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Empowerment, Marginalization, and "Community-integrated" GIS

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ABSTRACT: The "GIS and Society" literature has raised a number of critical issues concerning the political economy and epistemology of geographical information systems (GIS) and the politics and power relations associated with their use. Recently, attention has focused on the potential for GIS to help empower communities. This paper reviews the GIS and Society debate. Case studies of public participation GIS are reviewed. The GIS-empowerment-marginalization nexus is addressed through the concept of community-integrated GIS. It is argued that GIS is a contradictory technology that simultaneously marginalizes and empowers people and communities. As a result, the societal impacts of GIS are contingent upon particular configurations of place-based historical, socio-economic, political, and technological conditions.

Introduction

In April 1996 an influential group of academics and representatives from the private and public sector with a long history of involvement in GIS and spatial information handling and analysis, met to discuss scenarios for spatial information development and dissemination into the 21st century. In the workshop report, *The Future of Spatial Data and Society* (National Academy Press 1997), the National Research Council (NRC) participants argued that "spatial analysis will continue to grow in importance" in decision-making processes and that 'spatial capabilities will expand [citizen] involvement' (ibid., p. 3). They confidently predicted a continuing demand for spatial information and spatial reasoning:

> There is certainty that the society of 2010 will require increased use of spatial data and spatial thinking in problem solving, at scales from the human genome to the human body to the environment to galaxies.....[these] new technologies will ultimately lead to the empowerment of many individuals through better and more rapid access to public data, the ability to present data in more persuasive ways, improved communications and technologies to support collaboration, and the power of the Internet and the World Wide Web for rapid publication and dissemination of ideas and data (ibid., p. 24-25).

However, despite the stated importance of spatial data, reasoning, and technologies, workshop participants noted that these were likely to be accompanied by "possible restrictions on public access" to data, and "increasing privatization" of spatial data (ibid., p. 3). Not least, they cautioned, "It remains uncertain whether the citizens of this nation will be adequately prepared to reason spatially or to deal with spatial data" (ibid., p. 25). The ultimately contradictory nature of *The Future of Spatial Data and Society* was acknowledged by the NRC Mapping Science Committee which authored the report: "Not surprisingly, the workshop reached no conclusive consensus on the future of spatial data and society" (ibid., p. 37).

The societal impacts of spatial data in the new information age have been pursued in recent years under the umbrella title of GIS and Society. More precisely, and as captured in the NRC report, the debate has focused on geographic information as well as on the technologies *per se*. 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. Indeed, it has come to include discussions as to whether GIS is a tool or a science (Goodchild 1992; Pickles, forthcoming; Wright et. al. 1997). More recently, attention has also focused on the potential for a GIS that empowers communities, a "public participation GIS," which is the theme of this special issue of *Cartography and Geographic Information Systems*.

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We contend that a problematic dualism exists whereby GIS production and use is understood to be either empowering or marginalizing. This has contributed to the polemical nature of recent GIS and Society debate (Abler 1993; Aitken and Michel 1995; Curry 1994; Goodchild 1991; Goss 1995a; Lake 1993; McHaffie 1995; Obermeyer 1993; Onsrud and Rushton 1995; Openshaw 1991, 1992; Pickles 1991, 1995; Sheppard 1993a, 1993b, 1995; Smith 1992; Taylor and Overton 1992; Taylor and Johnston 1995). We argue instead that GIS is a contradictory technology that simultaneously marginalizes and empowers people and communities. The social and environmental impacts of GIS are therefore contingent upon a particular mix of historical, socio-economic, political, and technological conditions in particular places. To date, there has been a noticeable dearth of such contextual GIS and Society case study research.

This paper begins with a review of the early exchanges in the GIS and Society debate which contributed to the identification of critical issues surrounding the societal impacts of GIS. Dominant among these issues has been the perceived or real role of GIS in the marginalization of people and communities. We then examine a second GIS and Society phase in which polemical debate between loosely defined "social theorists" and "GIS practitioners" progressed into a more constructive research engagement in which community empowerment through GIS became a stated intention. In the final section of the paper, we address the GIS-empowerment-marginalization nexus through the concept of "community-integrated GIS."

GIS and Society

During the past decade, the rapid development of GIS, public acknowledgment of its capabilities, and the widespread adoption of GIS by business, academia, and state and federal government agencies, have all contributed to rapid acceptance of the technology (Harris and Elmes 1993). As a result, GIS diffusion has taken place in a climate ranging from unquestioning acceptance to a celebration about its technological capabilities and positive social impacts (Cowen 1995; Dobson 1993a, 1993b; Goodchild 1993; Marozas 1993; Obermeyer and Pinto 1994; Nietschmann 1995). In *Zeroing In: Geographic Information Systems at Work in the Community*, ESRI President Jack Dangermond refers to "a quiet revolution in the way people view their neighborhoods, towns, and cities: a revolution brought about by the computer technology known as GIS..." (Mitchell 1997, p. vii).

This "quiet revolution" has also generated criticism, conflict, and heated debate in which an alternative questioning perspective has more recently emerged. The implications of the "social theoretic" critique of how space is conceived and represented in GIS and the political economy of these conceptualizations for the recipients of GIS-based decision making extend well beyond the disciplinary bounds of geography. However, the most vociferous, if not fierce and often bitter, critique of GIS has come internally from within that discipline.

The origins of the GIS and Society debate can be traced back to the late 1980s. In retrospect, there has been little reflection in the GIS community as to the social, economic, and political implications of the technology. Given the early emphasis on algorithmic and computational developments, the creation of digital data with which to fuel these systems, the steep learning curve in both geographical concepts as well as GIS technology, and the need for demonstration projects, this is perhaps not surprising. It is nonetheless overdue (Pickles, forthcoming).

The broader issues that these critiques raised were not acknowledged until recently, though some early pioneers of GIS did recognize the importance of non-technical issues. Tomlinson in 1987 acknowledged that:

> .....in dealing with a relatively new technology such as GIS we have found over and over again in North America that the technical problems are minor in comparison with the human ones. The success or failure of a GIS effort has rarely depended on technical factors, and almost always on institutional or managerial ones (Chorley Committee 1987, p. 5).

Tomlinson, along with others (Chrisman 1987; Edney 1991) recognized that institutional and organizational responses to the implementation of GIS had a marked influence on the success or failure of a project. While it was acknowledged that these non-technical issues were an important corollary to the adoption of GIS, it was Chrisman who provided some of the earliest insights into the social and ethical implications of use of GIS and the responsibilities associated with software development. "As GIS finds its way into practical use, it must be accountable economically, politically, socially, and even ethically" (Chrisman 1987, p. 1367). The then recent advances made in GIS, he argued, had been achieved by exploiting the easy parts of the problem and "the tough issues, temporarily swept under the rug, will reemerge, perhaps to discredit the whole process" (ibid., p. 1367). Chrisman suggested that the design of equitable GIS should be based on social and cultural goals. As such, GIS is both an expression and a

part of a political process and not solely a technical or computational problem.

These thoughts pre-empted the onslaught of the social theory critique against the perceived positivism and hegemonic power relations embedded in GIS (Taylor 1990, 1991; Taylor and Overton 1991, 1992; Lake 1993). Much of this early concern focused on the claimed value-neutral and objective nature of GIS. Taylor (1990) argued that with the increasing popularity of GIS in geography, "facts" had risen to the top of the geographical agenda, accompanied by a concomitant retreat from knowledge to data. As a result, GIS was viewed as the geographer's greatest revenge in representing a return to a positivism of the very worst type—"naïve empiricism" that was indeed "anti-geography" (Taylor 1990, p. 212). Openshaw's (1991) response captured the surprise, frustration, and anger of the GIS community at the scale and intensity of such attacks. His counterclaims of "squelchy-soft" qualitative research paradigms, of "technical cripples" seeking to survive the new data and computer age by ignoring computer developments, that GIS provides the core and super-glue of geography and reinforces the dominance of data and objectivity in geography, merely exacerbated the polemic and polarity of the debate.

Subsequent exchanges (e.g., Taylor and Overton 1991) returned to the positivist philosophy that guides GIS and to the social relations embedded in the technology itself. "Data do not exist," they argued, "they have to be created...for whom, by whom, and for what purpose" is determined based on some economic, social, and political context (ibid., p. 1088). Data inequity between countries provided further cause for concern at the claims of a data-driven science. "Goodbye Africa—little data little geography," they chided as the data inequities dictated differential attention (ibid., p. 1088). What then of information of interpretive subjectivity and of the advances that had been made in human geography over the past three decades? Pickles (1991) provided additional criticism in questioning the (anti) democratic nature of GIS brought about by differential access to the technology. The surveillant capabilities of GIS, he claimed, pointed to a particular knowledge–power configuration in society which reinforced the technologies of normalization and knowledge engineering and the control of populations.

These critiques provided the basis for subsequent discussions on GIS and Society. Seeking to build upon these creative tensions, and aware of the pending publication of *Ground Truth: The Social Implications of Geographic Information Systems* (Pickles 1995), a workshop was proposed and organized in Friday Harbor, Washington State, in November 1993. The workshop on "Geographic Information and Society" was sponsored by the National Center for Geographic Information and Analysis (NCGIA) and some 23 papers were discussed, many of which were subsequently published in a special issue of *Cartography and Geographic Information Systems* (vol. 22, No. 1, 1995). The exchanges were decidedly positive and laid the foundation for an ongoing dialog and research agenda which included issues of access, ethics and values, representation, democratic practice, privacy and confidentiality (Sheppard 1995). Building on the success of the Friday Harbor meeting, a proposal was submitted to the NCGIA seeking support for Initiative 19, "GIS and Society: The Social Implications of How People, Space, and Environment are Represented in GIS." The first specialist meeting of this initiative was held in March 1996, in Minnesota, and the report was published in November of that year (Harris and Weiner 1996).

GIS contributes to the social and spatial marginalization of communities in three ways: 1) data access and the political economy of information; 2) geodemographics and the surveillant capabilities of GIS; and 3) digital representation, GIS epistemologies, and the multiple realities of landscape.

Data Access and the Political Economy of Information

Differential access to GIS data, hardware, software, and "humanware" is a significant component of the political economy of spatial decision making. Trends in the commodification of data and the movement toward a bureaucratic informational complex have also raised concerns regarding the role of spatial data institutions, privacy, and the intrusive role of geodemographics (Crampton 1995; Curry 1995; Goss 1995a, 1995b). Geographic information systems are neither objective nor value free. They are dependent upon human choices and constraints regarding the selection of coverages and attributes, scale, analytical procedures, and the decisions and outcomes arising from these analyses. GIS applications are underpinned by questions about whose data are to be included in the database and how are they to be used; who produces and controls the information and databases; who determines the questions to be asked; and whose views of the world are being captured and represented?

The politics and power relationships associated with spatial decision making are being transformed through differential access to GIS and data. Clearly, the technology has the potential to disenfranchise the weak and not so powerful through the selective participation of groups and individuals. Pickles (1991, p. 84) succinctly states that:

> For users of the technology, access to information and other users is greatly enhanced. But adoption also implies non-adoption or inability to adopt. Polarization of users and non-users results. Any assertion of the democratic nature and use of GIS must address this issue.

Traditionally, geographic information systems have favored top-down "expert" knowledge developed by technocrats within hierarchical institutional frameworks (Harris et. al. 1995). As a result, GIS technology usually reflects the mandate of the agency that operates it. Agencies have internal rules and value systems and are involved in self preservation. Because of the institutional location of the GIS production process, the technology tends to become further bureaucratized. The potential for knowledge distortion is, therefore, considerable (Taylor 1991).

Geodemographics and the Surveillant Capabilities of GIS

The problems of structural knowledge distortion and of differential access to data suggests that data availability is a prerequisite for the democratic use of GIS. There are, however, important and often conflicting issues regarding privacy, confidentiality, and surveillance. Goss (1995a, 1995b) and Curry (1994, 1995) express concern with the surveillant capabilities of GIS because of the ability to access, integrate, and combine previously separate databases. This capability provides opportunities for the targeting of groups and individuals who were essentially protected before the advent of GIS by the magnitude of the analog process required to combine separate databases. Developments in the field of geodemographics reflect one aspect of this surveillance capability—"We know who you are and we know where you live," states Goss in his case study of how corporations use GIS for strategic marketing (1995a, p. 171).

There can be no doubt that GIS to date has been closely aligned with capital and the state. Given the differential nature of GIS knowledge production, Pickles (forthcoming) goes so far as to call the "information society" a misnomer and questions claims that GIS fosters democratic practice or broadens access to information. Questions regarding the informational rights of individuals and communities to have access and control over information about them, and the ethical and responsible use of GIS in such matters, have yet to be fully addressed. Pickles suggests that while some within the GIS community have opened the window to ethically responsible research practice, he remains unconvinced that they can practically accept what might come through that window (Pickles, forthcoming; Wright et. al. 1997). Curry (1995) similarly identifies problems linked to "the inevitability of ethical inconsistency which are built into [GIS] through the intersection of the technological and the social." The technology, he claims, promotes the widespread use of unregulated data and employs visual representations which can attribute actions and beliefs to residents of particular areas. In this, Curry (1995) postulates, are deeper structural issues associated with the use of GIS which transcend more simplistic interpretations about access and the facilitation of greater knowledge inclusion within GIS.

Digital Representations, GIS Epistemologies, and the Multiple Realities of Landscape

Understanding and representing the multiple realities of space and environment is a critical GIS and societal concern. Mark (1993) raised important questions about whose view of the world is being represented in a GIS. GIS technology captures one official version of reality which is heavily biased toward a scientific, agency, and "expert" data-driven representation.

Certainly, the social history of GIS development places the technology within a western, first world science paradigm. The system is predominantly based upon the scientific map as metaphor and the basic spatial primitives of point, line, polygon, and pixel. But what of qualitative forms of knowledge? Non-Euclidean sketch maps, cognitive and mental maps, narrative and oral histories, pictorial images and moving images are generally excluded from current GIS knowledge bases. Such "alternative" forms of knowledge representation and understanding are crucial to understanding issues related to place, a premise claimed by GIS. GIS epistemologies and multiple realities thus pose considerable challenges to the GIS community with regard to handling potentially conflicting information arising from broadening the representation of groups within the system and combining top-down expert knowledge with bottom-up local knowledge (Rundstrom 1995). It is clear that the physical environment has been given greater emphasis within GIS because of the "ease" of capturing physical objects relative to more complex forms of cultural or societal phenomena.

Representing knowledge which may not conform to the scientific model of "truth" also poses ethical questions for many GIS practitioners and runs counter to the pursuit of accuracy, comprehensiveness, quality, and error minimization as currently practiced in GIS. The role of the technicist in this process, however, is pivotal. "Will the GIS specialists become the new priestly class, determining our

image of the world just as surely as did the makers of the mapaemundi?—the priests of the new era representing the world in their own image" (Harley 1990, p. 15).

GIS imposes a way of knowing and of representing nature and society spatially. The cartographic metaphor is a recent consequence of the academization of geography that has privileged the map and the map-based (and, thereby, GIS-based) conceptualization of space. This emphasis on cartographic space and spatial primitives runs counter to historically broader and richer epistemologies that existed in both western and non-western societies (Harley 1989; Krygier 1996). GIS thus imposes a particular logic in its use of Boolean logic in cartographic space (Sheppard 1995).

GIS, Marginalization, and Empowerment

At the Initiative 19 specialist meeting there was an interesting turn toward examining the potential for building and using GIS for community empowerment and the further democratization of spatial decision-making. GIS still tends to be viewed as either marginalizing or empowering. In reality, both processes are occurring simultaneously and are context dependent. For example, providing communities with greater access to data about their own areas also simultaneously increases the capability for greater surveillance over neighbors. Likewise, empowering groups through GIS technology can also simultaneously disempower historical leaders of that community who are uncomfortable with computer technology. A third example could be the use of GIS for real estate profiles in which the increased information about a neighborhood is offset by "red lining" of areas identified as having "problems."

GIS, Public Participation GIS, and Community Empowerment

There has been limited discussion to date as to what is actually implied by demands for a "democratic GIS" or, GIS for community empowerment. Chrisman (1987) placed equity as the most important goal in the use of GIS by contending that GIS "be developed on the primary principle that they will ensure fairer treatment of all those affected by the use of the information" (Chrisman 1987, 1369-1370). Edney argued in *Strategies for Maintaining the Democratic Nature of Geographic Systems* (1991) that democratic GIS is possible by overcoming issues associated with differential access to hardware, software, and data. Yapa (1991), however, identified a contradiction in the use of GIS for grassroots community development in that the technology is useful for uncovering "local resources" but are expensive and demand outside expertise.

This is also apparent in research on "participatory GIS" for rural land reform in South Africa (Harris et. al. 1995). Current GIS developments in South Africa fall within the modernist "development" paradigm which is top-down, technicist, and elitist. As a result, Western definitions of knowledge and meaning, represented as technical data in a computer system, are reified (ibid., p. 198). Harris et al. and Weiner et al. (1995) explore the potential for incorporating local knowledge within an alternative GIS production in pursuit of a participatory land reform project in the Kiepersol locality of South Africa's (former) Eastern Transvaal region. In these communities, as with many others in the country, the lack of even essential infrastructure such as electricity and drinking water, as well as the previous deliberate withholding of access to education, make the inherent contradictions of actually placing a "high-tech" participatory GIS in such communities starkly apparent.

A central theme of NCGIA Initiative 19 focused on how GIS could be modified, if at all, to address these concerns. At the Minnesota specialist meeting, "conventional" GIS applications were given the label of GIS1 and assumed to operate within a political economy of existing spatial data institutions. For convenience, systems deemed capable of modification in the light of the critiques, were labeled GIS1.2. Alternative GIS and production and use became known as GIS2 (Harris and Weiner 1996; Pickles, forthcoming). Discussion of these alternative GIS structures provided a useful framework within which to explore GIS and Society issues and to develop a research agenda and conceptualization of socially appropriate and democratic GIS.

> The democratization of GIS means that we must also consider .... how the systems and logic emerged within contemporary GIS and whether they can be changed.... If contemporary GIS can be thought of as predicated on the computerization of the cartographic industry (GIS-1), can we begin to think of alternatives (GIS-2) which might range from "knowledge-creation" environments (Goodchild 1995) to public access centers which address these issues? (Pickles, forthcoming).

A subsequent workshop at NCGIA-Maine on the theme of public participation GIS further explored the possibilities for conceptualizing, building, and implementing GIS2. Schroeder, one of the workshop organizers, noted, however, that:

> Instead of PPGIS replacing the term GIS2 as anticipated by workshop planners, these two terms came to signify an essential distinction in future GIS development, and were discussed throughout the workshop under somewhat contrasting lights. While GIS2 was situated within a framework of specifications to be applied to the future of the technology and its expanded capacities, PPGIS was attached to the particular problems of bringing a wider public effective use of the technology at whatever level its development may have attained (Schroeder 1996, p. 28).

We contend that the nature of the technology cannot be divorced from the politics and social relations associated with its use. Empowering communities through the use of GIS will therefore require innovative partnerships between GIS users and grassroots community organizations. There is an increasing number of case studies attempting to accomplish this.

Public Participation GIS Case Studies

A recent issue of *Cultural Survival Quarterly* contains rich case studies of how GIS, GPS, remotely sensed imagery, and sketch maps have been used for the representation of indigenous peoples' local knowledge about land rights, land use, and natural resources. The Eagle Project, for example, is located in the Great Lakes Drainage Basin of Central Ontario and involves an assembly of 61 indigenous communities in an environmental health and risk assessment study. The study involves re-mapping the basin focusing on the location of fishing and hunting areas and the impacts of toxic chemical exposure. The project sought to integrate "traditional knowledge into conventional scientific methodologies by acknowledging traditional territories and languages, and using a holistic approach" (Bird 1995, p. 23). Regional community liaison staff worked with communities in the collection of indigenous spatial information and its integration within conventional databases. Thus, local knowledge on the location of fishing sites was integrated with agency information on environmental contamination. A second phase linked land use to a land claims process, environmental monitoring and assessment, and environmental planning in "traditional territories." According to Bird (1995, p. 24):

> Now that environmental contamination is at a critical level, First Nations Elders and medicine people are finally being consulted to assist in correcting the errors of previous development and planning efforts... When examining the relationship among traditional beliefs, environmental contaminants and holistic health, indigenous communities will have the ability to incorporate new technologies to their advantage. EAGLE is exploring new ground with maps which plot information that demands attention.

Another informative project is located along the Ampiyacu River, a tributary of the Peruvian Amazon near the border with Brazil. The Joint Research Project on Economic Strategies for Indigenous Amazonians integrated GIS into a participatory project concerned with economic development strategies for indigenous people in the Amazon Basin (Smith 1993; 1995). The project combined field-based participatory mapping with satellite imagery, aerial photographs, and GIS. Transect walks, seasonal calendars, and intensive interviews provided rich social histories to aid interpretation of the spatial information. "Regional" (1:100,000) and "community" (1:50,000) scale maps were produced that identified demographic characteristics, property ownership / access patterns, hydrology, infrastructure, land use, land cover, deforestation, ecological niches, and indigenous production systems. Natural resource use was contextualized within an historical and political setting, and indigenous local knowledge and traditional resource management were incorporated into land and resource use plans and environmental monitoring. "The long-term goal is for each national Indian organization...to have an in-house GIS unit for territorial defense, planning and management, linked to the available technical support within the country" (Smith 1995, p. 48).

These two case studies are examples of how spatial information technologies are being used to support a variety of indigenous community struggles. However, important questions still remain regarding these projects. For example, who controls GIS production among indigenous populations and who has access to the databases? How does new spatial information filter through socially differentiated communities and are the projects that result largely popular? There are numerous other case studies from around the world.[1] To date, most of these projects are NGO based and are attempts to incorporate local knowledge into "development" decision making through alternative mapping exercises. Their main focus has been natural resource access inequities and the preservation of locally tested indigenous

[1] The special issue of *Cultural Survival Quarterly* includes an additional 12 community-based geomatics projects, although they do not all involve GIS. In the final chapter, guest editor Peter Poole identifies 60 geomatics projects associated with the WWF Biodiversity Program.

production strategies which are assumed to be sustainable. The analytical power of GIS functionality has yet to be fully realized in studies which involve indigenous communities. This is changing rather quickly, however, as alternative GIS production and use can now be found in a variety of social contexts.

One example of the latter is Interrain Pacific (http://www.interrain.org) which helps local organizations in the use of GIS and natural resource information. Interrain achieves these goals through training staff members of local community groups to build and use GIS and interpret aerial photographs and satellite images. Additionally, to allow for the exchange of information and experience, Interrain promotes connection to the Internet. It helps local groups build databases that include biophysical, social, economic and cultural information. Finally, to increase community understanding of the environment, they produce maps, ecosystem reports and educational materials.

Interrain has two main programs to assist conservation organizations, community groups, planners and researchers. The Bioregional Information System Program maintains regional comprehensive databases based on watershed boundaries. Also, in conjunction with local partners, the program establishes community information centers to link residents, students, educators and resource managers. The Watershed Information and Services Program includes GIS training and technical support, data compilation and project design, and community mapping. With this project, Interrain helped local conservation groups conduct a watershed assessment that evaluated the environmental impacts of a planned increase in logging activities.

The rapid development of GIS for community use raises a host of critical questions about the contradictory nature of GIS and societal dependence on technology. As seen in the previous examples, Hutchinson and Toledano (1993, p. 457) suggest that GIS for community empowerment requires that the technology be taken out of a conventional top-down development context. This, they contend, necessitates "demand-driven" and not "technology-driven" applications. GIS, in other words, must become an appropriate technology. Rundstrom (1995) takes an alternative perspective: "My interests in the geographical ideas of indigenous peoples of North America and the impact of Western technology in non-western settings have led me to consider GIS as potentially toxic to human diversity, notably the diversity of systems for knowing about the world" (p. 45). This conclusion is based on his contention that non-empirical and relational epistemologies of nature cannot be captured in digital form because indigenous knowledge is itself transformed by the logic of the technology. As a result, "geographical re-presentations—topographic maps, GIS, and other exotica—are just part of a much larger world of inscriptions used in Western technoscience to disenfranchise indigenous peoples" (ibid., p. 51).

We believe there is a middle ground that can be charted between these two very different GIS and Society positions. Recent case studies represent an important shift in scale and purpose from a critique of GIS to endeavors to operationalize GIS for community empowerment. The advocacy of popular causes, a more complete understanding of local issues, and greater community access to advanced technologies and digital information are successes that have already been demonstrated. Recent case studies, and Rundstrom's critique, also suggest that the integration of local knowledge and the representation of non-hegemonic epistemologies of space, environment, and territory are complex and potentially contradictory aspects of alternative GIS production and use.

Existing case studies demonstrate that communities remain dependent on technical support for the implementation and maintenance of specific projects and the filtering of geographic information into GIS by technical experts. How this influences the social relations between and within participating communities, agencies, and NGOs that promote such projects is not very well understood. To date, there is a very poor understanding of how PPGIS projects transform the power relations and associated politics within participating communities. Recognizing social differentiation and how GIS might change social dynamics within communities after specific projects have commenced is a critical issue that needs to be addressed and should be of primary concern when developing an alternative GIS.

Towards "Community-integrated" GIS

As we have alluded to above, it is common to find references to "democratizing GIS," "public participation GIS," and "the community." Unfortunately, these terms are often used without qualification and with too little appreciation of the complexities associated with specific GIS production and use. The simultaneous marginalization and empowerment afforded by GIS takes different forms in different places and is the product of the historical, social, and political context in which GIS is constructed and used. There has been little research concerning how GIS actually marginalizes communities and who, in those communities, are being marginalized. There are more case studies regarding the empowerment of people through the use of GIS though the implicit

assumption of community homogeneity is an underlying problem. To date, there is little evidence of genuinely "community-based" GIS, despite such stated intentions. Communities are becoming involved in GIS projects, but they are not in control of those projects and remain dependent on state agencies, NGOs, external funding, and technically oriented advocates. Thus, in our opinion, community-integrated GIS is a more realistic objective for alternative systems and applications.

Community-integrated GIS seek to broaden the use of digital spatial data handling technologies with the objective of increasing the number and diversity of people who are capable of participating in spatial decision-making. This assumes that the *production* of GIS is also made more inclusive. As a result, community-integrated GIS:

- Is likely to be agency-driven, but it is not top down nor privileged toward conventional expert knowledge;
- Assumes that local knowledge is valuable and expert;
- Broadens the access base to digital spatial information technology and data;
- Incorporates socially differentiated multiple realities of landscape;
- Integrates GIS and multimedia;
- Explores the potential for more democratic spatial decision making through greater community participation; and
- Assumes that spatial decision making is conflict ridden and embedded in local politics.

Community-integrated GIS recognizes GIS as an "expert" system but tests the capacity of the technology in the context of people and communities normally peripheral to spatial decision-making processes and politics. In this respect, a community-integrated GIS would contain not just the cartographic and attribute information traditionally associated with GIS but would be expanded to become a forum around which issues, information, alternative perspectives and decisions revolve. The difference here would be the explicit integration of a community's knowledge and involvement into the system rather than a system which is essentially "external" to a community. A community-integrated system should be "issue-driven" in that local knowledge, concerns, desires, and wishes are actually incorporated and embedded as layers or objects in the GIS. Such open forum GIS have the potential to raise all kinds of concerns regarding individual rights and confidentiality but come closer to how issues important to communities may be represented in a GIS and how communities might participate in the process of decision-making—a GIS equivalent of a New England town meeting. In this form the GIS provides an arena in which the politics and conflicts of spatial decision-making are played out openly.

Community-integrated GIS assumes the existence of socially differentiated understandings of landscape. In this context, a conflictual GIS would be an expectation rather than the surgically clean, objective, and homogenous spatial representation that it currently is. Implementing GIS clearly means that the issues of surveillance, privacy, confidentiality, and individual rights are not overcome but intensified. But these will be the prerogative of the communities themselves, not business or government.

A community-integrated GIS should be capable of incorporating information and knowledge in alternative forms which are not dependent on map as the sole mode of representation. Much has been written about the privileged position of the cartographic map and the dominance of spatial primitives in the representation of geographic information. To this, however, we now have the technical ability to combine other forms of representation, as well as other media. Linking narrative, oral histories, photographs, and moving images and animation to GIS provides enormous capability to increase not only the richness and diversity of the information available but to come closer to the ways in which communities know or conceive their space. The linkages between GIS and multimedia systems hold considerable potential for extending the knowledge base of GIS (e.g., Couclelis and Monmonier 1995). Current GIS are predominantly spatially deterministic in the sense that information that is fuzzy, or without a location, or which cannot be represented by a spatial primitive is excluded from the knowledge base. Extending the ability to incorporate alternative forms and ways of knowing would overcome these deficiencies and sensitize GIS to the communities which are represented in them.

There are obvious questions regarding not only the construction of a community-integrated GIS but also its sustainability. We do not assume that all communities would want, nor indeed warrant, a GIS. Such systems would not be applied universally but selectively, contingent upon the mix of social, historical, and political factors alluded to earlier. Although GIS software is becoming more user-friendly and less expensive, and the performance capabilities of PCs are providing incredible computing power at increasingly lower cost, we do not assume that community-integrated systems would necessarily be maintained by the citizens of a community, although this could obviously be the case. The Internet and the availability of interoperable GIS and media systems, along with initiatives such as the NSDI spatial data clearinghouse, will increasingly rely on the Internet as a means of accessing and enabling

distributed GIS and will provide empowering conditions for community access discussed above. However, we assume there will continue to be resource and humanware issues to overcome. What we are proposing therefore, is not a complete replacement of existing agency responsibility for local GIS but a redefining of what such systems might "look" like and how they might be extended into communities for greater public participation and ownership.

Project SCOPE (Specialized TeleCenters Of Professional Education) is an example of where this is starting to take place in the context of information technology in general (http://www.projectscope.org/televillage.htm). The project provides urban and rural communities, particularly women, children, and the disabled access to education, public health information, job training, and economic development programs. This objective is accomplished through the "televillage," a virtual community of people, schools, government agencies, and other organizations that are connected with one another by telecommunications. There are currently local telecenters in North America, Africa, Asia, Europe, and Central and South America, which incorporate local language and culture information in their programming. Project SCOPE has affiliations with local government agencies, non-profit organizations, and other groups which assist in setting up the telecenters and running the programs once they are established. There are about 20 such projects around the world.

We are establishing a community-integrated GIS in the Lowveld District of the Mpumalanga Province of South Africa.[1] Building on previous pilot research, this project tests the possibilities of alternative GIS production for participatory rural land reform (Harris et al. 1995; Weiner et al. 1995). In South Africa, GIS diffusion is mostly top-down, technicist, and elitist. It is also primarily used for map production, and in many cases stands accused of merely transforming bad data into impressive maps. Nevertheless, GIS is emerging rapidly in the "new" South Africa. Consulting firms—often linked to segments of the former apartheid state that were privatized—are thriving. Meanwhile, state agencies see GIS as a way of maintaining or increasing their power within a government bureaucracy that is in transition. As a result, the GIS business is booming, but the forms of GIS that are emerging are reinforcing the traditional forms of developmentalism and supporting a top-down and non-participatory planning environment.

Our project undertakes workshops to identify issues that communities view as critical for land reform. Appreciating the importance of socially differentiated knowledge, workshops are held with white farmers, their farm laborers, and residents of the former "homelands." Conventional GIS coverages of the district are combined with local knowledge comprising mental mapping exercises and intensive interviewing with GPS transect walking. Non-spatial information is also collected for use in a multimedia framework. At present, land reform consists primarily of specific projects which emerge as a farm becomes available on the market. It is anticipated that through this effort, projects will also be conceived as part of a broader provincial/district landscape politics and history which has many voices extending beyond the restricted sounds of willing buyers and sellers (Levin and Weiner 1997).

Conclusion

The concept of community-integrated GIS assumes the contradictory condition of the technology and is an attempt to more realistically conceptualize how GIS might support the aspirations of participating communities. Community-integrated GIS also assumes socially differentiated communities. Furthermore, because poverty and marginalization are political processes that result from particular configurations of power, it is also assumed that community-integrated GIS is conflictual, as hegemonic interpretations of present and future landscapes will be challenged.

We view public participation GIS as an important objective but remain cautious about claims that GIS fosters "grassroots" participation and the "empowerment" of communities. Participation and empowerment are "buzzwords" which often serve to legitimize policies and projects that, ironically, can have the opposite effect. We contend that GIS production and use are inherently contradictory, and that the GIS empowerment–marginalization nexus can only be understood within the political context of spatial decision-making in a particular place.

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