

From Geography to Mass Communications: A View of Participatory GIS Through the Lens of
McLuhan

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Dedication

This thesis is dedicated to all of the invisible peoples.

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Abstract

This thesis is a sojourn into Participatory Geographic Information Systems (PGIS) through an analysis of two case studies – the Manchester EoC and the Stories of the Ogiek – using Marshall McLuhan’s tetrad. Detailed GIS and PGIS background is provided with additional applications of various globalization theories. The study responds to an article written in 2003 by geography theorists who argued for the reconceptualization of GIS as communications media. The arguments are as follows: GIS and PGIS are communication media and should be considered as such within the field of communications; PGIS should be considered a separate evolutionary stage of GIS as exemplified through the tetradic analysis; Maps as media including GIS and PGIS enhance identity for those appropriately considered, and subsequently, PGIS represents a retrieval of marginalized peoples that had previously been obsolesced by ‘nation-state’ maps; And GIS and PGIS are uniquely applicable to the analysis of the complexities of globalization phenomenon and the inherent power struggles contained therein.

Note: This thesis contains a significant number of acronyms and technical terms. I have included a list of acronyms on p. x and a short glossary containing the most important terms on p. 80 for ease of reference.

Table of Contents

Dedication	iii
Acknowledgements	iv
Abstract	v
Table of Contents	vi
List of Tables	viii
List of Figures	ix
List of Acronyms	x
CHAPTER I	1
<i>Introduction</i>	1
<i>Clarification of globalization theories</i>	3
<i>Thesis goal</i>	3
<i>Background</i>	5
<i>Historical context</i>	5
<i>Technological cultural context</i>	10
CHAPTER II	12
<i>McLuhan and the Tetrad</i>	12
<i>Literature Review</i>	14
<i>Enhancement</i>	16
<i>Obsolescence</i>	17
<i>Retrieval</i>	17
<i>Reversal</i>	18

CHAPTER III	22
<i>Case studies</i>	22
<i>Manchester's EoC</i>	22
<i>Stories of the Ogiek</i>	24
<i>Tetradic Analysis</i>	28
<i>Discussion and Limitations</i>	30
<i>Manchester's EoC analysis</i>	30
<i>Stories of the Ogiek analysis</i>	31
CHAPTER IV	33
<i>Globalization, Power, and Opportunities for Further Research</i>	33
<i>PPGIS Globalization from below</i>	36
<i>GIS Globalization from above</i>	36
<i>Suggestions for further research</i>	38
<i>Conclusion</i>	41
Glossary	44
References	45

List of Tables

Table 1. Tetradic analysis of the Manchester EoC and Ogiek case studies.....29

List of Figures

Figure 1. The Manchester EoC mapping interface.....	23
Figure 2. Ogiek Elders posing behind their artwork.....	26
Figure 3. Ethnic map of Kenya from 1974.....	39

List of Acronyms

CBO	Community Based Organization
CUS	Census Use Study
CSISS	Center for the Spatially Integrated Social Sciences, University of California, Riverside
EoC	Environment on Call
EU	European Union
FCRMIC	Fisheries and Coastal Resource Management Interpretive Center
FISH	Fisheries Improved for Sustainable Harvest
GDP	Gross Domestic Product
GIS	Geographical Information Systems
GIT&S	Geo-spatial Information Technologies and Systems
GPS	Global Positioning Systems
GSD	Harvard Graduate School of Design
I-19	NCGIA research initiative I-19 (The Social Implications of How People, Space, and Environment are Represented in GIS) http://www.ncgia.ucsb.edu/varenius/jec.html
ICT	Information and Communication Technologies
IGN	Institut Geographique National
IPACC	Indigenous Peoples of Africa Co-ordinating Committee
ISK	Indigenous Spatial Knowledge
IT	Information Technology
KRIS	Kosovo Repatriation Information Support
LBS	Location Based Services
NCGIA	National Center for Geographic Information and Analysis
NEM	New East Manchester
NGO	Non Governmental Organization
OGC	Open Geospatial Consortium
OS	Ordnance Survey
OSCE	Organization for Security & Cooperation in Europe
P3DM	Participatory 3 Dimensional Modeling
PGIS	Participatory Geographical Information Systems
PPGIS	Public Participation Geographical Information Systems
SMS	Short Message Service (cell phone text messaging)
SSA	Sub-Saharan Africa
SYMAP	Synagraphic Mapping System
UNHCR	United Nations High Commissioner for Refugees

CHAPTER I

Introduction

When Marshall McLuhan coined the phrase “the medium is the message” in 1960 proposing the idea that a particular medium has effects on the user independent of the content, he created an entirely new way of considering our use of technologies and their subsequent cultural effects. Some understood him to consider content unimportant. That was not the case, as of course the medium would not exist without the content. Rather, as Levinson explains, he was concerned that “content grabs our attention to the detriment of our understanding and even perception of the medium and all else around it” (Levinson, 2001, p.36).

Although McLuhan was internationally renowned for his studies of mass media’s effects on thought and social behavior, his graduate studies at Cambridge were predominately in literature (McLuhan & Zingrone, 1995). His dissertation “examined the modern biases in logic and science that culminated in the triumph of the Newtonian worldview, and its clockwork mechanical perfection, in 19th-century Europe” (McLuhan & Zingrone, 1995, p.1). It appears that even early in his career McLuhan was focused on the potential effects of human artefacts on society, making his many subsequent years of exploration worthy of being described as expertise. He was publishing explanations of the perceptual changes occurring with users of electronic mass media before other theorists wrote on the electric form of the information revolution (McLuhan & Zingrone, 1995).

McLuhan garnered much criticism for his unusual ideas and cultish popularity. From early on, he was misunderstood, perhaps intentionally, as he was the bearer of bad news for some, in the idea of obsolescence. McLuhan was warning everyone, including those with rival agendas, that the effects of electronic media were obsolescing specialist enterprises when specialism was being hailed as a salvation (McLuhan & Zingrone, 1995). Many of his critics felt alienated by his aphoristic style that did not engage in the narrative bias of argument. Since his death in 1980, his “reputation has been in a sort of hiatus waiting for electronic reality to catch up” (McLuhan & Zingrone, 1995, p.3). With the digital revolution, it is now happening. There has been a revival of his theories due to a particular applicability to the digital age. Paul Levinson (2001) won the Lewis Mumford Award for Outstanding Scholarship in 2000 for *Digital McLuhan: A Guide to the Information Millennium*. Additionally, several authors reevaluating McLuhan were compiled in 2004 in the work titled, *At the Speed of Light There is Only Illumination: A Reappraisal of Marshall McLuhan* (Moss & Morra, 2004). McLuhan and Zingrone state,

Now that we too can see so much of what he perceived, it is possible, for example, to discuss “discarnate existence” with a young person who has spent the morning surfing the Internet in search of his invisible friends around the “Global Village,” or who appreciates, almost instinctively, how all media translate reality. (McLuhan & Zingrone, 1995, p.3)

This current applicability and my own resonance with “the medium is the message” led me to utilize McLuhan’s theories in an analysis of the present text, Participatory Geographical Information Systems (PGIS).

Participatory GIS is a mapping practice or process that involves bringing local stakeholders together for democratic involvement in public planning and development. The foundational technology of the practice is Geographic Information Systems (GIS) which are computerized software systems created for the storage and retrieval of and ability to manipulate, analyze, and display, georeferenced data. Rambaldi, Kwaku Kyem, McCall, and Weiner describe the emergence of PGIS as follows:

The state of affairs in mapping changed in the ‘90s, with the diffusion of modern spatial information technologies including geographic information systems (GIS), global positioning systems (GPS), remote sensing image analysis software and open access to spatial data and imagery via the Internet ... The new environment facilitated the integration of geo-spatial information technologies and systems (GIT&S) into community-centered initiatives. (Rambaldi, Kwaku Kyem, McCall, & Weiner, 2006, p.1)

PGIS practitioners were then able to utilize GIT&S technologies to combine various realities and diverse forms of information. PGIS has been used to educate, create community cohesion and social change, and empower marginalized peoples (Rambaldi, et al., 2006, p.1). The technological capabilities of GIS and detailed examples of the application of GIS and PGIS will be elaborate on throughout this paper.

The ability of GIS to integrate and analyze complex and diverse types of information make the technologies uniquely suited to consider the kaleidoscopic topic of globalization and how this medium intersects with it. Although there is no general consensus on a basic definition of the term globalization, or the idea’s usefulness in understanding international communications, it is common knowledge that new information and communication technologies (ICTs) have facilitated global interconnectivity (Thussu, 2006). Considering the complexity of the globalization phenomenon and the seemingly large role technology and media play in its occurrence, perhaps there are mediums that best exemplify the globalization message. With satellite imaging, the technology exists to view entire continents or zoom in to read the headline of a newspaper. A hawk, be it military or bird, increases its hunting grounds by flying higher and gaining perspective. Combining geospatial information with satellite imagery and a bit of software magic allows us to create multi-layered/multifaceted maps. While satellite imagery may have first been utilized for military surveillance operations, with open access to satellite imagery and the willingness of groups to facilitate the collection and GIS analysis of marginalized peoples’ geospatial data, narratives are emerging that had been rendered invisible by cultural imperialism. The fact that these stories or narratives of people’s connection to their location are generated by maps and geospatial data suggests that we should, as media scholars, consider what these abilities do to our understanding of maps in general and identity tied to locale. Further, how shall we recontextualize these technological capabilities as *media* and what are the theoretical implications for the redistribution of power (via access to technology formerly used only by state and military apparatuses)? How does the use of this technology help us to

assess ideas of globalization? These are questions I intend to answer by applying McLuhan's tetrad, a set of four questions applicable to any medium, to Participatory GIS. The tetrad will be explained in detail in chapter two.

Clarification of globalization theories.

There are many approaches to globalization theory including sociological, economic, technological, political, and cultural perspectives (Thussu, 2006). For the purposes of this thesis when discussing globalization (unless a specific theory is mentioned), I am not considering those aspects separately but utilizing Malcolm Water's (1995, p.3) basic definition that states, "A social process in which the constraints of geography on social and cultural arrangements recede and in which people become increasingly aware that they are receding." Additionally, I briefly mention Randviir's (2004) perspective on maps and globalization and explore Douglas Kellner's (2002), Arjun Appadurai's (1996 & 2006) and the Center for the Spatially Integrated Social Sciences' (CSISS) more specific contributions to globalization discourse as they apply to GIS and PGIS. I am including and applying globalization theory not only because I feel that GIS is a set of technologies uniquely suited to the complexities of globalization debates, but also because Participatory GIS itself is a product of globalization due to diffusion of technologies and beautifully suited to Kellner's "globalization from below" and Appadurai's grassroots globalization and cultural flows model, or landscapes. These theories will be briefly introduced here and applied in more detail in chapter four.

Douglas Kellner (2002) defines polar aspects of globalization, which he calls above and below. Globalization from above is the view that corporate capitalism and the capitalist state are dominating the world. Globalization from below refers to the ways in which small groups and social movements use the technology of globalization to further democratic, humanitarian, and environmental concerns (Kellner, 2002).

Arjun Appadurai (2006) has also written of the globalization from below phenomenon. In *Fear of Small Numbers: An Essay on the Geography of Anger*, he begins to tackle the question of why there appears to be increasing ethnocidal violence in modern day. While researching violence between Hindus and Muslims in Mumbai, India, Appadurai encountered globalization from below and called it grassroots globalization, or "the politics of hope" (2006, p.xi). The politics of hope includes the worldwide effort of nongovernmental activist organizations (NGOs) and movements to affect the global agenda with respect to human rights, the environment, disease, etc. (Appadurai, 2006). Participatory GIS is a proven globalization from below tool as we will see in the examples to come.

Thesis goal.

This thesis is predominantly inspired by Appadurai's (2006) "politics of hope," and my desire to contribute to further understanding of the possibilities of mediating between the "above" and "below." I was exploring McLuhan's theories as descriptive tools for globalization

from below, when a good friend and mentor, Dr. Tom Cooper¹ (personal communication, Spring of 2007), who studied under McLuhan, suggested I use McLuhan's tetrad, or laws of the media. It was serendipitous to then discover Sui and Goodchild's (2003) article arguing for the re-conceptualization of GIS as new communications media. Sui and Goodchild are two geographers who in 2003 published an article using McLuhan's tetrad to analyze the technologies of GIS. I intend this work to be both a response to Sui and Goodchild and an opportunity to compare and contrast their tetradic analysis of traditional GIS with one of PGIS. Additionally, I intend to begin a dialogue within the communications field to contribute to the dialogue begun in geographic and cartographic academia.

There are numerical data not presented in Sui and Goodchild's essay that bolster the argument for consideration of GIS as media. The technology of GIS is applicable to mass communication research because, in the year 2000, there were close to one hundred thousand licensed users of high-end GIS products which cost over \$10,000. Additionally, there were ten million people making regular use of GIS-like services through the World Wide Web such as online maps and route selections like Yahoo, Google, and Mapquest.com (Goodchild, 2000). It is likely that these numbers have increased significantly in present day 2008.

The analysis presented here is a tetradic analysis of PGIS including a comparison and contrast with Sui and Goodchild's tetradic analysis of GIS. Additionally, I will discuss the applicability of PGIS and GIS to globalization and power theories. My arguments include firstly that GIS and PGIS are communication media and should be considered as such within the field of communications. Secondly, I argue that PGIS should be considered a separate evolutionary stage of GIS as exemplified through the tetradic analysis. Thirdly, the media of maps in general, GIS and the process of PGIS affect and enhance identity for those appropriately considered, and PGIS represents a reemergence or retrieval of marginalized peoples that had previously been obsolesced by 'nation-state' maps void of their inclusion. The concepts of tetradic retrieval and obsolescence will be explained in chapter 2. Finally, GIS and PGIS are uniquely applicable technologies to the analysis of the complexities of globalization phenomenon and the inherent power struggles contained therein.

In order to lay a firm foundation upon which to perform a tetradic analysis, the following section will consider the background of GIS and PGIS. Chapter two will detail McLuhan's tetrad and applicable literature. Chapter three exhibits two case studies of PGIS, their tetradic analysis and discussion and limitations. Chapter four will discuss globalization and power theories, suggestions for further research and a conclusion.

¹ Dr. Tom Cooper graduated *magna cum laude* from Harvard University in 1973. He was an assistant to Marshall McLuhan from 1975-77 when he received his doctorate at the University of Toronto. Dr. Cooper also studied with Dr. Tom Easterbrook, one of Harold Innis' protégés who introduced McLuhan to Innis. Cooper has been an assistant speechwriter in the White House, a professor at Harvard, the University of Hawaii, Emerson and the Visiting Ethicist in Residence at Middle Tennessee State University during 2006-2007. He has also authored six books, over 100 scholarly articles and reviews, and was a co-nominee for the Nobel Peace Prize.

Background

Historical context.

The world is too large for general human perception, so we seek to represent it symbolically, usually in the form of maps or cartography (Holmes, 2003a). Globalization can be seen as a centuries old sociocultural process when one considers the history of cartography. Maps have been used throughout history to discuss the physical, cultural, and political structures of Earth. There is evidence that man's ability to produce maps preceded his linguistic capacities. The first plan-like landscape representations date back to 20,000 B.C. Some say this predates speech (Randviir, 2004). "Maps as representations of the humane environment are in connection with and represent man's understanding of the nature and structure of his surroundings. Therefore the history of mapping inevitably mirrors also the development of science and worldview" (Randviir, 2004, p.230-231).

Mapping is a very old and influential conceptual device that can be misleading in that maps give an impression of stability. In *Does the space make differences? Some geographical remarks about spatial information between Harold Innis and Marshall McLuhan*, Neve (2004) gives us a hint about the historical politics involved in map-making: "All description, explanation, or representation is necessarily in some sense a mapping of derivatives from the phenomena to be described onto some surface or matrix or system of coordinates" (Neve, 2004, p.154). Spatial information produced by the map works as an "information-processing entity," and explains the world mapped onto it. The map ultimately represents a choice or selection among alternative ways to represent the information. The ability to choose representations of the world gives the mapmaker great power (Neve, 2004) because, in principle, a map makes a distortion of the data to be recorded. Few world maps show boundary disputes or maritime boundaries and many display dated or incorrect information (Blake, 2005). We forget that maps are "merely a snapshot of political arrangements at a point in time" (Blake, 2005, p.15). In reality landscapes are constantly changing (Blake, 2005).

As we will see in chapter four and the discussion of Appadurai (1996 & 2006) and globalization, the speed of present day change with respect to globalization including technologies, global market forces, migration, etc. can be disconcerting. In the eighties, Frederic Jameson claimed there was an absence of aesthetic objects, and particularly maps, that could mediate the complexities of globalization debates and help people create appropriate representations of the contemporary world. He wrote of the need for "an aesthetics of cognitive mapping" to resolve "the incapacity of our minds, at least at present, to map the great global multinational and decentered communicational network in which we find ourselves caught as individual subjects" (Holmes, 2003b). Could participatory 3D Modeling offer one example of an answer to Jameson's lament? The practice of Participatory 3D Modeling directly utilizes participants' cognitive maps to build a physical model which is then reinserted back into a GIS database. The subsequent geospatial information is not limited by national or governmental boundaries. Data layers of watersheds, ethnic groups, economic ties, and land uses can be overlaid to map the complex flows that occur back and forth through national boundaries (Wood, 2005). If the medium is the message that changes the way we think – our cognitive space

(McLuhan & Fiore, 2001) - then Geographic Information Systems (GIS), as communications media, indeed may function as one of the aesthetic mapping tools advocated by Jameson.

Geospatial Information Systems (GIS) allow for easy user adaptation and real-time modeling of complex changing phenomenon such as global communication networks.

"Geospatial ... refers to any data, including maps and imagery, 'georeferenced' to a point or area on the earth's surface. These data can relate to physical features of the affected area as well as infrastructure, population locations, and other factors" (Wood, 2005, p.335). GIS is therefore a means to spatially organize a variety of data for any chosen area. The premise being that natural features, topography, bodies of water, etc. and disaster events such as earthquakes, hurricanes, or floods, as well as human activities, all occur on the earth's surface allowing connection by their relative location. Observations of specific details - deaths, crop yields, transportation, facilities, or the GDP of a whole country - can subsequently be "georeferenced" to a defined place or area. Once entered into a geospatial system, the different data can be "layered" to study patterns of human activities and their societal and environmental consequences. The data can also be linked to satellite images of earth's surface, or maps and precisely tied to specific points through the use of global positioning system (GPS) receivers. GIS software is specifically designed to sort through the complex data layers and display relationships underlying the context of the event or situation being considered (Wood, 2005). If properly applied, the software and linked data sets "can track a broad range of local, national, and international problems" (Wood, 2005, p.338).

The advent of GIS, which combines the resources of satellite imagery, geographically indexed databases, and global positioning technology, has revived the cartographic industry; yet the ideas of overlaid maps and georeferencing are not new. The French Cartographer Louis-Alexandre Berthier created maps of the Battle of Yorktown with hinged layers exhibiting troop movements (Klinkenberg, 1997). In the mid-19th century the "Atlas to Accompany the Second report of the Irish Railway Commissioners" included geology, topography, population and traffic flows on the same base map. In addition, Dr. John Snow provided an early example of geographical analysis with his map showing the locations of deaths by cholera in London in 1854. Snow's map was used to track the source of the outbreak back to a contaminated well (Klinkenberg, 1997).

The early computer era in the 1950s and 60s brought about changes in cartographic analysis spurred by the understanding that humans are fallible.

The earliest GIS, the Canada Geographic Information System..., was built to automate the processing of the information collected in map form by the Canada Land Inventory, and was justified on the simple proposition that computers could perform numeric determinations of area from digital representations of maps much more accurately and cheaply than humans working from the maps themselves. (Goodchild, 2000, p.5)

The U.S. Bureau of the Census followed suit by building a GIS for the 1970 census. Their justification was that computers could reduce the error rates normally occurring during tabulation and spatially aggregating census data (Goodchild, 2000). The innovation developed by the Census Use Study (CUS) programmers in the summer of 1967 "supported efficient digitization

and error removal...of census results” (Mark, Chrisman, Frank, McHaffie, & Pickles, 1997, p.10).

Although early development began with governmental agencies, it was not long before GIS research entered the private sector. The Harvard Lab for Computer Graphics and Spatial Analysis developed an automated mapping application called SYMAP in 1966 that was widely distributed helping to build the application base for GIS. Howard Fisher established the Harvard lab in the Graduate School of Design (GSD) with initial funding from the Ford Foundation. This placement in the GSD insulated the lab from the academic discipline of geography giving it a focus toward landscape architects, urban and regional planners, and resource managers (Mark, et al., 1997) – an interesting fact to consider relative to the development of Participatory GIS.

European countries also contributed to early experimentation and development of GIS. In contrast to the single civilian topographic mapping agency in the US, Europe has 30, which is more than the number of countries. Agencies in Sweden and Austria experimented with cadastral or public surveying of property mapping early in GIS history. The Ordnance Survey (OS) of the United Kingdom and later the Institut Geographique National (IGN) of France both founded GIS research and development laboratories. Twenty years later, both the OS and IGN have moved much of their production into the electronic age and are leaders in the production of digital data (Mark, et al., 1997).

GIS have been adopted in most industrialized countries, indicating some level of diffusion. Yet the extent of adoption tells us little about the effectiveness of the technologies. A study of the effectiveness of GIS in British local government concluded that implementation was very difficult (Erik de Man, 2000). Additionally, survey studies in Sub-Sahara Africa and Southeast Asia found that most existing GIS do not meet initial expectations. “Recognizing the significance of context for the effectiveness of geographic information technologies, recent publications focus on critical conditions and factors of that context” (Erik de Man, 2000, p.140). A study by Campbell emphasizes the importance of organizational cultures in the diffusion of GIS, and Wegener and Masser present a GIS diffusion scenario where the technology is used “in an open and participatory process of social experimentation and grassroots decision making” (Erik de Man, 2000). This indicates that Participatory GIS is an important method for the diffusion of GIS technologies globally.

A major hurdle in the development of GIS was crossed around 1980 when the price of computers fell. At that point, systems were available to universities, government and corporate regional offices, even single departments (Goodchild, 2000). “Suddenly GIS became affordable by organizations that could make effective use of it, and a commercial market for GIS software began to emerge” (Goodchild, 2000, p.6). Geographic Information Systems are now considered mainstream in the United States. “From their early days as an expensive custom-built luxury, they have been tweaked and prodded until they are now off-the-shelf necessities for all manner of public and private organizations” (Obermeyer, 1999). Once the commercial market was well established, focus could be shifted from research and development to possible applications. Institutional and societal applications have become focal points with the concern that “all voices should be heard in a democracy” sparking the development of Participatory GIS (Obermeyer, 1999, p.1).

In 1980 the Independent Commission on International Development produced a report containing a comprehensive analysis of various international development issues. Willy Brandt,

former Chancellor of West Germany chaired the commission and the report became known as the 'Brandt Report'. This report popularized the terms North and South for the developed countries which predominately occupy the northern hemisphere and the developing countries which are predominately found in the southern hemisphere. It is acknowledged that not all countries fit this description. The report also mentions the difference between comparatively huge populations in the South with relatively little wealth when compared to the North and its economic power (The Brandt Report, n.d.). Rambaldi, Kwaku Kyem, McCall & Weiner (2006) delineate differences in the evolution of participatory GIS practices within the North and the South.

The North and the South have evolved participatory GIS practices along slightly different paths. In the North practitioners have used the term Public Participation GIS or PPGIS to indicate the intersection of participatory *planning* and GIS often including very sophisticated approaches (Rambaldi, Kwaku Kyem, McCall & Weiner, 2006). PPGIS originally comes from the planning profession. Xavier Lopez of the University of Maine suggested the phrase at a workshop held to improve GIS access among non-governmental organizations (NGOs), and historically under-represented individuals (Obermeyer, 1999). In areas where technical capacity and cost have impeded GIS implementation, PPGIS has grown through organizational arrangements including: "Community-University partnerships with inner city communities, grassroots social organizations, and Internet-based PPGIS" (Rambaldi, et al., 2006, p.4). The costs of implementing GIS practice are therefore divided amongst the organizations. These organizations combine various modern communications technologies with GIS in the effort to facilitate dialogue among local groups. The focus of PPGIS projects often stems from issues associated with discriminatory zoning of ethnic groups including equity and environmental justice (Rambaldi, et al., 2006). An example of discriminatory environmental zoning would be when a toxic waste dumping ground is intentionally located in a minority neighborhood.

In contrast, the South's PGIS practice has emerged as "an intersection of participatory progressive development and GIT&S through the integration of low and high tech spatial information management applications" (Rambaldi, Kwaku Kyem, McCall & Weiner, 2006, p. 4). These PGIS are usually practiced in rural areas with heavy dependence on external technology inputs. The groups involved consist of development scientists, NGOs, traditional societies and other advocates. GIT&S are used to empower native and indigenous peoples. Technology intermediaries often support Community-based Organizations (CBOs) or indigenous groups in using GIT&S to achieve leverage in interactions with state bureaucracies or to meet their spatial planning needs. Many of these cases are non-documented or perhaps found amidst "grey" or not formally published literature (Rambaldi, et al., 2006).

In order to get a clear understanding of current PGIS practices, it is helpful to explore some early successes of participatory mapping, in defending indigenous lands. In the 1980s and 90s, bands of cattle ranchers, loggers, and landless peasant farmers began encroaching on native Indian homelands in the remote forests, savannas, and wetlands of Central America. In one particular instance in 1989,

Two boatloads of pistoleros (hired guns for a cattle rancher) came down from the headwaters of the Patuca River in eastern Honduras and pulled up on the shore of Krautara, a village of the Tawakha Sumu Indians. Armed with pistols and submachine guns, they unloaded their chain saws and sacks of food. They

proclaimed legal title to all of the surrounding land, even though they carried no papers. For three months, they occupied the Indian village... clearing at least 20 hectares of lush tropical rain forest for cattle pasture. (Denniston, 1994, p. 27)

Sadly, the colonial ignorance of labeling lands unsettled by explorers as “uninhabited” has continued into modern times. In addition, with no uninhabited arable land remaining in Central America, the only way to secure new land is to take it from those with less firepower. These events spurred gatherings of Indian leaders and cultural activists in Honduras and Panama. The goal was to remedy the political invisibility of the Indians. A mapping process including workshops, land-use surveys, and a national-level forum for presentation of the results occurred in Honduras and the Darien region of Panama (Denniston, 1994). The hand-drawn Indian maps often proved more accurate than the government produced maps, and the teams found that the “areas where the Indians lived coincided almost exactly with those in which the natural landscape had been preserved” (Denniston, 1994, p. 29). In addition, the maps provided the first clear picture of Indian territories and land use. The national forums gave the indigenous groups a chance to speak about their issues. The credibility of the mapping process allowed the Indians to “launch political campaigns on several issues including legalizing communal homelands, stemming the incursions of colonization by settlers and development by multinational companies, and resolving the relationship between Indian homelands and national protected areas” (Denniston, 1994, p. 30). The meetings proved successful with indigenous rights being seriously considered for the first time in Honduras by national politicians. The process also facilitated intertribal communication and in response, Elpidio Rosales, the 63-year-old regional chief of the Wounaan said, “Last night, I could not sleep, my head was so full of all the beautiful things that I have seen during the forum” (Denniston, 1994, p. 30). The production of the Honduran map generated funding for the Panamanian project from large conservation organizations such as The Inter-American Foundation and The Nature Conservancy (Denniston, 1994). In this early participatory mapping example, the indigenous Indians were rendered visible by the concrete representation of maps.

Participatory mapping processes have also been used to promote sustainability in rural areas. Backhaus (1991) discusses the socioeconomic issues involved in promoting sustainable farming practices to local farmers in northern Thailand. Early attempts to use maps and aerial photos failed due to lack of understanding by the villagers. It was then conceived to use a 3 dimensional topographical model, which proved to be easier for the villagers to identify with. Participants contributed information on boundaries, land use, resources, waterways, conflicts, etc. After the input, issues were prioritized and solutions suggested with the help of extensionists (Backhaus, 1991). Early topographical participatory planning represents the beginnings of Participatory 3D Modeling, P3DM.

P3DM is a practice often being utilized within PGIS to bring local stakeholders together in the planning process for developing areas. P3DM merges spatial GIS information with peoples’ cognitive maps to build a three dimensional multi-coded topographical map. The process begins with a topographical map and participants cutting out layers of cardboard to correspond with each of the lines representing a change in elevation. The cardboard layers are assembled and personal land use is applied through paints, push pins and yarn (Participatory 3Dimensional Modeling, n.d.). Local stakeholders work together to build the model and once it

is complete, a scaled georeferenced grid is applied and a photograph taken. The photograph is then imported into a GIS database for data extraction (Rambaldi, Kwaku Kyem, Mike McCall, & Weiner, 2006). Participatory 3D Modeling is best utilized jointly with Global Positioning Systems (GPS) and GIS in a Participatory GIS context (Participatory 3Dimensional Modeling, n.d.).

Technological cultural context.

Because the foundations of GIS software development are grounded in land use and census data analysis, this creates an easy move into the public planning process, which is heavily rooted in natural resource allocation. In addition, the placement of the Harvard lab within the Graduate School of Design instead of within the Geography Department was a unique coincidence which allowed for more foundational software development applicable to public planning. Even the concept of software itself is useful to a planning process that needs to input multiple types of data (Goodchild, 2000).

GIS as an integrated software environment for spatial analysis is supported by the economies of scale inherent in the software production process. Once a foundation has been built, in the form of routines for creation, editing, and basic housekeeping for a particular class of information, then it is easy to add large numbers of distinct functions. (Goodchild, 2000, p.6)

GIS technology as a mapping and planning tool for increasingly complex times might be seen as one of the more useful technological advances to date. At the same time, some cultural considerations are worth examining.

Early versions of GIS required intensive training and were not easy to use. The development of graphical user interfaces aided in the learning curve making recent versions much more user friendly. This potential need for expert understanding creates what Goodchild (2000) calls a tension between the populist view and the elitist view, or those who call for ease of use and accessibility and those inclined to lean towards only users well versed in the principles of spatial theory and geographic information science having access. This tension led the critic Taylor to call GIS the new imperialist geography (Mark, Chrisman, Frank, McHaffie, & Pickles, 1997). He suggests that

GIS emerged as a two-part strategy on the part of unreconstructed quantifiers who had by-passed the critiques levied against the empiricism of spatial analysis, and at the same time captured the rhetorical ground of a progressivist modernism... by readily accepting the switch from knowledge to information. (Mark, et al., 1997)

GIS practitioners saw Taylor's remarks as contrived, stemming from a reactionary desire to protect the current system of order (Mark, et al., 1997). As the technology and its applications grew, researchers began to consider the social process or construction of the technology.

The evolution of Public Participation GIS (PPGIS) is a direct result of research on societal issues that emerge with the implementation of GIS. The realization that GIS is not just a

tool for solving spatial analysis difficulties but is also a social process, inspired workshops in the nineties to consider how best to include all in a GIS process. Considering the limited cultural background of the technologies' developers, many scholars noted that marginal groups are poorly represented in most GIS (Obermeyer, 1999). "Individuals and citizen's groups without access to GIS and its cartographic capabilities may find it difficult to challenge such official reports as convincingly" (Obermeyer, 1999). Thus the planning profession and a desire to include all voices in a democracy birthed the idea of Public Participation GIS.

Participatory 3D Modeling goes one step further in eliminating the problems inherent to GIS due to technology gaps. "Compared to high-tech Spatial Information Technologies, P3DM is a proven method that can be handled in rural areas within locally available technical capacities, and can visualize spatial knowledge particularly among communities characterized by low literacy, language barriers and lack of basic utilities" (About Participatory 3D Modeling, n.d.) Thus P3DM can be used in developing areas when there is no computer technology available. Once the participants build the three dimensional model, the data can be entered into a GIS at another location for analysis.

CHAPTER II

McLuhan and the Tetrad

Marshall McLuhan and Quentin Fiore (2001) claim that media are extensions of human faculties. In *The Medium is the Massage: An inventory of effects* [sic], they write:

Electric circuitry, an extension of the central nervous system. Media, by altering the environment, evoke in us unique ratios of sense perceptions. The extension of any one sense alters the way we think and act – the way we perceive the world. When these ratios change, men change. (McLuhan & Fiore, 2001)

This is the basic idea behind the “medium is the message,” which Levinson (2001) calls McLuhan’s best-known aphorism. “Its fundamental meaning [is] that our use of any communications medium has an impact far greater than the given content of any communication, or what that medium may convey” (Levinson, 2001, p.35).

The idea of media being an extension of the message recipient that alters the receiver’s perceptions by enhancing one faculty or another is one area where McLuhan and Harold Innis, one of the scholars who influenced his work, diverged. Instead of recipients, Innis emphasized media as extensions of message senders (Babe, 2004). Additionally, Innis considered media either “time-biased” or “space-biased” while McLuhan distinguished media relative to their audile-tactile or visual properties (Babe, 2004, p.40). McLuhan accepted and elaborated upon Innis’s foundational idea that changes in the means of communication are responsible for civilizational change, yet as the above examples indicate, he inverted Innis’s fundamental dialectic (Babe, 2004).

In addition to these differences, there is another important variance between the two theorists that is paramount to McLuhan’s laws of the media. Babe states,

Adopting the stance of literary critic, McLuhan applied the rhetorical term *chiasmus* to media to indicate that at high intensity there is a reversal of a medium’s effects. Hence, McLuhan predicted the emergence with electronics of a new or secondary orality and foresaw the “re-tribalization” of humanity, albeit on a global scale... By contrast, Innis never proposed reversal – or that, for example, space-binding media would ultimately resurrect the importance of continuity or time. (Babe, 2004, p.42)

This fundamental divergence on the anticipated effects of electronic media on society is reason to prefer McLuhan’s tetrad over Innis’ theories as applied to Participatory GIS, which is partially an electronic medium.

In the late 1970’s, McLuhan pulled together many of his interrelated insights into what he called the four laws or effects of media. McLuhan named the laws the “tetrad” after the four questions that form the structure of the analysis tool. He was working on a book describing the tetrad when he suffered a stroke in 1979. The putative publisher chose not to publish it at that time, and it remained unpublished until 1988 when McLuhan’s son Eric was able to facilitate publication (Levinson, 2001).

The tetrad or four laws of media considered simultaneously as a cluster, is “an instrument for revealing and predicting the dynamics of situations and innovations” (McLuhan & McLuhan, 1988, p.105). It is comprised of four questions concerning the impact and development of any medium or technology (McLuhan & McLuhan, 1988). In *Laws of Media*, McLuhan describes the questions as such:

What does the artefact enhance or intensify or make possible or accelerate? ... If some aspect of a situation is enlarged or enhanced, simultaneously the old condition or unenhanced situation is displaced thereby. What is pushed aside or obsolesced by the ‘organ’? What recurrence or retrieval of earlier actions and services is brought into play simultaneously by the new form? ... When pushed to the limits of its potential... the new form will tend to reverse what had been its original characteristics. What is the reversal potential of the new form?
(McLuhan & McLuhan, 1988, p.98-99)

The words extend or amplify are also applicable to the enhancement category, displace to the obsolescence category, and overextension, revert, or “flip into” may also be used to describe reversal. To avoid confusion when referring to the tetrad throughout the remainder of this work, I intend to use the simple form of the questions such as, what does the technology or medium enhance, obsolesce, retrieve, and reverse into, unless one of the additional descriptive terms is more explanatory. The four terms will be italicized when directly referencing an important analysis, be it in this study or another author’s work.

Consideration of some examples will help to clarify how the tetrad works. McLuhan describes the *enhancements* or extensions of a chair, “each part is named for the part of the body that it extends and replaces... feet, legs, seat, back, arms, and so on. Each of these is systemically numbed in the user as the chair diverts energy from it in the direction of the head and eyes” (McLuhan & McLuhan, 1988, p.117). Levinson (2001) claims radio *amplifies* the voice to cover mass audiences essentially instantaneously. In addition, it *obsolesces* or pushes the mass medium of print aside in the instance of breaking news when the paper cannot be printed at a moment’s notice. Radio also *retrieves* the town crier who had previously been obsolesced by print, and finally when overextended, acoustic radio *reverses* into audio-visual television (Levinson, 2001).

As all technological development builds on previous invention, let us continue on and consider the television. Our visual faculties are *enhanced* by television but in a different way from the individual nature of reading printed newspapers or books separately. Television broadcasts visual imagery to a mass audience simultaneously in an “acoustic” all-at-once mode. It *obsolesces* radio by adding its main retrieval, the visual element. Television’s visual retrieval is a hybrid of previous print visuality with new electronic attributes. When taken to its limit, television *flips into* the personal computer screen (Levinson, 2001).

These two examples show us the interconnectedness of media technologies and how McLuhan’s tetrad may reveal those relationships. At the same time, there are other possible enhancements, reversals, etc. of television. Not only did TV *obsolesce* radio, but motion picture theaters as well. It also *flips into* many more technologies than just the computer, including

three-dimensional holography, the VCR and network television into cable television (Levinson, 2001).

Levinson (2001) considered the ongoing interconnectedness illustrated above similar to a spiral of evolution technologically. He called the phenomenon “Tetradic Wheels of Evolution” and describes it as follows:

There is a cyclical but progressive relationship among media and their effects which becomes plain when they are parsed according to the four “laws.” What radio obsolesces – visuality – television retrieves. And in so doing, television – what radio has flipped into – obsolesces the purely acoustic radio. There is a circularity of sorts here. (Levinson, 2001, p.190-191)

This spiral nature will be useful when we consider the evolution of PGIS out of GIS. The following section will review applicable literature followed by case studies of recent PGIS processes.

Literature Review

In 2003, geography theorists Sui and Goodchild proposed reconceptualizing GIS as communication media in the article titled *A Tetradic Analysis of GIS and Society Using McLuhan’s Law of the Media*. Before that time, most theoretical discourse involving GIS occurred within the fields of geography, public planning, natural resource management, and social sciences. Because the topic has only recently entered the realm of communications theory discourse, this literature review will be concise. I will review some aspects of McLuhan’s body of work that form foundational aspects of his law of the media and the tetrad and articles that consider similar effects of communications technologies. I will also consider the few articles I found directly referencing GIS and Marshall McLuhan. Additionally, I will review articles that have been written addressing Sui and Goodchild’s arguments and one compilation of participatory communication projects for social change.

A search of major communications journals yielded very few articles discussing GIS and none written by communication theorists specifically advocating GIS as communication media. That is not to say that they do not exist, but I feel confident they are not numerous. I did however discover one article published prior to Sui and Goodchild’s that mentions Global Positioning System (GPS) technology in reference to McLuhan’s tetrad. *Spatial Metaphor in the Work of Marshall McLuhan* argues that understanding spatial metaphor is crucial to the understanding of McLuhan’s laws of the media, or the tetrad (Gow, 2001).

The distinction between “visual space” and “acoustic space” dominates much of McLuhan’s writing as key spatial metaphors. McLuhan argued that the alphabet and typography brought about a separation of the visual sense that allowed for conceptualizing space as infinite, divisible, featureless, connected, and homogenous (Gow, 2001). In referencing this “visual space” Gow (2001, p.3) states, “It is, in effect, depicted in the abstract space of geometric figures and in the grid of the cartographer’s chart.” This statement indicates that McLuhan considered cartography a visual space medium. Interestingly, Gow provides us with a footnote to that

statement that argues Global Positioning System (GPS) technology could be considered as a *reversal* of print mapping in the tetradic sense, “using as it does an acoustic medium that applies visual space as its content” (Gow, 2001, p.13). This is Gow’s only referral to a GIS technology using the tetrad. This paper will explore similar ideas in the analysis section.

Another effect McLuhan attributed to “visual” technologies is the creation of center to periphery relations. Gow (2001, p.3) quotes McLuhan as saying, “Visually biased technology also creates centre-margin patterns of spatial organization and power relations.” This concept will be useful in considering the differences between print mapping and digital mapping in the PGIS process. Like GPS, PGIS is an acoustic medium applying visual space content. Participatory GIS projects often reveal peoples contained within the center-margin spatial organization of the dominant culture which had previously been rendered invisible by 2-dimensional print mapping

McLuhan believed electricity and its corresponding technologies brought back a resurgence of acoustic space beginning with the telegraph and its disruption of the center to periphery patterns common in print capitalism (Gow, 2001). He also considered modern telecommunications and data networks as acoustic having, “the intrinsic nature of a sphere, simultaneously resonating and structured around multiple and interconnected centres, relatively indifferent to background” (Gow, 2001, p.4). It is this juxtaposition of spatial metaphor that gives structure to McLuhan’s tetrad and a way to create dialectical relations between the visual and acoustic qualities. The concept of spatial metaphor also provides an ontological role in the tetrad revealing what McLuhan felt was the true nature of causality present in all media. McLuhan considered the tetrad an alternative model for the study of culture and technology (Gow, 2001). In concluding, Gow (2001, p.12) claims, “there is a need to explore McLuhan in the context of technology assessment, a field that has recently recognized the value of metaphor for structuring social interventions in the early stages of technology design and development.” It could be considered appropriate to utilize a model based on spatial metaphor to analyze PGIS, a technology that creates literal spatial metaphors.

Levinson (2001) also discusses McLuhan’s ideas of “visual” and “acoustic”. He states, “A prime concern of McLuhan’s was the way the alphabet and the printing press encouraged us to see the world as a series of discrete sources and pieces, from which we could be easily detached, as when closing a book” (Levinson, 2001, p.6). When reading a book, one reads from left to right in an ordered linear fashion. According to McLuhan, this detached sequential vision had replaced an earlier “acoustic” mode of perception that was present amongst tribal life. This “acoustic” mode consisted of “perceiving the world all at once, all around us, as a permeable extension of ourselves and we of it” (Levinson, 2001, p.6).

Benedict Anderson (1991) also argues that print had a profound affect on humanity. While McLuhan saw printing as creating separation and linear thinking, Anderson visualized on a larger scale of “thinking the nation” (Anderson, 1991). Anderson (1991) argues that print capitalism, through the weeding out of fringe dialects, eventually created the modern national boundaries. McLuhan on the other hand points toward the cartographic origins of nation-states as evidence that the map as a medium processes the world (Neve, 2004). Perhaps it was a combination of both, considering that maps during that time were solely printed media. If the onset of printing and print capitalism changes the way we think to a linear perspective (Levinson, 2001) and the formation of print languages allows us to organize into territories based on

common communication (Anderson, 1991), then what occurs when people work together in community planning using multifaceted high-technology maps such as the PGIS process?

Brian Holmes (2003a) considers a similar question as applied to particular types of non-participatory GIS. Although GIS technologies originated in the land inventory and census fields, they were further developed by the U.S. military to track enemy movements and target missiles. The same technology is now being used by private industry to manage mobile workforces and statistically target consumers (Holmes, 2003a). Holmes asks,

What kind of world do contemporary maps represent? What is it good for? What is the use of ‘getting some information,’ if the results are commercial or military propaganda? Or of ‘getting somewhere,’ if the destination is worthless, even repulsive? What shall we make of the contemporary design of our own minds? (Holmes, 2003a)

Perhaps Holmes too would find the PGIS process a point of hope.

Participatory GIS is very new to critical social discourse, yet GIS has been debated for some time now. Practitioners of GIS usually consider the technologies as “value free neutral tools for problem-solving” (Sui & Goodchild, 2003, p.5). In contrast, social theorists have labeled GIS as “socially biased technologies serving only corporate and state interests” (Sui & Goodchild, 2003, p.5). It is partially due to these diametrically opposed opinions that Sui and Goodchild proposed reconceptualizing GIS as media. Sui and Goodchild argue that GIS are increasingly being used to communicate crucial social and environmental information to society and therefore warrant closer inspection of their societal effects. The authors perform a detailed tetradic analysis of GIS considering what the technology enhances, obsolesces, retrieves, and reverses into. Because theirs is the only paper I found performing a full tetradic analysis of GIS technologies, I will provide a summary of their findings to compare and contrast with the analysis of PGIS. The four tetradic sections are labeled to aid the reader’s understanding.

Enhancement.

Sui and Goodchild (2003) begin their analysis by acknowledging the commonly held sentiment that GIS have greatly enhanced data inventory and database management of georeferenced information. In mapping, GIS have extended the hands for digital and real maps, and the eyes through remote sensing and aerial or satellite imagery. The brain’s power to navigate has been extended through car navigation systems and real-time GPS (Sui & Goodchild). The authors also claim extension of our minds “through integration with artificial intelligence, expert systems, various kinds of spatial analysis and modeling and even the incorporation of emotions into computing processes” (Sui & Goodchild, 2003, p.10). In addition, they argue that the visibility of geographical information has been enhanced and GIS should be considered a “part of the information revolution that has transformed our society from an industrial into a postindustrial one” (Sui & Goodchild, 2003, p.10).

Obsolescence.

When certain faculties and social practices are enhanced, others are made obsolete. This is the second effect considered in McLuhan's tetrad. Sui and Goodchild (2003) argue that GIS are "killing" some aspects of cartography such as the use of drawing pens and certain traditional field techniques. They also claim the desire to collect field data may be obsolescing because there is so much secondary data available via the Web etc. This lack of primary data for research and social applications may have profound legal, ethical and methodological implications. GPS and wireless computing in the field may be affecting practitioners' natural directional and navigational skills. Sui and Goodchild also mention GIS users' interest in learning a particular software package while showing little interest in how the algorithms work. They claim this outlook may have consequences where the "access to powerful GIS tools may be a greater interest in *doing the thing right* rather than in *doing the right thing*" (Sui & Goodchild, 2003, p.11).

Retrieval.

The third aspect of the tetrad claims technologies retrieve cultural elements that have previously been obsolesced by other technologies. McLuhan's ideas of visual and acoustic space are the elements Sui and Goodchild (2003) apply for their retrieval section, implying that GIS being an electronic media is aiding the retrieval of oral culture. They next address GIS directly claiming that in the 1980s and early 1990s, deficiencies in analytical capabilities of GIS software prompted retrieval of techniques used during the quantitative revolution. These efforts improved the spatial analysis and modeling tools, yet uncovered understanding that the "current conceptualizations of space and time in GIS are incomplete" (Sui and Goodchild, 2003, p. 11).

By incomplete they mean there is much information stored in humanity's cognitive space that is impossible for an analysis program to know without input. Sui and Goodchild thus claim that the second major retrieval is the study and incorporation into GIS of naïve geography (Sui and Goodchild, 2003). Naïve geography was defined in 1995 by Max Egenhofer and David Mark. The abstract contains a concise description:

Naïve Geography, the field of study that is concerned with formal models of the common-sense geographic world... is the body of knowledge that people have about the surrounding geographic world. Naïve Geography is envisioned to comprise a set of theories that provide the basis for designing future Geographic Information Systems that follow human intuition and are, therefore, easily accessible to a large range of users. (Egenhofer, M. & Mark, D., 1995, p.1)

I will venture to claim that many practices of Participatory 3D Modeling and PGIS fit well under the umbrella of naïve geography, but an in-depth discussion of such is beyond the scope of this paper.

Sui and Goodchild (2003) claim GIS has a third major retrieval effort, that of incorporating critical social theory to guide current practices. The authors mention two particular projects, the National Center for Geographic Information and Analysis's (NCGIA's)

initiative 19 (I 19) and the Varenus project. These projects consider various social implications of GIS including Participatory GIS (Goodchild, Mark, Egenhofer, & Kemp, 1997; & Craig, Harris, & Weiner, 1998). They claim these projects have moved away from the dominance of mapping, which is a visual mode technology, to more multimedia convergent technologies representing “different voices and narratives (for the ear)” (Sui and Goodchild, 2003, p.11). Tying in with McLuhan’s discourse of shifting metaphors, they argue that GIS have re-emphasized orality through giving new roles to speech, narrative and rhetoric. As media, GIS do more than just display beautiful imagery; they also provide stories for the information beheld. In addition to emphasizing rhetoric, Sui and Goodchild (2003) also claim some applications of GIS function as rhetorical devices for the creation of meaning and discourse. This is one of the main reasons they argue for the reconceptualization of GIS as media. They state:

Instead of regarding GIS as ‘a distant mirror’ faithfully reflecting reality (Pickles 1999), it is perhaps more appropriate to treat GIS as ‘a close dialogue’ among different players in society. By shifting our ocular metaphor to an aural one, we can be more sensitive to different voices and, possibly, to silences as well. (Sui & Goodchild, 2003, p.12)

Reversal.

The fourth and final element of McLuhan’s tetrad is reversal or the idea that when a technology is pushed to overextension, it will reverse into the opposite of what was originally intended. Sui and Goodchild (2003) mention a variety of names for this effect that have been proposed by critical scholars including Marx’s alienation, technopoly by Postman, and Habermas’ colonization of the lifeworld. McLuhan proposes that when a technology or medium is pushed to its limits, it ceases to be simply a vehicle and becomes also the navigator. Sui and Goodchild (2003, p.12) claim that many social theorists worry that within the context of GIS, the “computerization of the natural and cultural may inevitably lead to the naturalization and culturalization of the computerized.” There are examples of organizational mandates being modified to meet the technological requirements of GIS. There is also no way of representing uncertainty or unknown factors within a GIS. Sui and Goodchild (2003) claim that when GIS is the only available problem-solving tool, many practitioners will ignore the uncertainty rather than insisting on another option.

Sui and Goodchild (2003) also argue that GIS reversal leads to non-democratic practices in society. This argument assumes however that their practices are inherently democratic. They state, “GIS developments and applications are driven by corporate greed or the state’s insatiable desire to survey and collect intrusive information from ordinary citizens” (Sui & Goodchild, 2003, p.12). Some critics warn against the possibility of a super Panopticon monitoring our every move (Sui & Goodchild, 2003). The concept of a Panopticon will be explained in chapter 4.

The final reversal Sui & Goodchild (2003) discuss may be the most problematic - that of the potential for fantastic visual imagery to create a false sense of reality. They claim this may lead to ontological effects suppressing or excluding other ways of knowing. They state, “GIS

may become a prison which traps us into particular modes of knowing and separates us from the real world and its problems” (Sui & Goodchild, 2003, p.13). The authors conclude their reversal analysis with a metaphor of GIS being the electronic version of Plato’s cave or simply illusions of reality (Sui & Goodchild, 2003). I would challenge the intensity of these ideas and ask the question would those images be any less false than a two dimensional print map which shows only the representations intended by its maker?

Sui and Goodchild’s article has garnered significant attention in geographical and related fields. It is a required text in Geographic Information and Society taught at the State University of New York in Buffalo, NY (Cope & Mark, 2005). Also addressing their article, Schuurman describes GIS’s applications beyond geography as follows:

GIS has advanced far beyond the disciplinary boundaries of geography. It has become a means of disseminating social and environmental information to a broad public... Reconceptualizing GIS as media provides a basis for examination how space, people, environment and relationships are represented in GIS.
(Schuurman, 2003, p.2)

She further suggests that GIS have changed into a multidimensionally integrative discipline exceeding previous expectations for representation and communication (Schuurman, 2003). In addition to the original article, Sui wrote a similar article on Location Based Services (LBS) for the *Journal of Geographic Information Sciences* in 2004. LBS are a convergence of “spatial and communication technologies, including (but not limited to) GPS, GIS, wireless communication, mobile computing, the Internet, etc.” (Sui, 2004, p.166). Not surprisingly, in that article Sui proposes that LBS be treated as new media and proceeds to apply McLuhan’s law of media through a tetradic analysis (Sui, 2004).

William Crumplin (2007) was also influenced by Sui and Goodchild’s tetradic analysis of GIS. He contributes to the argument of GIS as media by including a list of different GIS definitions applicable to various groups of people compiled by Longley and others in 2001. Some examples are, “a container of maps in digital form [for] the general public, a computerized tool for solving geographic problems [for] decision makers, community groups, planners, ... [and] a tool for revealing what is otherwise invisible in geographic information [for] scientists, investigators” (Crumplin, 2007, p.66). Crumplin (2007) argues that this varied applicability across multiple user groups supports Sui and Goodchild’s assertion that GIS are communications media. He uses the reconceptualization of GIS as media and applies it on a micro scale to two case studies, one in Minneapolis and one in Kerala State, India. The India study was a one-time use of GIS technologies for a precise goal in a developing country while the Minneapolis case study is a broad and ongoing project focused on neighborhood revitalization in an urban area. Crumplin (2007, p.81) states, “Both studies ... illustrate the power of GIS as media to communicate findings and solutions to geographic problems.”

Rather than performing his own tetradic analysis, Crumplin relies on Sui and Goodchild’s analysis referring to it as the “GIS as media tetrad” (Crumplin, 2007, p.65). He claims that his micro level application supports Sui and Goodchild’s findings with a few exceptions. The GIS application in Kerala State, India focused on the social causes of land degradation. Hoeschele is the author of this study that Crumplin (2007) analyzes. He reports that this particular study did

not include local or experiential knowledge and input (Crumplin, 2007). Hoeschele appears to come from a very “above” perspective in applying a “critical analysis of the use of geographic information engineering by a state agency to emphasize the amount of land that is wasted by indigenous and peasant farmers, calling into question their ability to manage their land effectively” (Crumplin, 2007, p.79). This lack of inclusion of oral culture differs from Sui and Goodchild’s GIS *retrieval* analysis. Crumplin (2007) also states there was no evidence that Hoeschele’s study was informed by social theory – a second variation from Sui and Goodchild’s GIS *retrieval* analysis (Crumplin, 2007).

Crumplin argues that these differences do not invalidate the tetradic approach. He claims that it demonstrates that Sui and Goodchild’s analysis are simply examples. He also argues that the divergence shows the flexibility of the tetradic approach in that the questioning can lead to unique observations that might otherwise be unnoticed (Crumplin, 2007).

Crumplin (2007) also touches on the critiques levied against McLuhan. He writes that the two most influential ones by Williams and Carey focused on McLuhan’s early work significantly predating the final developments of the *Laws of Media*. Crumplin adds,

Paul Grosswiler (1998) and Glenn Willmott (1996) argue that McLuhan was not a technological determinist and that his approach was, in fact, humanist and interdisciplinary in nature. As the case study applications... illustrate, McLuhan’s concepts, contrary to Williams and Carey’s reading, force an analysis of the power relationships, institutional organization, and political economy within society. (Crumplin, 2007, p.71)

Power relations and globalization theories with respect to GIS and PGIS are discussed in chapter four.

Although there has been a lack of Participatory GIS as media in communications research, there are other participatory media projects occurring globally. In *Making Waves: Stories of Participatory Communication for Social Change*, Alfonso Dagron (2001) tells the story of fifty different participatory communication projects around the world. The media used mostly consisted of radio with a few video, theater, and Internet cases. Dagron claims that many participatory communication experiences never make it into scholarly debate due to the lack of cases written in English. Latin America began experimenting with participatory communications as early as the 1940’s with cases now numbering in the thousands, yet academics in North America and Europe have heard very little on the topic (Dagron, 2001). Dagron states,

Because of the language barriers and the scarce international visibility of most of the grassroots experiences, there is much misunderstanding among development organisations, and even academic institutions, about the essence of participatory communication practices that are alive and well in developing nations. In spite of the increasing awareness about the relevance in economic and social development, the concept of *participatory communication* still lacks an accurate definition that could contribute to a better understanding of the notion. (Dagron, 2001, p.8)

Dagron (2001) further claims that participatory communication is difficult to define because it is not a unified model of communication but a movement that is still shaping itself. Dagron quotes Shirley White describing this difficult to define phenomenon, “The word ‘participation’ is kaleidoscopic; it changes its colour and shape at the will of the hands in which [it] is held” (Dagron, 2001, p.8).

Dagron (2001) argues that communication has been and still is neglected in development projects. Social and cultural issues that are important for a communication strategy are often misunderstood by the economists and technicians in control of development. International donors, governments, NGOs, and implementers have tried large scale dissemination of information through mass media especially surrounding health issues and found this approach difficult to sustain without permanent funding. Also, the information was often too general to be culturally accepted and failed to establish a dialogue with communities. Implementers have since realized that beneficiaries need to be involved in development projects to build a sense of ownership which leads to sustainability of the project once external support is removed (Dagron, 2001).

Although there is no established ideal model for participatory communication, Dagron (2001) does list some desirable qualities that should be present in quality projects. He argues there are two main political implications that need consideration when dealing with participation in development and participatory communication – the issue of power and the issue of identity. He claims the democratization present in participatory communications cuts through the issue of power and builds cultural pride and self-esteem in those that have been marginalized. Dagron also lists several ideas that separate participatory communication from other developmental strategies for social change including: horizontal vs. vertical, process vs. campaign, long-term vs. short-term, collective vs. individual, with vs. for, specific vs. massive, people’s needs vs. donors’ musts, ownership vs. access, and consciousness vs. persuasion (Dagron, 2001). As the following case studies will demonstrate, Participatory GIS satisfies Dagron’s claim of the democratization of participatory communications building cultural pride and self-esteem in marginalized peoples. The cases also fulfill the majority of Dagron’s strategies for social change with the possible exception of long-term vs. short-term. Not all PGIS projects are carried through on a long-term basis.

CHAPTER III

Case studies

Participatory GIS is a practice emerging out of participatory approaches to planning and the management and communication of spatial information. PGIS combines various geo-spatial data collection and analysis methods including,

Sketch maps, Participatory 3D Models (P3DM), aerial photographs, satellite imagery, Global Positioning Systems (GPS) and Geographic Information Systems (GIS) to represent peoples' spatial knowledge in the forms of virtual or physical, 2 or 3 dimensional maps used as interactive vehicles for spatial learning, discussion, information exchange, analysis, decision making and advocacy. (Rambaldi, Kwaku Kyem, McCall, & Weiner, 2006, p.2)

The ability of a map to successfully communicate the intended information relies on the selected features and their manner of depiction. During PGIS practice, it is important that the map legend be created in a vocabulary fully understood by all participants so they can relate the information to their life-worlds. Rambaldi et al. state, "Producing, geo-referencing and visualizing indigenous spatial knowledge (ISK) helps communities engage in peer-to-peer dialogue and promotes their particular issues and concerns vis-à-vis higher level authorities and economic forces" (Rambaldi, Kwaku Kyem, McCall, & Weiner, 2006, p.2). ISK typically contains the following types of information: natural resource distribution, resource use, control and access, places of historic, cultural and religious significance, indigenous cosmovisions, and hazard perception such as floods and disease. ISK involves generations of practical knowledge and is often cognitively different from scientific knowledge (Rambaldi, et al., 2006).

Now that we have an understanding of McLuhan's tetrad, have seen it applied to GIS, and have re-oriented to the differences in PGIS, let us explore two very different case studies for tetradic analysis drawn from regions with differing levels of industrialization and development. The first, *Manchester's EoC* is an urban regeneration Public Participation GIS (PPGIS) from the industrialized North and the second, *Stories of the Ogiek*, is an indigenous spatial knowledge (ISK) PGIS from the developing South.

Manchester's EoC.

In *Public Participation in Local Policy Decision-making: The Role of Web-based Mapping*, Richard Kingston (2007) details a web based PPGIS being conducted by the City of Manchester in England. A large area known as New East Manchester (NEM) is being used as a testing ground for new e-participation tools. This area of the city is in the process of urban regeneration. Manchester has a history of strong support for the use of Information and Communication Technologies (ICTs) in business and community development (Kingston, 2007). Kingston (2007, p.140) states, "The underpinning philosophy of these initiatives has been that technology is a means to achieve sustainable regeneration rather than allowing the technology to dominate the regeneration process."

One way Manchester works toward sustainable regeneration is through their Council's Environmental Services Environment on Call (EoC) website. Through the EoC, people can report a range of environmental and social issues via e-mail, on-line forms, telephone, or text messaging. In order to improve this reporting system, the EoC has implemented a web-based mapping interface to allow the citizens to pinpoint the exact location of their complaint rather than trying to explain it verbally or in writing (Kingston, 2007). "This has raised some interesting issues in relation to how people understand mapping and their methods of navigation" (Kingston, 2007, p.140). Some critics have argued against mapping interfaces for public access use due to questions of map literacy; yet Kingston (2007) claims that ten years of PPGIS testing at local, regional and national levels indicates that people are capable of navigating around the on-line mapping interfaces. If the website contains a search function for streets or postal codes, after zooming in, users can quickly navigate from a familiar point to other locations by following known routes. Kingston (2007, p.141) states, "The provision of points on the map with linked digital photographs and panoramic views of well known landmarks also helps users orientate themselves on the map." In addition, there is evidence that young people often navigate the system for their older relatives who then let them know what they want to report (Kingston, 2007).

Issues reported to the EoC include but are not limited to, problems with ground maintenance, broken pavement, abandoned vehicles, uncollected waste, street lighting, graffiti, crime, etc. The addition of a GIS interface allows citizens to identify the exact location of their problem and input the necessary details into a web-based form. The advantage to this system is that the complaint gets forwarded directly to the team in charge of the issue instead of being routed through a call center. Future versions are expected to transmit directly into vehicles through GPS systems or cell phone SMS (Kingston, 2007). Figure 1 shows a screen shot of the EoC web interface.

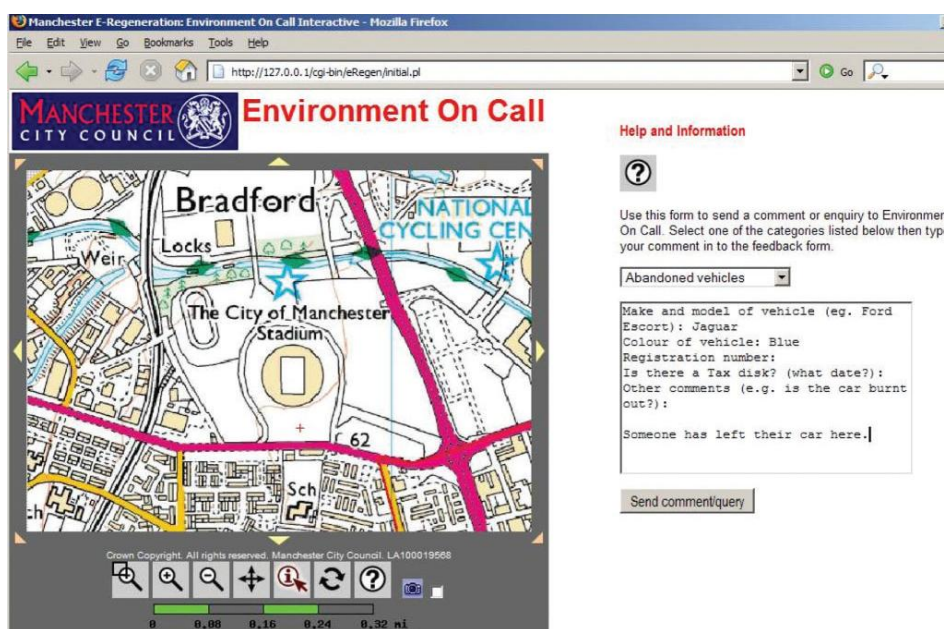


Figure 1. The Manchester EoC mapping interface (Kingston, 2007, p.142).

In addition to facilitating direct interaction between citizens and street operatives, the system provides data to the city council on service delivery and management. Kingston states,

The system generates a geo-referenced database which allows policy makers to monitor the types of complaints and enquiries being reported. This allows the city council to map and monitor the spatial location of the different types of service enquiry in real time allowing them to investigate persistent problems and target resources to appropriate parts of the city. (Kingston, 2007, p.141)

An example of this might be patterns of missed garbage pick-ups. The GIS's ability to monitor spatial dispersion of any particular issue allows policy officers to take appropriate action and investigate such common patterns. The map-enabled system has decreased the time spent by the Manchester city council in trying to identify exact locations of complaints (Kingston, 2007). This might lead one to argue that the city of Manchester's EoC website which contains a PPGIS, *amplifies* the city council's eyes, and ears *enhancing* efficiency and management of public issues.

Another area of possible *enhancement* is to accessibility. The EoC website is available twenty four hours a day allowing people to report issues anytime from the convenience of their own home or office. Of course it is important that the city government listens to what the people have to say. Kingston (2007) claims that trust is paramount to the success of such on-line participatory projects. The public needs to trust that the system will not be abused and reports will be followed through on, and they need to trust in the process and the information given. Kingston (2007, p.143) states, "A concern of citizens has been that such systems will not change what happens on the ground as it is still the same organization and people making decisions whether you complain by letter, telephone, in person or by e-mail."

Currently, Manchester's site is focused on reporting problems and making enquiries. Future developments are aimed at an e-Participation system that will support "open and transparent dialogue which has a spatial planning and regeneration focus" (Kingston, 2007, p.142). The new system will allow users to discuss and debate issues creating a geo-referenced database for the community.

The Manchester PPGIS case represents an internet based urban participatory project. In contrast, the next case involving the Ogiek, indigenous hunter-gatherers in Kenya, is a very different type of participatory project aimed at safeguarding cultural identity.

Stories of the Ogiek.

In *Through the Eyes of Hunter-Gatherers: participatory 3D modeling among Ogiek indigenous peoples in Kenya*, Rambaldi, Muchemi, Crawhall, and Monaci (2007) detail a participatory three-dimensional modeling (P3DM) exercise conducted in the village of Nessuit, Nakuru District, Kenya during August of 2006. This particular exercise is part of a larger project aimed at "Strengthening the East African Regional Mapping and Information Systems Network" (Rambaldi et al., 2007, p. 113). In addition to that objective, the Ogiek were given the opportunity to apply the P3DM to their circumstance of vulnerability and natural resource loss (Rambaldi et al., 2007).

The authors argue that within the participatory mapping process, the collaborative development of the map legend is paramount to the quality of the product. They state, “It is a community-developed and universally understood map legend that allows local spatial knowledge to be expressed in an objective and efficient manner which may contrast with the dominant intellectual framework which is usually presented on ‘official’ maps” (Rambaldi, Muchemi, Crawhall, & Monaci, 2007, p. 113). The map legend produced during the Ogiek project revealed interesting differences in the hunter-gatherer worldview relative to non hunter-gatherer society (Rambaldi et al., 2007).

The Ogiek live in the Mau Forest Complex – the largest single area of closed-canopy forest in Eastern Africa. They are one group of what are called ‘Dorobo’ peoples of Kenya. The Dorobo are hunter-gatherers whom the colonizing British felt should not survive. The British removed their legal status as an ethnic group denying their rights to land or identity. The Ogiek are still not formally recognized by the State leaving them vulnerable politically, economically and culturally. In the past decade, the Kenyan government has allowed logging in the Mau Forest depleting biological diversity and allowing the destruction of the Ogiek natural and cultural landscapes (Rambaldi, Muchemi, Crawhall, & Monaci, 2007).

In the interest of preserving their natural resources and cultural heritage, the Ogiek have resisted the attempts of colonial and post colonial governments to reallocate their lands or assimilate them into the dominant ethnic groups. In 1992, the Ogiek filed suit in court challenging general deforestation and the allocation of forest lots to non-Ogiek settlers. They also participated in a PGIS in 2005 to “delineate their ancestral lands and inventory natural and cultural resources” ((Rambaldi, Muchemi, Crawhall, & Monaci, 2007, p. 114). Their efforts gained international attention and activists at the 2005 Mapping for Change Conference in Nairobi requested that P3DM be introduced into the equation. Incredibly, for the P3DM, the Ogiek elders chose to use the process simply to document, safeguard, and transfer their traditional knowledge to their coming generations. “According to the elders, young people do not hunt, gather or even walk to the remoter parts of the ancestral Ogiek territory and are losing their cultural heritage and knowledge” (Rambaldi et al., 2007, p. 115).

The P3DM included local community members, facilitators, and national and international trainees. Approximately 120 Ogiek elders, men and women chosen by the twenty one clans, six schoolteachers, and thirty schoolchildren represented the local community. It was agreed upon to represent the physical biological and cultural environment of the Ogiek lands during the 1920s. Though only a few participants were alive at that time, they chose 1920 because their landscape was still pristine and it corresponded to the arrival of the first missionaries and foresters. When questioned as to how they could remember the territory so far back, middle-aged Ogiek replied that they were not ‘visitors’ and maintained detailed knowledge due to oral tradition with their parents and grandparents (Rambaldi, Muchemi, Crawhall, & Monaci, 2007).

There were many different criteria used by the Ogiek to differentiate between the land units within their territory including altitude, vegetation type, game, honey sweetness, and medicinal plants. Some of the legend items include homestead, bee hive, sacred tree, initiates wash place, logging company, cave, school, hunter trap, etc. Men and women contributed overlapping but distinctly different knowledge to the legend (Rambaldi, Muchemi, Crawhall, & Monaci, 2007). The authors state, “In particular women displayed deep knowledge of plants and

their medicinal uses, whereas men were more conversant with game and beehives distribution, and types of soil” (Rambaldi, et al., 2007, p. 119). When the Ogiek were enlightened as to the possible consequences of revealing uses of medicinal plants, they chose to record it yet keep it confidential (Rambaldi, et al., 2007).

Although the Ogiek have not participated in active hunting and gathering for more than two decades, the mapping process revealed that they still operate from a hunter-gatherer conceptual perception. The elders navigate through Ogiek territory using trees as boundary and site markers. Contrary to common agricultural and industrial societies’ practice of physically transforming their environment to create meaning, hunter-gatherers utilize memory and species information to record their cultural heritage (Rambaldi, Muchemi, Crawhall, & Monaci, 2007).

Another unique aspect of the Ogiek’s conceptual system was revealed in the labeling of pathways. Three types of pathways were included on the map: *wakta*, or indigenous human paths, *waktawo*, or broad paths used by outsiders that are associated with danger, and *irongiit*, or animal paths. At the completion of the mapping process, there were many *irongiit*, clearly marked *waktawo*, but very few *wakta*, or indigenous pathways. When asked by the facilitators if they had forgotten their paths, the Ogiek were puzzled by the ignorance of the question (Rambaldi, Muchemi, Crawhall, & Monaci, 2007). Rambaldi et al. describe their response, “Why would indigenous peoples have regular footpaths? If you have walked one way through the forest, you know what is there, you will come home a different way. ‘Only the hyena returns on its spoor!’” (2007, p.122)

The P3DM proved to be an inspiring and motivating process allowing the participants of all ages to engage with their landscape and heritage. This achieved the purpose of transferring knowledge and hopefully wisdom and values to the new generations. The three-dimensional modeling process has advantages over two-dimensional maps allowing youth to learn about contours and map making. Additionally, many elders and youth could engage the model together facilitating story telling, attention to detail, and the equitable inclusion of varying clans. The three-dimensional model stimulated memory allowing for the creation of a tangible natural landscape as well as capturing the Ogiek’s intangible cultural heritage (Rambaldi, Muchemi, Crawhall, & Monaci, 2007). The Ogiek elders and their 3D model are shown in Figure 2.



Figure 2. Ogiek Elders posing behind their artwork (Rambaldi, et al., 2007, p.125).

Rambaldi, Muchemi, Crawhall, and Monaci (2007) mention several positive accomplishments of the Ogiek P3DM. Firstly, the Indigenous Peoples of Africa Co-ordinating Committee (IPACC) brought several attendees from neighboring hunter-gatherer groups to observe the Ogiek's P3DM. Although they come from distinct cultural groups, they recognized the Ogiek priorities. This validated the unique world-view of hunter-gatherers with respect to their relationship with their natural resources creating solidarity amongst the groups. The mapping process also showed that "indigenous knowledge of biological systems and the endurance of their cultural frameworks for understanding the landscape and territory, outlast the specific economic system" (Rambaldi et al., 2007, p. 124). This retention of wisdom and information about the local ecology has significance for environmental preservation, education, and heritage policies (Rambaldi et al., 2007).

The wisdom and information held by indigenous peoples about their natural landscape is why it is so important to create the legend in the PGIS participants' language with respect to their culture. Rambaldi, Muchemi, Crawhall, and Monaci describe the challenges faced by marginalized peoples:

Their languages, knowledge and spiritual systems are marginalized, ignored or simply not understood by those in power. This not only includes state cartographers, but sometimes also those trying protect Africa's forests and biodiversity, who would otherwise be important allies... in defending the cultural and biological diversities of their territories. (Rambaldi et al., 2007, p. 124)

Research has demonstrated that indigenous peoples can understand two dimensional mapping, yet those maps have not shown promise in communicating the cultural framework that is linked to the natural system in a way that is easily transmitted to the dominant culture. Rambaldi et al. (2007, p.124) state, "At the heart of 'community' or participatory' mapping is the challenge to allow the dominant paradigm to subside and create an opportunity to witness the invisible, the silent, the unknown and the powerful indigenous and local paradigm." The P3DM process bridges the GIS digital divide for those that would otherwise be left behind (Rambaldi et al., 2007).

Participants of the P3DM claimed the method *enhanced* community cohesion revealing that the Ogiek are not scattered clans but a culture with a unique identity and knowledge system (Rambaldi, Muchemi, Crawhall, & Monaci, 2007). Perhaps the most telling positive achievements were revealed in the Ogiek's own words:

"I felt overwhelmed to see it [our land] brought back."

"I learned that we are lost and need to unite ourselves."

"We are happy for we have learnt things about our land we had forgotten."

"I discovered that we can do mapping which we thought we could not be able to do."

"I learnt that other people of different technologies can help unearth lost information."

"I felt proud of my clan territory being marked out and also the entire community land."

“I noticed that if there is a case, I can answer the questions of my living area because I know my landscape better.”

“I discovered that we have potentiality of managing of our rivers and plant trees.”

“I discovered that 3D Model help solving dispute/conflicts.”

“I learnt that this exercise could be of good help to the future generation in terms of learning.”

“I learned that indigenous knowledge is powerful.”

“I feel that these maps can be used by Ogiek people to enhance their land legal issues.” (Rambaldi et al., 2007, p.125-126)

In conclusion, The Ogiek participants claimed they had a more holistic comprehension of their social, cultural and biophysical environments. They also agreed to discuss amongst themselves the best way to proceed further with their model and GIS derived maps (Rambaldi et al., 2007).

Tetradic Analysis

Let us review the four questions of the tetrad to have them clear as we consider the two case studies. What does the technology enhance or amplify? What does it push aside or obsolesce? What does it retrieve that has previously been obsolesced? And, what does it reverse into when it has evolved beyond its original intent (Levinson, 2001)? The analysis has been collated into Table 1. Elements that occurred common to both of the Participatory GIS studies are shown next to each other and italicized for ease of reference.

Table 1. Tetradic analysis of the Manchester EoC and Ogiek case studies.

Tetradic Analysis	Case Studies	
	<i>Manchester EoC</i>	<i>Ogiek P3DM</i>
Enhancement	Accessibility Ease of reporting Government efficiency City management Pattern recognition Orientation Sustainable urban regeneration Documentation of location Self empowerment <i>Intergenerational communication</i> <i>Conflict resolution</i> <i>Map literacy</i> <i>Community participation</i>	Communication Solidarity Community cohesion Identity Legal Credibility Community education Knowledge transference Preservation of: Cultural heritage The Environment Oral culture <i>Intergenerational communication</i> <i>Conflict resolution</i> <i>Map literacy</i> <i>Community participation</i>
Obsolescence	Call center Lengthy complaint investigations <i>Traditional GIS</i>	2D print mapping Invisibility Dominant paradigm GIS digital divide Traditional cartography <i>Traditional GIS</i>
Retrieval	Community participation <i>Landmark navigation</i>	Visibility Indigenous paradigm Oral histories Memory Lost information Pride Hunter-gatherer world-view Empowerment <i>Landmark navigation</i>
Reversal	Panopticon Greater interactivity <i>Cell-phone/handheld GPS PGIS</i>	Legal backlash Legal validity Dilution (see discussion) Abuse or incorporation of Indigenous information <i>Cell-phone/handheld GPS PGIS</i>

Discussion and Limitations

An in depth exploration of each element listed in the analysis is beyond the scope of this paper, yet I will discuss a number of the findings and their interrelations to reveal the dialectical quality of McLuhan's tetrad.

Manchester's EoC analysis.

The accessibility of Manchester's EoC website compresses space and time similar to the telegraph (Carey, 1989), yet for many more users. Citizens gain the convenience of reporting problems from home at any time suitable to them. In the tetradic sense, this *enhances* self-empowerment by freeing up time and space. People no longer have to travel to a municipal office, call during business hours, or try to describe the location of their problem. The tools provided with the interactivity of the website such as panoramic views and search functions *enhance* the user's orientation abilities within the map allowing for subsequent *enhancement* of map literacy. The ability to perform a zip code search and then view images of the area also *retrieves* landmark navigation which had been obsolesced with traditional print mapping. The GIS analysis capabilities that allow citizens to pinpoint an exact location *enhance* the efficiency of responding agencies *obsolescing* the need for investigation of a descriptive location lacking GPS coordinates. In addition, the need for a call center may be *obsolesced* with greater diffusion of internet technologies, as reports are routed directly to the attending agency through the website instead of to the call center as a go between.

I have included community participation in *enhancement* and *retrieval*. It is easy to conceive that ease of use and accessibility *enhances* community participation. If we consider the fact that pre-modernity, most citizens of a town lived in close proximity and were intimately involved in local decision making processes, then it might also be conceivable that the compression of space and time through the Internet's accessibility also *retrieves* community participation previously obsolesced by urban sprawl.

The Manchester EoC website appears to be as beneficial to the city government as it is to the citizens. The ability to route problems directly to appropriate agencies clearly *enhances* management efficiency. Additionally, the analysis capabilities of the GIS *enhance* pattern recognition of repetitive problems allowing for appropriate solutions. This area is where the Manchester EoC PGIS has the potential to reverse into a Panopticon. It is possible that people could get overzealous in reporting problems facilitating authoritarian responses by the city government against its employees. When the technology proceeds to the level where a potential criminal report is sent directly into a police officer's squad car, the response time may become so quick that the opportunity for invasion of privacy increases dramatically. In relevant appropriate cases this would obviously be helpful, but one might imagine the possibilities for misunderstood reporting. There is a balancing element to this potential. As the website is voluntarily participatory, citizens could always stop reporting if the city appeared to be abusing the system.

Stories of the Ogiek analysis.

The P3DM project that was performed with the Ogiek involves higher stakes than the Manchester EoC case and thus tends to yield more details to analyze. The map building process revealed and thus *retrieved* the hunter-gatherer world-view as being common to more than just the Ogiek in Kenya. This commonality *enhanced* solidarity and community cohesion amongst those present. The process of creating a three-dimensional model that evolved into a familiar landscape *enhanced* communication and education through the interaction with visual elements while also communicating orally through storytelling and debate. This interaction with and through the three dimensional model also proved to *enhance* conflict resolution. Hopefully it will progress to aid conflict resolution at higher levels for the Ogiek. Such concrete products elucidating their cultural practices and land use *enhances* legal credibility within the court system.

There is circularity within the tetrad that traces the evolution of technologies. The retrieval and obsolescence elements are intertwined, with what is being retrieved having been previously obsolesced. All GIS practices and particularly Participatory 3D Modeling *obsolesce* traditional 2-dimensional print mapping. Bringing back to life the territory of the Ogiek also *retrieves* visibility and subsequently *obsolesces* invisibility of the hunter-gatherers. Similarly, the indigenous paradigm is *retrieved* as the dominant cultural paradigm is *obsolesced*. In their own words, the Ogiek spoke of *retrieving* lost information, memory, pride, and power, much of which had previously been obsolesced by the dominant cultural paradigm. The retrieval and validation of the Ogiek indigenous paradigm also *retrieves/reveals* landmark navigation as a common way of moving through territory. Finally, the fact that P3DM can be performed with locally available tools and little technology *obsolesces* the traditional GIS digital divide.

Now that we have considered enhancement, obsolescence, and retrieval, let us look at how any Participatory GIS similar to the one performed with the Ogiek might reverse. As GIS technologies become more widespread and the programming behind it more accessible, it is possible that the technological capability might become diluted or less accurate. The understanding of those capabilities is beyond the scope of this paper, yet I am considering the possibility partially based on Sui and Goodchild's argument that GIS are obsolescing proper cartographic fieldwork. They claim there is much GIS appropriate data and information available on the Internet (Sui & Goodchild, 2003). With increasing GIS applications available on the Internet and the culture of free access and sharing that pervades there, it is conceivable that the potential for dilution of quality exists. It is also possible that single layers of a GIS map will be printed and used without the benefit of the context present in the complete package.

Another way this dilution concept might evolve is through greater diffusion of cell phone and handheld GPS devices. As the diffusion increases, it is likely that more and more GIS applications will be created that can operate on smaller systems. There will come a time, however, when the processing capability of the handhelds is equivalent to that of traditional servers. The increase in handheld devices also increases the opportunities for a Panopticon as there will be more opportunity for governing agencies to track individuals. At the same time, assuming the web stays neutral, the opportunity for more reporting of agency abuses by citizens exists as a check and balance. For example, the Baka pygmies in Cameroon, Africa are currently

using handheld GPS devices to mark important trees and landmarks for accountability if they are found cut down or destroyed (Pygmies GPS system demo, n.d).

The retrieval of visibility and subsequent enhancement of legal credibility may *reverse* into legal backlash. This occurred in the Philippines in response to successfully argued PGIS cases. Hearn (2007, p.1) states, “Philippine lawmakers have changed an existing law so that only officially recognized engineers ‘could do anything related to measuring space... In short [participatory GIS] is illegal.’” It is also possible that the PGIS practices may yield, or *reverse* into, legal victories with appropriate reparations. Each case will have different probabilities in this regard depending on the depth of tensions with the dominant cultures.

Another possible *reversal* relative to the Ogiek type of PGIS would be the abuse or incorporation of indigenous information. When it was explained to the Ogiek what might occur if their uses of medicinal plants were revealed, they opted not to make that information public. It is easily conceivable what might occur if a large pharmaceutical company received such information. One could imagine the company would want to harvest and research such resources causing more invasion and destruction of indigenous land.

To close the analysis on a more entertaining note, consider this final *reversal* possibility. The ability of a P3DM to retrieve entire landscapes from other times might *reverse* into an Internet hosted orally historical virtual landscapes encyclopedia. It is possible that one day there would be a site with a GIS application where P3DMs are aggregated for public perusal. Would not it be fun to have a bird’s eye view of your hometown 100 years ago?

This study is limited by a lack of thorough understanding of GIS technology as that field is complex and beyond the scope of this paper. It is also limited in being only a textual analysis of other authors’ work. First-hand observance of Participatory GIS might yield more clarity and depth to the analysis.

CHAPTER IV

Globalization, Power, and Opportunities for Further Research

Marshall McLuhan developed the four questions comprising the tetrad as a heuristic device with which to explore the effects any particular medium or technology may have on our senses. He wished to expand beyond the traditional focus of the dominant paradigm in media research – that of content and messages (McLuhan & McLuhan, 1988). Participatory GIS is a process that can be applied in greatly varied situations, as we have seen. The tetrad therefore lends itself to exploration of the effects and uses of the artefacts of GIS and participatory practice easier than content per se. There are however, other theorists that present themselves as appropriate lenses to the analysis of PGIS practice. It may be suggested that any one of them could be considered for a closer inspection of the societal effects of PGIS. Several are well suited to discussion of the political, social and cultural occurrences surrounding the use of Participatory GIS and the content stored within the resulting product or products. A common theme we will see repeated is a dialectical or polar tension pattern played out through the control of power.

Maps and imagery can be interpreted in various ways depending on ones' background and perspective. In his *Fear of Small Numbers* book, Appadurai (2006) uses the word "geography" to define boundaries of anger. He is giving us a hint as to what he theorizes is one of the problems of increasing ethnocidal violence:

So what is it about minorities that seems to attract new forms and scales of violence in many different parts of the world? The first step to an answer is that both minorities and majorities are the products of a distinctly modern world of statistics, censuses, population maps, and other tools of state created mostly since the seventeenth century. (Appadurai, 2006, p.41)

He would seem to be saying that modern day technologies, which make mapping and characterization easier, are a large part of the problem of globalization related violence. Minorities are not defined until someone takes a census and deems them so. Spatialization of knowledge and values, and the related importance of location, connects globalization to the development of geographic and semiotic images of the world. Maps provide a visualization tool and subsequently through education, exert immense influence on people's understanding of the world (Randviir, 2004). If printed media change the way we think to a linear perspective, and the formation of print languages allows us to organize into territories based on common communication (Anderson, 1991), then what does the nation state's defining of populations through maps and census data do to the human psyche and society? Appadurai (2006) suggests that as new social and demographic categories, minorities invoke worry about human rights and citizenship issues. Having been defined as a 'minor' or less than, they often become the targets for marginalization or cleansing. This, Appadurai (2006) hypothesizes, is a displacement of anger and anxiety by states themselves due to economic instability caused by the increasing speed of globalization. PGIS projects that define marginalized groups in their own languages

with their input and ownership may mediate some of these conflicts as it arms them with their own mapping products with which to fight legal battles.

Appadurai (2006) references the culture of change in contemporary times and suggests it may create an anxiety of incompleteness. In previous research titled *Disjuncture and Difference in the Global Cultural Economy*, he develops a model of cultural flows to help describe the shifting instabilities of globalization. He uses the phrase the “globalization of primordia” to describe the spread over vast and irregular spaces as groups move yet stay linked to one another through media (Appadurai, 1996). With migrations of people, come necessary shifts in resource allocation and the need for resource management tools that can bridge cultural communication gaps. “Community exists when people who are interdependent struggle with the traditions that bind them and the interests that separate them so that they can realize a future that is an improvement on the present” (Spain, 1993, p.156-157). Participatory GIS, in communicating multiple issues present in a society, may help mediate the struggles inherent within growing and changing communities.

Appadurai (1996) divides his cultural flows model into five types of landscapes and describes how they overlap and form disjunctures. He argues that the disjunctive and unstable interplay of commerce, media, national policies, and consumer fantasies make ethnicity, for example, no longer tied to a locality but more of a global force. This movement and continued connection of people around the world is what Appadurai calls ethnoscaples. The four remaining flows in his model are technoscapes, financescapes, mediascapes, and ideoscapes (Appadurai, 1996).

Appadurai (1996) proposes these five ‘landscapes’ in an effort to provide a workable model to address the complexity of global culture. Technoscapes refer to the high-speed spread of technology innovations around the world. Financescape refers to the global currency markets and stock exchanges. The last two landscapes, mediascapes and ideoscapes both refer to global proliferation of imagery but mediascape is more cultural while ideoscapes are generally political or ideological in nature (Appadurai, 1996).

Because Appadurai’s model is focused on large scale movements, it is more applicable to GIS than PGIS. However, multiple PGIS projects could be input into a GIS along with a common large scale map containing the various PGIS and considered through Appadurai’s landscapes. A hypothetical study including multiple maps and PGIS is detailed at the end of this section. The following GIS study conducted in Kenya fits well within Appadurai’s landscapes model.

While developed countries often have mapping resources available to define population settlements for public health planning, low-income regions of the world usually do not. In Sub-Saharan Africa (SSA), the percentage of the population dwelling in urban areas is estimated to increase from 38% to 55% by the year 2030. This growth presents new challenges for public health planning in these countries. Satellite remote sensing offers an inexpensive and effective method for monitoring urbanization and mapping settlements. In *Defining approaches to settlement mapping for public health management in Kenya using medium spatial resolution satellite imagery*, the authors test two types of satellite imagery for efficacy in delineating settlements in Kenya. In keeping with the abilities of GIS, additional data layers were added for site validation including human population census data, land cover, and locations of medical facilities, villages, schools and market centers. The resulting maps were found to be effective in

delineating settlements across Kenya and will be used for improving public health planning in the future (Tatem, Noor, & Hay, 2004)

This study discusses overlaying data such as human settlements, medical facilities, and schools. These data categories could fall into Appadurai's ethnoscaples, technoscaples, and ideoscaples respectively. Appelbaum, Chase-Dunn, and Couclelis (2004) also discuss the power of GIS to analyze multiple flows of data. They include commodity chains, labor migration flows, and financial flows. Appadurai's model might place these in mediascaples, ethnoscaples, and financescaples respectively.

Let us delve deeper into the idea of control of power. A common theme throughout McLuhan's writings that comprise the tetrad is the ambivalent paradoxical nature of technology. He claims that overextension of a technology causes it to reverse or flip into a form that is very similar to its opposite (McLuhan & McLuhan, 1988). Now, consider for a moment a very simple example of power taken too far. If one squeezes a grape in the hand too hard, it will squish and ooze out juice between your fingers leaving something a bit different in your hand. What you now have is part of the grape, but some of the juice probably soaked into your skin and some escaped. Perhaps a seed slipped out with the juice and landed on fertile ground. In keeping with McLuhan's love of metaphor, consider the grape a marginalized population contained within the hand that is a country governed by a dominant culture group. If that government squeezes hard enough, it will break the container of culture surrounding a particular group (our grape). What remains may be smaller more manageable subgroups of the original population, while some of the people will be incorporated into the dominant culture (absorbed). Yet some will escape - be it literally out of the country, or within the country but outside of the dominant culture's infrastructure. If our seed (people who escaped the squeeze), found fertile ground to grow, they might decide to resist the ongoing imposition of power. The Ogiek hunter gatherers could be represented by our grape with the remaining elders being a seed in search of fertile ground. A seed contains all of the information needed to grow the complete plant. The Ogiek elders gathered to pool their knowledge and safeguard their cultural heritage. Through a Participatory 3D Modeling project, they planted a seed with their new generations. In globalization theory, these power struggles have been termed globalization from "above" and "below" by Douglas Kellner (2002).

Kellner (2002) argues against extreme right or left views of globalization. He advocates a non-binary more inclusive theory suggesting that the key to understanding globalization is to consider both the current technological revolution and the global restructuring of capitalism. The technological revolution provides an infrastructure for a global culture and economy. Kellner coins the term *technocapitalism* to represent the synthesis of capital and technology and contrasts the homogenizing effects of commercial capitalism with the heterogeneity encouraged by globalized culture (Kellner, 2002).

Considering these polar tensions, the potential cultural leveling of global capitalism and the resistance of local groups, Kellner (2002) describes what he calls globalization from above and from below. Globalization from above is the view that corporate capitalism and the capitalist state are dominating the world while globalization from below is the same as Appadurai's "politics of hope" and refers to the ways in which small groups and social movements use the technology of globalization to further democratic, humanitarian, and environmental concerns. Kellner critiques the anti-globalization doomsayers by arguing that

globalization creates conflicts between capitalism and democracy and provides new openings for struggle, resistance, and democratic transformation (Kellner, 2002). Consider the following examples that reveal how GIS may play a role in globalization from above and below.

PPGIS Globalization from below.

The University of California in Santa Barbara is conducting an ongoing applied research project investigating the potential of Public Participation GIS (PPGIS) to empower local communities, enhance global civil society, and contribute to public advocacy - especially in developing countries. This study was conducted in response to explosive growth in capital-intensive industrial shrimp farming in coastal areas of Asia, Latin America, and Africa. The aquaculture industry has begun to cause social dislocation, ecological change and environmental damage (Cissna, 1998).

Globalization of the industry, market forces, government policies, and the nature of scientific research all propel shrimp aquaculture development in a direction that is in conflict with efforts to meet human needs for food, viable social and economic systems, and healthy ecosystems" (Cissna, 1998).

The project is highly collaborative including academics, scientists, non-governmental organizations, grassroots groups, and private/public donors. Preliminary results suggest email, the Internet and the Web play a crucial role in the formation and maintenance of resistance networks. The study also reveals a significant desire by the grassroots non-governmental organizations for increased access and training in the use of spatial information technologies such as maps and GIS (Cissna, 1998). This PPGIS clearly represents a globalization from below example as the local fishermen, grassroots organizations, and other non-government organizations are mobilizing through the Internet to resist large-scale industrial shrimp farming. The Ogiek PGIS also represents a globalization from below example as the marginalized Ogiek utilized the technologies of the above to record and preserve their endangered cultural heritage.

GIS Globalization from above.

An example of applied GIS that follows Kellner's theory of globalization from above would be the use by international agencies involved in Kosovo in 1998. The OSCE-supported Kosovo Verification Mission and the UN High Commissioner for Refugees (UNHCR) worked together to monitor human rights violations. GIS was used to document patterns of forced expulsions of ethnic Albanians from their homes. The U.S. led Kosovo Repatriation Information Support (KRIS) project identified relevant data of safe cross-border repatriation to be included within the GIS-linked databases (Wood, 2005). In *Complex Emergency Response Planning and Coordination: Potential GIS Applications*, Wood (2005, p.338) reviews how "GIS was used as a multilateral information-sharing and mission-coordination tool." Although this was considered a humanitarian mission, it would still fall under globalization from above, as it is an example of the haves (U.S., UN, etc.) using technology to monitor and control a 'lesser' country.

The possibility of a super Panopticon from the proliferation of high-resolution satellite spying technologies was mentioned as a potential tetradic reversal for GIS technologies by Sui and Goodchild and PGIS by this author. The idea would definitely fall under Kellner's globalization from above as it would involve a powerful nation in control of satellite imagery and GPS information keeping track of their subjects. Panopticon is the name for an architectural structure created by Jeremy Bentham to separate and confine individuals such as convicts, madmen, or plague sufferers. Foucault's (1979) description and analysis popularized the concept. The basic idea is a structure with a tower containing windows placed within a ringed building divided into cells. The windows to both structures were constructed so the inmates could be viewed at all times but in no way could view their supervisor. Because the inmates did not know if the supervisor was present or not they behaved at all times regardless (Foucault, 1979). Foucault states,

Hence the major effect of the Panopticon: to induce in the inmate a state of conscious and permanent visibility that assures the automatic functioning of power. So to arrange things that the surveillance is permanent in its effects, even if it is discontinuous in its action; that the perfection of power should tend to render its actual exercise unnecessary; that this architectural apparatus should be a machine for creating and sustaining a power relation independent of the person who exercises it; in short, that the inmates should be caught up in a power situation of which they are themselves the bearers. (Foucault, 1979, p.201)

We have seen similar effects and behavior in the United States and the world since 9/11 and the resultant War on Terror. It is highly likely that satellite imagery is a tool used in surveillance of potential terrorist activity.

The Center for the Spatially Integrated Social Sciences (CSISS) at the University of California, Riverside, also consider GIS as potentially informative to globalization debates. In February of 2004, the CSISS held a workshop to develop ideas for research projects on the structure and dynamics of globalization using technologies such as GIS, spatial analysis methods, and sources of geographic information not usually employed by globalization researchers. The goal was to bring global scale techniques that have been used by geologists, climatologists and other earth scientists into the social-science arena. GIS's potential for testing causal social science models of historical development is only beginning to be tapped (Appelbaum, Chase-Dunn, & Couclelis, 2004).

Appelbaum, Chase-Dunn, and Couclelis (2004) argue that the comparative world-systems approach to globalization studies is one example that could benefit from spatial analysis techniques and GIS. The approach focuses on four types of social interaction networks: information, prestige goods, bulk goods, and political/military networks. Each of these networks functions on different spatial scales (Appelbaum, Chase-Dunn, and Couclelis, 2004). "The comparative world systems approach defines its units of analysis as systemic combinations of very different kinds of societies. Multicultural systems and core/periphery relations are studied as nested systems of networks that evolve the institutions necessary for populations, polities and networks to expand" (Appelbaum, Chase-Dunn, and Couclelis, 2004). The expansion and contraction of interaction networks in the past can be compared using GIS with the modern

world-system allowing for identification of structural and dynamic similarities and differences to be described across historical periods (Appelbaum, Chase-Dunn, and Couclelis, 2004).

GIS can greatly contribute to globalization research by helping to visualize, forecast, and analyze the enormous amount of spatial interactions and networks involved in global-scale phenomena. Such phenomena include, information flows, commodity chains, labor migration flows, financial flows, and human/environment interactions. In addition to the scientific value, GIS provides visualization tools through computer-animated maps that are extremely helpful for educating a wider public about globalization research (Appelbaum, Chase-Dunn, & Couclelis, 2004).

Suggestions for further research.

Consider how the PGIS case studies analyzed in this paper might be included in a globalization research project such as what the Center for Spatially Integrated Social Sciences (CSISS) has described above. The examples will be hypothetical yet they are also a recommendation for further research. Let us begin by mining historical archives for census information and maps of Kenya including perhaps, pre-colonial, British colonial, present day, and as many others as we could find that contributed differing information and loading them into a GIS database. We could then input the map created out of the Ogiek P3DM visualization of Kenya's Mau Forest Complex in 1920 and the Sub-Sahara Africa studies mentioned above. Any areas or times that were greatly underrepresented could be considered for PGIS projects such as was conducted with the Ogiek to create more indigenous spatial knowledge (ISK) maps from their oral histories. Once it was agreed that sufficient layers had been collected, spatial analysis considering numerous variables could be conducted. If we wanted to explore Appadurai's ethnoscaapes, we could ask the GIS to display migrations of any colonizing cultures in and out of Kenya, as well as the pre and post colonial effects on the indigenous communities and subsequent diasporas. We could also track the flows of ideoscaapes with reference to religion specifically in the movements of missionary settlements, indigenous shamans, and present day religious organizations.

Consider figure 3 below which is a map of Kenya from 1974 showing ethnic group locations. The map was produced by the U.S. Central Intelligence Agency and is hosted online by the University of Texas at Austin. Interestingly, although this map shows zones where various ethnic groups live within Kenya, the Ogiek are not delineated there (Kenya maps, 1974). We could certainly use such a map as a layer of ethnoscape data within a GIS and overlay the Ogiek P3DM into the appropriate area. The Ogiek's home territory of the Mau Forest is approximately 125 miles northwest of the capital city of Nairobi (Who are the Ogiek?, n.d.). It would then be easy to show that the Ogiek had been rendered invisible, or *obsolesced*, by such agency mapping and should be *retrieved* into public visibility.

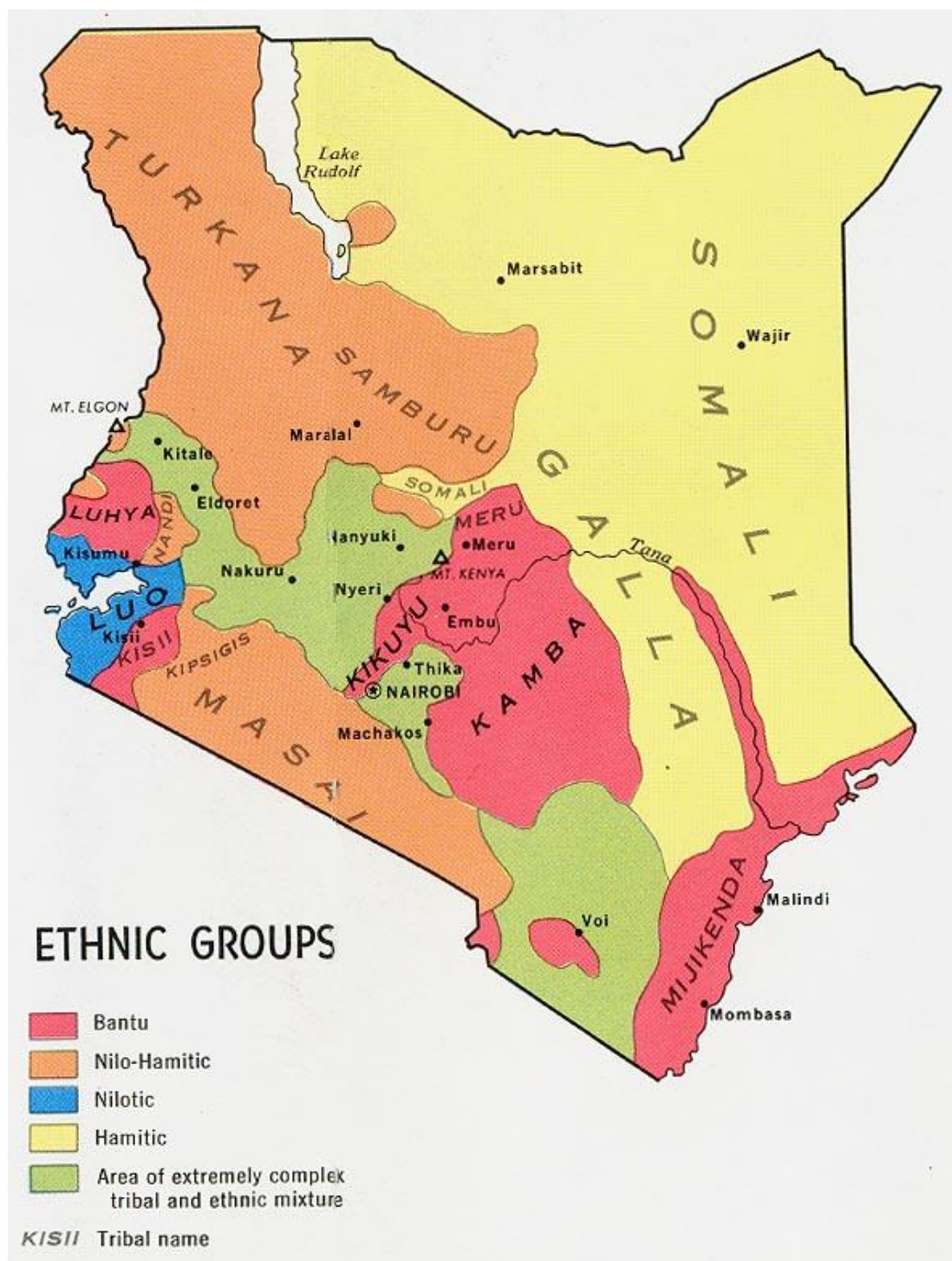


Figure 3. Ethnic map of Kenya from 1974 (Kenya Maps, 1974).

We could also perform a similar analysis using the Manchester EoC PPGIS. Maps and census data covering a set span of time in Manchester, England, or Europe – however large an area we wish to research – could be compiled and input into a GIS database. It is likely there is much more detailed information available for a country such as England versus Kenya. Continuing with Appadurai's model, we could observe the flows of financescapes on a micro-scale within Manchester from economic data representing differing neighborhood revitalization investments and city expenditures. On a macro-level, in Europe, we could track the formation of any European global markets, banking systems, and the formation of the EU and use of the euro and so forth.

The Manchester EoC PPGIS could also be analyzed through Kellner's above and below theory. Interestingly, the EoC case shows aspects of both sides. The site was built and is maintained by a government entity (above) yet it is utilized by and benefits the local residents (below). Such cases represent opportunities for the mediation of power struggles that occur in public planning, maintenance and development.

Another potential for further research that would remedy the reliance on other author's short term PGIS projects would be to conduct an ethnography of a group of people planning to engage in an ongoing PGIS. A good example would be the Fisheries Improved for Sustainable Harvest or FISH Project in Danajon Bank Philippines began in the spring of 2006. One of the goals was to create a three dimensional centerpiece display for the planned Talibon Fisheries and Coastal Resource Management Interpretive Center (FCRMIC) – an educational facility and information hub for the management of Danajon Bank. Danajon is the only double barrier reef in the Philippines and one of only three in the Indo-Pacific region. Preparations for the P3DM began in March and the workshop was held July 3-9th, 2006. A model was produced that measures 3 meters by 6 meters and covers an area of 481,000 hectares. Sea and land resources were coded including mangrove forests, sea grass beds, coral reefs etc. The model began with color-coding of resource use in the 1950s. Next, current information was added showing changes in resource and topography over the last 60 years including houses, power plants, roads etc. Occasionally disputes arose between official and local knowledge with precedence always being given to the local inhabitants. The project, which is still underway, needs a new set of informants for the Cebu side of the Bank, which includes 10 Bohol municipalities. The group plans to continue maintenance and updating of the model to ensure its value as an exhibit and educational and resource management tool (Sia, 2006).

Once completed, a GIS such as this can be used to forecast natural resource viability over time. If all of the local fishermen input their current and historical knowledge of fish species populations and diversity, the GIS may calculate whether the current level of harvest is sustainable. This information can then be used in negotiations with incoming industry (B. King,¹ personal communication, November 24, 2006). An ethnographer could observe whether such globalization from below efforts were successful. In addition, she or he could conduct an initial

¹ Bob King is a former executive of Camber Corporation, the corporation who mediated the Dayton Peace Accords. He is also a former board member of the Open Geospatial Consortium, and a former participant in Congressional hearings on commercial GIS satellite development.

tetradic analysis, such as was performed with the Manchester EoC and Ogiek case studies, and observe the technologies effects over time.

Conclusion

In 2003 Sui and Goodchild argued for the reconceptualization of GIS as communications media. This thesis provides contextualization of GIS and PGIS through various communications media theories including Marshall McLuhan's tetrad, participatory communications for social change, Kellner's globalization from above and below and Appadurai's landscapes and politics of hope. Subsequently, I reiterate the initial argument that GIS and PGIS are communication media and should be considered as such within the field of communications not only because it has been shown but also because prominent PGIS researchers are calling for more theory behind the applications. Rambaldi, Kwaku Kyem, McCall, and Weiner state, "PGIS practice is more advanced than the theory behind the applications (Rambaldi and Weiner, 2004) and that there is a need to evaluate the experiences (failures and successes), and develop guidelines and strategies for good practice" (2006, p.7).

The second argument mentioned at the beginning of this thesis suggests that PGIS should be considered a separate evolutionary stage of GIS and that this would be shown through the lens of the tetrad. Let us consider the final question or aspect of the tetrad – that of reversal - to explore why I suggest that evolution. The word reverse can be misleading in that some interpret it with a negative connotation. Like Levinson (2001) suggests, it might be easier to consider the idea of evolution. McLuhan used the term reversal because any given technology often evolves into something that is the opposite of what was originally intended. This opposite is not necessarily negative as the radio *reversing* into the television is not negative. To avoid this confusion, I will use evolution along with reversal to elucidate a final conclusion about the relationship of GIS and PGIS.

If we consider the rationale for the earliest GIS developed for the Canadian Land Inventory – that humans are fallible when computers are not – then one can see that Participatory GIS and particularly Participatory 3D Modeling is a direct *reversal* of GIS. In P3DM, the value is placed on human knowledge, and even memory through oral histories such as the Ogiek hunter-gatherers. Recall Levinson's (2001) example describing radio's *reversal* into television. The new technology - television - *retrieves* that which has been *obsolesced* by the old, or television *retrieves* the visual element that radio had *obsolesced* from print (Levinson, 2001). Sui and Goodchild (2003) make this PGIS reversal argument for us although it is not clear if they realize it. They claim two *retrievals* of GIS, that of naïve geography and the consideration of social implications in participatory projects, which both fall under the umbrella of Participatory GIS. If PGIS is considered a further evolution, or *reversal* of GIS, then these retrievals make more sense in that PGIS will have *retrieved* naïve geography and the consideration of social implications which had previously been *obsolesced* by less democratic mapping practices. I venture to assert that there is value towards understanding the evolution of GIS technologies by considering PGIS as a separate developmental stage.

This idea of PGIS representing a *reversal* or evolution of GIS also brings clarity to a tone that appears a few times throughout Sui and Goodchild's essay. There is content where they

seem to be defending GIS to critical scholars. They state, “The traditional conceptualization of GIS as neutral, value-free tools has increasingly been challenged by critical scholars” (Sui & Goodchild, 2003, p.6). Additionally, they argue that reversal of GIS leads to non-democratic practices in society (Sui & Goodchild, 2003). This *reversal* is only applicable if the current practices are inherently democratic. Again, if we consider the infancy of GIS and the costs to operate, it is clear that the technology was not inherently democratic. Allowing PGIS to represent a *reversal* or separate evolutionary stage brings in those democratic practices that could then evolve through Sui and Goodchild’s (2003) suggested reversal in the future of flipping back into non-democratic practices.

There is a second *reversal* suggestion that condenses much of what has been discussed here and satisfies the third argument. Consider the supposition that nation-state maps and printing press technology contributed to the creation of relatively homogenous cognitive views of “nations” through the use of 2-dimensional visually based media. Or further that those media *obsolesced* certain marginalized peoples by rendering them invisible as shown in the ethnic map of Kenya from 1974. Then the P3DM conducted with the Ogiek hunter-gatherers *retrieves* that visibility. Thus PGIS practices, through the use of an acoustic medium containing visual content *reverses* the effect of the homogenous nation created by print mapping back to a heterogeneous one with defined non-dominant cultures. This retrieval of marginalized peoples occurs through enhancing identity and legal credibility as shown in the Ogiek analysis.

The ability of GIS technologies to analyze and exhibit multifaceted information has been discussed throughout this paper. Contrary to the very one dimensionality of content on a print map that separates through creating invisibility and the lack of interconnectedness, PGIS creates cohesion through retrieving visibility and the interplay of multiple layers of information. The ability to see clear visual representations of the interconnectedness of people, livestock, game, flora, resources, institutions, and so forth with the land may facilitate appreciation for each of those elements. Similar to Appadurai’s landscapes, natural resources do not follow nation state boundaries. This is one reason GIS is such a powerful new mapping tool. Watersheds, coastlines, mountain ranges, and soil type boundaries, are all easily characterizable within the database as their own unique land area. Perhaps ecoregions can become new forms of identity and mediation. If environmentalism, in the sense of considering current and best for all concerned practices, can be seen as a tool or language to negotiate business be it local or global, then more positive aspects of detailed mapping may emerge.

In the past, many marginalized groups have jumped on the capital train due to lack of education and economic pressure. Cattle farmers in the Central and South American rainforest areas often clear cut to provide grazing land because they see the short-term profit presented in the livestock industry. This has been one of the greatest contributors to the loss of rainforest acreage. People concerned with the environmental impacts of rainforest loss have made efforts to educate local peoples on sustainably harvested rainforest resources that can also be profitable. Like the central role of the Manchester EoC PPGIS mentioned in the previous section, this educating and offering of alternatives is another area I see the potential for PGIS processes to be good mediation tools between the above and below. In *Community Resource Mapping in Sustainable Natural Resource Management: A Case Study of SW Uganda*, results showed that enthusiasm generated in the community resource mapping exercise greatly increased the number

of farmers interested in sustaining agroforestry intervention strategies. In addition to supporting decision making and planning, the community mapping product has been used to secure funding for developmental activities (Nabwire & Nyabenge 2006).

The fourth argument of GIS and PGIS being uniquely applicable technologies to certain theories of globalization was verified in the globalization, power, and opportunities for further research section detailing Appadurai, Kellner, and the Center for Spatially Integrated Social Sciences (CSISS) study. As globalization reaches more remote areas, we will continue to encounter tensions between peoples that previously were not in communication. It is possible for globalization to raise the standard of living for poor countries if handled properly and/or allowed. Modern day medical and transportation technologies have allowed the global spread of disease-controlling mechanisms. PGIS processes give the marginal communities and perhaps even governments, ammunition with which to fight invasive development. In the case of the indigenous Indians in Honduras and Panama and the Ogiek in Africa, their oral histories were documented for the first time. With a well-documented story to tell of natural resource history, needs, and sensitivities, groups will be better armed to resist and or negotiate with potentially harmful invasive governments and industry. These ‘stories’ within a PGIS database might also be easily transformed into news items allowing even greater dissemination of information. I believe it is not unreasonable to suppose that many of the human rights violations occurring through industrial globalization begin because of lack of information and education of the local people. Where Internet infrastructure exists, these PGIS products could be made widely available on the web for local peoples to access and if need be, to protest, negotiate, and choose not to enter the workforce and so forth. Perhaps cell phone GPS technology could be used to input data of events into a GIS real-time over the World Wide Web. Blogging of user experiences could also be included on a Web hosted GIS. All of these activities could easily be considered globalization from below or grassroots globalization further indicating the applicability of Participatory GIS to certain globalization debates.

The inclusion of GIS and PGIS in media communications research may facilitate new perspectives and input into mediated communication processes. Continued PGIS research and documentation will lead to precedent setting in more and more locations. With local and indigenous peoples coming to the negotiating table alongside international corporations and governmental agencies, the potential exists for true compromise between all affected parties. If not compromise, at least discussion and documentation of information previously swept under the rug may be realized. As this paper has shown, globalization is a process in which mapping as media has a strong responsibility. PGIS and GIS are used to communicate diverse information to and from varied groups of people and subsequently should be considered communication media. All peoples’ voices are valid and deserve to be heard. Participatory GIS practices allow those voices to sing and render visible those peoples that have been waiting to be recognized. When suppressed voices sing, Appadurai’s (2006) “politics of hope” grows. The human spirit has historically shown remarkable resilience when faced with oppressive technologies and authority. Eventually the have-nots show themselves to be very resourceful in using technology advances against the “above.” Perhaps the politics of hope are an indication that media, which are extensions of humanity, do change the world.

Glossary

geospatial “pertaining to the geographic location and characteristics of natural or constructed features and boundaries on, above, or below the earth's surface; esp. referring to data that is geographic and spatial in nature” (geospatial, n.d.).

Geographic Information Systems (GIS) “A computer application used to store, view, and analyze geographical information, especially maps” (GIS, n.d.).

Geographic Information Systems and Technologies (GIT&S) “These technologies include geographic information systems (GIS), low-cost global positioning system (GPS) equipment and satellite imagery” (Rambaldi, 2005).

Global Positioning Systems (GPS) “A system of satellites, computers, and receivers that is able to determine the latitude and longitude of a receiver on Earth by calculating the time difference for signals from different satellites to reach the receiver” (GPS, n.d.).

Participatory 3-Dimensional Modeling (P3DM) P3DM is a practice often being utilized within PGIS to bring local stakeholders together in the planning process for developing areas. P3DM merges spatial GIS information with peoples’ cognitive maps to build a three dimensional multi-coded topographical map. The process begins with a topographical map and participants cutting out layers of cardboard to correspond with each of the lines representing a change in elevation. The cardboard layers are assembled and personal land use is applied through paints, push pins and yarn (Participatory 3Dimensional Modeling, n.d.).

Participatory Geographical Information Systems (PGIS) “PGIS is the result of a spontaneous merger of Participatory Learning and Action (PLA) methods with GIT&S and builds on using combinations of geo-spatial information management tools to compose peoples’ spatial knowledge in the forms of virtual or physical maps used as interactive vehicles for spatial learning, discussion, information exchange, analysis and decision making (<http://pgis2005.cta.int/background.htm>). In terms of this definition, PGIS can be broken down into two components: (1) participation (obtaining local/indigenous knowledge); and (2) a conventional Geographic Information System (GIS)” (Mans, 2006, p. 2).

Tetrad A short title for McLuhan’s laws of the media comprised of the following four questions applicable to any human artefact: What does it enhance, obsolesce, retrieve, and reverse into? (McLuhan & McLuhan, 1988).

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