

Building Expertise to Support Digital Scholarship: A Global Perspective

Vivian Lewis, Lisa Spiro, Xuemao Wang, and Jon E. Cawthorne

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About the Authors

Vivian Lewis is university librarian at McMaster University in Hamilton, Ontario, Canada. Prior to assuming that role, she held the portfolio of associate university librarian for organizational development where she oversaw strategic planning, assessment, budget, human resources, and marketing. She is actively involved in the ongoing development of the Lewis & Ruth Sherman Centre for Digital Scholarship at McMaster University. Lewis is vice chair of the Ontario Consortium of University Libraries and a member of the board of directors of the Canadian Association of Research Libraries. She is a frequent speaker and writer on topics associated with strategic planning, assessment, and workforce transformation.

Lisa Spiro is executive director of Digital Scholarship Services at Rice University's Fondren Library. Her publications include "'This Is Why We Fight': Defining the Values of the Digital Humanities," in *Debates in the Digital* (University of Minnesota Press 2012), "Opening Up Digital Humanities Education," in *Digital Humanities Pedagogy* (Open Book Publishers 2013), and "Computing and Communicating Knowledge: Collaborative Approaches to Digital Humanities Projects," in *Collaborative Approaches to the Digital in English Studies* (Computers and Composition Digital Press 2012). Spiro was founding editor of the Digital Research Tools (DiRT) wiki, chair of the communications committee for the Alliance of Digital Humanities Organizations, and a member of the executive council of the Association for Computers and the Humanities. Currently she is a member of the steering committee for the Texas Digital Humanities Consortium. She has a PhD in English from the University of Virginia.

Xuemao Wang is dean and university librarian of the University of Cincinnati Libraries. He was formerly associate vice provost of University Libraries at Emory University and has also held positions at Johns Hopkins University's Sheridan Libraries, the Metropolitan New York Library Council, Queens Borough Public Library, and Sichuan Institute of Business Administration in China. He holds an MBA from Hofstra University, an MLIS from the University of South Carolina, and an MLS from Kutztown University. He has held leadership positions in the International Federation of Library Associations, is currently serving as director of the board for the Center for Research Libraries, and is a member of multiple committees within the Association of Research Libraries. He also serves as a special advisor to the university's president and provost of China affairs.

Jon E. Cawthorne is dean of West Virginia University (WVU) Libraries. He is responsible for Downtown, Evansdale, and Health Sciences Libraries, as well as the WVU Press. Cawthorne recently served as associate dean of public services and assessment at Florida State University Libraries. He has held progressively responsible positions in academic, public, and special library environments. His research interests include leadership, organizational development, and scenario planning for libraries. Cawthorne recently completed his PhD dissertation, "Viewing the Future of University Research Libraries through the Perspectives of Scenarios." He is coauthor, with Joan Giesecke and Debra Pearson, of *Navigating the Future with Scenario Planning: A Guidebook for Librarians* (ACRL 2015).

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Foreword

“Who the hell wants to hear actors talk?”

This quotation is attributed to Harry Warner, co-founder of Warner Brothers Studios, who incredulously wonders in 1927 why movies that feature actors speaking their lines would be popular. Warner Brothers had pioneered the Vitaphone movie that used recorded background music for its otherwise silent features, which seemed to Harry Warner sufficient. The quote, while amusing, has echoes in nearly every industry over time, as the appearance or prospect of a new technology has challenged and potentially disrupted a successful way of doing business. Higher education has been roiled for a few decades now, struggling to adopt and incorporate digital technology into its methods, behaviors, and procedures. Among the more contested fields of study has been the humanities, its practitioners often publicly exhibiting the tension of digital technology abutting the centuries-old, tested scholarship that relies on analog sources and methods of inquiry deemed appropriate to those media. While it is easy for us to characterize Harry Warner’s musing as a serious miscue or misreading, it is a logical response of someone who has achieved status within a particular set of rules and behaviors when confronted with a new technology that threatens the inherited means and methods of advancement.

Building Expertise to Support Digital Scholarship: A Global Perspective explores and enriches this vexed intellectual context. The authors draw on site visits and interviews of practicing digital scholars from around the world to ground their conclusions and recommendations. The principal investigators’ conversations and visits reveal heartening commonalities: digital scholarship is thriving; it is a global enterprise characterized by entrepreneurial energy, innovation, and highly collaborative communities of expertise; and it encourages a fluid interchange among professionals of various backgrounds. It succeeds in a non-hierarchical workplace in which scholars, librarians, support staff, archivists, and technologists can productively work together to create, discover, publish, and promote new forms of scholarly expression using digital technologies and tools.

Such vibrant work of digital scholars in supportive organizations is startling when one considers the speed with which these communities have evolved. In researching background to

this report, I came across a CLIR publication from 2001, titled *Scholarly Work in the Humanities and the Evolving Information Environment*. The following quote is indicative of the report's discoveries:

Humanities scholars are used to, and in some cases even prefer, information that is delivered to their desktops. This is especially true with finding aids; humanists expressed a common desire for online material that reveals the holdings of research collections and archives worldwide. Humanists are equally enamored of abstract, indexing, and citation services, and perhaps only slightly less of online journals. Where primary research materials are concerned, however, the scholars have yet to be convinced by digital editions.

This passage depicts a prevailing paradigm at the time: digital technology has made its appearance, and the chief mode of adoption is largely substitutional. Printed abstracts and catalogs, indexes, citations and other finding aids have been transferred to a digital medium and humanities scholars are comfortable with this migration. The digital shift allows the scholar to more easily discover non-local resources—an initial, crude step in the globalization of knowledge. Fundamentally, whatever finding tools and locators might be digital, the authoritative source materials for humanities research remained the printed page.

Just 15 years later, *Building Expertise to Support Digital Scholarship* describes a very different world of intellectual endeavor: a genuinely global enterprise. Not only is an array of new tools and applications available to facilitate scholarship, but the source materials are most likely digital, and—of critical importance—there is recognition of new methodologies, new questions, and new intellectual strategies requisite for working in this virtual ecology. New skill sets, collaborations, and cross-professional expertise now flourish. The singular scholar, so prevalent in the 2001 report, who tended to employ the digital revolution to speed access to printed sources, has begun to recede as the emblem of research, increasingly replaced by the image of a bustling community: a profound transformation of academic iconography. CLIR's 2015 report is in this respect a threshold document, providing thoughtful instances of successful endeavors that transcend geography and social custom, and highlighting a transformative shift from searching globally to working, thinking, discovering, creating, and publishing new scholarship within a global framework.

Tensions remain, many grounded in the persistence of traditional humanistic methods of research when confronting the robust, digital-reliant fields of study. The residual conflicts between the two "schools" are best articulated in the report's section on challenges facing digital organizations. Remnants of a more hierarchical approach to work, particularly in the demarcation of non-digital and digital scholarship, are apparent in some institutions. Funding is still tight for digital organizations, reflecting a hesitancy to support new models of research and new forms of expression. One of the most enduring, and to me troubling, obstacles is the painfully slow acceptance of digital scholarship as authoritative and appropriate for consideration of promotion and tenure. Status is cited as a source of contention in several of the challenges, with the scholarship that digital organizations support sometimes considered less important, or less authentic, than scholarship produced through traditional paths of academic inquiry.

The recommendations that conclude this report are thoughtful and tactical, and should be seriously considered by all institutions that host digital scholarship organizations or aspire to. In some respects, the wariness of adopting digital technologies in 2001, and the tenacity of tradition, were well founded: the new machines and software were disruptive, and did indeed entail new techniques of scholarly questioning and communication. How will this evolve? There is evidence of an increasing acceptance of digital scholarship for tenure and promotion, and the ranks of digital humanities conferences, journals, programs of study, and majors have definitely increased in the twenty-first century. Alternative academic careers are less alternate than a decade ago. While I would hesitate to predict precisely what will come to pass, I would hope that a CLIR report in 2020 would describe an academy in which the legacy of distinction between digital and traditional is porous to the point of irrelevance; that newer methods of inquiry are accepted as parcel to the grand humanistic tradition of rigorous research in the discovery of our place in the world, and our nature; and that digital-based scholarship is better understood as a remarkable undertaking at a time of significant transformation. This is a revolution of the organization of knowledge, a cultural phenomenon of unprecedented sweep and consequence, and we urgently need to understand, reflect upon, and interpret it. This report is a polished guide to the contemporary pursuit of that acculturation.

—*Charles Henry*

Executive Summary

As researchers pursue digital scholarship (the creation, production, analysis, or publishing and dissemination of new scholarship using digital or computational techniques), they are often challenged to develop new skill sets. What skills, competencies, knowledge, and mindsets should digital scholars possess? How are such attributes—which we group under the term *expertise*—best cultivated? Does the shape of expertise vary around the world? Such questions are being asked by institutions establishing or reshaping digital scholarship organizations (DSOs), instructors developing educational and training programs in digital scholarship, experienced and aspiring digital scholars defining what expertise they need to acquire, and researchers exploring the global nature of digital scholarship.

Through our pilot study, we sought to answer these questions with the broader aims of identifying the workforce-related factors important to the success of digital scholarship, helping training and educational programs define key goals, and contributing to the conversation about the global dimensions of digital scholarship. We focused on “best in class” DSOs, highlighting the human dimensions behind their success in areas such as research output, winning grants, international reputation, and innovative teaching or training programs. We conducted interviews with a range of people involved with leading DSOs, including directors, research staff, faculty, librarians, graduate students, and university administrators. We conducted site visits with all but one of the 16 institutions participating in our study, which enabled us to get a richer sense of the facilities, organizational context, and local culture. While most of our interviews focused on digital humanities, we also included several digital social science organizations to identify areas of commonality and contrast. We explored a variety of organizational structures, including research centers and institutes, an academic department, labs, a network, a nonprofit organization, and a company; these organizations were sponsored by academic schools, libraries, and information technology departments. To understand the global dimensions of digital scholarship, we examined organizations from Mexico, China, Taiwan, India, Germany, the United States, Canada, and the United Kingdom.

Since digital scholarship projects often require specific technical skills (such as expertise in text analysis or geographic information systems [GIS]), it was difficult to generalize about what particular

skill sets organizations should offer; in many ways that depends on the goals and focus of the organization. In addition, different skill sets were expected depending on one's position and degree of experience. However, our interviews revealed in particular the importance of collaborative competencies, reflecting the ways in which digital scholarship typically takes place in teams dependent on diverse expertise. Since digital scholarship often involves developing new methods, tools, and theoretical approaches, successful digital scholars usually exhibit creativity, curiosity, and an enthusiasm for learning, which we term *learning mindsets*. Some level of general domain knowledge is useful so that team members can understand the research questions they are pursuing, while researchers draw upon methodological competencies (such as data science and GIS) and technical skills (such as database design and programming) to carry out their research. Finally, managerial skills—particularly project management—are needed to ensure that projects are completed.

While self-education and learning by doing are the predominant ways that digital scholars have traditionally acquired expertise, they also appreciate being part of a community of practice, so that they can turn to colleagues for help solving a problem and learning something new. Many organizations host workshops and visiting speakers and enable faculty and staff to attend conferences, although it can be challenging for staff to secure travel funding. A couple of organizations provide dedicated research time to staff, so that they can experiment, stay abreast of the state of the art, and contribute their own research. Along with formal support for professional development, we noted the importance of a “learning culture” in fostering continuous learning. Organizations most successful at building expertise among faculty, students, and staff tended to share characteristics such as *an open and collaborative interdisciplinary culture* in which each team member contributes expertise and is respected for it; *global engagement*, which includes participating in multi-institutional research projects; an *entrepreneurial culture* in which experimentation is valued; and a *focus on teaching and learning* as well as research. We noted variation in the kind of *facilities* these organizations occupied; collaborative space seemed to be more important than top-notch hardware.

Since we were able to visit only a small number of organizations in each country or region included in the study, we don't feel comfortable making broad generalizations about the state of digital scholarship around the world. However, we did note some common factors that influenced the shape of digital scholarship expertise. These factors included *a tradition of digital scholarship*, as more established organizations could both build on existing structures and could be limited by them; *funding*; the degree of *involvement of the institution's library*; and variations in *academic career structures*, such as paths to promotion and the recognition of alternative academic careers.

Digital scholarship organizations face a number of challenges, particularly in securing adequate funding for their work. We want

to draw particular attention to the challenge of recruitment and retention. Typically, DSOs cannot compete with the private sector in offering high salaries or extensive opportunities for advancement; rather, they provide more flexible environments and an academic or intellectual atmosphere in which staff are encouraged to experiment and learn. Unfortunately, some staff at many organizations are hired on temporary contracts because of limited funding, so they often leave for more stable positions. We also noted a tension between research and service at some organizations, wherein these organizations viewed producing new knowledge as central to their mission but may also be expected to provide services to local researchers or to maintain existing projects. At a few organizations, we observed status differences between faculty and staff, particularly in the ability to be principal investigators on grants or to receive travel funding. Researchers whose first language is not English must often choose between reaching a smaller audience with work published in their native language and devoting significant time to translating their work into English.

We provide an extensive list of recommendations aimed at digital scholars, leaders of DSOs, universities and host organizations, funders, and the broader digital scholarship community. To highlight some of the most salient: We recommend that digital scholars take responsibility for their own learning, nurture their own curiosity, and actively pursue learning opportunities, including by participating in communities of practice and team projects. We advise the leaders of DSOs to encourage both structured and unstructured opportunities for learning by including dedicated staff research time in job descriptions, enabling staff to train and mentor, and hosting workshops, outside speakers, and other events. Host institutions such as universities should create more stable staff positions with paths to promotion and facilitate more stable funding for DSOs, while funders should support global digital scholarship exchanges. As for the digital scholarship community, we recommend heightening awareness of digital scholarship around the world through conference programs, funding initiatives, publications, and communities of practice, and promoting greater linguistic diversity. We hope that this report helps raise awareness of the range of expertise required for digital scholarship, the importance of a learning culture and active communities of practice in nurturing it, the challenges digital scholarship staff often face in finding stable careers, and the diversity of models for digital scholarship around the world.

Introduction

This project, funded by The Andrew W. Mellon Foundation, sheds light on the expertise required to support a robust and sustainable digital scholarship (DS) organization. Our focus is on, first, defining and describing the key domain knowledge, skills, competencies, and mindsets at some of the world's most prominent digital scholarship organizations. Second, we aim to identify and draw attention to the main strategies used to build this expertise, both formally and informally. To put this work in perspective, we further aim to identify significant characteristics of these organizations that appear to enable continuous learning. We set this work in a global context, examining leading digital scholarship organizations in China, India, Taiwan, the United Kingdom, Germany, Mexico, Canada, and the United States. Finally, we provide recommendations to help those currently involved in or considering embarking on a digital scholarship program.

We defined DS very broadly to include the creation, production, analysis, or dissemination of new scholarship using digital or computational techniques, or both. In this context, DS encompasses both new research (e.g., the creation of a new data set) and new tools (e.g., the design of a new digital approach for extracting meaning from traditional sources). Digital scholarship includes both the high-profile work taking place in the bricks and mortar DS centers and the more virtual and distributed DS activity being supported at other locations. Although much attention and activity in academia now centers on digital humanities (DH), this project takes a broader, more interdisciplinary approach by including several examples from digital social sciences.¹ Here, *digital scholarship* serves as an umbrella term to include both digital humanities and digital social science.

Most, but not all, of the organizations examined in this study exist on university campuses. As well, most but not all, are physical centers with discrete spaces and staff. Although digital scholarship *centers* receive much notice, we also explored other organizational models, such as labs, an academic department, an interdisciplinary school, a department or center within a research institute, a nongovernmental organization, a network, and a for-profit company spun off from a university. In some contexts (such as Germany), digital scholarship is becoming more integrated into the fabric of the university through the creation of tenured chairs and well-funded research groups for young researchers. Sponsors of these organizations include academic departments, research libraries, academic schools, the dean of research, and a national infrastructure institution. Given the variation in structure, the sites are described as *digital scholarship organizations* (DSOs).

¹ For more on digital social sciences, see Spiro 2014.

Core Questions

A central goal of DSOs is to offer access to and develop expertise. But what constitutes expertise in digital scholarship, and how could such expertise be nurtured or acquired? Are patterns evident across the broad spectrum of disciplinary and technical approaches now in practice? The project sought to answer three questions:

1. Is there a core set of domain knowledge, skills, competencies, and mindsets required to practice and support digital scholarship?
2. How is this expertise best developed?
3. Does the shape of this expertise vary around the world? Does the skill set or competency of the digital scholar in North America vary from that of her or his counterpart in China or India? What organizational strategies for cultivating expertise exist in different cultural contexts?

Literature Review

Our research did not find any comprehensive studies of the expertise critical to the practice of digital scholarship in a global context. Some more narrowly defined studies have been done on the skills profile for staff at digital humanities centers, the status of research staff at digital humanities centers, and the curriculum for digital humanities. These reports typically argue that digital humanities teams require people with diverse skill sets, including technical skills, project management skills, analytical skills, and domain knowledge, although certain skills may matter more depending on the project and one's role within it.

The role of librarians in digital humanities centers has also received some attention in the literature. Schaffner and Erway identified a mix of competencies important for librarians performing digital humanities work, including personal competencies (such as risk-taking or time management), administrative competencies (especially project management), library competencies (such as metadata expertise), and mathematical and technology competencies (such as statistics, programming, and interface design) (Schaffner and Erway 2014, 8). They acknowledged that these competencies might be spread across a team rather than residing in one individual. While Schaffner and Erway suggest that domain expertise (beyond expertise in librarianship) is not important for librarians on digital humanities teams, others emphasize that many library-based digital humanists are themselves researchers, often with MAs or PhDs (Porter 2014).

The concept of the DH researcher as a "hybrid" scholar comes up fairly frequently. Reside and Clement (2011) describe the scholarly staff at DH centers as bringing together technical expertise, graduate training in the humanities, and the ability to communicate well and to translate between technical and disciplinary concerns. Sehat and Farr reflect a similar theme, noting that young scholars need to understand the "changing field of humanistic inquiry" as well as "the computational sciences and technological innovations"

(Sehat and Farr 2009, 8). Emphasizing interdisciplinarity and versatility, Burdick et al. claim that “a new kind of digital humanist is emerging who combines in-depth training in a single humanistic subfield with a mix of skills drawn from design, computer science, media work, curatorial training and library science” (2012, 116). They identify several core competencies, which vary according to the nature of the project but typically include some mix of technical (e.g., database, XML), intellectual (e.g., iterative and lateral thinking), and administrative (e.g., intellectual property) skills (133).

Henry and Williford’s *Digging into Data* study reflects a similar theme. The authors suggest that digital scholarship teams often rely upon “hybrid” researchers who offer more than one type of expertise. They identify four types of generic expertise important to the projects: domain expertise (in-depth theoretical and factual knowledge of the research area), data management expertise (understanding how to collect, clean, curate, model, share, and use data), analytical expertise (e.g., research methods, computational skills), and project management skills (e.g., goal setting, communications) (Henry and Williford 2012). While these works may use different terminology and differ in their view of who needs to know what, there seems to be general agreement that the components of digital humanities expertise include a mix of analytical skills, domain knowledge, project management skills, and communication abilities.

The Components of Expertise

For purposes of this study, domain knowledge—the cumulated knowledge associated with a specific discipline or subject area—is only one component of expertise. The recognized “expert” will also display some combination of the following:

- *Skills*: A skill is defined as a learned capacity to carry out a specific task (e.g., proficiency in a specific programming language). Skills are often gained through formal training and repetition.
- *Competencies*: A competency is defined as a more abstract ability or fitness for success in a specific area. Competencies can take many forms including cognitive (e.g., computational expertise), emotional (e.g., self-awareness), and social (e.g., entrepreneurialism, inter- and transdisciplinary collaboration) (Boyatzis 2006, 7).
- *Mindsets*:² Mindset is defined as the collection of attitudes, inclinations, or habits of mind, which largely predetermine how an individual will respond in a given situation. These dispositions, such as curiosity or flexibility, may be enhanced or contained by circumstances, but are sometimes described as not naturally teachable.

² We originally focused our attention on knowledge, skills, and competencies. The critical importance of mindset emerged later in the study. Coauthor Lisa Spiro recalls first gleaning the importance of mindsets through a comment made several years ago by Dorothea Salo on Twitter or a listserv, but efforts to track down that reference proved fruitless.

In reality, the distinctions between these various aspects of expertise are blurred. For example, the ability to program in a specific programming language is typically described as a technological skill. The ability to program in many languages may be seen as reflecting the presence of a broad computational competence. At the same time, the curiosity and passion required to master new programming languages could be viewed as a mindset.

Methods

Through this Mellon planning grant study, we aimed to identify “best in class” DSOs and to determine, through site visits and interviews, the key workforce-related factors associated with their success, always with an eye to continuous improvement and shared learning. The sections that follow outline how sites were selected, how data were gathered during the site visits, how data were analyzed, study limitations, and challenges faced during the study.

Site Selection

Our original intention was to examine ten “best in class” digital scholarship centers: four in the United States, one in Canada, two in Europe, and three in the BRICS countries (Brazil, Russia, India, China, and South Africa). Although this mix in no way reflects the full geographic diversity of digital scholarship across the world, we determined that it would provide enough variety for a pilot study.

The slate of sites was ultimately expanded to 16 to enlarge the global nature of the study and make more effective use of travel time and resources. (For example, four sites were visited across China and Taiwan, two in the United Kingdom, and two in India.) At some sites, we visited multiple organizations, such as one or more digital humanities labs/centers, a digital social science center, or a library group.

We originally intended to visit Brazil, since we thought it was important to include Latin America in the study. When arranging that visit proved difficult, we decided to shift our attention to Mexico, where Red de Humanidades Digitales (RedHD) is doing innovative work building a network of digital humanists.

Prospective sites were identified through a combination of personal knowledge, research, and outreach to the digital humanities community, including attendance at the [2013](#) and [2014 Digital Humanities](#) conferences and a message to the Global Outlook: Digital Humanities (GO::DH) listserv, which led to two invitations to visit. More than 100 locations were identified (drawing in part from the list of centerNet members) and vetted based on factors such as the existence of grant funded research, unique mission, the amount and quality of research output, engagement in teaching and learning initiatives, and general reputation. The slate of proposed sites was adjusted to meet other criteria, such as geographic and disciplinary

diversity and the organization's ability to host a visit during the grant period. While we visited some of the leading DSOs, we did not visit all of them. For this reason, we emphasize that not being included in the study is no indicator of lack of merit. One site was approached for possible participation but had to decline because of conflicting priorities.

The breakdown by location was as follows:

LOCATION	# OF SITES
Canada	1
China	3
United Kingdom	2
Germany	2
India	2
Mexico	1
Taiwan	1
United States	4
TOTAL	16

Conducting the Interviews

The study involved the use of semi-structured interviews. Standard sets of questions were written for each category of participant (e.g., research staff, DSO leadership, senior university administrators, faculty and graduate students). Questions were adjusted according to the context within which the DSO was working as well as the general flow of conversation. Typically at least two members of our team visited the participating organizations. However, on one site visit, only one team member came in person, and one used Skype to participate remotely in all but one meeting. With another, we were not able to visit the organization in person and instead held an hour-long phone conversation with a senior administrator.

Analysis

Written records from each interview were coded using Dedoose, a commercial qualitative data analysis tool. We created a set of approximately 400 codes to capture the attributes of both the DSOs and the individuals associated with them. Some codes related to specific benchmarks (e.g., "provides time for research") while others were used to compile data regarding context (e.g., "number of staff"). Approximately 3,000 excerpts from the interviews were coded, with a total of approximately 6,000 code applications. Each transcript was coded by one PI. Key components of the codex were reviewed by a second PI, but the inspection was admittedly not exhaustive.

To maintain privacy, we are reporting at a high level and not identifying specific organizations or interviewees unless the information

is already public. While we did our best to capture interviewees' exact words, we have done light editing of some quotations for clarity.

To gather feedback on our preliminary results, we led a small focus group session at the Coalition for Networked Information (CNI) meeting in Washington DC in December 2014. As promised during the site visits, DSOs participating in the research project were given an opportunity to read and comment on the report before it was made final. This allowance was made to catch errors, verify comfort with the narrative, and provide an opportunity to comment on the findings.

Study Limitations

As a pilot project performed in different cultural contexts over about two years, this study is bound by several limitations that should be kept in mind when reviewing our findings.

Planning grant: The study is framed as a pilot under the Mellon planning grant program. Our objective was to test the research questions, methodology, and tools using a small sample of sites from around the world. As such, the data can be used to generate useful insights about the sites themselves, but generalizing the observations, even to the country level, comes with some risk. Important DS work is happening around the world and we were able to sample only a small piece of it.

Semi-structured interviews: The approach, based on semi-structured interviews, also posed some limitations. While the core questions were relatively standard from site to site, each site was unique and the direction that interviews took varied to some extent. Areas of focus evolved as knowledge gained from one location informed discussion at the next.

Snapshot: The study is a snapshot in time. The 16 DSOs are living organisms. Many noted significant changes in focus over their histories. Priorities shifted with changes in leadership (both within the DSO and in its parent institution), funding agency guidelines, and developments in research.

The concept of benchmarking: The study employs a benchmarking approach. Benchmarking is defined as the identification of best practices for the purposes of superior performance (Hamalainen 2002). We adopted, in Alstete's terminology, an "external collaborative benchmarking" approach, establishing "comparisons with a larger group of institutions who are not immediately competitors" (Alstete 1995).

The project goes beyond simple collection of input and output data (the hallmark of many benchmarking efforts in higher education) and drills down into the perceived strengths and weaknesses typically associated with these successful organizations. In this case, the approach is not so much to rank the various DSOs as to identify

patterns of practice associated with success.

The benchmarking process was more effective in some aspects of the study than in others. Benchmarking works best if the subjects resemble each other in terms of size, mission, and structure, but the global scope of our study, broad conception of digital scholarship (including digital humanities and digital social science), and focus on unique “best in class” institutions worked against such similarity. We developed an initial set of benchmarks that proved to be less relevant when viewed in the richer, more messy context of particular organizations, so the final set evolved more organically. The participating DSOs have different missions and are operating in different cultural contexts. Some aspects of mindset (e.g., deep curiosity) and culture appear absolutely critical to success, but are difficult to measure. In addition, we found that the unique cultures and practices of DSOs were often more interesting and significant than characteristics we could track through benchmarks, subtleties we were able to observe through site visits.

Challenges Faced during the Study

We encountered several challenges along the way.

- 1. Site selection:** Given that all four of the PIs are from North America (three are American and one is Canadian), selecting locations in the United States and Canada, as well as in the United Kingdom, was relatively easy. But as Isabel Galina has pointed out, awareness of digital humanities work in non-English speaking countries tends to be low, and our experience bears this out (Galina Russell 2014). We had less familiarity with DSOs in other parts of the world and hence needed to reach out to the global DS community to help with site selection, after conducting initial research to understand the landscape. We view the opportunity to showcase some of the work being done across the DS community as one of the contributions of the project.
- 2. Site visit arrangements:** Arranging dates that worked for both the sites and the PIs proved more difficult than originally anticipated. Sites needed a significant amount of lead time to arrange for key leaders and engaged members of their communities to be present.
- 3. Information gathering:** Compiling all the information required during the course of a visit was more difficult than expected. The duration of the visits varied considerably. (Most visits were a full day but actual length varied from an hour to two days.) Participants had a tremendous amount of information and wisdom to share and we often regretted not having more time to delve deeper into their stories.
- 4. Code entry and verification:** Coding the interview transcripts was time consuming and somewhat subjective. Different PIs focused on some aspects more than others. There was not enough time for all interviews to be coded by a single PI or to be coded and checked by two or more individuals.

- 5. Language:** Language did not prove to be as big of an issue as originally expected. Most of the participants interviewed, with the exception of those in China, had reasonably good English speaking skills (English is the first language of three of the four PIs). The fourth PI was able to translate between Chinese and English when necessary during the visits in China.

Skills, Competencies, and Mindsets Important to Digital Scholarship

What expertise is required to practice digital scholarship depends on several factors, including the mission and research focus of the DSO, one's position (such as faculty, project manager, developer, system administrator, or graduate student), the technical focus of the work (such as spatial humanities, computational social science, or text analysis), and one's seniority. Thus we cannot establish a definitive, universal set of skills, competencies, knowledge, and mindsets that all digital scholars must demonstrate. However, we can point to common expertise that seemed significant in many organizations. In general, DSOs aim to hire well-rounded staff who bring together the ability to collaborate well and have an open, curious mindset, basic domain knowledge, methodological competencies, and technical skills, as well as the ability to manage projects. Since both disciplinary and technical knowledge can be important, digital scholarship research staff often occupy hybrid roles: "I can bring my tech side, which I don't want to be 100% of me, with disciplinary ideas, which I don't want to be 100%, and mix them together." Although research staff typically did not have the depth of domain knowledge in a particular subject that faculty members did, they usually knew enough to understand research methods and disciplinary concerns.

During our interviews, faculty, research/technical staff, administrators, and graduate students mentioned the following skills, competencies, and mindsets as being most significant.

- 1. Collaborative Competencies.** Digital scholarship research typically occurs in teams, since it requires diverse expertise, involves interdisciplinary explorations of research problems, and is of such a scale that it would be difficult for an individual to accomplish alone. Hence collaborative skills, including interpersonal competencies, teamwork, and communication skills, rank as among the most important for digital scholars. As a manager at one DSO noted, "We really focus on personality. We are a highly collaborative working environment." Without contributions from team members with technical skills, many scholars could not accomplish their digital scholarship projects, so an interviewee suggested that "one main thing" scholars must demonstrate is "social competence, to formulate what you are looking for and ask for help and be interested." The leader of a DSO spoke to the importance of fostering mutual understanding among those with domain expertise and

technical expertise: “both have to profit from collaboration, so technical staff must understand scholarly problems, and vice versa.” To facilitate interdisciplinary collaborations, DSOs value staff who can translate between research questions and technical approaches—what the leader of one research organization termed “bridgeheads.” Through the process of collaboration, participants gain exposure to new ways of thinking and create new knowledge.

2. Learning Mindsets. As digital scholars tackle tough research problems and are challenged to develop new skills and ways of thinking in the process, they must be flexible, curious, willing to fail, and passionate about learning. As a manager at one digital humanities center noted, top performers are “creative, open, collaborative, willing to learn on their own,” a description that applied across a number of sites. Likewise, another organization sought staff with “curiosity, creativity, interest in pursuing new knowledge [and] partnering with scholars to do that.” Curiosity and an experimental attitude drive people to seek creative solutions to problems, embrace failure, and persist: “not being afraid to fail, but network, learn the resources until there is opportunity to capitalize on it [the learning].” Along with curiosity comes flexibility. Digital scholars are typically nimble enough to explore possibilities rather than be wedded to particular approaches—“to get ideas on the table, beat them up a little, roll them around.”

3. Domain Knowledge. Most interviewees believed that a background in the humanities or social sciences—or at least a broad understanding of the relevant discipline—was important for staff as well as faculty involved in digital scholarship work. Technical staff need enough domain knowledge to frame research questions and understand the research process. One programmer noted that his background in philosophy and English helped him “to understand the problems” and provided an important perspective on “how you can model the world.” Likewise, a librarian who collaborates with scholars emphasized the importance of having experience with exploring research questions, since “to ask a question, you need to understand what to do with data.” Training in the discipline gives staff “credibility,” so that they “can talk to faculty and grad students in their native language.” Many DSOs looked for staff with a strong disciplinary background, arguing that they could develop technical skills on the job but needed a core understanding of the discipline as a foundation: “We hire people with humanities background, and ask them to learn technologies. People with masters degree in computer science won’t be hired here.” Some digital humanities projects require specialized humanistic expertise, such as being able to recognize ancient Chinese characters. While most faculty and staff involved in digital humanities work have advanced degrees in the humanities, we did encounter a few with computer science backgrounds who demonstrated an appreciation for humanities research.

For faculty, domain knowledge was often emphasized more than other forms of expertise, although we witnessed variation in how much technical expertise was deemed to be necessary and what roles faculty members play in digital scholarship projects. In some organizations, faculty were expected to have or develop technical skills, while in others they relied primarily on the technical expertise of staff. To some extent, this split seems to be generational, as well as to reflect scholars' goals and the culture of the DSO; whereas once scholars may have needed to figure out their own way to accomplish digital scholarship projects, now they can increasingly turn to colleagues in DSOs. As one interviewee noted, many "old school" digital humanists are "hybrids" who bring together technical and disciplinary knowledge, while other scholars learn as much as they need to about the technology to be effective collaborators but leave technical work to others.

In a few organizations, faculty focused on domain expertise and needed to have only basic computer literacy. But even if faculty collaborators do not have sophisticated technical skills, another interviewee noted, "they have to have a sufficient understanding of technology to imagine the possible." For one scholar, developing her own technical skills—something that the head of the digital scholarship center required of scholarly collaborators—was "transformative." Another called the separation between technical skills and domain knowledge "useless," saying, "I come from a craftsman background. The best solutions are in working on concrete questions." The leader of a DSO stated bluntly that "real digital scholars have the computation"—although many faculty we interviewed didn't really view themselves as "digital scholars," preferring to base their identities on their academic disciplines.

4. Methodological Competencies. Digital scholarship organizations focus on a range of methods, including GIS, 3D modeling, network analysis, data visualization, data science, computational linguistics, and text encoding. Hence the methodological knowledge required for digital scholarship varies based on research focus. Cutting across most of these methods is a need to understand how to compile, organize, and analyze data. Methods tended to be explicitly mentioned more at digital social science organizations than at digital humanities organizations. As an interviewee at a digital social science organization stated, "Digital methods are central to what we do." Leaders of digital social science organizations emphasized the importance of having a strong background in social science to be able to ask well-formed questions, structure research appropriately, and use computational social science techniques wisely. If a researcher just "crunches numbers," valuing computation over the research question, it is likely that their "analysis makes no sense." Digital social science education programs provide a foundation in social science research methods, since it is crucial for those doing computational social research to comprehend "principles of reliability, validity, sampling, spurious relationships, [and the] logic of data analysis" and to understand the limitations of computational methods.

5. Technical Skills. Technical skills tended to be closely related to methodological expertise. We expected technical skills to be more prominent in our study, but it was challenging to identify a core set given the diverse work done by DSOs. Programming was the most commonly cited skill, followed by systems administration, database design and development, web design and development, XML and TEI, research data management, and the ability to learn new technologies quickly. Not surprisingly, organizations focusing on geospatial scholarship valued GIS skills, while those supporting textual editing projects emphasized TEI and XML. Participants at several sites identified digitization skills as critical. Social science organizations particularly valued data skills, including data retrieval, web scraping, data analysis, data security, system administration, statistics, and research data management. For those new to digital scholarship, basic computer literacy, including familiarity with key terms such as indexing, was valued. As for skills that digital scholars wanted to develop, programming ranked high; as one interviewee noted, “I would feel so powerful with programming.”

6. Managerial Skills. The importance of managerial skills typically depends on one’s role in an organization. For example, supervisory skills are important for those who manage people (including, in one case, graduate students who oversee undergraduate research assistants) and budgeting is important for financial administrators and organization leaders. But project management skills—the ability to get things done efficiently—are important regardless of role. Indeed, several DSOs supported staff positions explicitly focused on project management. Participants at several sites flagged grant writing as another key skill, which is not surprising considering that most centers depend on soft money for their livelihood.

How Skills, Competencies, and Mindsets are Developed

We were interested not only in what skills, competencies, and mindsets are required to support digital scholarship, but also in the strategies in place to support the building and maintenance of those attributes. Through our interviews, some strong patterns emerged in terms of both current practice and aspirations for the future.

We observed some variation between how the current leaders had developed their own expertise and what they saw as the needs of the generation of scholars coming after them. Most leaders and senior faculty and staff at the DSOs acknowledged that they were largely self taught. As one leader noted, “our generation taught ourselves to program [and to] design database models, along with writing a dissertation.” Another noted the importance of “being industrious on the weekends.” The need for self-education was clear: many of these leaders had been pioneers in their fields early in their

careers. During this time, there were few courses or institutes for which they could register. They were devising the processes and strategies for conducting digital scholarship as they went along.

While scholars today benefit from a broader array of educational opportunities, many still pursue self-education. Most individuals, at all levels in the DSOs, displayed a personal preference for experimentation and learning by doing rather than by reading a book or watching a tutorial. One participant noted, “practice is what makes me have the abilities I have.” Another mentioned the “iterative process of blind luck, and sacrifices to deity” required to solve problems and move work forward. This focus is borne out by the literature. As Galina points out, most people do not receive training in the skills necessary for digital work in the course of their undergraduate or graduate degrees, so often this takes place ad hoc, while working on a project (Galina Russell 2012).

We were struck by the strong focus on “community of practice” as the primary source of skill transfer. Participants spoke with passion about the importance of informal networks of colleagues in their learning. As one participant noted, “it is better to learn from your community than take specialized training thousands of miles away.” Internal events were often framed more as information sharing than formal training. The concept of “learn-do-teach” was occasionally mentioned, with colleagues teaching themselves a new skill, using it in a project, and then sharing that new expertise with others. There is an interplay between teaching and research; as a staff member at one center commented, they “put topics on workshop series that we want to learn,” since teaching is one of the best ways to learn. One individual described the “strong egalitarian exchange of knowledge” in his organization. Another described the process of learning a new skill or resource together in “sessions where we bang our heads against the wall but eventually work through it.”

Most DSOs brought in speakers to deliver guest lectures and workshops, although the frequency of this activity varied among organizations. Staff reported that these events were among the benefits of working in the organization. Guest lectures exposed people to new ideas and techniques, and helped build community.

Conference attendance was supported in principle, but funding was often a concern, particularly for staff who were dependent on grant funding to cover travel costs. Some DSOs support travel through their operational budgets. Others rely on funds from parent organizations, and still others bundle travel into grant applications.

A few DSOs support staff in developing their own research projects (in addition to the work coming into the center). A smaller number set an expectation that a percentage of each week (typically 20%, or one day per week) would be spent on personal research projects. Research time “evens the field with faculty,” encourages experimentation, and is “crucial in enabling staff development.” As the leader of one research organization noted, enabling staff to pursue their own research facilitates hiring the best people, and “research has value itself,” since “knowing and in some cases

defining the state of the art” is broadly important. While staff occasionally struggled to find time to pursue their own research, they viewed research time as an important benefit.

Some interviewees felt a strong commitment to training scholars and students beyond their own institutions as a contribution to the profession. The most successful programs (such as the Digital Humanities Summer Institute [DHSI] offered by the University of Victoria) can be described as community-driven and relatively fluid, with the curriculum changing as demand and teachers’ interest evolves. Bringing in students sparked energy and ideas and helped raise the visibility of the DSO. Of course, digital scholars likewise benefit from having easy access to training programs. While there are established training institutes for digital humanists in the United States (such as the NEH Summer Institutes and, more recently, HILT [Humanities Intensive Learning and Teaching]), Canada (DHSI), United Kingdom (Oxford Summer School), and Germany (The European Summer School in Digital Humanities at Leipzig University), such training has come more recently to other regions. In Mexico, for example, Galina and Priani found “training and retaining human resources are also key issues,” since it was difficult to recruit people with needed expertise and since most people “went through a steep learning process whilst developing their project and found little learning support” (Galina and Priani 2011). Hence one of the priorities for the RedHD network has been to provide training opportunities.

Since the 1990s, some DSOs have run fellowship programs in which faculty are awarded funds to collaborate with center personnel on projects and, in the process, acquire new ways of thinking about their work. While this model has yielded some very successful projects and can be, in the words of one DSO leader, “transformative,” at least one organization in the study indicated that they were backing away from it. The constant cycle of training new fellows is exhausting to the organization. Faculty cannot make sufficient progress on their projects during a one- or even two-year fellowship. Without ongoing support, even good projects stall when the fellowship ends and the faculty member is left to her or his own devices.

Characteristics of Organizations that Enable Continuous Learning

In addition to exploring how *digital scholars* acquire skills and competencies, we examined how *digital scholarship organizations* nurture expertise and knowledge creation. Despite the variation among DSOs included in our study, we observed that they typically cultivate an open, collaborative culture; work with partners in other countries; promote an entrepreneurial ethos; sponsor teaching and learning programs; and provide access to facilities that foster collaboration.

An Open and Collaborative Culture

The participating DSOs exhibited a strong focus on collaboration and teamwork. One student noted being “trained from the beginning that you can’t do it on your own.” The projects being worked on are often massive and complex. Real success requires a broad and deep set of skills. Some described the work more as a vocation than a set of tasks and deadlines. “We are thinking of DH as something that is more like a project than actual work. More like a vision we want to produce.”

The shape of the teams varied from place to place. Most described the work of the organization as largely team-driven with faculty and staff contributing their various skills and competencies to the larger enterprise. A smaller number framed the collaboration more at the level of researchers and faculty, with staff contributions restricted primarily to technical support roles and frequency of meetings somewhat less. Most, but not all, included students as integral members of their teams.

The culture was often described as consciously open and egalitarian. One staff participant said he felt treated as an “intellectual partner” with no sense of “hierarchy.” Another noted that staff in his organization were “permitted to debate” and “encouraged to make decisions at the lowest levels.” Members expressed “genuine interest in each other’s ideas,” with “lots of joint brainstorming” and a “collective culture.” Another said, “we’re an open environment, [we’re] encouraged to think, [and we] encourage each other to try out things we are unfamiliar with.” We observed relatively informal environments in most locations. One participant noted that the center encouraged a “shorts and sandals” environment. “Check your ego at the door. We are about open discussion; [we] establish a level playing field and bring in people from all over.” Such an open culture fosters the collaboration, creativity, and knowledge sharing important to digital scholarship, where important ideas and expertise can come from anyone in the organization.

We heard many faculty and staff within the DSOs talk about the importance of interdisciplinary conversations. The boundaries between humanities and social sciences, in particular, were described as very “fluid.” One described the center as “a place for many things. A place to gather people to talk about these things, to develop projects with the students and professions and librarians and people from other disciplines and areas, not just humanists.” One spoke with great pride about the tendency for large digital projects to be initiated by the humanist who then sought out partners from IT and across campus. Another described graduate students as the true source of integration between various disciplines.

Successfully building a sense of community and deep collaboration requires effort and structure. As one interviewee noted, “We were very concerned about this: everybody gets together and is enthusiastic, and everyone goes back to office and that’s it—they have their own research interests and their own lives.” Organizations

identified a variety of strategies for encouraging sharing. Staff members at one organization come together every Wednesday to share knowledge from different disciplinary perspectives. Another sponsors a writing club that gives staff dedicated free time to work on writing research results, encouraging them to ask questions of each other and fostering a “creative atmosphere across disciplines.” For several, regular events such as project meetings, lectures, conferences, training sessions, or informal get-togethers created a sense of community. Another described using a system for logging work online to keep colleagues informed, and a few used chat and video conferencing to connect distributed staff throughout the day, whether they were in different rooms, different cities, or even different countries.

International Engagement

We were struck by the strong focus on global engagement at most of the organizations we visited. Many organizations were involved in international research collaborations, and faculty and staff often had spent time abroad as students, visiting scholars or, in at least one case, as a faculty member. As a result of this global engagement, faculty and staff at DSOs are exposed to new ideas and skill sets, and can disseminate their own research and deepen collaborations that bring diverse resources and expertise.

Types of international engagement included collaborating on research projects, hosting joint conferences, participating in or hosting visiting scholar/professor programs, hosting training programs that attract an international audience, participating in training programs outside of the home country, or doing digital work paid for by funders outside of the home country. For example, Fudan University collaborates with Harvard and other institutions on the China GIS, while Jadavpur University’s School of Cultural Texts and Records collaborates with or is closely aligned with colleagues at universities in Italy, New Zealand, the United States, and the United Kingdom. The INKE network, based at the University of Victoria, involves collaborators in a few countries and has organized gatherings in Cuba, Japan, Australia, and the Netherlands as well as Canada and the United States. In the United States, Stanford’s CESTA has affiliated researchers in Italy, Germany, Australia, and Portugal. The Maryland Institute for Technology in the Humanities partnered with institutions in the United Kingdom and United States on the Shakespeare Quartos Archive, which was jointly funded by the US National Endowment for the Humanities and the UK Joint Information Systems Committee. Indeed, funding programs, particularly in the European Union, encourage collaboration across countries. For example, the University of Cologne coordinates the Digital Scholarly Editions Initial Training Network (DiXIT) project, a Europe-wide training network for digital scholarly editing that is funded by the European Commission and counts King’s College London and Oxford as members, along with universities in Sweden, the Netherlands, France, Italy, Ireland, Belgium, and Austria.

Entrepreneurial Ethos

Many of the organizations we visited operated in fairly decentralized environments and had a surprising amount of autonomy in terms of setting priorities. One staff member noted appreciation for the “open-endedness of support for trying new things out.” Several organizations benefited from an entrepreneurial culture that gave them the freedom to experiment with new educational and research initiatives. Often these organizations could use flexible funding to sponsor a workshop, hold a community event, or seed a new project. An administrator overseeing one digital humanities center compared his approach to that of the leader of a guerilla army, “You have a common mission, together with your troops in the jungle—searching for concrete solutions to reach the next point... We have to start with good ideas and minimal resources to reach the next step, [to] create the next evidence for the next step.” At another site, an interviewee noted the “startup culture” of the organization, as people had the flexibility to pursue their own projects.

Teaching and Learning

Almost every institution we visited offers some sort of educational program, whether a full graduate degree, a graduate certificate, graduate fellowships, graduate courses or training, a seminar series, or mentoring. This involvement in education is not surprising, since one of our selection criteria was that the organization offer innovative educational programs, but it also points to the ways in which students were often vital members of the local community of practice. A small number of programs involved undergraduates or were planning to do so. By working with faculty, staff, and (where applicable) postdocs on digital scholarship projects, students gain skills valuable in many careers and contribute to the development of knowledge. Through their educational programs, DSOs fulfilled a key part of their mission, created a more robust community, trained staff for ongoing projects and potential full-time positions, or generated tuition revenue. As one student-turned-staff member noted, working at a DSO as a student constituted “part of the education,” since it is “good in studying DH to have actual projects and data to work with.”

Many of the DSOs worked hard to integrate their teaching and research activities, some seeing the classroom as the best place to recruit new digital scholars. One participant noted, “we try to keep it quite practical and praxis oriented. We bring in real research projects as examples and have students work with real data.” Another noted that they were “placing their bets” on future scholars by building up educational opportunities for them.

We noticed some variation in whether organizations’ educational programs created opportunities for students to participate in project work. In a few places, disciplinary training took primacy over digital skills and methods. While students participated fully and enthusiastically in the community of practice at many

organizations—sometimes even teaching faculty digital skills through informal exchanges—at others they were more on the periphery.

Facilities

Collaborative spaces appeared to be critically important at virtually all sites we visited. The quality of space varied considerably. Some DSOs occupied cramped, bare-bones spaces, while others inhabited impressive, high-gloss offices. What really mattered was not the level of polish but the ability to come together for community building. One participant noted that he and his colleagues were “in each other’s hair” but the cramped nature of the accommodations fostered sharing. A graduate student noted the importance of the lab “as a space to base [one’s] self—in a research community, with postdocs,” as an “institutional home in a spatial and community-centered way.” Another stated, “I can’t imagine this success without people sitting beside each other.” Describing the importance of “physical proximity,” one interviewee spoke of the “intangibles in in-between moments—concrete exchange of skills and knowledge sets,” as well as the opportunity to work near those from other disciplines: “The fact that we have this space is so key.” Several participants described their DSOs as physical “hubs,” something that could be lost with the nature of their largely online work. One organization that lacked a lab longed for a common space where participants could collaborate on projects and get help with them.

We talked with a few staff who found the deeply collaborative spaces a bit too disruptive. The preferred configuration, at least for some colleagues, provides some personal space for quiet reflection, but with “huddle rooms” for group work.

The quality of hardware and software varied considerably. Some DSOs featured high-quality computers and data visualization walls, but most lacked such amenities. The participants typically downplayed the importance of hardware and software.

Digital Scholarship Expertise in a Global Context

Historically, much of the attention in the digital humanities community has centered on English-speaking countries, resulting in a sense of isolation among many scholars from other countries. As Isabel Galina Russell argues

Countries such as the United States, the United Kingdom, Canada and, to some extent, Germany, France, Italy and Australia have dominated scholarly digital humanities activity, with little or no participation from other regions of the world, such as Asia, Africa and Latin America. However, this does not necessarily mean that academics from these parts of the world are not involved in projects and activities that could be considered digital humanities related These scholars have, instead, worked independently and without knowledge of digital humanities as a field of enquiry in itself. (Galina Russell 2012)

By participating in the global digital scholarship community, researchers can be exposed to new ideas, hone their skills, form new collaborations, and be recognized more broadly for their contributions. Yet as a result of the anglophone focus of digital humanities work, important research produced in languages other than English often gets missed, potential collaborators do not find each other, and the community is not as rich as it might otherwise be. To address this gap, recent initiatives at several organizations seek to advance collaboration and communication among researchers and students from a range of countries (such as GO::DH); link together researchers who speak a common language (such as the francophone organization Humanistica); and highlight digital scholarship around the world (such as GO::DH's "Around DH in 80 Days"). By including organizations from China, India, Mexico, Taiwan, and Germany—as well as from the United Kingdom, Canada, and the United States—in our study, we hope to develop a more nuanced understanding of expertise in different cultural and national contexts.

We are reluctant to generalize about the state of digital scholarship in any particular nation, since we were only able to visit between one and four institutions in each country included in this study and since commenting on specific locations would undermine our pledge of confidentiality. At the same time, we hope to suggest ways that larger factors such as history, funding sources, academic culture, and the structure of academic work influence the practice of digital scholarship. As Galina and colleagues point out, "As any other field of inquiry, DH is uniquely characterized by the context in which it is practiced. The affordances and limitations of the resources, facilities, and institutions where we work are a constant reminder of it" (Galina et al. 2015). Our site visits and background research called attention to how local and national contexts shape digital scholarship. Significant factors are discussed in the following sections.

Tradition of Digital Scholarship

In many of the countries we visited, digital humanities has a fairly long history, which means that organizational structures are established, professional roles may be recognized, and training programs may be relatively well developed. This tradition serves as a point of pride and informs the mission and identity of the organization. Yet having an established history may also make it more challenging to adapt to new circumstances, such as bringing on staff with needed expertise, defining a new mission, dealing with leadership transitions, and sustaining the organization. As for digital social science, the use of computers for social science research originated in the 1960s (Cioffi-Revilla 2013), but researchers describe the "emergence" of computational science as a more recent phenomenon, driven by the availability of massive amounts of data and more powerful computers (Lazer et al. 2009).

In some countries, organizations have been working in digital humanities (or what was formerly called humanities computing) for about 50 years, while in others institutional structures for DH have arrived more recently. For example, in the United Kingdom, Cambridge's Centre for Literary and Linguistic Computing (now absorbed into Cambridge's University Information Services) started in 1963 (Gouglas et al. 2012), while King's College London's involvement in digital humanities began in the early 1970s (Kings College London 2015) and Oxford University has contributed to digital humanities research since the 1970s. In the United States, the University of Virginia's Institute for Advanced Technology in the Humanities was established in 1992, followed by the founding of the Center for History and New Media at George Mason University in 1994. National Taiwan University launched its first cultural heritage digitization project in 1996 (Hsiang n.d.), while Jadavpur University's School of Cultural Texts and Records was founded in 2003. In China and Mexico, a defined digital humanities community, with connections to the international community, has developed more recently, although scholars have been applying computing to humanities and social science research questions for significantly longer. The first digital humanities center in China was established in 2011 at Wuhan University (Yang 2012). However, historians and geographers at Fudan University's Research Center on History and Geography have been collaborating with researchers at Harvard and other institutions on a historical GIS of China since 2001 (Yang 2012). In Mexico, digital humanists were largely isolated from each other and from the global digital humanities community until the formation of RedHD in June 2011.

Funding

If there is any universal in our study, it is that almost all of the participating organizations worry about funding their work and are limited by the lack of adequate, stable funding. Of course, the amount and type of available funding help to determine whom organizations hire, for what work, and for how long. Many organizations are lean, operating with a core group of staff (often on short-term contracts) and affiliated faculty and graduate students. One organization mentioned relying on a spirit of volunteerism from participating faculty, which gives it both greater freedom and less stability. Many DSOs depend on external funding to support their work, which means that they must constantly pursue grants and that changes in funding priorities affect their research focuses.

Although we did not really delve into the national funding climate for higher education in interviews, there were signs of declining, changing, or limited support for digital scholarship research in many places. Some countries committed significant resources to digital humanities work (particularly the development of digital collections), while others received funding from a mix of public sources or lacked dedicated funding programs for digital

scholarship. For example, Taiwan's National Science Council (which is now called the Ministry of Science and Technology, or MOST) has funded digitization of and online access to cultural heritage materials since the late 1990s. The initial focus was on creating digital archives; recently, the focus has shifted to sustaining them and facilitating their use in interdisciplinary research (Du, Zhu, and Koronios 2014). In Germany, government provides funding at the state (e.g., state library), federal (German Research Foundation), and European Union level. Mexico lacks a national funding council focused on the humanities, so applications must be made to the National Council for Science and Technology. In the United Kingdom, research funding is determined in part by the outcome of the Research Excellence Framework (formerly called the Research Assessment Exercise, or RAE), an intensive review of faculty work that occurs every five years.

Most organizations rely on funding from multiple sources, including foundations and the parent institution, as well as fees from tuition and from contract and consulting work. For example, King's College London brings in money through "quality-related research funding" from the Higher Education Funding Council for England (which is based on Research Excellence Framework assessments), research grants, consultancy, and tuition for its teaching programs. India's School of Cultural Texts and Records has secured diverse, international funding for its projects, including from India's University Grants Commission and its Ministry of Culture, the British Council and the British Library's Endangered Archives Programme, ABP Limited (a media company), and the universities of Sydney and of New South Wales, Australia. In China, one university spun off a for-profit digital publishing company in order to fund digital humanities research and content development. Some organizations are diversifying their funding sources by becoming more engaged in graduate or undergraduate education or partnering with libraries. Perhaps the most financially stable DSOs were those based in or associated with libraries, which offer an ongoing source of institutional support.

The priorities of funding programs shape the work that DSOs undertake. Some organizations achieved their early successes by conducting digitization and digital collection projects, while others are continuing to compile and make accessible large corpora of culturally significant historical material. Such a focus on collection building seems to reflect both national priorities and the challenges of developing the necessary technical infrastructure, particularly for non-Latin character sets. For example, the School of Cultural Texts and Records developed specialized software for editing and documenting Bengali, "for the first time in any Indic script," according to its website. Taiwan's 15-year Digital Archives Program, which created more than 5 million digital collections, focused not only on digitization, but also on developing digital archives technologies (including database and language processing technologies) and fostering coordination among teams. Since

Chinese characters are ideographic and cannot be represented using ASCII code, new ways of recognizing and encoding characters had to be developed, along with methods for proper word segmentation (Du et al. 2014). A few DSOs were involved in academic publishing, which meant that the organization could disseminate its work and that students could learn skills significant to the publishing industry.

Role of the Research Library and Campus Computing

Many large research libraries in North America are introducing digital scholarship organizations, with varying levels of engagement from campus computing and academic departments. Lippincott and Goldenberg-Hart (2014) aptly distinguish library-championed digital scholarship centers from digital humanities centers led by academic units by their strong focus on digital scholarship (as opposed to DH) and by their service (versus research) focus. Our study focuses on organizations with a research mission, although several organizations in our study are based (physically or organizationally, or both) in the library or include library staff on their teams. Libraries at these institutions often want to hire librarians in “blended roles,” seeking staff with strong digital research skills even if they would have no formal involvement in a DSO.

Outside of North America, the research library generally played a far less prominent role in the DSOs we visited. A number of libraries maintained a fairly traditional, book-centric role and, as a result, tended not to hire staff with the skill set necessary to enhance campus DS initiatives. Some interviewees noted that their research libraries were more active in digital work in the early years, but mainly in the context of scanning large collections of text for use by scholars. Many interviewees spoke positively about their research libraries and some, both inside and outside of North America, expressed an interest in enhancing the relationship between libraries and DSOs. One center director appreciated having librarians on his team, saying, “I’ve never used a library science graduate who failed me. They are all outstanding.” In Taiwan, the director of National Taiwan University’s Research Center for Digital Humanities formerly held the position of university librarian.

Academic information technology departments tended not to be very involved in DSOs at most institutions we visited, focusing more on providing core infrastructure than on supporting specific research projects. This seems to reflect the lack of a strong tradition of university support for research computing in many countries. However, in a few cases information technology groups participated in campuswide networks for digital scholarship, offering core technical expertise.

Academic Career Structure

As Andrew Prescott notes, discussions of digital scholarship in the United States tend to fixate on questions of evaluating digital work for tenure and promotion, but approaches to tenure vary around the world (with many institutions not offering permanent employment), and the structure of faculty and staff roles (and even concepts of “faculty” and “staff”) varies (Prescott 2013). How roles are structured affects recruitment, promotion, and retention, as well as the availability of research positions and the risks that academics are willing to take in pursuing digital scholarship. Faculty positions are hard to come by, and research staff often occupy unstable positions funded by soft money. Some with digital scholarship training may attain more stable positions in industry, libraries, and other cultural heritage institutions, but their work there often is less engaged with cutting-edge research questions.

Academics seeking permanent faculty positions face significant challenges. While full professors in Germany seem to have a great deal of autonomy, ascending to that level is challenging. Germany’s higher education system (which is in the midst of reform) traditionally has differentiated among PhD candidates, senior research fellows / junior professors, C3 / W2 professorships, and C4 / W3 professorships; only the professorships are tenured, and these are limited in number (EUI 2014). In China, Wuhan University uses a rigid, exacting evaluation and promotion system in which promotions to higher ranks are limited and specific requirements must be met (González, Liu, and Shu 2012).

As difficult as it can be to secure a permanent faculty position, staff typically face significant instability in their careers, often living from contract to contract. In some countries, fellowships and research positions are part of the path to faculty jobs or are themselves permanent, but in many others they are more tenuous. In Germany, for example, “at the top is the professor, at the bottom students—the middle is problematic. There is not stability for research positions.” However, Germany’s Federal Ministry of Education and Research (BMBF) has funded several “junior researcher” groups in eHumanities to help young scholars hone their expertise by working on a research project. The lack of permanent positions for research staff contributes to problems with retention. Furthermore, staff positions can mean fewer privileges. Around the world we observed what Reside and Clements’s 2011 report, *Off the Tracks*, had previously found, primarily in the United States: academic staff at research centers are often classified as occupying “service” positions, which sometimes means that they cannot apply for grants or fellowships (Reside and Clement 2011).

A number of staff interviewed as part of this study are involved in “alternative academic” careers, or “alt-ac”—they have graduate training and are pursuing careers within academia broadly conceived (such as within universities, libraries, museums, and archives) rather than tenure-track faculty positions. The concept of “alt-ac” seems to be most prevalent in the United States and

Canada, where it provides a professional identity. However, around the world graduate students seemed aware of career opportunities beyond faculty positions, such as in publishing and the cultural heritage sector.

Challenges Faced by Digital Scholarship Organizations

Many organizations reported common challenges, particularly in recruiting and retaining qualified staff, that affect the expertise they can offer. These challenges include the following.

Funding

As noted previously, many organizations must constantly pursue funding, unless they have a substantial and stable funding source at their home institution. Some DSOs lose staff because of funding problems. The lack of funding limits what organizations can accomplish, even as they are creative in dealing with the constraints.

Lack of Time

Several organizations reported being so busy with projects that staff weren't always aware of what colleagues were doing. With an intense focus on specific projects, staff often lack time to systematize and sustain digital scholarship. In addition, the need to complete projects often takes priority over professional development. Even if professional development is part of the annual performance review, you "always run into [the] problem of what you would like to do and the constraints of actually getting the work done that puts the bread on the table." Even if staff are encouraged to pursue their own research, finding time to do so can be a significant challenge, since "getting stuff done on projects you're working on has to be a priority." Particularly at small support units, work can be disrupted if, for example, a staff member goes on vacation. At one center, the challenge of keeping up with a number of grant-funded projects led to a re-examination of mission.

Recruitment and Retention

Given the specialized skills needed for digital scholarship, it can be hard to find qualified staff, and retaining them can be even more difficult. The leader of one social science organization emphasized a "critical need for more people" to do systems administration, programming, data mining, and statistical computing in support of research. Digital scholarship organizations encounter intense competition for qualified staff from industry, particularly for people with a strong computer science background. As the leader of one DH center noted, "I can't offer them stocks." Large companies can

offer not only more lucrative salaries, but also a better career path with opportunities for advancement. In at least one case, the lack of qualified staff locally made it necessary to look to other countries for staff. Conversely, an interviewee noted his frustration that since there were no digital humanities professorships in his home country, two recent PhD graduates had to look elsewhere and “got snapped up” by foreign institutions.

Often, digital scholarship projects rely on graduate student assistants. The experience gives students opportunities to build their knowledge and provides inexpensive labor. But such projects must contend with frequent turnover; as one faculty member put it, “I get these MA students, I train them, they graduate.” One university that offers degree programs in digital scholarship tries to recruit its own students as staff, but there aren’t necessarily enough students to meet the demand, especially with competition from other organizations. Most of their graduates go to industry, since “they can offer more money. The only people we have are here because of idealism.”

Once centers recruit staff, they face the challenge of retaining them. Rather than occupying permanent positions, staff at DSOs often have short-term contracts tied to particular project, so they “can’t really build a career.” Staff and students cited the lack of a career path as a significant concern. One interviewee, describing the challenges faced by research assistants who live from research contract to research contract, dubbed these staff as the “academic proletariat.” Because of the instability of research jobs, “as soon as people have family and kids, they leave for more stable positions.” At one organization, all but two people out of a group of five or six left in the course of a year, lured by more money and greater stability. As a center director noted, it’s a “real shame because they don’t want to leave . . . They have a lot of freedom [and] can work on projects as they like, but they don’t really have a career, [and] no prospect of promotion.” When staff leave in the middle of projects, it can set back work and undermine teams. Recruiting new staff and helping them develop skills require significant investments of time and resources.

To recruit and retain staff, DSOs offer them the freedom and flexibility to explore engaging research problems. As a manager at one DSO noted, “We give them flexible scheduling and working environment. We let them do things they are interested in doing.” Another noted that “What academia offers is greater freedom,” as well as more interesting subject matter. Although staff may find greater compensation elsewhere, they are drawn by the experimental culture and challenge of the academic environment, where they are “rewarded for taking risks, being autonomous, producing new things instead of implementing a specification sheet.” For example, one staff member left a stable, permanent position at a big, bureaucratic organization for a job that lacks permanence, both because he “didn’t want to think that way” anymore and because he was drawn by the opportunity to spend one day a week on his own research. As Julia Flanders observes, “Digital centers typically can’t

pay competitive wages in sheer monetary terms, but they can (and should) pay extremely well in terms of the opportunity to learn” (Flanders 2011, 12).

Retaining staff means that the organization can depend on a solid base of expertise and promote a healthier learning culture. One center shifted from hiring short-term staff, such as graduate students, to hiring more long-term staff. Although such staffing imposes a greater financial burden, the leadership believes that staff needed “stability to learn from each other” and that retaining staff means that they can “develop their skills.”

Helping people develop their expertise is part of the mission of many organizations. Thus, some managers view the problem of retention with equanimity; as one suggested, it is “good if you have good chances on job market—it’s sign of excellence for our organization, [and] even a greater sign if you stay with us.”

Tension between Research and Services

Historically, many humanities computing centers (not necessarily those included in this study) originated as service units (Gouglas et al. 2012), which can contribute to an ongoing tension between a research and a service mission even today. Many DSOs in our study emphasized that they are not service units, since they partner with scholars, explore complex research questions, and maintain their autonomy. As one interviewee commented, “we’ve been careful not to become the service center for campus and place strong value in exploratory research versus functional applications of fairly straightforward and basic digital humanities efforts.” Pursuing research and creating new knowledge are central to the mission and identity of most organizations in this study. However, another interviewee noted a conflict between the desire to do research and the need to sustain projects. While the organization did not want to become a service provider, which would be “boring,” “maybe we need dedicated staff for the development and maintenance of technical services. If we had stable staff for basic technical solutions, we would be service providers on the one hand and [have] more freedom to research on the other.” A few organizations feel caught between research and service as result of being dependent on grant funding and other forms of external support.

Status Differences between Faculty and Staff

While most DSOs seemed quite collegial, with faculty members expressing appreciation for staff and vice versa, we observed a few instances of status differences. For example, at one university staff were not eligible to serve as the PI or co-PI on research grants that extend beyond the length of their contracts; one interviewee pointed to “two proposals that have fallen through because they’re small projects but I can’t head them up.” Sometimes staff could travel to conferences only if they were funded by grants or had

successfully applied for university-wide funding. A staff member at another organization reported being treated occasionally by faculty as a “local support guy” rather than as someone with specialized expertise. At the organizations with what appeared to be the most robust communities of practice, we observed a general lack of hierarchy.

Dealing with Change

Coping with ongoing change presented a significant challenge for some organizations. Such changes included new leadership, shifts in funding programs, different priorities for partners and supporters, alterations to university priorities, the evolution of research and the research environments, and more. Adapting to such changes entailed adjusting the organization’s mission, strategy, expertise, organizational structure, and staffing. A few interviewees reported difficulty in finding time to keep up with changes in technology and digital scholarship and to maintain their skills. Nevertheless, organizations are surviving in face of change, often through a combination of passion, effective leadership, and persistence.

Facilitating Collaboration

Collaboration is fundamental to digital scholarship, but it isn’t necessarily easy. Barriers to facilitating collaboration included scholars at a university not being aware of expertise at a DSO and turning elsewhere for collaborators, the complexity of institutions, facilitating transdisciplinary conversations, and a persistent culture of working alone.

Low Status of Digital Scholarship

Within their own institutions, DSOs sometimes faced a lack of awareness, and even hostility to their mission from more traditionally minded colleagues. One interviewee told of a humanities faculty member who complained at a high level about the center, claiming that digital and humanities were incompatible. While digital humanities was well established at some institutions, faculty and graduate students generally reported concerns about getting it recognized for purposes of tenure and promotion. Often scholars felt compelled to produce both a book and digital work to qualify for promotion. Even if a department were supportive of digital scholarship, there might be difficulty having it recognized at higher levels in the review process. Yet a graduate student suggested that concerns about tenure and promotion were “overblown” and that having digital expertise was a strength, since departments were looking for faculty with such skills.

Language of Scholarship

We heard from researchers in non-English speaking countries that language can be a barrier to participation in the global digital humanities community. As one noted, it is “difficult when you write in a language not English, or don’t write English well enough to be part of mainstream DH.” If a publication is not in English, it is less likely to receive international attention, since English has emerged as the lingua franca for most academic conversations. Translating an article into English takes significant time, imposing a considerable burden.

Recommendations

Through our site visits, we observed both common strengths of successful digital scholarship programs and unique characteristics of particular programs that deserve further recognition and emulation. We also heard recommendations from some organizations. Here we synthesize these observations as recommendations aimed at particular audiences. Of course, local context determines what models make sense; as Bethany Nowvskie observes, “a one-size-fits-all approach to digital scholarship support *never fits all*” (2014).

Digital Scholars

1. Ensure that clear goals inform your career choices. What is most valuable to you: the opportunity to transform research in your discipline or to pursue traditional research methods using digital techniques? Having an impact? Job stability? A high salary? The ability to keep learning, whether through a formal degree program or informally?
2. Do your homework. Understand the organizational culture of potential employers. Know the opportunities for advancement (or lack thereof) offered by particular positions. Understand the funding model and employment category for the position.
3. Nurture your own sense of curiosity, which can help direct research interests and motivate project participation.
4. Participate actively in communities of practice, and seek out opportunities to both learn from peers and communicate your own expertise to others.
5. Own your own learning. Don’t wait for learning opportunities to come: create them yourselves. For example, create a reading group, offer to train colleagues in new skills you’ve learned, or sign up for a training program.
6. Be a good teammate; work to the greater good of the entire team and share your knowledge.
7. Know enough to converse with team members about their areas of expertise and to make well-informed decisions about directions the research may take. Be aware of your own strengths and weaknesses. Identify where you may have gaps and push the limits of your own understanding.

Leaders of Digital Scholarship Organizations

1. In hiring, look for people with passion, curiosity, and the capability to deepen their expertise or to learn skills they currently lack.
2. Make it possible for staff and faculty within your organization to learn continually; create the infrastructure, culture, and recognition to facilitate ongoing learning.
3. Provide structured opportunities to come together as a community, such as through regularly scheduled lab meetings, workshops, and speakers.
4. Support informal opportunities to share knowledge, such as by providing common spaces, organizing get-togethers such as lunches and coffee, and encouraging organic, grassroots efforts.
5. Model continual learning yourself. This sets the tone and demonstrates that learning is central to the organization.
6. Include dedicated research time in staff job descriptions.
7. Enable staff to teach and mentor, such as through formal credit-based courses and in-house training and mentorship programs.
8. Host education and training programs (either in-house or for the broader community), with a focus on your organization's unique expertise.
9. Provide funding for staff and faculty to attend conferences and training. Explore options for securing this funding, such as through grant programs on campus or folding it into grant applications.
10. Establish your organization as a node in a larger network; enable researchers from other institutions in the region to come together to exchange ideas, collaborate on projects, participate in joint training, and take advantage of facilities not otherwise available.
11. Start with what will have most traction in your community. Conduct a needs assessment to identify obvious voids that the organizations can fill. What expertise do you need to bring on board or develop?

Universities and Host Organizations

1. Create stable, rewarding staff positions, with paths to promotion and permanence. We echo *Off the Tracks* in suggesting that organizations develop positions that recognize staff research contributions, such as "research faculty" and "library faculty."
2. Enable research staff as well as faculty to apply for grants (Reside and Clement 2011).
3. Offer seed funding for training and research programs to supplement DSO budgets.
4. Provide more stable, permanent funding for DSOs, such as through raising endowments, that enables them to become more engaged with teaching and learning, or associating them with the university library, a research institute, or academic school.
5. Ensure that digital scholarship is fairly evaluated in the tenure and promotion process.

6. Include DSOs in the context of the research ecosystem, particularly in relation to scholarly communication and publishing. Promote and enable DSOs in collaboration with institutions' office of research, university press, graduate school, and other core functional units.

Organizations that Fund Digital Scholarship

1. Foster international exchanges, such as through visiting scholar programs and collaborative research.
2. Support and encourage joint and international collaborative grant applications.
3. Include travel and training as expenses covered by grants.
4. Continue to provide funding for training and education programs.

Digital Scholarship Community

1. Heighten awareness of digital scholarship being done around the world by exploring research in a range of contexts, including by conducting site visits, attending conferences in other countries, and reading more widely.
2. Promote linguistic diversity and global digital scholarship awareness. While English may be adopted for pragmatic reasons, the digital scholarship community also needs to be sensitive to cultural and linguistic contexts. Conference organizers and editors should be sensitive to the extra effort required to translate work into English by ensuring, for example, that CFPs are circulated early to allow time for translation. In addition, there need to be more forums for sharing research in native languages, and English speakers need to be aware of these venues.
3. Expand the understanding of different models for DSOs. In what contexts does a lab make sense? A network? A center?
4. Participate in face-to-face meetings as well as in networks of researchers and practitioners, whether organized around geography, language, method, discipline, or something else. Promote groups that welcome both newcomers and veterans; encourage interdisciplinary discussion to raise awareness of different methods and disciplinary concerns. Consider organizing face-to-face conferences emerging out of such networks or discussion groups.

Future Work

As noted earlier, this project was framed as an exploratory study with the potential to lead to a more comprehensive research project. Our intent was to test the research questions, tools, and methodologies on a small sample of sites drawn from across the global DS community.

From a methodological standpoint, we are pleased with the semi-structured interviews as a strategy for extracting information

from a large number of sites but feel that some cleanup could be done on the coding used to analyze the data. Going forward, the PIs would reduce the number of codes and eliminate overlap. Additional time would be spent to allow the coding to be checked by a second PI.

As anticipated, further work needs to be done before findings can be generalized beyond the current population. First and foremost, the geographical scope must be expanded to fill obvious gaps. The strong focus on North American sites was reasonable given the travel logistics and the quality and prominence of work being done. To be truly global in scope, however, information should be gathered from DSOs in places such as Brazil, Spain, Portugal, Argentina, the Netherlands, Australia, Italy, France, Switzerland, and Japan—places where exciting work is being done and strong communities exist or are being built. Despite the relative ease of online communication and foreign travel, awareness of activity in other parts of the world is still not abundant.

The disciplinary focus should also be expanded. Our analysis of digital social science was only preliminary. In addition, exemplary work is being done in areas such as bioinformatics and transdisciplinary research.

More granular work should be done on job descriptions as a formal acknowledgement of domain knowledge, skills, competencies, and mindsets required to support DS. We believe that mining recent job descriptions could shed a clear light on DSO's anticipated needs.

Greater attention should also be given to organizations that are primarily oriented to service delivery. The sample population did not really reflect the growing number of DSOs popping up, often on university campuses, to support the research done by others. In many cases, these DSOs exist within university libraries. The relationship between the libraries and the DSOs warrants deeper analysis.

Finally, more exploration is required into the emerging curriculum for DS. Is there a core set of components required for a graduate (or undergraduate) program? How does this vary by region? How might hands-on research experiences enhance learning for graduate and undergraduate students? What are the best models for structuring graduate and undergraduate research experiences, such as courses, internships, fellowships, and paid work? Are there good models for the in-house training programs being held by DSOs around the world?

Conclusions

As we visited DSOs around the world, we noted a pattern. What sets apart leading organizations is the leader's vision; the curiosity, expertise, and collegiality of faculty, students, and staff; and the vibrancy of the community. As the leader of one organization observed, "the key is people." Rather than a single individual

possessing all of the necessary expertise, digital scholarship typically requires teams that bring together people with diverse skills and knowledge. Leaders set the tone for the organization, creating an environment that values sharing knowledge, playing with ideas, and pursuing constant learning; they also exercise political skills to secure necessary resources and demonstrate strategic vision in determining the mission of the organization. Students energize the organization, apprenticing on projects, exploring new approaches, and sharing their knowledge. Faculty speak of being transformed through being challenged to represent their knowledge in new ways and participating in the digital scholarship community, while staff derive satisfaction from solving problems, exploring new domains, and collaboratively producing knowledge. “Translators” facilitate smooth communication and common understanding.

Our findings about the importance of community in developing skills and in creating effective DSOs echo research on the ways in which people learn and innovate by participating in communities of practice (Brown and Duguid 1991). Much learning in digital scholarship takes place as people share their work with each other, talk through technical or methodological problems with peers, or discuss new developments in the field. Often research centers, including many we visited, attempt to cultivate a strong community in order to spark innovation and the exchange of knowledge. As Gary King of Harvard’s Institute for Quantitative Social Science observes, “community is the fundamental driver behind successful centers” (King 2014, 8).

References

All URLs are current as of October 15, 2015.

Alstete, Jeffrey W. 1995. *Benchmarking in Higher Education: Adapting Best Practices to Improve Quality*. George Washington University.

Boyatzis, Richard E. 2006. Competencies in the 21st Century. *Journal of Management Development* 27(1): 5-12.

Brown, John Seely, and Paul Duguid. 1991. Organizational Learning and Communities-of-Practice: Toward a Unified View of Working, Learning, and Innovation. *Organization Science* 2(1): 40–57.

Burdick, Anne, Johanna Drucker, Peter Lunenfeld, Todd Presner, and Jeffrey Schnapp. 2012. *Digital Humanities*. The MIT Press.

Cioffi-Revilla, Claudio. 2013. *Introduction to Computational Social Science: Principles and Applications*. Springer Science & Business Media.

Coleman, Nicole. 2014. The ATS Service Model. Academic Technology Specialists (May 21). Available at <https://web.stanford.edu/group/ats/cgi-bin/hivetalkin/?p=4391>.

Du, Jia Tina, Qinghua Zhu, and Andy Koronios, eds. 2014. *Library and Information Science Research in Asia-Oceania: Theory and Practice*. IGI Global. Available at http://www.academia.edu/10367675/What_s_Past_is_Prologue_A_15-Year_Review_of_Digital_Archives_Program_in_Taiwan.

EUI (European University Institute). 2014. Germany, Academic Career Structure. European University Institute, October 28, 2014. Available at <http://www.eui.eu/ProgrammesAndFellowships/AcademicCareersObservatory/AcademicCareersbyCountry/Germany.aspx>.

Flanders, Julia. 2011. Center for Digital Scholarship and Women Writers Project. In *Off the Tracks*, edited by Tanya Clement and Doug Reside. Maryland Institute for Technology in the Humanities. Available at <http://drum.lib.umd.edu/handle/1903/14731>.

Galina, Isabel, Erika Ortega, Ernesto Priani, and Paola Ricaurte. 2015. RedHD and Latin American Contexts: Self-Representation and Geopolitics in DH. *dh + lib* (February 2). Available at <http://acrl.ala.org/dh/2015/02/02/redhd-and-latin-american-contexts-self-representation-and-geopolitics-in-dh/>.

Galina, Isabel, and Ernesto Priani. 2011. Is There Anybody out There? Discovering New DH Practitioners in Other Countries. Digital Humanities 2011, Stanford University. Available at <http://dh2011abstracts.stanford.edu/xtf/view?docId=tei/ab-124.xml;query=;brand=default>.

Galina Russell. 2014. Geographical and Linguistic Diversity in the Digital Humanities. *Literary and Linguistic Computing* 29(3). Available at doi: 10.1093/llc/fqu005.

Galina Russell, Isabel. 2012. Case Study: Digital Humanities in Mexico in 'Institutional Models for Digital Humanities.' In *Digital Humanities in Practice*, edited by Claire Warwick, Melissa Terras, and Julianne Nyhan. Facet Publishing/ University College London. Available at <http://blogs.ucl.ac.uk/dh-in-practice/chapter-9/>.

González, Cristina, Yamin Liu, and Xiaoling Shu. 2012. *The Faculty Promotion and Merit System in China and the United States: The Cases of Wuhan University and the University of California, Davis*. UC Berkeley: Center for Studies in Higher Education. Available at <http://www.cshe.berkeley.edu/sites/default/files/shared/publications/docs/ROPS.Gonzalez%20et%20al.Faculty%20Promotion.10.1.2012.pdf>.

Gouglas, Sean, Geoffrey Rockwell, Victoria Smith, Sophia Hoosein, and Harvey Quamen. 2012. Before the Beginning: The Formation of Humanities Computing as a Discipline in Canada. *Digital Studies / Le Champ Numérique* 3(1). Available at http://www.digitalstudies.org/ojs/index.php/digital_studies/article/view/214.

Hämäläinen, Kauko, Kimmo Hämäläinen, Anette Dørge Jessen, Minna Kaartinen-Koutaniemi, and Dorte Kristoffersen. 2002. *Benchmarking in the Improvement of Higher Education*. European

Network for Quality Assurance in Higher Education (ENQUA) Workshop Reports 2. Helsinki: European Network for Quality Assurance in Higher Education. Available at <http://www.enqa.eu/indirme/papers-and-reports/workshop-and-seminar/benchmarking.pdf>.

Henry, Charles, and Christa Williford. 2012. *One Culture. Computationally Intensive Research in the Humanities and Social Sciences: A Report on the Experiences of First Respondents to the Digging Into Data Challenge*. Washington, D.C.: Council on Library and Information Resources. Available at <http://www.clir.org/pubs/reports/pub151>.

Hsiang, Jieh. 2015. "Building Digital Archive Systems for Scholarly Use." Presented at Digital Humanities 2015, Sydney, N.S.W, Australia.

Hsiang, Jieh. n.d. Digital Humanities in Taiwan. Power Point presentation. Available at <http://www.digital.ntu.edu.tw/dadh/programINFO/ppt/DH+in+Taiwan.pdf>.

King, Gary. 2014. Restructuring the Social Sciences: Reflections from Harvard's Institute for Quantitative Social Science. *PS: Political Science & Politics* 47(1): 165–72.

Kings College London. 2015. About Digital Humanities. Available at <http://www.kcl.ac.uk/artshums/depts/ddh/about/index.aspx>.

Lazer, David, Alex Pentland, Lada Adamic, Sinan Aral, Albert-László Barabási, Devon Brewer, Nicholas Christakis, et al. 2009. Computational Social Science. *Science* 323(5915): 721–23. Available at <http://www.sciencemag.org/content/323/5915/721>.

Lippincott, Joan, and Diane Goldenberg-Hart. 2014. Digital Scholarship Centers: Trends and Good Practice. Coalition for Networked Information. Available at http://www.cni.org/wp-content/uploads/2014/11/CNI-Digital-Schol.-Centers-report-2014.web_.pdf.

Nowviskie, Bethany. 2014. "Asking for It." Blog post, February 8, 2014. Available at <http://nowviskie.org/2014/asking-for-it/>.

Nowviskie, Bethany. 2012. "Too Small to Fail." Presented at the Japanese Association for Digital Humanities, University of Tokyo, (September 15). Available at <http://nowviskie.org/2012/too-small-to-fail/>.

Oxford University. n.d. digital.humanities@oxford. "About." Available at <https://digital.humanities.ox.ac.uk/about>.

Porter, Dot. 2014. What If We Do, in Fact, Know Best? A Response to the OCLC Report on DH and Research Libraries. Dh+lib (Feb. 12). Available at <http://acrl.ala.org/dh/2014/02/12/what-if-we-do-in-fact-know-best-a-response-to-the-oclc-report-on-dh-and-research-libraries/>.

Prescott, Andrew. 2013. Small Worlds and Big Tents. *Digital Riffs* (May). Available at <http://digitalriffs.blogspot.com/2013/05/small-worlds-and-big-tents.html>.

Reside, Doug, and Tanya Clement. 2011. *Off the Tracks: Laying New Lines for Digital Humanities Scholars*. Maryland Institute for Technology in the Humanities. Available at <http://drum.lib.umd.edu/handle/1903/14731>.

Sahle, Patrick. 2011. *Digitale Geisteswissenschaften*. Cologne Center for eHumanities (CCeH). Available at http://dig-hum.de/sites/dig-hum.de/files/cceh_broschuereweb.pdf.

Schaffner, Jennifer, and Ricky Erway. 2014. *Does Every Research Library Need a Digital Humanities Center?* Dublin, Ohio: OCLC Research. Available at <http://www.conference-center.oclc.org/content/dam/research/publications/library/2014/oclcresearch-digital-humanities-center-2014.pdf>.

Sehat, Connie Moon, and Erika Farr. 2009. *The Future of Digital Scholarship: Preparation, Training, Curricula. Report of a Colloquium on Education in Digital Scholarship, April 17–18, 2009*. Washington, D.C.: Council on Library and Information Resources. Available at <http://www.clir.org/pubs/archives/SehatFarr2009.pdf>.

Spence, Paul. 2015. "Digital Humanities as an Academic Department." Presented at Digital Humanities 2015, University of Western Sydney, July 3, 2015. Available at <http://www.paulspence.org/dh-as-acad-dept/>.

Spiro, Lisa. 2014. *Defining Digital Social Sciences*. *dh+lib* (April 9). Available at <http://acrl.ala.org/dh/2014/04/09/defining-digital-social-sciences/>.

University of Oxford. 2014. *Research Support Service Level Description*. IT Services. Available at <http://help.it.ox.ac.uk/internal/sld/research>.

Yang, Jianhang. 2012. "[FOCUS] Digital Humanities Research in China." *DH101*. Available at <http://dh101.ch/2012/10/16/focus-digital-humanities-research-in-china/>.

Websites cited

For links to centers visited for this study, see Appendix 1.

Digital Humanities 2013 (University of Nebraska-Lincoln, 16-19 July, 2013): <http://dh2013.unl.edu/>

Digital Humanities 2014 (Lausanne, Switzerland, 7-12 July, 2014): <http://dh2014.org/>

DiXiT: <http://dixit.uni-koeln.de/programme/>

University of Oxford Text Archive: <http://ota.ox.ac.uk/>

Related Reading

#alt-ac in Context. (n.d.). Available at <http://mediacommons.futureofthebook.org/alt-ac/alt-ac-context>.

Chen, Kuang-hua, and Bi-Shin Hsueh. 2014. Exploring Regional Development of Digital Humanities Researches: A Case Study for Taiwan. *Journal of Data Mining & Digital Humanities* 17 (June 24). Available at <http://jdmhdh.episciences.org/17>.

Hirsch, Brett D. 2012. Digital Humanities and the Place of Pedagogy. In Brett D. Hirsch, ed., *Digital Humanities Pedagogy: Practices, Principles and Politics*, 3–30. Open Book Publishers.

Maron, Nancy. The Department of Digital Humanities (DDH) at King's College London 2011. Ithaka S+R, 2011. Available at <http://sr.ithaka.org/research-publications/ddh-kings-college-london>.

Nowvieskie, Bethany. 2012. A Digital Boot Camp for Grad Students in the Humanities. *Chronicle of Higher Education* (April 29). Available at <http://chronicle.com/article/A-Digital-Boot-Camp-for-Grad/131665/>.

"Oxford Text Archive." Wikipedia, the Free Encyclopedia. Last modified March 9, 2013. Available http://en.wikipedia.org/w/index.php?title=Oxford_Text_Archive&oldid=543053833.

Wenger, Etienne. 2011. "Communities of Practice: A Brief Introduction." Available at <http://wenger-trayner.com/wp-content/uploads/2012/01/06-Brief-introduction-to-communities-of-practice.pdf>.

Xia, Jingfeng, and Minglu Wang. 2014. "Competencies and Responsibilities of Social Science Data Librarians: An Analysis of Job Descriptions." *College & Research Libraries* 75(3): 362–88.

APPENDIX 1:

Profiles of Participating Digital Scholarship Organizations

To give readers a sense of the scope of our study, we offer brief descriptions of participating organizations. In many instances, we interviewed faculty, students, or staff at multiple organizations affiliated with a particular university, so we include all those with a focus on digital humanities or digital social science here. To protect interviewees' confidentiality, we drew from publicly available information such as organizational websites in preparing these summaries.

Beijing Guoxue Times Culture Co. Ltd (affiliated with Capital Normal University), China

[Beijing Guoxue Times Culture Co.](#) ranks as one of the most unique digital humanities organizations we visited. While the organization is affiliated with Capital Normal University in Beijing, it is a for-profit digital humanities business corporation that issues public stock on China's stock market. Its main business is to digitize Chinese manuscripts and rare books and sell the collections and associated digital services and tools.

Centre for Internet and Society, India

[The Centre for Internet and Society](#) (CIS) is a nonprofit organization, based in Bengaluru and Delhi, that undertakes interdisciplinary research on Internet and digital technologies from policy and academic perspectives. The areas of focus include digital accessibility for persons with diverse abilities, access to knowledge, intellectual property rights, openness (including open data, free and open source software, open standards, open access to scholarly literature, open educational resources, and open video), Internet governance, telecommunication reform, digital privacy, and cybersecurity. The academic research at CIS seeks to understand the reconfigurations of social and cultural processes and structures as mediated through the Internet and digital media technologies, with a thematic focus on the histories of the Internet, digital knowledge, data systems, networked practices, and web cultures. Through its diverse initiatives, CIS seeks to explore, intervene in, and advance contemporary discourse and practices around the Internet, technology, and society in India and abroad.

Fudan University, China

The [Research Center on History and Geography](#) is located in the Institute of Chinese Historical Geography at Fudan University. This well-established interdisciplinary center is connected with institutions within and beyond China. The center's research and teaching focus is on using GIS technologies in historical geography research. The center is a founding member of an international digital humanities project known as CHGIS (China Historical GIS).

George Mason University, United States

George Mason University's [Roy Rosenzweig Center for History and New Media](#) (RRCHNM) uses digital media and computer technology to "democratize history." The center aims to preserve and promote history online, and to advance historical education across the United States and the world. Part of the Department of History and Art History, the center opened its doors in 1994 under the founding direction of Roy Rosenzweig. Currently, more than 35 scholars, developers, designers, researchers, and graduate and undergraduate students work together to create software and websites that are freely available to the public. Those projects are shaped by collaborations with universities, schools, libraries, archives, museums, and communities, and are funded by grants from government agencies and private organizations.

Major projects include open source software such as Zotero (a tool to manage citations and to gather full text, web pages, images, and other resources) and Omeka (a content management system for building online collections and exhibits); resources for teachers, such as Teachinghistory.org (a clearinghouse for K-12 US history); online collections such as the Papers of the War Department, 1784-1800 (which includes a platform for crowdsourced transcription); collecting sites, such as the September 11 Digital Archives; and interpretative sites, such as Histories of the National Mall.

In 2008, the center held the first THATCamp, an open, inexpensive unconference for humanists and technologists at all skill levels to meet and build together. Since that first event, more than one hundred THATCamps have been held around the world.

GESIS—Leibniz-Institute for the Social Sciences, Germany

Founded in 1986 as the German Social Science Infrastructure Services, [GESIS-Leibniz-Institute for the Social Sciences](#) is now a single institute with locations in Mannheim, Cologne, and Berlin. GESIS provides significant infrastructure services for the social sciences, offering databases and portals, consulting on survey design and developing data management plans, support in data collection and analysis, and data archiving. Although it is not focused exclusively on digital social science, it conducts research into applied computer and information science, including computational

social science and knowledge discovery. GESIS sponsors lectures, workshops, and training, such as methods seminars on topics such as text mining with R and multiple regression analysis.

Jadavpur University, India

The [School of Cultural Texts and Records](#) at Jadavpur University was established in 2003 to facilitate interdisciplinary activities across the fields of archiving, digitization, and bibliography; textual studies; editing; and book history. Faculty and staff are engaged in a variety of work associated with documenting and digitizing endangered cultural material. Key activities include editing electronic and print manuscripts; designing and building databases, indexes, and bibliographies; recording oral history and interviews; research; and training.

The school has one of the most extensive collections of modern Bengali literary manuscripts as well as one of the largest collections of recorded North Indian classical music from the earliest times.

The school has engaged in many prominent collaborations. It has executed five projects for the British Library's Endangered Archives project and has collaborated in preparing a complete electronic text of the Australian poet Charles Harpur's manuscripts, and of the manuscript of Thomas Hardy's *The Return of the Native*. The school's most substantial achievement to date is the Tagore Online Variorum Project, which led to the creation of Bichitra (lit. "the various"), the biggest integrated knowledge site devoted to any author in any language. It has also made great progress with its ongoing Short-Title Catalogue of Bengali books.

The school currently delivers a certificate course in editing and publishing. It also runs a course in digital humanities, the first in India, currently funded by the University Grants Commission.

[Jadavpur's Media Lab](#) was opened by the Department of Film Studies in July 2008 in the newly built Gandhi Bhavan. Lab staff are engaged in building research databases and digitizing documents related to Indian cinema and media. The lab also delivers training workshops in film, new media, and digital humanities. The Media Lab houses the Future of Celluloid project supported by the Navajbai RatanTata Trust (NRTT) under its Arts and Culture program. In addition, the lab is working on a major online annotated database on Indian cinema, available at www.indiancine.ma. The Media Lab hopes to bring together the skills of the scholar and the artist, the critic and the activist, into one process of creative learning.

Kings' College London, United Kingdom

Kings' College London's engagement in digital humanities dates back to the 1970s. In 2002, the Centre for Computing in the Humanities became an academic department (later renamed the [Department of Digital Humanities](#) [DDH]) in what is now the Faculty of Arts & Humanities, making it one of the few (and first)

academic departments devoted to DH. Since its founding, DDH has seen a “marked shift in character from a unit dominated by research grants—which allowed us to develop a lot of expertise in digital methods and tools, and gave us widespread experience working with partners in other humanities departments (including history, classics, English, Spanish & Portuguese, and music) at KCL and beyond—to an academic department with a more balanced portfolio of research grants and teaching” (Spence 2015). Ranked first in the United Kingdom (along with the Department of Culture, Media & Creative Industries) for “research power” by the Research Excellence Framework, DDH collaborates on a number of research projects in areas such as digital preservation, digital culture, the development of digital knowledge environments, digital libraries, and digital archives. DDH offers several degree programs, including a PhD in digital humanities (the first in the United Kingdom) as well as master of arts degrees in digital asset and media management, in digital humanities, and in digital culture and society. It recently launched an undergraduate degree program in digital culture.

National Taiwan University, Taiwan

Founded in 2007, National Taiwan University’s [Research Center for Digital Humanities](#) (RCDH) is somewhat unique in being led by a distinguished professor of computer science who was formerly the university librarian. RCDH has built 33 digital archives of Chinese language materials (such as the Taiwan History Digital Library) along with related search systems and tools. Through ongoing collaborations with humanities researchers, RCDH develops a system methodology that enables the exploration of the contexts surrounding documents (Hsiang 2015). RCDH hosts as an annual event—the International Conference of Digital Archives and Digital Humanities—which is entering its sixth year. Through its partnership with National Taiwan University Press, RCDH publishes the series *Digital Humanities* and other digital archives-related publications.

Red de Humanidades Digitales, Mexico

[Red de Humanidades Digitales](#), or RedHD, was founded in June 2011 by Mexican researchers who wanted to nurture the growth of digital humanities research and education across Mexico and Latin America. When RedHD was established, there were no digital humanities conferences or centers in Mexico, although there were dispersed digital humanities scholars (Galina Russell 2012). Rather than being a center based at a university, RedHD is a *network* that promotes digital humanities, facilitates training, and develops guidelines for digital humanities projects. It builds community through a multiauthor blog and events such as the 2nd Encuentro de Humanistas Digitales conference and an ongoing digital humanities seminar made available through video conferencing. In 2018, it will

host the international digital humanities conference in Mexico City in alliance with El Colegio de México and the Universidad Nacional Autónoma de México.

Stanford University, United States

At Stanford, the Center for Spatial and Textual Analysis (CESTA) fosters collaboration among digital humanities labs and projects. In addition, digital social science activities are coordinated by the Center for Computational Social Science. Stanford's library is involved in both organizations, particularly through the work of academic technology specialists.

- Supported by the office of the dean of research at Stanford, the Center for Spatial and Textual Analysis (CESTA) brings together the Spatial History Project, Humanities+Design, the Literary Lab, and, most recently (after our visit), the Poetic Media Lab. While the [Spatial History Project](#) focuses on understanding space through the production of visualizations, the [Literary Lab](#) uses computational methods to study literature. Humanities+Design draws upon computer science and design as well as the humanities to foster the development of new technologies for exploring and interpreting humanistic data. Across its labs, CESTA emphasizes interdisciplinary collaboration; all three labs involve students working in collaboration with faculty and staff. CESTA lays out specific guidelines for student work that emphasize both obligations (such as clear communication) and opportunities (such as gaining “deliverables” from their work, e.g., publications and new skills). In 2014, CESTA launched a graduate certificate in digital humanities that requires a core course in Spatial History, Literary Lab, or Humanities+Design, as well as an additional course in a subject such as network analysis and either an independent or collaborative research project.
- Part of the [Institute for Research in the Social Sciences](#), the [Center for Computational Social Science](#) (CSS) promotes research and education in the informed, theoretically sophisticated application of computational techniques to data on social phenomena. The center sponsors a summer workshop on computational techniques for social science graduate students, offers research funding for graduate students, and provides a CSS certificate for graduate students in social science.
- Stanford Library is well-represented at both CSS and CESTA and in digital humanities and computational social science research more generally through the work of its Academic Technology Specialists, Social Science Data and Software (SSDS) group, digital humanities developers, and hText: Humanities Text Services. All now belong to Stanford Library's [Center for Interdisciplinary Digital Research](#) (CIDR), which provides technical and project design support for faculty research, serves as a hub for sharing knowledge about digital methods, and produces research in DH and CSS. Stanford's academic technology specialists bring

together technical and disciplinary expertise, collaborating with faculty and staff in particular departments and programs (including CESTA and the Institute for Research in the Social Sciences) on the innovative use of technology in research and learning (Coleman 2014). [The Social Science Data and Software \(SSDS\)](#) group provides training, consulting, and support to researchers in acquiring, curating and preserving social science data and using quantitative and qualitative analysis software. hText offers text-related services for humanities research, such as curating and preserving digital library collections and providing training and outreach.

University of Cologne, Germany

One of the largest universities in Germany, the University of Cologne has worked in digital humanities for about 15 years and has two professorships focused on digital humanities (including the first in Germany). Cologne offers several degree programs in digital humanities, including an MA/BA in information processing in the humanities, MA/BA in media computer science, and an IT certificate from the Faculty of Arts and Humanities (Sahle 2011). Centers of activity in digital humanities at Cologne include the following:

- The [Cologne Center for eHumanities \(CCEH\)](#). Part of the Faculty of Arts at the University of Cologne, CCEH aims to support ongoing research projects; build capacity through workshops, lectures and other activities; coordinate education programs; and raise the visibility of DH at Cologne (“Ausgangslage”). As a contractual partner of the North Rhine-Westphalian Academy of Sciences and Arts, CCEH contributes to projects such as *Das altägyptische Totenbuch - Ein digitales Textzeugenarchiv*. Many of CCEH’s projects result from collaborating with local faculty and with other institutions. CCEH coordinates the [Digital Scholarly Editions Initial Training Network \(DiXiT\)](#), which involves partners in Sweden, the Netherlands, the United Kingdom, Austria, Ireland, Belgium, Italy, and France. Funded through Marie Curie Actions within the European Commission’s 7th Framework Programme, DiXiT provides research fellowships and coordinated training programs in digital scholarly editing to early stage and experienced researchers.
- The [Cologne Data Center for the Humanities](#), coordinated by the CCEH and supported by the Faculty of Arts of the University of Cologne, provides secure long-term backup, access and presentation of humanities research at the University of Cologne and partners.
- The [Cologne Digital Archaeology Laboratory \(CoDArchLab\)](#) develops and maintains *Arachne*, the central archaeological database of the German Archaeological Institute and the Archaeological Institute of the University of Cologne, along with other database projects. Students from Cologne’s digital humanities programs often work at CoDArchLab.

University of Maryland, United States

The [Maryland Institute for Technology in the Humanities](#) (MITH) is a leading digital humanities center specializing in large-scale text and image analytics for cultural heritage collections. The institute supports the exploration and visualization of digital materials, digital curation and preservation, linked data, and data publishing.

Jointly supported by the University of Maryland College of Arts and Humanities and the University of Maryland Libraries, MITH engages in deeply interdisciplinary work “at the intersection of technology and humanistic inquiry.” The composition of the team working in the institute reflects that collaborative nature (with two literature professors, a librarian, a historian, a computational linguist, and several talented staff colleagues.)

The institute's team members are active in applied research. They develop and support tools for preserving and archiving cultural heritage artifacts. They actively promote both “vintage computing” and data publishing to support and reveal scholarly work.

The MITH team is also actively involved in public programming and educational opportunities. They host an intensive program of conferences, lectures, fellowships, workshops, and weekly seminars.

The [University of Maryland Libraries](#) is one of the great research library systems in the United States. The library holds approximately 1.2 million books. The main library, McKeldin, is home to both the Terrapin Learning Commons and the John and Stella Graves MakerSpace.

University of Oxford, United Kingdom

Rather than consolidating expertise in a single center, Oxford (itself a decentralized institution) takes a networked approach to digital humanities, linking researchers and practitioners primarily at the Oxford Internet Institute, Oxford e-Research Centre, IT Services, the Bodleian Libraries, the Humanities Division, Oxford museums, and The Oxford Research Centre in the Humanities (TORCH). The [Digital.Humanities @ Oxford](#) website highlights researchers, projects and units, as well as support for digital humanities projects and events such as lectures and workshops. Our interviews focused on the following:

- **IT Services:** Long engaged in digital humanities, [IT Services](#) has hosted the [Oxford Text Archive](#), the British National Corpus and other significant digital humanities projects and collections. IT Services provides digital humanities consulting and support, offering expertise in areas such as open standards, database design and development, XML encoding, text encoding, and “developing IT aspects of funding proposals” (University of Oxford 2014). It also created the [Digital Humanities at Oxford Summer School](#), which offers week-long workshops for academics, students, project managers, technologists, librarians and others on topics such as crowdsourcing and humanities data

and is run by stakeholders from across the institution.

- **Oxford e-Research Centre:** Established in 2006, the [Oxford e-Research Centre](#) develops collaborative, interdisciplinary digital research projects and research infrastructure across the disciplines, including humanities, social sciences, and sciences. It emphasizes collaboration among researchers from different disciplines and among disciplinary experts and technologists. Its research areas include scientific computing, data management, e-Infrastructure, visual computing, and web science/social machines.
- **Oxford Internet Institute:** Founded in 2001, the [Oxford Internet Institute](#) (OII) researches the Internet's impact on society. Though based in social science, this department includes faculty not only from political science, sociology, anthropology, law, economics, communications, and geography, but also from computer science, physics, informatics, history, and development. Research themes include digital government and politics; Internet and society; information geographies and economies; science, learning, and technology; and Internet governance, regulation, and ethics. OII offers a MSc in Social Science of the Internet and a DPhil in Information, Communication and the Social Sciences.

University of Victoria, Canada

The University of Victoria has distinguished itself as a leading Canadian university in digital humanities based on research projects such as INKE (Implementing New Knowledge Environments), labs such as the Electronic Textual Cultures Lab (ETCL) and MakerLab in the Humanities, and status as the host of the annual Digital Humanities Summer Institute (DHSI).

- **Electronic Textual Cultures Lab:** The [ETCL](#) supports teaching, research, and service exploring “the past, present, and future of textual communication”; it also serves as the hub for digital humanities activities at the University of Victoria and beyond, coordinating DHSI and INKE. It provides an intellectual home for approximately 20 faculty, staff and students and has hosted more than 60 visiting scholars to date. ETCL organizes events such as brown bag lunch sessions, Nuts and Bolts of DH Discussions, and visiting speakers (some of whom participate in DHSI). Projects include Iter Community, which provides an environment for creating research communities focused on the Middle Ages and Renaissance; the Renaissance Knowledge Network (ReKN); and A Social Edition of the Devonshire Manuscript.
- **Digital Humanities Summer Institute:** Since 2004, the University of Victoria has hosted the well-respected [DHSI](#), which provides courses in areas such as text encoding, database development, electronic literature, physical computing, and digital pedagogy as well as community events such as lectures, colloquia, and receptions. DHSI drew more than 750 students in 2015. In 2016, DHSI will offer more than 40 week-long summer courses. The

University of Victoria offers a [graduate certificate in digital humanities](#) that gives credit for courses taken through DHSI and other members of the DH Training Network.

- **INKE:** Funded by the Social Sciences and Humanities Research Council (SSHRC) Major Collaborative Research Initiatives Program, INKE brings together researchers at multiple institutions and in a range of disciplines to study the future of reading and the book. INKE's international research group involves 35 researchers at 20 institutions working in research clusters focused on engagement, modelling, interface, and integration. INKE members develop models, prototypes, and interfaces that support new ways of reading and analyzing and producing texts. They also publish and present work on topics such as social knowledge creation, the digital book, academic prototyping, and research collaboration.
- **Maker Lab in the Humanities:** Launched in 2012, the [Maker Lab in the Humanities](#) brings together “cultural criticism and comparative media studies with computation, prototyping, electronics, and experimental methods,” serving as a humanities research lab and collaborative makerspace. It provides tools, space, educational opportunities, and community to facilitate faculty and graduate and undergraduate students developing range of projects, such as Kits for Cultural History, open source kits that allow users to reconstruct old technologies and media.
- **Humanities Computing and Media Centre (HCMC):** The [HCMC](#) grew out of the University of Victoria's Language Centre and is sponsored by the university's Faculty of Humanities. It assists researchers in applying for grants, planning projects, developing software, and overseeing contract work; it also helps instructors in developing educational websites and software.

University of Virginia, United States

Since the 1990s, the University of Virginia has been recognized as a leader in digital humanities, reflecting the success of projects such as Valley of the Shadow and the Rossetti Archive. Rather than there being a single center for digital scholarship, several organizations offer expertise in areas such as spatial humanities, XML, programming, web development, multimedia, and high performance computing. These include:

- **Digital Media Lab:** Based in the University of Virginia Library, the [Digital Media Lab](#) offers consulting, training, and facilities in digital media, drawing on staff expertise in areas such as “digital imaging, audiovisual production and post-production, physical interactivity, 2D/3D animation, mobile technologies, as well as visualization and delivery of media content.”
- **Institute for Advanced Technology in the Humanities (IATH):** Founded in 1992, [IATH](#) supports the integration of information technology into humanities research by offering consulting and technical support. Through its longstanding fellowship

program, IATH partners with faculty in developing scholarly projects, working intensely with them in conceptualizing and implementing projects.

- **Scholars' Lab:** Based in the University of Virginia Library, [Scholars' Lab](#) grew out of three previous centers at UVA, the Electronic Text Center, GeoStat Center, and the Research Computing Support center (Nowviskie 2012). Scholars' Lab faculty and staff consult with advanced students and researchers on projects in GIS, digital humanities, and scholarly making. Through its Praxis Program, Scholars' Lab offers a year-long paid apprenticeship in which a cohort of graduate students, mentored by staff, collaborate to develop a digital scholarly resource, in the process learning how to design and manage projects, program, create user interfaces, communicate online, and more.
- **SHANTI:** Sciences, Humanities & Arts Network of Technological Initiatives ([SHANTI](#)) provides a "digital ecology" to support the integration of information technology into research and learning across the university, offering tools and expertise for web publishing, media management, visualization, and more.
- **UVACSE:** University of Virginia Advanced Computing Services and Engagement ([UVACSE](#)) provides consultation, education, and technical expertise in support of high performance computing. Staff assist researchers in realizing computationally intensive projects, such as through optimizing code and developing programming solutions. UVACSE also offers a High Performance Computing (HPC) bootcamp.

Wuhan University, China

The Digital Humanities Research Center at Wuhan University was [founded in 2011](#) to facilitate interdisciplinary communication and collaboration across the fields of library and information science, digital publishing, text mining, information retrieval, GIS, digital cultural heritage protection, social network analysis, digital assets management, Chinese literature, and history. The center is part of the country's preeminent [School of Information Management](#), but researchers and faculty are drawn from interdisciplinary fields within Wuhan University, so it is unique in being a virtual research center. The center has contributed to the spread of digital humanities in China through its notable research and scientific communication activities.

APPENDIX 2:

Sample Interview Questions

Note: Not all of these questions will necessarily be asked, and others may be added.

Questions for Center/Program Leaders and Staff

1. What is the mission of your center/ department/ program?
2. What do you think are the key elements of the success of your center?
3. What challenges does your center face in accomplishing its mission?
4. What kind of services and programs does the center offer? Why does it focus on these areas?
5. What competencies and skills do your staff members currently have? What competencies and skills do you wish they had?
6. What incentives and support do staff receive to pursue professional development?
7. What sort of training and educational programs does the center offer to faculty, staff, students, and the larger community? What impact have these programs had?
8. How would you describe the center's culture? How does the center's culture contribute to the ability of staff, faculty, students and the larger community to generate ideas, develop expertise and share knowledge?
9. In an ideal world, what kind of programs would you like to see both in and beyond the university to help people develop their skills and knowledge in digital scholarship?
10. Where do you see your center going in the future?

Questions for Researchers and Students

1. Tell us about your current digital scholarship project(s). What are the project's goals?
2. What methods are you using in developing the project?
3. What skills and knowledge do you need to have in order to advance your project?
4. How have you developed these skills and knowledge?
5. How has the center helped you develop your skills? What support has been most important? Is there support you wish they could provide?
6. To what extent has your academic training prepared you to do digital scholarship?
7. What training programs have you participated in or outside of the university? How effective were these programs?

Questions for Leaders of Educational Programs

1. How do you approach developing digital scholarship curricula? What should students learn in the course of a digital scholarship graduate program? Undergraduate program (if applicable)?
2. What skills and knowledge do you need in order to advance your own work? How have you developed such skills and knowledge?
3. Are there any core competencies that digital scholars should demonstrate?
4. What are effective approaches to developing necessary skills and knowledge to do digital scholarship work?

Questions for Administrators

1. Why has your unit invested in support for digital scholarship? What role does digital scholarship play in your unit's strategic vision?
2. What do you think are key elements of the success of digital scholarship programs at your university?
3. How have the university's digital scholarship programs changed over time?
4. What challenges has the university encountered in trying to develop its digital scholarship programs? How has it addressed these challenges?
5. What skills and capacities do you think are important to digital scholarship?
6. How does your unit help faculty develop the skills they need to pursue digital scholarship? What about staff? Students? How do these approaches vary according to professional role, discipline and other factors?
7. What incentives and support does the university provide for staff to develop their skills and knowledge in digital scholarship?
8. How are skills gaps identified and addressed?