



Spatial History, deep mapping and digital storytelling: archaeology's future imagined through an engagement with the Digital Humanities



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ABSTRACT

Geospatial technologies are transforming the practice of the Digital Humanities, and these developments have direct relevance to the practice of scientifically oriented archaeology. The most recent “spatial turn” among digital humanists can be attributed to both the prevalence of tools like ArcGIS that facilitate such investigations as well as an interdisciplinary convergence upon theoretical models that conceive of socially constructed space. This article will briefly review the current state-of-the-art in the field of Spatial History as well as discuss a number of emerging trends such as deep mapping, digital storytelling and data visualization, utilizing examples from a variety of applications. Moreover, archaeologists can benefit from the substantial investments by the academy in the Digital Humanities, particularly in the United States and Canada. In sum, the article proposes that the scope of archaeological applications of geospatial technologies would be productively broadened through an increased engagement with the Digital Humanities.

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1. Introduction

Janus, the Roman god of beginnings and liminal spaces, is often depicted in iconography as having two faces that point in opposite directions (Hamer, 2005). Despite the proximity of Janus' faces, they cannot see one another. In a number of important ways, the predicament of Janus is a good metaphor to describe the relationship of scientifically oriented archaeology to the Digital Humanities at present. Even though archaeologists are frequently among the earliest adopters of digital technologies such as GIS (Geographical Information Systems), disciplinary boundaries between fields such as Anthropology and History result in missed opportunities, both intellectual and material.

Although there is no scholarly consensus on definitions, the Digital Humanities entail the use of computational methodologies to research humanistic questions. The field of Digital Humanities (DH), an outgrowth of humanities computing initiatives launched in the mid-twentieth century, is highly self-aware. Scholarship that addresses the question of what the Digital Humanities are or speculates upon their future forms have become a genre piece (Borgman, 2009; Gold, 2012; Kirschenbaum, 2010; Svensson, 2010).

Like archaeology, DH is an interdisciplinary field and features collaborative project-based approaches to research. Besides these described traits, DH also promotes an open-ended, exploratory research design rather than embracing empirical models of hypothesis or model testing. Accordingly, DH tends towards the *avant-garde* or visionary in its search for alternatives to traditional modes of knowledge production (Sousanis, 2015; Svensson, 2012).

In DH, technology is employed in a variety of ways: as a tool, an object of study, an expressive medium, an exploratory laboratory, a venue for activism, etc. (Svensson, 2010). In archaeology, by contrast, geospatial technologies are frequently conceived of and employed as powerful analytical or data-capture tools (Comer and Harrower, 2013; Zubrow, 2006), although there are important exceptions to the general trend such as applications in cultural heritage management, museum studies or combined-approach investigations (e.g. Price et al., 2013; Richards-Rissetto and Landau, 2014; von Schwerin et al., 2013).

Spatial History is a field that emerged in the early 2000s at the nexus of the Digital Humanities, Geography, Sociology, Anthropology and History (Gregory, 2005; Knowles, 2008; White, 2010). The field of Spatial History is already making valuable contributions to scholarship that may be readily differentiated from the manner in which most scientifically oriented archaeologists use geospatial technologies (Bodenhamer et al., 2015, 2010; Gregory, 2005;

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Gregory et al., 2015; Gregory and Geddes, 2014).

Despite archaeology embracing interdisciplinary approaches in general, the emergence of the spatial humanities has gone largely unnoticed among scientifically oriented archaeologists, including GIS users (Bodenhamer et al., 2010; Gregory and Geddes, 2014; Knowles, 2008). Many archaeologists, particularly Americanists whose research is largely based in Anthropology departments, may only be vaguely aware of the larger, long-established field of Digital Humanities more generally. Lack of awareness is not the only impediment to collaboration between archaeologists and digital humanists. Other barriers such as a lack of time or of institutional support certainly contribute to the present situation. However, there are a number of DH research characteristics such as open-ended data exploration, social engagement and a focus on narrative in research presentation that are germane to archaeological scholarship. Moreover, there are a variety of intellectual and material incentives that make DH-archaeological collaboration worthwhile.

2. Shifting epistemologies

The future of technologies such as GIS within scientifically oriented archaeology depends on how practitioners envision the nature of their intellectual enterprise. Are archaeologists scientists who engage in model testing to develop universalizing theories or are they humanists who employ scientific methodologies like GIS to answer historically specific and contingent questions?

An examination of the epistemological shift that has occurred in landscape studies, long-affiliated with GIS approaches, is particularly revealing. The theoretical emphases of regional landscape studies in Anglo-American archaeology have transformed in recent decades (Patterson, 2008). The cultural ecological approaches that were common in the mid-twentieth century have been challenged by a variety of post-modern, post-positivist philosophies (Ashmore, 2004; Knapp and Ashmore, 1999; Llobera, 1996). While some archaeologists previously equated the concept of landscape with the physical environment, a growing group of scholars now embraces a socio-historical perspective to the study of past landscapes. Therefore, the scope and focus of GIS-enabled studies have also shifted to explore humanistic questions. In response, landscape archaeologists (e.g. Knapp and Ashmore, 1999) called for approaches that incorporate social and spatial theory (Harvey, 1973; Lefebvre, 1991; Soja, 1989; Tuan, 1979), resulting in a shift in the field from an emphasis on behavioral modes of interaction to social dimensions of landscape production (David and Thomas, 2008; Milevski and Levy, 2016).

A review of current literature reveals that archaeologists have internalized the post-modern, post-positivist critiques leveled in recent decades (David and Thomas, 2008; Patterson, 2008), and are investigating traditionally humanistic lines of inquiry such as experience of space or tracing historically specific developments (Creekmore, 2014; David and Thomas, 2008; Earley-Spadoni, 2015a; Fisher, 2009; Fitzjohn, 2007; Giles, 2007; Harrower, 2016; Kosiba and Bauer, 2013; Richards-Rissetto and Landau, 2014; Ristvet, 2014; Supernant and Cookson, 2014; Wheatley, 2004). Given that the shift has already occurred from environmental to socio-historical conceptions of landscape, it is beneficial to define areas in which geospatial approaches can be broadened through an engagement with DH and Spatial History since landscape archaeology has many points of intersection with traditional humanistic inquiry.

3. Deep mapping

In recent years, deep mapping has emerged as a focus of

research in the Spatial Humanities (Bodenhamer et al., 2015; Roberts, 2016). It is important to note that there is no scholarly consensus on what a deep map is or what the process of deep mapping entails. I will provide a definition as a point of departure for discussing the topic. A deep map is a multi-layered, digital cartographic representation that allows map creators to annotate and illustrate geographical and social space in various ways, often using multi-media elements, commenting and super-imposable layers. Deep maps may integrate aspirational or imaginary space, and be collaborative, open-ended workspaces (Roberts, 2016). Deep mapping can provide temporal resolution to cartographic data (Ethington and Toyosawa, 2016), which addresses the fact that historical events occur in both space and time. However, static images are not particularly effective at capturing the temporal element of archaeological data. Deep mapping permits the animation of, for example, archaeological settlement systems to illustrate their temporal depth, the element of change over time (Gregory et al., 2015). Deep mapping is, furthermore, the process by which a deep map is produced, making it simultaneously a platform, product and process (Bodenhamer et al., 2015). A deep map is not simply a digital map—it is a complex construction composed of layers of meaning and process, as discussed below.

Deep mapping is relevant to the agenda of public archaeology because it provides a multi-media, intuitive way to display geographically referenced historical or archaeological data for both general and specialist audiences. The RICHES project at the University of Central Florida is a public history and archaeology interface that displays and analyzes images, objects, documents, oral histories, podcasts, videos etc. in an interactive mapping environment (<https://riches.cah.ucf.edu/>), drawing upon collections and archives housed at universities, museums, libraries and historical societies. A set of purpose-developed tools called the Mosaic Interface (MI), distinguishes the platform from a data archival project in that the MI analyzes each item for time, location, tags and topics to propose additional materials. An algorithm selects additional materials that may be germane to research interests, suggesting additional items a user may wish to consult (Fig. 1). The software uses the described algorithm to simulate having a talented archivist or librarian propose additional research materials for one's project based upon similarities with a viewed item. Users can create their own collections through storyboarding and bookbag tools created by RICHES. The platform also employs a number of purpose-developed tools that permit multiple geographical locations and attributes to be assigned to the same item, a situation that helps the platform developers express complex object biographies. This feature reflects the reality that an object can possess a complicated provenance, i.e. discovery in one place and a multi-locational history of ownership, crossing state or international borders.

Regarding digital storytelling, a topic that will be discussed in greater detail below, the Mosaic Interface permits users to contribute their own collections and develop their own narratives. The MI features tools such as digital exhibits, timelines, map overlays, and visualizations, allowing users to develop their own narratives, reflecting a post-modern interest in breaking down the traditional barriers of authorship-authority and subject-object; the platform also encourages the development of multiple narratives (e.g. Barthes, 1977; Ryan, 2002; White, 1987).

Multiple-geographical location functionality allows a single location to be expressed by a variety of historical and linguistic names, including, for example, Seminole or Spanish toponyms. Accordingly, deep mapping is an excellent format for discussing disputed geographies, a difficulty archaeologists frequently face. In many parts of the world, the simple act of applying a toponym, a name on a map, is a controversial gesture. Assigning a place name

geospatial technologies. One fruitful area of engagement for archaeologists to explore in the context of digital storytelling would be the use of unmanned aerial vehicles (UAVs) or “drones” to construct compelling narratives about ancient places and landscapes. Drones have been embraced by archaeologists in recent years as data-collection devices for the purposes of archaeometry, reconnaissance, site documentation, mapping, and photogrammetry (Casana, 2014; Gutiérrez and Searcy, 2016; Smith et al., 2014). Yet, the potential uses of UAVs for applications such as digital storytelling have not yet been fully realized in archaeological research contexts. Promising applications of digital storytelling include the presentation of research findings, public archaeology, heritage management, teaching and site documentation.

Employing a drone in field contexts no longer poses a substantial financial or technical challenge, although there are regulatory issues to consider. The cost to deploy a drone continues to become more affordable given the availability of lightweight, high-quality models such as the DJI Phantom series. Automated drone software, much of which is inexpensive or free, has developed quickly in the last two years. A number of software solutions allow users to, for example, automatically collect data for the construction of 3-D models by flying pre-determined transects as well as program flight paths for recording video. The advantage to using automated software for recording aerial video is the ability to mimic or exceed the technical capabilities of a skilled drone pilot, resulting in smooth and professional video footage. Regulatory conditions that govern drone flight vary from location to location, and it is critical to evaluate the operational requirements before employing UAVs in field contexts. Moreover, certain countries restrict the importation of drones or require special permits for their use.

One example of an archaeological project that has successfully employed digital storytelling, particularly drone photography, in the manner proposed above is the Cultural Landscapes of the Irish Coast Research Project (Kuijt et al., 2015). The group's presentation of research integrates historical analysis, photography, and short films to provide a unique archaeological and historical exploration of the Inishbofin and Inishark islands along the Irish coast. Combining the traditional with a digital twist, the project's publication is a print-format book which allows users to access short videos by scanning photos in the book with a mobile device (<https://islandplacesislandlives.com/>).

By way of example, Kuijt et al. depict the scale, landscape setting and state of preservation of a Cromwellian star fort (16th c.) with drone videography in a way that 2-D renderings cannot (<https://vimeo.com/134154449>). By using drone-based extreme long shots, the filmmakers show the interplay of historical monuments with the more modern legacies of fishing economies and tourism. The researchers communicate human-scale features by alternating between drone and fixed-camera setups, showing people interacting with the constructed environment. In addition to the visual elements, the videos are enriched by music that conveys a historically specific sense of place and cultural heritage. Drone photography as digital storytelling is, therefore, a valuable tool for expressing the scope and social context of archaeological features. Certainly, the project also demonstrates the potential of digital storytelling for public archaeology in its presentation of the histories of the islands of Inishbofin and Inishark.

As illustrated by the Cultural Landscapes of the Irish Coast Research Project, digital storytelling can play an important role in conveying the scale and complexity of archaeological structures within their landscapes. Post-modern phenomenological critiques of landscape archaeology (e.g. Tilley, 2008, 2004) argued that one must experience a landscape by dwelling within it (Heidegger, 1972; Ingold, 1993). Videos that incorporate drone footage more

effectively communicate the interplay of people, built structures and their environment than static representations like site plans and contour maps. Video is also a better visualization of movement within a landscape than static data representations (Cummings, 2008). While drone photography is not a necessary ingredient for digital storytelling, UAVs improve the ability to readily communicate large-scale or macro-scale phenomena in a way that terrestrial photography simply cannot.

Digital reconstructions and virtual worlds are another form of digital storytelling with a long tradition in DH as well as archaeology. Specifically, virtual and augmented reality in archaeology have taken various forms such as gaming environments or 3-D digital reconstructions (Chalikias et al., 2016; González-Tennant, 2016; Hiriart, 2016; Morgan, 2016, 2009; von Schwerin et al., 2013). Video Game Design, in particular, is a field that has emerged from a variety of disciplines including Computer Science and New Media Studies. The Florida Interactive Entertainment Academy at the University of Central Florida is an example of a highly ranked academic program specialized in game design (<https://fiea.ucf.edu/>). The “gamification” or the application of video game elements to non-gaming systems has already begun in archaeology (Champion, 2017; Morgan, 2016, 2009).

Recently, archaeologist and TED prize winner Sarah Parcak announced the use of the million-dollar prize to build an online platform named Global Xplorer (Gewin, 2016). Global Xplorer is a crowd-sourced concept that employs the established logic of gaming rewards to provide an incentive for the public to spend hours on the site identifying potential archaeological features or signs of looting using high-resolution satellite imagery after completing required training modules. Locational coordinates have been removed from the imagery to prevent the platform from becoming a tool for looters. The site features imagery from Peru in full cooperation with the antiquities authorities (<https://www.globalexplorer.org/>).

In sum, digital storytelling is an established topic of scholarship in the Digital Humanities that has the potential to enrich the research of scientifically oriented archaeologists in a number of substantive ways including the use of drone photography and virtual reality to communicate archaeological and historical narratives.

5. Data visualization

Data Visualization is another area that DH practitioners have focused upon in recent years, bringing the humanistic interest in narrativity (e.g. White, 1987) to the presentation and analysis of research results (Booker and Norton, 2009; Delaney, 2009). In particular, data visualization is relevant to scientifically oriented archaeology in that it can assist researchers in developing novel ways to display and explore data, thereby improving the scholarly communication of research (Mara and Bogacz, 2015). Moreover, attention to basic principles of cartography and the aesthetics of design is another area in which GIS experts in archaeology can productively engage with digital humanists and geographers.

Certainly, data visualization in archaeology and in GIS studies is not new. A bar chart is a data visualization in one of its most basic forms, and the presentation of GIS results have always relied upon the illustration of cartographic information. However, the emergence of Big Data projects (Cooper and Green, 2016) as well as the integration of social network analysis in archaeology (Collar et al., 2015) in recent years necessitates a re-visitation of the tools now available to display data in a more nuanced or visually compelling manner. In addition to their explanatory function, data visualization tools can be utilized to explore and understand the significance of data. In other words, data visualization tools allow researchers to

discover patterns that might not be readily apparent, for example, in tabular format. Furthermore, DH investigators and geographers have sought better ways to map time (DiBiase et al., 1992; Harrower and Fabrikant, 2008; White, 2010).

Archaeologists may benefit from using a wider array of geo-visual data models, a present trend in Spatial History (Delaney, 2009; Fyfe et al., 2009; White, 2010). For example, cartograms are a kind of map that has experienced a resurgence in popularity, particularly in media outlets such as the *New York Times*. Cartograms are maps in which a thematic variable—e.g. time, population or wealth—are proportionately distorted in the representation of land area (Tobler, 2004). In illustration, an electoral cartogram of the United States would depict states such as Florida and Connecticut as being larger than usual as a way of communicating the relatively larger population sizes in both places. Network connection maps, while more common in archaeological publications, are particularly germane to studies of roads, trade and communication systems (Brughmans, 2010; Collar et al., 2015). Rather than explaining an elaborate network of trade or communication that existed in antiquity in lines of prose, a good visualization can show readers the geographical extent, historical development and social intricacy of institutions in a few images. Graphic visualizations such as space-time cubes and mapping animations, for example, permit researchers to explore and communicate the temporal component of their research findings, a capability that allows archaeologists to nuance historical developments (Booker and Norton, 2009).

An adept illustration of a concept fulfills one of the basic requirements of good storytelling: show rather than tell. My archaeological research in the South Caucasus has focused upon, in part, tracing the development of visual communication networks composed of fire beacons (Earley-Spadoni, 2015a, 2015b). One challenge that I faced was that the off-the-shelf data visualization in ArcGIS, the viewshed analysis, was difficult to read and interpret, rendering the data difficult to explain to an audience (Fig. 2). However, when I represented the data as hierarchical networks (Figs. 3 and 4) using the visual logic of social network analysis, the findings—that elaborate communication networks existed during both the Early Iron and Urartian periods south of Lake Sevan—were easy to communicate.

Good principles of cartographic design intersect the perennial

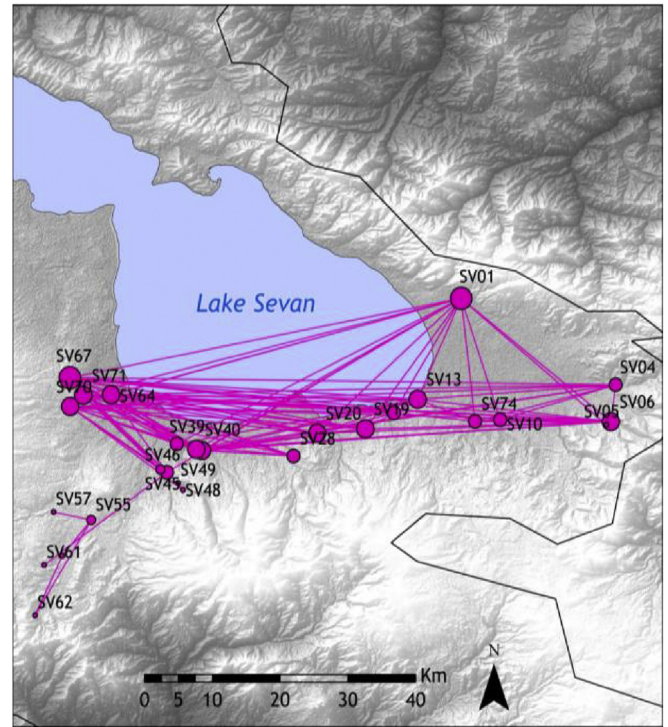


Fig. 3. Network map: Intervisibility of forts in the Early Iron period, Lake Sevan, Armenia.

topic of aesthetics in the humanities. The elements of design that make a map beautiful, to some extent, can be studied, replicated, and applied to geovisualization (e.g. Huffman and Wallace, 2012). While many practicing archaeologists possess formal training in GIS, relatively few have received systematic education in cartographic design or conventions. Within the field of geography, GIS specialists have sought collaborations with digital humanists from fields such as New Media Studies and Graphic Design to improve the visual and communicative appeal of digital maps (Cartwright et al., 2004; Huffman and Wallace, 2012). Archaeologists would,

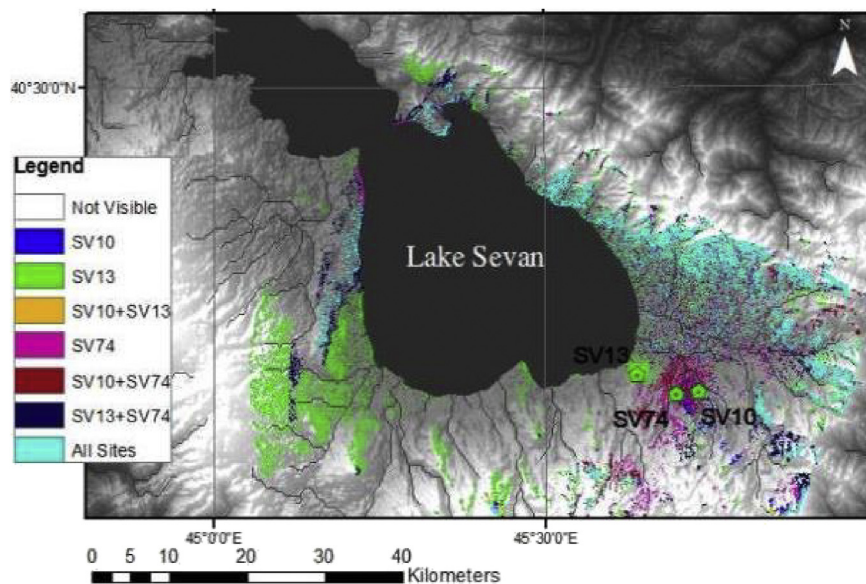


Fig. 2. A common, albeit relatively ineffective, visualization of intervisibility.

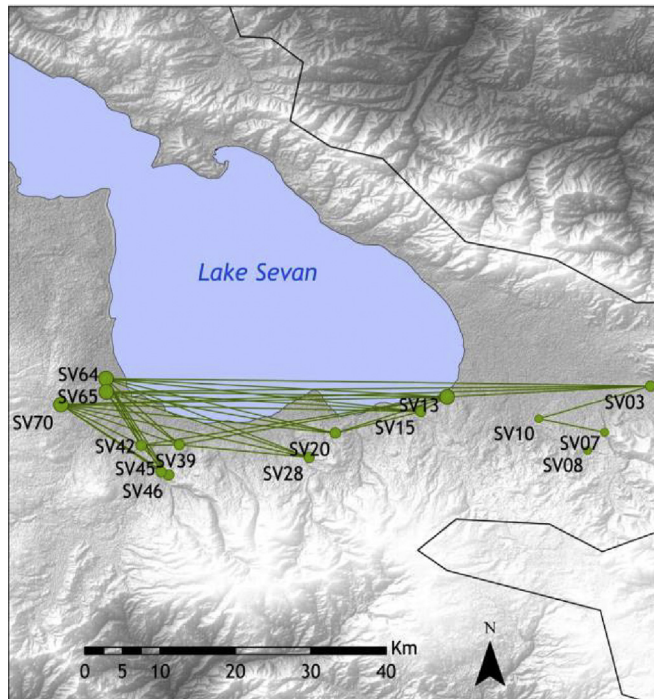


Fig. 4. Network map: Intervisibility of forts in the Urartian period, Lake Sevan, Armenia.

equally, benefit from collaborations with geographers and digital humanists towards cultivating the explanatory and aesthetic value of cartographic representations.

In sum, scientifically oriented archaeologists would benefit from engaging with a wider variety of data visualization tools, a current trend in the Spatial Humanities. Moreover, conventions of cartography and the aesthetic principles of good geovisual design should be incorporated into the curriculum in GIS studies in archaeology.

6. The enthusiasm of the academy

In recent years, the academy has taken notice of the interdisciplinary fields of DH, and has invested in its promise and future in a variety of concrete ways (Zorich, 2008). First, a number of funding opportunities has arisen both in the United States and Canada that are aimed directly at DH initiatives (Siemens, 2013). For example, the National Endowment for the Humanities funds a number of programs specific to Digital History research, which includes archaeology, such as Collaborative Research Grants, Digital Humanities Advancement Grants and the Digging into Data Challenge (www.neh.gov/grants), although the availability of funding for any particular program is subject to annual budget appropriations. While not specifically targeted towards DH initiatives, the National Geographic Society is interested in supporting innovations in technology, education, mapping, and storytelling, particularly data visualization, high-tech approaches, and cultural heritage preservation as a part of its recently revamped grant program (<http://www.nationalgeographic.org/grants>).

The number of Digital Humanities Centers (DHCs) and the dedicated DH staff working in interdisciplinary contexts and libraries has expanded in recent years (Fraistat, 2012; Vandegrift and Varner, 2013; Zorich, 2008). Some of the earliest DHCs emerged in the 1990s at Princeton, Rutgers, University of Virginia and Brown (Fraistat, 2012). Furthermore, DH Centers offer financial support for research to students and faculty in a variety of forms such as

internal grants and course-release time. DHCs also typically provide expertise in the form of GIS, digital editing and data visualization (Bergstrom, 2016). Many DHCs bestow graduate assistantships and post-doctoral fellowships through funding from agencies such as the Andrew Mellon Foundation and the Council on Library and Information Resources (CLIR). Digital Humanities initiatives have also been incorporated into the strategic planning and development programs at institutions such as the University of Pennsylvania and the University of Oxford, resulting in DH faculty cluster hiring. While not every university boasts a full-fledged DHC, many still have permanent DH research support, frequently housed in libraries or in academic departments such as English or New Media Studies. In other words, DH resources are no longer the exclusive domain of elite research universities, and university-based archaeologists can benefit from opening a dialog with digital humanists on their campuses.

The academy has also invested in the Spatial Humanities, a development that could provide opportunities for landscape archaeologists, particularly those who apply geospatial technologies to their historical research. For example, the Spatial History Project at Stanford is similar to a Digital Humanities Center in composition—with a dedicated lab and research staff—except that it was founded for the express purpose of exploring spatially oriented historical questions, using a variety of tools such as GIS, textual analysis and data visualization software. The Spatial History Project at Stanford is a part of a larger DH initiative, the Center for Spatial and Textual Analysis (CESTA), a cross-disciplinary research hub (<https://cesta.stanford.edu/>). The creation and funding of such centers is an opportunity for scientifically oriented archaeologists to recognize the academy's interest in spatially oriented humanities research and benefit from it by contextualizing archaeology initiatives through interdisciplinary engagement with DH.

There are good reasons for archaeology students to diversify skills and obtain specific experience in DH research environments. In particular, Master's degree or PhD holders who develop complementary skills as digital humanists broaden their employment opportunities. Compare, for example, the dearth of present employment opportunities for archaeologists in the United States (<http://careers.saa.org/>) with the relative wealth of opportunities available for digital humanists (<http://digitalhumanitiesnow.org>). In particular, there are numerous permanent positions in the Digital Humanities in library, DHC, cultural heritage and museum settings. Obtaining additional skills may also assist PhDs in acquiring tenure-track employment since DH and SH are new disciplines. Therefore, there are relatively few candidates who possess both highly specialized computing skills, such as GIS proficiency, and a PhD in the humanities (or a related field). While obtaining additional skills is by no means a panacea to combat the overall lack of employment opportunities, DH is another domain in which archaeologists can productively seek employment.

7. Conclusion

Revisiting the dilemma of the Roman god Janus, whose two faces could not see one another, we may take comfort in the realization that disciplinary boundaries between fields such as archaeology, History, Anthropology and the Digital Humanities reflect the history of scholarship of the disciplines in question rather than impassible barricades. The debates and achievements of DH, particularly the Spatial Humanities, are germane to scientifically oriented landscape archaeology and site-level studies. Therefore, GIS specialists in archaeology can contribute considerable experience, developed over decades of research, to applying geospatial technologies to historical questions. Moreover, archaeologists can benefit from theoretical developments derived from

DH to enrich their scholarly pursuits.

Despite the overwhelming advantages, there remain a number of obstacles to developing DH scholarship in the field of archaeology. One barrier to developing digital projects is that promotion and tenure criteria, which favor traditional print publication models, may not credit faculty members adequately for time, effort or the scholarly impact of their digital work. The American Historical Association recently tasked its constituency via digital white paper to substantially recognize digital scholarship in its faculty promotion criteria in light of productive new directions that the field has undergone (Ayers et al., 2015), providing a useful model of professional advocacy for archaeologists to adopt. Another barrier is the limited number of data types that are supported by traditional print journals. For example, certain digital file types as GIS files and 3-D models are typically relegated to online supplementary materials although the new *Studies in Digital Heritage* at Indiana University is a welcome exception to the general trend because the online journal allows authors to embed complex 3-D content within its open-source publications (<https://scholarworks.iu.edu/journals/index.php/sdh>).

As I have argued above, GIS specialists might productively emulate certain characteristics that typify Digital Humanities research. Specifically, deep mapping epitomizes the DH trait of open-ended data exploration as an explicit research methodology. Working towards improved narrativity in the presentation of research is equally desirable. In particular, archaeologists have the opportunity to increase social and public engagement by expanding our digital storytelling repertoire. In conclusion, increased collaboration with DH communities can provide archaeologists with a number of important opportunities, ranging from improved access to research funding to broadening the scope and impact of scholarly work through interdisciplinary dialog.

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