Chapter I

GIS as a Communication Process: Experience from the Milwaukee COMPASS Project

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Abstract

We examine the role of GIS in communication and decision-making processes by re-interpreting the experiences of the Milwaukee COMPASS Project (Community Mapping, Planning and Analysis for Safety Strategies) in the light of Enhanced Adoptive Structuration Theory. Using numerous practice-derived examples, we conclude that GIS not only facilitates and strengthens communication, but can be used to defuse political constraints to collaborative decision making.

Introduction

This chapter focuses on the communication process of the Milwaukee COMPASS, a federally funded demonstration project to use GIS to improve data sharing, public access to data, and reliance on data in public decision making. The overall goal of this chapter is an investigation of how well geographic information technologies support communication between city government, citizenry, technical staff, neighborhood organizations, and academic researchers. Probably the single most important aspect of Milwaukee's success story has been the common belief, *a priori*, among the participants, that communication, openness and collaboration are valuable to the policy-making and implementation processes. Without this tenet, they would probably not have been in the position to overcome many of the difficulties inherent to any multi-agency project. The political, technical and financial barriers to implementation are high, and will not be overcome unless the value is readily seen by a majority of participants. The experiences of the Milwaukee COMPASS project illustrate the power of GIS as a tool for improved communication across sectors in a community, and for opening new lines of communication among actors who simply need a common language to begin meaningful dialogs. It is, indeed, the power of GIS as a communication tool that facilitates the shared value among participants and makes community-wide, collaborative problem-solving efforts possible.

This research focuses on the communication process of innovation, diffusion, and adoption of spatial technologies to combat crime and foster healthy neighborhoods. The experiences of the Milwaukee COMPASS project are illustrative of these concepts because GIS played a central role in the project's mission, "to make public safety decision making more collaborative, strategic and data-driven" (City of Milwaukee, 2003).

GIS and Communication Processes

At least four forms of GIS communication processes have been described in the relevant literature:

(a) GIS as a mapping tool, mirroring the cartographic communication process (Foote & Crum, 1995);

(b) GIS as part of a decision support system and facilitating the communication between its various components – usually in a PPGIS (Merrick, 2003) or GIS-in-developing-countries context (Jenssen, 2002);

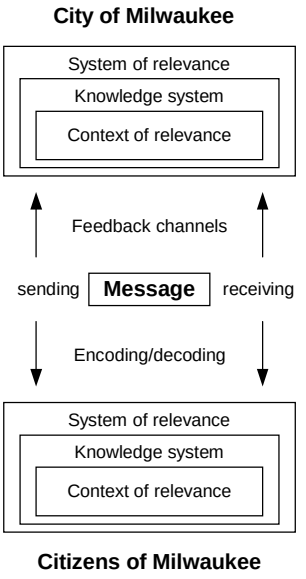
(c) Emerging as a tool for holding managers accountable for measurable results, beginning in law enforcement (Bratton & Knobler, 1998; Weisburd & Lum, 2001; Stoe, Watkins, Kerr, Rost & Craig, 2003) and spreading to other disciplines (Swope, 2001); and

(d) The low-level technical aspects of (b) and (c), that is, the communication between software objects in a Microsoft COM or Unix-based CORBA environment (Peng & Zhou, 2003).

Table 1. Milwaukee COMPASS Partnerships

Data Collection	
Police Department Assessor's Office Department of Neighborhood Services Fire Department Health Department Municipal Court Public Library Citywide Housing Coalition Milwaukee Public Schools Milwaukee County Children's Court Milwaukee County Sheriff's Office District Attorney's Office	Judicial Oversight Demonstration Project Safe & Sound, Inc. Community Partners Department of City Development Department of Corrections UWM - EPIC Northwest Side Community Development Corp. Project UJIMA – Children's Hospital YMCA of Metro Milwaukee Boys & Girls Clubs of Greater Milwaukee Police Athletic League (forthcoming)
Data Entry and Management for Community Groups	
Citywide Housing Coalition • LAND • Sherman Park • Westside Neighbors • ACTS • Harambee • Neighborhood Housing Services • Metcalfe Park • St. Martin DePorres	Community Prosecutors • District Attorney • Milwaukee Alliance • Harambee Ombudsman • Drug Abatement Hotline (pending)
Policy/Research Projects	
Urban League of Milwaukee Milwaukee County Sheriff's Department Weed & Seed / Community Partners City Attorney Department of Neighborhood Services Milwaukee Public Schools – School Safety (NIJ project) Department of City Development – Planning Division Judicial Enforcement Demonstration Initiative Task Force on Family Violence Safe & Sound, Inc. The Mayor's Commission on Crime Boys & Girls Clubs YMCA of Greater Milwaukee County Department on Aging U.S. Attorney, district office Firearm Injury Center	Community Advocates Brighter Futures Initiative Northwest Side Community Development Corp. Sherman Park Residents Association Community Care Organization Third District Community Justice Center Department of Corrections Mercy Memorial Baptist Church Merrill Park Neighborhood Association Metcalfe Park Residents Association Midtown Neighborhood Association Community Block Grant Administration Martin Drive Association Project UJIMA City Clerk – Nuisance Service Calls program

Figure 1. Socioinstitutional view of the GIS communication process

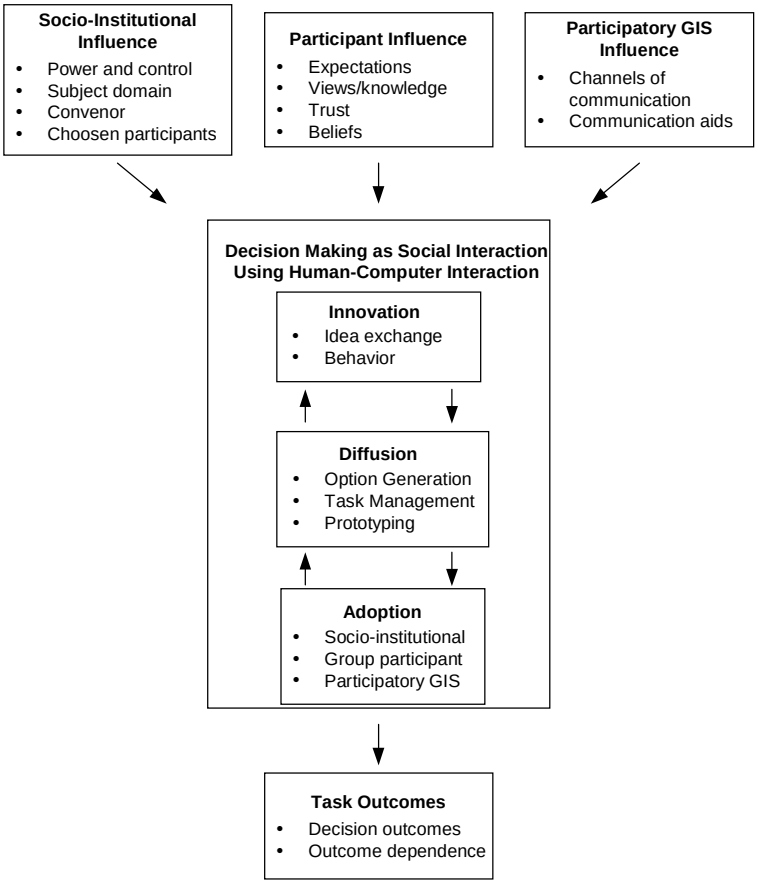


Of course, we cannot tackle information sharing without thinking about how this information is communicated.

Communicating Values through Information

One of the main issues with establishing a geographic information framework that partners as diverse as the COMPASS participants (see Table 1) are confronted with is the difference in agendas and value systems that these partners bring to the table. Agendas are usually well spelled out – they have been part of the original funding application to the National Institute of Justice (City of Milwaukee, 2001). Values, on the other hand, are usually not part of the communication among technical folks. The broad social values inherent in geospatial databases may be inescapable (Pickles, 1995) and, to the extent that they are taken for granted, not easily documented. However, the values embedded in databases as a function of institutional characteristics can be articulated and documented in metadata and subsequently communicated to the GIS user. This communication process is important since it affects the user's understanding of the limitations of the GIS and facilitates its appropriate use. The primary mechanisms that have evolved to serve this communication process are

Figure 2. Milwaukee COMPASS project interpreted in the light of Nyerges and Jankowski's (1997) Enhanced Adaptive Structuration Theory 2 (EAST2) as a conceptual map for understanding the communication processes that lead to a successful partnership



based on the Federal Geographic Data Committe's (FGDC) descriptors of geospatial data quality.

In general, we must take into account two factors integral to the role of information and technology in communication. First, different tools are used for communicating information. Second, a condition is essential for assuring good communication: mutual understandability among the partners. We have to assure that all partners engage in this mutual understandability. In linguistic or information science terms, the message emitted by the transmitter must be understood by the receiver (Figure 1) – that is, the relation between the signifier and the

signified must be the same for all partners. For communication to work, not only the ability of using a code, but also the will (or the obligation) is necessary. The roots of cooperation are found in the very structures of language (Habermas, 1990). If the project partners do not have an implicit commitment, then disagreement and misunderstandings arise. Hence, for good communication, it is not only important to speak the same language (English, German, Chinese), but also to know the values of the different actors.

Next, we need to explore in general the application of GIS as a tool to enhance the discovery and learning process and for the communication of findings. Nyerges and Jankowski's (1997) Enhanced Adaptive Structuration Theory (EAST) is particularly instructive, as well as applicable to the experiences in Milwaukee COMPASS. Derived from Gidden's 1984 Theory of Structuration, it lists 21 aspects of (GIS-based) collaboration in three categories identified as "convening," "social interaction" and "outcome." Our adaptation identifies basically the same phases but puts the emphasis on innovation, diffusion and adoption of communication technologies in general and GIS in particular (Figure 2).

This matches nicely with the works of Ramasubramanian (1995, 1999), whose identification of criteria for the successful adoption and use of spatial technologies in nonprofit organizations prove to be applicable to the communication between (local) government agencies and nonprofits as well.

We argue that in order to foster local ownership of GIS, one must understand the existing networks of communication and cooperation and utilize these to make GIS more relevant to citizens. Good communication is a critical first step to facilitating local ownership of GIS – both real and perceived – which in turn enhances its potential for long-term success at all levels of crime prevention.

Before we can apply these concepts and models to the Milwaukee COMPASS experiences, some history and background are necessary.

History of COMPASS

The US Department of Justice, Office of Justice Programs, National Institute of Justice (NIJ) initiated the COMPASS program with a pilot grant award to the Seattle Police Department in 1999 (Pendleton, 2000). In November 2001, after a competitive application process, NIJ awarded Milwaukee, WI, with the second two-year COMPASS grant. A third grant was awarded to the City of Redlands, CA, in spring of 2002.

A brief recounting of the history of the NIJ's efforts to develop and test collaborative, data-driven problem-solving strategies is necessary to fully appreciate the experiences of the Milwaukee COMPASS Project.

The Boston Gun Project

In the late 1990s, the Boston Police Department, the U.S. Attorney for the Eastern District of Massachusetts and others in the community created a partnership with researchers at Harvard University's Kennedy School of Government to address the rampant problem of juvenile gun violence. The researchers performed an intensive analysis of offense and arrest reports, as well as closely guarded intelligence information on gangs, gang members and other actors. Working closely with police officers and other front-line practitioners, they developed a more thorough, shared understanding of gun violence in Boston. The results of this work led the criminal justice community to develop some very targeted, and ultimately very successful, interventions (Kennedy, Braga & Piehl, 2002). Kennedy et al. also argue that the interactive problem-solving *process* was more instructive and more important to replication than the strategies that emerged: "Perhaps the most fundamental lesson here is that the basic approach the project followed – serious, sustained attention to an important problem, with ambitious goals – is worthwhile… One suspects that many difficult problems might appear less so if similarly addressed," (p. 44). In other words, it was a reliance on the data that made for effective, productive communication, which in turn led to progress against a seemingly intractable problem.

SACSI

In March 1998, the NIJ, which serves as the research and development arm of the U.S. Department of Justice, launched the Strategic Approaches to Community Safety Initiative (SACSI) to test a specific framework for combating local crime problems (Solomon, 1997). The stated goals were explicitly developed to replicate the elements of the Boston Gun Project in other communities: a) formation of an interagency working group; b) enhancement of a research and technology infrastructure; and c) use of a defined set of problem-solving process steps. Five cities were chosen to participate in the 2-year pilot project, with another five sites selected in 1999. The United States district attorneys' offices served as the coordinating agency for each local initiative, and convened a collaborative group of law enforcement practitioners and criminology researchers in their local communities. Each site selected a general category of public-

safety problem on which to focus (for example, gun violence, juvenile violence, sexual assault). Local academics, in an action research role, facilitated a structured, data-driven, problem-solving approach to understanding the selected problem, developing and implementing broad-based, strategic solutions to address the problems defined.

Results varied across the sites (Groff, 2000). But again, it was the *process* that endured: the key innovation of the SACSI process was a problem-solving process that became known as *incident review*. Based on the Boston process, incident review brings many practitioners – and their data – together to understand and solve problems. In terms of Figure 2, the incident review is a prototypical innovation that at the same time allowed the exchange of ideas, focused communication, eased task management, and finally facilitated the adoption solutions by all partners.

And Finally, COMPASS

In partnership with Chief Norm Stamper of the Seattle Police Department, NIJ staff created the COMPASS grant program in 1999. With GIS as a central component, COMPASS was sort of a fusion between the problem-solving approach of SACSI and the successful reliance on GIS by the New York Police Department as a tool for both strategic planning and holding managers accountable for results (Bratton & Knobler, 1998; Dussault, 1999; Silverman, 1999).

NIJ's description of COMPASS reveals a widening of the scope of the problem-solving process vis á vis SACSI and the Boston Gun Project:

"In recent years, a shift has occurred in local juvenile and criminal justice policy development toward a more collaborative approach that relies on analyzing public safety problems to develop strategic interventions to address them. This approach needs to be supported by timely, accurate, multi-disciplinary and automated data with a geographic reference. Jurisdictions that have developed such data systems, analytic capacity, and collaborative partnerships have experienced great success in reducing crime and addressing public safety problems," (NIJ, 2000).

The two key differences between COMPASS and the problem-solving efforts that preceded it are an explicit reliance on GIS and an opening of the process to actors outside the criminal justice community. In other words, COMPASS was an attempt to replicate the problem-solving process across many different policy areas and policy issues, within a single local site. And GIS is *the* communication tool that is critical to focusing such a broad, ambitious level of community dialog into productive, problem-solving processes.

It is a poignant illustration of this chapter's key tenets that GIS proves to be the critical element in considering a project as broad and ambitious as COMPASS. The utility of GIS as a problem-solving tool that encourages both collaboration and strategic thinking is one of the most important aspects of the "experiment" that is COMPASS.

Milwaukee, in its application for funding as a COMPASS pilot site, posited that grant resources could be used to apply the community's existing GIS capacity to improving decision making in a number of arenas – basically by providing a platform and a process for more effective communication and collaboration across sectors, and organizational "silos." Milwaukee had the distinct advantage of a strong GIS infrastructure already in place. The city of Milwaukee first implemented GIS in 1976, and has continued to innovate its geographic systems. The University of Wisconsin-Milwaukee's School of Architecture, Regional and Urban Planning, the research partner in the project, offers one of the oldest GIS certificate programs in the nation. Implementation was a matter of using this infrastructure and technological capacity to reach out to policy-makers and problem-solvers.

Figure 3. COMPASS utilizes GIS as a communication tool over the Internet, and in focused group settings

Implementation

Milwaukee COMPASS Mission and Goals

The Milwaukee COMPASS project team adopted a process-oriented mission: "To make public safety and other decision making in Milwaukee more strategic, collaborative and data-driven." The team adopted four goals in support of that mission:

1. Create a shared data infrastructure.
2. Use the Internet to make data available to the community.
3. Demonstrate the problem-solving potential of GIS.
4. Support ongoing collaborations and evaluations of public-safety programs in the community.

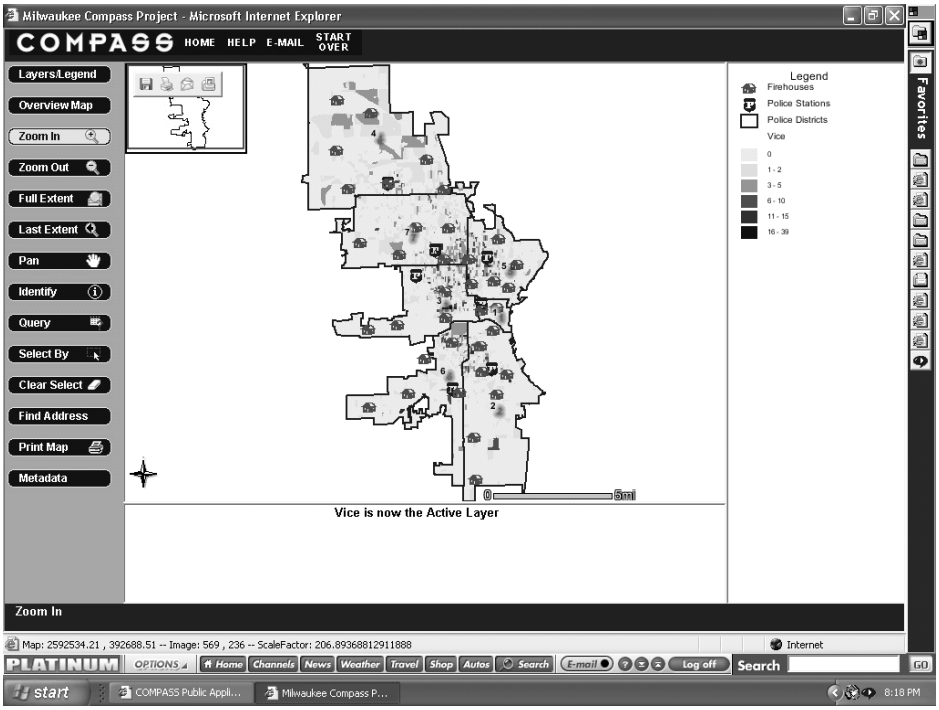
A complete report on implementation of the project is beyond the scope here. It is, however, instructive to describe the COMPASS project in terms of the process of innovation, diffusion and adoption of new technologies. In the sections that follow, we use examples from the COMPASS experiences to illustrate the theoretical concepts discussed above.

Innovations

While the project did not result in the creation of any substantially new technologies, it was essentially an attempt to apply such technologies as GIS, HTML and Java to problems directly relevant to neighborhood public safety in Milwaukee.

- *The Web site: Pushing maps to the public.* COMPASS aggressively exploited the Internet as a means to open new lines of communication with residents, and to improve existing communication between community-based organizations and public agencies. In fact, the first product that the project produced was an Internet Map Server-based (IMS) Web site, pushing crime data and other information to residents (see Figure 3).
- *Java-enabled Web applications: Pulling data from the community.* Eventually, COMPASS staff adopted Java-based tools to enable commu-

Figure 4. Community mapping option of the COMPASS project allows citizens to interactively zoom into a neighborhood of interest

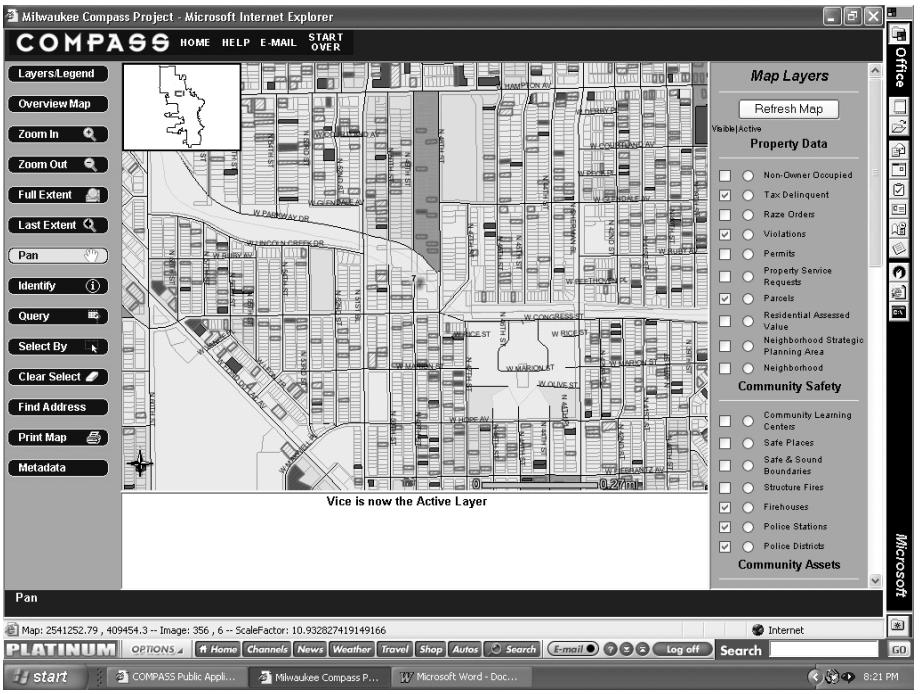


nity groups to both download raw data sets and to enter data directly onto the city's Web site, *www.milwaukee.gov/compass*.

"Community Mapping" is a GIS application using ESRI's ArcIMS technology to give residents the ability to create maps of specific neighborhoods, incorporating data of their choosing. Users include individual residents, community organizers, community-based organizations and even public officials who want a quick, intuitive view of their own data. Figures 4 and 5 illustrate the ability to interactively define different map layers to view, and to zoom-in on specific neighborhoods to reveal more detailed geographic information.

This was in response to the Citywide Housing Coalition, a group of neighborhood organizations that has been working with the city's Department of Neighborhood Services (building code compliance) for several years on prioritizing and addressing dilapidated housing. The Java application streamlines the neighborhood groups' data entry, automatically geocodes the data they collect about problem housing, and tightens the communication between the groups and the

Figure 5: Milwaukee is one of only a handful of cities in the U.S. where ordinary citizens have access to parcel-level crime and property data

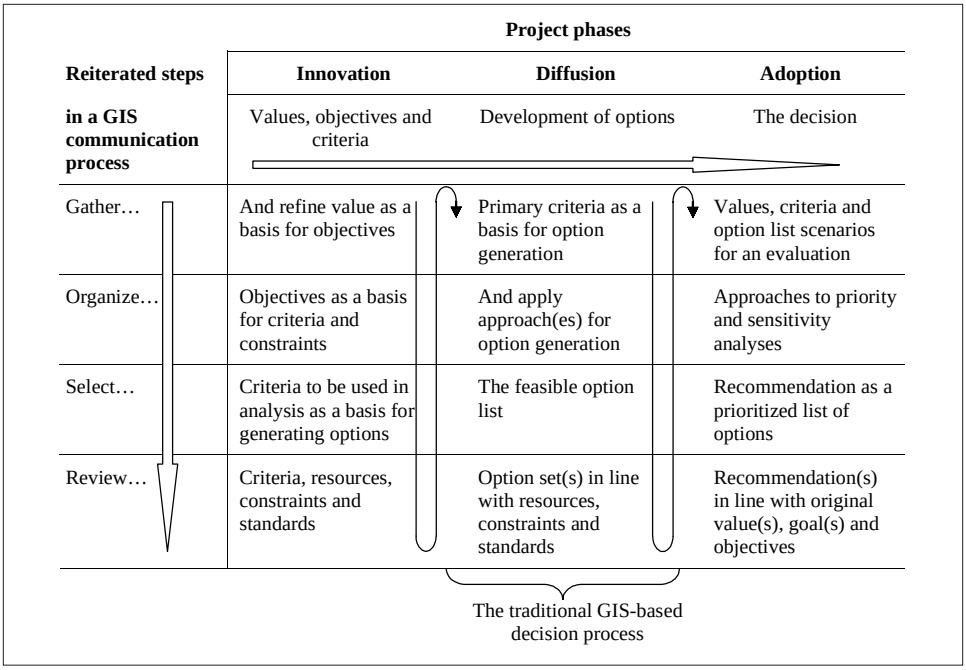


city. This helps to both reduce the time frame and increasing the accuracy of communication between diverse groups. In terms of the Figures 2 and 6, this is a prime example of an innovative use of technology to improve the timeliness and accuracy of the group processes of idea exchange, task management and behavior.

Informal feedback from Internet users told COMPASS staff that people did not necessarily value the mapping capability to discover new things about their neighborhoods. Residents and organizers familiar with a neighborhood and its problems found few surprises in the data that agencies would allow to be published on the public site.

What users did with the maps, however, was to some extent surprising. Many of them used the maps to communicate a problem to their elected officials and other stakeholders not as intimately familiar with a neighborhood's problems. Not only did grant writers use the sight to illustrate need in a particular area, but neighborhood organizations also frequently reported using maps generated on the COMPASS Web site to alert police, building inspectors, and others to

Figure 6: Repeat cycle of communicative steps in a GIS-based spatial decision support process (important is the wider context, revisiting the original values, and anticipating the political feasibility of policy recommendations)

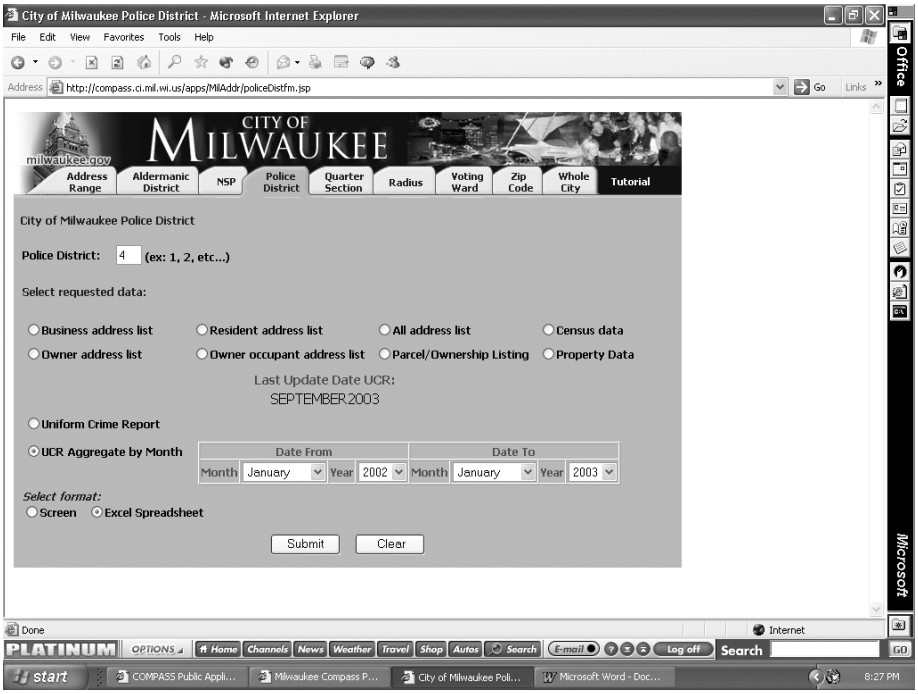


patterns that seemed to be emerging. The commissioner of Milwaukee's Department of Neighborhood Services even used COMPASS maps to show aldermen the activities in which his department was engaged in their districts.

"Query & Download" utilizes Java programming to enable users to download raw data sets for their own analysis. Users may select a specific geography, then download selected data sets to an Excel Spreadsheet file. This application demonstrates that geographic analysis is about more than simply map production, since GIS is the technology that enables the user to select a meaningful – and manageable – subset of very large, citywide data sets, and put the data directly to use by downloading to his or her desktop (Figure 7).

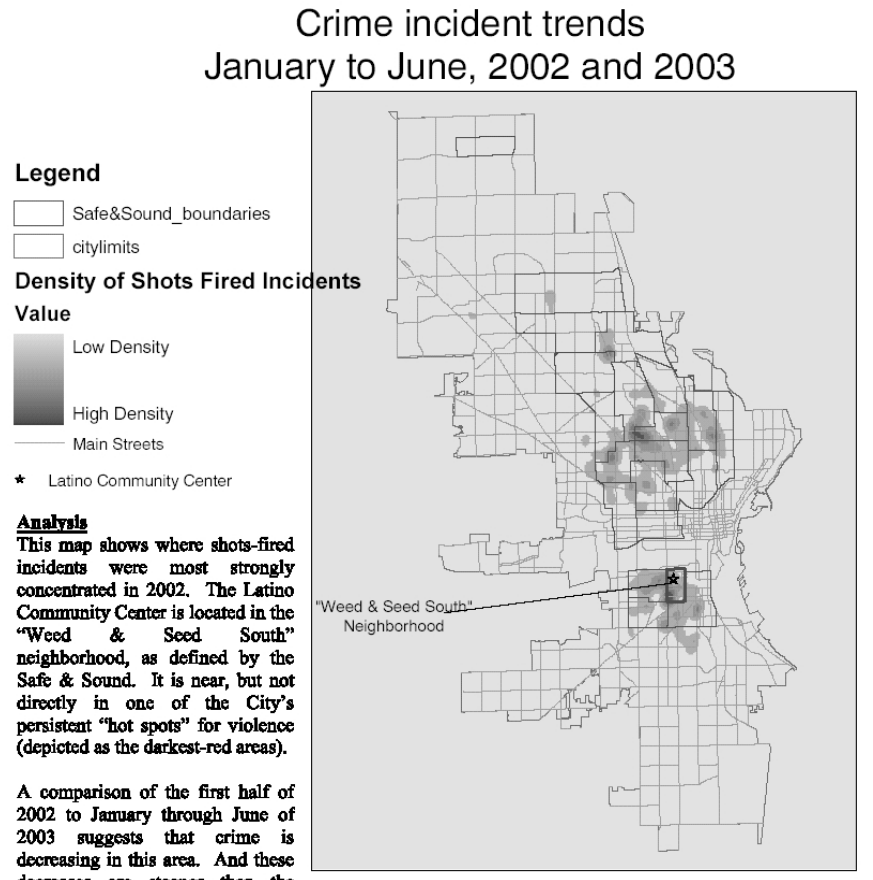
"CompStat for the Community." In addition to the Internet, COMPASS staff found it necessary to "take the show on the road," and present its results to its constituent groups (Table 1). COMPASS used specific requests for data or maps as opportunities to demonstrate to Milwaukee's community leaders the power of GIS and of sharing data across organizational boundaries. Perhaps most

Figure 7. Query and download option allows citizens to access the raw data for further analysis in a software package of their choice



importantly, GIS – when it is used to integrate diverse sources of data – is a powerful tool for convening diverse constituent groups. Figure 8 is an example of a map that was developed to support a community organizing/public-safety initiative on Milwaukee's north side. The COMPASS director used a laptop and LCD projector to depict maps of the neighborhood in a meeting that involved residents, faith-based leaders, the local aldermen and the two police captains whose patrol districts included the targeted neighborhood. These people collaboratively interacted with the GIS in real time, reacting to different map layers, and requesting that specific data sources be displayed and the map view be zoomed to a particular section of the neighborhood. The participants' ability to change the map view on the fly, as the discussion around neighborhood safety ebbed and flowed, helped to focus the discussion and led to plans for a collaborative, law enforcement/community response to gang activity and dilapidated housing in a few specific blocks. Again, this is not an innovation in the sense of a new technology, but an application of the technology in a way that was new to the participants and opened up new lines of communication.

Figure 8. Example demonstrating the analytical capabilities that COMPASS provides the citizens of Milwaukee (and beyond)



Analysis

This map shows where shots-fired incidents were most strongly concentrated in 2002. The Latino Community Center is located in the "Weed & Seed South" neighborhood, as defined by the Safe & Sound. It is near, but not directly in one of the City's persistent "hot spots" for violence (depicted as the darkest-red areas).

A comparison of the first half of 2002 to January through June of 2003 suggests that crime is decreasing in this area. And these decreases are steeper than the declines in these crime categories for the entire City, as shown in the table at right

Data Sources: Safe & Sound, Inc. Milwaukee Police Department

Map prepared by: Milwaukee COMPASS Project

	Weed & Seed South Neighborhoo			Citywide		
	Jan-June 2002	Jan-June 2003	Percent Change	Jan-June 2002	Jan-June 2003	Percent Change
Violent Incidents						
Homicide	0	0	-	51	45	-11.8%
Sexual Assault	13	6	-53.8%	471	378	-19.7%
Robbery	29	20	-31.0%	1329	1183	-11.0%
Aggravated Assault	13	8	-38.5%	724	668	-7.7%
"Quality of Life" Incidents						
Burglary	39	23	-41.0%	3092	2567	-17.0%
Retail Theft	0	1	-	542	420	-22.5%
Simple Battery	45	36	-20.0%	2952	2443	-17.2%
Disorderly Conduct	24	17	-29.2%	1458	1217	-16.5%

Diffusion

In essence, the first and foremost outcome of a successful communication process is the process itself. An answer to the question being sought is only secondary to that. Diffusion, as a component of communication, is the set of processes employed to ensure that innovations in communication, such as those described above, are applied in practice.

GIS facilitates more complex communication than the two-way dialog modeled in Figure 1. There are often multiple receivers with multiple agendas and environmental constraints. And the communication process is *iterative*. The sender (GIS staff and researchers) often must refine the message (maps, analysis, other portrayals of the data) several times in order to achieve consonance with the receiver (one or more public officials, community leaders or other stakeholders). Thus feedback from the receiver to the sender is a critical part of how the model worked in the case of Milwaukee COMPASS.

- *Prototyping the Web site.* The diffusion strategy was the technical innovation itself. COMPASS staff very quickly assembled a prototype Web-based, community-mapping interface. This was important to the ability to diffuse the general idea throughout the community – a picture is worth a thousand words, basically. This was viewed as a much more efficient, effective implementation path than developing a comprehensive needs assessment. Community participants have proven to be very effective at fine-tuning the Web tools, as well as specific analytical tools and processes that were developed for specific problem-solving settings. It is doubtful that a structured, thorough (and time-consuming) needs-evaluation process would have yielded this level of buy-in.
- *Requests for specialized maps: Helping agencies attract funds and tell their story.* As the idea became embedded in institutions in the community, the demand rose for COMPASS' GIS staff to provide maps and analysis of an agency's data for that agency's own review and dissemination. Although almost antithetical to the goal of *collaborative* decision making, COMPASS did add considerable value to the policy space, by helping agencies tell the story that is inherent in their own data. An unexpected example was the city of Milwaukee Department of Neighborhood Services. The department provided COMPASS with data on citizen complaints about rats and other "vector" nuisances. COMPASS provided a simple map, plotting all rat complaints citywide. The department then used this map to prioritize neighborhoods for trash and alley clean-up projects. They also displayed the map at a press conference, where they publicly announced

their spring cleanup strategies. Thus, GIS also enables a form of political communication: government officials using GIS to "spin" a potentially negative story like rat-infested alleys in their favor. This experience underlines Ramasubramanian's assertion (1999) that one of the main uses of GIS is its capability to assist organizations in reframing their position.

- *Communication loops.* Another example helps illustrate the iterative nature of the communication process. The county sheriff wanted to embark on an initiative to reduce firearm violence. With no new resources to add to the initiative, the department had to make the most strategic, targeted use of existing resources. They approached the COMPASS project for help. The first step was to plot shootings in the city of Milwaukee for 2002. Since the dots covered large portions of the city, the next step was to develop a smoothed-surface map in an attempt to statistically highlight concentrations of gun violence. The resulting kernel-density map suggested to department officials that gun violence was most heavily concentrated in a few neighborhoods across the city. As the sheriff's department implemented the initiative and gained experience on the street, they inquired about the temporal patterns of gun violence. This led to COMPASS staff analyzing time by day of week and hour of the day. Further refinements, including mapping specific types of drug arrests and adding tax-delinquent properties, helped to both refine the department's implementation on the street, and further improve the communication process between researcher and practitioner.
- *GIS in support of collaboration*. As noted above, Milwaukee had many collaborative initiatives already in place prior to implementation of COMPASS – working to achieve diverse neighborhood-oriented goals from funding after-school safe places to mobilizing against absentee landlords. The COMPASS team made a concerted effort from the beginning to reach these collaborative groups.

The existence of a partnership across sectors or around a specific policy issue or objective, already made the case for a shared data system: if partners were working together, their data should be integrated as well. GIS allowed for a low-cost means of integration, and protection of confidentiality (Mamalian, LaVigne & Groff, 2001; McEwen & Wartell, 2001).

While it is difficult to get busy public executives to take the time, and to suspend their judgment long enough to step through a structured decision-making process, GIS can be used as an especially effective communication tool to overcome communication barriers. Because it is a graphical representation of a particular phenomenon, a map (or, in the case of interactive GIS

presentations, a series of maps) can serve as a shared starting point, a way of grounding the multiple perspectives of diverse stakeholders in a common picture of reality. COMPASS is currently working with a group consisting of several faith leaders, a gang outreach worker from a local youth center, three police captains, a staff member from the U.S. Attorney's Office, and a sheriff's captain to target a very small, problem-ridden neighborhood for a collaborative, coordinated "intervention." The group started this process by viewing maps of a larger area, selecting which problems (specific types of crime, housing violations) and assets they wanted to view, and using the GIS software to "zoom" into several specific neighborhoods, before settling on one that presented both serious crime problems and several opportunities for rebuilding the neighborhood. All of this was accomplished in a 2-hour meeting in the back room of a community-based organization a few blocks from the problem area. The ability to interactively produce different map views "on the fly," reflecting and channeling the discussion as it flowed, was a very powerful demonstration of GIS making high-level communication highly productive and effective among very diverse participants.

Adoption

The ultimate test of the value of the innovations, and the effectiveness of the diffusion strategies, is how deeply and widely the system becomes embedded in the community. As a means of tying together many different ideas, we attempt in this final section to identify and summarize a set of critical success factors that enable a GIS to improve community communication.

- *Willing and ready receivers.* Public agencies face a trade-off in committing to a collaborative, data-sharing process. The potential for improved results, and the goodwill of participation, must be placed in the balance against the political and public relations of risk "opening" the agency up to criticism and opening its protected data to interpretation. For some agencies, who may be mired in a traditional isolationist mode or politically embattled, the calculation will tilt in the favor of remaining closed to the process. The key piece of advice, and the lesson learned in the COMPASS project, is to take every opportunity to work with those who are willing to participate. Not only will the process be mutually beneficial, but the communication of successful results will also put political pressure on the non-participants to join the bandwagon.
- *Technical capacity of the sender.* It goes without saying that the GIS professionals and researchers conducting the process must be highly

capable, well-equipped technologically, and familiar with their data. It is also important to note that the quality and accuracy of the message emitting from these professionals improves over time, with experience, and with trial and error at providing maps and analysis that generate real communication.

- For example, early on the COMPASS staff attempted to form a partnership with the local planning department. The idea was to incorporate crime analysis into a neighborhood economic development plan. However, the presentation of the crime maps and analysis was not directly on point, and the aggressive time frame of the development plan meant an opportunity was lost. This failure to improve communication, however, led to future successes as the staff improved their ability to meet users' needs in a timely fashion.
- *Timely messages*. Obviously, the data must be timely. "Annual report" data, summarizing last year or the year before, does not lead to productive communication or effective strategy. This alludes to another critical type of communication: negotiation of data-sharing agreements. COMPASS was able to develop protocols for public and nonprofit agencies to provide timely, regular updates of information, sometimes only a week old. This was accomplished only through intensive, iterative communication – both verbal and written – that took into account all of the political, technical and fiscal challenges of such an open-ended data-sharing agreement. This negotiation must be explicit of all risks of information sharing, and therefore must describe the benefits of sharing information (and using GIS) equally explicitly.
- *Time and a process to fine-tune the message.* It bears repeating that the process of communication based on GIS is *iterative***.** As a result, GIS analysts must learn to allow enough time for the receivers to absorb the message and generate meaningful feedback. A structured process helps this endeavor (Figure 3). More importantly, if the process is shaped around a critical public policy issue, the participants are motivated to participate in the process.
- *Metadata as communication.* As noted above, metadata is a key piece of any GIS system or infrastructure. Through COMPASS, we learn that (a) metadata can take both formal (written, structured) and informal (spoken, unstructured) forms, and (b) metadata itself is an aspect of the communication process. To be sure, formal metadata are provided on the COMPASS Web site and conform to the FGDC standards. And, as in many development projects, a lag in documenting metadata has led to confusion on the part of users, when metadata do not accurately describe such details as the time frame of the data being presented.

But conversations involving metadata happen on a less formal plane as well. For example, when presenting a map in an interactive meeting, a participant might ask something like, "So, what does this map show?" This question then launches a discussion of data elements, time frame, and even the data-capture process. For example, nearly every projection of a specific crime category on a map is accompanied by a discussion of Uniform Crime Reporting, the process of filing police reports and the suspected patterns of unreported crime. These conversations do not reflect FGDC standards, and unfortunately do not always get captured in writing. However, they are a critical piece of the communication, because they ensure that the participants do in fact have as similar an understanding of the shared picture as possible.

Being nimble: Adopting to shifting political, policy and funding priorities. By now, the dissonance between the original four goals and the diverse array of COMPASS projects is no doubt apparent to the reader. This has occurred because the team employed one overriding imperative: do not pass up an opportunity to demonstrate to the local community the capacity of GIS to improve communication and decision-making processes.

Thus when an opportunity arose, for example, to map complaints about rats, or to build a data-management application for a community housing survey, the COMPASS project staff was nimble enough to adjust goals, objectives and priorities to accommodate any demand for data-driven decision making that arose (Figure 6). In other words, the philosophical approach to the innovation, diffusion and adoption of GIS as a community decision-making tool was to be opportunistic, as opposed to espousing a structured planning model and process.

This "open" philosophical approach led to a wide diversity of experiences and opportunities. Some of the attempts to integrate GIS into existing, established problem-solving processes failed. Others took unexpected directions. The result is a wide set of experiences that speak to GIS as a communication tool.

Willingness to accept failure. The general concept of "data-driven problem-solving" is a tougher sell than specific tools, such as an Internet mapping interface. Thus, the COMPASS project team members made a number of early attempts to integrate the idea of GIS-driven decision making, planning or problem solving across a wide variety of settings and actors. Some of these, such as an attempt to integrate crime trend analysis into an economic development plan, did not pan out. Others, such as the partnership with the Citywide Housing Coalition, only came about after several attempts at a more aggressive GIS-focused, problem-solving approach to housing problems. GIS practitioners and researchers alike need to realize that they will not "bat 1,000" in their attempts at using GIS in action research. But they also should realize that success often comes only after several iterations, which give their local community time and exposure to the utility of GIS and the value of sharing data. By understanding the general conceptual theories laid out here, and recognizing the critical success factors for

effective GIS-oriented communication, they will, over time, increase their success rate and their value to the local community.

Conclusion

COMPASS Milwaukee provides the necessary communication and data management network to support better access to crime-relevant data and facilitate communication among citizens, the scientific community and policy-makers.

From an organizational perspective, GIS provides a common framework, and beyond that even a common language for the technical staff involved. Whether it is a simple question of data format, more difficult issues of data organization, or a really complex problem such as firearm violence, the information technology background of staff in all organizations involved, combined with their peculiar spatial perspective and local geographic knowledge, formed a valuable supporting structure for the COMPASS project.

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