A Roadmap to Applied Digital Heritage: Introduction to the Special Issue on Digital Heritage Technologies, Applications and Impacts

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The recent "digital turn" in archaeology has driven methodological advances and opened new research avenues, with wide ranging impacts at multiple scales. The proliferation of methods such as 3D imaging, remote sensing, laser scanning and photogrammetry has led to the datafication of archaeology [Caraher 2016: 467, Mayer-Schönberger et al. 2013: 73]. This process is most evident in research on digital surveying, data visualization, digital archiving, mapping, and image processing, which prioritize the creation and manipulation of large digital datasets. These research avenues often generate more intellectual traffic than "slow archaeology" routes [Caraher 2016], which adopt a reflexive approach to knowledge production, embrace the inherent complexity of digital datasets, emphasize craft modes of archaeological documentation [Perry 2015], and "highlight the value of small and properly contextualized data" [Kansa 2016: 466]. Confronting the growing tension between big data and slow archaeology will be an iterative process. It will evolve as researchers and other stakeholder groups assess the value of digital approaches to preserving, communicating, and interpreting the past as it relates to the present. This special issue of Studies in Digital Heritage is the outcome of a symposium at the 2018 Society for American Archaeology (SAA) conference in Washington, D.C., entitled "Digital Heritage Technologies, Applications, and Impacts." The articles within contribute to this dialogue by critically assessing the challenges and successes of recent digital heritage projects in museums, teaching and fieldwork contexts.

Key words:
Applied digital heritage, public engagement, digital archaeology, digital museology, community engagement

SDH Reference:
Laura K. Harrison. 2018. A Roadmap to Applied Digital Heritage: Introduction to the Special Issue on Digital Heritage Technologies, Applications and Impacts. SDH, 3, 1, 40-45.

DOI: 10.14434/sdh.v3i1.27552

1. DIGITAL HERITAGE IN THE 21ST CENTURY

Advances in digital heritage practice are driven by technological breakthroughs that expand what is possible in terms of recordkeeping, analysis, education, outreach and community engagement. Powerful digital tools, ranging from hardware and software to open data archives and interactive apps, catalyze public interest and understanding of archaeology [Economou 2015]. These new

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technologies encourage comparative research and transparency, close the loop on data lifecycles [Kansa and Kansa 2018], streamline data collection in the field [Roosevelt et al. 2015], and increase multisensory engagement with the archaeological record [Jamil et al. 2018]. In short, they propel innovative, digitally-driven research.

The promising future of digital heritage does not render it immune to critique, however. As the field matures, it will be important to consider how current research impacts future directions. While it is critical to keep pace with technological advancements in digital tools, an avalanche of big data can distract from higher-level interpretive and analytical tasks [Huggett 2015: 91, Petrovic et. al. 2011]. Just as expensive imaging equipment, powerful graphics-enabled computers, and virtual reality setups will expand capabilities for many, they will also exist as barriers to access for others. In turn, this creates tension in a field that often explicitly frames heritage as a human right and promotes virtualization as a globally beneficial endeavor. How are we to combat critiques of technological fetishism? Is it possible to build open digital databases that favor the democratization of science, rather than implicitly reinforcing divisions between developed and less-developed nations, researchers and other stakeholder communities? There is no singular solution to these challenges. As digital heritage continues to evolve in the 21st century, novel scenarios that challenge the ethics, practice, and intellectual value of this work will emerge.

These changes are occurring at a time when archaeology is more public than ever. The information revolution has vastly increased the public reach of archaeology, so that everything from routine fieldwork activities to fully realized interactive VR and AR experiences are reaching global audiences. With this widening network of archaeological communication, heritage professionals are engaging with issues of how the past relates to the present on a larger scale than ever before [Moshenska 2009]. Social media platforms and open access heritage databases create spaces for fresh conversation around the meaning and value of both tangible and intangible heritage. While these platforms often amplify marginalized voices and groups, such as women, minorities, indigenous, descendant communities, and LGBTQIA+, they can also reinforce established modes of archaeological authority that undermine the democratization of science [Walker 2014]. As online tribes form, they become venues for new heritage movements and controversies to arise [Richardson 2013, Richardson and Lindgren 2017]. A recent example is the public outcry over the Dakota Access Pipeline construction on Native American lands [Smith and van Ierland 2018].

The conversation around what's next in the field of digital heritage is thus not a question of technology, but rather one of impact. What are the outcomes of going digital, and what will digital heritage look like 5, 50 or 100 years from now?

The concept of applied digital heritage offers a route forward. Like applied anthropology, this type of community focused practice emphasizes participatory engagement with heritage resources. Its focus is on putting research to good use and solving practical problems. In addition, immersive VR and AR applications for heritage sites draw in new audiences and expand knowledge and appreciation of archaeology by increasing stakeholder engagement. Online story maps and virtual tours also offer a means of digital storytelling, which enlivens archaeological knowledge production by combining rich multimedia experiences with nonlinear narratives. These approaches employ digital tools as signposts that direct heritage conversations and interpretations to novel destinations.

2. SAA SESSION AND THE SPECIAL ISSUE

The Society for American Archaeology 2018 symposium in Washington, D.C. provided the impetus for this special issue. The symposium aimed to catalyze critical discourse about the applications and impacts of digital heritage. While discussion about technical aspects of heritage documentation and open data frameworks were critical elements of many papers, the focus of the symposium was not to simply celebrate the achievements of big data approaches in archaeology. Rather, discussion centered on the thorny issues of how virtualization impacts data use and reuse, archaeological interpretation and analysis, outreach efforts and community engagement, among others. This reflects a realization among participants that digital tools and techniques are a new standard in the field and the lab – the initial forays into the digital realm are giving way to a more mature digital heritage practice. As we arrive at this juncture, it is critical to unpack the goals, problems and prospects of this "digital turn."

Participants in the 2018 Society for American Archaeology symposium author three of the articles in this special issue: Katherine Cook and Geneveive Hill; Davide Tanasi, Ilenia Gradante and Stephan Hassam; and Adam Rabinowitz. The article by Kevin Gartski, Chris Larkee and John LaDisa was solicited to add expertise and case studies in relevant areas to the central focus of this issue. Each article in this special issue discusses the broader theoretical foundation and intellectual goals of our growing discipline with reference to one or more specific examples.

An emergent theme in digital heritage is the importance of digital heritage as a process: a series of digital and analog steps that collectively result in scientific insight, community engagement, or another desired outcome. In their article, Katherine Cook and Genevieve Hill explore this idea of "hybrid digital heritage" by emphasizing the collaborative experience of making a digital application in a museum. Students from the University of Victoria collaborated with the Royal British Columbia Museum to produce a pop-up exhibit that combined community-engaged archaeological research and digital heritage resources, with the goal of increasing access to archaeological collections, building upon existing permanent museum exhibits, and creating a more inclusive history of place. In doing so, participants engaged with difficult issues surrounding conflict and colonial legacies, while also gaining valuable professional skills pertaining to pedagogy, digital applications and technology, and logistics. An analysis of student perspectives on the project, and a candid evaluation of project successes and shortcomings by the authors is eye-opening. While there is recognized value in establishing long-term collaborative processes through co-creation, the structural complexities of supporting these longitudinal projects in universities, museums, and communities is a major challenge for the future.

A frequently overlooked element of digital heritage dissemination is how the end user experience with the digital dataset impacts scientific and public consumption. Adam Rabinowitz's article offers a critical appraisal of the communicative potential of archaeological data by investigating how multiple audiences respond to 2D and 3D archaeological datasets of varying resolution. The qualitative study investigates five different audiences, including an archaeozoologist, historic preservationist, and undergraduate students in Classical Archaeology, among others. An unexpected outcome is the realization that end users are not very interested in paradata: they exhibit a high degree of trust that model makers are truthful in disclosing the accuracy and precision of their

models. Rabinowitz notes that this finding is concerning, and that it may be worthwhile to investigate better ways of communicating technical details of models, so that users better understand and appreciate the process by which the models are created. This qualitative study also elucidates a preference among scholarly and general audiences for a continuous path between low- and high-resolution models that progresses from 2D photographs to increasingly large and complex 3D models, with thoughtful signposting along the way. Overall, the article offers a valuable thought experiment in assessing the often-unexpected impacts of digital heritage datasets on public, academic, and specialist audiences.

One of the most the many pressing questions shaping today's digital heritage practice is whether digital tools bring us closer or further away from the trowel's edge. As Kevin Gartski, Chris Larkee and John LaDisa point out in their article, immersive 3D visualizations have been underutilized in the classroom. A key reason for this is that digital applications improve student understanding of the complex spatial and visual aspects of excavation, which are often available only by traveling to an archaeological site or museum. The article details how 3D models of archaeological sites and artifacts are projected in the MARVL Lab at Marquette University, and incorporated into interactive course instruction in an introductory anthropology course. Faculty members guide students through the processes of interpreting stratigraphy and explain archaeological field methods. Viewing and manipulating excavation trenches in this way allows students to improve their spatial understanding of archaeological sites and offers insight into the mechanisms by which archaeologists draw conclusions about past peoples from material culture remains. Although the immersive visualization lacks the haptic experience of an actual excavation, it conveys fundamentals of archaeological knowledge production that are useful in the absence of a firsthand experience.

One of the key discussions at the 2018 SAA symposium was a conversation about how 3D documentation methods, which surpass 2D methods in many ways, enhance archaeological recording, and may even come to replace it. In this context, Davide Tanasi, Ilenia Gradante and Stephan Hassam discuss their experience scanning the Catacombs of St. Lucy in Sicily – a highly inaccessible archaeological context in which much of the existing graphic documentation is outdated and incomplete. The team used multiple 3D imaging techniques to collect data from multiple dimly lit underground contexts, which are in a poor state of preservation and are prone to flooding. The open dissemination of such collections advances academic scholarship by enhancing accessibility, and the 3D scanning and data processing was incorporated into an instructional context in which students learned low-cost methods of digital archaeology data collection and processing. The multiscalar approach outlined here is a representation of best practices in 3D digital recording and dissemination that mobilizes low-cost documentation methods to reach multiple stakeholder groups.

3. CONCLUSION

The papers in the SAA symposium entitled "Digital Heritage Technologies, Applications, and Impacts" explored the transformative role of digitization on archaeological practice in the 21st century, and offered insight into topics such as reflexivity in digital archaeology, knowledge production in the

digital age, the ethical and political issues surrounding open data, the importance of data curation, contextualization and dissemination, and the slow data critique. Similarly, the papers in this special issue highlight key issues at the forefront of discussions about contemporary digital heritage practice. Each of these articles engages with the concept of applied digital heritage, and together they envision a roadmap to a participatory and reflexive future for archaeology in the digital age.

5. ACKNOWLEDGEMENTS

I would like to thank the 2018 Society for American Archaeology symposium participants for their contributions to a grounded and critical discussion about the current state of digital heritage as a field. The discussion was instrumental in shaping the ideas laid out in this article.

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Received March 2019; revised April 2019; accepted May 2019.