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Reconstructing Women's Lives in a Small Minnesota City:

Implementing ArcGIS in the humanities classroom

Historians have long employed maps to study the past and to communicate their findings. But the advent of geographic information systems has introduced powerful tools for spatial analysis and visualization that promise to be a game-changer for working historians and other humanists alike. Or so one would think. Although I am a relative newcomer to GIS, I am convinced of its surpassing value in expanding approaches to research, teaching and learning; so much so that I want to encourage other humanities scholars on my campus to develop spatial perspectives and GIS. For this reason I co-lead a Mellon grant focused on digital humanities in 2015 and 2016 that included training with spatial digital tools. Yet only a few faculty on my campus have incorporated spatial perspectives in their classrooms and scholarship. Last summer I considered how I might continue to encourage the development of geospatial perspectives in general, and geographic information system technologies in particular, among humanities faculty at my college. While the web includes an increasing number of examples of projects to investigate and share with colleagues, I thought I could best encourage the use of GIS through leading by example. Thus this past academic year I experimented with GIS as a tool for historical research with students in two different classes over two semesters. This presentation shares my process with those efforts and highlights what I have learned along the way. I hope that others will find my experience helpful.

I initially chose to incorporate a GIS project into my upper-level undergraduate women's history seminar in Fall 2017. I wanted students to gain experience in identifying spatial information, to develop skills in organizing that information, and to use GIS to analyze their spatial data and communicate their findings. I selected that course for implementation because it was smaller than my 100-level courses, with a cap of 20 students, and because I hoped students in an advanced course would be more open to experimenting with new tools for understanding women's history.

In choosing a project for the class, I wanted to use local data in order to make the material more real for the students, to encourage their engagement with the community in which they currently live, and to allow them to make a scholarly contribution based on original research.

This local focus, however, meant finding and creating our own historical database that included spatial data related to women's history. The first task was to locate a map to represent the local past landscape. I knew fire insurance maps were good sources for historical maps, so I investigated what was available for my community. I also wanted materials from a pre-1920 time period, because I knew it would be easier for us to incorporate qualitative source materials into our work if we weren't constantly facing copyright issues. Luckily my local historical society had recently obtained digital copies of Sanborn fire insurance maps for our community, Moorhead, MN, beginning in the late nineteenth century and continuing sporadically through the 1920s. If you aren't familiar with fire insurance maps, they provide detailed information about the constructed environment of urban areas, including such information as outlines of buildings and the materials used in constructing them, street names, house numbers, property boundaries, and building titles or business names. Though the Sanborn maps for Moorhead did not cover the entire city, they included the downtown/business area and some surrounding streets, as well as the two higher education institutions in Moorhead.

The next task was to find other spatial data available for Moorhead women that could be linked with the Sanborn maps. I turned to source materials I already used in some of my own non-spatial historical research, including census data and city directories. The 1905 Minnesota State Census included street addresses for residents, and I located a 1905 Moorhead city directory that listed, at least for some women, both residential and employment addresses. And Sanborn maps existed for Moorhead from 1906. The 1906 Sanborn maps, the 1905 state census, and the 1905 city directory, then, were the raw materials for our project.

Having determined the basic components for the project, I developed the workflow as shown on this slide. You can see that most steps relate to preparing the data—a point I'll return to later.

The Sanborn maps were in a digital format—scans obtained from the Library of Congress, though they weren't georectified. Fortunately the City of Moorhead was interested in georectifying the maps for their own purposes and was willing to prioritize the 1906 maps that we wanted.¹ By about the midpoint of the fall semester, the city provided us with composite georectified Sanborn maps that could serve as the basemap for our GIS work.

¹ While the experience of georectification would have been instructive for my students, having that step outsourced saved us valuable time and effort.

Meanwhile I introduced to students the idea of using geography and place for understanding women's experiences, primarily through discussing secondary source readings. For example, we read and analyzed an article investigating male urban workers in Victoria, British Columbia. It illustrated how GIS could be used to reconstruct an urban landscape and increase understanding of a population that left very few qualitative records.² We discussed what parallels our own study of an underrepresented population—women workers—might have and brainstormed potential questions a place-based perspective might help us answer, starting with broader questions and then working our way to more specific questions we thought our data could help us answer.

Reflecting back on that introduction, I ought to have spent more time acquainting students with spatial perspectives and working with GIS. Reading about someone else's use of GIS is different than using it oneself. The next time around, as I move forward in working with these materials with future students, I will include more hands-on GIS work such as map lessons set up in ArcGIS on-line.³

While waiting for the city to complete georectification of the insurance maps, we worked to prepare the other historical data. First on the list was the 1905 Minnesota census.⁴ Since the focus of our research was on women and work (excluding unpaid household labor), we initially considered including only women who had occupations listed on the census or in the city directory. When that resulted in a small sample size,⁵ we reevaluated the data, and determined to follow the census-taker's practice of including students and widows as occupations (note: the census did not list "housewife" as an occupation).

² Patrick A. Dunae, et. al. "Dwelling Places and Social Spaces: Revealing the Environments of Urban Workers in Victoria Using Historical GIS," *Labour/Le Travail* 72 (Fall 2013): 37-73.

³ E.g. have students find a georeferenced historical map and load it in arcgis online, then use a storymap swipe or spyglass to look at how location has changed over time.

⁴ We needed to determine who exactly to include in our dataset. Our first limiting criterion was females age fourteen and above. Our reasoning was that compulsory school attendance up to age fourteen was common in the early twentieth century and we were interested in women and work. It was also an age by which young women were likely to have been confirmed, a rite of passage to adulthood among the northern European immigrants who comprised a good portion of Moorhead's immigrant population. A young woman reaching age fourteen, by which time she had usually graduated from the eighth grade, was often in a position to choose to pursue employment, or to continue her education at high school and later college.

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The census data had already been transcribed into an excel spreadsheet by volunteers at our local historical society. This saved us a good deal of time. On the other hand, because a number of different volunteers had worked on the transcribing, all with different levels of understanding of the data and with varying abilities to read cursive and decipher census-takers' sometimes difficult-to-unravel handwriting, it quickly became clear that the census data needed a lot of cleaning. I converted the excel file to a google spreadsheet so all students could have access to the material enabling us to work on cleaning the data together.

I had naively assumed that the cleaning process would be aided by the combined efforts of twenty students—I divided up the census data between the students, and provided detailed instructions for cleaning. What became apparent over time, however, was that like the volunteers who had originally transcribed the census data, students had varying levels of understanding of the material and varying levels of commitment to the project. Much checking and re-checking of the data was required on my part.

In terms of the city directory, we started with a scan of the printed directory, which I again placed on a Google drive so that all students could access it. I then created a Google spreadsheet for entering the city directory data. Pages of the directory were assigned to each student to transcribe into the spreadsheet. We created unique keys in both the census and city directory feature classes and spreadsheets so we could do a join on the variables. This portion of the project went relatively smoothly, and also aroused students' interest as they recognized addresses and business names with which they were familiar. It was through the transcribing process that some class members became more engaged with the research materials and thus more committed to the project.

Our next step was to cross-reference the women from our census data and our city directory data. Because the information in these sources was collected at different times in 1905, and by different methods, we found that some women were listed only in the census, some only in the city directory, and some were listed in both. If we wanted to map residences, and when the data allowed, workplaces, we had to be sure we weren't duplicating or missing women that met our criteria. This step was time-

consuming.⁶ Only careful sleuthing in matching addresses and occupations, sometimes involving looking at actual scanned manuscript census pages, provided answers. Some students took on this detective work with gusto, others found it tedious and did not put forth their best efforts, variations we did not discover until later on in the project.

With the census data cleaned and the city directory data transcribed, by mid-semester the students were able to begin placing points in a feature of the women's residences on the Sanborn maps. Some challenges arose here when women's addresses were located in areas not covered by the Sanborn maps, and street names had changed over time so contemporary street maps were not helpful. I had to locate additional historical city maps and later Sanborn maps in order for the students to map women's residences, and even then, point placement was challenging. As you can see on the Sanborn maps, streets often had two sets of numbers, reflecting name and numbering changes over time.

What we all discovered is something I didn't have a good sense of until experiencing it first-hand—that preparing the historical database took the bulk of the time available for the project, leaving only limited time for analysis (more on that later).

By the end of the fall semester, we were left with most, but not all residences and workplaces plotted. The census and city tables were not yet joined to the point features of women's residences and work locations, and there was no time for carefully analyzing the data to answer our original questions.

Thus what began as a one-semester project stretched into a second semester. Fortunately four students who were in the women's history class in the fall had enrolled in my digital history class in the spring. As their semester work they were assigned the task of completing the Moorhead Working Women project—including completing the plotting, analyzing the data, and communicating their findings to a broader public.

Once this smaller, focused group began working intensively with the data, however, we discovered a number of plotting errors. More even than I had originally anticipated or recognized. The group

⁶ For example, our region features strong Scandinavian settlement, and it took time to determine which if any of the nineteen women with the last name Peterson, or the three named Lena Peterson, were unique to the city directory listing, or matched a census listing. Was Lena short for Evelina? Nicolina? Emelina?

determined among themselves that they should start over with the plotting in order to ensure the accuracy of their analysis. Disheartened by the performance of the previous class, but encouraged by the care and concern exhibited by these students, I agreed.

The students didn't finish the plotting until early April. Then we were finally able to join the data to the Sanborn basemap. They began to examine their map with some of our initial exploratory questions in mind. Students found limited evidence of ethnic clustering of residences or occupations. The strongest occupational clustering of residences included female educators and students who lived in close proximity to schools/colleges, as indicated on this heatmap. Their analysis also revealed that women who lived in Moorhead but were employed across the river in Fargo tended to work in more skilled occupations, particularly as clerks. They likely had higher wages and were able to afford street car fare for transportation to and from their workplaces.⁷

As the students analyzed the map, they also debated different strategies for communicating their findings. Unlike the broad mix of majors I had in the women's history class in the fall, this group of students were all Heritage and Museum Studies majors—students who hope to someday work in a historical or art museum or a public history or heritage facility. The students found the information regarding Moorhead's women fascinating, and they wanted to encourage others to explore that data. They were very interested in *engaging* their audience with the materials they had created, not just communicating their own interpretations. This made sense to me, as well, since they wanted to encourage their audience to think historically, and thinking historically involves filtering information (whether one is working with qualitative, quantitative, or spatial sources). The group first experimented with several different storymap templates, but found these didn't fit the level of interactivity they hoped to offer, so they decided to build their own webapp using Esri's online web appbuilder. The students wanted users to be able to explore the data they had gathered. For example, they wanted a user to be able to investigate whether his or her Moorhead ancestor was employed and where she lived using the app. And they wanted future students to be able to explore questions regarding age, occupation, ethnic origin or period of residency for these women. At my encouragement the students also created a storymap as a gateway to the app, to explain the research questions motivating the

⁷ We also recognized that in spite of our efforts, we missed women: Neither the city directory or the census could capture temporary migration of women very well.

project, to describe how the project was conducted, and they hope, to draw people into the webapp as an interactive tool.

LOOKING AHEAD

I plan to return to this spatial data again when I teach the digital history and women's history courses in 2019. Though we ended up with only limited time to research archival sources to enrich and augment our map this year, I plan to work with students to add some of these elements in the future. There is potential for developing the work into a deep map that includes a variety of human expressions related to the places we have mapped—such as written sources, images, statistical data, perhaps even sound. Newspapers, business records, police records, and other sources exist with spatial references for mapping the social and economic geography of Moorhead women. Incorporating such materials would allow for a fuller and deeper understanding of women's experiences than reading the written accounts alone, or viewing maps or images without an understanding of their larger context. This returns us to my opening point about the power of GIS for analysis and visualization even in traditional historical and humanities research, and frames some brief concluding comments.

CONCLUSIONS

I initially set out to use GIS and spatial perspectives in my teaching in order to develop my own skills and to serve as an example to encourage other humanities faculty. Though it took longer than anticipated, the project resulted in some positive outcomes, including the storymap and web app I shared with you, as well as a good deal of learning along the way by both the students and myself. Using ArcGIS required students to think about aspects of women's lives and experiences that they would not have considered by examining traditional historical sources, in particular the spatial patterning of women's residences. Mapping women's lives according to concepts of space and place allowed students to imagine how Moorhead women physically moved through their daily lives. Going further, students began to analyze how the spatial environment shaped choices and behaviors of women in Moorhead's workforce. This work provided them with a deeper and fuller understanding of women workers than they could draw from their textbooks or from primary sources such as newspaper accounts, though the kind of deep mapping I suggested earlier could further enrich this material. Students' use of storymap and the webapp also provided them with new opportunities to promote community engagement and historical understanding.

From the instructor perspective, I advanced some of my GIS skills through this project, and also learned not to underestimate the amount of time GIS projects take. As historian Lincoln Mullen has noted, historical mapping typically follows an 80/20 rule. "80 percent of your time is spent gathering data; 20 percent is spent doing analysis." He argues that this is a good thing, because more time is spent actually doing historical research rather than "operating levers and knobs."⁸ Mullen is absolutely correct, but I had not realized this reality going into the project and I ought to have allotted more time for the creation of our own spatial data and its place within the course. In using GIS in the humanities, one should weigh carefully the benefits and drawbacks of using already existing data versus creating one's own data. Historical spatial humanities data is much less available than contemporary spatial data. And one should think carefully about the scale of the project, as well. I learned that having smaller groups of students working on data entry and data cleaning results in more consistency and fewer errors, though less material can be processed. Still, all of this leaves me more convinced than ever that spatial learning in history and humanities classrooms is worth the extra effort required.

What about my efforts to lead by example? I believe in some small ways they nudged our humanities programs toward spatial thinking and the use of GIS. There admittedly remains a reluctance on the part of many humanities faculty to take on projects incorporating spatial perspectives and GIS. Nonetheless, having a concrete example of student work to share, and being able to serve as a resource to others, heads us in the right direction. Big changes require many smaller steps. I am hopeful that other faculty might be willing to work collaboratively on projects using spatial data and spatial perspectives.

⁸ Lincoln Mullen, "Introduction to Spatial History and Mapping - Doing Digital History," n.d., 24., <https://lincolnmullen.com/files/pdf/spatial-history.doing-dh.pdf>.