

Convergence of digital humanities and digital libraries

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Abstract

Purpose – Digital humanities (DH) has become a much discussed topic among both humanities scholars and library professionals. The library and information science (LIS) community has taken efforts in providing new facilities and developing new services to meet humanities scholars' changing research behaviors and needs employing digital tools and methods. How to effectively collaborate with the DH community has been a challenging task to LIS in their digital library (DL) development endeavors. The purpose of this paper is to discover productive ways for LIS to support DH scholarship, specifically, what DL components, including content, technology, and service, should and could be developed for digital humanists.

Design/methodology/approach – As an initial effort of the Digital Humanities Interest Group at University of California, Irvine Libraries, the examination is primarily based on a cross-boundary environmental scan in both DH and DL fields. The environmental survey includes both a literature review and web and physical site visits. The survey results, especially a gap analysis between the behaviors and needs of humanities scholars and the digital content, technologies, and services currently offered by the DL community, are used to shape the proposed roles of DH librarianship.

Findings – First, DH's innovative approach to research and teaching practices brings opportunities and challenges. Second, DH research is collaborative work. Third, major channels are established for the DH community. Fourth, various tools and data sets are developed to support different types of projects. Fifth, DH community has unbalanced geographical and disciplinary distribution. Sixth, DH research output still lacks attention, integration, and sustainability. Finally, LIS professionals play unique roles in DH projects. Overall, the communities of DH and DL share common goals and tasks.

Practical implications – This paper proposes these present and future roles of LIS professionals: creator and contributor; curator; messenger and liaison; educator; mediator and interpreter; host; partner; innovator; "hybrid scholar"; advocate; consultant. At the organizational level, libraries should demonstrate higher efficiency and effectiveness in the services by revamping organizational culture or structure to stimulate and realize more and deeper cross-boundary conversations and collaborations. On a larger scale, the DL community should strive to become more visible, valuable, and approachable to the DH community; and even better, become part of it.

Originality/value – This paper examines both DH and DL fields critically and connects the two communities by discovering gaps and commonalities. Based on the findings, the authors recommend roles and actions to be taken by LIS professionals, libraries, and the DL community. This paper is valuable to both humanities scholars who are seeking support in their research using digital methods and LIS professionals who are interested in providing more effective and suitable services. The paper also helps library administrators and aspiring librarians better understand the concept of DH and grasp insight on the present and future of DH librarianship.

Keywords Digital curation, Digital humanities, Digital libraries, Scholarly communication, Faculty-librarian collaboration

Paper type Conceptual paper



Introduction

In 1945, American engineer and inventor Vannevar Bush, in his famous essay, "As we may think," described how the Memex, an imaginary device that employed prescient principles of the internet, could change the way a historian would do research (Bush, 1945). Almost 70 years later, Bush's Memex dream has come true for historians and their fellow humanities scholars, owing largely to the rapid development of computing and

Although there is no explicit mention of libraries, the model suggests roles that LIS professionals could play in DH: particularly content and technology. Providing access and archiving services to scholarly communities is a core mission of academic libraries.

Despite the natural fit of librarianship with DH and a growing number of collaborative projects between LIS professionals and DH specialists, we discovered from the literature that it is not easy to initiate and sustain such collaborations for these reasons: first, traditionally trained humanities scholars are stereotyped for their self-contained research activities (Spiro, 2011), and thus significant efforts are needed from LIS professionals to build and promote trust with them; second, as a field at its embryo stage, DH remains uncertain about how to ensure successful projects with long-lasting impact.

This paper attempts to identify areas of DH activities that LIS professionals may provide supports for and proposes roles that we may take in order to meet the emerging and evolving needs and developments of DH. As an initial effort of the University of California, Irvine (UCI) Libraries' Digital Humanities Interest Group (DHIG), our investigation is primarily based upon a cross-boundary environmental scan of current literature and open web resources in both DH and LIS fields, particularly those of digital libraries (DL) within LIS. For the purpose of this paper, we define DL broadly as collections, tools, and services created and delivered in the digital format.

Research objectives

The ultimate goal of our research is to identify gaps, if any, between the current state of the DH community and the provisions of support from the DL field. Within the DH community, we are interested in finding out major players, recent projects including both successes and failures, and what kind of external assistance is needed. Meanwhile, within the DL domain, we investigated current efforts made by LIS professionals in connecting themselves with DH scholars and how they have contributed to DH projects and developments. Based on our cross-boundary examination, we will propose recommendations for filling the gaps, if they are found.

Methodology

We combined a literature review of representative humanities and LIS publications with selected virtual and physical visits to humanities schools, research centers, and academic libraries. The physical visits were very limited for the writing of this paper because of the authors' time constraints.

For DH literature, we used JSTOR because it is known as the best source for retrieving works by humanists. For DL literature, we chose to search EBSCO's Library, Information Science & Technology Abstracts (LISTA). From the large pool of works retrieved (with a total a number of over 200), we selected only 69 articles for review based upon the criteria of subject representativeness, geographic balance, and authors' credentials.

Web site visits were based on the worldwide DH center list provided at <http://dhcenternet.org>, with a total of 193 entries. As some entries are for single DH projects, professional societies, or funding agencies, we ended up with a pool of 107 functioning DH centers for review. By "functioning," we mean a center has to have a group of supporting staff and affiliated faculty, and has to have a stated mission of ongoing support to collaborative DH projects and/or programs. Similar to the literature review,

the DH centers selected represent a wide range of geographical, subject, and operational parameters. Considering DH center as the hubs within or among institutions for DH research and education, virtual visits to these representative centers should be indicative of the status quo of the DH community.

On March 17, 2014, we visited University of California, Los Angeles (UCLA) and had face-to-face meetings with staff members from its Center for Digital Humanities (CDH), Center for Primary Research and Training, and Digital Library Program. The site was chosen for CDH's reputation and proximity to UCI. Founded in the early 1990s, UCLA's CDH currently has 35 affiliated faculty members from some 20 different departments in the fields of arts, architecture, information studies, theater, film, television, and other humanities and social science disciplines. It also has a close relationship with five other centers and institutes on campus, including the library, where the librarian for Digital Research and Scholarship serves as the liaison to CDH. CDH not only serves as a hub for DH research, but also offers certificate-based education. On April 18, 2014, we attended a Digital Humanities Southern California Meeting held at University of California, San Diego, and interacted with a mixed group of DH scholars, LIS professionals, and graduate and doctoral students from both fields. This meeting took an informal "unconference" approach, providing a channel for conversations among different stakeholders. Two prominent themes that emerged were the development and sharing of a DH curriculum, and the keenness for more and deeper cross-institutional collaborations. Issues such as funding, preservation, access, and getting faculty buy-in were discussed. For faculty buy-in, the discussion surfaced that specific technology names (e.g. "GIS") were perceived to be more effective when communicating with faculty. Most faculty and lecturers recognized the value of librarians; and a few of their research interest and activities overlap those of LIS professionals, such as the uses and implementation of Resource Description Framework (www.w3.org/RDF/), Functional Requirements for Bibliographic Records (www.loc.gov/cds/downloads/FRBR.PDF), and Bibliographic Framework Initiative (www.loc.gov/bibframe/) in relation to DH.

Findings

The following findings about the current state of the DH field demonstrate both its potential for exciting growth and the challenges that still remain.

A. Potential

1. *DH creates knowledge through new methods.* The power of modern computing technology lies in its ability to process, organize, store, and retrieve information beyond human capacity. This kind of power enables humanities scholars to perform tasks that would have been impossible to accomplish with traditional line-by-line reading. Gilliland *et al.* (2011) were able to employ GIS to situate individual census households at high spatial precision. LaFarge (1996) confirmed the Bearded Lady archetype through synthesizing two images of the Mona Lisa and Leonardo Da Vinci's 1512 self-portrait. Dalbello (2011) pointed out that digital technologies generate new forms of learning experience and revitalize students' interaction with learning objects, but in a decontextualized setting. Grieve and Campbell (2014) examined how contemporary gaming culture helps young generations to understand what religion is, does, and means. Similarly, Marchionini's (2000) longitudinal evaluation studies of the Perseus

Digital Library (www.perseus.tufts.edu/hopper/) demonstrated how students used classics materials that would have been difficult for them to access in the physical world, and how computer-augmented tools made it easier for them to discover, interpret, archive, and collaborate with their peers.

2. *DH scholars across disciplines are highly collaborative.* Digital technologies have also brought opportunities for humanities scholars to collaborate despite subject and geographical boundaries, although not without cost as will be discussed in the “Challenges” section. Further, the technology-dependent nature of DH demands that scholars carry out their projects by working closely with information scientists and technology specialists. It was the “unbearable lightness of a shared methodology” in computing humanities that made cross-disciplinary collaboration possible (Meister, 2012). Meanwhile, funding agencies require teamwork (Siemens *et al.*, 2011). Almost all the empirical research and DH projects we have reviewed are conducted by people from multiple disciplines, which is quite different from traditional humanities scholarship. For example, two computer scientists applied constraint logic programming to help a literature professor in the analysis of the chronology of William Faulkner’s “A Rose for Emily” (Burg *et al.*, 2000). Collaboration is rewarding, yet requires high-level right and merit management to reach fairness among collaborators, as pointed by Spiro (2011).

3. *DH scholarship reaches a broader audience with built-in discovery tools.* The unit of currency in DH is not necessarily an article or a book, but rather, a project; which is usually published using an open web platform, allowing users to dynamically interact with underlying data. Changes in research workflow also make an impact on how scholars communicate and collaborate. The need for multi-authoring has made online publishing and collaborative tools such as Scalar, Omeka, Drupal, and Wordpress more important. For example, the Getty is currently working on an open source workspace (<https://blogs.getty.edu/iris/creating-getty-scholars-workspace-lessons-from-the-digital-humanities-trenches/>) for scholars to collaborate online and to continue working on projects after they leave the Getty’s archive (Baca, 2012).

Some DH projects include the crafting of their own tools, while others depend on tools made by others. A major task for DH researchers is to identify tools that will complement the data collected and the research question asked. Tool hubs like Bamboo Dirt (<http://dirtdirectory.org>) and GitHub (<https://github.com/explore>) help scholars identify the tools they need to perform their desired work. One excellent resource maintained DH scholar and Professor of English at University of California, Santa Barbara, Alan Liu, lists current tools, guides, and data sets; and demarcates which are trending. Table I lists frequently used DH tools, their application areas, and sample projects (<http://dhresourcesforprojectbuilding.pbworks.com/w/page/69244243/FrontPage>).

Some tools require a great deal of fluency with coding and mark-up, while others are crafted in intuitive ways for digital novices to use. Digital collections for DH researchers are also increasingly accessible to the public. Professor Liu’s resource lists open access data collections (<http://dhresourcesforprojectbuilding.pbworks.com/w/page/69244469/Data%20Collections%20and%20Datasets>).

4. *The DH community has established major scholarly communication, professionalization, and educational channels for itself.* Similar to other fields, the DH community has its own established channels for scholarly communication among

DH application areas	Supporting tools	Example projects
Critical curation – create a corpus of texts, images and both digitized and born digital, often across institutional holdings	Omeka (open source digital asset management tools built by the George Mason University)	Digital Public Library of America The Europeana
Augmented editions (e.g. textual analysis and text collation) – annotate, collate, comment, crowdsourcing and add layers of meaning onto a textual corpora	Juxtacommons, PoemViewer, Tapor, TXM, Voyant tools, and Wordhoard	Perseus Project created by Tufts Mining the Dispatch
Topic modeling – weight words within a given work to see how certain concepts are formulated	MALLET	Elijah Meeks’s modeling of DH definitions
Cultural analytics – look at larger trends in culture using big data and visualization techniques	R, Google Ngram viewer, Gephi, RAW, D3.js, ManyEyes, and MALLET	Phototrails
Visualization – makes trends and arguments visible using charts, graphs, wordclouds, and virtual representation of reality	Gephi, RAW, R, ManyEyes, Scalar, Second Life, GISArc	HyperCities at UCLA The Virtual Harlem Project
Network analysis – model the relationships between data to make meaningful connection	GEPHI	Mapping the Republic of Letters from Stanford Linked Jazz
Animated Archive – bring archival and primary source material alive through a digital platform	Scalar, Omeka, Drupal, and Wordpress	Los Angeles Aqueduct MediaNOLA
Gaming – employ interactive media to engage users; crowdsourcing content		Metadata Games (MG) AnteaterTag@UCI one of many MG uses

Table I.
A selective list of
digital humanities
modes, tools,
and projects

scholars and practitioners, which include societies and organizations, themed publications and conferences, as well as education and research programs.

At the international level, the Alliance of Digital Humanities Organizations (<http://adho.org>) “promotes and supports digital research and teaching across all arts and humanities disciplines, acting as a community-based advisory force, and supporting excellence in research, publication, collaboration and training.” ADHO sponsors several peer-reviewed journals, book series, special interests groups, and annual conferences, as well as oversees awards to recognize outstanding DH scholars, among which the Busa Prize is the highest honor (<http://adho.org/awards/roberto-busa-prize>).

Another significant international organization is the Humanities Arts Science Technology Advanced Collaboratory (HASTAC, www.hastac.org). HASTAC organizes international conferences, recognizes outstanding scholars and projects, and networks over 13,000 members from humanities, arts, social sciences, and science and engineering.

Various journals exist as a platform for DH scholars to publish their research output. To name several:

- *Computers and the Humanities* (1966-2004, continued by language resources and evaluation);
- *International Journal of Humanities and Arts Computing* (formerly *History and Computing*);
- *Digital Humanities Quarterly (DHQ)*, an open-access and peer-reviewed journal;
- *Journal of Digital Humanities*, an open-access and peer-reviewed journal, in which the articles are the editors’ choices from *Digital Humanities Now*;
- *Digital Humanities Now*;
- *Journal of the Chicago Colloquium on Digital Humanities and Computer Science*;
- *Literary and Linguistic Computing*, an Oxford journal;
- *Computer Music Journal*, an MIT journal; and
- *Leonardo*, a leading international journal in computing arts and music, also from MIT.

DH scholarship has dedicated funding channels, including the National Endowment for the Humanities (www.neh.gov), the MacArthur Foundation (www.macfound.org), and the Andrew W. Mellon Foundation (<http://mellon.org>). In addition, starting in 2010, Google offers annual DH research grants encouraging humanities scholars to exploit Google Books.

Workshops and summer institutes have been deemed as effective ways of giving “researchers the chance to work with techniques and concepts with which they are not necessarily familiar and to reflect upon their own disciplinary practice from the outside” (Beale *et al.*, 2013). Several well-established training programs include:

- Digital Humanities Summer Institute (www.dhsi.org), once a year at the University of Victoria;
- The Digital.Humanities@Oxford Summer School (<http://digital.humanities.ox.ac.uk/dhoxss/>), an annual program;

- Nebraska Digital Forum (<http://unlcms.unl.edu/cas/center-for-digital-research-in-the-humanities/news-events/nebraskaforum>), an annual program; and
- The Humanities and Technology Camp (<http://thatcamp.org>), an unconference format sponsored by George Mason University.

Degree programs and certificates are now provided at many institutions, such as UCLA, Loyola University, and University College London. These programs play a significant role in training future DH scholars and practitioners. There are also web sites, blogs, and special interest listservs developed for advocating DH research – examples include 4Humanities (<http://4humanities.org>), HASTAC blogs (www.hastac.org/blogs), and GeoHumanities (<http://lists.lists.digitalhumanities.org/mailman/listinfo/geohumsig>).

B. Challenges

1. *DH is not generally respected by peers, nor accepted as qualifying scholarship by tenure review committees.* While DH scholars are enthusiastic about their work, their novel methodologies and the theoretical assumptions behind their work have been questioned by their peers from traditional humanities schools of thought. Even within the DH community itself, there exist debates on the reliability and soundness of different approaches. In one recent example, a dispute between two influential Shakespeare researchers and DH scholars erupted when Burrows (2012), counter-attacked the criticism made by Vickers (2011), who questioned the reliability of Burrow's computational stylistics approach for studying authorship attribution. Researchers choose sides, such as Smith (2002) with Burrows, and Raben (2007) with Vickers.

Some scholars (Borgman, 2009; Flanders, 2009) also point out the insufficient value of DH work in faculty academic review. Most scholars are tied to institutions which have historically valued book and journal article publications above other forms in promotion and tenure. However, these criteria may soon change: recently Peter K. Bol, the Vice Provost for Advances in Learning at Harvard University, announced that database creation had become an acceptable criterion for academic advancement at Harvard (Bol, 2014). Where prestigious universities lead, others will follow.

2. *The DH community has unbalanced geographical and disciplinary distributions.* As major hubs for cross-disciplinary collaborations, many DH centers and laboratories have been developed at the institutional, regional, and/or national levels. European (especially the UK) and North American (predominantly in the USA) academia have been leading the collaborative efforts, with a few in Asia and Oceania. European and North American centers also differ in terms of libraries' involvement, educational programs, and operational level. In Europe, DH centers are usually located in academic units or separate spaces other than libraries, and often do not mention libraries as collaborators. North American centers, however, tend to have a closer and more explicit tie between DH centers and libraries; many centers are physically located in university libraries. For example, two DH centers, the Digital Humanities Center at Columbia University and the Institute for Digital Arts and Humanities at Indiana University were initiated and are continuously operated by their libraries.

European centers are taking the lead on educational programs. Ten out of the 52 centers provide formal educational opportunities. King's College (London) even has a separate Department of Digital Humanities. In contrast, only three out of

44 North American counterparts provide degree- or certificate-based DH education: University of Nebraska for the former, and UCLA and Texas A&M University for the latter.

In North America, DH centers tend to serve individual higher institutions, but some also serve multi-institutions, such as the Tri-Co Digital Humanities Initiative (<http://tdh.brynmawr.edu>). Meanwhile, several European centers are operated at a national level, which include the Arts and Humanities Data Service (www.ahds.ac.uk), Centre National Pour la Numérisation de Sources Visuelles (www.cn2sv.cnrs.fr), digHUMLab (<http://dighumlab.com>), Denmark, and the Institute for Corpus Linguistics and Text Technology (www.oaaw.ac.at/icltt/), Austria.

Apart from the unbalanced geographic distribution, DH research also weighs differently from discipline to discipline. Huggett (2012) examined the subject representation of articles in the journal *Computers and the Humanities* (1966-2004) and found that 87 percent were related to literature and linguistics. His analysis of a few other DH journals showed a similar pattern – there is a significant bias toward linguistics, literature, and history.

Juola (2008) conducted an analysis of the flagship journal in the field, *Computers and the Humanities* (1999-2004). The results show only five out of 205 author affiliations were Ivy League schools; and the cross-citation of DH works was low, concluding that the DH community as a whole tends to be marginal.

Similarly, related DH collections are not yet integrated. These digital collections are distributed in different schools, academic units, museums, archives, and libraries. Few efforts have been made to link related resources together. For instance, Perseus Digital Library and the Thesaurus Linguae Graecae (<http://stephanus.tlg.uci.edu>) both cover ancient Greek literary texts, but neither refer to the other. Further, there seems no “one-stop shop” for all available digital resources for any particular area of study.

3. *The technologies used in DH create barriers for new scholars to learn and for projects to be sustainable.* Besides the institutional resistance to new forms of research, powerful technologies also create barriers, as some technologies are not intuitive to use and may require a great volume of information to generate meaning results. Jessop (2008) discussed a few factors that may hinder the use of GIS technology in DH scholarship.

Among numerous DH research collections, there are many that have been well developed, maintained, and used, such as the Index Thomisticus (www.ahds.ac.uk), Perseus Digital Library, and American Memory (<http://memory.loc.gov/ammem/index.html>). However, Kretzschmar and Potter (2010) cautioned that even well-established large DH projects, such as the Linguistic Atlas Project (<http://us.english.uga.edu>), is at risk of sunset in the future, if funding and staffing are not secured.

Trying different sources of support seems an effective way to rescue a project at risk. Some DH projects are able to sustain themselves through transformation from not-for-profit to for-profit model or vice versa. Originally developed at the UCI with an endowment of \$1 million in 1972, Thesaurus Linguae Graecae had difficulty in growth and advancing technologically in the early 1990s, but now it is available for subscription and supports itself through subscription fees. Chinese Biographical Database (<http://isites.harvard.edu/icb/icb.do?keyword=k16229>), a long-term collaborative project among Harvard, Academia Sinica Taiwan, and Peking University, was originally hosted

at a commercial server in Taiwan; and was later migrated to Harvard's servers reducing cost of server hosting and maintenance.

Discussion

According to LISTA, the first time the term “DH” appeared in LIS literature is in the June 1998 issue of *Information Technology & Libraries*, in a two-page report on The National Initiative for a Networked Cultural Heritage. As an evolving field, DH recently has generated more attention from the LIS community. A November 2011 report by the Association of Research Libraries was devoted to the topic (Bryson *et al.*, 2011). Sula (2013) reported a steady increase of publications on DH in LISTA since 2005, which nearly doubled in 2012. Vol. 53 issue 1 (2013) of *Journal of Library Administration* is dedicated to the theme of “Digital humanities in libraries.” At the 2014 midwinter meeting of the Association of College and Research Libraries, a decision was made at the Board of Directors to establish a Digital Humanities Discussion Group; a listserv was thus established and later merged with the earlier and similar interest of the Digital Library Federation into “dh+lib” (<http://acrl.ala.org/dh/>).

Many DH projects and initiatives have embraced LIS professionals' involvement. Green (2014) examined five case studies that exemplify how academic librarians have collaborated with faculty on DH initiatives. Freire (2013) reported on a new research infrastructure being created by the European Library to better support DH researchers. Harkema and Nygren (2012) narrated how Historypin (www.historypin.org) was incorporated with a library's digital collection from the beginning of the project to enhance the user interface. The Columbia University Libraries also started their The Developing Librarian Project (www.developinglibrarian.org), a two-year training program with the goal of helping librarians acquiring new skills and methodologies in DH.

The position of DH centers with relation to libraries is in debate. Vandegrift (2012) argued that the library is a natural place for DH projects. There are a few highly active DH centers physically located within their respective university libraries, such as Maryland Institute for Technology in the Humanities (<http://mith.umd.edu>) at the University of Maryland, College Park; ScholarsLab (<http://scholarslab.org/about/>) at the University of Virginia; and the Digital Scholarship Commons (<http://digitalscholarship.emory.edu>) at Emory University. However, relatively few libraries have DH centers or programs and many initiatives are still in development (Posner, 2013). Schaffner and Erway (2014) discussed whether every research library needs a DH center.

Roberto Busa, the father of DH research said, “The use of computers is not aimed toward less human effort, or for doing things faster and with less labour, but for more human work, more mental effort” (Busa, 1976). LIS professionals carry the mission of connecting the power of modern information technology with more “human” and “mental” effort. To accomplish this mission, we need to continue building and expanding our expertise. Self-promotion, trust building, and playing a curator role are particularly important in response to the challenges of working with humanists and sustaining and maximizing the value of DH projects. Reflecting on the history and most recent practices of our profession, we believe we have experience playing the following roles that are ready to be repurposed or extended to support DH:

- Content provider or creator who identifies and develops large (in size) and diverse (in format and subject) digital collections that are openly available for use and reuse. One effective way is to build on-demand digital collections, such as

what has been done at UCLA Libraries (Rimmer *et al.*, 2008). Meanwhile, it is beneficial to associate appropriate tools to the collections for community annotation and collation. Alternatively, we could negotiate digital corpora from vendors.

- Curator who evaluates, selects, organizes, and preserves digital publications, tools, projects, training materials, and more, ensuring their sustainability and long-term access. Johnston (2013) addressed the sustainability issue of DH projects by pinpointing “active management” and “starting [preservation] at the beginning of the life cycle.” Doug Reside, the first digital curator at the New York Public Library for the Performing Arts, suggested that in order to establish legitimacy in the eyes of the scholarly establishment, curators must build tools for gathering metrics into their projects and cooperate with external peer review groups (Clement *et al.*, 2013).
- Messenger or liaison who proactively finds appropriate digital collections, tools, services, and funding opportunities for their potential users on demand. When introducing novelty, prepare answers to questions such as “Why should I use this [e.g. tool]?” “What type of research questions can I use this [e.g. tool] to help answer?” and so on, before addressing how to use them.
- Educator or instructor who transfers necessary skills to humanities scholars through hands-on workshops and consultations to minimize “productive unease” when a scholar interacts with digital content and technology (Flanders, 2009). To accomplish this, we will need to continue learning emerging DH tools. An example in this area is the *digiPrep* workshop (<https://digitalhumanities.stanford.edu/digiPrep>) at Stanford.
- Consultant who delivers professional advice to DH scholars on copyright, open access, and related issues.

In the meantime, new roles we should develop include:

- Mediator and interpreter who possess both subject knowledge and information technology expertise, translating between humanities scholars and information technologists for optimal collaborative effectiveness. As Juola (2008) noted, “digital humanities specialists should be in a unique position to identify the needs of mainstream humanities scholars and to suggest computational solutions that the mainstream scholars will be glad to accept.” We can repurpose the role of digital humanists to our own advantage.
- Host who creates and provides physical and virtual spaces equipped with essential technology for the DH community’s teaching, research, and team building activities. These spaces can also be used to host DH interest groups and summer institutes offering a platform for different groups (e.g. DH scholars, librarians, and developers) to learn from and collaborate with each other.
- Partner who provides supporting services and engages in the development of new tools and resources. Siemens (2009) provided implications for practice drawn upon a qualitative study using in-depth interviews that we find inspiring and useful when working within DH teams, the nature of which is often collaborative and multidisciplinary.
- Innovator who generates and shares new ideas based on the latest research in user and information studies; who actively experiments with web interfaces, data

mining, data visualization, and other innovative projects; and who creates a sustainable infrastructure for DH research and scholarly communication.

- Hybrid scholar with both expertise in DH and LIS.
- Advocate who promotes DH research and collaborations to peripheral disciplines, fellow humanities researchers, and a much broader community.

In response to these roles, a number of librarians initiated the DHIG at UCI Libraries in January 2014 with support from library administration. The intended outcomes of this group in the first 12 months, as envisioned by its founding members, included:

- forming our own understanding of DH by exploring concepts, tools, and applications in order to establish a core definition that directs our energy and work;
- promoting ourselves, acknowledging that DH is known by many different rubrics, and using the existing library infrastructure to connect interested outside parties to knowledgeable librarians and library staff; and
- proposing and facilitating new initiatives and services that may introduce successful and sustainable partnerships with others on campus and in the region for our libraries.

In terms of whether every library should develop a DH center or laboratory, we agree with Schaffner and Erway (2014) that no one answer fits all. Individual libraries should determine their approaches and projects based on the needs of their local clientele and available resources including human and financial. Although the placement of DH centers inside or outside libraries may impact LIS professionals' roles, we identify the key issues not as physical, but rather, in better communication, alignment with user needs, and increasing awareness as observed and expressed by Gretchen Gueguen, the digital archivist for Digital Curation Services at the University of Virginia Libraries (Clement *et al.*, 2013).

Looking ahead, we will need hybrid professionals who possess both subject knowledge and technical expertise. Amy Earhart, assistant professor of English at Texas A&M University who was interviewed by Clement *et al.* (2013), "hopes to witness a continued blurring of the lines separating the scholar, the librarian/archivist, the editor, and the information technology (IT) expert." We are seeing LIS education responding to this need by offering new courses, such as the iSchool of Illinois (www.lis.illinois.edu). At the organizational level, libraries should demonstrate higher efficiency and effectiveness in our services by revamping organizational culture and structure to stimulate and create more and deeper cross-boundary conversations and collaborations. Facing the rapidly evolving digital information landscapes, including that of DH, we need to start thinking and acting like a start-up. Providing user-centered services requires us to begin forming the habit of agile learning by doing. Library leaders and administrators should be more flexible, open-minded, and ready to experiment and take risks. Murphy (2012) argued, "Simply, we must engage. Taking a 'wait and see' approach, or ignoring the issues altogether, does our users a disservice. While the DH landscape may seem tumultuous and uncertain, even foreign, libraries must do their best to move forward." Meanwhile, we need to deepen our conversations and collaborations with the scholarly community by continuously and consistently demonstrating our professional value and validity. This activity should take place not only within DH, but in a wide array of disciplines, because of there are synergies

between DH and other data intensive initiatives emerging around the globe, including those in research data curation, data analysis and visualization, and data metrics.

Conclusion

The communities of DH and DL share common goals and tasks (Vandegrift, 2012). The nature of DH projects and funding agencies' requirements for teamwork present a great opportunity for scholars and practitioners from both fields to work together. To make collaborative work more successful, we, LIS professionals, need to challenge ourselves to continuously grow new skill sets on top of existing expertise and becoming hybrid professionals. The DL community should strive to make ourselves more visible, valuable, and approachable to the DH community. Even better, the DL community need to become part of the DH community.

References

- Baca, M. (2012), "Digital mellini: project update and observations on translating historical texts", *Getty Research Journal*, No. 4, pp. 153-160, available at: www.jstor.org/stable/41413138?seq=1#page_scan_tab_contents (accessed April 4, 2015).
- Beale, G., Beale, N., Dawson, I. and Minkin, L. (2013), "Making digital: visual approaches to the digital humanities", *Journal of Digital Humanities*, Vol. 2 No. 3, available at: <http://journalofdigitalhumanities.org/2-3/making-digital-visual-approaches-to-the-digital-humanities/> (accessed April 1, 2014).
- Bol, P.K. (2014), "Collections, modules, and MOOCs: roles for East Asian libraries", paper presented at Council for East Asian Libraries (CEAL) Annual Meeting, Philadelphia, PA, March 26-27.
- Borgman, C.L. (2009), "The digital future is now: a call to action for the humanities", *Digital Humanities Quarterly*, Vol. 3 No. 4, available at: www.digitalhumanities.org/dhq/vol/3/4/000077/000077.html (accessed August 24, 2014).
- Bryson, T., Posner, M., St Pierre, A. and Varner, S. (2011), *SPEC Kit 326: Digital Humanities*, Association of Research Libraries, Washington, DC, available at: <http://publications.arl.org/Digital-Humanities-SPEC-Kit-326/> (accessed April 2, 2015).
- Burg, J., Boyle, A. and Lang, S.D. (2000), "Using constraint logic programming to analyze the chronology in 'a rose for emily'", *Computers and the Humanities*, Vol. 34 No. 4, pp. 377-392.
- Burrows, J. (2012), "A second opinion on 'Shakespeare and authorship studies in the twenty-first century'", *Shakespeare Quarterly*, Vol. 63 No. 3, pp. 355-392.
- Busa, R. (1976), "Why can a computer do so little?", *ALLC Bulletin*, Vol. 4 No. 1, pp. 1-3.
- Bush, V. (1945), "As we may think", *Atlantic Monthly*, July, pp. 1-8.
- Clement, T., Hagenmaier, W. and Levine Knies, J. (2013), "Toward a notion of the archive of the future: impressions of practice by librarians, archivists, and digital humanities scholars", *The Library Quarterly*, Vol. 83 No. 2, pp. 112-130.
- Dalbello, M. (2011), "A genealogy of digital humanities", *Journal of Documentation*, Vol. 67 No. 3, pp. 480-506.
- Flanders, J. (2009), "The productive unease of 21st-century digital scholarship", *Digital Humanities Quarterly*, Vol. 3 No. 3, available at: www.digitalhumanities.org/dhq/vol/3/3/000055/000055.html (accessed March 1, 2014).
- Freire, N. (2013), "Facilitating access and reuse of research materials: the case of the European library", paper presented at *Mining the Digital Information Networks, 17th International Conference on Electronic Publishing, Karlskrona, June 13-14*, available at: http://elpub.scix.net/cgi-bin/works/Show?107_elpub2013 (accessed August 25, 2014).

- Gilliland, J.A., Olson, S.H. and Gauvreau, D. (2011), "Did segregation increase as the city expanded?: the case of montreal, 1881-1901", *Social Science History*, Vol. 35 No. 4, pp. 465-503.
- Green, H.E. (2014), "Facilitating communities of practice in digital humanities: librarian collaborations for research and training in text encoding", *The Library Quarterly: Information, Community, Policy*, Vol. 84 No. 2, pp. 219-234.
- Grieve, G.P. and Campbell, H.A. (2014), "Studying religion in digital gaming: a critical review of an emerging field", *Online Heidelberg Journal of Religions on the Internet*, Vol. 5, pp. 51-67, available at: <http://journals.ub.uni-heidelberg.de/index.php/religions/issue/archive>; <http://nbn-resolving.de/urn:nbn:de:bsz:16-rel-121835>
- Harkema, C. and Nygren, C. (2012), "Historypin for library image collections: new modes of access for unique materials at the university of Saskatchewan library", *Partnership: The Canadian Journal Of Library & Information Practice & Research*, Vol. 7 No. 2, pp. 1-11.
- Hockney, S. (2004), "The history of humanities computing", in Schreibman, S., Siemens, R. and Unsworth, J. (Eds), *A Companion to Digital Humanities*, Blackwell, Oxford, n.p. available at: <http://digitalhumanities.org:3030/companion/view?docId=blackwell/9781405103213/9781405103213.xml&doc.view=print&chunk.id=ss1-2-1&toc.depth=1&toc.id=0> (accessed April 16, 2015).
- Huggett, J. (2012), "Core or periphery? Digital humanities from an archaeological perspective", *Historical Social Research/Historische Sozialforschung: Controversies around the Digital Humanities*, Vol. 37 No. 3, pp. 86-105.
- Ide, N. and Mylonas, E. (2004), "From the editors", *Computers and the Humanities*, Vol. 38 No. 4, pp. iii-iv.
- Jessop, M. (2008), "The inhibition of geographical information in digital humanities scholarship", *Literary and Linguistic Computing*, Vol. 23 No. 1, pp. 39-50.
- Johnston, L. (2013), "Digital humanities and digital preservation", available at: <http://blogs.loc.gov/digitalpreservation/2013/04/digital-humanities-and-digital-preservation/> (accessed April 1, 2014).
- Juola, P. (2008), "Killer applications in digital humanities", *Literary and Linguistic Computing*, Vol. 23 No. 1, pp. 73-83.
- Kirschenbaum, M.G. (2010), "What is digital humanities and what's it doing in English departments?", *ADE Bulletin*, No. 150, pp. 55-61, available at: www.ade.org/bulletin/; www.ade.org/cgi-shl/docstudio/docs.pl?adefl_bulletin_c_ade_150_55&from=adefl_bulletin_t_ade150_0
- Kretzschmar, W.A. and Potter, W.G. (2010), "Library collaboration with large digital humanities projects", *Literary and Linguistic Computing*, Vol. 25 No. 4, pp. 439-445.
- LaFarge, A. (1996), "The bearded lady and the shaven man: Mona Lisa, meet 'Mona/Leo'", *Leonardo*, Vol. 29 No. 5, pp. 379-383.
- Marchionini, G. (2000), "Evaluating digital libraries: a longitudinal and multifaceted view", *Library Trends*, Vol. 49 No. 2, pp. 304-333.
- Meeks, E. (n.d.), "Comprehending the digital humanities", available at: <https://dhs.stanford.edu/comprehending-the-digital-humanities> (accessed August 22, 2014).
- Meister, J.C. (2012), "'DH is Us' or on the unbearable lightness of a shared methodology", *Historical Social Research/Historische Sozialforschung*, Vol. 37 No. 3, pp. 77-85.
- Murphy, B.P. (2012), "The qumran visualization project: prospects for digital humanities in theological libraries", *Theological Librarianship*, Vol. 5 No. 2, pp. 29-38.
- Posner, M. (2013), "No half measures: overcoming common challenges to doing digital humanities in the library", *Journal of Library Administration*, Vol. 53 No. 1, pp. 43-52.

- Raben, J. (2007), "Introducing issues in humanities computing", *Digital Humanities Quarterly*, Vol. 1 No. 1, available at: www.digitalhumanities.org/dhq/vol/1/1/000008/000008.html (accessed April 12, 2014).
- Rimmer, J., Warwick, C., Blandford, A., Gow, J. and Buchanan, G. (2008), "An examination of the physical and the digital qualities of humanities research", *Information Processing and Management*, Vol. 44 No. 3, pp. 1374-1392.
- Schaffner, J. and Erway, R. (2014), "Does every research library need a digital humanities center?", available at: www.oclc.org/content/dam/research/publications/library/2014/oclcresearch-digital-humanities-center-2014.pdf (accessed April 1, 2014).
- Siemens, L. (2009), "It's a team if you use 'reply all': an exploration of research teams in digital humanities environments", *Literary and Linguistic Computing*, Vol. 24 No. 2, pp. 225-233.
- Siemens, L., Cunnineham, R., Duf, W. and Warwick, C. (2011), "A tale of two cities: implications of the similarities and differences in collaborative approaches within the digital libraries and digital humanities communities", *Literary and Linguistic Computing*, Vol. 26 No. 3, pp. 335-348.
- Smith, M.N. (2002), "Computing: what has American literary study to do with it?", *American Literature*, Vol. 74 No. 4, pp. 833-857.
- Spiro, L. (2011), "Computing and communicating knowledge: collaborative approaches to digital humanities projects", in McGrath, L. (Ed.), *Collaborative Approaches to the Digital in English Studies*, Utah State University Press, Logan, UT, pp. 44-81, available at: http://ccdigitalpress.org/cad/Ch2_Spiro.pdf
- Sula, C.A. (2013), "Digital humanities and libraries: a conceptual model", *Journal of Library Administration*, Vol. 53 No. 1, pp. 10-26.
- Vandegrift, M. (2012), "What is digital humanities and what's it doing in the library?", available at: www.inthelibrarywiththeleadpipe.org/2012/dhandthelib/ (accessed April 1, 2014).
- Vickers, B. (2011), "Shakespeare and authorship studies in the twenty-first century", *Shakespeare Quarterly*, Vol. 62 No. 1, pp. 106-142.
- Waters, D. (2014), "The digital humanities and their effects on academic publishing and library practices in the changing ecology of scholarly communications", paper presented at Council for East Asian Libraries (CEAL) Annual Meeting, Philadelphia, PA, March 26-27.

Further reading

- Liu, A. (2012), "The state of the digital humanities: a report and a critique", *Arts and Humanities in Higher Education*, Vol. 11 No. 8, pp. 8-41.

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