MOBILIZING *the* PAST *for a* DIGITAL FUTURE

The Potential of Digital Archaeology

Edited by
Erin Walcek Averett
Jody Michael Gordon
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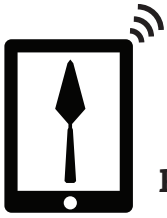

Preface & Acknowledgments

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).

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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.

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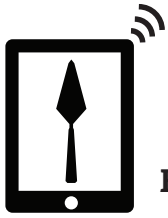
October 1, 2016



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

1.2.
Are We Ready for New (Digital) Ways to Record Archaeological Fieldwork? A Case Study from Pompeii

Steven J. R. Ellis

One of the more fundamental developments in archaeological fieldwork in recent years, and arguably much longer still, has been the introduction of the tablet computer. No other fieldwork tool, or even methodological approach, can be shown to have as many uses, with so much impact, across so many of our current fieldwork recording practices. Yet while I initially described the impact of the tablet as "revolutionizing" archaeological fieldwork, now six summers worth of fieldwork experience has given me some cause to question the impact of tablet computing across the broader discipline (see, esp., Apple Inc. 2010 for the coverage of our research that was profiled on the Apple.com website for much of 2010). To be clear, I stand by the claim that tablets like the iPad will ultimately be seen as having *eventually* revolutionized the ways we record our archaeological fieldwork. The question is, however: why is it taking so long? Systemic revolutions are normally known for their rapidity as much as for their ubiquity.

If tablet computing can be seen as transforming the ways we record archaeological fieldwork, then its impact will have to be measured through the lens of hindsight by those in a generation or two or more. One aim of this chapter is to provide the future student, interested in (the history of) archaeological methodologies, a sense of the disciplinary reception of tablet computers in the recording of archaeological fieldwork (said student would do well to read the thoughts on this "paradigm shift" in Roosevelt *et al.* 2015, esp. 339–340; see also Biddle's observations of systemic change, of almost half a century ago, in Biddle and Kjolbye-Biddle 1969). For while there may be an inevitable sense that computers should be used in undertaking and

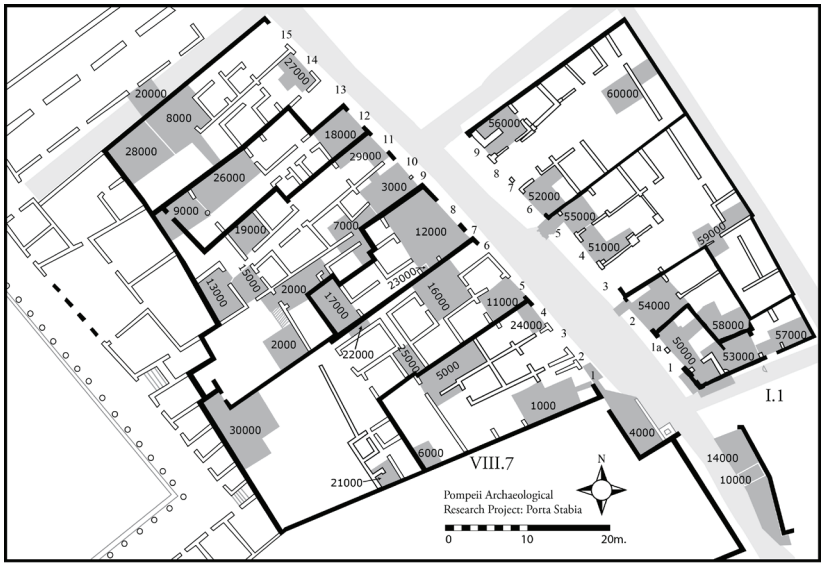


Figure 1: Plan of the PARP:PS excavation site with locations of trenches.

Figure 2: General view of the PARP:PS excavation site.

advancing archaeological research, there is still considerable consternation for change in the way we do our fieldwork.

My experience over the *longue durée* (of barely six field seasons . . .) of using the iPad to record archaeological fieldwork is fairly extensive, covering a handful of projects under my direction and co-direction that can be summarized as follows:

1. *Archaeological excavations*. A large ("big dig") excavation of two Pompeian insulae and their surrounds (FIGS. 1, 2) as part of the Pompeii Archaeological Research Project: Porta Stabia (PARP:PS), which is based at the University of Cincinnati and the American Academy in Rome (for select publications, see Ellis 2011; Ellis *et al*. 2011, 2012, 2015; Ellis in press a; for a more complete bibliography, see http://classics.uc.edu/pompeii/). The comprehensiveness of the PARP:PS team's approach to urban excavations, as well as the scale of the site itself—some 600 years of the social and (infra-) structural making of an urban neighborhood covering around 4,500m^2, including 10 building plots with 20 shop-fronts, as well as infrastructure from fountains to fortifications and from main streets to one of the city's busiest gates—amounted to a massive and complicated digital recording strategy and dataset. Our use of the iPad covered excavation and post-excavation seasons; the project's earliest years pre-dated the iPad.
2. *Architectural surveys*. A survey of the standing remains of one of the largest structures in Pompeii, the Quadriporticus. The Pompeii Quadriporticus Project (PQP), which I co-direct with Eric Poehler, is based at University of Massachusetts Amherst and the University of Cincinnati (see Poehler and Ellis 2011, 2012, 2013, 2014; Poehler, Ch. 1.7). Our four fieldwork seasons were all undertaken with the iPad.
3. *Archival and legacy data studies*. A legacy data project, including architectural survey, of the Panhellenic sanctuary at Isthmia, Greece (see Ellis *et al*. 2008; Ellis and Poehler 2015).
4. *Urban field surveys*. A study of the retail landscapes of more than 100 Roman cities throughout the Mediterranean (Ellis in press b).

Pompeii and the iPad

Before offering something of a very brief overview of my experience with tablets in archaeological field recording, some points of clarification are necessary. The first is that the remainder of this chapter will draw mostly from my experience of using iPads at our Pompeii excavations. The second clarification is that our team's use of these tablets was as a *field device*. This may seem obvious, but it is a point that I have often had to clarify to (conference) rooms full of archaeologists, some of whom have wondered, and often-enough assumed, that we had used the iPad to replace all forms of digital technology from site cameras to office computers. Rather, we use them *mostly* in the field to replace paper notebooks, paper forms, and mylar paper; only rarely did they supplement computers in the field office or library. A third and broader point of clarification—one that is lost to many of the current debates about "going digital"—is the fact that *all* archaeological "projects" are essentially digital projects; I think it is necessary here to define an archaeological "project" *only* as research that is being systematically published. Unless we are to submit photo- or carbonized-copies of our paper-based records (numbering as they are in the hundreds and thousands) to archival holdings and university libraries or elsewhere, taking all of those data and observations or ideas from the trench, site, or field to publication requires passing it through some kind of digital filter. As blindingly obvious as that point may be, it has some resonance for some of the following discussions. To my mind, that digital filter works best—not just for efficiency of data recording, but for the quality and quantity of information that comes from the essentially close relationship between digital recording and engagement with the material—when it is fitted to the site itself.

The final point of clarification is that the overview that follows is aimed at (or perhaps limited to) what are, to me, the more interesting and deeply entrenched aspects of the use of tablets in archaeological fieldwork. It is thus not about the types of apps we have used or an assessment of how we used them. Besides, for the past three seasons we have conducted so-called study seasons with no excavations, and thus—for the most part—have had a somewhat limited need for tablets as field devices. During this time, which is about half the life of the iPad itself, practically every app we had ever used during the excavations has since been significantly updated, while countless

others have appeared that we have yet to use. Even the hardware of the iPad has changed significantly enough from the versions we used for the first three fieldwork seasons; it is now possible to use them to take (at least) decent photos, for example, and to do respectable photogrammetry. Even with these issues aside, much better articles than the one I could write—or rather, could want to write—have focused on the more detailed utility of apps, iPad hardware, and, more interestingly, on calculating the ways in which tablets have improved the efficiency, clarity, volume, and value of field data (from among several, see Fee, Ch. 2.1; Motz, Ch. 1.3; Poehler, Ch. 1.7; Wallrodt, Ch. 1.1; see also, esp., Berggren *et al.* 2015; Roosevelt *et al.* 2015, as well as Poehler and Ellis 2012, 2013, 2014; Fee *et al.* 2013; Austin 2014).

What is worthwhile to point out is that our results and experiences are rather similar, or at least familiar, to those who have actually used tablets in recording field research. The impact of our use of the iPad on our project can be (overly-)summarized as having brought:

1. Faster and more efficient data capture. This data was also cleaner and more accurate than we had ever collected on paper. For example, of the hundreds of thousands of words and numbers recorded on the iPad, not a single one proved illegible. The simplest measure of a spellcheck, for example, ensured that most words were correct, and the occasional process of respelling a word often prompted some necessary review of the syntax of the sentence just written. Data and word searches were especially helpful for recalling various details. More information was recorded for every structure, trench, and context, whether in tabular form or as written descriptions, than had been achieved with pen and paper. Moreover, that (extra) information, from simple descriptions to more thoughtful observations and analyses, was typically of a richer quality (some thoughts on gauging "quality" in field recording are given below).
2. More dynamic data. The entering of more types of data improved our engagement with the material during the recording process, as well as (immediately) fueling a series of otherwise less obvious questions of the metadata behind the more overt datasets and questions.
3. More secure data. All of our field data was regularly backed up through the course of a day, and in multiple places. Whereas our earlier paper-based systems saw our documents and forms

being backed up by scans and photocopies, the more immediate system of backing up our digital data to several devices and servers provided an arguably more stable system of data storage and security. Certainly the newfound simplicity and speed with which our data could be backed up meant that it was done more often than could ever have been feasible in our earlier paper-based system.

4. Better on-site access to the data, and to so much more information besides. Even without access to the Internet, there is an extraordinary amount of data that can be pulled up to benefit the field observations and analyses (see, esp., Poehler and Ellis 2014). The ability to draw on such a wealth of data while still in the field is of enormous analytical benefit to the ongoing research and recording.

The iPad thus radically transformed the ways in which we recorded, and engaged with, the excavation of a large urban site. Many of these improvements from using tablet computers instead of pieces of paper were to be expected, but other advantages were not as readily anticipated. For example, the ability to access live data—whether from trench to trench, or between the various teams of excavators or bio-archaeologists or conservators—caused a heightened engagement between the different cogs of the team network, creating something of an "interdisciplinary" communication that was more active and fruitful than our experience from the pre-iPad years of the project (on the approaches to improving the communication of various subgroups across large fieldwork teams, see Berggren *et al*. 2015: 436, 446). Another striking advantage relates to the non-technical and simple (but not *simplified*) utility of so many of the apps. Almost all of the apps we used had familiar interfaces: for example, we used FileMaker for our databases, Pages for our word-processing, and iDraw and TouchDraw for our vector-based drawing. With genuine respect to those who have spent some years toward developing custom-built, stand-alone apps that can handle a host of archaeological field recording practices, our experience has been one of contentment with the range of commercial apps chosen. This was in part a product of necessity. Given our adoption of the iPad immediately upon its release in 2010, our fleet of apps were those "off-the-shelf" and immediately available (credit here should be given to John Wallrodt of the University of Cincinnati, who tirelessly tested and developed our paperless system so that we were in the field with a fully-operational paperless

system just two months after the release of the iPad; see Wallrodt, Ch. 1.1). But with the proven effectiveness of those apps, their minimal cost (constituting a tiny fraction of 1% of the project budget), stability and available technical support (and ongoing updates), and not least the fact that the vast majority of field data for all archaeological projects is really rather simple and easily handled by such apps, what was once a necessity—the off-the-shelf app—has since become something of a philosophy.

Naturally, some more difficult aspects were encountered along the way to recording digitally in the field, even if their currency or impact on the project has been close to minuscule by comparison to the number and scale of the benefits of going digital. The most significant of these has been the integration of all parts—or rather, people—of the project; it is one thing to convert a paper-based project to a paperless system, but it is another to convert *all* of the project's team members to that system (for some of the challenges of integrating digital systems into established fieldwork projects, but from a pre-iPad perspective, see Fisher *et al.* 2010). It is a common practice for "specialists" on archaeological projects, for example, to bring with them their own rather idiosyncratic systems, honed over decades and on multiple types of projects, to record their data. A good many of the specialists on the Pompeii excavations maintained these time-honored, paper-based recording systems. Naturally that data made its way into our system using more traditional, and achingly time-consuming, methods of data-entry, and the time spent doing that was a reminder of how such resources of a project can be better spent. The integration of paper-based records into a digital system also exposed just how limited the range and potential utility of "traditional" data can be. In part, this experience also served as a reminder that the use of tablets leads toward, and promotes, more of a centralized and integrated system for data structure that is beneficial for everything from data-security to site-wide and multivariate analyses to the management of productivity and publication goals.

Digital Recording in Archaeological Fieldwork

Our experience in converting a paper-based project to a paperless one has thus been overwhelmingly positive. As much seems true for the several other archaeological projects that have since adopted tablets

in their field recording strategies (see, e.g., Austin 2014; Roosevelt *et al*. 2015). But for all the ways in which tablet computers have revolutionized the recording process of so many archaeological projects, the reception of tablets in field archaeology has been strikingly pessimistic and polarizing. It is especially the sharply negative reception of the tablet that I currently find to be of more interest than the continued detailing and explication of their value and utility, especially as much of the reaction speaks to a romanticization of 20th-century fieldwork methodologies married to a broader disciplinary consternation for change in the way we do things. So while an integrated digital data system—from site to analysis to publication and archive—can be described as the "Holy Grail" (May and Crossby 2010: 49), it still is questioned whether it could—or rather, *should*—be possible to convert the "complexities" of the archaeological recording process from tried and tested blank pieces of paper and forms to a computerized system. To be clear, the remainder of what I have to say about the negative, or at least pessimistic, reactions to tablets in archaeology is drawn more from "front-line" experience than from what I can learn via peer-reviewed publications. And this scenario can only in part be pinned on the fact that the topic—if for tablets more so than digital devices per se—is still relatively new; even so, Christopher Roosevelt and his colleagues have now shown us that a comprehensive treatment of the topic can be made in a relatively brief period (Roosevelt *et al*. 2015).

Part of the aim of my contribution to this volume is to gauge something of the disciplinary-wide reception to tablets in the recording of archaeological fieldwork. Many will agree that this is a watershed moment in our approach to archaeological fieldwork. And many will also agree that much valuable information about the immediate reception of such paradigm shifts can be too easily lost, forgotten over time unless accounts like (but also against) this one are presented; similarly, it was through people like Martin Biddle and Birthe Kjolbye-Biddle that we now have, for just one example, a contemporary voice on the rapid and fundamental reorganization of archaeological fieldwork under the metric system (Biddle and Kjolbye-Biddle 1969; for related developments under the Winchester Research Unit, see most recently Leighton 2015: 74). To wait for a more steady stream of (potentially revisionist?) publications on our matter at hand is to risk losing the sense of how these digital developments were played out at precisely the time of their advent. Especially important is the fact that

the lack of peer-reviewed publications on the reception of tablets in archaeology currently belies the views of a rather sizable demographic in field archaeology who are otherwise considerably vocal—whether in classrooms or conference halls, on-site or online—about their distrust of digital devices in the recording of archaeological fieldwork, and (so) of the data and knowledge these approaches produce.

To return to those arguments for the continued use of paper over computer, a good number of them have explored the limits of logic, with complaints that range from the naive to the more measured and constructive. Those at the former end hardly warrant reaction. A strange but common question, for example, is how a tablet could possibly operate in the rain—a question as easily applicable to a piece of paper as a tablet—to how secure the digital data might be should a giant magnet fall from the sky. This represents something similar of the concerns for how digital tools might—or rather, will not—stand up to the rigors of archaeological fieldwork that were encountered in the responses of archaeologists to digital pens (collected in Fisher *et al*. 2010, esp. 5–6). That loose-leaf paper and pencil may be the preferred medium for recording in the midst of a rainstorm, or during some apocalyptic magnet attack, demonstrates just how far we can often be from a reasoned discussion of emerging field methodologies. Even so, no small amount of time has been lost in allaying these concerns, whether in the field, at archaeological conferences, or, perhaps ironically, through debates conducted in (no-longer-live) online blog entries.

Especially common are the concerns for the (immediate and ongoing) security of digital data; this is of course a concern that is as valid for digital data as it should be for paper-based data. Given our collective experience, this is of little wonder: it might be impossible to find a practicing archaeologist of any generation who has not experienced some traumatic loss of digital data, particularly prior to the most recent advances in cloud-based server technologies. From an inability to open, or even find, old digital files, to the misplacing or physical breakage of floppy disks, Zip disks, and thumb-drives, the threat of losing digital data challenges our confidence in converting to a fully digital system. And while it has been pointed out to me that a paper notepad might survive the fall from a 4th-story window better than an iPad (for which I have some personal experience), it remains harder to scrunch up or tear apart a tablet like it is a piece

of paper. But our collective experiences of data loss are for the most part generational, and arguably amateur. More than tablets, it is the related advent of cloud-based storage that should remind us of the anachronistic nature of our memory for lost data. While an iPad can be misplaced or break (not quite) as easily as a paper notepad or floppy disk, the fact that its data can have already, and immediately, been synchronized to any number of devices and servers should drastically minimize most fears of data loss. Of course our (inevitable) inability to lose digital data does not solve what should be the principal, omnipresent concern: data curation. Just as it is not enough to simply *have* hard-copy datasets—they require ongoing organization and physical maintenance—so too are digital datasets demanding of constant curatorial care. This is an important topic for which more discussion, and a different and more developed paper than this one, is essential (see Eiteljorg 2011).

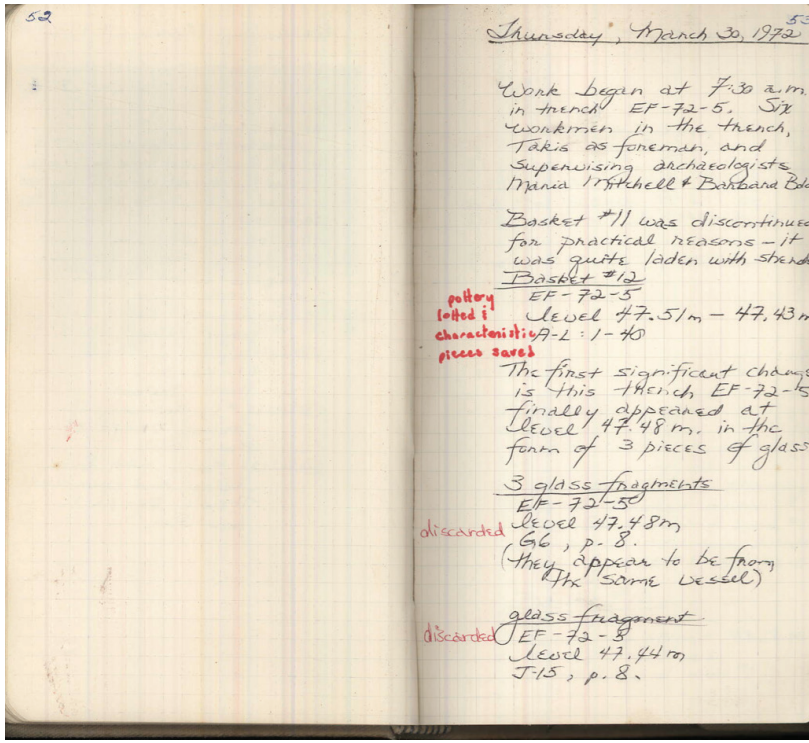
Slow Archaeology: De-skilling and (or in?) the "Golden Age"

From among the range of concerns for digital field recording are a number of more thought-provoking issues that are worthy, and sometimes demanding, of response. Several of these fall under the notion that field recording with tablets threatens the once careful and considered field methodologies of the past (see, e.g., Caraher, Ch. 4.1; see also Caraher 2013; and, in support, Nakassis 2015). The most convincing among the proponents of this threat is Bill Caraher, who has championed the intellectual value of a "slow archaeology," a kind of archaeological philosophy that urges more caution about the speed and growing industrialization of our fieldwork processes, a good many of which are (in)arguably associated with the shift from analog to digital recording tools (Caraher 2013; Ch. 4.1). More specifically, these concerns for digital field recording are about a "de-skilling" (after Caraher) of archaeological method, as well as a worry that the efficiency brought about by digital field recording leads mostly—or rather, merely—to the collection/creation of more and more data. Especially interesting is the idea that the use of a tablet to complete forms, construct narratives, and draw archaeological objects and their stratified relationships leads to a lack of engagement with the subject matter and thus ultimately risks a de-skilling of our otherwise

craft-like archaeological fieldwork methodologies. To the (well-intentioned) provocation that those of us using technology to record our fieldwork are becoming "de-skilled," at least by comparison to those who record on paper, I might, in keeping with the spirit of Caraher, tease with another: if it is not simply an assumption, where is the weight of evidence that our broader discipline was ever very *skilled* at field recording in the first place?

As hubristic as it may seem to some archaeological circles to question our broader disciplinary skill set, the reality is that for the vast majority of data that survive from (too few) academic archaeological projects over the past century or so, the bulk of it was not skillfully crafted by the deft hands of the archaeological doyens who led these projects, but was cobbled together by their inexperienced students or (rarely much better) their apprenticing supervisors (see Leighton 2015 on how the structure of archaeological teams can vary so markedly across contemporary cultures and the impact this has on the methodologies and outcomes). The evidence lays in the legacy data, which too often constitutes the *only*—skilled or otherwise—record of field research and the corresponding intellectual understanding of a site. And it is here that any challenging of the archaeological skill sets of those who record with iPads, or of those who generated the legacy datasets from paper, requires some necessary clarification. Are we targeting the quality of the fieldwork and its "knowledge production," and thus, unfortunately, the archaeological acumen of the individual or of the team? Or are our critiques directed at *only* the quality of the recording? There is, of course, a complex interconnection between doing archaeological fieldwork and recording archaeological fieldwork. It is often the same thing, and yet sometimes not. But for as long as the data and archives and (more rarely the) publications are all that survive of the fieldwork and ideas and (more commonly the) destruction, then these datasets represent the skilled and unskilled fieldwork methodologies and results in their *entirety*.

To stage our understanding of recorded fieldwork, therefore, on the notebooks of named scholars—whether Carl Blegen, Frank Brown, Flinders Petrie, or Alfred Morley—is to deny that the vast majority of fieldwork data survives instead from the hands of relatively inexperienced students (on the history of diary entries in archaeology, see Mickel 2015, 301–302; see also Kidder 1959; Hodder 1989; Pavel 2010; on inexperience in archaeological teams, see Leighton 2015).


52

53

Thursday, March 30, 1972

Work began at 7:30 a.m. in trench EF-72-5. Six workmen in the trench, Takis as foreman, and supervising archaeologists Maria Mitchell & Barbara Bates.

Basket #11 was discontinued for practical reasons – it was quite laden with sherds.

Basket #12
EF-72-5
Level 47.51m – 47.43m

pottery lotted & characteristic pieces saved

A-L : 1-40

The first significant change is this trench, EF-72-5 finally appeared at level 47.48 m. in the form of 3 pieces of glass.

3 glass fragments
EF-72-5
Level 47.48m
G6, p. 8.
(they appear to be from the same vessel)

discarded

glass fragment
EF-72-5
Level 47.44m
J-15, p. 8.

discarded

Figure 3: A fairly typical daily entry from the Isthmia excavation notebooks; here we learn that a context was closed because it contained so many artifacts, while another context is identified by a "significant change" because it contained three pieces of glass (Pages 52–53 of Isthmia Notebook 1972-MM-BB-I).

Almost all of the recorded fieldwork for the American excavations at the Panhellenic sanctuary at Isthmia, for example, was not crafted by Oscar Broneer or Paul Clement, but scribbled down by well-intentioned novices (FIG. 3; see Ellis *et al*. 2008; Ellis and Poehler 2015; on the question of "trust" in the production of field records, see Leighton 2015: esp. 75–77). For my own legacy data project at that site, barely 10% of the recorded, stratified contexts from the 1970s excavations can be reassembled to form an approximated matrix; these records, however, come from a period in our discipline that should otherwise (or arguably) be seen as foundational to our understanding of taphonomy, site formation processes, and the recording of stratified sequences (Schiffer 1972, 1987; Harris 1975; see also Biddle and Kjolbye-Biddle 1969). Even the briefest of surveys of legacy data for so many 20th-century excavations, even if too rarely available, shows that our experience at Isthmia is hardly unique (see, e.g., Bibby 1993: 110; see also Mickel 2015: 301). It is rare to happen upon a legacy data project that reports skillfully crafted, paper-based datasets (Allison 2008). I want to be careful here to avoid the slippery slope toward unfairly deriding the archaeological acumen of past generations (see, e.g., Matskevich's 2011 review of Pavel 2010). Exceptions exist, albeit arguably, for expertly excavated sites with *all* attendant parts: accompanying and suitably skilled notebooks, datasets, and, by definition, resultant publications and well-maintained archives. But these are surely too few to reconcile any such notion that dependable skill sets once defined the paper-based recording of archaeological fieldwork, or that we should endeavor to maintain those standards.

Revisionism and the Infallibility of Paper

A related socio-academic development connected with the consternation for tablets in fieldwork is the coincidental revisionism of traditional paper recording methods. Opponents to paperless methods now speak to an infallibility of paper, where the horrors of the past (but also present)—be they easily lost or damaged forms, limited and physically located copies, faded and illegible information—are now either forgotten or cast in a more positive and forgiving light. Set against the fragility of a tablet, paper records are (re)imagined as dependable and indestructible, or "real" and "secure" (May and Crossby 2010: 49), robust characters in a halcyonic vision of when

archaeology was done right (see, e.g., some of the collected opinions on analog and digital methods in Warwick *et al.* 2009). As much as I do not want to present digital data as perfect in every way, neither can I accept the same fantasy for paper-based records. Paper, moreover, is presented as a superior medium for the many associated tasks of field recording, from the jotting down of the simplest notes and records, to the nuanced and crafted care of site illustration, or the transcribing of complex and intellectual thought. In this context, the cognitive freedom of a blank page of a paper notebook is presented in opposition to the rigidly organized database fields that atomize the bits of data that are thought to be more typically collected in an iPad (for more on these debates on the use of structured forms or diary-style entries, see Latour 1987; Bibby 1993: 110; Pavel 2010: 142–146; Matskevich 2011).

That there is some reflexive value in recording data and thoughts onto a blank page is undeniable, even if such a method, when performed exclusively, is less effective (Mickel 2015 demonstrates how each form of recording, albeit redundant, is essential; on studies for and against the metacognitive value of digital and paper-based note-taking methods, see: (those for) Driver 2002; Bebell and Kay 2010; (those against) Awwad *et al.* 2013; Sana *et al*. 2013). But the unstructured diary entry onto a blank page is not an exclusive privilege of the paper notebook, and nor is the intellectual value of that kind of recording method necessarily jeopardized by the use of an iPad. The unstructured blank page, being the best-equipped feature of a piece of paper's arsenal, is, after all, but one of the hundreds of utilities enjoyed on a tablet. For our recording of the Pompeii excavations, open-page diary-style entries were effectively produced in concert with the forms and database recording. Whether reflexive or redundant, recording in this way produced a richer body of data; each data structure, after all, whether in the form of drop-down lists and check-boxes, or free-form textual descriptions and sketches, has (potential) value and (some) limitations. And in reality, our post-excavation processing of the data has drawn immeasurably more valuable information from the structured data. Still it is necessary to recognize the related role of diary-style entries in the formation of those datasets, difficult though it may be to qualify or quantify. So while it is true that field data is becoming more and more atomized—a scenario that is promoted or exacerbated, depending on one's view—by the bringing of databases

into the trench via tablets, I would argue that both structured and unstructured recording should, and can, be performed regardless of the medium.

Digital Illustration is Illustration

Some confusion and misunderstanding similarly circulates about the use of a tablet to draw archaeological objects and their stratified relationships and contexts. There is some irony here, given that in our experience it was digital illustration where we made some of the most significant improvements to the quality, not just quantity, of information we could gather while in the field; this is similarly the case for the use of tablets for illustration at Çatalhöyük in Turkey (Berggren *et al*. 2015: 443). Streamlined though the illustration process may now be, particularly given the utility of templates in vector-based drawing environments, still—and critically—the drawing process is not entirely automated. So while there is an appearance that digital illustration with a tablet is somewhat akin to the automated process of taking a 3D laser scan or a digital photograph, in reality the process retains the essential, or "traditional" skills and values of illustration; the objects and their stratified relationships are individually drawn by hand on-site and not (just) laser-scanned. Digital illustration is still illustration. There is no less engagement with the trench or architecture; rather, it could be argued that there is a heightened commitment to the material given that the ability to draw directly into a vector-based layering system allows for a more dynamic, yet cleaner, drawing process (on the knowledge-making of visual recording, see Perry 2014, esp. 194–198; on improved engagement between excavation and recording with tablets at Çatalhöyük, see Berggren *et al*. 2015: 443). Both accuracy and precision are thus improved, not least because drawings can now be easily achieved at any scale, including 1:1. On the one hand, the scale and precision of digital illustration allows for more detail as necessary; on the other hand, the utility of the medium allows for simple but accurate sketches that combine photographs and other datasets. Whether through technical illustration or more free-form sketches, the value of engaging, even slowly, with every last object and relationship is not lost to digital illustration.

A Question(ing) of Efficiency

Odd though it may seem to any archaeologist who has tried to balance the research goals of a team of scholars with the many financial, administrative, and peer/academic pressures, some of the benefits or outcomes from the increased levels of efficiency in fieldwork brought about by tablet computers have been called to question (Caraher 2015; Ch. 4.1; Nakassis 2015). Beyond the concerns that efficiency amounts to less engagement with the trench or site, doubts have been cast as to whether the improved efficiency corresponds with a greater understanding of the subject matter (e.g., Hopkins (2010) has questioned whether the efficiency associated with these new methods represents any kind of advance in knowledge over the way sites were investigated some 150 years ago; see also Nakassis (2015), who in response to Roosevelt *et al.* (2015), questions whether their ultimate contributions are in any way better because of the efficiency of their fieldwork). That line of enquiry is at once reasonable, even if any proposed answer—one way or the other—will prove subjective and difficult to attest; surely any such demonstration of an improved understanding of a site that is based on a recording system, whether digital or paper-based, is endlessly debatable (see, again the example of Nakassis (2015), noting the efficiency and impressive documentation of the fieldwork [on a granary] as outlined in Roosevelt *et al.* 2015, questions if their efforts "get us something important. . . does it help us interpret the granary any better? It hasn't seemed to thus far."). How does one, for example, demonstrate that the ideas and analyses of a team of scholars are now stronger under a newer recording system? Or that the intellectual value of a more traditional project, if eventually published, is that much stronger than that of a paperless project? The measure of sound fieldwork and recording methods must surely and always be relative to a healthy and respectable publication record.

In any case, it is hard to imagine that many archaeologists would—indeed *should*, as a matter of best practices—argue against a more efficient and productive fieldwork system. Not only are most archaeological projects obliged to publish as much high-quality research as is (un)reasonably possible, but the best of these projects of course *want* to be active and productive. Efficiency in the way we do things is for the vast majority of projects, paperless or otherwise, more of an aspiration than a distraction. It is a goal that does not come at the cost of

intellectual engagement, but in my experience is paid for by the time once spent performing some of the most time-consuming and menial but necessary duties: typically data-entry and scanning, but the list of tedious tasks is a long one. None of this need necessarily threaten the core values that are being attributed to a slow archaeology. That there is some value in the brand(ing) of slow archaeology is, of course, inarguable: more time spent in the field giving thought and discussion to the archaeology, rather than merely to recording it, is crucial to our understating of the site. In this we should remain grateful to Caraher for (re)raising these issues, or aspirations, at a time of great change in the way we collect data for the production of knowledge. And it should follow that just as much be true for our published records, which should provide analysis, context, and interpretation of the material, not just a record of it; can I therefore call for a "Slow Publication" movement? In the meantime, to stick with the recording processes, I simply do not see that digital recording methodologies, by definition, should pose such a grave threat to knowledge production. For in spite of the efficiency of tablets, and true though it may be that more and more data can be collected with them (as if an abundance of data were a problem for a discipline that has been plagued by unpublished research projects with nonexistent datasets), it is by far the greater engagement with the archaeology, while still in the trench or the field, that characterizes my own experience of paperless archaeology. For the Pompeii excavations, and I suspect as much is true for other paperless projects, the emphasis has never shifted from in-trench engagement and analysis to some kind of robotic, single-minded (or mindless, as is the inference) hunger for more and more data.

Our Disciplinary Consternation for Change

Should we be surprised by the opposition to paperless archaeology? For all the new developments that ameliorate each generation of archaeological research, we continue to be a discipline that more often prides itself on our traditional ways of doing things (e.g., the long-held recording systems, whose increasingly inveterate nature lends some kind of earnest but imagined authority and quality). In some ways this is not unlike the "blackboxing" of older methods, whether weak or strong, from necessary and ongoing scrutiny (Leighton 2015: 68–69;

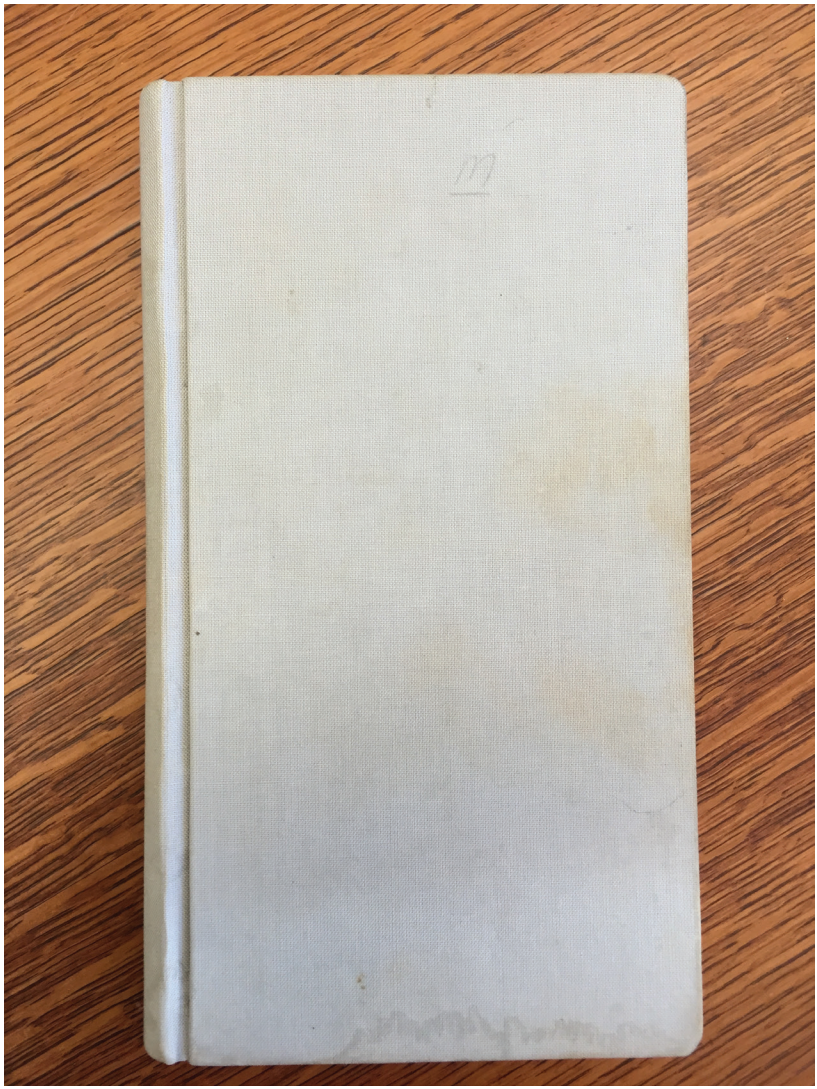


Figure 4: The little grey notebook so familiar to any Greek archaeologist of the past century (Photo courtesy of Jack Davis).

for the term "blackbox," see Latour and Woolgar 1979: 51). Some of these systemic routines are manifest in the little gray notebooks used almost universally, and for close to a century, in Greek archaeology (FIG. 4). It is their heredity that transcends their practical qualities as sturdy, conveniently-sized books to write things in; as much seems true of the olive-oil, motor-oil, and feta tins that have been (re)used as artifact storage containers by the Athenian Agora excavations from the 1930s until the present (they are now lined, not replaced, to minimize corrosion of artifacts). These objects, and the systems they maintain, are continually used—indeed, celebrated—because they have always been used. While I share the same fond nostalgia for objects of heritage in our field, I am as much intrigued as I am concerned by the opposition we create between tradition and innovation in the ways which we record our fieldwork. Venerated notions of experience are ceremonially draped over the more traditional systems so as to explain, maintain, and not least ritualize the status quo (for the broader setting, see Morris 1994). The wider socio-academic implications of what is a willful rejection of change, however, are troubling: can we really imagine that there is some intellectual value in continuing to record data in the same ways as was done generations ago?

As convinced as I am of the values of going digital in archaeological fieldwork, I believe it all the more important that regardless of the paper-based or paperless medium, we should recognize the intellectual value in developing and testing new ideas in methodology rather than maintaining and championing old ones. And while this may require a more realistic than romantic retrospection of our discipline's past, it also demands the kinds of debates that have been rightly provoked by the call for (a return to) slow archaeology. Here we should remind ourselves that the values associated with a slow archaeology are the same as those for a "Good Archaeology," and that none of these need necessarily be the exclusive purview of a paper-based recording system, past or present. But the methodological introspection prompted by these debates—even if it has been aimed more squarely at paperless archaeology—is in any case critical for a period that will inevitably be seen as the transition from paper to digital recording. How long this transitional period lasts—one generation, or two, or more(?)—is difficult to answer. The more important measure should be of the products of paperless (and any surviving

paper-based) archaeological projects: the quality and quantity of their data, the maintenance of their archives, and the overall contribution of their publications and broader outreach.

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