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Source: *World Archaeology*, DECEMBER 2012, Vol. 44, No. 4, OPEN ARCHAEOLOGY (DECEMBER 2012), pp. 521-537

Published by: Taylor & Francis, Ltd.

Stable URL: https://www.jstor.org/stable/42003547

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Colleen Morgan and Stuart Eve

Abstract

The power and the promise of digital technology provides the opportunity to revolutionise the way we think about and do archaeology. This opportunity has been seized by a few enterprising archaeologists, but can only be fully realised when a culture of participation and sharing is fostered in both academic and professional realms. Digital literacy and critical digital media object creation cannot be the realm of only a few heritage professionals, but should be cultivated and rewarded as we create new publication standards throughout archaeology. We present the background of digital participatory culture, the current entanglement of open source, open access, and for-profit technology in archaeology, and offer a challenge: to create a more ubiquitous, reflexive, open and participatory archaeology on both the institutional and the individual level.

Keywords

Digital archaeology; open access; open source; multivocality; digital participation; reflexive archaeology; archaeological theory; new media.

In this digital age archaeologists are creating multimedia experiences of the past, directly authored by archaeologists collaborating with stakeholders, and these experiences are available to anyone with a connection to the Internet. Self-identified 'digital archaeologists' are creating text, photographs, videos, 3D reconstructions, video games and music and augmenting reality, all to communicate past lifeways to present and future people. As a community, we offer sparse poetry in 140 characters or less and lushly reconstructed virtual landscapes. We are using technology to haunt the present with the past. We are a consortium of academics, professionals, students and avocational archaeologists and we want to share.

The grey literature of our profession is written in obfuscatory technical jargon, filed into repositories, classified as secret by builders or the state, always in the passive, authorless voice wherein trenches are excavated and artefacts are found and cleared away.

Routledge
Taylor & Francis Group

World Archaeology Vol. 44(4): 521–537 *Open Archaeology*
 ISSN 0043-8243 print/1470-1375 online
http://dx.doi.org/10.1080/00438243.2012.741810

Integrating 'new and different media in imaginative practices' is seen by many archaeologists as 'too chaotic, too confusing, too messy' (Witmore 2009). If there is a public day, an archaeologist (not the busy director or silent excavator) may address a small audience, no photographs, please. An activist, open, digital archaeology is the opposite of archaeological grey literature. We blog in plain language, we make our photographs and our videos free to view, use and redistribute, we distribute calls to action and we discuss, argue and record our conversations using Twitter and Storify. Noisy, multilingual and multi-authored, and sadly often unarchivable or incompatible with traditional means of archaeological publication, there is so much colour and life in our digital village that it defies boundaries and descriptions. Krysta Ryzewski (2009) identifies this 'techno-savvy' cohort as mobilizing convergences: a 'young, rising generation of archaeologists for whom new media have always been familiar, if not indispensable, components of their everyday lives'. Our 'digital village' as described by Ezra Zubrow (2006), allows us to communicate with one another unhindered, with the traditional boundaries of distance and professional status obsolete at an ever-increasing rate (see also Shanks 2007). In the time that it will take for this publication to make it to print, we will have disseminated the knowledge that this article contains and it will be obsolete. New excavation blogs will start, thousands of photos will be posted and digital archaeology will have moved on.

Though the array of professional, academic and avocational archaeologists who explicitly consider themselves digital practitioners are a fractured community, we have become self-aware: evidence of this can be seen in the growing number of conferences featuring sessions on many different aspects of digital archaeology, but also in the growing din of online conversation, escalating hits and the increase in prominent blogging archaeologists such as Mary Beard, Michael Smith and Rosemary Joyce. Yet even many of the most fervent members of our community are unfamiliar with the longer legacy of open source and open access in computer programming and the later, complementary DIY or 'Maker culture' that fostered the sociality of Web 2.0. Visual studies and especially new media are burgeoning academic fields currently receiving more attention in archaeological literature (e.g. Perry 2009a). The bulk of archaeological research performed with the tools of digital media ignores their broader theoretical and political context even as these technologies become enmeshed in our daily lives, yet there is a growing body of archaeological literature that makes good use of theory regarding digital media. Michael Shanks's (1997) engagement with archaeological photography and hypermedia grounded much later work, and his students Timothy Webmoor and Chris Witmore continued to research digital media, with a particular emphasis in materiality and what they termed 'symmetrical archaeology' (Shanks and Webmoor 2010; Webmoor 2008; Witmore 2004, 2009). Ruth Van Dyke (2006) provides a summary of visual media in archaeology and encourages her colleagues to experiment with new technologies. While these explorations have been important in forging an interdisciplinary space between new media and archaeology, there has been relatively little emphasis on digital media in archaeology as an emancipatory force; Rosemary Joyce and Ruth Tringham (2007) emphasise that digital media can help the 'archaeological author/interpreter go beyond the de-construction that has characterized much feminist and post-processual archaeology, to enable the construction of an engendered history'. We position ourselves as building on Joyce and Tringham's feminist, emancipatory position in regard to digital media in archaeology. As

they state, 'We do not have the luxury of ignoring these media ... a failure to explore them will deprive us of an opportunity to develop new ways of representing archaeology as a multi-voiced, multi-stranded, contingent process' (Joyce and Tringham 2007: 333).

Our contribution to this interdisciplinary conversation is a challenge to both the professional and academic archaeological world. We take our cue from Donna Haraway's (1991) assertion that we are all cyborgs, a 'hybrid of machine and organism', that we delegate a significant share of our work and life as archaeologists to digital devices; we assert that, instead of a minority fringe of technologically minded specialists, we are *all* digital archaeologists (see also Harrison 2010). As Julian Richards (1998: 18) predicted, 'the continued global expansion and commercialism of the Internet will dominate archaeological applications for the foreseeable future'. As digital archaeologists, we email each other, enter our data into databases, upload photographs and try to understand, organise and preserve our digital traces. The challenge issued in this article is, given that we are all digital archaeologists, what are you doing to further a reflexive, open and participatory archaeology on both the institutional and the individual level? We do not have all of the answers, but we invite you into our conversation, two digital archaeologists occupying the borderlands between professional and academic domains, experimenting with digital archaeology. As described in the biographical notes at the end of this article, Stuart Eve has been a partner of a UK-based commercial archaeology partnership for 10 years, but is also undertaking PhD research investigating how *in situ* data visualisation methods can be used for landscape archaeology. Colleen Morgan has worked internationally on both developer-funded and academic archaeological projects, and her PhD has maintained strong connections between technology and the practicalities of excavation (Morgan 2012). We first sketch the current digital climate in archaeology and wider participatory internet culture, then offer the practical example of the participatory digital strategy undertaken as part of the Prescot Street excavation, undertaken by L–P: Archaeology. Finally, we provide an examination of the creation of digital archaeological objects and a recommendation for projects going forward.

Archaeology and participatory internet culture

In the admittedly chaotic world of digital archaeology and online culture, it can be difficult to tease out meaningful trajectories and genealogies. The 'extraordinary liveliness' (Gane 2006: 142) of current digital archaeological practice is an incredible bricolage, the full description of which lies outside of the scope of this article. Still, those of us who are interested in an activist, open, digital archaeology have found each other through sessions and online through blogs, mailing lists, Twitter and Facebook. In *Here Comes Everybody*, prominent internet scholar Clay Shirky (2008: 49) explains the logic of group undertaking as a 'kind of ladder of activities, activities that are enabled or improved by social tools' with the rungs of the ladder being 'sharing, cooperation, and collective action'. Shirky credits the ease of online sharing with increased democratisation – the ability for small groups to take on institutions and institutional monopolies on power. Similarly, computer scientist Eric Paulos's (2009) *Manifesto of Open Disruption and Participation* calls for the creation of 'an entirely new form of citizen volunteerism, community involvement and

participation' to 'effect real political change'. This was shown recently in April 2012, when the president of the Archaeological Institute of America (AIA) released a statement condemning open access for archaeological publications. Among a generalised outcry on archaeology blogs and on Twitter, an online group of interested archaeologists took notice, discussed the statement, then crafted a response on an open wiki to counter the anti-open access sentiments.[1] The combination of online tools made a rapid response possible, and the AIA had to enter a dialogue regarding their stance on open access. Elizabeth Bartman, president of the AIA, first printed a partial retraction, then a clarification, yet the issue still remains pertinent (Rocks-Macqueen 2012). Shirky (2008: 159) makes an apt point: 'social tools don't create collective action – they merely remove the obstacles to it'.

Within archaeology, Randall McGuire (2008: 22) seeks to remove the secrecy surrounding the production of 'texts, cultural artefacts, and meanings that appear natural, given, and unalterable'. With the tools of new media, archaeologists can inexpensively create their own media products and share them instantly on the internet. In this way, archaeologists can circumvent the popular media to present their own stories transparently. These same technologies can provide a means to construct co-creatively the past with the active participation of stakeholders. Meg Conkey and Ruth Tringham put forward the concept of decentralising authority in archaeology while in the classroom and position archaeology as crucial to contemporary cultural politics. In addition, they identify the popular media as serving the 'very same controlling agents that have fostered patriarchal, essentialist, authoritative thinking' and assert that for this reason an 'explicit engagement with the media is even more crucial' (Conkey and Tringham 1996: 233). Rosemary Joyce and Ruth Tringham (2007: 330–1) raise the legitimate concern of unequal access to digital resources, but argue that technological access quickly reaches beyond the first adopters to benefit women and disempowered groups. Removing the obstacles to collective action can lead to a realisation of emancipatory goals in archaeology, but must be accompanied by a high investment in digital outreach at every stage of research.

To demonstrate an example of participatory digital archaeology in action, we offer L–P: Archaeology's award-winning Prescot Street developer-funded excavation.[2] The digital approach used at Prescot Street is published in Eve (2008), Hunt and Shepherd (2008), Hunt et al. (2008) and Richardson (2008); here, we present only a snapshot of the techniques employed. The methodology incorporates a paper and digital recording system that provided an immediate view of the data generated daily at the Prescot Street excavation, allowing a radical transparency rarely found on commercial excavations. The concept of radical transparency, of revealing the process of the construction of knowledge and thereby decentralising the power inherent in interpretation has become more common in the era of blogging and WikiLeaks but is still uncommon in developer-funded archaeology. When this transparency is expected from project participants but not practised by those in positions of control, what could be used for insights into the archaeological practice quickly becomes an inappropriate means of control and exploitation (Boyd 2010). During the Prescot Street excavations all participants, including the project managers, had access to the database, blogged their experiences and shot a series of short videos of the excavation, and later of the post-excavation process including the analysis of artefacts associated with the project. While Stanford's Metamedia Lab and

Brown's Joukowsky Institute explored digital media and outreach in the form of 3D visualisations and wikis for students in private academic institutions, and the public universities of University of California, Berkeley and University of California, Los Angeles developed Open Knowledge and the Public Interest (OKAPI) and the Cultural Virtual Reality Lab respectively, the Prescot Street project provides a relatively early success in showing the potential for digital archaeological outreach to incorporate a reflexive, open, participatory methodology in developer-funded archaeology.

Prescot Street

L–P : Archaeology is a commercial archaeology company based in the United Kingdom, working primarily on behalf of property developers, architects or infrastructure companies and providing specialist archaeological advice and services to the industry. L–P is unique in that all of the partners in the firm are strongly committed to open digital methods in archaeology and therefore have spent many years developing workflows and software to aid their fieldwork and the dissemination of the results. One of their main digital outreach projects was the excavation in advance of the construction of a major London hotel, on Prescot Street in the area of the Eastern Roman Cemetery.

The Prescot Street project began in 2008 and was designed from the outset to fulfil the official requirements of the local and national planning law, as well as to include a substantial outreach element, so the archaeology could be shared as it was being excavated and analysed. The target audience was not only the general public, but also included professional researchers, meaning the output needed to be technical as well as understandable by an interested amateur. As with most archaeological projects, the non-digital aspects were the same: following the Museum of London's single-context recording system (Spence 1994), all contexts and features were recorded on pro-forma paper recording forms, photographs were taken, samples and finds were sent to specialists and their interpretations incorporated within the final analysis. Within commercial excavations this type of traditional approach is essential, as the paper records form the archive required (by planning law) for deposition with the local museum (in this case, the Museum of London). These records need to be deposited on archival quality paper; however, this does not preclude depositing print-outs of digital capture. The challenge undertaken at Prescot Street was to enhance and release this archive digitally at the time of creation, without impacting on the tight time and cost constraints of a commercial excavation. The hybrid paper/digital archive conforms to national requirements, but also allows the data to be examined immediately and interrogated by anyone – even people not part of the excavation.

One concern with undertaking a hybrid paper/digital recording system is the labour needed to enter the data into the database. This is not a small undertaking, and at the Prescot Street excavations there was a dedicated part-time data-entry staff member. While this has a cost implication, the benefits of having the records entered on site with the excavators available for clarification of handwriting or interpretation, along with the lack of time lag for getting the data to external specialists, outweighed the extra expense. Some academic projects, such as the University of Cincinnati's PARP:PS project (http://

classics.uc.edu/pompeii/index.php/project.html), prefer a 'born-digital' approach, eschewing paper records completely. At present, this approach is not used very often on UK commercial excavations; however, as tablet-based PCs are becoming more robust and ubiquitous, it is likely that a born-digital approach will be adopted in the future.

The majority of archaeological excavations record the process using a paper recording system to document the stratigraphic units and relationships. Many excavations now also use some form of digital database to store the information carried by these paper sheets. However, not all excavations share these data, or even store them in an easily-shared format. There are many different database systems that have the ability both to store and to share archaeological data online – some require a user fee such as the Integrated Archaeological Database (www.iadb.co.uk) and Intrasis (www.intrasis.com), whereas some are completely free to use, such as OpenContext (www.opencontext.org) and the Archaeological Recording Kit (ARK; ark.lparchaeology.com). The Prescot Street excavation data were entered into the ARK system (http://www.lparchaeology.com/prescot/ark/) daily and immediately released online.

A blogging system was also used extensively to allow the excavators, surveyors, supervisors and directors to record their thoughts and current interpretations. The staff were not briefed on what to write; instead they were allowed the freedom to write what they thought was necessary. This resulted in a number of different approaches, with some excavators clearly more interested in this reflexive outlet than others. In fact, some were horrified at the idea of putting their thoughts 'out there' and saw the blogging as an intrusion on their day-to-day work. Others embraced it as an opportunity not only to talk about what they were excavating (Clarke 2008), but also to enter into a debate about the methodology used on site (Ross 2008). In addition, interim reports have been published online that present the 'official' interpretation of the site, these are held in a separate part of the website to enable visitors to see the officially adopted synthesis of the site. Commenting is enabled to encourage people to join in and offer different interpretations.

As of 2012 the project is entering its final write-up stage, four years after the end of the excavations. In the normal closed-access model the data from the project would not yet be available, and even once deposited would only be accessible to people able to make the physical journey to the Museum of London archives. The conclusions from the site (and their implications for the archaeology of London) would only be available once the final publication is released (either in a paper journal or a monograph), which could take another two years – meaning the results from the site would not be available to be accessed for six years after the excavation itself.

Using the Prescot Street model, however, the raw data have been available for those four years in an open format that can be examined and used in inter-site analysis. The current and ongoing interpretations are instantly available and can be discussed and refined with input from others, rather than being confined in closed archives. That is not to say that the final publication should not be written, peer-reviewed and taken as the official interpretation of the site produced by the people that excavated it – but it does mean that opportunities for alternative interpretations and reflexive thought about the site have been available throughout the project's life and have the potential to influence the final outcome.

We have chosen this example to demonstrate that it is cost effective and relatively easy to undertake 'open archaeology' even within the constraints of a commercial excavation in London. Within the UK, approximately 90 per cent of all archaeological excavations undertaken are developer-funded (Mike Heyworth[3], personal communication) and these are often undertaken with severe time and money constraints. The introduction of statutory requirements such as Planning Policy Statement 5 (DCLG 2010) and the subsequent National Planning Policy Framework (DCLG 2012) have reiterated the requirement for developers to publish the results of investigations and introduced the need to encourage greater public engagement with the archaeological aspects of the development. Owing to these statutory policies and recent guidance from the Institute for Archaeologists (IfA 2008: para 3.7.3) public outreach in the UK is now moving away from being an option and towards being a requirement for every developer-funded project.

The Prescot Street digital strategy was undertaken with free and open source software (see below for discussion), the only additional costs were three days set-up time for the system (although this would now be reduced as the system has been refined) and a part-time member of staff to oversee the digital aspects and data entry. As has been already stated the core staff of L–P: Archaeology are unusually technically savvy and therefore the set-up time may be a little longer for a unit that does not have in-house expertise. The part-time member of staff was one of the archaeological excavators hired for the project and when taken on had very little experience of computers or digital methods. The total cost of the digital strategy, including all software, staff-time, equipment, data entry and website maintenance made up only 2.14 per cent of the overall excavation budget. As can be seen from the work at Prescot Street, it is cost effective and technically easy to release data and interpretation from an excavation, and we advocate this for every site. Given the current financial constraints on commercial archaeology units, this statement may be seen as overblown; however, with planning laws moving towards a requirement for public outreach and the low percentage of budget needed to make it happen, there would seem to be no better time to put the systems in place and we hope to demonstrate that there are now few technical reasons to prevent approaching all excavation with an open agenda.

How to 'do' a more reflexive, open and participatory digital archaeology

Elaborating on the Prescot Street strategy, we ask: how is a politically and theoretically informed interpretive digital archaeology accomplished? Taking a cue from Conkey and Gero's (1997) suggestions regarding how to 'do' feminist archaeology, we suggest four points on how to 'do' digital archaeology. The first point draws directly from Conkey and Gero's (1997: 429) call to 'increase the visibility of human agency in knowledge production' and absolute attention to authorship. As the creator or co-creator or remediator of digital archaeological objects, it is important not only to disclose fully interpretive decisions but also to understand the creation of these objects as a reflexive action, ripe with authorial intent (see also Perry 2009b). Second, digital media allows for the inclusion of multiple perspectives and Conkey and Gero's second point, 'less hierarchical organisation'. On its surface, inclusion in the creation of digital media objects does not seem to be a difficult task; however, much of the work is done far away from the

excavation, removed from 'the trowel's edge'. Third, a serious evaluation of sharing, openness and transparency associated with each project, agreed upon by all members of the project, is necessary. Whenever possible, external stakeholders should also be involved and consulted regarding the policy. If archaeological information cannot be shared, it should be for a stated and definite reason. Finally, careful attention needs to be paid to the multiple contexts that digital objects inhabit and the affordances and accommodations that arise with creating objects in this network of meaning. Each of these points bears expanding, but it is also important to note that they are used consciously, explicitly and in concert with one another.

Authorship

Authorship in archaeological interpretation has its own body of literature that cannot be encompassed in this short article (but see Hodder 1989; Hutson 2002; Shanks and McGuire 1996; Shanks and Tilley 1987). While issues raised by these authors such as the ownership of information and interpretation and power differentials regarding publication still exist, they are complicated by digital archaeology, in that authorship can be expanded to mean embedded information in 3D reconstructions through to citational difficulties when referencing blog posts and Facebook groups. In this case, the topic of blogging can be instructive. While there are a few anonymous archaeology bloggers, most find it extremely difficult to write about their work or topics that are close to them without revealing their identity. As the formerly negative attitudes towards blogging change, most archaeological bloggers are open with their identity and use their blogging activity to promote their work. Being a public intellectual has the advantage that bloggers may give credentials with which to back up their arguments, especially in light of the copious amounts of misinformation that can invade discussions of archaeological topics. To give an example, Rosemary Joyce, a professor of archaeology from the University of California, Berkeley, disputed the news media's characterisation of Neanderthal remains as evidence of 'gay cavemen' by citing extensive research on her blog (Joyce 2011). This refutation was then subsequently reported in the media, an instructive corrective and a stunning example of the power of authorship in being the loudest, best informed person in the room.

In the case of visual media, authorship can be less obvious, especially if watermarked images are cropped or metadata are stripped from the object. 3D visualisations complicate this topic further, wherein the finished result can be a collaborative effort among several archaeologists. This is complicated more by Barthes' position of co-authorship of visual media, that of the maker and the viewer being co-authors of the meaning of the object (Barthes 1972). Indeed, digital objects can be more explicitly co-opted through remixing of the meaning, or repositioning and re-contextualising the object to illustrate meanings that can directly contradict the original author's intent. Tringham cites Bolter and Grusin's concepts of Respectful Remediation and Radical/Revolutionary Remediation regarding this potential for re-contextualisation of archaeological interpretations as 'part of the de-centering – nothing is sacred; the construction of knowledge is essentially collaborative and cumulative' (Tringham et al. 2007: 2). Indeed, re-contextualisations of interpretations can bring new interest and perspectives to a topic that many might see as dry and

unengaging. A good internet citizen would preserve the authorship chain by linking back to the original creation and providing a citation, but this is the exception rather than the rule. A progressive approach to digital archaeology would not only embed the digital object with appropriate authorial metadata but also an interesting and accessible interpretive context – a solid foundation to inspire creative re-use and sharing.

In the case of Prescot Street, ARK allows all entries in the database to be commented upon, tagged and re-interpreted. This allows for alternative interpretations of the raw data themselves, as well as the final 'official' interpretations of the site – an example of true multivocality. Although someone who has not seen a context being excavated may be unable to comment on its shape or dimensions, they may have something useful to say about its interpretation. It is important to ensure the voice of the original excavator is loud and clear; therefore all comments or changes are logged with the name of the author and the time and date of the comment – and of course, the original digital object is not deleted.

Although we have provided a strong argument in favour of transparent and reflexive authorship of digital objects, it would be remiss to ignore the anonymising potential of the internet for political action in archaeology. With the increased visibility of individuals who participate in the role of public intellectual on the internet, there are several instances in which it could be desirable to remain anonymous. While it can certainly be argued that there is no such thing as true internet anonymity, because of various methods of tracking individual ISPs and because the pool of archaeologists who participate on the Internet is small and self-selecting, some archaeologists use tactical anonymity for information sharing in risky contexts. For example, many prospective graduate students and recent PhDs use anonymous wikis to update their fellow academic position-seekers regarding the process of selection and hiring. Using wikis in this way can combat the opacity of academic process for the traditionally disempowered and disenfranchised candidate pool. In another example, a high-profile academic archaeologist maintained a veneer of anonymity to translate and share information regarding a government coup that not only brought misery to the citizens of that country, but also destroyed years of research and directly affected the country's cultural heritage. Anonymous participation by informed citizenry can certainly contribute to the emancipatory power of the internet, albeit at a cost of devalued information that is not backed by known scholarship. Multivocal interpretation in digital archaeology only really works when the tenor and pitch of the voice can be correctly assessed.

Inclusion

While certainly informed by many opinions, the creation of digital media interpretations is often performed in relative seclusion, away from the excavation trenches, by specialists who are highly trained in computer techniques but can sometimes lack general archaeological skills. Although this is an unfortunate side effect of the growing specialisation in archaeology, it is one that can be remedied through direct action. Democratising digital media creation has the benefit of both opening up archaeological interpretation to multiple voices and also of teaching traditionally disempowered populations skills that can translate into increased self-expression and greater job

opportunities. Before the prevalence of digital technology, film and photography shot on site would have to be saved and then processed at a later date, sometimes by professionals with no connection to the project or to archaeology in general. With the increased portability of high-powered computers and the ubiquity of the internet, digital processing can be done on site by archaeologists participating in the excavation process. For example, Anies Hassan, one of the professional excavators at Prescot Street, took it upon himself to create a videography element to the fieldwork – which he shot and edited himself using the iMovie computer program – while still participating in the excavation.

Greater inclusivity in the creation of digital archaeological objects can be characterised as falling along a spectrum. While some of the equipment involved in the process can be expensive and fragile, surely it can be trusted with people who are trusted to excavate the archaeological record. Mistakes and accidents happen, but they also happen with the most trained of digital specialists and should not be an excuse to keep media-making equipment out of the hands of everyone on the excavation. It is not uncommon for site archaeologists to take their own digital photographs, but the media is then taken out of the archaeologist's hands to be processed and catalogued by a media specialist. Often the photographs taken by excavators and students are not catalogued at all, but dumped into generalised folders or ignored entirely.

Training in digital methods should be applied site-wide and should follow the process from beginning to end, that is, from the creation of the digital object through to curation, remixing and remediation. During this training there should be an emphasis on the possibilities of narrative structure in these objects, such as using photographs to tell a story about the excavation. All digital media should be accounted for as part of the larger site archive, and including lower-quality camera-phone photographs and video in the archive can lend unexpected insights to the archaeological process. On some sites (such as those in London) the photographic record is still required to be on print film: the Museum of London archiving guidelines state 'fieldwork photographs should consist of black and white print film *and, in addition*, either 35mm colour transparencies, or digital images' (2009: part 2.2.1.2, emphasis added). This does not preclude the creation of the digital images by scanning the film photographs, but it does affect the immediacy of the object creation. Finally, as Jonathan Bateman (2005: 196) notes, photography on site can be generally divided into formal excavation shots and personal, social shots, but blurring the two can provide 'immediate and thoughtful engagement with the people around'. Using digital recording can be a means to bring site participants together, rather than delineate social roles within the excavation.

Openness/transparency/sharing

Along with training the field crew in digital recording methods and maintaining an inclusive archive, the digital objects created during archaeological investigations should be shared as widely as possible. While there are certainly instances in which sharing knowledge is not desirable, for instance when the pursuit of archaeological knowledge clashes with tribal beliefs (Kansa et al. 2005), sharing should be the 'default' for archaeological knowledge, especially when the majority of projects are funded directly or

indirectly through public resources. Repositioning sharing as a central goal in all stages of research can substantially improve the public profile of the project and increase the chance that the information will be retained (Tringham 2012). While this kind of cloud-hosting of archaeological information certainly cannot replace the archive, making it easy for stakeholders to locate, share, copy, appropriate and remix digital archaeological objects can make them more appealing for personal curation, in effect 'crowd-sourcing' the archive. Much of the content on the web is used in this fashion regardless of copyright and availability, but making the copyright for text, photographs and other digital objects clear from the outset emphasises the willingness to share the content as widely as possible. Additionally, it can speed the publishing process if such permissions are clearly granted from the outset. Even further, designating an open copyright expresses the creator's knowledge and willingness to engage in a very public debate over rights in the digital age.

Explicit designation of copyright through Creative Commons, an alternative copyright that allows the creator of the work to designate how the work can be shared, has grown in use in archaeology. Founded in 2001, Creative Commons aims to 'build a layer of reasonable copyright on top of the extremes that now reign ... making it easy for people to build upon other people's work' (Lessig 2004: 282). Some archaeologists are willing to assign a Creative Commons copyright to online content, but it is rarely used in print, and difficult to indicate for some digital works, such as 3D reconstructions. Archaeological knowledge production is collaborative; making this production explicit by engaging with copyright and the sharing of ideas at the outset of a project adds transparency to the process. The inspiration for Creative Commons stemmed from the Open Source movement and the Free Software Foundation, both founded by Richard Stallman in the 1990s. Stallman had worked as a hacker in a lab at MIT, developing software before there was extensive software licensing. When software started shipping with nondisclosure agreements, Stallman saw this as deeply antisocial, meaning that 'the first step in using a computer was to promise not to help your neighbour' (Lessig 2004: 18). The Free Software Foundation has since had a tremendous impact on the computing world, even if many people who now use computers do not realise the intellectual and spiritual debt that internet culture owes to Richard Stallman. Deeper than the commitment to licensing creative content under the Creative Commons, the principles of the Free Software Foundation require that the source code for software is fully disclosed and fully modifiable by all who use software licensed under its aegis.

While some archaeologists are marginally aware of Creative Commons licensing, many archaeologists exclusively use proprietary software. The software often is the industry standard and there are not necessarily good alternatives available. In 2011, common proprietary software used by archaeologists included ArcGIS, the extremely popular Geographic Information System (GIS) software suite, which costs US$1,500 for a single-user licence; and Microsoft Access, an overwhelmingly popular database, the software for which costs US$99 per licence. More specialised software such as Autodesk's CAD package costs US$4,000 for a single licence and yet interpretive projects and publications are increasingly calling for visualisations that require the detail and complexity that expensive proprietary software can provide. Whether they are students or professionals, archaeologists generally do not have the money to purchase the sophisticated software with expensive licensing, so the copies are often illegitimate and can stop working at any

time. It is common knowledge that some archaeologists have thousands and sometimes tens of thousands of dollars worth of illegally downloaded software to perform everyday tasks and do not hesitate to publish results and visualisations gained from using this illegal software. Whether or not the archaeologist has a philosophical commitment to Open Source and Creative Commons, it is in their interest to prevent the catastrophic data loss that is possible with proprietary formats and illegitimate software.

The Prescot Street excavations used almost exclusively open-source or free software, with the notable exception of iMovie. The majority of the excavation data (contexts, photos, samples, etc.) were entered into the ARK database; blogging was undertaken in the Textpattern Content Management System; photo sharing was via Flickr (http://www.flickr.com/). The spatial data were digitised using ESRI's proprietary ArcGIS package (as this was the in-house GIS package at the time). However, this was not vital for the system, and the latest versions of gvSIG (http://www.gvsig.gva.es) or QGIS (http://www.qgis.org/) would be more than adequate. The spatial data are shared over the internet using the University of Minnesota's Mapserver (http://mapserver.org/). The site publication text is being written using Open Office.

However, even in cases in which there are free alternatives such as Open Office, many archaeologists do not feel as though they have the time to learn to use different software and worry that results will suffer. A more formal study of software use among archaeologists would be required to make steps towards educating archaeologists to use open source software, data formats and preservation standards; however, there are many places for archaeologists to fit into the open source and sharing spectrum, whether it involves Creative Commons licensing for photographs or developing specialised software. While there certainly are complex issues regarding sharing archaeological knowledge, supporting efforts to incorporate a more open and robust approach to sharing would benefit our collections, our connection to our stakeholders and the longevity of the archive.

Contextualisation

Digital artefacts are by nature multiple. In his seminal work, *The Language of New Media*, Lev Manovich put forth five principles in which new media is different from old media. While these principles are debatable (as has been shown by much of the subsequent literature, by Manovich himself and others), he specifically cites the materiality of digital media in the qualities he describes as digital media's numerical representation and modularity, qualities that enable this media to exist in multiple places, multiple states and with inconsistent qualities (Manovich 2002). For example, this digital photograph of a set of Victorian building foundations taken at Prescot Street (Fig. 1; http://www.flickr.com/photos/prescotdig/2346651735/), exists as a numerical sequence as a file on the Casio EX-Z57, then was downloaded onto a laptop, then another copy was modified in the Gnu Image Manipulation Program (GIMP), then this JPEG copy along with the RAW file was backed up onto the off-site project server. The photograph was uploaded to the internet as a file on Flickr, where it was accessed 247 times as of April 2012. The photograph was then shared to different Flickr albums and comments were attached, expanding on the social history of the building that the photograph depicts – for example, Flickr user chrisdb1,

Figure 1 Foundations of a Victorian terrace house on the boundary between no. 4 and 6 South Tenter Street, London.

unconnected with the project, commented that his great, great grandfather Thomas Goggin, a lighterman with four children, used to live in the building. The photograph exists in multiple places, in multiple forms, where it serves multiple purposes. This multiple nature complicates digital media creation, and it is easy to lose control of the object. Copies of the photograph could have been downloaded from Flickr, printed out (indeed it is reproduced in this article) or used on other websites, but with consent, as the photograph was licensed under Creative Commons. The perceived loss of control of aspects of the archaeological archive can be hard to come to terms with, and can present difficulties when working in countries that require full disclosure to the government before any public outreach can be performed.

Just as digital artefacts occupy multiple contexts, they are also created in very specific geographic locations with differing political and social milieux. A photograph of a student and a local worker in close contact can be interpreted by academic audiences as connoting a positive 'outreach' situation, and by local audiences as evidence of an inappropriate relationship. Stakeholders are often ignored while creating archaeological digital media, but there is also a lack of reflexivity in digital media authorship. A digital photograph or video requires the presence of the initial creator of the digital media, but later iterations or modifications in Photoshop or GIMP do not require an on-site presence. This is particularly common and apparent with virtual reconstructions, where most of the creators involved have not excavated the archaeology that they are reconstructing. Worse, the object is not made accessible to the community or discussed after the initial reconstruction.

The creation of digital media should involve the willingness to consider the context in which it was made and disseminated, with the emphasis on bringing it back to the place and people from which it originated. A few crucial questions should be asked in the

process of this creation: What does media-making mean in the area in which you are working? What does it mean that you, in particular, are making the media? Is a digital format appropriate? If you are based in the United States, should you consult Human Subjects Review before creating the media, or before disseminating the results? What does the digitality of the object afford? Finally, what is the political and socio-economic context of this media? Following the points that we have introduced leads to the creation of mature, robust and actualised archaeological digital media that can be subjected to peer review, be used for tenure-track promotion material and contribute to an emancipatory archaeology.

Going forward

With the Prescot Street project, L–P: Archaeology successfully integrated digital recording and outreach into the economically harsh and unaccommodating environment of British contract archaeology. Other projects, both academic and professional, have been relatively slow to follow. A digital ecology takes time to form; not only does it require a familiarity with the swiftly changing technology that it incorporates, but it also needs attention and care – an untended digital garden will quickly wilt and rot away. However, as we are all digital archaeologists we are creating new digital objects everyday, whether typing up our field notebooks, creating slideshows for lectures or sorting through our collections of photographs. In creating our digital interpretations we are performing our profession and the archaeological record and discourse a disservice if we do not keep in mind authorship, inclusion, openness and contextualisation. By doing so, however, we will enliven our literature and interpretations, and make them robust enough to merit inclusion (and perhaps reward) in our profession's canon. We therefore return to the question in our opening paragraph: we are all, whether we like it or not, digital archaeologists – so what are *you* doing to participate?

Acknowledgements

A partial version of this article was presented by Colleen Morgan at the Moesgaard Museum in Aarhus, 2009. The title of the article refers to the work of Tim Kerr, Austin-based artist and musician.

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Notes

1 This statement can be viewed at: http://archaeology.okfn.org/2012/04/30/the-aia-and-open-access-an-open-letter/.

2 The Ralph Merrifield Award for London Archaeology, awarded by the London & Middlesex Archaeological Society to L–P: Archaeology for its public outreach programme.
3 Director of the Council for British Archaeology.

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