Introduction

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The purpose of this volume is to present a cross-section of projects performed by Classicists (archaeologists, ancient historians, philologists, etc.) using advanced digital methods and technologies, and thereby to illustrate some of the main challenges and opportunities offered to Classical scholarship by the Digital Humanities. No such volume can hope to be a comprehensive review of the current state of digital research in the area of Classics, and this is not our purpose. By presenting a representative cross-section of scholarship and focusing as much as possible on the research itself rather than a meta-discussion or history of the discipline, we hope to show some ways in which digital methods are pervading, and in some senses transforming, the study of antiquity across the board.

Collections of papers on digital Classical topics have often focused on one of two things. On the one hand Jon Solomon’s 1993 collection is a history of digital resources in Classical Studies, with retrospective papers by the founders of many of the great innovative projects of the 1970s and 1980s. On the other, the recent Festschrift for Ross Scaife in Digital Humanities Quarterly is forward looking, explicitly imagining Classical Studies in 2018, but from the point of view of a very specific technological perspective: the scale and power of cyber-infrastructure. Both of these approaches to discussing the discipline of Digital Classics are of course important reflections of the present state of the art: the foundational projects influence all that come after them (and many are in fact still active and ground-breaking), and predicting the future of a discipline is clearly both a rhetorical comment upon the observed state of the present and a recommended pathway for future utopian development.

All of the chapters in this volume are research papers in their own right, which engage with and contribute to the history of scholarship both in the study of Classical Antiquity and in the Digital Humanities. Half of the papers originated as presentations made at the Digital Classicist seminar series at the Institute of Classical Studies in London in the summer of 2007 (Bowman et al., Dunn, Fulford et al., OKell et al., Smith); a few were given at conference panels we organized at the Classical Association Annual Conference held in Birmingham in the same

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and a couple are new papers written specially for this volume (Cayless, Heath). This publication collects together scholarship on a wide range of Classical subjects, exemplifying multiple technical approaches, and taking a variety of forms; it shows that this diversity of scholarly activity contributes in a coherent way to the academic agenda that makes Classical Studies a leader in the use of modern and innovative methods. Collectively, this volume illustrates and explores the highly collaborative nature of research in this field, the interdisciplinarity that has always been core to Classical Studies, the importance of innovation and creativity in the study of the ancient world, and above all the fact that digital research relies just as heavily upon traditionally rigorous scholarship as mainstream Classics does.

The Digital Classicist, established in 2004, is a network, a community of users, and has become defined by what we (as a community) do. There is a website (<http://www.digitalclassicist.org/>) hosted at the Centre for Computing in the Humanities at King’s College London, and a wiki (<http://wiki.digitalclassicist.org/>) where, as well as sharing information about themselves and their own work, members collaboratively compile, review and comment upon articles on digital projects, tools, and research questions of particular relevance to the ancient world. They also list guides to practice, introduce the discussion forum and, most importantly, list events. It is these events that more than anything else define the Digital Classicist community by providing a showcase for our members’ research and a venue for discussion, introductions and inspiration for new collaborative relationships and projects.

The most striking and successful aspect of Digital Classics is its sense of community and collaboration. Digital Classicists do not work in isolation; they develop projects in tandem with colleagues in other humanities disciplines or with experts in technical fields: engineers, computer scientists and civil engineers. They do not publish expensive monographs destined to be checked out of libraries once every few years; they collect data, conduct research, develop tools and resources, and importantly make them available electronically, often under free and open licenses such as Creative Commons, for reference and for re-use by scholars, students and non-specialists alike. It is this sense of community, combining the promise of the Social Web and the infrastructures of Linked Data and e-Science, that the Digital Classicist (in collaboration with and taking the lead from the Stoa Consortium and the Perseus Project) aims to encourage among scholars of the ancient world.

4 Creative Commons, <http://www.creativecommons.org/>.
The important distinction between research in the Digital Humanities (whether Classics or any other humanistic discipline), and traditional research that merely makes use of digital tools or methods, is that the former by definition involves interdisciplinary work between multiple skill-sets. It may be that a given Classical scholar also has the technical skills to build and develop tools and innovative digital methodologies, but no scholar can possibly possess all of the skills and resources to perform digital research in complete isolation. To some extent this has always been true in the Classics. As Italo Gallo pointed out in a handbook on papyrology over twenty years ago:

According to its obvious etymology, ‘papyrology’ means ‘the study of papyri’, both as a writing material obtained from the papyrus plant and from the point of view of its written content. In the first … meaning, technical knowledge is required, in botany, organic chemistry, climate geography, and the like, which is not usually part of a papyrologist’s basic training, so that he will often need to consult experts in these fields: ideally, they will collaborate.

Just as no papyrologist is expected to possess all of the scientific and forensic skills to research the more technical side of their field entirely alone, so no Classicist will master all of the computational skills and research methods necessary to conduct innovative digital research in complete isolation.

Classicists are used to this situation, belonging as they do to one of the most interdisciplinary and diverse disciplines in the academy (as Melissa Terras points out in Chapter 10 of this volume). Classics departments are already filled with experts on literature, history, archaeology, ethnography, mythology, religion, philosophy, palaeography, linguistics, art, heritage and reception. In recent years we have known Classicists who have also taken higher degrees or professional training in (for example) film studies, psychology, history of medicine, Asian linguistics, politics or economics, anthropology, geology and biology, all with a view to increasing their proficiency in their own academic area. These are scholars who are not only aware of the importance of applying the expertise of multiple disciplines to the complex problem of studying an ancient culture, but also of the importance of collaboration with academics from different backgrounds and with different skills.

Equally, Classicists are now striving to learn more about the digital resources and methods available to enhance publication and research on antiquity. Computational techniques are undeniably useful, but research is not just about using tools so much as mastering them, understanding how they work, their history and social/political context. One can perhaps not collaborate with a computer scientist without learning something about their discipline, language and tools, but no individual can learn enough about these disciplinary competences to completely do away with the

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need for collaboration, in one form or another. We should highlight that the use of Open Source software and Open Access publication is a form of collaboration enabling, even if the collaboration is asynchronous rather than as a conventional team. Concern with issues like the use of open standards (such as the TEI, as discussed by Charlotte Tupman in Chapter 4), and the use and evaluation of Social Web and Linked Data protocols (see Sebastian Heath’s discussion in Chapter 2, and Stuart Dunn’s in Chapter 3) also further the needs of collaboration and open scholarship.

Digital research, or e-Research, in our view, involves the use of computational methods and theories to enable real advances in Classical research. We are not concerned merely with the convenience or speed that computers can bring to research and publication, but especially with methods and digital practices that can add to the empirical understanding of facts about the ancient world, its literature and its people, or the continuing use of that heritage in later texts and ages.

There are lessons to be learned from the different trajectories of two major Classical projects that were both founded in 1972, and are both still giants in the field. The Thesaurus Linguae Graecae (TLG), while a technologically innovative project from the outset, and one which has changed the study of Greek literature and continues to be indispensable to it, has not made a great contribution in tools, protocols or theory to the Digital Humanities as a discipline. This state of affairs is of course largely because of the closed, for-profit and self-sufficient strategy of the TLG, and is not a criticism of the project or its policies. The Lexicon of Greek Personal Names (LGPN), on the other hand, began life as a technologically conservative project, geared to the production of paper volumes of the Lexicon. The LGPN has always been reactive to changes in technology rather than proactive as the TLG was. As a result of this, however, researchers there have been able to change with the times, adopt new database and web technologies as they have appeared, and are now actively contributing to the development of standards in XML, onomastics and geo-tagging, and sharing data and tools widely. It may be counter-intuitive that a reactive attitude leads to more productive digital research than a proactive one, but as Gregory Crane has pointed out, we as Classicists

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10 Lexicon of Greek Personal Names, <http://www.lgpn.ox.ac.uk/>.
should not be inventing technologies when there are information professionals in better-funded disciplines whose needs overlap to a large degree with our own.\textsuperscript{11}

The Digital Classicist therefore serves as a community of expertise centred on the application of Digital Humanities methods, cyberinfrastructure, e-Science and Computer Science research to the study of the ancient world. This field often focuses on collaborative research between Classicists and computer scientists to apply large-scale computational resources to problems across disciplines. Such collaboration pushes forward both fields – with digital tools serving Classics, ancient material validating new computational methods and the research agenda being driven forward by the needs of – and contributing to – both disciplines. Digital infrastructure, Open Access publication, re-use of freely licensed data, and Semantic Web technologies will enable Classics, archaeology, and associated disciplines fully to engage with an increasingly digital academic environment. The Digital Classicist fosters engagement with and expresses the outcomes of several related interest groups and projects; it is an inclusive forum for Classicists interested in advanced digital methods, and also presents concrete agendas and engages with the mature community of practice that combines digital and ancient studies.

The Digital Classicist works closely with and shares the concerns of several other communities; there are sufficient scholars who are members of both (or all) groups to bring together several agendas and needs. These communities include: Antiquist,\textsuperscript{12} a community of cultural heritage professionals; the Arts and Humanities e-Science community,\textsuperscript{13} who according to their statement ‘support, co-ordinate and promote e-Science [a broad term encompassing grid technologies, distributed and high-performance computing, and the e-Infrastructure needed by “big science”] in all arts and humanities disciplines’; the Scaife Digital Library (SDL),\textsuperscript{14} ‘a distributed collection and a method whereby humanists from around the world can automatically aggregate their content’.

The sub-disciplines spanned by the chapters in this volume include archaeology and geography, text, linguistics, reception and community building; and most chapters cover more than one of these. The chapters themselves take different forms, through pedagogical questions to theoretical, disciplinary or methodological discussions. The academic content of the chapters includes resources for research and teaching, tools for the Classical scholar, international and academic standards.

\textsuperscript{13} Arts and Humanities e-Science Support Centre, <http://www.ahessc.ac.uk/>.
and protocols, and reports on original research. The digital methods in evidence in this cross-section of scholarship are also wide-ranging: text and data markup; databases, data management and search techniques; network analysis; e-Science and cyberinfrastructure. This diversity of topics, forms, contents and methods enhances the underlying unity of the Digital Classicist community and its collaborative nature.

The chapters include historical surveys (Fulford et al.) as well as futuristic proposals (Terras, Toufexis), demonstrations of the impact of innovative methodologies on Classical research (Tupman) as well as reports of advanced tools, technology and services (Bowman et al., OKell et al., Smith), and discussion of Classical research in the Web 2.0 environment (Cayless, Dunn, Heath). The unifying agenda of this volume is not based on any particular technology, methodology, approach or philosophy, but focuses rather on the future of Classics as part of a community of expertise and practice. Together, we explore concepts of disciplinarity and interdisciplinarity; research practice and pedagogy in the age of the Internet and Social Web; digital tools and methods for publication and communication; standards and recommendations for interoperability and compatibility; strategies and resources for preservation and maintenance of fragile digital output.

The first section of this volume is comprised of three chapters that address aspects of digital practice in Classical archaeology and geography. This section includes an account of the history of informatic and technical support for field archaeology, an exploration of the implications of Internet publication for amateur and commercial contributions to numismatic and archaeological bibliography, and a discussion of the complex advances in geographic methodology brought about by the Social Web and Linked Data resources and tools. Collaboration and outreach play a large part in all three of these chapters, inasmuch as none of these advances take place in isolation, and all have implications both for the researcher and the consumer of that research, the academic audience and the wider, public audience that every scholar also needs to address.

In the opening chapter, ‘Silchester Roman Town: Developing Virtual Research Practice’, Michael Fulford et al. recount research from a major project run over the last decade by the Archaeology Department at the University of Reading. They examine the history of IT use at Silchester and the effects that this has had on all aspects of excavation, recording and publication at one of the largest open-area research excavations in the country. The Integrated Archaeological Database (IADB) has been key to the success of the Silchester excavations, providing access to all the digitized site data from context cards to photographs and plans. It can be accessed via the Internet, allowing the geographically dispersed research team to keep in contact with the core team at Reading and with excavators on site. The increasing amounts of excavation data being ‘born digital’ has led to decreased publication time; multiple authors working in a collaborative environment within the IADB; and electronic publication of the research output. This chapter shows the development of a project from largely analogue origins to the gradual adoption
of cutting-edge and innovative technologies that transform the research process. It also serves both as an introduction to the volume, showing the development of many of the themes that will be explored further, and as a useful guide to archaeologists looking for the state of the art in excavation support technologies.

Sebastian Heath’s chapter, ‘Diversity and Reuse of Digital Resources for Ancient Mediterranean Material Culture’, begins with the observation that materials relating to ancient material culture are increasingly appearing on the Internet. One source is the scholarly community (professional and academic archaeologists and art historians affiliated with universities, museums and such institutions); another is commercial dealers of unprovenanced antiquities who are making very effective use of the Internet to promote their businesses. Heath points out that the output of the ‘commercial community’ is often more accessible on the Internet than that of the scholarly one. Major auction houses selling ancient art, and in particular coins, regularly publish online high-quality images and descriptions of the objects they have sold. Commercial entities are relatively permissive in the reproduction rights they grant for this copyrighted material. This openness by commercial organizations is in contrast to most sources of scholarly information: academic journals are frequently unavailable except through gated and subscription sites; museums and field projects – with notable exceptions – put only a small proportion of their collections online and comprehensiveness is often curtailed in the name of protecting publication rights. Documenting the choices made by commercial and scholarly sources of information shows the practical implications of these choices. The increasing role of search engines such as Google in mediating the discovery of and access to information means that commercial and scholarly information exist side by side. There are lessons to be learned from this analysis, not only for scholars and teachers making use of online materials in their research and pedagogy, but especially for academics seeking to publish online and create rich resources for the academic community at large.

Working in complex digital environments often provides opportunities to reassess entrenched assumptions about many basic concepts in the humanities. In Chapter 3, ‘Space as an Artefact: A Perspective on “Neogeography” from the Digital Humanities’, Stuart Dunn shows how the emergence in the past few years of ‘neogeography’ – broadly speaking the application of so-called Web 2.0 methods and technologies in the visualization and analysis of geospatial information – provides opportunities for a rethink of how we understand the concept of ‘space’. However, the growth of neogeography has been accompanied by relatively little consideration of that broader Web 2.0 context, particularly with regard to the implications of enabling wider user communities to access, manipulate, provide and ‘mash up’ geospatial data. This chapter ties together many of the issues that are important to this section: the use of emerging technologies and the way it transforms both publication and research; the grounding of digital humanities methods in the disciplines of archaeology and geography; the importance of understanding both technological and disciplinary issues for all academics moving forward.
The next section of this volume focuses on another aspect of Classical academia: scholarship around ancient texts and languages, literary, philological and linguistic studies. This section includes some reflections on the way digital research and open publication can blur some of the traditional sub-disciplinary boundaries between textual scholars and archaeologists (in epigraphy), a project report on how a virtual research environment can foster both collaboration and technological adoption by diverse scholars (in papyrology), and some thoughts on how digital methods combined with large numbers of Open Access texts could offer new opportunities for diachronic linguistic study of the history of the Greek language. The importance of open standards and open publication are core strands in this section.

Charlotte Tupman’s chapter, ‘Contextual Epigraphy and XML: Digital Publication and its Application to the Study of Inscribed Funerary Monuments’, aims to reunite inscribed texts with the artefacts on which they sit, and their original contexts through the medium of electronic publication. She describes traditional methods of publishing inscribed funerary material, exploring both the benefits and limitations, before moving on to digital methods of publication and considering how these might contribute to original research questions, as well as making materials available for further use via widely adopted open standards. Tupman’s chapter draws on the work of the highly active EpiDoc community, and applies the lessons learned from several recent and ongoing projects to her own forthcoming work, demonstrating that digital research (and indeed all scientific research) is both collaborative and cumulative.

How might collaborating scholars in different physical locations be brought together along with a disparate range of resources so that they might work more effectively? ‘A Virtual Research Environment for the Study of Documents and Manuscripts’ by Alan Bowman et al. describes the background to such a project and outlines the need for these tools in document and manuscript studies. This chapter focuses on the development of technologies and methods to address concrete user requirements, with data drawn from studying the process and methodology of the research conducted in the area of ancient documents, consultation and a continuous dialogue with both discipline specialists and technical and infrastructure developers. Bowman’s chapter shares with the first chapter in this volume the theme of the needs of the target discipline. Again open standards are highlighted here, with access to rich digital materials essential for such enhanced collaborative work, and also the importance of building innovative methods on the firm foundation of established academic practice.

In ‘One Era’s Nonsense, Another’s Norm: Diachronic Study of Greek and the Computer’, Notis Toufexis considers the study of Greek, a linguistic label that covers a span of almost three millennia (from about the eighth century BC until the present day), and the ways in which new methodologies and resources can contribute to and transform our investigations into its development and evolution. In particular, he proposes a detailed, digitally enabled analysis of the textual and

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linguistic multiplicity in ‘diplomatic’ editions of literary manuscripts, texts whose scribal variants are almost universally normalized in traditional textual criticism to Classical or Koine forms. The existence of large numbers of freely available texts in open standards, and of high-powered digital approaches such as computational linguistics and text-mining, make such work both possible and essential to the study of language development from Antiquity and beyond.

The final and most diverse section of this volume considers infrastructural and disciplinary issues, including digital citation and reference; the preservation of texts in a digital medium that feels far more fragile than the papyrus and parchment that have survived since Antiquity; the possibilities of digitally disseminated resources to be packaged for a powerful pedagogical environment; and finally the question of how digital research and resources affect the very definition and understanding of our academic discipline.

Neel Smith’s chapter, ‘Digital Infrastructure and the Homer Multitext Project’, introduces an innovative online resource that takes advantage of many of the possibilities opened up by digital research and publication. The Homer Multitext Project (HMP) views different versions of the *Iliad* not as sources for reconstruction of an ‘original’ text, but rather as evidence for the fluidity of the textual tradition that developed from the oral origins of the *Iliad*. HMP already includes digital editions of six *Iliad* manuscripts, and has begun work on digital texts of the scholiastic comments. Smith summarizes the long-term archival plans including data warehousing supported by Google, and the importance of supporting flexible scholarly reuse of materials. This chapter then explores the details of an architecture allowing distinct components (digital images, texts of the *Iliad*, scholiastic texts, *inter alia*) to be used independently, combined in various ways and cited, via the robust Canonical Text Services protocols. Smith brings together many of the key themes in this volume; open standards for publication and Open Access distribution are here seen not merely as desirable means for improving interoperability and enabling further research, but they are the essential underpinnings of this kind of project.

How does the claim of the Greek historian Thucydides that his work is designed to be a ‘possession for all time’, and his apparent success, give us a model for digital archiving today? This is the starting point for Hugh Cayless’s chapter ‘*Ktêma es aiei*: Digital Permanence from an Ancient Perspective’. We cannot predict how future generations will view or use the works in our care and since the things a culture values can change radically over the course of several generations, there is no guarantee that the intrinsic value of a work will be estimated in the same way a hundred or a thousand years from now. Therefore, while due care must be taken in preserving digital resources in our archives, their long-term survival, Cayless argues, may best be ensured by releasing copies from our control and thus developing a self-sustaining community of interest. The use of open standards and Open Access licences, as we have argued throughout this volume, will highly increase the possibility of our publications being duplicated, repurposed, circulated and therefore preserved.
Based on research and data gathering, Eleanor OKell et al., from the History, Classics and Archaeology Subject Centre in the UK, give us, ‘Creating a Generative Learning Object: Working in an “Ill-Structured” Environment and Getting Students to Think’. How might we model the teaching process focusing on disciplinary concerns and our students’ critical thinking skills to create reusable learning objects? Using a case study of the Altar of Zeus at Pergamum the team exteriorize a disciplinary teaching process and render it electronically. At the same time, they demonstrate that innovative learning technologies need not be imposed upon disciplines from outside but rather that they should be constructed to suit these disciplines’ own pedagogical requirements and allow practitioners to maintain control over their teaching materials. Again we see that interdisciplinary collaboration is essential to fulfil the most promising potentialities of digital research.

Finally, Melissa Terras draws together many of the central themes of this volume in Chapter 10, ‘The Digital Classicist: Disciplinary Focus and Interdisciplinary Vision’. She sketches out issues of disciplinarity and the benefits of interdisciplinary research, observing that Classicists have always been at the forefront of innovation and collaborative thinking. There are potential problem areas, including disciplinary identity, skill sets and expectations for publication, which need to be negotiated at the outset of any project. What are the benefits of utilizing computational technologies to undertake research on Classical Antiquity? Important case studies (including projects described in Chapters 1 and 5) are used to tease out and highlight the need for effective communication and collaboration between competing academic disciplines. By understanding interdisciplinarity (which has always been part of Classical scholarship due to the disparate subjects and methods routinely utilized) those undertaking Digital Classics research should be ideally placed to undertake collaborative and digitally innovative projects.

As we noted above, this volume does not seek comprehensively to cover all aspects of innovative digital research in the study of the ancient world, but rather to create a snapshot of the research activities of Digital Classicist members as represented by a selection of the papers given at our Summer seminars and conference panels in one particular year, 2007. Most notably, none of the chapters in this volume deals with image processing and visualization and its importance in our field of academic research. The following Summer’s seminar series saw two major imaging projects reported and discussed: the Codex Sinaiticus project at the British Library, which features the oldest almost complete copy of the New Testament, and EDUCE: Enhanced Digital Unwrapping for Conservation and Exploration at the University of Kentucky, which is using non-invasive volumetric scanning techniques to virtually unroll inaccessible manuscripts such as the carbonized papyri of Herculaneum.

The natural delay between the delivery of papers at a work-in-progress seminar and the appearance of chapters in a published volume means that things have moved on since many of the ideas in this volume were presented in 2007. This book, almost every word of which has been a collaborative endeavour between the authors, editors and reviewers, is very different from how we might have imagined it then. The Digital Classicist has moved on in the intervening period, with our seminars and other occasional talks now being podcast as Open Access audio recordings along with accompanying slides and published on our seminar web page.¹⁸ Events such as these are still the focus of the community and provide our members with a venue to showcase what is innovative and important in the areas where Classics, technology, and e-Science intersect. The 2009 summer seminars in London were specifically selected for the way they demonstrated collaborative projects at the cutting edge between Classics and Computer Science, and half of the speakers came from outside of the UK. Conference panels are planned for future Classical Association (UK) and American Philological Association annual conferences. The summer seminars at the Institute for Classical Studies in London will continue to provide a focus; we have envisaged small summative conferences at the end of future seasons. The Digital Practice seminars being hosted at the Institute for the Study of the Ancient World, New York University,¹⁹ will give a wider international dimension to our events.

As rich as are the chapters that make up this volume, and as important as are some of the themes we have highlighted here, this record barely scratches the surface of the huge range of research that Digital Classicists are carrying out around the world. There will be many more seminars, and volumes of papers as well as monographs before anything like a comprehensive account of the digital development of Classical Studies can be proposed.

¹⁹ ISAW Events Calendar: <http://www.nyu.edu/isaw/events.htm>.