INTRODUCTION

Archaeological theory and digital pasts

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We live in a digital age; a world where computers are omni-present, but in which we are only just beginning to understand how to productively apply them to our lives. In a very short period computers have come from being great number crunching machines to being 'neat' and 'nifty' gadgets, from being almost inaccessible to being everyday devices that we have come to rely upon – perhaps too much. Yet, despite the presence of computers in our offices, homes, cars, planes and, in fact almost every device in the modern world, we do not always know how to utilize them to their best advantage. This is certainly the case in the study of archaeology. To this end one can say that digital archaeology is not so much a specialism, nor a theoretical school, but an approach – a way of better utilizing computers based on an understanding of the strengths and limits of computers and information technology as a whole. This volume presents an overview of some of the more useful and innovative applications of computers to our understanding of the archaeological past. It shows good examples of how technology is being integrated into our approaches to theory, practice and indeed demonstrates how they are assisting in the marriage between the two.

Digital Archaeology explores the basic relationships that archaeologists have with Information and Communication Technology (ICT) and digital technology to assess the impact that such innovations have had on the very basic ways that archaeology is performed and considered. To this end this volume is intended not just for IT or ICT specialists in archaeology, nor for adherents to any one specific theoretical school, but for all those who are interested in and concerned with better understanding how digital approaches have impacted archaeology. It examines the ways that technologies can and do bridge the gap between what have become discrete branches of the same discipline. All of the contributors to this volume are interested in better ways of utilizing computers and computer based technologies in the pursuit of an archaeological past. Towards this end, all of the papers in this volume discuss the formation, current state, and the potential use of ICT in different aspects of archaeology, and/or demonstrate different specific applications which holistically integrate the substance and theory of

archaeology with digital approaches. In all the contributions, the explicit aim has been to focus upon how ICT and other digital techniques are integrated into archaeological theory and practice in ways that expand the limits of what is possible within archaeology.

The idea of this book began in the spring of 2000, when André Tschan gathered Vuk Trifkovic and ourselves to discuss the idea of holding a session at the Theoretical Archaeology Group held in Oxford that year (TAG-2000). Its title was *Archaeological Theory for a Digital Past*, and it consisted of an all-day session that delivered a full range of interesting and stimulating papers, all ultimately concerned with how ICT has been productively added to the 'archaeologist's toolbox' in all facets of the discipline, from field work to data analysis and publication. Sadly, and indeed ironically, before the conference even took place, André developed an inner-ear disorder that prevented him from being in the presence of electronic equipment for extended periods and so was unable to continue with the project. The world of archaeological computing has been a far less interesting one ever since. In spite of this, *Digital Archaeology* continued on.

Since we began, however, both technology and this project have changed. Some of the papers presented at TAG were too dated by the time the volume could be prepared, some authors who participated in the conference were forced to bow out due to other obligations, and others were added because their work had appeared or indeed had gained relevance due to the changes in the digital world. As a result, this volume has changed just as both technology and its application to archaeology have changed.

Yet, in other ways, this volume remains essentially the same work that was conceived of in early 2000. It is an examination of how approaches to archaeology, both methodological and theoretical, need to intelligently utilize the world of Information and Communication Technology and how this can redefine the potential of archaeology in the twenty-first century. As such, this volume is divided into different sections based upon a natural division suggested by Ezra Zubrow, author of Chapter 1. To ensure that the holistic nature of the applications presented in this book are clearly demonstrated, authors were encouraged to provide a much broader context, including an almost equal part of substance, digital methodology, and theoretical consideration.

Thus the book begins, not surprisingly, at the beginning, with Zubrow's *Digital Archaeology: A historical context*. As its title promises, this work provides the context and sets the stage for the rest of the work. A unique combination of general historic overviews and personal observations, Zubrow's work discusses where we have come from, and guides us down the road of how digital archaeology might best be applied. Like any good contextual overview, Zubrow's work also suggests the structure for the rest of the volume, defined by five areas of impact that computers have had and can have in archaeology:

1 ICT and digital techniques are changing the actual practice of recording and representing archaeological data;
2 the influence of the advancement in computers on the use of quantitative methods in archaeology;
3 how ICT has created modelling processes to better understand the interaction between people and their environment;
4 how digital techniques have allowed the development of virtual, hyper and alternate realities;
5 and finally how such approaches have vastly increased the dissemination of information to both professionals and the public.

On their own, each area represents a separate aspect in which digital archaeology is developing, but together represent a manner in which our present approaches to archaeology are being changed, challenged and developed to create new paradigms. As such, Zubrow leads us to the important and perhaps paradoxical conclusion that the development of ICT and digital techniques has now entered a stage in which a combination of factors have begun to make even fairly sophisticated analysis and techniques accessible to a non-dedicated ICT specialist. This increasing egalitarian integration of ICT and digital techniques through all aspects of archaeology has enormous implications, both with regards to digitally empowering archaeologists, and bringing non-ICT specialists deeper into the mix and debate. It holds the potential end result of increasing interaction between different theoretical paradigms and digital approaches. Taken to their conclusions, digital techniques will ultimately redefine the roles of all involved in the archaeological process, from the digger in the field, to the interested public. Recognizing this is the first step to taking an active part in shaping these roles, rather than letting them be haphazardly assigned.

To define these roles we begin by noting what in many ways is the most basic impact of the introduction of ICT to archaeology: the gathering and management of data. Thus the second section of this book examines some of the ways in which computing and technology is changing the recording and interaction with data on site, and the ramifications of these changes in terms of data management. The examples given in this section both come from the front lines of the world of contract archaeology and cultural resource management – the world where most archaeology is actually done. Unfortunately, this side of archaeology is often underemphasized or even excluded from much academic consideration and publication, yet it is here that most data is recorded, and where most archaeological work is performed. Indeed, many of the most innovative and influential uses of computer based technologies in archaeology have and are developing out of this world, both in terms of practical data gathering, and indeed in the very ways in which computers can be used to shape the considerations of the excavation process. The growing incorporation of ICT in all aspects of

commercial archaeology can and has actually served as a valuable link between the commercial, academic and heritage management sectors. Here also are the projects and circumstances where the use and management of such technologies are put to their greatest limits, and where problems, when they occur are most readily and drastically noticed.

The effectiveness of digital technology in field archaeology and the impacts that this has is well illustrated by Bradley's account of the practical use of real-time recording on two very different sites: the historic buildings of Dorchester Abbey, and the excavation of the 'Ferrybridge Chariot burial'. In both of these projects, reflectorless total stations were linked directly to computers, allowing the results or detailed data capture to be shown as recording was taking place. In both cases, this allowed fuller, more informed decisions to be made regarding the excavation and/or the recording of the buildings, and for reflective interpretive analyses to be accessed during the recording processes.

In a broader consideration, Backhouse discusses some of the problems created by the use of computer based applications in archaeology from the perspective of contracting archaeology (or Cultural Resource Management). He notes how the ease and availability of digital techniques have resulted in the creation of a mountain of data that must be both managed and archived without the clear knowledge or understanding of how and when the presence of such information is to be useful. He then goes on to discuss the ways in which the Framework project (jointly run by Oxford Archaeology and Wessex Archaeology) has not only addressed this problem, but has used information technology to integrate archaeological theory and archaeological method and re-introduce the importance of the excavator's perceptions into the final interpretational processes. This use of ICT has had a significant impact, both in the empowerment of the excavators, and in the ability for the final report writers to better gain the 'digger's eye view' of each pit and trench as it has been excavated. It has, in a sense allowed us to better utilize not just the technology, but that most important of all archaeological resources, the archaeologists.

Yet some elements of archaeology cannot be productively done in the field, and indeed can only be attempted through the examination of collected datasets. The third section of this volume discusses this by focusing on quantitative archaeology: the statistics and number crunching of large datasets. As is pointed out by Zubrow, even basic statistical analysis required massive investment in both time and resources just 30 years ago. Desktop computers with standard and effective software packages have dramatically changed this, to the point where most projects have a database of some sort, and the capacity to conduct a full suite of statistical procedures. This ability to manage, manipulate, and work with large and complex datasets most certainly alters the very nature and scope of the questions that can be asked of the data, and the answers received.

In his chapter, Evans explores the use of simple statistics and large datasets

to understand theoretically based questions. He illustrates this with a case that examines how patterns related to concepts of gender and identity can begin to be seen when exceptionally large datasets are examined using even mundane quantitative approaches. An illustrative case, his chapter shows how information technology allows one to begin addressing theory through the use of properly defined questions and how the increasing ability to work with large and complex datasets and statistical procedures influence this. He does this using easily accessible quantitative methods, hinting at the patterns and perceptional expansions that can be obtained through the use of more sophisticated methods.

The fourth section is dedicated to one of the most informative developments in the archaeological use of computers, the use of Geographic Information Systems (GIS) in the modelling of real world processes in the attempt to simulate and perhaps gain new insights into the interaction between humans and their environments. This is an area in which a significant amount of focus has gone into over the past decade, and many of the more talked about developments in ICT in archaeology have focused. As the general use of GIS and related techniques have now become well established in the literature, we have included several chapters which focus on less conventional aspects of archaeological inquiry, as well as an innovative and informed appraisal of technique and exploration of techniques commonly applied in landscape archaeology. Using GIS, these papers examine a variety of significant developments in our ability to more fully understand the archaeological world in particular issues of scale that are inherently relevant in both landscape studies and ICT.

One of the key ways in which GIS has influenced the study of landscape is the ability it has provided for us to examine different scales of human interaction within an overall methodological framework. It has allowed us to explore multiple scales simultaneously, allowing each to feed into the other. The first demonstration of this is by Palmer and Daly, who use a combination of ethnoarchaeological survey and Geographic Information System (GIS) analysis to study nomadic pastoralists living in the Wadi Faynan area in southern Jordan. In their work they examine and bridge the distinct but related scales of large 'regional' issues and the more intimate social practices related to individual sites and families.

In his contribution, Frachetti furthers the interrelated study of scale in his use of GIS and remote sensing to examine the mobile societies of the Eastern Eurasian steppes. His approach, which more fully utilizes some of the more sophisticated elements of GIS programs, examines the landscape and how different elements of scale impact the nature of the human interaction within it. He notes not only the issues of the pragmatic use of space, but also introduces elements of cultural modelling into the system, testing elements of our assumptions about pastoralists, and their relationship with the world about them.

Yet the study of scale is only one aspect of GIS, and in his chapter, Llobera provides a much needed leap forward in the use of digital approaches to explore the visual patterns of past landscapes. Breaking from the growingly mundane uses of GIS, Llobera develops the use of the cumulative viewshed as a tool for exploring development of visual structures within landscape. Through the introduction of such operational approaches, Llobera shows new techniques that, when properly applied, could have drastic impacts on the study of human interaction with the landscape.

The fifth section discusses the development of virtual realities, and how they impact our perceptions and understanding of the past. This side of archaeology is developing into one of the main and most important interfaces between archaeologists and the rest of the world – connecting archaeology into the mainstream world of multimedia and the internet, presenting information in ways that can easily grasp the imagination, attention and interest of the non-professional public. But such techniques also provide further research potential – allowing archaeologists to explore different aspects of the past in new and creative ways. Moving beyond the simple illustrative and visually exciting factors that characterized their introduction, this section shows elements of how the creation of virtual realities can expand our ability to study and understand the archaeological past.

In their chapter, Gearey and Chapman blur the boundaries between GIS modelling and virtual reality through the intelligent use of both to explore issues of palaeovegetation and the landscape. Using known environmental factors Gearey and Chapman use GIS to build up the vegetative elements of archaeological sites and explore the perceptual impact of different approaches to the sites, showing how, if used creatively, such modelling and uses of differing virtual reality approaches can change our perception of the impact of given sites based upon the important data frequently neglected in many such studies. This is followed by Earl's in-depth examinations of the technical realm of virtual reality (VR) modelling, showing how improvements in our technical capacity to simulate the real world can be used to impact our ability to understand it. He illustrates how changes coming out of cinemagraphic approaches to VR can impact our study of the past. Yet he not only sings its praises, but also examines the limitations that such approaches have, discussing both the drawbacks and the advantages that arise from each.

The sixth section of the book discusses what is perhaps the most significant impact of the digital revolution upon archaeology and indeed the rest of the world: the dissemination of information. This part is the foundation for an inspired and innovative way to make archaeology a truly inclusive discipline, increasing the possibilities for people to present and access the past regardless of their relationships to it. Furthermore, it is one of the main vehicles for encouraging multi-vocality and pluralism, while changing the very definition of how data can be structured and presented – redefining who can be involved in an informed interpretative process.

Richards' discussion of the developments of digital publishing gives an in-depth look at the issues involved with publishing across the various digital media, and discusses the ways that electronic publishing has and will continue to impact archaeology. Lock's chapter on the use of digital resources in the educational environment examines how technological resources are being used in the learning environment. Avoiding the technophillic approach, Lock discusses the realities of how computer assisted learning can work to build a better educational environment, and how broader developments in this field are beginning to resonate in archaeology. The development of such approaches can potentially re-structure how archaeology can be taught.

Finally, Baines and Brophy discuss one of the key elements faced when using ICT for the structuring of ideas into a predetermined format. They examine the strengths and problems involved in the creation of digital thesauri for archaeology. Using concrete examples, they show how lack of control can lead to meaningless word searches, but how important subtleties in meanings can be lost with the introduction of too strong a digital hierarchy of words. This is a valuable contribution to the theoretical discussion of the very nature of the categories into which we put archaeological data and how this translates in an ICT environment.

Digital archaeology should exist to assist us in the performance of archaeology as a whole. It should not be a secret knowledge, nor a distinct school of thought, but rather simply seen as archaeology done well, using all of the tools available to aid in better recovering, understanding and presenting the past. In the end, there is no such thing as digital archaeology. What exists, or at least what should exist, are intelligent and practical ways of applying the use of computers to archaeology that better enable us to pursue both our theoretical questions and our methodological applications.