MOBILIZING *the* PAST *for a* DIGITAL FUTURE

The Potential of Digital Archaeology

Edited by
Erin Walcek Averett
Jody Michael Gordon
Derek B. Counts

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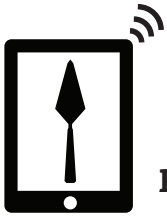


Preface & Acknowledgments

This volume stems from the workshop, "Mobilizing the Past for a Digital Future: the Future of Digital Archaeology," funded by a National Endowment for the Humanities Digital Humanities Start-Up grant (#HD-51851-14), which took place 27-28 February 2015 at Wentworth Institute of Technology in Boston (http://uwm.edu/mobilizing-the-past/). The workshop, organized by this volume's editors, was largely spurred by our own attempts with developing a digital archaeological workflow using mobile tablet computers on the Athienou Archaeological Project (http://aap.toumazou.org; Gordon *et al.*, Ch. 1.4) and our concern for what the future of a mobile and digital archaeology might be. Our initial experiments were exciting, challenging, and rewarding; yet, we were also frustrated by the lack of intra-disciplinary discourse between projects utilizing digital approaches to facilitate archaeological data recording and processing.

Based on our experiences, we decided to initiate a dialogue that could inform our own work and be of use to other projects struggling with similar challenges. Hence, the "Mobilizing the Past" workshop concept was born and a range of digital archaeologists, working in private and academic settings in both Old World and New World archaeology, were invited to participate. In addition, a livestream of the workshop allowed the active participation on Twitter from over 21 countires, including 31 US states (@MobileArc15, #MobileArc).[1]

[1] For commentary produced by the social media followers for this event, see: https://twitter.com/electricarchaeo/status/571866193667047424, http://shawngraham.github.io/exercise/mobilearcday1wordcloud.html, https://twitter.com/electricarchaeo/status/571867092091338752, http://www.diachronicdesign.com/blog/2015/02/28/15-mobilizing-the-past-for-the-digital-future-conference-day-1-roundup/.

Although the workshop was initially aimed at processes of archaeological data recording in the field, it soon became clear that these practices were entangled with larger digital archaeological systems and even socio-economic and ethical concerns. Thus, the final workshop's discursive purview expanded beyond the use of mobile devices in the field to embrace a range of issues currently affecting digital archaeology, which we define as the use of computerized, and especially internet-compatible and portable, tools and systems aimed at facilitating the documentation and interpretation of material culture as well as its publication and dissemination. In total, the workshop included 21 presentations organized into five sessions (see program, http://mobilizingthepast.mukurtu.net/digital-heritage/mobilizing-past-conference-program), including a keynote lecture by John Wallrodt on the state of the field, "Why paperless?: Digital Technology and Archaeology," and a plenary lecture by Bernard Frischer, "The Ara Pacis and Montecitorio Obelisk of Augustus: A Simpirical Investigation," which explored how digital data can be transformed into virtual archaeological landscapes.

The session themes were specifically devised to explore how archaeological data was digitally collected, processed, and analyzed as it moved from the trench to the lab to the digital repository. The first session, "App/Database Development and Use for Mobile Computing in Archaeology," included papers primarily focused on software for field recording and spatial visualization. The second session, "Mobile Computing in the Field," assembled a range of presenters whose projects had actively utilized mobile computing devices (such as Apple iPads) for archaeological data recording and was concerned with shedding light on their utility within a range of fieldwork situations. The third session, "Systems for Archaeological Data Management," offered presentations on several types of archaeological workflows that marshal born-digital data from the field to publication, including fully bespoken paperless systems, do-it-yourself ("DIY") paperless systems, and hybrid digital-paper systems. The fourth and final session, "Pedagogy, Data Curation, and Reflection," mainly dealt with teaching digital methodologies and the use of digital repositories and linked open data to enhance field research. This session's final paper, William Caraher's "Toward a Slow Archaeology," however, noted digital archaeology's successes in terms of

time and money saved and the collection of more data, but also called for a more measured consideration of the significant changes that these technologies are having on how archaeologists engage with and interpret archaeological materials.

The workshop's overarching goal was to bring together leading practitioners of digital archaeology in order to discuss the use, creation, and implementation of mobile and digital, or so-called "paperless," archaeological data recording systems. Originally, we hoped to come up with a range of best practices for mobile computing in the field – a manual of sorts – that could be used by newer projects interested in experimenting with digital methods, or even by established projects hoping to revise their digital workflows in order to increase their efficiency or, alternatively, reflect on their utility and ethical implications. Yet, what the workshop ultimately proved is that there are many ways to "do" digital archaeology, and that archaeology as a discipline is engaged in a process of discovering what digital archaeology should (and, perhaps, should not) be as we progress towards a future where all archaeologists, whether they like it or not, must engage with what Steven Ellis has called the "digital filter."

So, (un)fortunately, this volume is not a "how-to" manual. In the end, there seems to be no uniform way to "mobilize the past." Instead, this volume reprises the workshop's presentations—now revised and enriched based on the meeting's debates as well as the editorial and peer review processes—in order to provide archaeologists with an extremely rich, diverse, and reflexive overview of the process of defining what digital archaeology is and what it can and should perhaps be. It also provides two erudite response papers that together form a didactic manifesto aimed at outlining a possible future for digital archaeology that is critical, diverse, data-rich, efficient, open, and most importantly, ethical. If this volume, which we offer both expeditiously and freely, helps make this ethos a reality, we foresee a bright future for mobilizing the past.

* * *

No multifaceted academic endeavor like *Mobilizing the Past* can be realized without the support of a range of institutions and individ-

uals who believe in the organizers' plans and goals. Thus, we would like to thank the following institutions and individuals for their logistical, financial, and academic support in making both the workshop and this volume a reality. First and foremost, we extend our gratitude toward The National Endowment for the Humanities (NEH) for providing us with a Digital Humanities Start-Up Grant (#HD-51851-14), and especially to Jennifer Serventi and Perry Collins for their invaluable assistance through the application process and beyond. Without the financial support from this grant the workshop and this publication would not have been possible. We would also like to thank Susan Alcock (Special Counsel for Institutional Outreach and Engagement, University of Michigan) for supporting our grant application and workshop.

The workshop was graciously hosted by Wentworth Institute of Technology (Boston, MA). For help with hosting we would like to thank in particular Zorica Pantić (President), Russell Pinizzotto (Provost), Charlene Roy (Director of Business Services), Patrick Hafford (Dean, College of Arts and Sciences), Ronald Bernier (Chair, Humanities and Social Sciences), Charles Wiseman (Chair, Computer Science and Networking), Tristan Cary (Manager of User Services, Media Services), and Claudio Santiago (Utility Coordinator, Physical Plant).

Invaluable financial and logistical support was also generously provided by the Department of Fine and Performing Arts and Sponsored Programs Administration at Creighton University (Omaha, NE). In particular, we are grateful to Fred Hanna (Chair, Fine and Performing Arts) and J. Buresh (Program Manager, Fine and Performing Arts), and to Beth Herr (Director, Sponsored Programs Administration) and Barbara Bittner (Senior Communications Management, Sponsored Programs Administration) for assistance managing the NEH grant and more. Additional support was provided by The University of Wisconsin-Milwaukee; in particular, David Clark (Associate Dean, College of Letters and Science), and Kate Negri (Academic Department Assistant, Department of Art History). Further support was provided by Davidson College and, most importantly, we express our gratitude to Michael K. Toumazou (Director, Athienou Archaeological Project) for believing in and supporting our

research and for allowing us to integrate mobile devices and digital workflows in the field.

The workshop itself benefitted from the help of Kathryn Grossman (Massachusetts Institute of Technology) and Tate Paulette (Brown University) for on-site registration and much more. Special thanks goes to Daniel Coslett (University of Washington) for graphic design work for both the workshop materials and this volume. We would also like to thank Scott Moore (Indiana University of Pennsylvania) for managing our workshop social media presence and his support throughout this project from workshop to publication.

This publication was a pleasure to edit, thanks in no small part to Bill Caraher (Director and Publisher, The Digital Press at the University of North Dakota), who provided us with an outstanding collaborative publishing experience. We would also like to thank Jennifer Sacher (Managing Editor, INSTAP Academic Press) for her conscientious copyediting and Brandon Olson for his careful reading of the final proofs. Moreover, we sincerely appreciate the efforts of this volume's anonymous reviewers, who provided detailed, thought-provoking, and timely feedback on the papers; their insights greatly improved this publication. We are also grateful to Michael Ashley and his team at the Center for Digital Archaeology for their help setting up the accompanying Mobilizing the Past Mukurtu site and Kristin M. Woodward of the University of Wisconsin-Milwaukee Libraries for assistance with publishing and archiving this project through UWM Digital Commons. In addition, we are grateful to the volume's two respondents, Morag Kersel (DePaul University) and Adam Rabinowitz (University of Texas at Austin), who generated erudite responses to the chapters in the volume. Last but not least, we owe our gratitude to all of the presenters who attended the workshop in Boston, our audience from the Boston area, and our colleagues on Twitter (and most notably, Shawn Graham of Carlton University for his word clouds) who keenly "tuned in" via the workshop's live-stream. Finally, we extend our warmest thanks to the contributors of this volume for their excellent and timely chapters. This volume, of course, would not have been possible without such excellent papers.

As this list of collaborators demonstrates, the discipline of archaeology and its digital future remains a vital area of interest for people who value the past's ability to inform the present, and who

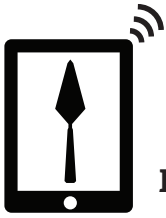
recognize our ethical responsibility to consider technology's role in contemporary society. For our part, we hope that the experiences and issues presented in this volume help to shape new intra-disciplinary and critical ways of mobilizing the past so that human knowledge can continue to develop ethically at the intersection of archaeology and technology.

Erin Walcek Averett (Department of Fine and Performing Arts and Classical and Near Eastern Studies, Creighton University)

Jody Michael Gordon (Department of Humanities and Social Sciences, Wentworth Institute of Technology)

Derek B. Counts (Department of Art History, University of Wisconsin-Milwaukee)

October 1, 2016



How To Use This Book

The Digital Press at the University of North Dakota is a collaborative press and *Mobilizing the Past for a Digital Future* is an open, collaborative project. The synergistic nature of this project manifests itself in the two links that appear in a box at the end of every chapter.

The first link directs the reader to a site dedicated to the book, which is powered and hosted by the Center for Digital Archaeology's (CoDA) Mukurtu.net. The Murkutu application was designed to help indigenous communities share and manage their cultural heritage, but we have adapted it to share the digital heritage produced at the "Mobilizing the Past" workshop and during the course of making this book. Michael Ashley, the Director of Technology at CoDA, participated in the "Mobilizing the Past" workshop and facilitated our collaboration. The Mukurtu.net site (https://mobilizingthepast.mukurtu.net) has space dedicated to every chapter that includes a PDF of the chapter, a video of the paper presented at the workshop, and any supplemental material supplied by the authors. The QR code in the box directs readers to the same space and is designed to streamline the digital integration of the paper book.

The second link in the box provides open access to the individual chapter archived within University of Wisconsin-Milwaukee's installation of Digital Commons, where the entire volume can also be downloaded. Kristin M. Woodward (UWM Libraries) facilitated the creation of these pages and ensured that the book and individual chapters included proper metadata.

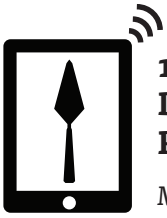
Our hope is that these collaborations, in addition to the open license under which this book is published, expose the book to a wider audience and provide a platform that ensures the continued availability of the digital complements and supplements to the text. Partnerships with CoDA and the University of Wisconsin-Milwaukee reflect the collaborative spirit of The Digital Press, this project, and digital archaeology in general.

Abbreviations

AAI	Alexandria Archive Institute
AAP	Athienou Archaeological Project
ABS	acrylonitrile butadiene styrene (plastic)
ADS	Archaeological Data Service
Alt-Acs	Alternative Academics
API	application programming interface
ARA	archaeological resource assessment
ARC	Australian Research Council
ARIS	adaptive resolution imaging sonar
ASV	autonomous surface vehicle
BLM	Bureau of Land Management
BLOB	Binary Large Object
BOR	Bureau of Reclamation
BYOD	bring your own device
CAD	computer-aided design
CDL	California Digital Library
CHDK	Canon Hack Development Kit
cm	centimeter/s
CMOS	complementary metal-oxide semiconductor
CoDA	Center for Digital Archaeology
COLLADA	COLLAborative Design Activity
CRM	cultural resource management
CSS	Cascading Style Sheet
CSV	comma separated values
DBMS	desktop database management system
DEM	digital elevation model
DINAA	Digital Index of North American Archaeology
DIY	do-it-yourself
DoD	Department of Defense
DVL	doppler velocity log
EAV	entity-attribute-value
EDM	electronic distance measurement
EU	excavation unit/s
FAIMS	Federated Archaeological Information Management System
fMRI	functional magnetic resonance imaging
GIS	geographical information system
GCP	ground control point
GNSS	global navigation satellite system
GPR	ground-penetrating radar

GUI	graphic user interface
ha	hectare/s
hr	hour/s
Hz	Hertz
HDSM	high-density survey and measurement
ICE	Image Composite Editor (Microsoft)
iOS	iPhone operating system
INS	inertial motion sensor
IPinCH	Intellectual Property in Cultural Heritage
IT	information technology
KAP	Kaymakçı Archaeological Project
KARS	Keos Archaeological Regional Survey
km	kilometer/s
LABUST	Laboratory for Underwater Systems and Technologies (University of Zagreb)
LAN	local area network
LIEF	Linkage Infrastructure Equipment and Facilities
LOD	linked open data
LTE	Long-Term Evolution
m	meter/s
masl	meters above sea level
MEMSAP	Malawi Earlier-Middle Stone Age Project
MOA	memoranda of agreement
MOOC	Massive Online Open Course
NGWSP	Navajo-Gallup Water Supply Project
NeCTAR	National eResearch Collaboration Tools and Resources
NEH	National Endowment for the Humanities
NHPA	National Historic Preservation Act
NPS	National Park Service
NRHP	National Register of Historic Places
NSF	National Science Foundation
OCR	optical character reader
OS	operating system
PA	programmatic agreement
PAP	pole aerial photography
PARP:PS	Pompeii Archaeological Research Project: Porta Stabia
PATA	Proyecto Arqueológico Tuti Antiguo
PBMP	Pompeii Bibliography and Mapping Project
PDA	personal digital assistant

PIARA	Proyecto de Investigación Arqueológico Regional Ancash
PKAP	Pyla-Koutsopetra Archaeological Project
Pladypos	PLAtform for DYnamic POSitioning
PLoS	Public Library of Science
PQP	Pompeii Quadriporticus Project
PZAC	Proyecto Arqueológico Zaña Colonial
QA	quality assurance
QC	quality control
QR	quick response
REVEAL	Reconstruction and Exploratory Visualization: Engineering meets ArchaeoLogy
ROS	robot operating system
ROV	remotely operated vehicle
RRN	Reciprocal Research Network
RSS	Rich Site Summary
RTK	real-time kinetic global navigation satellite system
SfM	structure from motion
SHPO	State Historic Preservation Office
SKAP	Say Kah Archaeological Project
SLAM	simultaneous localization and mapping
SMU	square meter unit/s
SU	stratigraphic unit/s
SVP	Sangro Valley Project
TCP	traditional cultural properties
tDAR	the Digital Archaeological Record
UAV	unmanned aerial vehicle
UNASAM	National University of Ancash, Santiago Antúnez de Mayolo
UQ	University of Queensland
USACE	U.S. Army Corp of Engineers
USBL	ultra-short baseline
USFS	U.S. Forest Service
USV	unmanned surface vehicle
UTM	universal transverse mercator
XML	Extensible Markup Language



1.6.
Digital Archaeology in the Rural Andes: Problems and Prospects

Matthew Sayre

The prospects for digital archaeology are exciting and they can broaden our sense of community archaeology. The opportunity to expose new generations of students and community members to the stirring analytical possibilities that digital archaeology can provide opens up new areas for dialogue. As technology changes rapidly, and we train new generations of students who have never had the experience of using a film camera, we must be aware that this can lead them to assume that "Slow Archaeology" (Caraher 2013; Ch. 4.1) or paper recording are antiquated. Archaeologists, of all people, however, should realize that older technologies often continue to be useful. In this chapter I attempt to present and investigate these issues in an accessible manner. The two major issues addressed are (1) the process of implementing digital recording methods, and (2) our project's effort to engage in a community-focused effort to decolonize digital archaeology.

I describe here the attempts of the archaeological project at Chavín de Huántar, in Peru, to move fully into digital recording of archaeological data (for similar topics, see Ellis, Ch. 1.2; Motz, Ch. 1.3; Wernke *et al.*, Ch. 2.3). There were both pragmatic and theoretical difficulties in our attempts to transition into a digital program, and while the pragmatic and theoretical concerns did overlap, some of the theoretical difficulties could also be regarded as ethical issues.

Many of the problems that our project experienced in converting to digital recording methods were related to the particulars of the site. As will be described below, there are distinct concerns that arise working in a rural setting in the developing world, and many of these

Figure 1: Map of Chavín de Huántar in Peru.

issues would not emerge in the same way if our project were situated near an urban center in the "First World." While many of these issues arise due to economic inequality, there are also issues about who gets to use advanced technology and how archaeologists can decolonize the acquisition and processing of data.

The Project at Chavín de Huántar, Peru

Chavín de Huántar is a UNESCO World Heritage Site that was inscribed in the UNESCO list in 1985 (FIG. 1). Its early inclusion on the list was in recognition of its tremendous importance in the history of the Andean region as well as in the history of Peruvian archaeology. The site and similarly named culture principally developed between 1200–500 B.C. (Rick *et al*. 2011). It is recognized that the site functioned as a ceremonial and pilgrimage center that attracted people from across the region. This site is composed of an elaborate stone temple, constructed plazas, and surrounding ritual facilities. The ceremonial and monumental nature of the site is visible in its fine stonework with elaborate iconography that depicts anthropomorphic as well as zoomorphic imagery from across the region, as well as in its internal gallery system and extensive canal network that runs across the site, connecting it to other water movement features at the boundaries of the temple (Burger 1995; Rick 2008). Sites of this complexity often have formally separated ritual space along with evidence of inter-regional interaction (Rowe 1963; Moore 2005).

The Stanford Project began work at the site in 1994, and although the early years of the project were devoted to the then-novel technology of theodolite mapping (Kembel 2008), the group has since moved beyond mapping and now encompasses many different aspects of anthropological and archaeological research. Initial work at the site focused on the monumental center, but later projects have expanded to include encompassing areas (Mesia 2012; Contreras 2014; Sayre *et al*. 2015). Over the years the project has expanded, and there has been a consistent emphasis on including new technologies that permit more accurate recording of spatial and archaeological data (Ristevski 2006; Kembel 2008; Contreras 2009; Rick *et al*. 2011).

The project has included archaeologists from around the world, but the majority of the professional team is Peruvian and there are

many local workers on the project who have developed expertise over decades of fieldwork. This on-the-job training shares similarities with the archaeological field school experience, but the local excavators often come from farming families. As such, these workers come to the project with extensive expertise in working with local soils and sediments.

In the rural Andean region of Peru there are many areas with high levels of poverty (Matos Mar 1984). Since colonial times, much of the wealth of the country has been concentrated on the coast and in the capital of Lima. This has left the highlands as a region that has suffered both economic and racial injustice. Up until the 1960s, inhabitants of the highlands were commonly referred to as indians (*indios*), which was considered a pejorative term (Matos Mar 1984). Currently, people in the region commonly refer to themselves as peasants (*campesinos*), a term that was preferred by government officials. Many aspects of the project at Chavín are impacted by this history of working in an under-resourced region with a history of mistreatment by coastal elites.

Our Experience with Digital Recording

The Chavín archaeological project was an early adopter of digital recording techniques, beginning with its use of laser theodolites in the 1990s. Many of the problems that arose with the early adoption of digital technologies were inherent to the process of applying recently developed software to a new region. The software that our team, in particular John Rick of Stanford University, was trained in in 2011 was the PC-based REVEAL platform (Reconstruction and Exploratory Visualization: Engineering meets ArchaeoLogy). The platform was deployed significantly in the 2011 field season.

REVEAL's developers state that it is "a system for streamlined powerful sensing, archiving, extracting information from, visualizing and communicating, archaeological site-excavation data" (https://vision.lems.brown.edu/project_desc/Reveal), and the platform is available to the archaeology community as an open-source project. It provides core computer-vision/pattern-recognition/machine-learning research with applications to archaeology and the humanities. The website describes this process, stating ". . . REVEAL Analyzer provides the excavator, researcher, or student with

integrated multi-format access to the tables, photographs, and 3D models in the database. Exploring and filtering the data in plan view, 3D view, photo view, or tabular view generates automatic back-end queries to extract, format, and display relevant information from the database." While this program is admirable in its ambition and scope, we encountered some difficulties applying this program to fieldwork in the rural Andes.

Many of the complications that arose were due to differences in archaeological practice around the world. Much of the REVEAL program appears to have been developed with the terminology and techniques of Mediterranean archaeology in mind, but different standards and methodologies around the world lead to different definitions of artifacts, site types, and soil counts. For example, trenches and spits are typical spatial excavation areas in the Mediterranean, whereas many projects in the Americas rely on spatial units of varying sizes. The denotation of units is also an issue as more and more projects in the Andes are moving away from using standardized unit sizes (such as 2 x 2 m units) and moving toward using the locus system of excavation that permits users to easily construct Harris matrices (Harris 1979). This is further complicated by the issue in Peru that some governmental authorities prefer to see standard unit areas when they inspect excavations, while others require the use of the locus excavation system and the completion of a Harris matrix at the end of the season. Another difference in technique is that in the Andes, archaeologists routinely use bucket counts in order to document the density of finds, and in this case the REVEAL program allowed for baskets of dirt, which did not seem to connect immediately with density computational outputs (e.g., the Chavín project typically uses 10-liter buckets to measure soil volume). These examples highlight the tension that exists between standardized group software and bespoke systems designed by individuals for use by a small and specialized excavation team (for more specialized discussions of this issue, see Castro López *et al.*, Ch. 3.1; Dufton, Ch. 3.3).

There were issues with the REVEAL software that arose at our field site that would likely not be major issues in regions of the world that have reliable Internet access. The lack of reliable access led to syncing problems, including the inability to synchronize data files easily with Dropbox accounts. In general, a significant advantage to digital recording of archaeological field data is the capacity to export data

files into online databases. If this is possible, it enables specialists to access field data immediately as well as help all members of the field team avoid the double duty of entering paper field forms into databases that are generally stored online. The project was unfortunately unable to avoid this double recording of forms.

Some of the strengths of the REVEAL software were compelling enough to make our team excited about future possibilities. The software had great compatibility with PC-based tablets and the software synchronized well across desktops and laptop computers (this is always an issue in areas with limited access to wireless Internet). Many of the problems of synchronization were resolved once a local intranet was established. Additionally, the tablets were compatible with Windows, and access to other operating systems in Peru can be difficult to manage.

One final issue we faced was how to create documents for government review agencies. This matter arose as many forms are recorded in both Spanish and English. While the original forms are all in Spanish, some of the team members (primarily North American undergraduate students) are monolingual English speakers, and we have to consistently translate content into Spanish. This problem continues to exist and will likely not be eliminated by technology. This double work of translation may eventually be solved by translation software, but for now the manual entering and translating of paper field forms into databases is still more clearly managed by having only one typed, final form.

Early Adopters, Students, and the Value of Digital Methodologies

The varied backgrounds of excavators on projects are something that all larger excavation teams will encounter. This is a particular issue on field schools where participants are just beginning to learn archaeological terminology. As directors train students in new terminology and skills, such as recording differences in micro-stratigraphy, the means by which they record those notes may be less of hindrance to the students than the challenge of fieldwork itself (see Ellis, Ch. 1.2, for a critical discussion of this issue).

The collection and correction of written forms is a standardized practice on most projects and this is an area where the online

management of group files facilitates work. If supervisors have access at all times to students' field forms, they can correct and add notes at any point in time. As we train students in field note taking and digital methodology it is possible to show them that these skills are applicable outside of archaeological excavations. The ability to synthesize, store, and process large amounts of digital data is a skillset that is transferable to many other fields. This is part of the advantage of being early adapters of new technologies; the skills learned in a class setting can then be taken outside of the classroom and integrated into private and public sector occupations (cf., Bria and DeTore, Ch. 1.5; Kansa, Ch. 4.2)

As I have previously discussed, field schools are an example of the flipped classroom (Sayre 2014). In these settings, students are taking material from lectures and books and applying it to a real world context. Their supervisors are responsible for answering questions and guiding them through the learning process so that they can begin to identify stratigraphic changes and significant finds on their own. The goal of developing independent and self-guided learners is one that melds well with the digital domain. As information is recorded and uploaded to digital databases, it enables new learners to pose questions of their peers and supervisors, thus creating a more open and questioning community of archaeologists than would be possible if field excavators were simply recording their notes in field notebooks that would solely be reviewed by their immediate supervisor.

One area of laboratory work where we have rapidly implemented digital methodologies is in the recording and processing of architectural and ceramic data. These two types of cultural material traditionally required specialists to spend tremendous amounts of time drawing in the field and in the laboratory. As digital photography and photogrammetry have become increasingly more advanced over time, we have been able to spend less time drawing these objects and more time creating accurate three-dimensional models of artifacts, ceramics, and walls (FIG. 2). The team members who specialize in creating these models can take these digital skills and apply them to many domains. This was a central topic of the documentary that I helped to produce (www.intothefieldfilm.com), which seeks to present the importance of archaeology to a broad public audience.

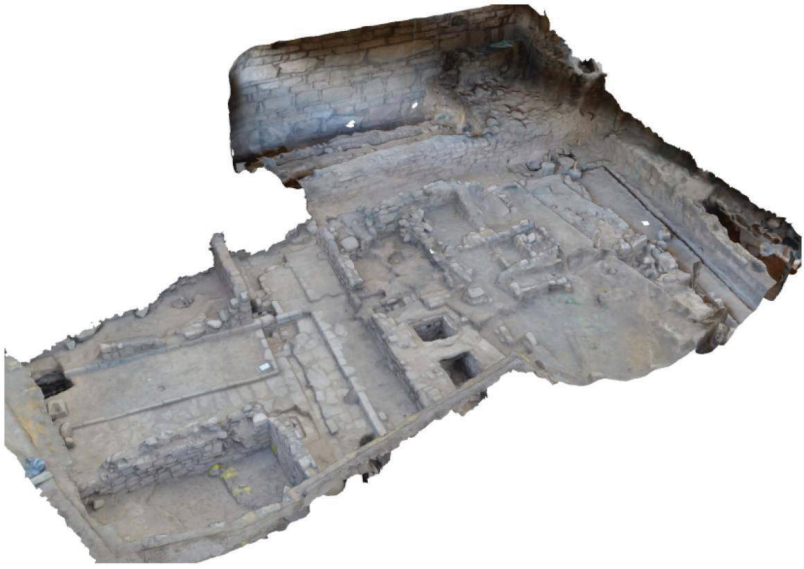


Figure 2: Creating a photogrammetry model of architecture at Chavín. Figure courtesy of J. Rick.

Technical Advantages of Digital Archaeology

There are many advantages to switching toward digital archaeology. While this chapter has emphasized some of the difficulties of this work, in particular those that arise while working in a rural setting in a developing nation, one of the reasons why this transition is occurring is because there are significant benefits to changing practices.

The real-time processing of data, both visual and textual, is important. As three-dimensional visual data becomes more nuanced and detailed, it will permit researchers to ask new questions of the spaces that have been excavated and how those spaces relate to the broader world around them. The syncing of written records with online databases will provide access for remote researchers, particularly specialists who are not always present on-site, to provide insights and ask question of field researchers. It will also permit fluid exportation of visual and textual data for final reports and later academic research. The relative ease with which researchers can share their data with the public could lessen the tendency of contract and academic archaeology to produce grey literature that is not easily accessible to interested parties.

Digital archaeology also provides the possibility of creating a more environmentally sustainable archaeology. The lower reliability on paper will lessen the impact on the environment, and the increased emphasis on digital tools could lead more projects to invest in solar digital chargers and other sources providing clean energy for archaeological field and laboratory projects. While this transition has not yet occurred, a fully digital project may feel greater need to make this change. This does not mean, however, that there are still not social issues involved in the transition to digital recording.

"No One Steals Paper," or Digital Archaeology within a Developing World Context

Digital archaeology does not solely exist in the ethereal "series of tubes" that is the Internet; rather, its application and practice occurs in real world settings. For example, there were less than five telephones in town when I first came to Chavín de Huántar in Peru in 2002. Soon the number of fixed lines expanded and people began to construct Internet cafés. Over the years these cafés converted into gaming and

chat centers as the Internet connections were too slow to engage in any serious work. This change was soon followed by the introduction of cellular phones, which soon became the dominant means of communication in town. In fact, they remain the primary means of communication with the outside world as there is still verypoor reliable Internet access. While our project has established a good intranet system, there is still little access to outside connections.

The local population continues to have little connection to email or cloud services. This lack of availability prevents our project from being able to reliably store terabytes of archaeological/visual data online. Limited connections also prevent us from engaging in some of the more compelling aspects of digital archaeology, such as the immediate uploading of visual data onto cloud platforms that are accessible by outside researchers working offsite. While we currently maintain databases that are accessible after the field season, there is a positive impact resulting from the lack of cloud access at the site as it makes it necessary for project members to come to the site and interact with their fellow archaeologists. These in-person moments can lead to conversations and correlations that may not have happened if people were not physically present on the project site.

There are a number of cost requirements that have also impeded the project's transition to a fully digital program (see Castro López *et al.*, Ch. 3.1; Ellis, Ch. 1.2). Some of the hardware costs will be clear to all researchers, but some of the costs vary based upon the location and local realities of the project site. For example, a major international project working at pre-ceramic sites in coastal Peru has stated that they anticipate having a three-year replacement timeline for all hardware (J. Rick, personal communication 2015). This rapid replacement timeline is partially a result of working in a desert environment where dust and wind negatively impact the preservation of equipment. Field archaeology, however, is always hard on equipment and dirt is omnipresent at archaeological field sites, and a three-year timeline for replacing all tablets, desktops, and field computers is a high cost for most academic or contract archaeology projects.

One particular concern that arises in many places in the developing world is that class difference becomes apparent when archaeologists are seen carrying tablets and digital equipment around town in local communities. The value of this equipment, which routinely is above a thousand dollars per instrument, is beyond the purchasing power

of nearly all people in the developing world. For example, the daily wage in many areas of rural Peru is routinely less than US$10 per day (Zambrano *et al.* 2014), and many people do not have access to paid labor positions. Thus, there are many members of these communities who get by on less than US$5 per day (Matos Mar 1984; Zambrano *et al.* 2014). This wealth discrepancy can lead to tensions within the local populace, who can begin to view the archaeological project as a wealthy influx of outsiders with little knowledge of how difficult life can be for common people in their communities. It could also attract the unwanted attention of criminal elements that exist in all communities around the world.

One particular concern in recent years in Peru has been payroll robberies, and one Peruvian project on the coast of Peru experienced such an event in recent years (J. Rick, personal communication 2015). Local community members learned the payday of local field workers and realized that the cash payments were being delivered once every two weeks by truck. This truck was stopped at gunpoint on the road and robbed. Quite clearly, no member of an archaeology project wishes to put any member of the project in the face of deadly harm. While some payments can now be made directly into bank accounts, it is also clear that there is not too much of a distinction between cash robberies and robberies focused on hardware and equipment. This is why some members of the archaeological community (J. Rick, personal communication 2015) say, "no one steals paper." The recording of excavation data on paper limits the amount of visible valuable equipment in the field and also adds to the sense that the work is academic in nature and not engaged in ostentatious displays of wealth.

Decolonizing Archaeological Practice

There are inherent social tensions in almost all realms of archaeological practice. These tensions are often magnified when archaeologists work abroad, and they can be further compounded when a group of archaeologists from the global north works in the global south. This is the case with our project, where the directors of the project are Peruvian and North American. While the permitting process for all fieldwork in Peru is managed and granted by the cabinet-level office of the Ministry of Culture, there are also non-bureaucratic concerns that

Figure 3: Dr. John Rick and local expert José Luis Cruzado Coronel working on the digital archeoacoustics project.

have to be addressed. Some of these concerns center around economic inequality and access to technology.

The Chavín project works in a rural Andean town where many of the local inhabitants lack formal employment. When formal work does exist, it routinely pays less than the official minimum wage of 750 soles (roughly US$230) per month. This leaves a community composed of workers who generally earn less than US$5 per day. While many members of the local community grow and raise most of their food, they also seek to own technology and material goods that connect them to the broader world.

The Chavín archaeological project uses standard technology for its research. These include personal computers, desktops, digital cameras, tablet computers, theodolites, and scanning machines. Each of these pieces of equipment generally costs over US$1,000. This represents almost half a year's salary for many members of the local community and undoubtedly causes tension. Many members of the archaeological project find it awkward when a local community member asks them how much their camera, phone, or shoes cost, but it must be acknowledged that these are natural questions that provide useful information to people who need to negotiate their salaries and other forms of compensation with people who are coming from other areas of the country or from abroad. The differences in income and access to material goods can lead to problems and adversely affect community relations.

One of the means by which our project director has attempted to enhance community relations is by making sure that members of the local community are trained in the use of advanced technology. Beginning in 2003, Rick began to hire local high-school students to learn how to use digital cameras and to process the images they took on project computers using sophisticated software. The removal of expensive equipment from the archaeologists' hands and its placement in the hands of local community members visually displayed how technology can be democratizing (FIG. 3). In this case, trust and openness with local community members led to increased reciprocated trust. In addition, many of these local students took the digital skills that they learned and applied them in other careers.

If we are to decolonize archaeology, we must go beyond simply handing the camera over to a different set of hands. The local *campesino* has more to offer than day labor. As workers collaborate together

on the excavation process, many local insights should be added into the interpretation process. Some of those insights involve training outside archaeologists to view the landscape and environment through local eyes. An additional means of decolonizing the discipline, and turning to more community-based research has been simply to ask what the local community would like from the archaeological project. In our case, the answers have varied tremendously—everything from language lessons to enhanced business contacts with the tourism industry have been requested. As the project responds to the needs and requests of the community, they expand the scope and importance of the project.

In the end, much of the research at the site has been guided by the words of previous Chavín project director, Luis Lumbreras (1981: 6, with translation by the author):

> La arqueología no es, como no lo es ninguna ciencia, una etérea actividad académica aislada de los problemas de la sociedad donde se desarrolla; es, y siempre ha sido, un instrumento activo de la lucha social que [. . .] sirve para cohesionar y dar sustento a la clase social que la utiliza. La Arqueología es arma de opresión cuando sirve para justificar la explotación de los campesinos indígenas de nuestros países, desarrollando teorías que muestran su inferioridad histórica frente a los invasores europeos y su proclividad a la decadencia. Es arma de opresión cuando saluda y engrandece el pasado para denostar el presente, creando la retrógrada convicción de que 'todo tiempo pasado fue mejor' [. . .] Es arma de opresión cuando convierte en objeto al sujeto histórico. La arqueología, en cambio, es arma de liberación cuando descubre las raíces históricas de los pueblos, enseñando el origen y carácter de su condición de explotados; es arma de liberación, cuando muestra y descubre la transitoriedad de los estados y las clases sociales, la transitoriedad de las instituciones y las pautas de conducta. Es arma de liberación cuando se articula con las demás ciencias sociales, las que se ocupan de los problemas de hoy, y muestra la unidad procesal de la historia en sus términos generales y en sus particularidades regionales o locales.

> Archaeology is not, as it is not any other science, an esoteric academic activity isolated from the problems of the society in which it develops; it is and it has always been, an active instrument of social struggle that [. . .] serves to unite and support the social class that uses it. Archaeology is a weapon of oppression when it justifies the exploitation of indigenous peasants in our countries, while developing theories that show their historical inferiority to the European invaders and their proclivity toward decadence and decline. It is a weapon of oppression when it enhances the past to insult the present, creating the retrograde conviction that 'all the past was better' [. . .] it is a weapon of oppression when it converts an historical subject into an object. Archaeology, however, is a weapon of liberation when it discovers the historical roots of the people, teaching them the origins and character of their current exploited status; it is a weapon of liberation, when it reveals the transience of states and social classes, the transience of institutions and patterns of behavior. It is a weapon of liberation when it joins with the other social sciences, those dealing with the problems of today, and shows the procedural/processual unity of history in general terms along with its regional and local particularities.

Much of this chapter has focused on the real world problems and benefits of switching to digital platforms. As the quote from Lumbreras makes clear, we must always be cognizant of the fact that the knowledge we produce has real world implications and the tools that we use in developing that knowledge can also serve similar ends.

Conclusion

As Sonya Atalay (2012: 2) stated: "If we problematize archaeology's future, three important considerations come to the forefront: the issue of *relevance*, the question of *audience*, and concerns about *benefits*." Digital archaeology must also confront these same three issues. One might argue that the relevance, audience, and benefits of digital archaeology are primarily designed for and associated with wealthy universities. But this chapter has attempted to demonstrate that digital archaeology is relevant to a broader public and community audience

than only academics in the global north. There are many in the public who find digital methods to be both relevant and beneficial to their communities. However, these communities are not always naturally included stakeholders in these conversations, and this remains an issue that must always be acknowledged and addressed.

The chapters in this volume come from a workshop that brought together a broad array of researchers in an attempt to formulate future best practices in digitizing archaeology. While many of the chapters directly engage with some of the technical tools involved in the transition to digital archaeology, this contribution has hopefully added more of the human element into the picture. We must remain committed to working in communities and creating scholarly work that engages with, and is influenced by, the people and communities that surround us.

https://mobilizingthepast.mukurtu.net/collection/16-digital-archaeology-rural-andes-problems-and-prospects

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