

Meg Merrick, Program Coordinator  
Community Geography Project  
Institute of Portland Metropolitan Studies  
Portland State University  
Portland, OR 97207  
Ph. (503) 725-5170, Fax (503) 725-5199, Email MerrickM@pdx.edu

Jon Dorwart, Research Assistant  
Community Geography Project  
Institute of Portland Metropolitan Studies  
Portland State University  
Portland, OR 97207  
Ph. (503) 725-5170, Fax (503) 725-5199, Email dorwarj@pdx.edu

### **GIS as a Vehicle for Community-Based Problem Solving: A Training Model**

**Abstract:** The mission of the Community Geography Project of the Institute of Portland Metropolitan Studies at Portland State University is to empower community members of all ages through the effective use of geographic information systems (GIS) technology and asset mapping methods. Training is designed to encourage participants to critically evaluate information and pose new, constructive questions about their communities and the metropolitan region. The project is predicated on the notion that in order for community members to be able explore issues using GIS on their own terms, they will have to be able to understand and use the capabilities and analytical power of GIS technology as well as have access to the technology and data. In January 2001, the project was awarded a \$259,000 grant from The Ford Foundation to train volunteers from six community nonprofits in partnership with K-12 schools over two years. Given the mission and goals of the Community Geography Project, the style of the training that we provide is critical. GIS technology is seen as a vehicle for critical thinking and geographic literacy rather than a software package to be learned through generic tutorials or a tool that prescribes answers to questions. Using our community partnerships as examples, this paper focuses on the highly interactive training method that we have developed that promotes questioning of data, analysis, and output, as well as the connections between the local and regional, and the past with the present and future. The presentation provides a model for training that could be used by community members, community-based organizations, K-12 educators, and GIS professional volunteers.

### **INTRODUCTION**

Many observers of the fields of geography and planning have pointed to both the marginalizing and empowering aspects of the introduction of geographical

information systems (GIS) to the public realm. Despite concerns that the institutions that have been the primary designers of GIS systems may lack accountability to the broader community in which they act, improved public access to GIS tools and data suggests opportunities for community empowerment that have broad implications (Chrisman, 1987; Craig, 1998; Harris 1998; Pickles, 1995; Seiber, 2000; Weiner, 2001). Nonetheless, the creation of the data upon which GIS depends, has historically arisen from, and is still maintained largely by well-funded, politically powerful public and private institutions, capable of surveying extensive geographical areas (McHaffie, 1995). Since these observations were noted, greater access to public data (particularly via the Internet), GIS technology (lower cost computers and software), as well as a growing public awareness of GIS and GPS technologies, have only increased the use of GIS data by citizens and community groups. In light of the prescribed nature of available GIS data and improved access, many local community-based organizations are discovering opportunities to collect their own local data and combine these observations with existing GIS datasets to enable them to become more strategic in their planning and mobilization efforts (Sieber 2000; Weiner 2002).

However, effective citizen use of GIS depends on users' ability to critically evaluate the nature and lineage of the spatial data that form the basis of geographic information systems. GIS analysis should be conceptualized as an iterative and interactive process, a kind of conversation with data, that is a vehicle for asking new and better questions. This can be seen as an analytical and creative challenge for community-based organizations that has the potential to promote geographic literacy and provide community members with a tool to create powerful visual representations that explore and communicate relationships within their communities and regions, and the experiences of day-to-day life.

The mission of the Community Geography Project of the Institute of Portland Metropolitan Studies at Portland State University is to empower community members of all ages through the effective use of GIS technology and asset mapping methods (Kretzmann and McKnight, 1993). The project is predicated on the notion that in order for community members to be able explore issues using GIS on their own terms, they will have to be able to understand and use the capabilities and analytical power of GIS technology, critically evaluate the nature and lineage of data and outputs of GIS analysis, and communicate what they have done, as well as have access to the computers, software, and data.

Building sustained expertise within the communities in which we work is another principal goal of our project. Recognizing the limitations that many community-based organizations have in terms of budget and staff, and also recognizing the attraction that GIS technology has for many young people including at-risk youth (based on our own experience), as well as the emphasis for community-based learning in our region's school districts, we actively encourage partnerships between community groups and schools.

In January 2001, the project was awarded a \$259,000 grant from The Ford Foundation to train volunteers (in GIS technology and asset mapping methods) from six community nonprofits in partnership with K-12 schools over two years. Projects have included environmental, historical and community-building applications of GIS. Our first year projects include: The Old Town History Project a grassroots, place-based history making of Portland's Old North End; the Sherwood Institute for Sustainability, an endeavor to build sustainability through a variety of projects from community trail mapping to community history; and The Wetlands Conservancy /Open Meadow Alternative School, which focuses on building a model for ground-truthing wetlands data. This March we selected three new partners. They are: Friends of Trees, an organization that would like to use GIS to promote and protect tree canopy in the Portland metropolitan area; Johnson Creek Watershed Coalition, a group that advocates for the recognition and protection of the last remaining open stream in Portland's Eastside; and the Oregon Child Development Coalition, that is assisting in Hispanic community asset mapping.

Given the purpose and goals of the Community Geography Project, the style of the training that we provide is crucial. From our point of view, participatory GIS must recognize the importance of critical thinking skills and that an iterative process that includes questioning, observation, analysis, and presenting findings as well as acting on these findings are fundamental to understanding what is involved in geographically grounded inquiry. This means that in the training scenario, GIS users formulate meaningful questions about their communities and region, collect primary and secondary data in the field and elsewhere, provide quality control by evaluating data and ground-truthing data, do GIS analysis, articulate justifiable conclusions cartographically and verbally, and suggest new questions based on their observations and analysis. A training environment is created in which participants in these projects are encouraged to view the whole process as interactive, one that questions the data, the choice of analysis, the outcomes of analysis – to suggest new, more informed questions.

## **MODEL FOR TRAINING**

### **User Questions and Local Data**

The model for training is based on community driven questions generated by our partners (trainees). This is important because the trainees are excited about the issues that they are pursuing and have a strong incentive to do high quality work – both in terms of data (collection and entry) and analysis. Trainees' knowledge about place can also provide valuable ground-truthing of local data and analysis that isn't possible with datasets about unfamiliar places. This is unlike generic tutorials that are designed to appeal to a broad, widely distributed audience. Moreover, exercises in such tutorials are designed to work. The disadvantage to this is that not having to work through technical and logistical difficulties as they

typically arise in self-designed inquiry cheats trainees of valuable lessons and experience. The incentive to work through difficulties is much greater when the question belongs to the user. Moreover, working on local trainee-generated questions means that we are working on their projects immediately, providing our partners with tangible benefits.

### **The Power of Simple Applications**

Our training recognizes and emphasizes the power of simple GIS processes and analyses. Our experience indicates that sometimes well-intentioned GIS professionals discourage public use of the technology by the use of jargon, emphasis on complex technical and database issues, and promoting highly sophisticated, or, as in most internet map server applications, overly simplistic and limited uses of the technology. In exploring the most fundamental question to geography, why things are where they are, relatively simple processes, such as (in ESRI's parlance) "geocoding," "joining tables," "hotlinking," and heads-up digitizing, go a long way toward exploring this question. In combination with each other and with the addition of geoprocessing tools, nonprofessional users, who are taught how to interpret spatial relationships, have a tremendous amount of analytical power at their disposal. They also have access to a tool that allows for a relatively easy means to produce and edit professional quality cartographic products.

### **Promoting Critical Thinking at Each Stage of Inquiry**

*Data:* Nonprofessional users of GIS tend not to question the accuracy of well-packaged data from public and commercial sources. An advantage to training that is focused on local questions of meaning to participants, rather than generic tutorials, is that they tend to be engaged enough to get through the learning curve of GIS software and data-related issues. Since they have a deep knowledge of the locality, they often can identify inaccuracies in the datasets with which they are working and therefore readily understand the importance of metadata in tracking data lineage in other people's data as well as their own.

The students of the CRUE (Corps for Restoring Urban Environments) program of Open Meadow Alternative School have planted native species and monitored plant growth at specific sites for a number of years. They are using GIS to analyze various factors, such as soils, slope, and proximate land uses, in relationship to the success or failure of various plant species. In their analysis, it seemed logical to include the vegetation layer available through the Portland metropolitan area's regional government, Metro. Because of their knowledge of the sites and a training atmosphere that encouraged critical thinking, the students immediately questioned the accuracy of Metro's data. Metro's metadata revealed that not only was the data ten years old but that it would be "updated as needed" – which led to a discussion about the cost of the data, who would use it, and why (all power-related issues).

We have come to accept such inaccuracies as tremendous learning experiences and due to the complexities and size of many of the datasets that we work with, such opportunities happen all of the time: why isn't my school included in the "schools" theme? Why are schools classified as "commercial"? Why is one vacant lot assessed at \$20,000 and the adjacent lot (same size and zoning) assessed at \$200,000? What are some implications of incorrect data and how might scale make a difference?

*Analysis:* When nonprofessional users are trained exclusively with prepackaged data and tutorials, they never have to go through the process of having to develop a research question and determine what data they will need and how that might affect data collection and the analytical processes within the GIS. For example, the Old Town History Project was interested in mapping historical businesses and their owners. Because Sanborn Fire Insurance Maps were available to photograph, the decision was made to geo-reference the Sanborn Maps to a current tax lot theme. Although the Sanborn Maps include a wealth of information regarding the construction and land use of the individual buildings, they do not provide business names or ownership information. Business names and addresses, however, can be found in the City's historic reverse directories. Having access to the addresses meant that geocoding could be done. Volunteers' (with the Old Town History Project) current knowledge of Old Town in conjunction with the Sanborn Maps, made it clear, however, that before 1936, Portland had a different street numbering system, therefore, geocoding using the current streets theme would provide totally inaccurate results. With the information provided by the Sanborn Maps of 1879 and 1926, new street themes were developed to reflect the old street address ranges to make geocoding of historic data possible. Business owners are to be found in other sources and "joined" to the geocoded business themes in the future. It is expected that patterns of business types and ownership, in conjunction with historic Census data, will reveal new insights into the power relationships that played out in Old Town's multi-ethnic history.

Inculcating the habit of interacting with data is central to our training. An African American community member questioned that her community had a much lower percentage of African Americans than an adjacent community as revealed in a map she was making. In checking the data, it became clear that records had been shifted in the database resulting in faulty analysis. This would not have been an obvious error to someone who didn't know the community well.

Moreover, the default settings that come with GIS software packages are presumably chosen for the widest possible use – and with the novice user in mind. However, they can create, particularly in the areas of data classification and symbolization, confusing or misleading results. Knowledge of place can act to ground-truth the meaning of data classification. Does the data classification result in an outcome that resembles what you know about the place? Based on what you

know about your community, how do the various classification systems affect the meaning of the resulting map?

***Outcomes of Analysis.*** After more than ten years of planting and replacing street trees to enhance the environmental quality of the Portland metropolitan area, Friends of Trees (FOT), a nonprofit organization, would like to be able to assess their tree planting efforts. Where are Friends of Trees planted? How healthy are the trees? What is the survival rate? Are monocultures developing in some locations? Friends of Trees has collected data based on the addresses of the location of the trees. Recognizing the analytical power that they will have using GIS technology, the database is being redesigned to accommodate a finer level of resolution. After performing an initial geocoding exercise to get a snapshot of where the trees are located, discussion has begun to focus more on Friends of Trees second goal, which is to build community. FOT has been aware for some time that some neighborhoods are less receptive to their efforts than others. The map has created a dialogue that has focused on people rather than trees and new questions have come to the fore. Why do some neighborhoods appear to be more receptive of tree-planting campaigns than others? FOT provides trees free in low-income neighborhoods; do income, education, ethnicity, or race make a difference? Who are the crew leaders in successful locations and do they make a difference? One of the neighborhoods with a great deal of FOT activity may also be home to a high concentration of community-based organizations – this data will be collected and mapped to see if there is any correlation. This is a project that appeared to be strictly environmental in quality but the power of GIS is its multi-dimensionality that can reveal human-environmental interaction.

In all of the projects in which we are involved, we encourage our partners to use the tool of GIS to begin to probe these relationships and to tell their own stories. Seeing maps, GIS's unique output, as a means to tell stories, and GIS technology as a medium with which to have a conversation, invites the possibility to more fully comprehend human-environmental interaction and issues of power as played out on the landscape. Participatory GIS, approached in this way, has the potential for providing insights to policy-makers that aren't possible in institutional settings. Ultimately, it provides a method to help raise new questions that can help shape community agendas and inspire action.

## **CONCLUSIONS**

The Community Geography Project recognizes that participatory GIS requires a different approach to training from the most widely available methods: generic tutorials and short-term generic workshops. The approach that we have developed recognizes the importance of personal knowledge of "place," process, and the opportunity that the interactive quality of GIS analysis provides for questioning and discussion among participants in the process of inquiry. From our point of view, the quality of the work depends in large part on the ability of the nonprofessional user to question the validity and accuracy of data, analysis,

and output based on the user's own experience. This is possible in the PPGIS setting because users come to the process already engaged in their communities.

We have also discovered that learning to use GIS in this way takes time and repetition. We are working with each of our partners, under the Ford Foundation grant (meeting on an average of once-a-week) for one year – and that isn't long enough to acquire total fluency in the language of geography and critical analysis. This is not to say, however, that our partners have not gotten results that have been effective and empowering – to the contrary. The year one community-based organizations, without exception, have come to more fully value and understand the power of geographic inquiry using the tool of GIS to inform their mobilization efforts. All of our year one partners are seeking ways to continue the training and further the work. Moreover, the experiences that our school partners have had and the enthusiasm with which faculty and students have embraced this community-based work as a vehicle for critical thinking and civic engagement, as well as the associated school districts' new interest (based, in part, on the experience of our school participants) in developing community-based curricula (focused on the needs of community-based organizations) using GIS, gives us hope that for future generations, thinking spatially in conjunction with acting locally, will be second hand.

## **BIBLIOGRAPHY**

Chrisman, Nicolas, 1987. "Design of Geographic Information Systems Based on social and Cultural Goals," *Photogrammetric Engineering & Remote Sensing*. 53(10): 1367-1370.

Craig, W., and S. Elwood, 1998. "How and Why Community Groups Use Maps and Geographic Information," *Cartography and Geographic Information Systems*. 25(2): 95-104.

Harris, T.M., D. Weiner, T., T. Warner, and R. Levin, 1995. "Pursuing Social Goals Through Participatory GIS: Redressing South Africa's Historical Political Ecology," in Pickles, J., ed. *Ground Truth: The Social Implications of Geographic Information Systems*. New York: Guilford. Pp.196-222.

Harris, Trevor and Daniel Wiener, 1998. "Empowerment, Marginalization, and "Community-integrated" GIS," *Cartography and Geographic Information Systems*. Vol. 25. No. 2. pp. 67-76.

Kretzman, J.P., and J.L. McKnight, 1993. *Building Communities from the Inside Out: A Path Toward Finding and Mobilizing a Community's Assets*. Chicago: ACTA Publications.

McHaffie, Patrick H., 1995. "Manufacturing Metaphors: Public Cartography, the Market, and Democracy," in Pickles, J., ed. *Ground Truth: The Social Implications of Geographic Information Systems*. New York: Guilford. 113-129.

Pickles, John, 1995. *Ground Truth*. The Guilford Press.

Sieber, Renee, 2000. "Conforming (to) the Opposition: the Social Construction of Geographical Information Systems in Social Movements," *International Journal of Geographical Information Science*. 13(8): 775-793.

Weiner, Daniel, Trevor Harris and William Craig, 2001. "Community Participation and Geographic Information Systems." *Spoletto Conference on PPGIS position paper*.