Editorial

Giorgos Papantoniou*, Apostolos Sarris, Christine E. Morris, Athanasios K. Vionis

Digital Humanities and Ritual Space: A Reappraisal

<https://doi.org/10.1515/opar-2020-0103>

Received March 31, 2020; accepted March 31, 2020

Abstract: In this editorial article for the Special Issue on *Unlocking Sacred Landscapes: Digital Humanities and Ritual Space*, we introduce the applicability of digital humanities to the study of ritual space. The Issue focuses on digital approaches both to ritual space and to artefacts relating to ritual practice and cult. The terms ritual and cult are used broadly to include sanctuaries, temples and churches, as well as the domestic and funerary spheres of life. We include contributions with a strong methodological focus on computational developments, digitisation processes and spatial analyses. Although the main focus of the *Unlocking Sacred Landscapes* (UnSaLa) Research Network is the Mediterranean region, we have also encouraged colleagues working in other areas of the world to contribute to this volume, with a view to stimulating wider methodological dialogues and comparative approaches. The chronological span ranges from prehistory to the recent past, and includes cultural heritage management.

1 Introduction

Digital humanities comprises a field that has evolved through several genealogies of approaches, previously known as ‘humanities computing’, ‘humanist informatics’ or ‘digital resources in the humanities’, and it provides a platform for the dialogue between the humanities (in their broader sense) and computer applications, such as digital data use and storage, data modelling, Information Technologies (IT) or geo-temporal visualisation (Nyhan, Terras, & Vanhoutte, 2013, pp. 1–5; Neilson, Levenberg, & Rheams, 2018, pp. 1–4). Living in a digital age, usually referred to as ‘information era’, within which the preservation of human values has become of utmost importance (Keen, 2018), this fusion between social sciences and computational methods/mathematics was unavoidable (Le Deuff, 2018). This process led to the convergence of new computational techniques and visualisation technologies in the arts and humanities and to the development of fresh approaches to the study of new as well as traditional corpora (Berry, 2012).

This is obviously not to delimit digital humanities and establish definite boundaries to this expanding field by providing a fossilising definition, as a number of published works have already shown (Terras, 2006; Terras, Nyhan, & Vanhoutte, 2013; Schreibman, Siemens, & Unsworth, 2016; Levenberg, Neilson,

Article note: This article is a part of the Special Issue on *Unlocking Sacred Landscapes: Digital Humanities and Ritual Space*, edited by Giorgos Papantoniou, Apostolos Sarris, Christine E. Morris & Athanasios K. Vionis

***Corresponding author: Giorgos Papantoniou**, Senior Research Fellow, Archaeological Research Unit, Department of History and Archaeology, University of Cyprus, P.O.Box 20537, 1678 Nicosia, Cyprus, E-mail: papantoniou.giorgos@ucy.ac.cy

Apostolos Sarris, Sylvia Ioannou Chair in Digital Humanities, Archaeological Research Unit, Department of History and Archaeology, University of Cyprus, P.O.Box 20537, 1678 Nicosia, Cyprus, E-mail: sarris.apostolos@ucy.ac.cy

Christine E. Morris, Andrew A. David Associate Professor in Greek Archaeology and History, Department of Classics, Trinity College Dublin, Dublin 2, Ireland, E-mail: cmorris@tcd.ie

Athanasios K. Vionis, Associate Professor of Byzantine Archaeology and Art, Archaeological Research Unit, Department of History and Archaeology, University of Cyprus, P.O.Box 20537, 1678 Nicosia, Cyprus, E-mail: vionis@ucy.ac.cy

& Rheams, 2018; Edmond, 2020). By moving the emphasis from ‘computing’ to ‘humanities’, the creative possibilities of digital technologies can now be summoned to strengthen the capacity of studying, analysing, visualising and interpreting a range of cultural materials and practices, through the making of virtual worlds, mapping and geospatial analysis, graphical and network analysis, data modelling, text encoding, online data sharing, etc. (Schreibman, Siemens, & Unsworth, 2016; Levenberg, Neilson, & Rheams, 2018; Flanders & Jannidis, 2019). In this respect, one could argue that we are gradually moving towards a digital cultural heritage era. This does not mean we can transform into purely ‘digital scientists’ solely by bringing cultural heritage experiences into the public domain, be that cultural atlases, museum collections and digital archives (cf. Kenderdine, 2016, pp. 22–24). Essentially, we remain what we are by discipline (even if this is also disputed today due to the interdisciplinary nature of most of our fields), by providing an ‘alter-ego’ in our research and by performing an interactive narrative and encompassing embodiment through cultural heritage visualisation.

Digital humanities arose from the research community’s need to try to tame the ‘Big Data’ or large amounts of data such as text, images, videos and metadata (Levenberg, Neilson, & Rheams, 2018, pp. 319–320) and to analyse the exponential increase of information that is created in the different fields of humanities; in other words, information that cannot be easily mastered, analysed or comprehended in the conventional ways. Actually, digital technologies aim to transform Big Data into useful data, namely Smart Data (Zeng, 2017; Iafrate, 2015, p. 13). Smart Data can cope with the incoherencies, fragmentation and complexity of the original information, leading to a more systematic and organic synthesis of the data. Digital technologies aim to help us to comprehend humanities in ways that are different from the mainstream, to construct new narratives, and to generate new knowledge. Crossing the borders among sciences, digital humanities contribute and transform the Big Data to Smart Questions and Theories (Sarris, 2019). In this sense, computational methods, information technologies and digital media have provided us alternative means of communication, visibility, fusion and diffusion of information and ideas. They have transformed the way of conducting and supporting research, coding and decoding evidence, and of extracting useful statistics and results. Irrespective of whether we are dealing with texts, language, images, music, historical events or archaeological data, computation methods have shaped the research landscape, by providing different dimensions to the analysis of all of the above. Digital mapping and spatial modelling, cultural analytics, text mining, data visualisation and connectivity, knowledge representation and computational thinking are all included within the arena of digital humanities, providing a common interface for the cross-fertilisation and communication among the various topics.

2 The *Unlocking Sacred Landscapes* (UnSaLa) Network

It was within this framework that the *Unlocking Sacred Landscapes* (UnSaLa) Research Network was established in 2015, in the context of an individual research project entitled *Unlocking Sacred Landscapes: A Holistic Approach to Cypriot Sanctuaries and Religion*, originally funded by the Irish Research Council and the Marie Curie Actions of the European Commission. This larger collaborative Network aimed to promote dialogue between different approaches and between scholars working on the sacred landscapes of different periods and in different parts of the Mediterranean region. More specifically, UnSaLa is an interdisciplinary Network concerned with the diachronic study of the temporality, spatiality and materiality of Mediterranean sacred landscapes in general. The Network initiated its activities based on an agreement of collaboration between the Department of Classics of Trinity College Dublin, the Laboratory of Geophysical-Satellite Remote Sensing and Archaeo-environment (GeoSat ReSeArch Lab) of the Foundation of Research and Technology – Hellas (FORTH), and the Archaeological Research Unit of the University of Cyprus. From 2015 to 2018, the project received funding from the Research Training Group *Archaeology of Pre-Modern Economies*, a joint research programme of the Universities of Bonn and Cologne, funded by the Deutschen Forschungsgemeinschaft (DFG). More recently, UnSaLa moved to the University of Cyprus, where it is currently funded by the European Regional Development Fund and the Republic of Cyprus through the Research and Innovation Foundation to continue its activities and collaborate closely with the *Settled and*

Sacred Landscapes of Cyprus archaeological project (SeSaLaC) (cf. Papantoniou, Morris, & Vionis, 2019; Papantoniou, 2019, p. 6, for more details on the mission of the Network).

Archaeological study, mainly in areas outside the Mediterranean, has turned to geographical and phenomenological approaches as a route towards understanding how knowledge and power are implicated in the creation of (sacred) landscapes and (ritual) space. The organisation of space should be regarded as the merging of the material with the symbolic, as socially constructed and experienced, and as shaped by all aspects of human life – social, political, economic and ritual. While the employment of geographic applications (mainly via Geographic Information Systems – GIS) in modelling human behaviour (cf. Lake, 2007; van Leusen, 2011; Nakoinz & Knitter, 2016) or new technologies for capturing the dynamics of cultural landscapes is constantly emerging and developing in the study of Mediterranean landscapes and spaces (cf. Paliou & Knight, 2013; Paliou, Lieberwirth, & Polla, 2014; Sarris et al., 2015; Giesekeing, 2018), the employment of approaches that give agency to the archaeo-environment and nature remain relatively underdeveloped (cf. Plumwood, 2006), as, perhaps to a lesser extent, are experiential approaches when it comes to religious landscapes and space. Since the encapsulation of the idea of establishing the UnSaLa Network, digital humanities had a major role and impact in our thinking. As the case studies in this Special Issue, as well as the first UnSaLa volume (Papantoniou, Morris, & Vionis, 2019), demonstrate, such approaches are becoming part of the interpretative toolkit of Mediterranean ritual and religious studies. The editors' research engagement with digital humanities (discussed further below) provides a means through which to illustrate the range and applicability of digital approaches to the study of sacred landscapes and ritual space.

Giorgos Papantoniou has worked on the digitisation of artefacts (as has Christine Morris, see below). In particular, the digitisation (next to chemical and statistical analyses) of figurines of deities and other types from the House of Orpheus in Nea Paphos (in collaboration with the Cyprus University of Technology and the Thetis Authentics in Athens) has been used to reproduce digital and actual replicas. These gave us the opportunity to reconstruct at an experimental level the *chaîne opératoire* of the production of Hellenistic and Roman terracottas (Fig. 1). The development of educational programmes (based on the aforementioned reconstructions) contribute to teaching at primary and secondary education, as well as at University level, while digital tools and education entertainment (or 'edutainment') offer the opportunity to interact with the virtual objects, stimulating the learning process (Papantoniou et al., 2012, 2017; Papantoniou, Michaelides, & Dikomitou-Eliadou, 2019) (Fig. 2).

Figure 1: (a) Smoothing surfaces for the creation of copies and new moulds (both 3D and physical). (b) Using a 3D-printed mould to reproduce a copy of a terracotta figurine.

Papantoniou has also been actively involved in the development of methodologies concerning the applicability of GIS approaches on sacred landscapes, in an effort to understand better the territoriality of the Cypro-Archaic and Cypro-Classical polities. The mapping of the Cypro-Archaic sanctuaries, for example, clearly shows that extra-urban shrines effectively, and perhaps metaphorically, created rings (or zones) of sites demarcating the various polities. Whether specific sanctuaries lying far away from the polities' urban horizons were intentionally founded to mark boundaries remains hypothetical and problematic. In the archaeological literature, specific remote cult sites have been termed 'frontier sanctuaries'. Environmental and GIS analyses employed recently in the context of UnSaLa, reinforce this argument about

the territoriality of Iron Age Cypriot sanctuaries, placing them at the same time on economic routes related to the island's copper industry and arable land for agricultural production (Papantoniou & Bourogiannis, 2018; Papantoniou & Kyriakou, 2018; Papantoniou & Vionis, 2018; Papantoniou, 2019) (Fig. 3).

Figure 2: Virtual reality view of a terracotta figurine representing Aphrodite.

Figure 3: Viewshed analysis from the Agia Irini sanctuary; digital data courtesy of the Geological Survey Department, Cyprus (GIS analysis by Charalambos Paraskeva).

Through the employment of remote sensing techniques, Apostolos Sarris and his team at the GeoSat ReSeArch Lab have been involved in a number of campaigns studying the dynamics of ritual or sacred landscapes. Obviously, geophysical techniques applied in a manifold way (Sarris, 2013) have played a crucial role for the investigation of a wide spectrum of sacred places spanning from temples to cemeteries (Sarris & Papadopoulos, 2013). There are, of course, no recipes for the mapping and detection of them, as each one has very distinct characteristics. We can have small inhumation and cremation graves, rock cut tombs (Fig. 4) and monumental tumuli; each one of them requires a different strategy of exploration (Sarris et al., 2001a; Sarris et al., 20016a; Papadopoulos et al., 2019). There are cases where the survey is shallow and even above the existing architecture, as the case of the Vranas-Marathon tumuli (Fig. 4) (Sarris et al., 2016b), or cases in which we need to have a large penetration depth, as in the exploration of the Old Jewish cemetery of Alexandria where soil resistance mapping was targeted at 10m depth (Sarris et al., 2001b). The GPR and microgravity techniques, together with ERT, have been proved to be extremely successful in the detection of large rock-cut, chamber and tholos tombs as in the case of the Roman cemetery at Kenchreai in Corinth (Sarris et al., 2007). The particular methods are also effective within urban environments, buildings and monuments, as was the case of the application of ERT and GPR at the Agios Andreas church in Loutraki (Papadopoulos & Sarris, 2011) or in the main square of Rethymno (Mikrasiaton Square) mapping the relics of the monastery of St. Frangiskos (Fig. 4) (Papadopoulos et al., 2012). This was very similar to the quest of the grave of Andreas Vesalius in Zakynthos, which combined GIS rectification of historical maps and geophysical prospection within the city that had been completely destructed by the 1953 earthquake (Sarris et al., 2019). Similar work can also be done by looking at historical aerial and satellite images and historical plans. GIS spatial analyses have been used to analyse the location of the tombs, churches, peak sanctuaries (Fig. 5) and cemeteries with respect to their surroundings (Soetens et al., 2008, Charitopoulos et al., 2009; Sarris and Dederix, 2014; Sarris et al., 2015). These kind of applications have not left out of our attention the more recent and historical cemeteries or monasteries (Fig. 5) (Johannson et al., 2007). A number of the above have been also included in Web databases and WEB_GIS applications that are accessible to the scientific community and the wider public.

Christine Morris, working in collaboration with Alan Peatfield, and more recently Brendan O'Neill, has applied digital tools to a specific kind of ritual space, the Minoan peak sanctuaries of Bronze Age Crete. The earlier phase of work at the site of Atsipadhes Korakias has involved the development of an intra-site GIS. As the excavations took place in 1989, the project was not 'born digital' but became so with the creation of a relational database (holding full details of every figurine fragment including its excavated position on the site). This data interfaces with a GIS, so that it is possible to place the excavated material back virtually into its spatial context within the site (Peatfield & Morris, 2012, 2019). As a methodological tool this has been vital for effectively visualising the material and beyond that for giving us greater freedom to explore and test questions raised by the material, notably the distributions, densities and distinctive concentrations of particular kinds of figurines and indeed other object types within the site (Figs. 6, 7). Other kinds of spatial relationships also come into play such as inter-visibility between the different areas of the site (its two main terraces and the rock drop between them), and between specific parts of the site and the wider settled landscape (Peatfield & Morris, 2019; cf. Megarry, 2011, p. 417, fig. 3). Since relatively few peak sanctuaries have had the benefit of such detailed excavation (much material comes from older, partial excavations) such rich contextual data affords an important opportunity to consider the spatial dynamics of ritual. It is worth noting here also the range of interesting work done using GIS tools such as viewshed analysis and cost-surface to look at the wider peak sanctuary landscapes: locations, inter-visibility, travel routes etc (Soetens et al., 2008; Megarry, 2011, 2012).

Morris, Peatfield and O'Neill (2018, 2019) have also developed *Figures in 3D* project, which uses 3D laser scanning (Fig. 8), together with 3D printing, as a method of recording, studying and, ultimately, sharing data about the clay figurines – mainly of humans, animals and anatomical body parts – which are recovered in large quantities from peak sanctuaries. This work has been expanded to include the material from the *East Cretan Peak Sanctuaries Project* (ECPSP), which seeks to publish legacy material in collaboration with the excavator of these sites, Costis Davaras. Like Papantoniou's collaborative project on the much later figurines from the House of Orpheus in Nea Paphos (see above), this 3D work has aided in stylistic

Figure 4: (a) Images of the excavations in a cremation grave (top) and a urn grave and pit (below) based on the magnetic survey carried out at Békés Koldus-Zug site in Hungary (Sarris et al., 20016a). (b) GPR reflection signals produced by underground rock cut Roman tombs from Axos, central Crete (Sarris & Papadopoulos, 2013). (c) Results of the GPR survey that was carried out within the area covered by tumuli I, II and III at Vranas, Marathon: left image shows the GPR depth slice at 1.40–1.50m below the surface and right image shows the diagrammatic interpretation of the suggested GPR reflectors (Sarris et al., 2016b). (d) Rectification and overlay of the 70cm GPR depth slice on the Quickbird satellite image covering the Mikrasiaton Square at the centre of Rethymno, Crete (left image). The interpretation of the GPR reflectors indicated the architectural relics of the Venetian period Saint Frangiskos monastery (Papadopoulos et al., 2012).

Figure 5: (a) Comparison of cumulative viewshed analysis of the Protopalatial and Neopalatial peak sanctuaries in Crete (Soetens et al., 2008). (b) Spatial distribution of the graves of the Muslim cemetery of Yeni Mahalle in Komotini, N. Greece. (c) Cost-surface analysis of the 17th century monasteries in the West Mirabelo region, East Crete (Johannson et al., 2007).

Figure 6: GIS map showing the distribution of figurine fragments on the site, represented as percentages within the trench areas (A: upper terrace; B: rock clefts; C-F: lower terrace).

Figure 7: GIS mapping of the overall distribution of human figurine fragments, and showing the spatial distribution of figurines performing open or closed gestures.

Figure 8: 3D laser scanning set (using NextEngine), with figurine held in position on the rotating turntable.

and technological study of the figurines (Fig. 9). The work has also prompted us to be reflective about the different ways in which archaeologists record and interpret their material, seeing digital imaging as part of a larger toolkit of representation techniques including drawing and photography (but not a replacement for them). And, more unexpectedly, it has prompted a new dialogue about ‘making’ which draws on both experimental work in clay and the data from the 3D models (Morris, Peatfield, & O’Neill, 2019). By virtue of their immediacy on the computer screen and the viewer’s ability to interact and play with the image, the 3D models make the figurine material more accessible to a wider audience, while the 3D prints offer sensory engagement with material that is typically behind the glass of the museum case or in storage (Fig. 10). Our participation in ‘Discover Research Dublin’ in 2013 and 2015 (part of European Researchers’ Night) which was aimed at the public, and especially young people, demonstrated for us the ‘edutainment’ value of digital modelling, complementing its usefulness as a tool for developing a better understanding of the figurine corpus in its ritual contexts.

Figure 9: Still from the digital model of a female figurine from Prinias (HN 5932).

Figure 10: 3D print of a clay anatomical model of a hand (held in the hand).

Figure 11: Cost-surface analysis of Middle Byzantine settlement sites in the area of Tanagra (central Greece), showing two major groups and village-community areas, i.e. Polykarpos-Thomas-Aikaterini and Nikolaos-Dimitrios-Anna (GIS analysis by Niki Kyriakou).

Athanasios Vionis, with an interest in landscape archaeology and theoretical approaches deriving from historical geography, such as ‘settlement chamber theory’ and ‘central place theory’ (Papantoniou & Vionis, 2019; Vionis & Papantoniou, 2019), has been researching settlement formation and hierarchies in the post-Roman era in the Eastern Mediterranean (5th–19th centuries), on the basis of documentary sources, archaeological data, ecological and topographic factors. Through the application of GIS analyses (e.g. cost-surface and viewshed), he was able to identify settlement hierarchies, visualise inter-site relationships (town, village, hamlet, farm) and trace the formation of village-community territorial boundaries (Fig. 11), confirming the textual record for the Middle Byzantine era in the 11th–12th centuries AD (Vionis, 2017a). This approach of reconstructing territorial patterns opened up the avenue for investigating historical processes related to the formation of power structures and the territorial imprint of Byzantine bishoprics as successors of the administrative Roman *civitates*, after Christianity became the official religion of the Eastern Roman or Byzantine Empire in the late 4th century AD. Various spatial analyses, combined with historical and archaeological evidence, showed that early Christian basilicas functioned as a conceptual ‘boundary’ or ‘territorial markers’ between bishoprics/towns in central Greece, the Aegean islands and Cyprus, served as symbols of community ownership and comprised local ‘central places’ of production and economic activities within their respective micro-regions (Vionis, 2017b; Vionis & Papantoniou, 2017). Similar attempts to place Christian basilicas and Early Medieval bishoprics in their spatial context and to examine their distribution within religious, administrative and territorial/economic networks have very recently been successfully undertaken by other scholars in continental Europe, e.g. Bavaria (cf. Winckler, 2019), and in the Eastern Mediterranean, e.g. Cyprus (cf. Kyriakou, 2019). GIS analyses, employed to

examine the distribution of religious structures on the islands of Naxos and Cyprus diachronically (Middle-Late Byzantine eras), have produced important results regarding the role of rural churches as markers of settlement under divine protection, spaces to bury the dead and promote memory and ‘liminal’ zones defining community or monastic properties (Fig. 12) (Vionis, 2019).

Figure 12: Viewshed analysis from different ‘liminal’ churches on the hills above the valley of Drymalia in Naxos, showing that this network of sacred monuments overlooks the concentration of Byzantine settlements in the valley floor, forming a conceptual boundary around this rural community (GIS analysis by Vassilis Trigkas).

SeSaLaC, the core archaeological field-project of the Network (after its base moved to the University of Cyprus), is a multi-period surface survey project in the Xeros River valley, 2500 ha in size, situated 20 km southwest of Larnaka and 5 km inland from the south coast of Cyprus in the Larnaka district (Fig. 13). The project aims to identify, map and interpret traces of pre-modern human activity in the valley in order to examine the interaction of secular and religious space with the natural environment (Papantoniou & Vionis, 2018; Vionis, 2018), using a range of informed methods of intensive field survey and digital recording. Such practices include the systematic counting of pottery densities (with the use of palmtop computers with a GPS receiver by each walker, entering georeferenced information onto a digital form designed in ArcPad) in transects comprising of squares of 150x150m and running north-south throughout our survey area, aerial photography (with the use of a UAV), micro-topographical surveys (with the use of a Differential GPS), and the in-situ digital recording of monuments and other built structures (with the use of Robotic Total Station), supported by the technical equipment of the Artefact and Landscape Studies Laboratory (ArtLandS Lab) of the Archaeological Research Unit of the University of Cyprus (Fig. 14). This comprises an attempt for a ‘best practice’ in academic archaeological documentation, quite common nowadays amongst different excavation and survey projects (cf. Wallrodt, 2016), supplemented by relevant software for the laboratory recording and analyses of archaeological artefacts, such as the SIMPLEX pottery database (designed and used by the SeSaLaC project), GIS spatial analyses and various photogrammetric and statistical techniques.

Figure 13: The SeSaLaC survey area with transects (zones of squares: 150x150m) investigated in 2015–2016 and 2017 (map drafted by Charalambos Paraskeva).

Figure 14: Micro-topographical map of the Geometric–Medieval site of Panagia Kofinou, showing the location of churches and rock-cut tombs (map by Niki Kyriakou).

3 Digital Humanities and Ritual Space: The Volume

The idea for the creation of the present volume emerged during the Second International Meeting of UnSaLa, held at the GeoSat ReSeArch Lab of FORTH in Rethymnon, Crete, from October 19th–21st, 2018. The first meeting of the Network was hosted at Trinity College Dublin, in May 15th–17th, 2015, on the topic *Spatial Analysis of Ritual and Cult in the Mediterranean*, while the third meeting will be held in the Archaeological Research Unit of the University of Cyprus in 2021 on the topic *Religious and Island Identities in Context*.

As mentioned above, the theme of this Special Issue sprang out of our interests in and interactions with the applications of digital humanities to the study of ritual space. The Issue focuses on digital approaches both to ritual space and to artefacts relating to ritual practice and cult. The terms ritual and cult are used broadly to include sanctuaries, temples and churches, as well as the domestic and funerary spheres of life. This Special Issue includes contributions with a strong methodological focus on computational developments, digitisation processes and spatial analyses. Although the main focus of the UnSaLa Network is the Mediterranean region, we have also encouraged colleagues working in other areas of the world to contribute to this volume, with a view to stimulating wider methodological dialogues and comparative approaches. The chronological span is open, ranging from prehistory to the recent past, and including cultural heritage management.

More specifically, we have included archaeological, art-historical, anthropological, ethnographic, historical, computational, cultural heritage or inter-disciplinary contributions dealing with: (1) inter- and intra-site GIS approaches and spatial statistics and modelling of ritual space and/or its associated material assemblages; (2) digitisation and virtual reconstruction of ritual space and/or its associated material assemblages; (3) remote sensing, aerial and satellite approaches to ritual space; (4) other computational methods and developments (such as space metrology and 3D modelling) applied to ritual space and/or its associated material assemblages; (5) digital approaches to culture heritage management and culture heritage studies of ritual space and/or its associated material assemblages; (6) digital approaches to phenomenological, performative and experiential analyses related to ritual space and/or its associated material assemblages.

Since an abstract precedes each contribution, we find it unnecessary to summarise the contents and impact of each article in this Special Issue. The contributions have been organised into four thematic units: (1) Reconstructing Ritual Space; (2) Networks and Acoustics; (3) GIS and Sacred Landscapes, and (4) Memory and Experience. However, many of the individual articles touch on more than one of these general structural themes, and of course the topics themselves have significant points of dialogue and intersection.

In conclusion, this Special Issue demonstrates how digital tools offer a new perspective in our conception of both theory and practice in archaeological research and in the humanities in general, and more specifically on the archaeology of ritual space. This may bring some anxiety to some researchers (either due to the exponential advancements of technology that cannot be easily followed) or even a complete denial because they may consider that we are shifting from the well-established norm of thinking in the humanities. However, digital methods are not limited to the provision of an advancement of accuracy, accessibility, quantification and management of the existing information. On the contrary, they are opening up innovative avenues of exploration, they are fusing different sciences and disciplines together, and they provide a platform of collaboration and interaction that moves away from standardisation by opening new directions in theory and practice. In this way, digital technologies provide a stimulating way of approaching humanities, driving us towards new and unmapped ways of thinking.

Acknowledgments: The Rethymnon meeting was intended as a gathering (of both young and established scholars) for the discussion of the relation between digital humanities and ritual space in the Mediterranean from a wide (and comparative) geographical spectrum, tackling, amongst other things, issues of cross-cultural importance, and using a variety of approaches and methodologies. This meeting and the publication of this Special Issue would not have materialised without the financial support by the Society for Promotion of Hellenic Studies, Trinity College Dublin, and the European Regional Development Fund and the Republic of Cyprus through the Research and Innovation Foundation (project: EXCELLENCE/1216/0362). The workshop

culminated in a visit to Cretan sacred landscapes, and we are most grateful to Dr Christina Tsigonaki of the University of Crete for guiding us around the ancient city of Eleutherna. For practical support in organising the workshop we are indebted to Chrystalla Loizou and Thea Christoforou (PhD candidates, University of Cyprus). We are particularly grateful to all the authors who, with enthusiasm, have been engaged in this fascinating process. We are most grateful to the anonymous reviewers, who made a number of important suggestions for improvement, both with regard to individual papers and to the volume as a whole. Finally, we owe a debt of gratitude to the *Open Archaeology* editors, and particularly to the managing editor Katarzyna Michalak, who have been unfailingly helpful and supportive throughout the preparation of this volume.

References

- Berry, D. M. (Ed.). (2012). *Understanding Digital Humanities*. Cham: Palgrave Macmillan. Doi: 10.1057/9780230371934
- Charitopoulos, E., Papadakis, M., Kosmidis, I., Sarris, A., & Trompoukis, K. (2009). Fevers Research in Crete. Drawing Evidence From Cretan Tradition of Saint John (Aghios Ioannis) Rigologos, Poster presented at the *5th Meeting of the International Society for the History of Medicine*, Nicosia, Cyprus.
- Edmond, J. (Ed.). (2020). *Digital Technology and the Practice of Humanities Research*. Cambridge: Open Book Publishers. Doi: 10.11647/obp.0192
- Flanders, J. & Jannidis, F. (Eds.). (2019). *The Shape of Data in the Digital Humanities: Modeling Texts and Text-based Resources*. London, New York: Routledge.
- Giesekeing, J. J. (2018). Where Are We? The Method of Mapping with GIS in Digital Humanities. *American Quarterly*, 70(3), 641–648. Doi: 10.1353/aq.2018.0047
- Iafrate, F. (2015). *From Big Data to Smart Data*. ISTE Ltd: London and John Wiley & Sons Inc: Hoboken NJ. Doi: 10.1002/9781119116189
- Johannsson, H., Felicori, M., Borgatti, C., Caraceni, S., Garutti, L., Vysniauskiene, A., Baliulyte, I., Zabiela, S., Sarris, A., & Peraki, E. (2007). E-Mem: An Interactive Graveyard Information Management Tool & Virtual Memoriam Database, In A. Figueiredo & G. Velho (Eds.), *Proceedings of the XXXIII Computer Applications and Quantitative Methods in Archaeology Conference (March 2005, Tomar, Portugal): The World in Your Eyes* (pp. 145–150). Tomar: Associacao para o Desenvolvimento das Aplicacoes Informaticas e Novas Tecnologias em Arqueologia.
- Keen, A. (2018). *How to Fix the Future: Staying Human in the Digital Age*. London: Atlantic Books.
- Kenderdine, S. (2016). Embodiment, Entanglement, and Immersion in Digital Cultural Heritage. In S. Schreibman, R. Siemens, & J. Unsworth (Eds.), *A New Companion to Digital Humanities* (pp. 22–41). Oxford: Wiley-Blackwell.
- Kyriakou, N. (2019). The Sacred Landscapes of Cyprus in Late Antiquity: Cityscapes and Peripheries in Context. In G. Papantoniou, C. E Morris, & A. K. Vionis (Eds.), *Unlocking Sacred Landscapes: Spatial Analysis of Ritual and Cult in the Mediterranean*. Studies in Mediterranean Archaeology 151 (pp. 47–66). Nicosia: Astrom Editions.
- Lake, M. (2007). Viewing space. *World Archaeology*, 39(1), 1–3. Doi: 10.1080/00438240601148731
- Le Deuff, O. (2018). *Digital Humanities: History and Development*. Intellectual Technologies Set 4. London: Wiley. Doi: 10.1002/9781119308195
- Levenberg, L., Neilson, T., & Rheams, D. (Eds.). (2018). *Research Methods for the Digital Humanities*. Cham: Palgrave Macmillan. Doi: 10.1007/978-3-319-96713-4
- Megarry, W. (2011). Pastoralism and Peak? A GIS Study into the Origins of Minoan Peak Sanctuaries in Eastern Crete. In E. Jerem, F. Redő & V. Szeverényi (Eds.), *On the Road to Reconstructing the Past. Computer Applications and Quantitative Methods in Archaeology (CAA). Proceedings of the 36th International Conference. Budapest, April 2-6, 2008* (pp. 415–422). Archaeolingua, Budapest.
- Megarry, W. (2012). Experiencing the Mountain in Minoan Crete: Exploring the Evolution of a Bronze Age Sacred Landscape using GIS. Unpublished PhD thesis, University College Dublin.
- Morris, C. E., Peatfield, A., & O'Neill, B. (2018). 'Figures in 3D': Digital Perspectives on Cretan Bronze Age Figurines. In B. Molloy (Ed.), *Topical Issue on Exploring Advances in the Use of 3D Models of Objects in Archaeological Research, Open Archaeology* 4(1), 50–61. Doi: 10.1515/opar-2018-0003
- Morris, C., O'Neill, B., & Peatfield, A. (2019). Thinking through our hands: Making and understanding Minoan female anthropomorphic figurines from the peak sanctuary of Prinias, Crete. In Souyoudzoglou-Haywood C. & O'Sullivan A. (Eds.), *Experimental Archaeology: Making, Understanding, Story-telling* (pp. 53-62). Summertown, Oxford: Archaeopress. Doi:10.2307/j.ctvpmw4g8.10
- Nakoinz, O. & Knitter, D. (2016). *Modelling Human Behaviour in Landscapes: Basic Concepts and Modelling Elements*. Basel: Springer-Verlag. Doi: 10.1007/978-3-319-29538-1
- Neilson, T., Levenberg, L., & Rheams, D. (2018). Introduction: Research Methods for the Digital Humanities. In L. Levenberg, T. Neilson, & D. Rheams (Eds.), *Research Methods for the Digital Humanities* (pp. 1–14). Cham: Palgrave Macmillan. Doi: 10.1007/978-3-319-96713-4_1

- Nyhan, J., Terras, M., & Vanhoutte, E. (2013). Introduction. In M. Terras, J. Nyhan, & E. Vanhoutte (Eds.), *Defining Digital Humanities: A Reader* (pp. 1–10). Surrey: Ashgate.
- Paliou, E. & Knight, D. J. (2013). Mapping the senses: perceptual and social aspects of Late Antique liturgy in San Vitale, Ravenna. In F. Contreras, M. Farjas, & F. J. Melero (Eds.), *CAA2010: Fusion of Cultures. Proceedings of the 38th Annual Conference on Computer Applications and Quantitative Methods in Archaeology*. BAR International Series 2494 (pp. 229–236). Oxford: Archaeopress.
- Paliou, E., Lieberwirth, U., & Polla, S. (Eds.). (2014). *Spatial Analysis and Social Spaces: Interdisciplinary Approaches to the Interpretation of Prehistoric and Historic Built Environments*. Topoi 18. Berlin: De Gruyter. Doi: 10.1515/9783110266436
- Papadopoulos, N. & Sarris, A. (2011). Integrated Geophysical Survey to Characterize the Subsurface Properties Below and Around the Area of Saint Andreas Church (Loutraki, Greece). In W. Börner & S. Uhlirz (Eds.), *Proceedings of the 14th International Congress Cultural Heritage and New Technologies* (pp. 643–652). Vienna: Museen der Stadt Wien – Stadtar-chäologie.
- Papadopoulos, G. N., Sarris, A., & Giapitsoglou, C. (2012). Mapping the Buried Archaeological Remains in the Area of the Old Turkish School of Rethymno (Crete, Greece) through the Application of Surface ERT and GPR Techniques. In N. Zacharias, M. Georgakopoulou, K. Polycreti, G. Fakorellis, & T. Vakoulis (Eds.), *Πρακτικά 5ου Συμποσίου Ελληνικής Αρχαιομετρικής Εταιρείας [Praktika 5ou Symposiou Ellinikis Archaioimetrikis Etaireias (Proceedings of the 5th Symposium of the Hellenic Society for Archaeometry)]* (pp. 101–106). Athens: Papazisi Publications.
- Papadopoulos, N., Oikonomou, D., Cantoro, G., Andronikidis, N., & Sarris, A. (2019). 3-D resistivity imaging of rock-cut chamber tombs: the case of the Mycenaean Cemetery in Prosilio, Greece. Poster presented at the *13th International Conference on Archaeological Prospection*, Sligo, Ireland.
- Papantoniou, G. (2019). Unlocking Sacred Landscapes: The Applicability of a GIS Approach to the Territorial Formation of the Cypro-Archaic and Cypro-Classical Polities. In G. Papantoniou, C. E. Morris, & A. K. Vionis (Eds.), *Unlocking Sacred Landscapes: Spatial Analysis of Ritual and Cult in the Mediterranean*. Studies in Mediterranean Archaeology 151 (pp. 3–21). Nicosia: Astrom Editions.
- Papantoniou, G., Loizides, F., Lanitis, A., & Michaelides, D. (2012). Digitization, Restoration and Visualization of Terracotta Figurines from the ‘House of Orpheus’, Nea Paphos. In M. Ioannides, D. Fritsch, J. Leissner, R. Davies, F. Remondino, & R. Caffo (Eds.), *Progress in Cultural Heritage Preservation 4th International Conference, EuroMed 2012, Limassol, Cyprus, October 29 – November 3, 2012 Proceedings*. Lecture Notes on Computer Sciences 7616 (pp. 543–550). Berlin Heidelberg: Springer-Verlag.
- Papantoniou, G., Loizides, F., Lanitis, A., & Michaelides, D. (2017). The use of information technology applications for supporting the study and interpretation of terracotta figurines from the House of Orpheus in Nea Paphos. *Kölner und Bonner Archaeologica*, 7, 219–228.
- Papantoniou, G. & Bourogiannis, G. (2018). Sanctuaries as central places: revisiting the Agia Irini sanctuary in Iron Age Cyprus. *Land* 7.139. Doi: 103390/land7040139.
- Papantoniou, G. & Vionis, A. K. (2018). The river as an economic asset: settlement and society in the Xeros Valley in Cyprus. *Land* 7.157. Doi: 10.3390/land7040157.
- Papantoniou, G. & Kyriakou, N. (2018). Sacred Landscapes and the Territoriality of Iron Age Cypriot Polities: The Applicability of GIS. *American Journal of Archaeology*, 122, 541–577. Doi: 10.3764/aja.122.4.0541
- Papantoniou, G. & Vionis, A. K. (Eds.). (2019). *Central Places and Un-Central Landscapes: Political Economies and Natural Resources in the Longue Durée*. Basel: MDPI.
- Papantoniou, G., Michaelides, D., & Dikomitou-Eliadou, M. (2019). Hellenistic and Roman Terracottas from Domestic Contexts: The Case of the House of Orpheus in Nea Paphos. In G. Papantoniou, D. Michaelides, & M. Dikomitou-Eliadou (Eds.), *Hellenistic and Roman Terracottas*. Monumenta Graeca et Romana 23 (pp. 7–43). Leiden: Brill.
- Papantoniou, G., Morris, C. E., & Vionis, A. K. (2019). Spatial Analysis of Ritual and Cult: An Introduction. In G. Papantoniou, C. E. Morris, & A. K. Vionis (Eds.), *Unlocking Sacred Landscapes: Spatial Analysis of Ritual and Cult in the Mediterranean*. Studies in Mediterranean Archaeology 151 (pp. ix–xviii). Nicosia: Astrom Editions.
- Peatfield, A. A. D. & Morris, C. E. (2012). Dynamic Spirituality on Minoan Peak Sanctuaries. In K. Rountree, C. E. Morris, & A. A. D. Peatfield (Eds.), *Archaeology of Spiritualities* (pp. 227–245). New York: Springer. Doi: 10.1007/978-1-4614-3354-5_11
- Peatfield, A. A. D. & Morris, C. E. (2019). Space, Place and Performance on the Peak Sanctuary of Atsipadhes Korakias, Crete. In G. Papantoniou, C. E. Morris, & A. K. Vionis (Eds.), *Unlocking Sacred Landscapes: Spatial Analysis of Ritual and Cult in the Mediterranean*. Studies in Mediterranean Archaeology 151 (pp. 189–200). Nicosia: Astrom Editions.
- Plumwood, V. (2006). The concept of a cultural landscape: Nature, culture and agency in the land. *Ethics and the Environment*, 11(2), 115–150. Doi: 10.2979/ETE.2006.11.2.115
- Sarris, A. (2019). Digitizing the Echoes of the Past, *Textualising the Experience – Digitalising the Text: Cyprus through Travel Literature (15th-18th c.)*, Round Table at the 4th International Conference of the Sylvia Ioannou Foundation, Nicosia.
- Sarris, A. (2013). Multi+ or Manifold Geophysical Prospection? In G. Earl, T. Sly, A. Chrysanthi, P. Murrieta-Flores, C. Papadopoulos, I. Romanowska, & D. Wheatley (Eds.), *Archaeology in the Digital Era – Volume II, e-Papers from the 40th Conference on Computer Applications and Quantitative Methods in Archaeology (CAA2012), Southampton, 26-30 March 2012* (pp. 761–770). Amsterdam: Amsterdam University Press.

- Sarris, A. & Papadopoulos, N. (2013). Looking for Graves: Geophysical Prospection of Cemeteries. In W. Börner & S. Uhlirz (Eds.), *Proceedings of the 16th International Congress on "Cultural Heritage and New Technologies", Vienna, Austria, Nov. 11-13, 2012*, Vienna: Museen der Stadt Wien –Stadtarchäologie (CD-ROM publication).
- Sarris, A. & Dederix, S. (2014). GIS for Archaeology & Cultural Resources Management in Greece. Quo Vadis? In N. Zacharias (Ed.), *Proceedings of the 3rd Conference Arch_RNT on Archaeological Research and New Technologies* (pp. 7–20). Kalamata: Publications of the University of Peloponnese.
- Sarris, A., Papadopoulos, N., Dederix, S., Driessen, J., Dirix, Th., & Merkouri, Chr. (2019). The Quest of the Grave of Andreas Vesalius in Zakynthos. In P. Kyriakidis, A. Agapiou, & V. Lysandrou (Eds.), *Spreading Excellence in Computer Applications for Archaeology and Cultural Heritage. Proceedings of the 3rd Conference on Computer Applications and Quantitative Methods in Archaeology Greek Chapter (CAA-GR) Limassol, 18-20 June 2018* (pp. 11–18). Limassol: Cyprus University of Technology.
- Sarris, A., Dziechciarz, P., Kelly, D., Duffy, P., Parditka, G., & Giblin, J. (2016a). Construction of a Geophysical Signature Archive for the Investigation of Bronze Age sites. The Case of Békés 103 (Jégvermi-kert) in Eastern Hungary. Poster presented at the 21st International Conference on Cultural Heritage and New Technologies, Vienna, Austria.
- Sarris, A., Papadopoulos, N., Kalayci, T., Argyriou, N., Symirdanis, K., & Nikas, N. (2016b). Γεωφυσικές έρευνες στον αρχαιολογικό χώρο των προϊστορικών τύμβων Βρανά-Μαραθώνα, [Geophysikes ereynes ston archaiologiko choro ton proistorikon tymvon Vrana Marathona (Geophysical research in the archaeological site of the Vrana Marathonas prehistoric tumuli)]. In M. Pantelidou-Gkofa, G. Touchais, A. Philippa-Touchais, & N. Papademetriou (Eds.), Μελέτη Προϊστορικών Τύμβων Βρανά Μαραθώνος, Πρακτικά της Εν Αθήναις Αρχαιολογικής Εταιρείας του Έτους 2016 [Meleti Proistorikon Tymvon Brana Marathonos. Praktika tis En Athinais Archaologikis Etaireias toy Etoys 2016 (Study of the Prehistoric Vrana Marathonos Tumuli. Proceedings of the Archaeological Society at Athens for the Year 2016)]. (pp. 53–56 & 61–62). Athens: The Archaeological Society at Athens.
- Sarris, A., Papadopoulos, N., Cantoro, G., Agapiou, A., Déderix, S., Tsigonaki, Ch., & Devolder, D. (2015). New Technologies for Capturing the Dynamics of Cultural Landscapes. In P. Karanastasi, A. Tzigonaki, & Ch. Tsigonaki (Eds.), Αρχαιολογικό Έργο Κρήτης: Πρακτικά της 3ης Συνάντησης. Ρέθυμνο 5–8 Δεκεμβρίου 2013 [Archailogiko Ergo Kritis: Praktika tis 3is Synantisis. Rethymno 5–8 Dekemvriou 2013 (Archaeological Work on Crete. Proceedings of the 3rd Meeting. Rethymno 5–8 December 2013)]. (pp. 689–699). Rethymnon: Faculty of Letters Publications, University of Crete – Ministry of Culture and Sports, Ephorate of Antiquities of Rethymnon.
- Sarris, A., Dunn, R. K., Rife, J. L., Papadopoulos, N., Kokkinou, E., & Mundigler, C. (2007). Geological and Geophysical Investigations in the Roman Cemetery at Kenchreai (Korinthia), Greece. *Journal of Archaeological Prospection*, 14(1), 1–23. Doi: 10.1002/arp.280
- Sarris, A., Poulioudis, G., Giourou, A., Kevgas, V., Triantaphyllos, D., & Terzopoulou, D. (2001a). Geophysical Investigations of Tumuli in Thrace, N. Greece, *Proceedings of the 32nd International Symposium on Archaeometry, 15–19 May 2000, Mexico City*. Mexico: University of Mexico (CD-ROM publication).
- Sarris, A., Vafidis, A., Economou, N., Poulioudis, G., & Limneou-Papakosta, C. (2001b). Prospecting the Old Jewish Cemetery in the centre of Alexandria, Egypt, Poster presented at the 4th International Conference on Archaeological Prospection, Austrian Academy of Sciences, Vienna.
- Schreibman, S., Siemens, R., & Unsworth, J. (Eds.). (2016). *A New Companion to Digital Humanities*. Oxford: Wiley-Blackwell.
- Soetens, S., Sarris, A., & Vansteenhuyse, K. (2008). Between Peak and Palace. Reinterpretation of the Minoan cultural landscape in Space and Time, In Y. Facorellis, N. Zacharias, & K. Polikreti (Eds.), *Proceedings of the 4th Symposium of the Hellenic Society for Archaeometry, National Hellenic Research Foundation, Athens 28-31 May 2003*, British Archaeological Reports International Series 1746 (pp. 153–161). Oxford: Archaeopress.
- Terras, M. (2006). Disciplined: Using educational studies to analyse humanities computing. *Literary and Linguistic Computing*, 21(2), 229–246. Doi: 10.1093/litc/fql022
- Terras, M., Nyhan, J., & Vanhoutte, E. (Eds.). (2013). *Defining Digital Humanities: A Reader*. Surrey: Ashgate.
- van Leusen, M. (2011). Some Reflections on the Role of GIS in Landscape Archaeology. In V. Mayoral-Herrera & S. Celestino-Pérez (Eds.), *Tecnologías de información geográfica y análisis arqueológico del territorio. Actas del V Simposio Internacional de Arqueología de Mérida (Anejos de Archivo Espanol de Arqueologia* (Vol. 59, pp. 829–832). Mérida: Instituto de Arqueología de Mérida.
- Vionis, A. K. (2017a). Understanding settlements in Byzantine Greece: New data and approaches for Boeotia, sixth to thirteenth century. *Hesperia*, 71, 127–173.
- Vionis, A. K. (2017b). Sacred townscapes in Late Antique Greece: Christianisation and economic diversity in the Aegean. *Journal of Mediterranean Archaeology*, 30(2), 141–165. Doi: 10.1558/jmea.35403
- Vionis, A. K. (2018). Settled and Sacred Landscapes of Cyprus: Church and Landscape in the Xeros Valley during the Early Byzantine Period. In M. Horster, D. Nicolaou, & S. Rogge (Eds.), *Church Building in Cyprus (Fourth to Seventh Centuries): A Mirror of Intercultural Contacts in the Eastern Mediterranean*. Schriften des Instituts für Interdisziplinäre Zypern-Studien 12 (pp. 45–70). Münster: Waxmann Verlag.
- Vionis, A. K. (2019). The Spatiality of the Byzantine/Medieval Rural Church: Landscape Parallels from the Aegean and Cyprus. In G. Papantoniou, C. E. Morris, & A. K. Vionis (Eds.), *Unlocking Sacred Landscapes: Spatial Analysis of Ritual and Cult in the Mediterranean*. Studies in Mediterranean Archaeology 151 (pp. 67–83). Nicosia: Astrom Editions.

- Vionis, A. K. & Papantoniou, G. (2017). Sacred landscapes as economic central places in Late Antique Naxos and Cyprus. *Antiquité Tardive*, 25, 263–286. Doi: 10.1484/J.AT.5.114862
- Vionis, A. K. & Papantoniou, G. (2019). Central place theory reloaded and revised: political economy and landscape dynamics in the *longue durée*. *Land* 8.36. Doi: 10.3390/land8020036.
- Zeng, M. L. (2017). Smart Data for Digital Humanities. *Journal of Data and Information Science*, 2, 1–12.
- Wallrodt, J. (2016). Why Paperless: Technology and Changes in Archaeological Practice, 1996–2016. In E. Walcek Averett, J. M. Gordon, & D. B. Counts (Eds.), *Mobilizing the Past for a Digital Future: The Potential of Digital Archaeology* (pp. 33–50). North Dakota: The Digital Press at the University of North Dakota.
- Winckler, K. (2019). The Territory of the Bishop: Ritual and Diocesan Boundaries in Early Medieval Bavaria. In M. S. Popović, V. Pollaczek, B. Koschicek, & S. Eichert (Eds.), *Power in Landscape: Geographic and Digital Approaches on Historical Research* (pp. 33–44). Leipzig: Eudora-Verlag Leipzig.