Improving GIS Consultations: A Case Study at Yale University Library

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Abstract

For the last decade and a half, Geographic Information Systems (GIS) services in academic libraries have been developing, and GIS librarians have been experimenting with different ways to provide these services. However, there has been virtually nothing in the literature with respect to GIS consultation statistics. One goal of this article is to discuss a four-year case study on the use of GIS consultation statistics to give a better understanding of what GIS librarians might typically expect as far as number of patrons, their characteristics, amount of time spent with them, and the amount of data distributed to them while running a GIS service at an academic library. Techniques for reducing the amount of time spent with patrons while developing a higher degree of efficiency and effectiveness in conducting GIS consultations will also be explored. Finally, a juxtaposition of GIS consultations with other types of library reference services will reveal significant differences between them.

Introduction

What kind of workload can a Geographic Information Systems (GIS) librarian expect from GIS consultation services? How much time will he or she be spending on this activity, or what average amount of time will they spend on a single consultation? How much data will they be distributing to patrons on average? What can be done to make consultations less time-consuming and more efficient and effective? Answers to these questions will be explored through the use of GIS consultation statistics that have been collected for a four-year period at the Yale University Library Map

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Collection GIS Service. However, a brief review of the current literature on reference statistics will prepare us for this exploration.

With the progression of digital technology over the last decade and a half, librarians have been able to provide patrons with access to a larger array of digital data and information more rapidly and have used electronic sources more often for reference (Cardina & Wicks, 2004). This progression has allowed an increase in the capability of what can be provided through reference, but it has also created an increase in the demand for reference information via these new technologies (Tenopir, 1998). Even though the number of reference interviews has decreased during this time, they now take longer (Mayfield, 2000; Warner, 2001).

Even with an evident trend toward providing reference for digital services and content in academic libraries, there is not much in the library literature on detailed statistics for reference services. Spencer and Dorsey (1998) identify total and average times for reference interviews broken down by affiliated and nonaffiliated patrons for an Arizona State University West study over the span of a year with one week a month selected randomly for data collection. They cite an overall mean of five minutes per patron and identify reference exceeding eleven minutes having occurred only 27.2 percent of the time. Most other studies had smaller samples and even less distinction among types of patrons.

The library literature for GIS reference in particular was even sparser. Kinikin and Hench (2005) present a weekly GIS service utilization table based on a survey of eleven libraries; the survey identifies one GIS user per week for four libraries, one to two users per week for another four libraries, no libraries with three to four users a week, and five or more users for one library. This fails to provide a clear picture of different types of GIS users and the actual time spent on consultations. This article will reveal more detailed statistics for GIS consultations based on a case study at Yale University Library. First, however, a preliminary review of the differences between GIS consultations and other types of library reference is warranted to set the stage for understanding these statistics.

It can be argued that the growth of digital technology has had a greater impact on GIS services in libraries compared to other emerging services that incorporate electronic resources since GIS depends completely on this type of technology. It follows that GIS reference or consultations can be much more involved and time-consuming not only because they completely depend on computer technology but also because of the more complex structure and variety of GIS software and geospatial data.

Robust GIS software is not as simple to use as a software program that may display a textual source of information such as a digitized journal article or a raster image such as a digital photograph. Patrons must learn how to interpret spatial data and create information from this data via manipulation through GIS software. This software can contain hundreds

of tools, extensions, and additional scripts that can potentially be used to manipulate GIS data. This means that a GIS reference librarian must take into account a much broader range of service issues when conducting consultations for patrons, which add significant challenges that exceed those of general library reference.

These challenges include first and foremost providing training for patrons to enable them to use the GIS data they acquire. GIS software has a steep learning curve and takes an individual with a variety of abilities to successfully employ the technology (Deckelbaum, 1999). For robust GIS software such as ArcGIS, it can take a minimum of fifteen hours just to learn the basics. There are also many different applications of the software that span many different disciplines. Simply knowing what specific tools can do in the software does not necessarily or easily translate into knowing what spatial methodology to apply for specific disciplines. As a result, patrons can easily spend thirty or more hours just learning enough of the software to tackle a significant research project. Thus, the GIS librarian is required to possess a substantial skill set in order to be an effective reference librarian or consultant. This skill set includes familiarity with GIS software in many disciplines, available training courses or tutorials, sources of additional or extensible GIS software, and hundreds of software and application books.

Another challenge is training patrons on how to manipulate GIS data through processing tasks such as file format conversion, re-projection, and geo-processing. Information is often created and developed by these processes, unlike a published book or print map that has already been turned into information. So simply having the data in hand—or in this case, on digital media—often does not provide a patron with enough to glean any substantial information. Having more data layers that are spatially synchronized will better enable patrons to garner more information and perform deeper analysis. For the GIS librarian, this again requires a substantial skill set—in this case, skill in data manipulation. It is often the case that most of the time patrons spend utilizing GIS as a tool for their research project is spent manipulating GIS data.

The third and final significant challenge is providing the patron with training in information management. This challenge may well be a significant part of general library reference as well, particularly with those who handle digital data or information. However, GIS patrons often collect tens of layers of data, which can be manipulated several times. For some GIS data formats, one layer can be composed of up to eighteen different files organized in multiple folders. This can result in hundreds of files that need to be managed and whose structure must be understood, even if a patron is only using as little as ten layers. The patron must also understand at least the basics of geodesy (coordinate systems and projections) and its relationship to the organization and display of their layers. This can be a

very difficult topic to teach to patrons who have no background in geography. If patrons do not acquire data management skills, particularly for large projects, they could lose track of layers they had manipulated, end up with layers that are not spatially synchronized, and potentially waste hours of time trying to locate specific layers.

These additional significant challenges that are part of GIS consultations affected the resulting statistics that were collected at Yale University Library, mostly by adding a significantly longer amount of time to the average GIS consultation.

Description of Yale University

Before analyzing the GIS consultation statistics that have been collected, a description of Yale University and its library will provide a better understanding of the results. The environment in which the following statistics were collected certainly does not fit the mold of every university, as different universities may have different models of service, which may vary according to the expertise of staff and level of service it provides (Deckelbaum, 1999). However, this sample study may at least offer librarians providing GIS services a general guide on what can be expected for GIS consultations.

In the four-year period of the study, which spans from July of 2001 to June of 2005, Yale University had an enrollment of approximately 11,000 students, of which about half were undergrads and the other half graduate students. There were approximately 3,000 faculty and 7,000 staff at the university. The university contained no geography department and only offered GIS courses in two departments—Forestry and Environmental Studies, and Epidemiology and Public Health. There were a few service centers on campus that provided some level of GIS service but not at the comprehensive level provided by the Yale University Map Collection GIS Service. Many of the service centers simply offered lab computers with GIS software or had a collection of a particular type of geospatial data such as Federal Depository data or satellite photos.

Description of GIS Service

The Yale University Library Map Collection GIS Service is responsible for serving all Yale-affiliated patrons, which include students, faculty, and staff. Public patrons are not eligible for GIS Service. The staff of the GIS Service is made up of a permanent GIS Specialist along with an array of constantly changing staff. During the four-year period of the study, the GIS Service has included up to as many as four concurrent student employees, a casual employee, and two clerical and technical employees, all of which were part-time employees. Currently, there is one GIS Specialist, one full-time managerial and professional GIS Assistant, and one student worker.

Due to its location in the Yale Map Collection, the GIS Service had some degree of overlap with the print map collection. This overlap most

often manifested itself in the form of digital scans of paper maps in the collection. However, the Map Collection and the GIS Service were still considered separate services and the statistics collected were applicable to GIS patrons only. One exception was patrons who requested digital scans of maps and who may or may not have had them georeferenced for use in a GIS. Since the GIS Service ran the scanning service, these patrons were added to the statistics.

Statistics Collection Method

Martindale (2004) points out that it is important to keep statistics on GIS consultations because they are useful as a measure of successful service. The Yale Map Collection GIS Service maintains a Microsoft Access database called the Daily Log that is used to track patron consultations as well as other tasks that are performed on a daily basis. It has been in operation since the first day the GIS Service was started on July 2, 2001. It was created for many reasons, but the two most important are to keep track of the patrons being helped (the GIS Service can be involved with as many as thirty consultation projects at a given time), and to formulate statistics to discover trends and make adjustments in the service.

The statistics that have been collected include the time spent not only finding GIS data for patrons but also assisting patrons in the manipulation of this data as well as providing software and information management training. Group instruction sessions were counted as one consultation. For example, if a GIS workshop was given to a class of fifty students, the Daily Log would record it as one consultation. Also, there were cases where a single patron consulted with the GIS Service for more than one GIS project, or several patrons working in a team consulted the GIS Service. Therefore, consultations rather than patrons are described as single entities in the statistics.

Data on consultations were entered daily into the Daily Log on a continual basis. The disadvantage of this was that it took a long time to enter the data, and employees had to be constantly aware of how they spent every minute. However, it has been well worth the time compared to the time that would be spent trying to keep up with and remember the progress of several simultaneous consultations. The ability to be able to profile a patron consultation project at any time on the database and get up to speed with a patron about the current progress of their project makes a GIS service very efficient. Another advantage is being able to have multiple staff members handle a single consultation.

Evaluation of Statistics

Table 1 shows the total and average hours spent on consultations broken down by patron type. It shows that master's students took up the most amount of time with about 30 percent of all consultations. All graduate

Table 1. Time Spent on GIS Consultations by Patron Type, 2001–2005

Patron Type	Total Minutes	Consultations	Total Hours	Percentage of Total Time	Average Mean Time (Hours) per Consultation Project
Faculty	30,070	61	501.17	19.81	8.22
Total Graduate Students	74,413	346	1240.22	49.03	3.58
Masters Students	45,751	291	762.52	30.14	2.62
Doctoral Students	28,662	55	477.70	18.88	8.69
Undergrads	15,524	54	258.73	10.23	4.79
Staff	21,159	137	352.65	13.94	2.57
All Others	10,608	20	176.80	6.99	1.84
Grand Total	151,774	618	2,529.56	100	4.09

Table 2. GIS Consultation by Contact Type, 2001–2005

Contact Type	Total Contacts	Average Mean Number of Contacts per Consultation Project
In Person	1,839	2.98
Email	500	0.8
Phone	164	0.26
All Contact Types	2,503	4.05

students accounted for about half of total consultation time. Given that about half of Yale students are graduates, this appears to explain the statistic. However, while this fact may explain most of this number, the total number of undergraduate consultations (54) was low because undergrads typically do not have time to incorporate GIS in their coursework. Even though they are required to write a senior thesis, which most of the undergrads consulted were working on, there were not as many undergrads working on long-term projects as graduates or faculty. These statistics show that GIS consultations are typically geared toward patrons who have time to work on long-term projects.

Table 1 also reveals that the average amount of time spent per consultation project is about four hours. Faculty and doctoral students typically average about twice as much time per consultation project as undergrads or graduates. This is useful information when starting a consultation project and trying to determine how much time you will spend consulting. You can develop a prepared plan for dealing with each of the different types of patrons.

Table 2 shows what you might expect by way of contact when conducting GIS consultations. The GIS Service averaged about four different visits by patrons overall, most visits being in person. This makes sense, as it is difficult to conduct a consultation over the phone or email unless it is for a specific and quickly solved problem. The highly visual nature of GIS usually requires an in-person demonstration to explain a GIS problem to a patron. This also

Table 3. Time Spent on GIS Consultations by Department, 2001–2005

Department	Hours	Percentage of Total Time
Forestry & Environmental Studies	659.68	26.08
Anthropology/Archaeology	361.33	14.28
Art & Architecture	310.75	12.28
Epidemiology & Public Health	108.73	4.30
Political Science	99.83	3.95
Economics	88.08	3.48
History	138.42	5.47
American Studies	67.80	2.68
International & Area Studies	61.05	2.41
School of Management	34.42	1.36
All Other Departments	599.46	23.70
Grand Total	2,529.56	100

Table 4. GIS Consultation Statistics by Year

	2001–2002	2002–2003	2003–2004	2004–2005	All Years
Total Consultations	114	187	211	162	618
Total Time Spent on all Consultations (hours)	613.71	709.68	844.71	361.46	2,529.56
Average Mean Time Spent per Consultation (hours)	5.38	3.79	4	2.23	4.09

Note: Total consultations for all years do not add up to 674 because there were consultations that overlapped from one year to another and were counted twice in more than one year.

shows that GIS consultations rarely can be completed in one session. The GIS Service has consulted with some patrons in as many as thirty different sessions spanning several months or even several years.

Table 3 shows consultation projects by department and the percentage of time out of the total hours spent on consultations by each department. Clearly, Forestry and Environmental Science, Archaeology, and Art and Architecture have far more users of GIS than any other department. These statistics can be useful in determining for which departments to focus workshops, targeting departments with much potential but little use, or determining the discipline-specific types of GIS resources to collect. It can also be useful in determining the cost share of a GIS software site license for which a department should be responsible.

Table 4 shows the trend over time of the number of consultations along with total and average time spent on them for each of the four years in the study period. It can be seen that the GIS Service saw a steady increase in the number of and total time spent on consultation projects, but the average amount of time spent on each consultation decreased. This can be explained by the initial creation of the GIS Service in 2001. There was no GIS Service in the library prior to July 2001 and it was subsequently built from scratch. As more patrons learned of the service, word spread and the number of consultations increased until reaching a peak in the 2003–2004

period. Around this time, the GIS Service had applied enough efficient consultation techniques and made enough faculty contacts to reach more patrons with fewer consultations by providing more workshops and class demonstrations (as stated above, group consultations were counted as one consultation). This explains the drop in the number of consultations and total time spent on them. Besides these reasons, the experience of the GIS Service for the first three years of the study had a significant effect on increasing the efficiency and effectiveness of consultation projects.

Suggestions for Improving GIS Consultations

One of the best ways to improve the efficiency and effectiveness of GIS consultations is to recognize different types of patrons and have a plan to deal with their particular situations in the most effective manner. The following is a list of the ten most distinct types of patrons that have been encountered at the Yale Map Collection GIS Service in the four-year consultation period, along with suggestions on effective consultation techniques.

The Sleeper

These patrons will initially come in for a consultation in which you spend a significant amount of time consulting with them on how to incorporate GIS into their research. They then show up six months later, never having made one bit of progress. They have not completed any self-paced training you have given them or even looked at or lost any data you distributed to them; they want to start all over again with the GIS consultation as if you were meeting them for an initial visit.

To avoid wasting reference time on the Sleeper, try to gauge how much work patrons are willing to put into utilizing GIS as a tool in their research. Tell patrons that learning to use GIS software will not only take a significant period of time, but data processing, analysis, and cartography can be very time-consuming as well. Try to start off novice GIS users slowly so you do not invest too much consultation time unnecessarily. If they show progress on something small, such as completing an online training course or processing a small set of data, then you can provide continued assistance with more confidence that they will follow through for the rest of the GIS project.

The Data Collector

These patrons want to collect every little bit of GIS data they can get their hands on even if it is not necessary for their research. These are the patrons who want over a thousand census attributes when you are creating a census layer for them or want data that over-expands their study area by an unnecessary amount "just in case" they might need it. Try to get these patrons to focus on their research questions and the specific datasets they will need to answer those questions. It always helps to establish a geographic study area with bounding coordinates with the patrons before rushing into

a data search. Explain or demonstrate to them how long it takes to process or analyze GIS data with a small sample so they have an idea what it will take for larger datasets. You could also just distribute the data they need and show them how to acquire the "just in case" data themselves.

Seeking a Professional Cartographer

Although cartography is an important part of using GIS in research or coursework, it can be a tricky issue when it comes to GIS consultations. Yale University has no geography department or any other department that teaches a cartography course. Therefore, there are not many students or faculty who are familiar with cartographic techniques, particularly with GIS software. However, often the best way to share research that utilizes GIS is through a map.

The Map Collection GIS Service has been dealing with this issue for many years and has developed a policy of assisting patrons with cartography but only to a certain point. You want to avoid patrons with no cartographic background requesting a map be made for them. A professor who wants you to make a map of X, Y, and Z and have it ready by next week as if you were running a professional cartography business, or a student hovering over your shoulder telling you to move a label a few millimeters to the right then a few millimeters back to the left, is not the most efficient use of your time as a GIS librarian. Unless your library has the resources for it, it is best to limit cartographic assistance to specific cartographic techniques. Patrons can consult with you just for advanced cartographic techniques and save your consultation time by learning basic techniques on their own. There are several short online tutorials available for this type of training, such as the Environmental Systems Research Institute's (ESRI) "The 15-Minute Map."

The Enigma

This type of patron is probably common among many types of library reference services. They are the type of patrons who want your assistance but do not want to tell you much about their research, as if it were classified Top Secret. The goal with these patrons is to gain their trust and explain to them that there are certain things you need to know in order to help them. However, there may be cases where they just will not reveal certain types of information. In these cases, it still may be possible to help the patrons with certain consultation techniques. For example, if an archeologist is doing a dig at a sensitive site for which she does not want to reveal the location, but she wants to plot Global Positioning System (GPS) locations collected from the site in a GIS, you could show her how to plot the points using a different set of GPS points or XY data so she can repeat the technique in private.

Don Quixote

These patrons do not realize the limitations of using GIS or acquiring data for their research. Don Quixote will ask for a GIS layer of all the streets in Connecticut in 1930 so he can geocode addresses from the 1930 U.S. Census (which is only available on paper) by next week. Don Quixote will ask for 1-meter color satellite photos for the whole country of Zimbabwe. For this type of patron, it is best to explain the limitations of acquiring or developing GIS data due to time and budget. Make it clear how much time you are willing to spend acquiring or processing GIS data for them and determine if they are willing or even able to spend the rest of the time needed to reach the goals of their project.

The Lounge Lizard

These patrons will try to utilize every possible second of your time to help them with their GIS project. They will call or email you several times a day asking what button to click next in the GIS software. They will pop up in your office without an appointment, even when you are in an appointment with another patron, to ask you a burning GIS question that just can not wait. They hang out in the GIS lab constantly on a computer to be near you in case they have a question (even though there are many labs with GIS software on campus that can be used). They will even ask for help from other advanced users in the GIS lab trying to concentrate on their own projects.

Get these patrons to invest time into learning at least the basic GIS software tools and analysis techniques early in their project. Suggest online training courses such as ESRI's Virtual Campus (if your library uses ArcGIS software) or GIS courses that your university offers. Build a substantial GIS reference collection that includes books on GSI software and applications to provide patrons with other sources of information they can consult besides you. Lastly, build your own GIS tutorials on short, task-based techniques such as georeferencing or geocoding so you can hand patrons a sheet of instructions or point them to a Web site instead of spending many minutes or even hours explaining techniques to them.

Indiana Jones

Lamont and Marley (1998) point out that digital map collections can be modeled on print map collections that are focused on the geographic region in which the institution is located. While it holds true that most patrons will most likely request data for a local area such as New Haven or the state of Connecticut, I have found that a substantial number of patrons at Yale University conduct research all over the world and therefore need data that spans this geographic extent—often at a large scale. Indiana Jones is a patron who is studying yak herds in central Asia or rain forests in Costa Rica, or conducting an archaeological excavation in Syria. It can be difficult to deal with these patrons due to the lack of data available

for their geographic areas of study, which are often third world countries with sparse mapping. You must often resort to supplying satellite images or scanned and georeferenced maps of their area if little or no GIS data can be obtained.

However, these patrons can often still be helped and can also be an advantage for collection development. Although you may not be able to acquire data through normal channels, the patron can often serve as his own resource with a little guidance. These patrons often spend a significant amount of time in their geographic study area, speak the local language, and have made local contacts. You can steer them in the right direction to find the data they need, which may be available from a national mapping agency or a local company only if you are actually physically present in that country and know the right people. Sometimes deals can be worked out so that the patron can acquire a standard dataset for the whole country or region for your GIS collection.

Also, these patrons are often doctoral students who may spend much of their time at their study site collecting their own data via GPS or surveying devices. They can be helped by teaching them how to take their own raw data and make it into GIS layers with which they can perform more analysis. For example, a patron who collects XYZ locations can be shown how to interpolate the data into a high-resolution digital elevation model, which can be further developed into slope or aspect surface layers.

The Sponge

These are patrons who can learn GIS very quickly and have a strong desire to become proficient in using GIS software. They often start out as non-GIS or novice users and quickly soak up anything you expose them to. They finish sixteen-hour online GIS courses in one weekend, familiarize themselves with enough data sources to acquire most or all of the data they need, and consult with you only after unsuccessfully tackling a GIS problem themselves for two hours.

These are highly desired patrons that make your consultations with them less involved. However, after discovering a patron is a Sponge, try to convey to them that they need not waste too much time trying to tackle a GIS problem themselves. A two-hour problem may be answered in a one-minute consultation. It may also be beneficial to consult with them a little longer than normal. The fact that they learn quickly will make them into advanced users in a short period of time. As a recognized advanced user, they may often help colleagues in their department with minor GIS problems or may even end up working for the library GIS service as a student employee.

The Ninja

The Ninja is another desirable type of GIS patron. This is a patron who is already a highly skilled and deft user of GIS. These patrons may have

already taken several advanced GIS courses or may have had several years of real-world project experience with GIS. They often use more than just standard GIS desktop software, utilizing and disseminating GIS data on interactive mapping sites or relational databases. They may have mastered additional software for spatial analysis such as remote sensing, statistical, or Computer Aided Design and Drafting (CADD) software.

During consultations, they usually just need help finding a particular dataset or just need you to purchase one they have already found. However, they may sometimes ask complex questions that strain the limits of your own GIS experience and expertise. Be prepared for the Ninja by having a plan for questions you may not be able to answer immediately. One plan may be to refer the patron to another librarian or faculty member in the area of expertise about which they are asking. For example, if they are asking questions about spatial statistics and this is not your strongest area, you could refer them to a statistics/data librarian or mathematics professor. Another plan could be contacting GIS colleagues or your GIS software vendor, or posting to a GIS listserv. A final solution could be spending the time to figure out a solution to a GIS problem on your own. Try to avoid spending extended periods of time researching an answer to a tough question while the patron is consulting with you in person. This may end up wasting both the patron's and your time. Help the patron with whatever you are immediately able to, and then contact him later to set up another appointment once you have had time to research the question.

The Philanthropist

This patron can be a wonderful resource to a GIS service and can also be identified as a virtual employee. These patrons may be developing Sponges or GIS Ninjas who take it upon themselves to share their collected data or expertise. They may offer to provide a copy of a significant or valuable dataset that they acquired to the library so other users may access it for research. They will get involved with you in projects that involve building geodatabases or interactive mapping sites, lending their time and technical skill to advance the GIS infrastructure in your library or university. It can be very productive to accept the generosity of the Philanthropist, as it can make your job as a GIS librarian easier by having additional GIS expertise that can be tapped. However, be sure not to be too much of a drain on this type of patron and try to work with them in a way that makes it just as beneficial to them as it is for you. A GIS project that satisfies part of their research requirements and builds needed GIS infrastructure in the library would be a prime example of this balance.

Conclusion

It is apparent the GIS reference or consultations are more involved and require more time and expertise from librarians compared to other types

of library reference. The four-year statistical study shows that GIS librarians can expect to spend an average of four hours for a single consultation that can span months of time interspersed with several meetings. It also shows that about 155 consultations a year can be expected from an academic university similar to Yale. Statistics, such as those from the four-year study, can be useful for organizing and determining the future direction of a GIS service. And finally, recognizing different types of patrons and utilizing techniques to deal with them can lead to more effective and efficient consultations.

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