Brian Thayer
Department of Geography
University of Wisconsin-Milwaukee
Bolton Hall 441
P.O. Box 413
Milwaukee, WI 53201-0413
Ph: 414.916.9126
Fax: 414.229.3981
E-mail: bpthayer@uwm.edu

Abstract

Developing a Community Information System to Assist Neighborhood Revitalization Efforts: Case Study of the Harambee Community Milwaukee, WI

Public participation geographic information system literature has explored using community information systems in marginalized neighborhoods to allow the community itself to play a larger role in the planning and decision-making processes that impact its citizens. However, there are a number of challenges in creating such a system. Technological complexity and costs have been cited as the biggest barriers. This research will look at whether a user-friendly website hosted from a University server could possibly address both concerns. The potential of using this approach to create a more democratic practice of the technology is poorly understood due to a lack of empirical research on the subject. Drawing upon past studies investigating the local political context of previous initiatives and organizational structure in the City of Milwaukee, an intranet website was implemented and customized for the Harambee community. Taking this bottom-up approach and incorporating local knowledge was the foundation for building the website. This research has created an awareness of the value of public information in neighborhood revitalization efforts and has allowed for a better theoretical understanding of university-community partnerships and organizational structure.

FROM GEOGRAPHIC INFORMATION SCIENCE TO COMMUNITY INFORMATION SYSTEMS

The Materialization of the GIS and Society Research Agenda

In the early 1990's, geographic information systems (GIS)[1] became an indispensable planning tool in the public sector at the federal, state, and local levels. The technology was hailed as the fastest means of accessing and manipulating a wide range of information, which simplified the visualization and analysis of spatial data (Innes and Simpson 1993, Ghose and Huxold 2001). However, as these applications proliferated and diffused into the private sector, GIS began to draw criticism, most of which emanated from social theorists who believed the GIS community neglected to address the technology's increasingly significant social and political implications. Indeed, software developers often pushed the boundaries of this cutting-edge technology increasing its functionality faster than developing theoretical constructs. Therefore, while the number of GIS applications was increasing, the disregard for examining philosophical considerations resulted in an incomplete comprehension of the technology (Pickles 1995). Both defenders and critics of the technology verbalized their opposing viewpoints by discrediting each other's stance in published literature, but no constructive dialogue between the two parties took place for several years. While academics such as Taylor felt that GIS was incapable of producing knowledge, others such as Openshaw, a GIS scholar

[1] GIS is a computer system capable of capturing, storing, analyzing, and displaying geographically referenced information (spatial data); that is, data identified according to location drawn from digital databases. Practitioners often define a GIS to also include the procedures, operating personnel, and spatial data that go into the system.

and practitioner asserted that information was essential to the advancement of knowledge (Taylor 1990, Openshaw 1991, Taylor and Overton 1991). These distinct ontological differences demonstrate just how far apart advocates and critics were in opinion with respect to GIS technology in the early 1990's – some posited GIS information led to the formation of knowledge while others claimed the application of GIS was in of itself a retreat from knowledge. The inability of both sides to recognize and understand each other's disciplinary viewpoints resulted in an impasse that lasted several years.

While the criticism varied considerably, foremost was the belief that GIS had rudimentary methodological, epistemological and ethical shortcomings. To many critical social theorists, GIS represented a return to logical positivism, reductionism, and nomothetic methods present during the quantitative revolution in the 1960's (Smith 1992, Lake 1993, Schuurman 2004). Pickles in his groundbreaking edited volume *Ground Truth* postulated that the technology was fundamentally altering the ways in which users were viewing the world. Also raising epistemological concerns was Eric Sheppard, a researcher at the University of Minnesota, who cautioned that a rise in GIS-based applications would likely minimize the importance of feminist and other interpretive approaches in favor of empirical data (Sheppard 1993, 1995). Many scholars called for the development of a critical discourse that would contest notions that GIS was value-neutral (as many GIS practitioners and researchers were claiming) and advance the position that the technology was socially constructed (Openshaw 1991, Dobson 1993, Innes and Simpson 1993, Sheppard 1993, Aitken and Michel 1995, Pickles 1995, Harris and Weiner 1996).

A rising number of technically savvy GIS scholars critical of these potentially negative aspects of the technology helped foster communication between GIS proponents and social theorists. Michael Goodchild, a well-respected geographer at the University of California-Santa Barbara as well as Director of the National Center for Geographic Information and Analysis (NCGIA), found himself in a unique position to push the heated debate surrounding GIS to the forefront and encourage a more constructive dialogue on the subject. Scholars began to realize there was a pressing need to recognize and develop the science in GIS – a means to separate the technology's utility and toolmaking capabilities from the intellectual curiosity about the nature of GIS itself (Wright et.al. 1997). In 1992, Goodchild helped coin the research term 'GIScience' which would place a stronger emphasis on gaining a better understanding of the theoretical underpinnings surrounding GIS technology (Goodchild 1990, 1992). Although the expression did not become a part of the academic lexicon until later in the decade, most scholars loosely accepted the term to mean 'research about GIS' rather than 'research using GIS'. Several years later, Pickles would suggest the following definition for GIScience: "the scholarly investigation of [GIS] origins, logics, systems, new capacities, and new uses" (Pickles 1997:369). With Goodchild's facilitation, the NCGIA sponsored a conference in Friday Harbor, WA to reconcile the opposing factions that had developed over this debate. The conference led to the establishment of NCGIA Research Initiative #19, a call for papers to investigate the social consequences of GIS and examine how spatial entities were being represented in the systems. Social theorists, human geographers, and GIS scholars met at an Initiative #19 specialist meeting in 1996 to engage in constructive criticism of the technology. The workshop was considered a huge

success as it was well attended with 32 position papers being accepted. Interest in the social ramifications of GIS representation grew, specific research topics were developed, and subsequent meetings were scheduled to ensure that discussion on the subject would continue. An entirely new dialogue between social theorists and GIS practitioners transpired, and along with this increased communication came a heightened awareness of other controversial issues surrounding GIS. New research questions were raised to investigate the technical and representational issues surrounding GIS and its use among different groups in society.

Taken together, the publication of *Ground Truth*, along with the Initiative #19 specialist meeting, led to the emergence of a research theme within the realm of GIScience called 'GIS and Society'. In a special issue published within *Cartography and Geographic Information Systems*, Sheppard set forth a research agenda on this theme by highlighting several issues he felt future scholars should consider. In doing so, he continued to ease the tension between the 'techies' and 'intellectuals' while maintaining his belief that the development of GIS is in itself a reflection of the social environment it came from (Sheppard 1995). Scholars responded by continuing to question the efficiency in which a GIS user could effectively study social processes. For instance, those that valued subjectivity revealed how the technology could be manipulated and used as a means to achieving an end (Lake 1993). Many epistemological concerns were grounded in ethics with scholars Curry and Goss calling attention to privacy issues surrounding the technology's surveillant capabilities (Curry 1995, Goss 1995). Lake warned how an individual's rights could easily be violated in cases where one is unjustly categorized in a digital database as part of a larger group leading to false assumptions of homogeneity

otherwise known as the modifiable areal unit problem (MAUP) (Lake 1993). Still others pointed out that despite a rise in GIS use by the public along with declining costs, developers of the technology ultimately retained control over its use. Smaller organizations using GIS often found themselves indebted to consultants, as the very nature of the technology often posed limits on what they could or could not do with it. This 'technocracy' Obermeyer warned, could mislead organizations into believing they held much more control over the technology than they actually did (Obermeyer 1995, Aitken and Michel 1995, Clark 1998). However, while a contentious debate over GIS issues still existed, the aforementioned concerns represented an entirely new set of questions that had not yet been effectively addressed in the academic arena up until that point; questions that came as a direct result from the conferences, specialist meetings, and publications that addressed the earlier concerns and allowed for more productive communication.

Public Participation GIS

By 1996, GIS was a multi-billion dollar industry and a mainstream software package (Obermeyer 1998, Schuurman 2000). While GIS continued to grow even more essential as a planning tool in the public sector, the technology was also being rapidly accepted in the private sector leading some scholars to speculate that the development of GIS was being motivated more by profit than driven by research (Harris and Weiner 1998). The systems were becoming more conducive to commercial activity which concerned scholars who believed that a continuation of this trend might lead to an under-representation of marginalized groups in society and allow for data collection that may

not be in the public's best interest (Aitken and Michel 1995, Curry 1995, Goss 1995, Pickles 1995, Sheppard 1995, Obermeyer 1998). As a result, GIScience scholars met at a workshop at the University of Maine in 1997 to discuss the potential ramifications of the diffusion and widespread adoption of GIS technology in society. The primary focus of the meeting centered on whether or not certain parts of society were being adequately represented in planning and decision-making processes. These researchers also began to scrutinize GIS use by the public to determine whether a truly democratic GIS was possible. This exploration triggered a new GIS and Society research direction – a branch called public participation GIS (PPGIS) (Harris and Weiner 1998, Obermeyer 1998). Central to the PPGIS research agenda were issues of proper access to spatial data, the potential for GIS to empower citizens, and the impacts the technology might have in restructuring power relations.

PPGIS can be defined as the use of spatial information by the public – typically by community organizations or grassroots groups (Brown et.al. 2003). This 'use' of GIS may include the viewing of spatial data on a community-access website, retrieving property information from a computer terminal in a government building, or directly acquiring maps or geographic information from an external source for local analysis. As GIS became more accessible to the public, some neighborhood organizations - especially those in distressed areas - began demonstrating a strong interest in learning more about spatial data. Many organizers recognized the potential of GIS and sought to utilize the technology to develop their own strategic plans in order to better understand trends occurring in their community and to influence public policy (Ghose 2001). PPGIS research has shown that effective access to local geographic information is often a

catalyst in the development of more efficient planning efforts which, in many cases, has led to community empowerment (State Cartographers Office 1998).

However, PPGIS research has shown GIS can simultaneously empower *and* marginalize both individuals and community groups (Harris and Weiner 1998). Extant literature on PPGIS has demonstrated that introducing GIS technology to a community organization can create sets of power relations within an organization and disenfranchise certain individuals who may not be technically savvy (Aitken and Michel 1995). Lack of data access is another problem organizations face when attempting to empower themselves through GIS and is perhaps the biggest contributing factor preventing more PPGIS success stories (Barndt 1998). Differential access to data among communities led researchers to question claims made by various governmental agencies that GIS promotes democracy by increasing access to information (Harris and Weiner 1998). Democratizing GIS use for community empowerment is an extremely difficult pursuit and the challenge is made even more difficult given that the effectiveness of PPGIS initiatives are highly context dependent (Ghose and Elwood 2003). PPGIS initiatives are influenced by a complicated set of local interrelationships that vary from place to place and seek to ensure that all groups of society are being represented accurately and fairly within a GIS. Therefore, a more complete description of PPGIS research takes into consideration the socio-political contexts in which the public becomes engaged with spatial data. Examining these contextual factors can prove helpful in predicting how GIS technology might be utilized most effectively leading to successful initiatives (Elwood and Ghose 2004).

Recent PPGIS research has investigated the reasons why a particular initiative can succeed in one location and fail in another. Establishing PPGIS initiatives is a complex process and is primarily affected by two major factors: the local political context of PPGIS initiatives and organizational structure (Ghose and Huxhold 2001, Ghose and Elwood 2003). Stakeholder organizations involved in the PPGIS process typically interact to some degree to foster community participation which affects the planning strategies and actions taken by neighborhood-based community organizations (Ramasubramanian 1998, Ghose and Elwood 2003). Ordinarily, stakeholders can provide better access to data, assist with eliminating costs, help citizens participate in the planning process, and directly produce GIS services themselves. On the other hand, PPGIS initiatives utilizing a 'top-down' approach can result in a community organization becoming too dependent on external entities who take on the role of technical expert. PPGIS initiatives can also overemphasize the use of quantitative data in planning efforts to present a more convincing argument to change public policy (Ghose and Huxold 2001).

Relationships and power dynamics between different organizations as well as their political and social status may contribute to local variability and influence the effectiveness of PPGIS efforts as well. Organizational knowledge, staff, leadership stability, and the presence of information technology personnel also shape the efficiency of PPGIS initiatives. Recent literature has suggested that the ability of an organization to adapt when facing adversity – such as dealing with constraints upon their use of GIS - is critical as well. Perhaps most importantly, relationships among different organizations

and organizational status are key indicators that influence PPGIS success (Elwood and Ghose 2004).

Community Information Systems (CIS)

Since PPGIS is a relatively recent phenomenon with its success tied closely to contextual factors, there exist infinite opportunities to expand upon the current body of PPGIS knowledge. Scholars have continued to explore the overlapping relationships within the local political context and organizational context, but have also started to look more closely at citizen participation to understand the differential needs of GIS and how best to provide a community organization with spatial data. A study at the University of Minnesota explored the advantages and disadvantages of providing different modes of GIS to community organizations including Internet map servers, spatial data distribution facilities, and in-house community information systems (CIS). Since the authors found that there was no single superior mode of GIS provision because of a variance in contextual factors, they concluded, "(further) analysis is needed to examine ways in which these different modes of provision might enhance or undermine democratic decision-making processes within community organizations" (Leitner et.al. 2000:54).

A CIS seeks to allow marginalized neighborhood organizations to play a larger role in the planning and decision-making processes that impact its citizens. Conceptually, a CIS assumes that local knowledge is valuable and access to spatial data is readily available through a collaborating partner. This mode of provision gives an organization primary control over a GIS and allows them to formulate meaningful questions relevant

to their community without depending on external GIS experts (Barndt 1998). As the technology was not initially designed for smaller community organizations, this 'bottom-up' or vertically integrated approach to GIS implementation would allow a community to conduct its own analysis of spatial data outside of the limitations existing GIS software imposes. Furthermore, an in-house CIS would allow a community immediate access to information offering the organization a level of independence that most other PPGIS initiatives do not provide (Ghose 2001). However, the establishment of GIS and databases in a community organization's office is still a rare phenomenon (Leitner et.al. 2000).

Due to the lack of published literature on CIS along with its powerful potential, further research involving CIS implementation may reveal enormous benefits and provide much needed insight into the role of contextual factors that shape PPGIS initiatives. Only a few case studies have been published thus far concerning the implementation of an in-house CIS. In these case studies, community members acquired spatial data, were trained to use GIS technology, gained the skills necessary to perform spatial analysis, and successfully created maps of their communities. However, in all of these studies, the CIS proved to be unsustainable and ultimately unsuccessful as time passed. Many of the reasons cited were that GIS technology was too complex and that turnovers in staff and leadership wiped out too many pre-existing resources (Ghose 2001). The research presented in this thesis applies a new strategy that seeks to overcome these obstacles and push CIS-related solutions to the forefront of future PPGIS initiatives.

BACKGROUND

This research project involves the development of an Intranet GIS site that was created specifically for a single neighborhood organization in the Milwaukee area. It utilizes a bottom-up approach to create a CIS based on the priorities and needs of this one particular community and will not rely on costly experts. Technological complexity and costs have been cited as the biggest barriers to successful PPGIS initiatives in the past (Barndt 1998). This research will look at whether a user-friendly website hosted from a university server could possibly address both concerns. Adopting this new approach will provide the PPGIS community with the seedlings to begin exploring an alternate method in which to tackle future initiatives.

Research Methodology

This research began with the goal to select an inner-city community organization in which to work with. For this task, I examined past studies conducted by Ghose on PPGIS efforts among different inner-city community organizations in Milwaukee (Ghose, 2001). In addition, I sought advice from the Data Center Program at the Non Profit Center of Milwaukee, which has served as a provider of GIS services to inner-city community organizations for 10 years and running. Based on this feedback, I found six community organizations that have been effective users of spatial data and maps. Two-hour long, semi-structured interviews were than carried out with four of them using carefully worded questions. During these preliminary interviews, I paid close attention to see which organization was best able to articulate how it might incorporate its local

knowledge into a CIS. I also reviewed organizational documents for additional insight. One organization for instance, had created a 150-page Neighborhood Strategic Planning document as recent as 2004, which provided detailed information and insight into what their most pressing needs were. For this reason and many others, Harambee Ombudsman Project, Inc (HOPI) was selected as the most optimal community organization in which to work and develop a CIS with. Their organizational qualities and assets set them far apart from the rest. Even though they had not directly used GIS before, they were quite familiar with using spatial data and maps. For instance, Harambee took better advantage of Milwaukee's Data Center for their spatial knowledge production efforts than other community-based organizations and therefore had a better feel for GIS. This, in turn, enabled them to articulate their ideas and needs more clearly to me. They also possessed a wealth of local knowledge that could be integrated into the community information system, making it a more bottom-up project in the spirit of a true PPGIS. In addition, this organization was comprised of a seasoned group of experienced and dedicated organizers who were passionate about their jobs. The director of the City of Milwaukee's GIS Program even joked how one Harambee staff member seems to be present at virtually every meeting she attends speaking to the organizer's dedication. Lastly, it was quite evident from the first interview that the Harambee staff was a very tight group who seemed to really have an affinity for one another.

Positionality

Thus far, I have been very aware of my positionality in working in the Harambee community. The most important aspect of this project is to let the organizers at HOPI

define the community information system for themselves - I was careful to not come across as the GIS 'expert' who defined the project. As a white male researcher coming into a very poor, predominantly black inner city area, I also needed to make sure that I gained their trust. It took at least four meetings until I finally got the impression that we were both truly comfortable working with each other. It's difficult to ascertain as to what extent race played a role in gaining their trust, but it definitely was a factor, as Milwaukee is a hyper-segregated city and all 5 full-time staff members at HOPI are African-American. Surprisingly, my position as a student may have negatively affected the development of trust between us. As I began to conduct more in-depth interviews with HOPI, I learned that the community had collaborated with several students from the University of Wisconsin-Milwaukee (UWM) in the past which they did not describe as positive experiences. They spoke of how students would come in and study their organization yet never seemed to follow through on what they initially promised to do. These negative experiences in working with students at UWM certainly did not help my case and contributed to my outsider status. Gaining trust with Harambee's organizers did not happen overnight, and still needs to be negotiated slowly and carefully in order to retain that trust.

LOCAL KNOWLEDGE

HOPI came up with their own ideas as far as how to incorporate their local knowledge into the website and make it a user-friendly environment for them. HOPI expressed frustration with the property search function on the City of Milwaukee's GIS

website, “Map Milwaukee”, which required them to negotiate through a confusing and difficult user interface. Organizers in the Harambee community said they stopped using Map Milwaukee because of this complexity. They also wanted to have the ability to make on-the-fly census and property maps. One of the organizers said, “when I go to meetings I like to be on top of the game. I’d like to walk in & slap some kind of property or census map on an overhead and just blow people away. People’s mouths would just drop” (Harambee Ombudsman Project Inc. 2006).

More significantly, another staff member at Harambee carries five activity sheets around with him wherever he goes and collects data from within the community on a daily basis. This organizer documents the locations of abandoned automobiles, boarded-up homes, potential drug houses, street dealers, and special pickups that need to be made. He also scours the streets for new potential residential contacts for neighborhood watch purposes. It was decided that the best way to incorporate this local data into the CIS would be to create web forms for each of these activity sheets so they could input this information at any time themselves. Currently, their collected hard copy forms sit in several cardboard boxes in a distant warehouse. So, while collecting the information itself was, at one point, very important to HOPI in that it led to their better comprehension of pertinent community issues, the knowledge has not been fully or effectively used by HOPI. Organizers find it difficult to prove or articulate just how widespread any given problem is since there is no mechanism in place that would allow them to obtain a true spatial understanding of the trends occurring in their neighborhood. They perceive the spatial knowledge production process as a way of empowering themselves and have been receptive to the idea of mapping these results. Incorporating this particular functionality

into the CIS is critical, but has also proven to be complex.

PRELIMINARY RESULTS

Thus far, these web forms (based from each activity sheet) have been created, but there have been some technical issues with figuring out just how to automatically generate map points on the site from typing in a street address. Once this is accomplished, HOPI will be able to add, edit and delete records in a database and map trends occurring in their community.

In a more positive development, HOPI now has the ability to generate thematic maps on the fly. Currently, they can map hundreds of fields at the tract level using Census 2000 data to generate maps that reflect economic, social, housing, and demographic information within their community and surrounding areas. One of the other functions they requested was to do property buffers. The secretary at HOPI told me of the lengthy process she needs to negotiate in order to simply send out a mailing list to people within a particular area of the community. Now an application enables them to select whatever properties they wish and export the selected addresses straight into an excel spreadsheet. It also must be mentioned that Harambee has a very interesting way of breaking up their neighborhood into six separate clusters which have been incorporated into the site. According to an organizer, "each one of those clusters is a separate neighborhood with different issues and concerns. We call these cluster boundary neighborhoods and they're not aligned with the City of Milwaukee's neighborhood boundaries" (Harambee Ombudsman Project Inc. 2006). Using the activity sheet forms,

Harambee organizers should be able to map trends by individual clusters and scale down to their community needs rather than be stuck working within the geography that the City has set for them arbitrarily.

Research Questions

This research will continue to address the following questions and issues:

A. How does the local political context currently influence citizen participation in the planning and implementation of GIS at the neighborhood level in Milwaukee? External stakeholders involved in PPGIS initiatives will be studied in order to gauge their roles in fostering community participation and determine the extent in which they allow community organizations to be active participants in the PPGIS process.

B. How important has HOPI viewed the application of GIS technology in assisting with their past planning efforts and how might the organization make more effective use of spatial data? Will HOPI continue to possess enough technical savvy to bring forth innovative ideas themselves or will they rely on other actors to help with creating their vision? What data are they interested in and who have they traditionally received the data from? Might there exist a way in which to better incorporate local knowledge of their neighborhood by creating or modifying existing data sets?

C. How will HOPI utilize the CIS that is developed for them and how user-friendly will it ultimately be? Will the technology assist primarily with day-to-day activities or could it help their long-term planning efforts by giving them the ability to identify trends in their community? What, if any, organizational characteristics will be conducive to the implementation and utilization of the technology? Will the technology have any negative intra-organizational impacts?

D. What will be the biggest challenges to CIS implementation and how might they be overcome? What will be the advantages and disadvantages of CIS implementation over that of an in-house desktop GIS?

E. Will the CIS suffice itself, or will HOPI still need to rely upon other actors for expertise and GIS data? Could the creation of a secure intranet-based GIS be a sustainable PPGIS solution with the support of external stakeholders such as the Nonprofit Center of Milwaukee, the University of Wisconsin-Milwaukee, and the City of Milwaukee? If so, could this model be applied to other community-based organizations in the area?

CONCLUSION

While the feedback from HOPI has been positive thus far, the site is still unfinished and the organization has only just started using a stripped down version of the

site on a regular basis a few short weeks ago. In addition, the research and development of the CIS has been both extremely challenging and extremely rewarding. Time will tell, but all indications appear as though choosing an organization with the ability to express their own ideas and local knowledge into the GIS – on their terms – have been essential in building, what is thus far, a successful community information system.

ACKNOWLEDGEMENTS

I would like to acknowledge the assistance and support of my advisor Dr. Rina Ghose in providing the foundation for and helping me shape this research. In addition, I would also like to thank Joyce Witebsky for her generous technical support in developing the website.

ABOUT THE AUTHOR

Brian Thayer is currently working on his Master's Thesis at the University of Wisconsin-Milwaukee (UWM). He received a GIS certificate from the School of Architecture and Urban Planning at UWM in 2006 and is a founding member of the school's GIS Club. Before then, he worked for three years at a county planning department in North Carolina as a GIS Programmer Analyst. His current research interests include the application of GIS for social justice, neighborhood preservation management and urban land use planning purposes.

REFERENCES

Aitken, S.C. and S.M. Michel, 1995, Who Contrives the "Real" in GIS? Geographic Information, Planning and Critical Theory, Cartography and Geographic Information Systems, 22(1), 17-29.

Barndt, M., 1998, Public Participation GIS: Barriers to Implementation, Cartography and Geographic Information Systems, 25(2), 105-112.

Brown, D. et.al., 2003, Geography in America at the Dawn of the 21st Century. In Gaile, G.L. and C.J Willmott (Eds.), (Oxford: Oxford University Press).

Clark, M.J., 1998, GIS - Democracy or Delusion?, Environment and Planning A, 30(2), 303-316.

Curry, M.R., 1995, Rethinking Rights and Responsibilities in Geographic Information Systems: Beyond the Power of Image, Cartography and Geographic Information Systems, 22(1), 58-69.

Elwood, S. and R. Ghose, 2004, PPGIS in Community Development Planning: Framing the Organizational Context, Cartographica, 38(3-4), 19-33.

Ghose, R. and S. Elwood., 2003, Public Participation GIS and the Local Political Context: Propositions and Research Directions, Journal of the Urban and Regional Information Systems Association, 15(2), 17-24.

Ghose, R., 2001, Use of Information Technology for Community Empowerment: Transforming Geographic Information Systems Into Community Information Systems, Transactions in GIS, 5(2), 141-163.

Ghose, R. and W.E. Huxold, 2001, Roles of Local Contextual Factors in Building Public Participation GIS: The Milwaukee Experience, Cartography and Geographic Information Science, 28(3), 195-208.

Goodchild, M.F., 1992, Geographical Information Science, International Journal of Geographical Information Systems, 6(1), 31- 45.

Goodchild, M.F., 1990, Keynote Address: Spatial Information Science, Proceedings, 4th International Symposium on Spatial Data Handling, Zurich, Switzerland, 1990, 11-12.

Goss, J., 1995, Marketing the New Marketing: The Strategic Discourse of Geodemographic Information Systems. In J. Pickles (Ed.), Ground Truth: The Social Implications of Geographic Information Systems, (New York: Guilford Press), 130-170.

Harambee Ombudsman Project Inc.,

Harris, T. and D. Weiner, 1998, Empowerment, Marginalization, and 'Community-Integrated' GIS, Cartography and Geographic Information Systems, 25(2), 67-76.
Harris, T. and D. Weiner, 1996, GIS and Society: The Social Implications of How People, Space and Environment are Represented in GIS, NCGIA Technical Report 96-97, Scientific Report for Initiative #19 Specialist Meeting, South Haven, MN, March 2-5, 1996.

Lake, R.W., 1993, Planning and Applied Geography: Positivism, Ethics, and Geographic Information Systems, Progress in Human Geography, 17(3), 401-413.

Leitner, H. et.al., 2000, Modes of GIS Provision and their Appropriateness for Neighborhood Organizations: Examples from Minneapolis and St. Paul, Minnesota, Journal of the Urban and Regional Information Systems Association, 12(4), 43-56.

Obermeyer, N.J., 1998, The Evolution of Public Participation GIS, Cartography and Geographic Information Systems, 25(2), 65-66.

Obermeyer, N.J., 1995, The Hidden GIS Technocracy, Cartography and Geographic Information Systems, 22(1), 78-83.

Openshaw, S., 1991, A View on the GIS Crisis in Geography, or, Using GIS to Put Humpty Dumpty Back Together Again, Environment and Planning A, 23(5), 621-628.

Pickles, J., 1997, Tool or Science? GIS, Technoscience, and the Theoretical Turn, Annals of the Association of American Geographers, 87(2), 363-372.

Pickles, J., 1995, Representations in an Electronic Age: Geography, GIS, and Democracy In J. Pickles (Ed.), Ground Truth: The Social Implications of Geographic Information Systems, (New York: Guilford Press), 1-30.

Ramasubramanian, L., 1998, Knowledge Production and Use in Community-based Organizations: Examining the Impacts and Influence of Information Technologies, Ph.D. Dissertation, School of Architecture and Urban Planning, University of Wisconsin-Milwaukee.

Schuurman, N., 2004, GIS: A Short Introduction (Malden, MA: Blackwell).

Schuurman, N., 2000, Trouble in the Heartland: GIS and its Critics in the 1990s, Progress in Human Geography, 24(3), 569-590.

Sheppard, E., 1993, Automated Geography: What Kind of Geography for What Kind of Society?, The Professional Geographer, 45(4), 457-460.

Smith, N., 1992, History and Philosophy of Geography: Real Wars, Theory Wars, Progress in Human Geography, 16(2), 257-271.

State Cartographer's Office, 1998, Wisconsin Mapping Bulletin, 24(4), 1-3.

Taylor, P.J. and M. Overton., 1991, Further Thoughts on Geography and GIS, Environment and Planning A, 23(8), 1087 – 1094.

Taylor, P.J., 1990, GKS, Political Geography Quarterly, 9(3), 211-212.

Wright, D. J., 1997. GIS: Tool or Science? Demystifying the Persistent Ambiguity of GIS as "Tool" Versus "Science", Annals of the Association of American Geographers, 87(2), 346-362.