

featured article

The paper addresses how a map librarian gains entree to the fast track world of computer cartography. The history of machine-readable information in libraries has been rocky. As information resides more frequently on tape or disk, libraries will need to embrace the technology. By obtaining seed money from a Federal Library Services and Construction Act grant, the Map Library at the University of Connecticut, procured hardware, software and boundary files. With the aid of a research assistant, the librarian wrote a SAS program, PTOLEMY, which allows users to map their data. PTOLEMY is a menued environment running on the mainframe. Users may access the mapping system from remote sites.

Libraries have always been ready to embrace technological innovations. Incandescent lighting and xerographic copying were seen by librarians as provocative enhancements to the access of information. Computers made early entree into libraries as tools for storing and manipulating bibliographic records. As early as 1957, York Lucci and Stein Rokkan proposed a library center of machine-readable survey research data in a project sponsored by the School of Library Service at Columbia University. But machine-readable data files (MRDF), as a format, have not succeeded in library collections. To date relatively few libraries have developed an awareness of machine-readable data files beyond a collection of codebooks and referral directories, often times working within an informal relationship with campus computing facilities and the campus' Inter-University Consortium for Political Science Research (ICPSR) node.

It is a common misconception among computer specialists that a library is a book storehouse rather than a dynamic access point to information. Unfortunately, this misconception is often reinforced by the library's reluctance to collect the "book" tools of the computer trade, i.e. manuals, codebooks and documentation.

In a recent article, William Arm (1984) points out that "for many years librarians have been asking computing specialists for assistance. Unfortunately, assistance has not been forthcoming." At the same time the computing systems of our universities have become enormous collections of poorly indexed tools and resources. In the days when computing was restricted to a few specialists this was not important. When computer users were concentrated into terminal clusters, with many users sitting side by side, word of mouth was still an effective way of disseminating information. Now that computing has become widely distributed across campus, some better way is needed for scholars to learn of the riches at their fingertips.

The computing community is in need of the skills and experience the library profession can offer. The duplication of materials and effort in the computing community is a recognized problem. Computing specialists have failed to take the long term "research view" of the growing core of machine-readable information. Librarians have either failed to consider machine-readable information significant enough to acquire and control, or we have underestimated our ability and responsibility to handle it.

Our dilemma, the Librarian's Dilemma, is the almost total transference of information from paper to electronic format. Joseph Raben (1979) has observed that "After five hundred years as the sole basis of printing technology, metal type is joining the spinning wheel, the water wheel, the cotton gin, the steam engine and now the propeller-driven airplane as

The Librarian's Dilemma: A Map Librarian's Access to Machine-Readable Information

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THE ORIGINS OF PTOLEMY

exemplars of mechanisms that were vast improvements over those they replaced but that still had to yield to even superior ones." Paper, as a medium for storing and disseminating information, falls short of machine-readable information. Ironically, in 1989 much information exists in machine-readable form from author, through the editor, publisher and printer, until it is finally printed and distributed on paper.

At a backyard barbecue in Alexandria, Virginia in 1983, I got my first whiff that things in the Map Library profession were about to change radically. A friend, working at the Bureau of the Census, was discussing the 1980 decennial census and all the problems the Bureau was having getting its information out. He mentioned TIGER (Topologically Integrated Geographic Encoding and Referencing), the Bureau's redesigned Geographic Support System that consolidated the address coding, mapping and geographic inventory functions into a single database. When I got back to the University of Connecticut I began to gather bits and pieces of information about TIGER. There wasn't much. What there was indicated a thrust by two major mapping agencies to automate their mapping programs. It was disturbing to a paper Map Librarian.

A year later, attending my first National Cartographic Information Center (NCIC) State Affiliate meeting at the U.S. Geological Survey in Reston, Virginia, my counterpart from the Connecticut Department of Environmental Protection (DEP) was scurrying around the Survey like crazy acquiring Digital Elevation Models and Digital Line Graphs of the state. The DEP was working cooperatively with the Survey to develop a State Geographical Information System (GIS). When we went home at the end of the week the digital maps went with us.

I began to hear rumors of a planned coordination between UConn's Natural Renewable Resources Department and DEP. Then, in a time of little growth at the University, the Department of Geography managed to get the go-ahead for a graduate program in GIS. A half-million dollar High Tech Grant was awarded for a GIS Lab and an Image Analysis Lab. Electronic mapping was getting close to home. I quietly endured an anxiety attack . . .

When a Medical Anthropologist walked in and started talking about mapping epidemiological research in Hartford's Hispanic population the whole thing sort of came to roost right there in the Map Library. Those guys that ask questions five years ahead of anyone else . . . you've got to admire—and listen—to them.

Certainly, my greatest fear as a Map Librarian came when I realized how readily convertible to math maps are. How inherently Cartesian they are. How nicely geographers have developed the ideas of XYZ, arcs, nodes, polygons, *et al*, and then raster scanners. Can they make it any easier? I was terrified that my paper Map Library would become an anachronism in a decade. I resolved to develop a plan.

DEVELOPING A PLAN OF ACTION FOR THE INFORMATION AGE

Contrary to popular belief, Map Libraries are not resource havens in most university research libraries. Reference desks, systems operations, cataloging departments, preservation/conservation laboratories, even Art Libraries always seem to be able to make a better case for resources. Always in need of equipment, *money*, space, *money*, personnel, *money*; map libraries are a lot of fun if you thrive on challenge. I think a successful Map Librarian has to be a cross between a scrounger, raconteur, hail-fellow-well-met, a good scout, a Radar O'Reilly kind of guy. Kind of a sneaky, manipulative, evil genius behind the beard who is working hard to slice out an empire before anyone notices.

In 1984 the Map Library got an Online Computer Library Center (OCLC) M300, a rebuilt IBM PC. OCLC is an international library network and shared database of some 13 million bibliographic records. In 1984, OCLC began to replace its dedicated dumb terminals with IBM PC's to which it added a board and replaced the standard IBM keyboard with an OCLC keyboard. I used the M300 to catalog maps. It had no graphics capabilities, but it was a computer and it made me begin to think.

With the M300 I got OCLC terminal software, which, when I logged onto OCLC gave me as stupid a terminal as you can get. In order to play on the PC I had to use DOS. It's amazing what you can do using EDLIN and batch commands. It wasn't long before I got a version of PC-Write, File Express and other shareware. I made an acquisitions list. I remember thinking I'd never have any need of DBase because as a librarian what would I need a sophisticated database manager for?

But then a germ of an idea began to form in my mind: *what if I didn't use the computer just as a bibliographic tool? What if I used the computer to do what it was meant for . . . computing!*

What did I need to make the TIGER roar in the Map Library, to tap into a Connecticut GIS and let Geography grad students convert paper maps to digital code? *Money!* One thing about computers, you can do almost anything you want if you have enough money.

I figured, correctly as it turns out, that the library administrators were not about to give me the \$20,000 I might need to build and configure a cartographic workstation in the Map Library. I needed to find money from non-standard sources. I needed to write a *grant*.

To get a grant funded, of course, you are competing with others who think their ideas are better than yours. I needed to find that special something, a gimmick that made my grant better than theirs. This is about when that Medical Anthropology student sauntered into the map library and asked for some maps of Hartford to digitize. He described his idea to me and I put him in touch with the right people and thereby discovered my gimmick.

What's special about my Map Library is that it is at the University of Connecticut and also at the University is the Roper Center, *the* archive of public opinion data. The Roper Center is affiliated with the Institute of Social Inquiry. And the Institute is a Census Data Users State Affiliate. The Institute has the Census' summary tape files for Connecticut and the expertise to tailor the information.

I wrote all this up in a memo to my boss: RE: NCIC, ISI, Roper Center, IBM, digitizing data, TIGER. I gave it to him and let him simmer with the alphabet stew. I waited about a week and then, like Radar O'Reilly, I came in with a plan of action. He signed it. What he signed wasn't worth a cent, but it gave him the idea I was going to pursue a plan of action. And it sanctioned the pursuit of that action.

I began to make the case for getting at "primary information on tape." I began to talk to people about cataloging data files. Now that's radical. Make a bibliographic record for a data file. I pulled out all the old librarian arguments: freedom of information, rights of the citizen, information rich getting richer, information poor getting poorer, censorship through equipment costs. I began to develop into a librarian who sees the focus on cartographic information, regardless of its format; map, tape, image, whatever.

One day, one of the library muckety-mucks was mucking through the halls of the administrative suite asking if anyone knew of a grant idea because she had this notice of *free Library Service and Construction Act (ISCA) money*. My boss, Colonel Potter, having signed the plan of action,

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THE GRANT PROPOSAL

suggested me. It probably went something like this: "McGlamery's got an idea he trots out every now and then. Give it to him and see if it shuts him up." She did.

I wrote a grant, "Maps for the Future: Computer-assisted Cartography for the Community." I agonized over that title. It has every soft, fuzzy, hugable, cartographic word I could think of! I submitted it on April Fools Day, of course.

I wrote the LSCA grant as a research and implementation grant. My proposal was to create a facility to serve as a library cartographic workstation. A *library* tool designed to access information in a cartographic format. It is not a geography department workstation nor a cartographic laboratory. The map librarian's job is *not* map making. It's providing access to machine readable information in a cartographic format.

The primary part of the grant involves generating maps of demographic data from distributed sites. I am interested in providing accessibility to as broad a user group as possible. I decided to design a system to be put on the university's mainframe computer using the mapping capabilities of SAS/Graph rather than a PC-based system in the Map Library. A couple of good reasons for a distributed network come to mind:

1. As a map librarian I have been an information node for social scientists trying to map their data. Typically they use SAS/Graph to make something that looks like a map, but usually doesn't act like a map.
2. There are users who have data, know nothing about SAS/Graph, or maps, or computers, but who want to map their information.
3. For many of these users, purchasing a mapping package and graphic hardware for the few maps they need to make is not feasible.
4. There is an extended group of SAS users in the state who meet on an irregular basis and who keep in touch with a newsletter and via electronic mail.

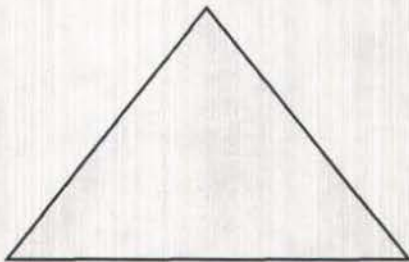


Figure 1: Model of a research library



Figure 2: Model of a computer program

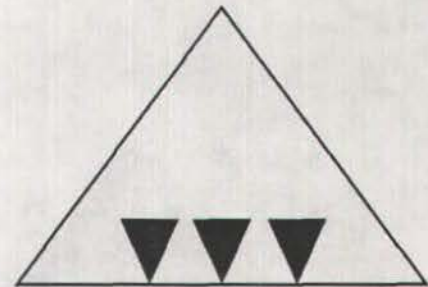


Figure 3: Model of computer applications in a research library

IMPLEMENTATION

About June 20th I pulled out the manuscript and brushed it off. For sure it hadn't stood a chance against ramps for the handicapped or record conversion for a special collection of 18th century German economic treatises. Two days later I got a call that it had been accepted with full funding (\$17,600). Great idea. Good luck. Anxiety attack . . .

Computers are tricky. They seem really complex, but are really very simple. Libraries are also tricky. They seem very simple but are really

very complex.

Computer programs are designed with a single function in mind. As that function is attained, another is added, and so on, and so on. An effective program is a model of logical progression. I saw it as an inverted pyramid, functional point at the bottom and building toward complexity (Figure 1).

Libraries, on the other hand, are big, broad-based pyramids (Figure 2). Ponderous storehouses of information, described and accessed through card catalogs. The idea of a research collection is, ideally, that anyone can come in, at any time, and ask any question, at any level, and expect to get an answer. Maybe they will . . .

Now, how was I to apply that pivotal computer pyramid to the ponderous library pyramid? The answer lay in the opposite of what maps do. Maps tend to be format specific, not subject specific. Topographic quadrangles, for example, answer all kinds of questions, from hiking to civil engineering to historical geography. Computer programs, on the other hand, are subject specific. I guessed, then, that this library computer-assisted cartographic workstation was going to be a multifaceted, subject specific station. I imagined it as a lot of little inverted pyramids lined up in the ponderous, squat pyramid, each facet pointing to a different type of map need: demographic, base map, geologic, topographic, image analysis and so on (Figure 3).

With the grant I hired a Research Assistant from the Geography Department. I purchased computer equipment: a high-resolution graphics monitor, an EGA graphics card, a CD-ROM reader, 20Mb Bernoulli disk drive, digitizing tablet and a color inkjet printer. I acquired software: Tektronix emulation software, and Windows and SAS Manuals. I also procured data files: a tailored version of the GBF DIME Files of the tracts of Connecticut from Geographic Data Technology, Chadwick-Healey's SUPERMAP, and the National Atlas on CD-ROM from GEOvision. With these I have put together a SAS/Graph-SAS/AF program we call PTOLEMY.

PTOLEMY is a menued mapping facility. The user enters cued information at the appropriate points in the session and PTOLEMY builds a SAS/Graph program that utilizes DIME boundary files, either user supplied or "canned" data sets, and appropriate output devices. I've tried to make it as much like a PC program as possible.

What PTOLEMY does is sequentially build a SAS/Graph program. The

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=====
=                                     =
=                               WELCOME TO PTOLEMY                               =
=                               ----- -- -----                               =
=                                     =
=       An Interactive Mapping Package Developed                               =
=                                     =
=               At The Map Library Of                                         =
=                                     =
=               The Homer Babbidge Library                                     =
=                                     =
=               The University Of Connecticut                                 =
=                                     =
=====
Please enter a 1 on the Command line to continue
    
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Figure 4: PTOLEMY title screen

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=====
= During your PTOLEMY session you will be creating                          =
= a SAS/Graph program which can be viewed and                               =
= printed. You will be asked to supply information                           =
= in a prescribed sequence. In order to "back-up"                           =
= through the program hit the PF3 key. The sequence is:                     =
= 1. Name your terminal type. You may only view from a graphics terminal or a =
= graphics card running Y-Term.                                             =
= 2. Name your data set. PTOLEMY supplies a 1980 Census data set. Your data =
= set must be in SAS format. See the HELP selection on the menu if you have =
= any questions.                                                            =
= 3. Choose your pattern. Y-Term only views Black-on-White, but you can name =
= a color printer.                                                           =
= ANY QUESTIONS CALL: P. McGlamery; 486-4589                               =
=====
Please enter a 1 on the Command line to begin
    
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Figure 5: PTOLEMY explanation screen

first steps are introductory: a title screen (Figure 4) and explanation of what will be asked of the user (Figure 5). The program begins by instructing the user to select an output device, then asks whether the data set is user-supplied or PTOLEMY-supplied (The PTOLEMY data set menu is shown in Figure 6). After the data has been determined the base map is selected. The grant provided funding for the purchase of tailored DIME boundary files. We groomed them a bit by replacing the state code with a town code that was derived from the alphabetical listing of the towns and mounted them on the mainframe. The user can select a variety of configurations of town and tract level maps of Connecticut. Two lines of title are

supplied. Finally the user is asked to selected hatched or solid fill and color choice. The output (Figure 7) appears on the screen or is picked up in the Computer Centers Output Room, depending on the user's choice.

The program attempts to effect clear cartographic communication by following fundamental cartographic principles. By limiting choices and sequencing decisions, the user is not overwhelmed with choices. The cartographer will systematically work through notions of map purpose and map type. The user, however, will often approach computer cartography like a kid in a candy store and end up with something that looks like a map, but doesn't act like a map because it is illegible or misleading. PTOLEMY provides the user with a simplified decision tree: it will be a choropleth map, the hatching will be thus and so, the color will be your choice of red, blue, green, and so on.

The choice of which data classification techniques should be provided for users was a major difficulty. Since many statisticians seem to prefer quartiles, I decided to make quartile classification the default for PTOLEMY. I will, however, work with users to produce the classification that represents their data most appropriately. What PTOLEMY attempts to do is provide a straightforward tool for illustrating statistical information cartographically.

What PTOLEMY attempts to do is provide a straightforward tool for illustrating statistical information cartographically

PTOLEMY, the hardware purchased to support it, and most importantly the lessons learned while developing it, have brought the Map Library significantly closer to dealing with the problems of providing the user with machine-readable information. As we enter the next decade with TIGER, Mark II, enhanced demographic information, high-volume storage media, educated users and increased demands, the librarian will inevitably have to deal with the 'new' information formats. I'm looking forward to the rest of the story.

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=====
"
=
= Please Enter The Ptolemy Name Which Corresponds To
= The Desired Data Set
=
= Data Set Description PTOLEMY Name
=
= 1) Total Population - POP
= 2) Percent Of Population In Professional
= Occupations - PROCC
= 3) Percent Of Population With High School
= Degree - HIGH
= 4) Mean Family Income - INCOME
= 5) Mean Home Value - Owner Occupied - HOME
= 6) Mean Contract Rent - RENT
= 7) Percent Population Below Age 18 - CHILD
= 8) Persons Per Household - POPHOU
= 9) Fertility Rate - FERT
= 10) Percent Single Family Housing - SHOUS
= 11) Percent Of Population Non-White - NWHITE
= 12) Percent Single-Parent Households - SPRNT
=
= PTOLEMY NAME: &varnm
=====

```

Press the PF3 key to continue

Figure 6: PTOLEMY data set menu

Arms, William Y. (1984) "Scholarly information," *College and Research Libraries*, May, pp. 165-169.

Raben, Joseph (1979) "The electronic revolution and the world just around the corner," *Scholarly Publishing*, April, pp. 195-209.

REFERENCES

Editor's note: Information about the TIGER data format and proposed products was distributed by representatives of the Bureau of the Census at the Denver NACIS meeting. The following persons were responsible for a report entitled "The TIGER File: Proposed Products": Robert A. LaMacchia, Geography Division, (301) 763-4708; Silla G. Tomasi, Geography Division, (301) 763-4700; and Sheldon K. Piepenburg, Data User Services Division, (301) 763-1808. The best description of TIGER's data structure issued thus far is probably a paper distributed by Frederick R. Broom, Geography Division, entitled: "TIGER Preliminary Design and Structure Overview: The Core of the Geographic Support System for 1990." Information on obtaining a sample prototype TIGER file for Boone County, Missouri is included in the Cartographic Techniques section of this issue. SAS is a statistical package produced and marketed by the SAS Institute, Inc., Box 8000, Cary, NY 27511-8000.

POPULATION, 1980 CENSUS DATA CONNECTICUT

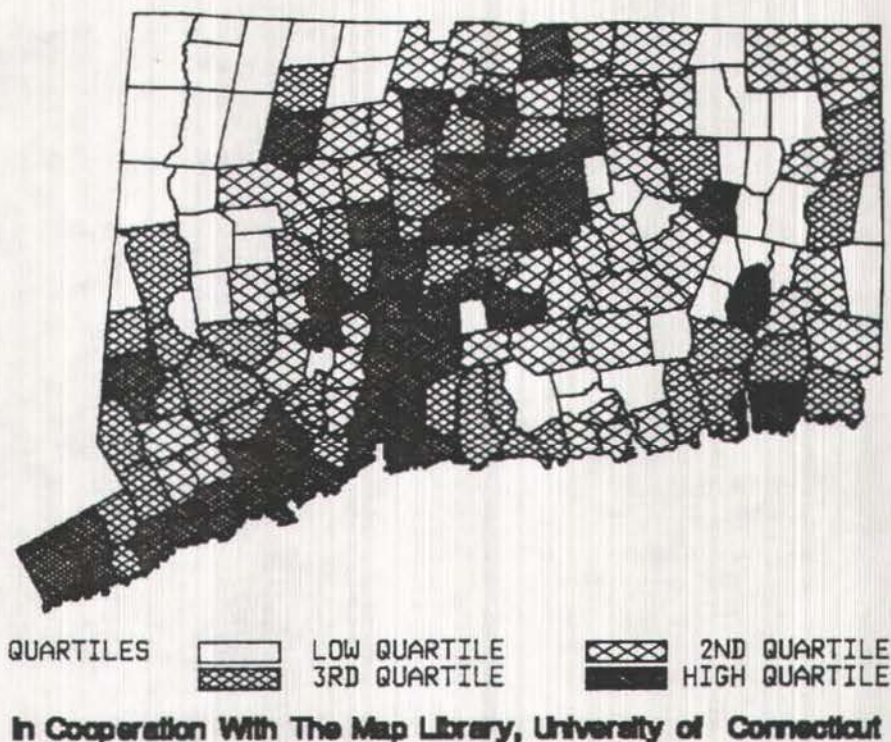


Figure 7: Sample PTOLEMY output

Este artículo trata sobre cómo un bibliotecario de mapas consiguió entrar al versátil mundo de la cartografía por computador. Aunque la evolución de información computarizada en bibliotecas ha sido intermitente, a medida que mas información es almacenada en cinta o disco las bibliotecas tendrán que asimilar la tecnología e incorporarla en sus operaciones. Atravez de una subvención del Acta Federal de Servicios y Construcción de Bibliotecas, la biblioteca de mapas de la Universidad de Connecticut obtuvo equipos de computador, paquetes y programas, y archivos de frontera. Con la ayuda de un asistente de investigación, el bibliotecario escribió un programa en SAS, llamado PTOLEMY, que permite a usuarios trazar mapas con sus datos. PTOLEMY funciona a base de menús en el "mainframe," y los usuarios pueden entrar al programa desde puntos remotos.

El dilema del bibliotecario de mapas: su acceso a la información computarizado

Extracto