. While in Montreal he was a founding member of the Hexagram Institute and was Research Director for Immersive Environments, VR and Audience. His most recent award is Honorary Senior Research Fellow, Department of Antiquity and Archaeology, at University of Birmingham, UK.

**David Tomčík** is a student at the Institute of New Technologies and Applied Informatics in the Technical University of Liberec. His research involves the application of novel technologies for design of 3D models with reference to their coordinate space. He is primarily interested in creation of processes for the creation of models and data conversions using freeware tools. David is currently working on his Ph.D. thesis although he is also working as a commercial IT analyst.

**Dr. Roger H. White** is an archaeologist who has worked for much of his academic life on the Roman town of Wroxeter in Shropshire. He has broad interests in the archaeology of the later Roman Empire and the early Middle Ages, and at the transition between the two. Since 2000, he has been Academic Director at Ironbridge Institute and has increasingly focused on heritage and its management as

well as looking at the archaeology of the industrial age. He also has strong interests in material culture and its study. He has an active engagement in the archaeology sector through membership of the English Heritage Advisory Committee and his editorship of the journal *The Historic Environment. Policy and Practice*.

**Dr. Sandra I. Woolley** is a lecturer in the School of Electronic, Electrical and Computer Engineering at The University of Birmingham, U.K. She trained as a graduate apprentice engineer with Lucas Aerospace, U.K. and received the Ph.D. degree in Electronic Engineering from The University of Manchester in 1994 before working as a researcher at the National Institute of Standards and Technology (NIST), Maryland, U.S.A. She has lectured students in a variety of subjects, including microcontrollers, multimedia and computer networking. She has previously researched digital imaging and data storage, and her current research interests include aspects of e-health and, in particular, new applications in rehabilitation and assistive technology. She also works on multidisciplinary research in cultural heritage and has enjoyed contributing to two Leverhulme funded projects related to the digital heritage of cuneiform tablets.