Research Article

Use of Information Technology for Community Empowerment: Transforming Geographic Information Systems into Community Information Systems

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Abstract
GIS has emerged as an elitist, anti-democratic technology by virtue of its technological complexity and cost. The question of democratizing this technology has been addressed in the GIS and Society literature. This paper addresses the thorny issue of uneven access to GIS and the associated social power it confers. Following the principle that effective access to information leads to better government as well as to community empowerment, this paper explores the issues of providing equitable access to GIS at the grass-roots level. The paper discusses a university/community partnership with the distressed, inner city neighborhood of Metcalfe Park in Milwaukee, Wisconsin. In this project, the members of an inner-city neighborhood organization were given training in GIS for accessing public information, creating new databases from their own surveys, and analyzing these databases, with the purpose of making them able and active adjuncts to the conduct of city management and the formation of public policy. The paper evaluates the successes and failures of the project. It also explores the nature of GIS usage in this resource poor community organization between 1993–2000.

1 Introduction

Deindustrialization and disinvestment processes have severely affected many American cities once teeming with manufacturing and heavy industries, blighting central-city neighborhoods with rising rates of poverty, unemployment, and crime, and generally degrading the standard of living. To counter these trends, certain government agencies

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and NGOs have implemented programs for revitalizing declining neighborhoods. Simultaneously, an important shift in local governance strategies has occurred, and citizen-based neighborhood groups and other local community organizations in cities across the country are now increasingly involved in creating and implementing their own neighborhood strategic plans to solve such problems in their communities. The involvement of local citizens and their organizations in the inner-city neighborhood planning and revitalization process has generally been welcomed by scholars and planning officials, who recognize the importance of citizen participation in planning and understand the value of the local knowledge that neighborhood resident's possess (Gans 1991, Handler 1996, Healy 1997). The inclusion of residents in information gathering, policy study, and policy formation hardly requires argument – it benefits agencies just as much as residents by making them partners rather than adversaries (Hasson and Ley 1994).

Through neighborhood empowerment, residents of affected central city neighborhoods have fought for inclusion in the neighborhood planning process. Various strategies of neighborhood empowerment exist; they range, among others, from participation in traditional politics, to direct-action community organizing, through transformative social change (Hanna and Robinson 1994). These processes are hampered by the general difficulty that community members face in gathering and understanding relevant information, particularly that concerned with spatial data (Castells 1996, Ramasubramanian 1998, Barndt 1998a, Craig 1998, Leitner et al. 1998, Elwood 2000). Here recent technology provides an answer. In today's cybernetic age, electronic technology is the fastest and surest way to access, transfer, and manipulate spatial information. Ease of visualizing and analyzing neighborhood-based spatial data makes GIS especially useful to neighborhood planner, citizen, and professional alike. With this technology, both planning agencies and community organizations can play an increasingly significant role in implementing neighborhood revitalization programs and in assessing neighborhood markets and needs (Sawicki and Craig 1996, Ramasubramanian 1998, Kellogg 1999, Elwood 2000, Ghose and Huxhold 2000a, b). In practice, implementation of GIS and other information technologies, by virtue of their complexity and cost, has effectively raised barriers to empowerment by creating exclusive, sophisticated user-communities beyond the reach of less powerful, resource poor citizens (Castells 1996, Harris and Weiner 1998a, Elwood 2000).

Traditionally, it has been official government planning agencies that can avail themselves of the expertise and resources of GIS, the Internet, and other information technologies. Lacking time, resources, expertise, or technical savvy, citizens of lower income neighborhoods find their political voices made small. However, if information is power ... and if community is built through dialogue, then informatics permit both to emerge for those who would otherwise have no voice and no space for collective action (Pickles 1995, 10). Such issues have been critically examined in the GIS and Society literature, which studies "the societal impacts of spatial data in the new information age... The GIS and Society literature raises a number of issues concerning the epistemology and political economy of GIS and the politics and power relations associated with their use" (Harris and Weiner 1998a, 67). The hegemonic power relations embedded within GIS along with its elitist and anti-democratic nature caused by differential access to data and technology have raised considerable concern among scholars (Pickles 1991, 1995; Lake 1993; Aitken and Michel 1995; Curry 1995; McHaffie 1995; Rundstrom 1995; Taylor and Johnston 1995; Weiner et al. 1995).

Consequently, the issue of making GIS/IT available to community organizations has received considerable attention among GIS professionals and scholars (Hutchinson and Toledano 1993; Barndt and Craig 1994; Obermeyer 1995; Sheppard 1995; Sawicki and Craig 1996; Barndt 1998a, b, 1999; Clark 1998; Elwood and Leitner 1998; Craig and Elwood 1998; Harris and Weiner 1998a, b; Howard 1998; Kim 1998; Leitner et al. 1998). The establishment of "Empowerment, Marginalization and Public Participation GIS," or PPGIS, as a research focus addressed by NCGIA Research Initiative 19 and Project Varenius demonstrates the importance of creating a more democratic practice of GIS (Obermeyer 1998).

Following the principle that effective access to information creates more opportunities for both better government and community empowerment, this paper explores the issues of providing equitable access to GIS among traditionally marginalized citizens. The paper examines the case study of the inner-city neighborhood of Metcalfe Park in Milwaukee, Wisconsin. In this project, residents of an inner-city neighborhood became active participants in building a community information system, learning to access public information and create and analyze new databases derived from their own surveys, all with the purpose of making these residents useful actors in city management and in the formation of public policy. Finally, using the case of Metcalfe Park, the paper examines the complexities that are embedded in the process of establishing a sustainable PPGIS initiative in distressed, resource poor, neighborhood organizations.

2 Facilitating Public Participation GIS: Role of Data Providers

A number of programs have been developed to provide access to data and GIS analysis to citizens in local community organizations (e.g. Barndt and Craig 1994; Sawicki and Peterman 1998). Some of the noted GIS providers within the midwestern US include the Center for Neighborhood Technology and Chicago Area Geographic Information Study (hosted by University of Illinois-Chicago) in Chicago, Center on Urban Poverty and Social Change (hosted by Case Western Reserve University) and Northern Ohio Data and Information Service Neighborhood Link (hosted by Cleveland State University) in Cleveland, Michigan Metropolitan Information Center (hosted by Wayne State University) in Detroit, GIS Print Room (hosted by Public Works Department, City of Minneapolis) and Automated Cartographic Information Center (hosted by University of Minnesota) in Minneapolis (Sawicki and Peterman 1998). Such programs developed in concert with non-profit organizations such as NGOs, libraries, universities and government agencies, have been key agents in providing access to GIS and data for citizens. While it is difficult to provide a comprehensive list of PPGIS providers across the nation, it is possible to get an idea of their distribution through the research of Barndt and Craig (1994), Sawicki and Craig (1996) and Sawicki and Peterman (1998). Sawicki and Peterman have documented over 50 PPGIS providers located mainly in major US cities. These organizations contribute actively to neighborhood empowerment by assisting community organizations in planning and program development by providing them with direct access to information and by charging reduced fees for analytical data services. They provide valuable statistical information on such items as racial and ethnic composition of neighborhoods, age distribution of residents, labor-force participation, educational attainment, housing

stocks, land use and zoning, mortgage investment, marriage rates and family structures, income level, dependence on public assistance, movement of people, crime statistics, and public safety.

In the case of Milwaukee, public participation GIS is aided by the Neighborhood Data Center of Milwaukee Associates for Urban Development that was established in 1992. It is a significant data- and GIS-providing agency that has been created expressly to assist local community organizations in their research. While it has gone through a change in name and is now known as the Data Center Program of the Nonprofit Center of Milwaukee, its mission remains the same. The center supports the idea that information from various sources can be displayed and analyzed most effectively through GIS. It uses data from census demographics, city property files, school enrollments, and inventories of businesses and services to analyze crime incidence, public welfare, health, services to youth, etc. The Data Center provides services to neighborhood organizations on request, and works in collaboration with that organization (Barndt and Craig 1994; Barndt 1998a).

3 Obstacles to Information Empowerment

GIS data and service providers such as the Nonprofit Center have come closest to answering neighborhood needs for information access. Unfortunately, many grassroots community organizations are unaware either of the various public databases that exist or of the ways these can be used. Non-profit organizations and data suppliers are usually eager to assist such grassroots organizations, but their names and willingness to help remain largely unknown to neighborhood residents.

In light of the prevailing public unawareness of this service, several agenda questions present themselves:

1. How can we build sophisticated user communities among the residents in grassroots community organizations that:
   (a) are aware of the existence of public databases,
   (b) ask meaningful questions of databases,
   (c) are aware of the types of analyses that can be carried out with such information, and
   (d) will have an impact on the decision-making process?
2. How can grassroots organizations be made aware of the existence of agencies that can provide access to pertinent data, information technology and GIS?
3. How can such organizations build upon their valuable local knowledge to create new databases?
4. How can they afford the services of data suppliers?
5. How can data be obtained by community organizations from reluctant sources?
6. How can these organizations have access to GIS and other information technology that will assist in their decision making and participatory planning processes?

In order to be of use to grassroots organizations, GIS needs to be transformed into CIS – Community Information Systems – whereby a sophisticated users' community gains access directly to spatial information technology and public data as well as the opportunity to build its own community database, and is aware of the kinds of questions to ask and the types of analyses to conduct, so that its voice can be heard

throughout the information-gathering and decision-making processes. Universities and GIS data and service providing organizations can become directly involved with the residents of inner-city neighborhoods to create such a CIS. The project with the Metcalfe Park Residents Association (MPRA) provides a case study in the search for methods by which such empowerment can be provided at a grass-roots level by systematically fostering broad public knowledge of information technology and providing free or inexpensive access to it.

4 The Project Site: Metcalfe Park Neighborhood

The Metcalfe Park neighborhood is a mixed residential and industrial neighborhood in the central city of Milwaukee. Its boundaries are 27th Street, North Avenue, 39th Street, and Center Street. The neighborhood is bisected by the 30th Street industrial corridor, where Master Lock, Steeltech, and other companies are located. The bulk of the remaining land is in dense residential use. The neighborhood has undergone a demographic transition between 1970–90. The massive white flight it experienced in that interval has caused it to become composed mainly of African Americans (88.9%), with only 7.4% of its population being white. Not only does this neighborhood have a high poverty rate (54%), it has seen an especially high rate of female poverty, with 70% of its female-headed households living below the poverty level. Approximately 41% of the residents rely on some form of income maintenance, while 23% of the population is unemployed (with 41% of the young, female-headed households being unemployed). In terms of education, only 49% have completed high school (Social Development Commission Report 1994).

Along with poverty and unemployment problems, the neighborhood has also faced a 145% increase in personal crime since 1975. High rates of poverty, unemployment, and crime have thus depressed the standard of living, at a time when rates of teenage pregnancy, infant mortality, chronic diseases, and alcohol and drug abuse were increasing. In addition to such problems, the neighborhood has also seen its residential buildings decaying. Virtually all of its housing units were built before 1940, and many have been poorly maintained. Of all available housing units, 72% are rentals, often owned by absentee landlords, many of them neglectful (sometimes purposefully so). Vacancies and board-ups are common with 13.6% of the housing units being vacant (Social Development Commission Report 1994).

In 1990 the City of Milwaukee began efforts to address the problems of Metcalfe Park, intending to devise a model that could be applied to other troubled neighborhoods within the city. As the first step, the City of Milwaukee invested $1.4 million in an effort both to revitalize decaying housing in troubled neighborhoods and to enhance the economies of such neighborhoods. A major investment of $600,000 was made through the Central City Initiative (CCI), a redevelopment project that combines HOME funds from the Department of Housing and Urban Development and Community Development Block Grants (CDBG) to rehabilitate housing and promote home ownership. Metcalfe Park was chosen as one of two pilot neighborhoods in the nation for this new program. The City of Milwaukee also chose to recruit the fullest possible participation of affected Metcalfe Park residents; the result was the formation of the community organization called the Metcalfe Park Residents Association (MPRA). In 1993, the MPRA consisted of a board of directors and sub-committees on

housing, crime, and sanitation. This board appointed residents to the Development Advisory Group of the CCI program. Thus members of the MPRA participating in this project had an organizational structure already in place and had been working on their urban problems for quite some time. The MPRA had little prior experience of using a computer and did not own a computer in its office. It was a classic "resource poor" organization (Sawicki and Craig 1996) with financial constraints that limited its ability to afford software, hardware, data and training. The majority of the nine members participating in this project were homeowners in Metcalfe Park with little or no prior experience with computers. Of these nine members, seven were African American males, two were African American females and one was a Caucasian male.

5 Developing a Community Information System

5.1 The Project Goals

University-community partnerships have been a common and established approach for neighborhood planning, particularly in assisting community organizations in areas of community improvement (Rubin 1998). A similar approach can be taken in order to foster public participation GIS (Leitner et al. 1998, 2000; Kellogg 1999). Such partnerships are deemed as advantageous in several respects. First, they provide easier access for the neighborhood organization "to the rich potential sources of GIS expertise at the university. Second, this expertise can be focused on the specific data and application needs of the neighborhood. Third, costs associated with learning and maintaining the system are lower. Finally, this approach can improve the level of communication and interaction" between academic institutions and associated communities (Leitner et al. 1998, 23). Such partnerships are equally advantageous to the university team for a number of reasons. For the University of Wisconsin-Milwaukee (UWM), such partnerships fulfill the university's mission statement which declared "an institutional commitment to serve Milwaukee and Wisconsin by providing a wide range of research and service expertise and by maintaining strong and dynamic partnerships with the various communities and organizations in the region" (University of Wisconsin-Milwaukee 2000).

This urban mission is reflected in the goals of the various departments within UWM. The Department of Urban Planning's mission statement, for example reflects such intentions:

> Our commitment to revitalizing urban centers and building healthy metropolitan areas is renewed every day as the faculty reaches out to the Milwaukee community as a living laboratory for learning and discovery. The second year core courses, and many elective courses, involve students in real-life planning experiences. Students work in groups, under faculty supervision, for clients in the community. Students experience first-hand the challenges of articulating a vision, finding solutions, analyzing policies, and preparing plans (School of Architecture and Urban Planning at University of Wisconsin-Milwaukee 2000).

These objectives along with the goal of providing public access to GIS have been pursued through university-community partnership for several years in the advanced urban GIS course offered in the School of Architecture and Urban Planning at UWM.

The project of building a CIS for Metcalfe Park also began in this course. The MPRA was chosen by the university team to be the participating community organization for several reasons. First, it was identified as located in a deeply troubled neighborhood in dire need of revitalization. Second, the university's ties with this neighborhood's community organization had already been established through a prior project that had been led by one of the members of the university team. Third, the community organization at Metcalfe Park had expressed its dissatisfaction with renewal efforts made under the auspices of City Hall. Members of this organization felt that several key issues had not been addressed. They also felt that they as a community faced difficulties in participating effectively in the revitalization program.

At the beginning of this project short- and long-term goals were defined by the university team. The short term goals were:

- To create an awareness of the value and utility of public information in neighborhood empowerment.
- To educate the community team on information technology and GIS.
- To familiarize it with existing public databases and data-providing organizations.
- To provide a short training session in GIS to the participants of the community team. It was assumed that a hands-on training would provide a better sense of awareness of the technology, and make CIS an inclusive process.
- To assist the community team with creating their own neighborhood databases based on local knowledge of their community.

The long term goals were:

- To establish a continued use of information technology and GIS analysis among inner city community organizations. This would begin through the establishment of a community in-house GIS at Metcalfe Park.
- To enable a stronger citizen participation in the neighborhood planning process, especially on decisions concerning allocations of funding and future developments.
- To promote empowerment of citizens traditionally excluded from the decision-making process in neighborhood planning.

Once the goals were established, a group of graduate students (including myself) from UWM approached the residents of the Metcalfe Park Neighborhood with the project proposal in the Fall of 1993.

5.2 *The Project and the Process: Comprehending Resident Interest*

Would the community organization of Milwaukee's toughest inner-city neighborhood be interested in learning about information technology and GIS as a planning and empowerment tool so that it could participate in decisions affecting resource allocations in their neighborhood? Would it be interested in acquiring its own set of such tools? The MPRA was interested and accepted our proposal. Nine Metcalfe Park residents who were also members of the MPRA volunteered to participate in the project. Eight graduate students volunteered to form the university team. Thus, a university/community partnership was formed, in which the role of the university team was to introduce GIS and IT to the community organization of Metcalfe Park, which in turn was an active partner and played a key role in defining community concerns and in

finding solutions to social problems. Bringing the technology and resources of the university to the neighborhood, creating the GIS, training the members of the MPRA, and learning how to act in a supportive capacity to the community team, were all challenging tasks that required effort on several fronts and an orderly plan.

5.3 Interaction with the MPRA

The first step in the project concentrated on establishing a relationship between the University team and the MPRA. During this period, the University team had several meetings with the MPRA members to discuss the scope and structure of the project. These meetings were held in the Metcalfe Park neighborhood. An integral part of these meetings consisted of letting the members of the organization determine their own concerns and ambitions. These members discussed problems of their neighborhood they felt had been overlooked by City Hall. They enumerated several concerns they perceived to be critical to achieving revitalization goals. One key issue was identifying absentee landlords in the neighborhood who had let their properties deteriorate. Other key issues involved identifying tax delinquencies and building code violations as well as real estate property sales in their neighborhood. Some other important concerns related to the increasing number of vacant lots and boarded up properties, the problems of coping with accumulations of garbage and with the increase of crime. These discussions in turn led to identification of the community organization's data needs. During these meetings the University team made a list of the most serious data needs expressed by the community organization. The University team felt that they could provide data and analyses on most issues of concern. However, several other issues were also brought up by the MPRA that fell beyond the abilities of GIS to solve. Thus, the limitations of GIS in assisting neighborhood planning were discussed with the community team as well.

The next step for the University team focused on explaining the concept and process of GIS to the residents. The next three meetings followed a process of paper-to-computer exercises designed to show the progression of moving from paper lists and maps, to computer databases, and then to a GIS where the data are linked interactively to digital maps. This process was based loosely on Huxhold's County GIS exercise (Huxhold 1991, 142). It attempted to demonstrate how one could begin with raw data, sift it for useful information, and then use the results to formulate plans for action.

5.4 Conducting Neighborhood Surveys with Residents

Since spatial data forms the backbone of any GIS, the project began by addressing the sources of data that would be most valuable to the residents. Both publicly available data and community-based data were deemed necessary to form the database for the Metcalfe GIS. Neighborhood surveys were conducted to gather community-based data and to demonstrate how databases could be built. The MPRA was particularly interested in collecting address-based data on boarded-up homes, vacant lots, and properties that contained substantial accumulations of garbage, rubbish, and debris and consequently posed threats to health and safety. Project members walked through the neighborhood, taking note of boarded-up properties, vacant lots, and sanitation problems. Later, data from the survey were transferred to a paper map showing parcels of properties in the neighborhood, with a variety of colored dots representing classified

conditions. This particular exercise introduced the community team to the concept of spatial analysis, as the colored dots assisted them to see patterns of problems, configurations not apparent during the neighborhood strolls.

The next steps were to introduce the community team to public databases and to inform them of organizations that provide access to and analysis of such data. A visit to the Data Center Program of the Nonprofit Center of Milwaukee was made to achieve these goals. The members of the community team were first introduced to the paper form of the most relevant public database – the MPROP database (Master Property file), which they examined for information about their own neighborhood. The paper format of MPROP is vast, and it is extremely time-consuming and difficult to access parcel-based neighborhood information from the hard copy of the MPROP. Therefore the data center director demonstrated the ease of accessing MPROP data by computer. He also performed GIS queries and some spatial analysis as part of the demonstration. This allowed the community team members to comprehend how the computer simplified and accelerated the research process.

5.5 *Creation of Digital Data by University Team*

GIS users are familiar with the complexity involved and technical expertise required for creating digital maps and databases in GIS before any analysis can begin. Finding suitable base maps and editing them, and finding databases and learning the geocoding process between maps and databases comprised the next parts of the project for the University team. The steps included obtaining and editing a digital map of the area, obtaining a database containing the information the community team wanted, and manipulating the geocoding process to make the map and database interactive. These operations were performed in Arc/Info. However, ArcView 1.0 was chosen for the display and analysis tasks because of its comparatively user-friendly nature.

A digital map of the Metcalfe Park neighborhood was obtained from the Information Systems Division of the City of Milwaukee. The City provided digital quarter-section maps, 1/2 mile by 1/2 mile square graphical representations of the legal surveys of the land showing all the parcels of property in that area. The Metcalfe Park boundaries were within three adjacent quarter sections (numbers 325, 326 and 327). These separate quarter sections were joined together, edited, and parcels checked for changes in ownership. The topology of the map was then built, making each parcel into a polygon with its own internal identification, to give the computer the ability to identify the logical relationships between objects on the map. Lastly, the digital map was edited to eliminate the area outside of the Metcalfe Park boundaries.

The MPROP database was chosen to be the major data source in response to the needs assessment and MPRA requests. MPROP was built for tax-assessment purposes and each parcel of land is identified with a unique tax-key number in this file. Additional information regarding census tract and block number, police district, aldermanic district, building inspection area, and fire department district are also provided. Detailed information about the parcel is given, such as ownership, zoning, land use, SIC code, past and present assessed value of land and structure separately, past and present tax-exemption status of land and structure, structural information on homes and buildings, year of change of assessment code, property transfer information, tax delinquency status, building code violations, and raze status. The database also indicates if the building is registered with the Milwaukee County Historical Society.

This database was extremely useful to the members of the MPRA for their work on housing issues. Prior to this project, the MPRA had partially utilized this data, but were acquiring information through the time-consuming and cumbersome process of visiting City Hall and tracking paper copies of records on a department to department basis.

In addition to MPROP, three other databases were built, based on the MPRA survey data and needs. The first contained address-based data on the location of vacant and boarded-up homes in the area, data acquired via windshield surveys by residents in 1991, 1992, and 1993. The second database was built with data gathered from sanitation surveys conducted by a university/community team, wherein residents recorded the location of parcels that exhibited problems with, for example, loose garbage, abandoned cars, fallen trees or overgrown vegetation, and tires or hazardous wastes. The third database recorded the names and addresses of the residents participating in the MPRA so that the organization could keep track of its active members.

These databases could now be linked to the Metcalfe Park digital map. To accomplish the geocoding process, the City_Pts file was obtained from the city. This file contained locational points with x-y coordinates attached to them. These points were matched with the internal identification of the parcel polygons of the digital map, a shared feature. These files and the MPROP database were then joined and checked for errors. The digital Metcalfe Park map and MPROP database were now linked and made interactive. Geocoding the MPRA's own database with the digital Metcalfe Park map was accomplished through an address-matching process.

5.6 *The Training Process*

Having perceived the speed of accessing and analyzing information through the computer, the community team was now prepared to undertake training in the use of ArcView 1.0, a program chosen for its user-friendly interface. Four training sessions were organized, each more detailed than the last. A recapitulation of past lessons initiated each session, to reinforce previously learned skills.

The training sessions were conducted in the GIS Lab of the UWM School of Architecture and Urban Planning. The basic premise was to have a student instructor guide the group through the assigned instructions on a computer linked with an overhead screen with all residents able to view the screen. Two community team members were assigned to one computer, accompanied by one student member to provide individual assistance (Figure 1). The basic concept was one of hearing, seeing, and doing. MPRA members would hear a description of the lesson, see it demonstrated, and try it themselves (Arnold et al. 1991, 25).

The first training session (November 18, 1993) concentrated on the basics and introduced the class to computer use. This included defining various terms such as keyboard, mouse, and monitor, and instruction in techniques such as pointing and clicking a mouse. Once the participants mastered these skills, the university training team introduced the community team members to ArcView 1.0. Topics covered included how to start the program, elements of the various windows and menus and their use, and the basics of building a theme. This session was necessary to bring all the community team members (of whom most had never used a computer) up to speed on the basics of computer use. The end product of the session was construction of a theme (land use for example), and printing of a land-use map of Metcalfe Park.

Figure 1   Training session in progress at University of Wisconsin-Milwaukee

At the second training session (December 2, 1993), community team members learned to analyze data using ArcView's Query function. The goal was to introduce them to some of the spatial analysis functions of ArcView, such as color, legends, and class values. While the overhead was used at this session, individual university team members were still paired up with the community team members to provide additional assistance. This training session demonstrated the capabilities of GIS to the community team, who could then see the possibilities this software offered to their organization (Figure 2).

The third training session (December 9, 1993) helped the community team to use GIS to analyze problems specific to their neighborhood, to get a feel for the limitations of the city's data, and to learn how to work around those limitations. The primary focus of this session was to gather information about properties owned by certain problem landlords. Here, the instructor took the suggestion of the community team members and began to build query files for certain landlords. After the community team completed this step, the instructor described the various ploys landlords use to confuse city records, and then demonstrated ways ArcView could broaden its search to look behind altered names and registration ruses. By using this method, the number of identified properties increased tremendously. The community team members were most interested in the ability of GIS to create a visual record of these properties within minutes. The ability to recognize absentee landlords and to track down previously unknown landlords was of great interest to the community team. By the end of the session, the community team members were building their own queries covering topics from slum landlords to building-code violations. For the first time, the community team members were starting to receive the information they said they wanted at our first meeting.

**Figure 2**   Residents of Metcalfe Park learn to use GIS at the training session

The fourth training session (December 16, 1993) was structured somewhat differently and attempted to make the connection back to the paper maps with which the process had started. Here the emphasis was on using printed maps and tables, whether by hand or computer, in order to perform spatial analyses. Discussion focused mainly on what the patterns on the maps meant, and on what the community organization could do with this information. How to use the sanitation survey to get city action was also discussed. The community team's first surveys were shown in computer maps.

6 Findings

The community team members were deeply interested in tracking down absentee landlords and in finding code violations of buildings. Their other interests included current and past land uses, the status of vacancy and board-ups in the neighborhood over time, records of tax delinquencies, real estate sales, buyer and assessment information, sanitation data, and crime records. They found answers to their questions in two ways: by performing queries in the MPROP database and by constructing maps from the MPROP and their own survey database. Query searches were particularly helpful in tracking down absentee landlords or slumlords, who took no responsibility for upkeep of their rental properties and allowed them to deteriorate. Such query searches were also helpful in unearthing the records of tax delinquencies in their neighborhood. Lacking such data, the community team members had previously been unable to take action. Access to such data proved to be

the first step in their empowerment, for they now had evidence in the form of data, tables and maps with which to reaffirm and refine their agenda. The maps that were created as part of the project assisted the residents to visualize the precise locations of problems in their neighborhoods. Maps are a powerful medium that can often convey and communicate information more effectively than words. As Craig and Elwood (1998, 103) pointed out in their research, maps can provide "general information about the community down to details about a single property". Spatial data displayed in maps can provide assistance to community groups to "improve administrative efficiency and effectiveness, to identify key strategic issues facing the community and useful ways of addressing them, to transform plans into tactical actions, and to organize members of the community" (Craig and Elwood 1998, 103). In this project mapping was emphasized to display the results of queries and to visually represent the neighborhood data. The community team members found the maps that they created as part of the project to be an effective vehicle for expressing some of their concerns. One of the useful maps for the community team members was the land use map of the neighborhood. This map showed that while residential land use was still dominant, there were a considerable number of vacant lots in the neighborhood, a sign of deterioration. There were also many commercial and industrial properties within the neighborhood, which could also indicate the presence of environmental degradation.

Using the data from their own surveys, the community team members created maps that showed the location of boarded-up homes and vacant lots by address (Figures 3 and 4). While these maps appear to be crude by today's standards and do not include necessary cartographic elements such as a scale bar, these were powerful tools to voice the neighborhood's concerns. Such maps would assist the MPRA to represent

BOARDUPS
● **PROPERTY**
LOT OUTLINE
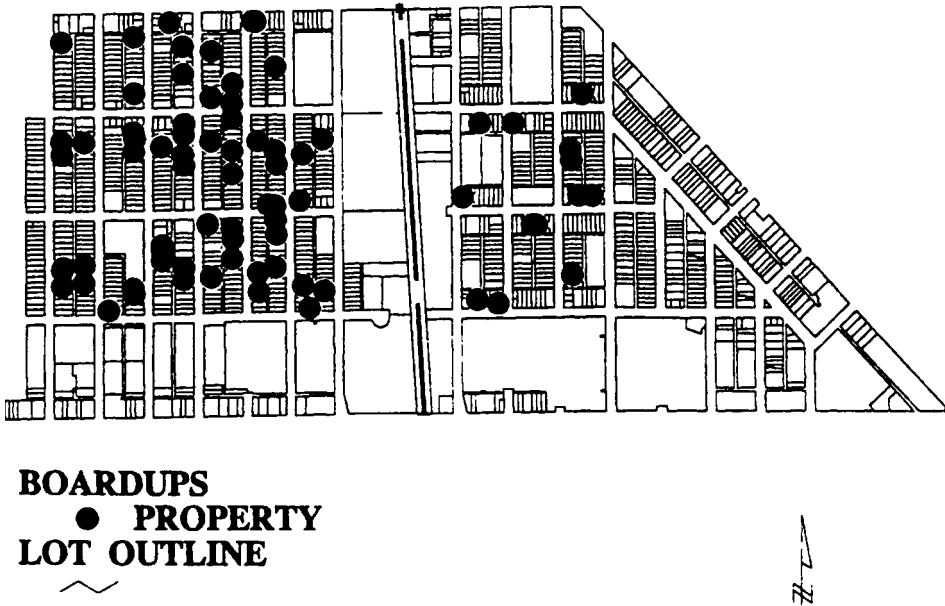
Figure 3 MPRA Created Map Showing Boarded Up Homes in Metcalfe Park, 1993

VACANT LOT
● PROPERTY
LOT OUTLINE
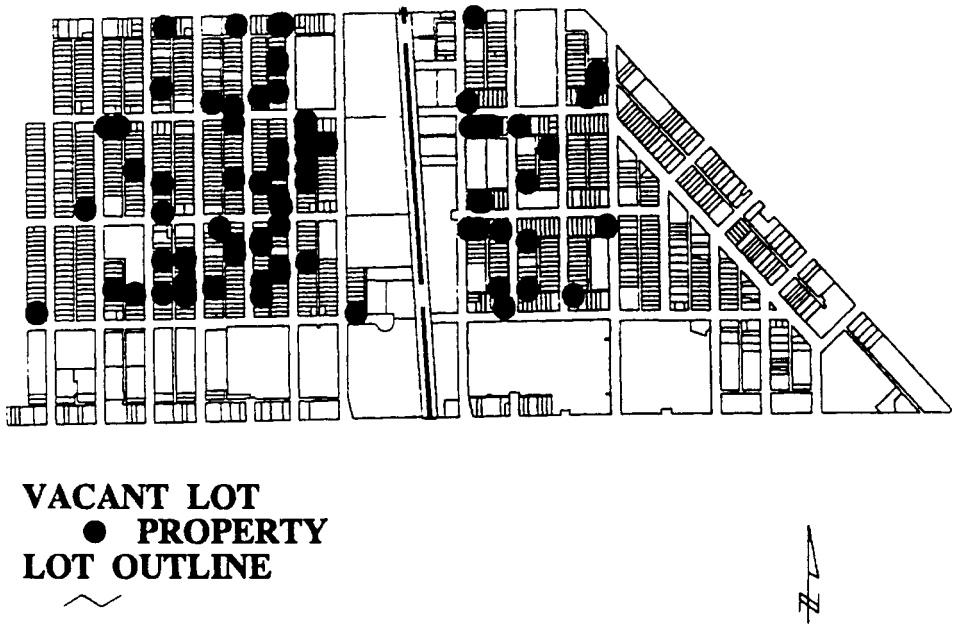
Figure 4   MPRA Created Map Showing Vacant Lots in Metcalfe Park, 1993

its concerns with visual aids to planners regarding increases in vacancies and board-ups in their neighborhood. The sanitation survey data compiled by the MPRA also produced useful maps depicting problem areas by address. Timely garbage removal had become a major issue for the neighborhood. This map showed the precise locations of the problems – parcels that contained old cars, garbage, yards full of junk or old tires – visible signs also of neighborhood decay. Such a map, and its associated data, would enable residents to voice their concerns to the Department of Sanitation.

One of the hindrances to Metcalfe Park residents' collective efforts to revitalize themselves lay in the fact that many residential properties were owned by absentee landlords who had little stake or interest in either neighborhood appearance or revitalization. Maps were drawn to emphasize the location of properties that were owner-occupied and those that were not. Such information was useful to members of the MPRA in their commitment to address the problems of absentee ownership.

In general, the community team discovered that although the City of Milwaukee presides over a vast repository of records that they could use for their purposes, they as residents of Metcalfe Park had a wealth of specialized knowledge about their neighborhood that could not be found in city records, and that they were able to find instances where their information was more accurate than the city's.

6.1 Project Outcomes

This project successfully introduced the community team to the wide array of information and the technology that can be used for the purposes of participatory empowerment in the civic process. The community team expressed interest in

continuing to work with the MPROP database, and decided to continue with their sanitation survey as well. At the end of the project, the MPRA expressed its desire to correlate the survey with the job planning of city departments responsible for sanitation clean-up efforts. The MPRA also intended to include gang-graffiti identification in its future sanitation surveys in order to assist the gang-crime's unit of the Milwaukee Police Department (MPD) and Social Development Commissions' Youth Diversion program. The MPRA felt that such specific data expressed through maps and tables would help them to communicate their concerns more powerfully to those responsible for sanitation services. This survey and its reworking are examples of how the CIS process can mature and adapt to deal more effectively with the residents' wants and needs in a changing context.

Members of the MPRA also expressed interest in expanding the scope of their research to include the issue of crime. In order to effectively plan anti-crime strategies, residents need a greater understanding of crime patterns. Foot-patrol officers, block-watch captains, mobile-watch participants and other residents involved in community policing efforts could greatly benefit from seeing the incidence of crime and patterns of crime over time displayed spatially. A crime-incidence database was being developed to provide address-specific data in order to assist with community policing activities in the Metcalfe Park Neighborhood. The participation of two Milwaukee Police Department officers in the project and the close cooperation between the police and the residents in neighborhood improvement efforts presented a unique opportunity for the residents to obtain the appropriate information for spatial analysis of crime data.

6.2 *Project Evaluation and Long Term Outcomes*

The project was successful in reaching all of its short-term goals and several of its long-term goals. First, it successfully applied GIS in a new context, giving citizens with little or no previous computer experience a powerful instrument they could use in their ongoing efforts to solve real and often complex problems within their neighborhoods. It created an awareness of the value and utility of public information in neighborhood planning efforts. It helped to redistribute socially significant measures of the analytic power of GIS from the elite user group of planners and corporations to disadvantaged sectors of the public. It addressed the thorny issues of unequal access to high-tech tools and to the associated social power they confer. It incorporated the participation of local residents and their community knowledge into the framework of GIS, creating in effect a "community-integrated GIS" (Harris and Weiner 1998a). Finally, it introduced the MPRA to institutions such as the UWM and the NonProfit Center, through which the organization could continue to sustain their planning efforts.

Second, this project established a model for applying GIS to neighborhood planning and community development. This model established a process that can lead to meaningful citizen participation, especially by those groups of people who have traditionally been excluded from the planning process (McGinniss and Gray 1987, 1). This project sought, of necessity, to establish a paradigm for cooperation by educational institutions, urban planning experts, and ordinary citizens in their mutual efforts to address the problems of older urban neighborhoods.

Third, this project built a relationship between the residents and the students where each group benefited mutually from an exchange of knowledge and experience.

With the assistance of an interactive learning approach, the learning process became democratic and more interesting.

This project also successfully fulfilled the university's "urban mission" and provided real-life planning experiences to graduate students of UWM. While all of the students in the university team were deeply interested in the cause of citizen participation in the inner city planning process, few of us actually had the opportunity to work with citizens of distressed inner city neighborhoods. This project took us to the heart of inner city Milwaukee and provided the first opportunity to interact with the residents and assist a resource-poor, grassroots neighborhood organization in their planning process.

Other than the training sessions, all of the meetings between university and community teams were held at Metcalfe Park. These meetings, and the neighborhood surveys with the community team, offered us the opportunity to better understand the concerns of the Metcalfe Park neighborhood. This project had a long lasting effect on the graduate students and influenced a number of us to embark on careers facilitating citizen participation in the community planning process.

The project also experienced failure in one major area. One of the long-term goals was to establish a community in-house GIS in the Metcalfe Park neighborhood. "A community-based (in-house) GIS is usually designed as an independent node located within the community organization, usually at its office" (Leitner et al. 1998, 7). There are several advantages to a community in-house GIS:

> Neighborhood organizers and residents do not have to travel outside the neighborhood, but rather are able to gain direct and immediate access to information as needed for neighborhood planning and organizing purposes. Furthermore, an in-house system may be tailored to the specific needs of the community organizations because it allows them to create and interactively manipulate their own databases and maps, rather than relying on pre-defined data sets or maps. The responsiveness of an in-house GIS to neighborhood needs is potentially enhanced by the fact that neighborhood organizations are the primary stakeholders in an in-house system… It offers the possibility to build skills and expertise within the community… (Leitner et al. 1998, 7).

Implementation of such a goal can be hindered by financial considerations, such as the ability of organizations to purchase expensive hardware and software. In order to overcome such a problem, the University and ESRI agreed to provide the citizens with a computer and necessary software, in order to encourage them to pursue exploration of IT/GIS on their own. Thus, access to expensive hardware and software was mitigated. However, there still remained barriers to implementing an in-house GIS within the Metcalfe Park neighborhood. The complexity of GIS proved to be too difficult to master for the MPRA. The technological challenges of performing searches, queries and accessing information proved too daunting. Since the MPRA did not have the funds to employ a GIS specialist as a staff member in its office, it abandoned the goal of building a community-in house GIS. Instead, the MPRA developed a network of collaborative partnerships with established organizations to satisfy its GIS needs. From 1994 onwards, the Data Center Program of the Nonprofit Center became a major partner in providing assistance with the GIS and geographic data needs of the MPRA.

The MPRA also maintained its ties with UWM and sustained its PPGIS efforts through university/community partnerships. University and Community partnerships

have proved to be rewarding for several reasons (Leitner et al. 1998, Kellogg 1999). It is a cost effective way for grassroots organizations to have access to GIS expertise and to focus upon the data and application needs of the neighborhood. Through a separate course in Urban Planning, graduate students at UWM continued to work with the Metcalfe Park data and to track housing trends over time. One of the outcomes of such collaboration is seen in maps that document changes over time in the Metcalfe Park neighborhood. Maps were drawn to address land-use change over time, the status of boarded-up homes and to analyze the trends during the period 1993–1996. Such trends-over-time analyses were done with maps depicting parcel-by-parcel locations of owner-occupied properties, both residential and non-residential, in 1995 and by comparing them to the locations of owner-occupied properties in 1993. The location of vacant properties in 1995 was shown in another map and comparison with the 1993 data was made as well. Thus the residents of Metcalfe Park continued to receive information regarding some of their key concerns through the University-Community partnership.

The changing local political context of Milwaukee was another key factor that influenced the MPRA to continue its PPGIS efforts. Since 1996, the process of allocating Community Development Block Grant (CDBG) money influenced several neighborhood organizations across Milwaukee to establish PPGIS efforts through partnerships with both UWM and the NonProfit Center. While CDBG funds were provided directly to local governments, it was expected that the revitalization activities facilitated with CDBG funds would involve local citizen participation. Milwaukee's Community Block Grant Administration (CBGA) oversees the distribution of these funds. "The agency relies on neighborhood strategic planning as the best way to target funds effectively, because it identifies the needs of an entire neighborhood instead of basing decisions on individual agencies' budget demands" (Huxhold and Martin 1996, 54). Each neighborhood is asked to formulate its strategic plan defining issues of neighborhood concern, such as crime mitigation, youth programs, employment opportunities, job training, housing rehabilitation, tenant advocacy, health care, and recreational opportunities. CBGA has identified seventeen Neighborhood Strategic Planning (NSP) areas in the city of Milwaukee. Within these NSP areas, CBGA allocates funding to community-based organizations that address one of the following areas: reduce the decline in owner occupancy; reduce the overall crime rate; arrest or reduce the decline in property values. Metcalfe Park is identified as one of the critical NSP areas. For the MPRA, the need to address such issues effectively led to a need for neighborhood-based spatial data analysis and to the need for GIS. In an effort to address such needs, the MPRA has sought out the assistance of both the UWM and the Data Center of the NonProfit Center. This is not an uncommon situation, for PPGIS studies have shown that grassroots community organizations of inner city neighborhoods often assemble a complex network of partners, ranging from university partnerships to federal and local government agencies to non profit organizations, supporting community based research or technological access, to support their PPGIS efforts (Barndt 1998b, 1999; Leitner et al. 1998, 2000). For Metcalfe Park, these partnerships assisted the organization to use geographic data and analysis in its formulation of its strategic plans, which in turn helped them to receive CDBG funds.

A key issue in establishing public participation GIS at the grassroots level involves the question of sustainability (Barndt 1999). For the MPRA, establishment of a sustainable GIS agenda was dealt a severe blow when it experienced two rapid turnovers in staff and in leadership (Barndt 2000, pers. comm.; Moore 2000, pers.

comm.). The last turnover in 1999 was devastating to the organization for it wiped out a number of pre-existing resources and much of the past GIS research activities and initiatives. The MPRA reemerged as a smaller organization, with a new executive director, Larry Moore, two full-time staff members, and one half-time staff member. Currently it is in the process of electing a new board of directors comprised of nine residents from the Metcalfe Park neighborhood. Monthly meetings are now held by the MPRA, with between forty and seventy residents of the neighborhood attending these meetings. Attendees receive information regarding building inspections, sanitation issues and other concerns. Free memberships are being offered to the residents of Metcalfe Park, and members in turn will elect the new board of directors. The organization continues to value the use of IT/GIS and currently uses two computers for word processing, desktop publication and Internet exploration. In the future, the organization aims to use the computers for data storage and analysis, as well as other organizational purposes.

While neighborhood conditions have improved in Metcalfe Park over the years (Moore 2000, pers. comm.), it continues to be plagued by a series of problems that were present at the time of the first UWM project in 1993. These problems include signs of urban blight such as dumping of garbage and other materials (cars, refrigerators, tires), the presence of vacant lots, boarded-up homes, and problems of absentee landlords. In order to address such problems, the MPRA is implementing new strategies. While the turnovers in the MPRA brought a halt to the neighborhood surveys, such as the sanitation survey and the vacant lot/board-up survey, there is once again a neighborhood clean up strategy initiated by the MPRA. A pilot project was conducted over the summer of 2000, involving several departments at City Hall, including the Sanitation Division and the Nuisance Section of the Department of Neighborhood Services, as well as neighborhood residents of Metcalfe Park. The MPRA continues to focus on "establishing a consistent leadership without rapid turnovers, going after housing rehabilitation, increasing home ownership, economic redevelopment" (Moore 2000, pers. comm.).

The MPRA also plans to address these community concerns through a continued use of GIS and geographic data. The NonProfit Center has assisted the MPRA in producing asset lists, mapping ownership patterns, evaluating housing value changes and preparing formal land use maps (Barndt 2000, pers. comm.). It has also assisted the MPRA in receiving "a broad set of maps and tables during its strategic planning in 1999" (Barndt 2000, pers. comm.). The Data Center has assisted the MPRA "to identify data to monitor neighborhood conditions and support initiatives, justify existing programs or funding" (Moore 2000, pers. comm.).

The new executive director at the MPRA feels that use of geographic data and its analysis is vitally important for community organizations in their planning efforts, because

"for one, you can use data to determine if you are being effective with your strategies, and if you are not, then you can change your strategies. Utilizing data to show different strategies ... what can the data tell me about the changing property values, has the home ownership been increasing or decreasing, what were the types of crime or number of instances around the particular area where the decreases [of home ownership] are occurring, how do you cross reference that type of data that's the way I perceive of using data" (Moore 2000, pers. comm.).

Moore also perceives GIS to be an effective instrument that would help the organization to use data effectively, the use of which would facilitate in turn the organization's participation in the City of Milwaukee's efforts of inner city revitalization. As he states:

"In the long run I am sure these [data and GIS] help you to get better funds because these help you to understand the transformation of your neighborhood, and what types of instances occurred or activities occurred during that transformation, so that based upon those activities that occurred now you can predict some probabilities of the neighborhood turning around or getting worse" (Moore 2000, pers. comm.).

For these reasons, Moore feels that it is vital for the MPRA to be an active GIS user in its daily planning efforts. While appreciating the assistance with geographic data compilation and analysis from the Data Center, Moore feels that the technical complexity of GIS has caused the MPRA to act as an occasional client of the Data Center rather than being active GIS users in its daily planning activities:

"The problem is that we are only utilizing that data when it is vitally necessary. Such as last time I met with Data Center when I had less than two weeks to form a strategic plan. I haven't seen the data since then. The unfortunate reality with the Data Center is that they have staff turnovers as well. There is no concentrated effort. If they hire a person who would work with community groups only from 9 am to 5 pm for the entire year, then we could go on working with Data Center. But they [Data Center] have too many things going on" (Moore 2000, pers. comm.).

Moore feels that regular use of geographic data and its analysis would be far more helpful for his organization in creating effective neighborhood planning strategies. Consequently, he feels that the MPRA should seek other alternatives in order to create an active sustainable implementation of public participation GIS. The MPRA has once again approached UWM faculty members to initiate another university/community partnership through the Applied GIS course. The MPRA hopes to initiate a long-term partnership with the university through which a community in-house GIS can be established and training, workshop or seminars can be provided to staff members of the MPRA (Moore 2000, pers. comm.). The MPRA also plans to employ a full time staff person well versed in technical aspects "of getting that data, crunching it, talking to other experts, proposing strategies to the community organizing NSP people" (Moore 2000, pers. comm.). While acknowledging that problems of "staff turnovers, salary issues are concerns in using GIS and data in CBOs (community based organizations)", the MPRA is optimistic about finding the money and eventually implementing a sustainable and active use of GIS (Moore 2000, pers. comm.).

7 Conclusions

In his book *Ground Truth*, theorist and critic John Pickles states "GIS is a set of tools, technologies, approaches and ideas that are vitally embedded in broader transformations of science, society and culture" (Pickles 1995, 4). As he so effectively demonstrated, "the development and application of GIS have rarely been treated as having serious political and social implications" (Pickles 1995, 5). Thus impacts on issues such as individual autonomy, privacy, access, and systems of governance have

remained largely unstudied. The problems caused by the elitist nature of GIS, along with the hegemonic power relations embedded within have been acknowledged in the GIS and Society literature (Yapa 1991, Abler 1993, McHaffie 1995, Harris and Weiner 1998a, Obermeyer 1998). PPGIS studies have emerged in response and a range of initiatives have been undertaken to provide more equitable access to GIS for marginalized groups. Universities, non-profit organizations, local government agencies, as well as federal agencies such as Housing and Urban Development (HUD), have been key players in establishing PPGIS among resource poor community organizations to assist with their planning efforts. Studies have shown that establishing public participation GIS is a complex process affected by the local political context including factors such as the openness of local government to sharing necessary resources for urban GIS analysis, openness to including community groups as egalitarian participants in the planning process, and local government agencies' own experience and expertise with using GIS for urban planning applications (Elwood 2000). In the case of Milwaukee, local political contexts have strongly influenced the need for GIS based analysis among various neighborhood organizations. The city itself has a strong history of using GIS in its urban planning applications, has become sensitive to the issue of citizen participation in planning, and has encouraged stronger citizen participation in local governance. The decision to introduce the concept of Neighborhood Strategic Planning is an indication of City of Milwaukee's agenda of incorporating local community organizations in the urban revitalization process. Such a strategy involves "encouraging stakeholders within local neighborhoods to build strategic neighborhood plans" leading to the organizations now "…being encouraged to select priority targets for comprehensive development within their neighborhood. This focus has created a demand for more and more precise levels of information" (Barndt 1999, 11). In order to provide access to geographic data and GIS analysis to grassroots community organizations, the city has provided a contingency grant from CDBG funds to the NonProfit Center "to underwrite the costs of service to grass-roots organizations in Milwaukee" (Barndt 1999, 11). These varying local political contexts are all ultimately influencing community organizations such as the MPRA in their approach to use data and GIS in their planning efforts. In order to obtain access to data and GIS based analysis, community organizations such as the MPRA also routinely establish a network of collaborations (Barndt 1999). Such collaborative partners have differential impacts upon the effectiveness and sustainability of PPGIS initiatives. Finally, it is also obvious that sustainable GIS initiatives can also be adversely affected by an organization's internal turmoil, rapid turnover and change in leadership. For the MPRA, such turnovers have hurt its efforts to empower itself and emerge as a strong participant in the neighborhood planning process.

This paper explored the attempts to democratize GIS at the grassroots level through a university/community partnership. More studies of this type are needed, and there is a need to follow up such work with evaluations on how community organizations actively use GIS in their daily planning activities, on what types of policy changes they are able to bring with such information empowerment, and on whether the introduction of GIS within community organizations creates its own set of power relations between those who possess the new technical skills and those who do not.

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