[DA-031] GIS&T and Libraries, Archives, and Museums

Abstract

Libraries, archives, and museums (LAMs) are an important part of the GIS&T ecosystem and they engage in numerous activities that are critical for students, researchers, and practitioners. Traditionally these organizations have been at the forefront of developing infrastructures and services that connect researchers and others to historical and contemporary GIS data, including print maps. More recently, as a result of greater interest in spatial thinking and research, these organizations and institutions have become a place for instruction, outreach, and practice. This entry will discuss the historical role that LAMs have played in supporting and developing GIS&T as well as focus on current trends.

Keywords: archives, georeferencing, library, metadata, museum, VGI, volunteered geographic information (VGI)

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Explanation

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1. Introduction

Libraries, archives, and museums all incorporate and utilize GIS, mapping, and related technologies within their respective organizational workflows and through the multitude of ways in which they engage with the public. Many of these organizations now have positions or entire departments that are responsible for stewarding GIS services, maintaining and developing GIS resources, and generally advocating for GIS&T to their communities. Two of the most important areas in which these organizations highlight their work within GIS&T is through their mission to provide access to historical and contemporary geospatial materials (maps, datasets, etc.) that can be used in a GIS and in providing educational opportunities for spatial thinking and GIS skills development. These institutions also highlight how

individual organizations can collaborate and work together with one another to provide access to GIS data, archival materials, and even educational resources.

A unique aspect of these institutions is their ability to engage and share GIS&T in ways that are accessible to a broad, diverse, and sometimes specialized group of individuals and communities. All of these organizations have vibrant and active lifelong learners as part of their user communities. As a result, for many people their first exposure to geospatial thinking and tools (beyond mainstream applications such as popular mapping platforms like Google Maps) is through a library or museum. Because of the opportunity to connect with such a wide and varied audience, partnerships with leading GIS providers such as Esri, CARTO, Google, and many others is commonplace within and across these organizations. Moreover, the development and/or prototyping of free and open source tools and technologies often emerge from within these organizations.

One unifying theme across all of these organizations is that they typically maintain historical print map collections that are made available to researchers and the public. These collections provide important context and data for current GIS applications and research. More and more these collections are digitized and converted into geospatial data so that they can be used alongside contemporary GIS data. The role of historical GIS data is significant as researchers and others who are seeking answers to contemporary issues and problems require historical context in order to conduct their research. As a result, new methods and practices are being developed to digitize and enhance historical materials with geospatial information in order to be used as research data. In addition, many researchers who may not belong to fields traditionally associated with GIS are finding valuable ways of engaging with these materials and exploring how spatial methods could impact their areas of inquiry.

Finding relevant and ready to use GIS data has always been a challenge for researchers, organizations, and other interested individuals. Academic libraries have recently made some new developments in creating a unified search engine that provides access to GIS data across multiple academic institutions. Another important area that has received significant attention across all of these institutions is reimagining the role of collections and how they can be used by various academic disciplines and research methods. Some institutions have already considered the importance of including additional metadata for collections, such as latitude and longitude, so that a collection can be placed within a GIS. More and more though a systematic approach to thinking about how collections can be used computationally has emerged through an IMLS (Institute of Museum and Library Services) grant funded initiative, Collections as Data.

Many of these institutions have strong educational programs, including workshops, public forums, specialized databases, and many other outreach opportunities. Through these programs individuals, classes, and other organizations are exposed to GIS&T and in many cases are encouraged to develop skills and knowledge in GIS. In particular, libraries (both academic and public) have played a crucial role in developing robust and collaborative spaces and programming that advance GIS&T. In another area, museums have played an important role in introducing GIS to the public through citizen science programming and other crowdsourcing initiatives. For example, many museums have created and/or provided access to GIS based crowd-sourcing apps that connect communities with their lived-environment and local history. Other organizations, like the Getty Research Institute, have created databases such as the Getty Thesaurus of Geographic Names. Strictly speaking this

is not a GIS database, but as is often the case, this type of resource enriches GIS resources and helps provide a reference point for researching and designating place names, which is an essential part of GIS and mapping.

The relationship between providing access to historical and contemporary geospatial data and a strong mission for teaching and learning situates libraries, museums, and archives as vibrant hubs for GIS&T. Not only can they provide a critical and holistic perspective to understanding the history of GIS&T, but they are at the forefront of new technologies and methods for advancing GIS research. The rest of this entry will highlight a selection of relevant examples and other contributions that show how these organizations help to shape and impact GIS&T.

2. Education

LAMs often provide the first educational opportunities for students, researchers, and community members to interact with and learn more about GIS and related technologies. In fact, some of the most important educational opportunities outside of traditional geography departments or GIS departments can be found through the workshops, courses, presentations, exhibits, and other events that are offered by LAMs. Many organizations have rich instructional and research departments that provide in-depth workshops/courses that not only teach practical GIS skills using tools and software, but also critical approaches to how GIS can be used to better understand a variety of issues, problems, and questions. Public and academic libraries have been at the forefront of developing and supporting instruction around GIS, but museums and galleries have also started to implement rich instructional programming that is featured in exhibits (in-person and online), public presentations, and other events that connect visitors to GIS. One strength that all of these organizations leverage when developing instructional engagements is highlighting and utilizing their cultural and historical collections (maps, photos, archival materials, etc.) in order to show how GIS can be used to better understand a collection or problem. This practical and user-focused approach encourages participation by community members and helps to make the technology and software more accessible to a wider audience. A great example of this is how public libraries frequently hold events that introduce researchers to local collections, such as Fire Insurance maps or other planning maps, within a GIS framework in order to learn more about the current built environment. With freely available tools such QGIS and ArcGIS Online, community members can explore map collections as well as publicly available datasets to learn more about issues impacting their neighborhoods. LAMs are also an ideal space for community members to gather and learn more about the how maps and GIS impact political and social issues through public speaking events that introduce GIS projects and work.

Academic libraries in particular have had a long history in GIS instruction and literacy. In the 1990s ESRI and ARL (Association of Research Libraries) introduced a GIS literacy project and partnered with 30 academic libraries across the country in order to introduce GIS to libraries, develop GIS professionals within library organizations, make connections between GIS communities, promote research and use of government information, and spur library projects that could harness GIS technology and methods. More recently the Association of College and Research Libraries (ACRL) implemented a Framework for Information Literacy for Higher Education. The Framework provides six frames that consist of core information

literacy concepts. GIS and other librarians have worked with this frame to consider how to better provide instruction in more specialized areas of librarianship, such as data and GIS. One of the more important outcomes of the Framework has been to consider information literacy holistically and as a result GIS information literacy has been incorporated throughout the library, including in traditional areas such as supporting writing programs and within specialized collections.

In addition to purchasing books, GIS datasets, and other materials related to GIS&T, libraries also subscribe to powerful databases that provide access to GIS data and easy to use tools that allow users to create and share maps. As a result, many academic libraries (and some public libraries) provide workshops and other learning opportunities that introduce researchers to these tools. Databases such as SocialExplorer, SimplyAnalytics, PolicyMap, dataplanet (SAGE), and others provide access to an incredibly deep and rich collection of data that can be used in GIS. Moreover, databases such as SocialExplorer and SimplyAnalytics provide interactive web maps that allow users to explore and visualize data. These databases can be used by almost any researcher and with minimal to no previous GIS training. Through these workshops active GIS user communities are supported by the library and further connect users to other library materials that could be used within a GIS. In addition, because of the expertise and infrastructure available within libraries, events such as mapathons, are frequently held within these spaces.

3. Access to GIS Data

The accessibility of GIS data to researchers, students, and public citizens continues to be one of the most important areas in which LAMs develop resources and services. Many LAMs actively create, acquire, and curate spatial data across a range of disciplines. In addition, LAMs have become trusted repositories for GIS data for academics and non-academics alike.

In particular, libraries have played an important role in engaging with GIS&T and developing tools, data portals, and other services that have made GIS more accessible to their respective communities. In particular, providing access to GIS data has always been a primary concern for libraries, especially academic libraries. Purchasing, storing, and sharing GIS data is a challenge for many libraries because data often falls outside of traditional print and electronic resource purchasing. Many datasets have significant restrictions on how they are to be used by researchers which runs counter to library collection development plans which require accessibility to materials for all patrons affiliated with a University and even outside of the University. For many libraries that has meant emphasizing the discoverability of datasets and then mediating their access as necessary. As traditional content has shifted to digital formats libraries have been able to adapt and create better infrastructures and policies for geospatial data. Likewise, geospatial data vendors have also made their data more accessible in order to meet the restrictions of library acquisition departments.

Libraries have begun to strategize how to create research portals that search across multiple libraries and institutions. GeoBlacklight is a multi-institution open source project that is focused on finding and sharing geospatial data. Institutions must still host their own data but this project enables institutions to make their data accessible beyond their own

communities. Importantly the project allows for institutions to collaborate on creating metadata for geospatial data thereby improving discoverability and making the metadata creation process easier, faster, and more accurate and reliable. The search itself allows users to perform traditional keyword searchers or utilize an interactive map that filters data availability by geographic location.

4. Georeferencing and Historical Maps

One specific use case that is worth taking a closer look at within the areas of education and access to GIS data has been the practice of georeferencing (see, e.g., Historical Maps in GIS, Georeferencing and Georectification, and Aerial Photography: History and Georeferencing). The ability to look at and interact with high quality scans of georeferenced historical maps has transformed academic research and introduced basic GIS tools and methods to the public. The David Rumsey Map Collection (now at Stanford University) and the New York Public Library are two institutions that are particularly well-known for their work in this area and have developed a rich set of resources for engaging with their print map collections. In particular, both organizations have created easy to use georeferencing tools that have introduced the process of georeferencing to the public. Through simple web map interfaces individuals can select historical maps, be guided through the process of how to georeference them, and then be able to see the maps overlaid on a contemporary map.

Taken together these two institutions currently have over 50,000 georeferenced maps that can be viewed and used by researchers in their own projects. The use of georeferenced maps is one of the primary ways that researchers and the public first engage with GIS software and see how a GIS can provide valuable insights into better understanding space and place. These georeferencing platforms also provide users with a concrete example of how crowdsourcing and volunteered geographic information can benefit public research. The georeferenced maps are made available to a broad community of researchers and other members of the public and promote the use of these collections.

5. Citizen Science

Volunteered Geographic Information and crowdsourcing of data has become a ubiquitous part of the GIS&T ecosystem. Museums have played an important role in introducing this work to the public and enabling people to contribute to projects ethically and responsibly. In particular, they have played a vital role in developing projects that harness GIS technologies that explore the built environment and our relationship to it. Helping to utilize and develop tools such as the iNaturalist app, museums have introduced basic GIS concepts and methods of how to collect and share data spatially. For example, the L.A. Nature Map at Los Angeles's Natural History Museum is seamlessly integrated into a permanent exhibit that is focused on local urban nature and community science. This project asks museum visitors to understand their experience with nature spatially and also lets them easily see how VGI can help build an important shared educational resource. There are numerous examples of museums harnessing GIS technology in order to collaborate and partner with their patrons in this way. In the process, relevant datasets are created for researchers and the public alike.

6. Archives

Archives are often situated within libraries and museums or in some cases are their own independent entity. Archives play a special role in preserving historical materials and specialize in documenting materials in a way that captures their historical significance. Some of the most significant and important historical maps of record are housed in specialized archival spaces that preserve these materials but also provide access to researchers. One example of such a space is the Sanborn Fire Insurance Atlas Collection at California State University Northridge which provides access to one of the largest Sanborn map collections in the world. These maps are fragile, difficult to use because of their size and weight, and require special facilities for storage and accessibility. An archive provides the opportunity for researchers and the public to interact and use these maps while at the same time ensuring that they will be preserved for future generations. More recently, important work within the GIS&T community has focused on the incredible amount of data that is located within a historical map. Using special methods and digital processing historical maps are not only being digitized for use as georeferenced maps, but layers of additional data are also being processed creating complex geospatial objects that can be used by a diverse research community as well as the public.

7. Collections as Data

A recent development that links together libraries, museums, and archives is Collections as Data, the Institute of Museum and Library Services' grant funded initiative that is focused on the computational possibilities of traditional collections at these institutions. At its core, Collections as Data advocates for how institutions can help to provide access to their collections, regardless of format (maps, books, photographs, etc.), so that they can be used outside of traditional research and with computational tools and methods. In the traditional model, most archival and special collections (which maps are often a part of) are used by researchers on an individual and case by case basis. Sometimes a researcher will request and use an entire collection but the mediation and access to these materials is still difficult, time-consuming, and oriented to looking at and working with individual research objects. Collections as Data leverages already existing metadata or creates new workflows for working with a collection at scale. The implications for GIS&T are important as one of the simplest ways that collections can be turned into data is by adding latitude and longitude data to an individual record. Geolocating a collection immediately transforms how it can be used for research, showing connections and relationships across space that might have otherwise been harder to see. An exciting result of this work is that many collections can now be used in novel and exciting new ways, especially by researchers and others in a variety of different fields.

8. Conclusion

Libraries, archives, and museums play a critical role within the GIS&T community. They facilitate a range of programs and services including education, advocacy, providing access to GIS data, and preservation of archival materials and GIS data. They have developed

frameworks for how to work with GIS data and technologies while providing support for GIS researchers through their countless collaborations and willingness to work across institutions. A shared commitment to GIS&T across these institutions provides a model for how to develop, share, and advocate for GIS programs, services, and spatial thinking more broadly.