THE SATELLITES'S CATROUCHE: A DIGITAL INTERPLAY OF HISTORIC MAPS AND GEOSPATIAL DATA

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Abstract

History museums and historical societies are entering the world of geospatial data curation somewhat behind libraries, who are engaging questions of standards, practices, storage, access, long/short-term value, etc. While geoarchiving praxis may be similar in museums and libraries, the history museum traditionally has a different relationship with their holdings. Their institutional role is not only to catalog, archive, and disseminate data, but also to interpret and contextualize them. Geospatial data functions on multiple levels at once: as a culturally constructed object and as a 'real-world' platform to situate other digital resources. This paper investigates how historical museums understand and exhibit historic geospatial data by evaluating a web mapping tool created by the Minnesota Historical Society, called True North: Mapping Minnesota's History.

In the époque of digital aerial photography and watch-chain GPS, users of geospatial data often carry unexamined expectations. True North has shown that, when laid atop satellite or aerial imagery, historic maps can broaden our understanding of digital representation by merging scales and perspectives. This conflation of data types stands before a long discourse on how people parse art and science, and it is at the heart of how museums navigate the space between archival map collections and new digital geospatial data.

BACKGROUND AND THEORETICAL FRAMEWORK

This paper explores the theories and practice of developing a web-based GIS (Geographic Information System) to display geospatial collections and digital historic resources together. Although metadata creation and digital archiving practices are important steps in the life of a digital project, this paper focuses on the aspects of exhibit and display only.

The Minnesota Historical Society (MHS) is a private, non-profit educational and cultural institution established in 1849 to preserve and share Minnesota history. Our collections are diverse and substantial for a state historical society: nearly 550,000 books, 37,000 maps, 250,000 photographs, 165,000 historical artifacts, nearly 800,000 archaeological items, 38,000 cubic feet of manuscripts, 45,000 cubic feet of government records, and 5,500 paintings, prints and drawings. MHS has made it a priority to create a broad based digital collection- almost solely by scanning our analog collections. For example, hundreds of thousands of photographs, all of the original land survey plats, and many objects in the 3D collections have been digitized. These are available for view, download or purchase online. Despite their availability, each holding type resides in a separate, searchable database. However, with a grant from the Bush Foundation, a federated search engine is in the process of being created, to facilitate searching across these data silos. This search engine will include a keyword search, a people search and a place search. This final category, 'place search,' speaks to a contemporary paradigm shift, wherein history is being searched for and situated on a map. People are beginning to re-conceptualize the concept of 'where.' Not simply in the ways of the old school, long duree histories (where plaques mark the places where treaties were signed, or 'something important happened here'), but in a far more immediate, hyper-localized, personal way (see Google APIs, Flickr geotagging, contributory GIS). GIS and web mapping have democratized the map; with aerial photography and 'zoom' capabilities, users can see the shadow of their dog in their own backyard. Put simply, Google Earth has raised the bar.

For this reason - this shift toward a geography of the personal and the local – the ways museums display maps and geospatial data is critical. Museums are developing tools that allow users to have a more intimate connection with their collections. MHS developed True North, an online web mapping tool that uses digital maps as an access point to the many stories and material collections of Minnesota's history. Digital maps are not just raw information, but context for the large and small-scale events that play out on our land and make Minnesota History what it is. GIS allows users to zoom in and find out how many layers of history juxtapose right atop their home.

True North is a collaborative effort between MHS and the Land Management Information Center (LMIC). It was developed to give 4th-12th grade social studies classrooms the tools to engage MHS' digital collections in a contextual and meaningful way. Supported by the Institute for Museum and Library Services (IMLS), the *True North* website integrates more than 200 Minnesota map layers and remote databases into a free online tool. The layers include modern demographic, environmental and economic maps, as well as historical maps and data-based representations of historic events (such as Dakota War battle sites and regions devastated by the 1870s grasshopper plagues). Maps are integrated with archival photographs, artifacts, newspapers, etc; so, for example, if a historic 1880 railroad map were turned on, GIS points showing locations and photographs of 1880 rail stations could be overlaid. While this mediated mapping tool is just one of many important steps in the process of digital curation, its use speaks to the central question: how does geospatial data shape the way all other cultural heritage data is understood, searched and contextualized?

PROJECT PREPARATION

Prior to beginning any work, MHS staff conducted focus groups with teachers and researchers to determine what the needs for maps were. From these groups grew an outline of the project. When funding from the IMLS was granted, a True North project team was assembled, including a project lead, an education/content specialist, a GIS

specialist, a web programmer and a demographer. The latter two are staff at LMIC, a division of the Department of Administration charged with coordinating Geographic Information technology in the State. Subsequently, an advisory board was gathered, including local historians and technology experts, such as members of the geography faculty from Macalester College, high school and middle school teachers, staff from the Department of Education, and members of the Indian Advisory Council. The development of the True North project is fundamentally guided by this collaborative effort and by a community-based input model.

DEVELOPING AN AUDIENCE

MHS has a diverse audience, including scholars, genealogists, researchers and students. Students are the primary audience for the True North Project, however, adult learners and researchers are a close secondary audience. Minnesota has new state standards put out by the Department of Education that require students to more implicitly make connections between geography and history. These standards read like "*Students will describe the impact of industrialization on work, home, leisure life, politics, immigration, urbanization, and changes in the physical landscape*" and "*Students will understand the concepts of historical context and multiple causation.*"

Traditionally, teaching this land/history connection meant a map in the classroom-usually a scroll-on-springs pulled down from above the blackboard. But now, with GIS, teachers can pull up multiple maps simultaneously, lay them atop one another like transparencies of old, to make connections and teach lessons. The 4th-12th grade audience of teachers and students is savvy one. They are used to the ease and aesthetics of existing online mapping systems to get directions and see the weather. Yet, despite being web savvy, most users don't have the technical skills, the server space, or the knowledge of where to find data beyond the layers seen on Google Earth. This subsequent data, which has been created and made accessible by places like the University of Minnesota, the Department of Natural Resources and LMIC, makes up the bulk of data displayed in True North.

INTEGRATING DATA TYPES

The True North website has more than 200 map layers available for overlay. These layers extend well beyond the historic, and are not only from the Minnesota Historical Society. The list stretches from glaciations to light rail transit, and is organized according to teaching standards: Examples of maps include: POW camps in Minnesota, Solar Power Potential, 2002 Census Ethnicity by block group, 19th century railroads, soil fertility, annual rainfall by decade, streetcar lines, Fur Trading Posts, State Parks, etc.

Housing diverse data is not an uncommon practice for geospatial libraries, which often function as clearinghouses for geospatial data created by disparate sources. But, MHS does not seek to be a clearinghouse for geospatial data, at least not at this point. MHS made the connections with the other purveyors of geospatial data for the sole purpose of *exhibiting the data together.* Each agency maintains, updates and archives their own data. True North pulls it together with the layers of history as an added dimension. This juxtaposition of data creates a rich, multidimensional way to teach history. And this collaboration facilitates statewide standards, interdisciplinary perspective, and new projects.

Aside from the datasets, True North displays over 100 historic layers. The historic layers are in both vector and raster format. They include, for example, line files of streetcar routes, polygon coverages of areas devastated by locust plagues, and scanned, georeferenced archival maps at multiple scales. Displaying scanned archival maps in this way is a fairly easy process, but a more complex issue. The map collection at the Minnesota Historical Society consists of about 19,000 maps and nearly 2,000 volumes of atlases. The collection strongly emphasizes Minnesota Territory and the state of Minnesota, its regions, counties and cities from 1849 to the present. The collection also includes selected maps and atlases of a wider geographic area encompassing North America, Canada, the United States, the Great Lakes, and the Mississippi River Valley. Together these materials trace the process of discovery, exploration, settlement and

development of the state and region as well as past and present relationships with other areas. Several hundred of these maps have been digitized, and MHS is in the process of creating a digital map repository. The Minnesota Historical Society has another website to display its scanned map collection in a flat, non-georeferenced way. Users of this site can zoom in and out using a simple, if clunky, interface. Despite its simplicity and limited usability, this older interface displays maps in a non-modified way (not counting changes to color or grain through scanning and digital processing) – maps stay true to their original form. Inserting scanned archival maps into a GIS requires significantly more manipulation. Georectification, a process that is more an art than a science, can significantly skew topology in efforts to match one map's extents with another. Here, map projections and know-how of the GIS technician can make a great difference. In the end, because historic maps are imperfect creations, inserting them into a GIS based on meter-resolution or detailed precision will be difficult.

On the contrary, born digital raster maps, created in the last 40 years, are often data rich, accurate and detailed to a small scale. They are made of millions of pixels, each representing a fixed data area with associated attribute information. This detail is central to the interactive aspect of GIS. The ability to zoom in to maps means that a born-digital statewide land use map, for example, displays clear, usable data at a 1:340000 scale as well as a 1:12000 scale. In other words, if you zoom into a born-digital map, you are likely to have it be meaningful down to the localized level in a way that is impossible with scanned archival maps. Take a scanned version of Nicollet's map of the hydrological basin of the upper Mississippi River from 1839, for example. It is at a fixed scale, with a fixed perspective. Zoom in and you'll see only the rough meal of paper and ink. This can be a frustrating experience for users who try. Therefore, using historic maps with born digital data in a single interface is a powerful teaching tool for students who may expect all data to translate to the roof-top level. It teaches the important lesson that we all become blind at certain scales. By using historic maps in conjunction with aerial photographs, for example, users can better see and understand the lineage of cartography, where explorers went wrong, how rivers have changed course, and even how the same

stream can have multiple names over time. It is also a way to show users that historic geospatial data is almost always generalized or uncertain. Many of historic maps bear the marks of geographic generalization (they teach where grasshoppers ravaged the prairie, for example, but cannot show precise locations). Juxtaposing the historic map atop satellite imagery may correctly show the streetcar line that dissected your street, but it also may display fur trade posts that seem to float directly in the midst of a lake. Finally, displaying scanned and georeferenced historic maps with the born digital geospatial data force the questions: what is art and what is science? And how much are aerial photographs, too, a cultural creation? Both map creators and users learn from these lessons. They should not dissuade the user. They *should* be dissuaded by an interface that is not appropriate or savvy.

THE MAPPING INTERFACE

Technology

True North is built on an open source web mapping software called Mapserver, which was originally developed at the University of Minnesota. Mapserver has been extensively used for web mapping by Minnesota state agencies and other organizations worldwide. As an open source product, enhancements have been contributed from collaborators around the world. Using open source technology was another way to collaborate with the community, by sharing advice, expertise and code, and also a way for MHS to make a fiscally responsible decision.

Design

Digital maps are now well integrated into our digital culture, for things like address lookup and weather predictions. Therefore, the bar is significantly raised for museums to meet their web users at a comfortable place. Because the True North audience is already web-savvy, it was necessary to create an interface that had technical power, familiar tools and an aesthetically pleasing skin. The latter, perhaps, is of foremost importance,

particularly when serving a youthful audience. Many young users are familiar with Google Earth-like, proprietary interfaces that provide 'tested and approved' nice views, and a relative-ease for simple programming. Whereas, until recently, open source GIS programs were robust and contained deep data, but were often developed for the GIS professional, and were not particularly attractive. To mediate this issue, True North hired a designer to build a savvier, 'kid-friendly' interface. The designer rounded the edges of the existing tools, created a pleasing color scheme and developed a logo. A simple but effective step. Classroom testers and focus groups all commented on the fun look and feel of True North.

Layout

The True North website is comprised of two sections and four major pieces. The two sections: Maps and Lessons, serve two different audiences. The Maps section serves 9th-12th graders and the Lessons section serves 4th-8th graders. In the Map section, 9th-12th graders are free to make connections by layering maps willy-nilly. Their geo-playground is focused by 'Thematic Guides' that suggest which maps build a story together. The freedom afforded to 9-12th grade mapping section is guided by the aforementioned State Education Standards, that stress cognitive reason skills for high school social studies classrooms: they need to learn *how* to think about time and place. This section has four major pieces: the Map List, the Map, the Legend, and the Historic Links. Historic Links will be discussed in further detail in the Connecting Collections section below.

In contrast, 4th-8th grade standards stress specific content retention. The Lesson section serves this group by functioning like a filmstrip. Each page contains historic information, leading questions, and a map for the student to refer to. As students click on to the next page, they move step-by-step through an organized lesson. For example, the lesson on the Fur Trade shows a map of the watersheds overlayed with points representing locations of fur trade posts and portages. Students are asked to answer and understand things like, "What do you notice about the pattern of distribution of the American, British, and French fur posts?" before they move on to the next page.

Prior to public release, the layout of the site itself changed drastically, as our understanding of the priorities of user needs developed, and a re-design was necessary. This was extremely helpful, and allowed easier access, but nonetheless took a good deal of time.

CONNECTING COLLECTIONS TO MAPS

The items in the Society's collections number in the millions and comprise the following categories: archaeology; three-dimensional; manuscripts; printed materials; art; sound and visual; oral history; and government records. The Library, Publications, and Collections Division has oversight of the collections. The Division provides extensive access to the collections through its library and especially through the use of technology and the World Wide Web.

One of the four major pieces of the mapping section is History Links. When a map is selected, a list of relevant, thematic sources appears beside the map. These are live links to existing digital collections that serve to flesh out or elucidate the story of the map. As mentioned above, digital collections at the Minnesota Historical Society are housed in their own areas, managed by their own curators. For example, historic photographs and images of the items in the museum's 3D collection have separate, searchable, public databases. True North staff strategically selected relevant items from these collections to facilitate teachers' searches. In this aspect, True North is a mediated experience, functioning almost like an online exhibit, with intended lessons and focused direction. However, rather than simply being a clearinghouse for teachers to search and access historic digital data, True North re-situates the digital resources in a geographic framework. Because curators don't have to lug items out and lay them side by side, digital resources can by manipulated by users, and juxtaposed to make new connections. These new connections are *visually exposed* and all tied to a physical place. So, for example, images of historic railroad stations are tied to maps depicting rail lines by decade; images of 1850s land survey equipment accompany a map of Township/Range

grid; and thousands of architectural photos are geocoded by address to appear when zoomed into a neighborhood. The MHS also has a place names database that was developed from a book by Warren Upham, a compulsive collector of minutiae who gathered Minnesota's geographic names from 1879 until his book was first published in 1920. This includes the etymology of all the lakes, cities, townships and places in Minnesota. This database has been linked to the search and query functions of the True North maps, so that users can click on a place and see the meaning behind its name.

Because history is a palimpsest, the geographic dimension crosses and re-crosses temporal boundaries. Therefore, it is not enough to simply situate digital archives on any one map – for example, the satellite imagery of 2008 may function as a contemporary pallet, but it is not accurate when overlaid with historic collections. Take photographs from 1920 Saint Paul. They may fall on streets that no longer exist. Only a 1920 street map can successfully ameliorate this situation. Herein lies the power of the GIS. Multiple historic maps can be overlaid (like transparencies of old), to more accurately frame the geographic context of the artifacts. True North has historic maps that span pre-territorial Minnesota, to 1960s maps showing the construction of the freeway right through the center of town.

REPURPOSING DATA

The Minnesota Historical Society remains true to its primary function as a content provider. Rather than develop the technology for the project internally, MHS partnered with the Land Management Information Center. LMIC has had 40 years of experience developing GIS and geospatial data projects. In the short-term, such a partnership freed MHS from training historians to be 'techies' and vice versa. In the long-term, however, it may be necessary for institutions like MHS to move technological know-how from project to production. The very theme of this conference: "The Digital Curation of Cultural Heritage," speaks directly to the need for cultural heritage institutions to directly confront not only the creation and storage of born digital data, but also the display of this data.

WHAT'S AHEAD?

Over the course of developing True North, almost 100 new historic datasets were created. These are georeferenced archival maps, vectorized transportation maps, and born-digital statewide raster files. MHS is now in the process of developing standards for archiving these datasets so they can be repurposed. Moreover, MHS recently hired a curator of GIS and Digital Maps to oversee future geospatial data curation and accessions. As mapping continues to grow in public sphere, participatory GIS will be the next phase.

MHS has a new website called Placeography that lets users upload images and stories about places that have meaning *to them* – places that may never make it to the National Register of Historic Places. Places like their grandfather's old butcher shop. This focus on the *local* speaks to an important moment in mapping history. We are engaging history at multiple scales simultaneously, but moreover, at a highly personalized level. One example was recently displayed at a mapping exhibit in Minneapolis, Minnesota called We Are Here. The exhibit displayed a digital map that culled blogs around the world to find sentences that began with "I feel" or 'I am feeling', and then mapped the emotions of the world's population, based on what adjective followed. For example, "I feel happy, or I feel disappointed" This was automatically generated and updated every 10 minutes, and created a chromatic map of the world based on the emotions of those individuals blogging. Tallinn, Estonia was hello for predominantly happy on March 4th,2008 - a sunny day, while Saint Paul, USA was grey and mostly disappointed over the Christmas holidays, 2007. The world, in these maps, is a sway of thousands of emotions and colors. While this site may not be a way to study very distant history, it is certainly a site that is creating history – it is the geographic compilation of 1000s of global voices, blogging simultaneously about their experience in the world today. Something to look back on, perhaps in the same way we now regard paper diaries and letters.

CONCLUSION

Curating historic and cultural geospatial data in 2008 means recognizing that maps are now a way for people to situate, illustrate and explore their world - on an immediate local and global level. By displaying geospatial data with a multiplicity of data sources and layered digital resources, museums can better serve their audiences and exhibit the depth of history lived in one place.

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