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Cover Page Footnote
This paper and the research behind it would not have been possible without the support of my Certificate of Advanced Study program advisor, Dr. Linda C. Smith, at the School of Information Sciences, University of Illinois at Urbana-Champaign, and the contributions of the project team members, Dr. Steven B. Miles and Miss Chang Xu, at the History Department, Washington University in Saint Louis.
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Introduction

Digital humanities have evolved over the past half-century from the initial emergence of humanities computing in 1949 to the latest accommodation of communication and Internet technologies. The kernel of digital humanities is an application of a variety of computer technologies under the umbrella term of “digital” into humanistic pedagogy and research. Digital humanities are academic and innovative in nature and interdisciplinary in scope. The innovative nature of digital humanities, in particular, the core undertakings of digital humanities, the digitization, analysis, and visualization of sources and data, relieves humanistic scholars from laborious work, and more importantly, introduces a quantitative approach to the conventional humanistic inquiry that largely relies on sources and is mostly case-based. Digital humanities not only mean computational tools but also “methodological focal points.” (Schreibman, Siemens and Unsworth 2004).

Libraries, in particular, academic libraries, are naturally tied to digital humanities because of their commonalities in the mission, key activities, core competencies required, and the collaborative nature of their work. Libraries and digital humanities both have a long-term mission to preserve cultural and historical heritages and therefore exhibit similar activities such as collecting, organizing, and providing access to resources (Vandegrift and Varner 2013). It seems natural for academic libraries to extend library services to digital humanities to support the educational and research activities of their parent institutions. The survey conducted by the Association of Research Libraries in 2016 revealed that 59% of its 124 members have been involved in digital scholarship in some way (Mulligan 2016). Academic libraries establish partnerships with digital humanities initiatives on campus through the approach of infrastructure and/or services in a purposeful, organic, or serendipitous way (Elliott et al. 2015). A variety of cases reported that public service librarians and technical service librarians (catalog and metadata librarians) are more
frequently involved in digital humanities projects through their public-facing roles or unique skills (Bryson et al. 2011), in addition to digital humanities/GIS librarians and IT professionals.

This report details the collaborations of a Chinese Studies Librarian with a faculty member and a Ph.D. student from the History Department, Washington University in Saint Louis, in the 2019 Humanities Digital Summer workshop jointly offered by the Interdisciplinary Project in the Humanities and the Humanities Digital Workshop on campus. The project is a visualization of social connections and geographic movement of Xie Lansheng, a well-known litterateur in the Qing dynasty, using Gephi and ArcGIS. I hope that the visualization project detailed in this report will trigger more interest in digital humanities and lessons discussed will inspire other subject/liaison librarians and provide indications for the development and implementation of a scalable and sustainable digital humanities program.

**Conceptual framework**

Digital humanities, advocated as “the first next big thing in a long time” by William Pannapacker (2009), are at the intersection of computer technologies and humanistic disciplines. As an interdisciplinary field, it refers to the application of a variety of computer technologies under the umbrella term of “digital” into humanistic pedagogy and research. Digital humanities are academic and innovative in nature and interdisciplinary in scope. Sula (2013) pointed out that digital humanities not only focus on “the application of computing technologies to humanistic inquires” but also on “humanistic reflections on the significance of that technology.” The Association of Research Libraries investigated the participation and support of members to digital scholarship in 2016 and defined digital humanities as “an emerging field which employs computer-based technologies with the aim of exploring new areas of inquiry in the humanities” (Mulligan 2016, 2). Kirschenbaum (2010) gave a more explicit explanation of specific practices of digital humanities. Digital humanities processes sources/artifacts in electronic format including investigation, analysis, synthesis, and presentation, and studies the impact of these media on humanistic disciplines, and the contribution of humanistic disciplines to our knowledge of computing. Vandegrift and Varner (2013) emphasized that digital humanities have an invigorating effect on humanistic scholarship. Digital humanities transform humanistic teaching by connecting students to course materials in multiple and exciting ways, revolutionizes scholarly publishing by making previously hard-to-find resources and scholarship accessible to the public, and renovates the research by investigating digital resources using sophisticated programming or data visualization tools.

The humanities study aspects of human society and culture and differentiate itself as one of the fundamental branches of knowledge from science and social science in two important dimensions: sources of evidence, influences of social and cultural conditions, and ethical value on the questions asked (Kagan 2009). Gardiner and Musto (2015, 15) pointed out that humanities study human behaviors and cultures “as created and manifested in and by individuals as opposed to the natural world or the broad patterns of human society”. Humanists would attempt to offer a model of the "real world" created by individual humans
as close as possible for a research purpose, and the “real world” is represented in historical and cultural records. Digital humanities inform humanistic inquiry mainly via “digitization” and “application tools,” in particular, on sources and an interpretation of sources. Gardiner and Musto (2015) generalized digital tools as software applications for the analysis, manipulation, and presentation of data, and grouped them into five types based on sources being processed and desired outputs or results: Text-based tools, data-based tools, image/sound-based tools, video/audio processing tools, and outcome-based tools. A variety of digital humanities applications, platforms, or tools could be encapsulated into the three core undertakings: Digitization, Analysis, and Visualization. The digitization provides wide and remote access to resources and also preserves historical and cultural heritages; and the analysis or visualization add values to digitized sources (Vandegrift and Varner 2013). The analysis screens pieces of sources and illuminates relationships/structures and patterns; and the use of technologies advances the accuracy, consistency, and objectiveness of results. The visualization of sources or data, in particular, the use of three-dimensional and virtual reality technologies, contextualizes sources that have historical background or temporal and spatial context. It provides a virtual experience and also enriches details, and all these could convey their cultural and historical information or enhance their intrinsic artistic or aesthetic values. The three core practices of digital humanities have been dramatically changing the way that humanistic scholars gather, organize, analyze, and interpret sources of evidence, as well as disseminate findings. Wang (2010) commented that digital humanities have transformed conventional empirical humanistic research by introducing a quantitative approach to process a large scale of sources to generate repetitive or applicable patterns or models. Schreibman, Siemens and Unsworth (2004) pointed out that digital humanities not only mean computational tools but also “methodological focal points.”

Libraries, in particular, academic libraries, are naturally tied to digital humanities because of their commonalities in terms of the mission, key activities, core competencies required, and the collaborative nature. Libraries and digital humanities exhibit a similar nature as a cultural heritage institution or an interdisciplinary field. Each in their own way, they both have a long-term mission to preserve cultural heritages and therefore exhibit similar activities. Vandegrift and Varner (2013) commented that while libraries and humanities have always had a great deal in common, one distinguished commonality is that they both preserve our shared, collective memory, and therefore are tasked with similar activities, such as collecting, organizing, and providing access. Showers (2012) highlighted five overlapping areas between digital humanities and libraries: Managing data, “embedded” librarianship, digitization and curation, digital preservation, and discovery and dissemination. Sula (2013) compared the five most common topics in digital humanities that were identified from the 2005-2012 Library, Information Science and Technology Abstracts, with competencies of librarianship recommended by the American Library Association in 2009; and concluded that digital humanities engagement are similar to the core competencies concerning information resources (digital resources), knowledge organization (cataloging and metadata), and technological knowledge and skills such as content management and user services. She examined the “service-oriented” nature inherent in the locations and activities of digital humanities centers and interactions with libraries and positioned digital humanities work within the user-centered paradigm of library and information science.
Academic libraries extend library services to digital humanities to fulfill the mission “to support the educational and research activities of their parent institutions through the provision of collections, services, and user education” (McDonald and Levine-Clark 2017). Libraries partner with digital humanities through the infrastructure and/or services, for instance, establishing a dedicated digital humanities space/center in a library and/or providing digitization, consultation and pedagogical services, and project collaboration (Zorich 2008; Vinopal and McCormick 2013; Melton 2016; Wong 2016). Courtney and Dallis (2015) summarized three overarching partnering models: “Embedded in existing library services,” “Librarians on DS project teams,” and “Building expertise,” based on a survey of public service directors of members of the Committee on Institutional Cooperation, a consortium of the Big Ten universities. Elliott et al. (2015) conducted an environmental scan of 16 benchmarked peer libraries of the University of Arizona Libraries which revealed that the majority adopted the “extension” model to support digital humanities, such as the extension of liaison and research services, development of digital humanities resources and subject guides, and repository services. The authors also highlighted the visibility of partnerships, for instance, a visible advisory or leadership role, dedicated digital humanities librarians, detailed digital humanities subject guides or websites, or campus-wide events such as a symposium or conference.

Librarians have honed some skills required in digital humanities. In addition to functional specialists, such as digital humanities/GIS librarians and IT professionals, providing core technical support, public service librarians (subject librarians, research and instruction librarians, and special collection librarians), and technical services librarians (catalog and metadata librarians), are more frequently involved in digital humanities initiatives on campus (Bryson et al. 2011). The involvement of metadata librarians ensures the integration of the metadata principles and methods into the infrastructure needs of digital humanities projects and enhances the accessibility of the outcome of the project such as a website or repository. Public service librarians extend their research/reference or instruction services to digital humanities via their public-facing or liaison roles; they more likely act as leaders to advocate or connect campus needs to library services. Jaguszewski and Williams (2013) and Auckland (2012) examined the role of liaison librarians in the transformation of higher education empowered by rapidly changing technologies and advocated an engagement model to better understand and support the evolving research, instruction, and scholarly communication needs. A transformation to the engagement model requires a reskilling of liaison librarians and collaborations between liaisons and functional specialists. Liaison librarians “must be knowledgeable, confident, proactive, and politically savvy” (Jaguszewski and Williams 2013, 16). A variety of cases demonstrated the participation and value of subject librarians (Cordell et al. 2015), metadata librarians (McFall 2015; Hoeve, Pankl, and Crosby 2015), and instruction librarians (Mourer 2017; Powell and Kong 2017) in digital humanities initiatives. Corlett-Rivera (2017) described her experience as a subject librarian to lead a cataloging and digitalization project of French pamphlets that led to the creation of a Digital History website. The author recommended leveraging skills and network, seeking training opportunities, being prepared for role shifting, and proactive communication and marketing; and more importantly, looking at these digital projects as a further development of our subject expertise and an amplification of our outreach efforts.
Xie Lansheng visualization

Campus scan
Washington University in Saint Louis (WashU) is a medium-sized private research university with approximately 15,000 students and 3,890 academic staff, and billions of endowments. The University has developed a conducive campus atmosphere on humanistic pedagogy and research. The School of Arts and Sciences, and the Sam Fox School of Design and Visual Arts, offer extensive programs in humanistic disciplines, such as literature, history, anthropology, religious studies, philosophy, art history, area studies, language learning, film and media studies, and performing arts. The Interdisciplinary Project in the Humanities (IPH) offers undergraduate interdisciplinary programs (major and a Text and Tradition minor) with a focus on the canonical texts in European and American literature, philosophy, history, and arts. The Center for the Humanities offers internal funding opportunities to enhance the ability of faculty to compete for external funding opportunities with a mission to facilitate humanistic research by nurturing innovative research and transformative pedagogy. Relevant programs have offered digital humanities courses. For instance, The IPH offers Introduction to Digital Humanities, Data Manipulation for the Humanities, Data Science for the Humanities courses, and internship and practicum in digital humanities. The American Culture Studies and English Literature programs both offer the Introduction to Digital Humanities, and the Anthropology and Archaeology programs both offer introductory and advanced GIS courses. Faculty have strong research backgrounds and interests in digital humanities and have been constantly funded by research grants from the National Endowment for the Humanities.

The Humanities Digital Workshop (HDW) on campus offers project consulting and support for faculty to pursue digital methodologies in their research and pedagogy, and it also provides students with opportunities to participate in research projects led by faculty. Every summer the HDW offers summer fellowships for students to work along with faculty on digital humanities research project; and the summer project work can count toward the 3 units of research requirement for the graduate certificate or undergraduate minor in Data Science in the Humanities, which is home-based in IPH. The summer fellowship requires eight weeks (30 hours per week required for undergraduate students and 20 hours per week for graduate students) of on-site project work. Project teams comprising students, faculty, and librarians, are formed based on the interests and expertise of team members. The 2019 summer workshop ranged from June 3 to July 26 and involved a large group of 14 faculty, 3 librarians, 11 graduate students, and 9 undergraduate students. The Xie Lansheng project team was one of the groups that comprised the Chinese Studies Librarian (me), a Ph.D. student, and a faculty member from the History Department.

The WashU Libraries are a large academic library system with 5.5 million volumes of collection and multiple distributed libraries. Among the five administrative divisions of the library system, the Digital Scholarship and Technology Services governs the digital scholarship services (data services librarians and IT professionals); and the Special Collection Services (special collection curators), and Research and Academic Collaboration Services (subject librarians), are involved in the services and activities. The digital scholarship services and partnering model have been developed in a purposeful and organic
On the one hand, subject librarians and special collection curators have extended their liaison services and have actively participated in digital humanities projects; and the network with faculty, students, and campus specialists has been established. On the other hand, new librarian lines, such as Humanities Data Curator, Data Visualization Specialist, Digital Preservation Librarian, and Repository Services Manager, have been created to support the digital scholarship services. The current digital humanities services are primarily hosted in the Data Services unit. The Unit, with five full-time specialists, provides a variety of data services such as GIS, text mining, network analysis, data analysis and visualization, virtual reality, and data curation and management. The Unit also offers GIS teaching in the University College. The research studio managed by the Unit is equipped with computer workstations and application software and is a campus hub that provides consultation services and digital tools training.

**Project background and process**

The Xie Lansheng project is funded by a research grant and led by Dr. Steven B. Miles, Professor of History and International and Area Studies, at the School of Arts and Sciences. Xie Lansheng (1769-1831) is a well-known litterateur in the Qing dynasty and he has been titled a scholar, artist, poet, and gentry in Chinese literature (Li 2014). A significant role he played was as the chief compiler of the Guangdong Provincial Gazetteer (廣東通志). In his entire life, Xie Lansheng had been in charge of several ancient academies (書院) in different areas of Guangdong Province; he had wide social connections with many public figures, such as governmental officials, gentry, litterateur, artists, and monks. Xie Lansheng left behind a precious diary manuscript, Changxinxing Studio Diary (常惺惺齋日記), which recorded 11 years of his daily life from Jiaqing 24 (1819) to Daoguang 9 (1829) including his work in ancient academies, travels, and social activities. The diary also depicts the cultural and scholarly activities during this time (the eve of the Opium War) in Guangdong Province.

![Figure 1. Project process and key steps.](image-url)
The expected outcome of the project is a website implemented with the diary manuscript, its English translation, graphical visualization of his social connections and geographic movement, his family tree, and additional research resources. The website will serve as a pedagogical resource as well as a research tool with source data and data visualization. The visualization component is to visualize the social connections and geographic movement of Xie Lansheng from 1819 to 1829 based on his 11-years diary. The visualization project has been part of the HDW summer fellowship since 2017. The previous two years have completed the data processing and visualization of Jiaqing 24 (1819) and 25 (1820). The 2019 project team with a Ph.D. student and the Chinese Studies Librarian worked on the year of Daoguang 5 (1825). Figure 1 illustrates the 2019 project work process and key steps. The project started from the data transcription and encoding in a spreadsheet, data conversion to CSV format, to the visualization of social connections and geographic movements respectively using Gephi and ArcGIS.

**Date source and encoding**
Data were transcribed and encoded from the printed diary, Changxingxing Studio Diary (常惺惺齋日記) edited by Li Ruoqing and published by Guangdong People’s Publisher in 2014, checking against the diary manuscript when in doubt. Figure 2 illustrates an alignment of a page of the diary manuscript and the corresponding printed page. The diary was written in formatted pages with lined columns for the mornings and afternoons, respectively, on a specific date (in the traditional Chinese calendar date). Xie Lansheng narrated his daily activities in columns set for particular time periods. Numbers on the top of the page were the incomes he earned on the day. The manuscript was consulted in terms of words or punctuations when encountering difficulties in understanding the narrative context or interpreting the data.

![Figure 2. Diary manuscript vs. the printed diary.](image)

The data spreadsheet contains six core data elements and structures: Date (Lunar/Gregorian date), Season/weather, Participant, Event/activity, Direction, and Place. The six core elements were identified based on four broad questions to be answered in daily narratives: when, who, where, and what, and to build connections between Xie Lansheng and people via events/activities or places. In particular, the element of “activities” is subordinate
to “event” and applicable to more than one activity (participant) in an event. The following is an event example on February 2 (March 21, 1825):

徐春帆来午面，携到包孝廉昚伯名世信書一函

*Xu Chunfan came for noon noodles, and brought with him a letter by Bao Shichen*

In the example, the event of “visit” involved two activities, dining and receiving a letter; and two participants: Xu Chunfan and Bao Shichen.

The following fundamental rules were set to achieve a consistency of data transcription and encoding across years:

- Do not transcribe and encode an event or activities that cannot contribute to a social connection or visualization, for instance, not involving Xie Lansheng or two of the three elements, “participants,” “event/activity,” and “place,” are not available.
- The data transcription and encoding should be faithful to the diary. For instance, an event and relevant activities should be transcribed and encoded in a logical sequence.
- Be conservative when in doubt.

Four controlled vocabularies were applied to achieve data consistency and to facilitate data browsing and visualization: Personal/Group names, Geographic names, Direction, and Activities. The first two vocabularies consolidate alternative names to facilitate data browsing and visualization, and the last two are standardized lists for tagging. All the controlled vocabularies require updates and maintenance. In particular, the personal and geographic names authority sheets require reference research.

**Visualization of social connections**

The social connection of Xie Lansheng was visualized using Gephi, an open-source software. The data was converted and processed outside using Python language, including the calculation of communities, betweenness, and K-core; and the node list was imported into Gephi. A variety of social connections could be visualized based on different weights, such as event (one event is considered one connection.), activities, or place, and displayed in a unimodal graph (without weights) or bimodal graph (with weights). Additional attributes can be added to graphs, for instance, participants’ social roles such as monks, officials, or gentry taken from the printed diary (488-501). In specific, four types of unimodal and two types of bimodal connections could be visualized: three unimodal people-people networks (with or without participants’ social roles) based on event, activities, or activities omitting visits respectively, unimodal people-people network with places/activities as edges, and two bimodal people-place networks based on event or activities.

Figure 3 is a unimodal graph that visualizes the social connections between Xie Lansheng and participants with an indication of participants’ social roles, as well as in-group connections among participants. As shown in Figure 3, nodes represent participants; and the colors of nodes indicate the social roles of participants. For instance, the orange node of Xia Xiushu (夏修恕) indicates that he was an official. The size of nodes indicates the scale of the social connection of a participant. Obviously, Xie Lansheng (謝蘭生) is represented by the
largest node. The density of edges that connect people indicates the scale of connections. For instance, Xie Lansheng is connected to his students (諸生) by a dense edge, which means they had very frequent interactions. Figure 4 illustrates bimodal connections grouped by places. As shown in Figure 4, the Yangcheng Studio (羊城書院) is the place which most connected people.

**Visualization of geographic movement**
The geographic movement of Xie Lansheng was visualized using ArcGIS online, an application software subscribed by the libraries. The visualization website includes an introduction, Spyglass, and geographic movement in specific years. In particular, the geographic movement in Daoguang 5 (1825) is visualized by months. Figure 5 shows the first month's data table and Figure 6 shows the visualization in the month. Related places (indicated by dots) with dates will show up by moving the cursor in the time scale. When clicking a specific place, a pop-up message will show up that explains the place and specific activities that occurred on the day.
Figure 3. Unimodal people-peoples network based on "event" with people's attributes.
Figure 4. Unimodal people-place network based on event.
Discussion and conclusion

While following the same project process as before to add one-year data transcription and visualization, a significant contribution of the 2019 project work was a consolidation of metadata and controlled vocabularies, and the refinement of the visualization of social connections and geographic movement. The functional metadata elements set, controlled vocabularies, and data transcription rules that were consolidated in alignment with the
visualization objective maintain the data consistency and also lay a good foundation for the data visualization. For instance, the addition of a new element of “event” to accommodate “activity” provides more dimensions for the visualization of social connections and improves data accuracy. The addition of the two new data elements, “season” and “weather,” provides a potential for data analysis, for instance, an analysis of activities in different seasons or days like “rain” or “dry” days. The introduction of the two controlled vocabularies, Activities” and “Direction,” and the development of data transcription fundamental rules, ensures the data consistency across years. The visualization of geographic movement has been leveraged to a higher granularity level, by month.

The challenges encountered involved data interpretation in the diary context, manual maintenance of controlled vocabularies, and the implementation of advanced functions of data visualization using the two selected application software. An accurate data transcription requires an interpretation of the context in which a relevant event occurred. For instance, on which day an artistic or literary transaction started and on which day it ended. Also, as the author may not explicitly state the names of a person or place in each sentence, an inference or a judgment on the exact person or place is required sometimes. The updating and maintenance of controlled vocabularies require much research as well as subject knowledge. Quite a few incomplete full names still remain in the datasheet and require updates. Due to the limitation of the two applied software, some visualization ideas could not be appropriately implemented. For instance, an association of accumulated weights on activities could not be processed in Gephi when a time interval is added to a social network. The system only takes the last entry in the data table. Also, the current geographic movement visualization shows geographic places with a timeline but would not show the movement direction from one place to another in ArcGIS online.

My contributions as a subject/liaison librarian collaborating in this digital humanities project included data transcription, project design, and a connection to the GIS librarian. I completed the data transcription and encoding for the five months August to December 1825, proposed multiple dimensional visualizations of social connections, introduced the project to the GIS librarian, and built a connection for project consultation and software training. The most significant contribution was an introduction of the concept of metadata, controlled vocabularies, and transcription rules to this visualization project that significantly improved the outcome and made room for future refinement. The major challenges encountered included time commitment and a grasp of programming languages and visualization tools. As a distributed librarian to manage the operations of a distributed library and a subject librarian to perform multiple job duties, maintaining 20 hours per week across eight weeks was a huge challenge for me. I in fact used my own time (every Saturday) to complete assignments. Further activities such as project recap and conference presentations all required extra time commitment. While I had an understanding and basic knowledge of digital humanities, the relevant programming languages and visualization tools were still a challenge for me.

My case of a collaboration of a subject librarian in a digital humanities project further demonstrates the value of library science and the important roles of librarians in this newly emerging field. Library science knowledge and expertise are very useful and librarians can play an important role in digital humanities initiatives on campus in terms of their project
experiences and resources. Faculty and students appreciate librarians’ values and contributions that ensure the success of their projects. Specific expertise and skills applied depend on the individual librarians’ background, experiences, and interests. In addition, my participation in this project as a subject librarian has greatly facilitated my communication and further collaboration with faculty and students in library services, such as research consultations and collection development. The collaborative project and the summer workshop were good opportunities for librarians including subject librarians and GIS librarians to interact with students and faculty, as well as to introduce library services to users and to enhance the library image.

The challenges subject librarians might encounter in partnering with digital humanities initiatives could involve expertise and skills required, time investment, and ultimately, sustainable support. Participation in digital humanities projects require an understanding of digital humanities, subject knowledge including language skills, project management capabilities, and a familiarity with relevant library resources and digital tools, as well as communication skills. To be fully equipped with this expertise and skills could be a big challenge for subject librarians. Life-long learning is a mission and collaboration with other librarians is strongly recommended. Participation in and support to digital humanities projects currently seems an individual choice of subject librarians. A lack of a holistic program, training opportunities, and time investment, could diminish sustainable and constant support to faculty and students’ needs on campus. Institutional and administrative factors such as needs assessment, long-term strategies, permanent staffing, and institution-level motivation and training, need to be in place to provide a partnership for sustainable and scalable services.

References


