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# Contents

## Refereed




**On the Cover:**
The White Knight. A title reserved for the knight who exhibited the most chivalry, loyalty, and bravery on the battlefield. A symbol of honor and nobility that served as a beacon to those he swore to protect. In GIS the battlefield is only symbolic. The enemy does not carry a sword and ride atop a black steed. To the GIS professional, the adversary is a lack of access to good data for making better decisions; the adversary is overcome through vision, passion, skill, perseverance, and collective action. It is up to today's white knights of GIS to ensure that their organizations adopt and utilize geospatial technology effectively to provide a better environment for those who rely on them. The individuals profiled in an article by William Craig are just a sample of the thousands of GIS champions who help to improve the use of spatial information technology around the world. Their unique contributions, along with others, are the subject of an article entitled "White Knights of Spatial Data Infrastructure: The Role and Motivation of Key Individuals "which highlights this issue of the URISA Journal.

# Journal

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# Editors and Review Board

# Changes in the URISA Journal

If we have done an effective job in transitions, you may not have noticed a few changes in the URISA Journal. The first is this letter from the editor—I have served in this role since just after the Chicago URISA Annual Conference in 2002. If you have a chance, please thank Harlan Onsrud, my predecessor, for putting the journal on solid footing and easing it through a transition to the modern world of Internet-mediated publication. His ideas for using the Web to broaden review of submissions and allow for innovative uses of the Web as part of the publication process have helped widen the reach and usefulness of the journal.

We have a few other new names on the masthead as well. David Tulloch is now the book review editor. If you are interested in contributing in this area or have ideas about which books should be reviewed, please contact David (dtulloch@crssa.rutgers.edu). Jay Lee is still the software review editor. The message is the same—get in touch if you would like to contribute in this area. We no longer have a literature review section editor. After several years of creating incredibly useful summaries of new literature, Zorica Nedovic-Budic has stepped down. This would be a great opportunity for a young professor who needs to be tracking what's new anyway! I'd like to welcome Mark Harrower, Assistant Professor of Geography at the University of Wisconsin-Madison, as a new thematic editor in the area of Geographic Information Science. We will be making more changes in thematic editors to suit the new focus of the journal, as explained in the following paragraph.

Another change in this issue is reinstituting editorials. R. Bradley Tombs' article on blocking public access to geospatial data has not been through our ordinary peer review process; it is not a research-based manuscript. Rather, it contributes an interesting perspective to consider, hopefully inciting further dialogue. I will use our thematic editors as a sounding board to judge whether future policy reviews and polemics are well written and thought provoking. You may note that the articles by Joffe and Craig in this issue do not follow the style of typical academic journal articles either (though both were vetted through standard review procedures). Let me know whether this more relaxed approach to style works for you.

Finally, the major change to be made in future issues is to sharpen the focus of the journal, based both on my perception of the interests and needs of URISA Journal readers and on feedback from our article review board. The journal's strengths and unique niche lie in two areas, and I will be particularly interested in seeking submissions that fall within these broad categories:

- Urban and regional applications of geospatial technologies (e.g., urban modeling, decision support systems, implementation issues in local agencies, public participation GIS);
- Nontechnical aspects of geospatial sciences, including organizational, institutional, legal, and economic issues.

Please let me know what you think of these changes.

Steve Ventura (sventura@wisc.edu)
Editor-in-Chief, URISA Journal

# White Knights of Spatial Data Infrastructure: The Role and Motivation of Key Individuals[1]

*William J. Craig*

***Abstract:*** *Most of the literature about sharing data has focused on institutional issues and wrongly ignores the key role of individuals. Data sharing across levels of government is necessary if we are to achieve a National Spatial Data Infrastructure; this is not something the federal government can do on its own. Local and state governments are the primary sources for many of the core data layers and supplementary to others. Using Minnesota as an example, there is ample evidence of state and local developing and sharing of data. In each case, one or more key individuals were responsible for developing that data and making it available to others. Nine individuals were interviewed to learn the roles they played and their motivation for making their data available for sharing. Three common themes emerged that explained what motivated them. First and foremost was their idealism, their sense that better data will lead to better decisions, that sharing good data is valuable. Second is enlightened self-interest; by sharing, they got something in return even if it was intangible. Third is their involvement in a professional culture that honors serving society and cooperating with peers. These motivations are similar to those of knights of yore and to our newly adopted GIS code of ethics that focus on serving the needs of others. The GIS profession could encourage more individuals to play the role of White Knight by focusing attention on issues related to these motivating factors.*

## Introduction

In 1995, I wrote an article called "Why We Can't Share Data: Institutional Inertia." The basis for the article was a frustrating personal history of being unable to access government data. My conclusion was that the problems were institutional. No organization that refused me data had a mandate to share data, so each traveled its own path—taking care of its own business—without taking any steps that would make its data more useful to me or to anyone else. I saw the mandates as coming from an elected governing body and beyond the control of the organization itself.

I was wrong! At least partially wrong. In almost every case, the reason the organization didn't share data was the lack of a motivated individual who had the vision and perseverance to make the data available to others. Such an individual would do the right thing in the absence of policies that limited sharing and would work to change or manipulate those policies if they did exist. I've since witnessed many instances of organizations rising above their self-serving needs to share data and in each instance there was a key person who made the difference. Such people see sharing data as beneficial to their own organization and to society, so they extend themselves to make it happen. I had misread Weber's (1947) description of bureaucracy as one of total control over scope of task and missed his message about bureaucrats using their professionalism and skills to get the job done right.

Individuals are the key. Much of the early discussion about the diffusion of GIS into organizations focused on the value of the *White Knight,* the person with the vision and motivation to convince an entire organization to adopt GIS technology. Why didn't we think about the white knight of data development and data sharing? The *White Knights of Spatial Data Infrastructure*.

Most of what has been written on the topic of data sharing has focused on institutional issues. Onsrud and Rushton's 1995 seminal book, *Sharing Geographic Information*, including 29 separately authored chapters, is almost entirely about institutional issues. Nedovic-Budic and Pinto (for example, see 1999, 2004) have provided many wonderful insights on data sharing, but were always looking at organizational relationships and structures. Reports published by the National Research Council (1993, 2001) discuss ways to improve partnerships among different levels of government. The National Map proposal (USGS 2001) encourages such partnerships with hopes that they will yield the data necessary to produce up-to-date topographic maps of the nation. Croswell (1991) made recommendations for improving the chances for GIS success; most of those recommendations were organizational; those dealing with personnel were focused on educational, political, and structural issues.

A few writers have focused on the impact of individuals on organizations. Harvey (2001) talked about the critical importance of actor networks, in which individuals collaborate with each other; this is in contrast with, and often a precursor to, social networks that institutionalize those collaborations. Cross and Prusak (2002) similarly discussed the value of individuals connecting within and across organizations. Niemann and Niemann published a series in the *Geo Info Systems* trade magazine from 1993 to 1998 that highlighted the contributions of some 20 individuals who were key to the development, utilization, and sharing of GIS across organizations. Two major themes run through their conversations with these key individuals: the desire to make better decisions through the use of GIS (for example, see Niemann and Niemann 1993) and the critical value of working with supportive colleagues (for instance, see Niemann and Niemann 1998).

Perhaps researchers abandoned work on the role of key individuals because they, as individuals, were too unique. If each case is unique, then it would be impossible to replicate. So we switched to institutional research where lessons learned could be adopted in new locations. This paper explores two hypotheses. First, individuals have played critical roles in developing a spatial data infrastructure (SDI). Second, individual motivation has common themes that are encountered repeatedly. To explore those hypotheses, this paper first explains the nature of SDI, then examines the relatively successful SDI of the State of Minnesota. For each identified data access site or unique data theme, one or more key individuals was identified and each was interviewed to learn about the roles they played and their motivation for playing these roles.

## Spatial Data Infrastructure

The availability of good data is crucial if a GIS (or any information system) is to be useful. For most organizations, the core of their data comes from their own operations, but the data become more useful if combined with other data. For example, a utility company maintains data on the location of its lines, but the data are more useful when combined with road rights-of-way and the locations of structures. A synergy occurs, where the whole is more valuable than the sum of its parts.

If additional data can be acquired from another source with minimal effort, they will certainly be utilized. If substantial effort is required to obtain the additional data, the data will be ignored and the system will be less useful. In the United States, it has become increasingly easy to acquire data because of data clearinghouses that provide metadata documenting data specifications and include contact information—if not the ability to download the data directly. The range of data sets now available is enormous.

The use of the word *infrastructure* implies a core set of spatial data that is as important to the nation's information highway as the road network is to the movement of goods. It also implies a public good that justifies public expenditure to implement and maintain. The rationale behind this approach was presented in *Toward a Coordinated Spatial Data Infrastructure for the Nation* (National Research Council 1993). From a federal perspective, that core data set has been defined by the FGDC (1997) in its *Framework* data and by the USGS (2001) as components of *The National Map*. A 2003 report of the National Research Council looked at the sources for that core data. The results are presented in Table 1.

It is obvious that federal agencies have great need for data assistance—primary and supplementary—from state and local governments. That need is reciprocal for those state, county, and municipal governments. They need federal data as well as data from each other.[2] The list of data needs of state and local governments includes those items in Table 1, plus many others. They are working to find solutions to their own data needs through the development of plans, standards, documentation, and clearinghouses. Many have been inspired by the idea of developing an *Implementation Plan* that operates as a strategic plan for their own spatial data infrastructure.

Sharing data has many advantages, but most of them accrue to the organizations receiving the data. It is usually cheaper and quicker to use existing data than to re-create them. To the extent that the owner is maintaining the data as part of a mission, the source data will be more detailed, more accurate, and more current than could be expected from any other source. There is little incentive for the owner to share data.

**Table 1.** Responsibilities for core data layers

| Theme | Federal | State | Local |
|---|---|---|---|
| Digital ortho- imagery (scale dependent) | Primary at coarse resolution | Supplementary | Primary at fine resolution |
| Elevation | Primary at course resolution | Supplementary along highways | Primary at fine resolution |
| Bathymetry | Primary for offshore | Supplementary for lakes and reservoirs | Supplementary for ponds |
| Hydrography | Primary | Supplementary | Supplementary |
| Transportation | Supplementary | Primary for highways | Primary for streets |
| Government units | Primary for states and international | Primary for counties | Primary for municipalities |
| Boundaries of public lands | Primary for federal lands | Primary for state lands | Supplementary |
| Structures | Supplementary | Supplementary | Primary |
| Geographic names | Primary for cultural features | Supplementary | Primary for street names |
| Land cover and land use | Primary for land cover | Supplementary for both | Primary for land use |
| Cadastral information | Primary for PLSS, leases and easements on public lands | Supplementary | Primary |
| Geodetic control | Primary | Supplementary | Supplementary |

*Source: Adapted from National Research Council, 2003, 68-69.*

Given the lack of incentives, it is astounding how much data is being shared. Federal agencies were driven in that direction by a 1994 Executive Order (Clinton 1994), and the effort to make data available continues with the Bush administration's Geospatial One-Stop program as part of the E-Government initiative (see http://www.whitehouse.gov/omb/egov/). There is no comparable explanation for the widespread sharing of data by state and local governments, yet it is those data that are key to the development and support of a National Spatial Data Infrastructure (NSDI).

### Minnesota's SDI

Minnesota has a reputation for developing and sharing data, beginning in the late 1960s when the state initiated GIS software and data development (Foresman 1998). The state has continued to be a leader, developing and sharing some of the most current and complete statewide data sets available anywhere in the country. Coordinating bodies, agencies, and individuals have all contributed to this success. Minnesota is used here as a case study; in some ways it is uniquely successful and serves as a model for other states, but in other ways it quite similar to other states and could be representative of all of them.

Minnesota has an usual mix of coordinating and supporting bodies. A Governor's Council on Geographic Information (http://www.gis.state.mn.us/) works on statewide standards and policy issues. The nonprofit Minnesota GIS/LIS Consortium (http://www.mngislis.org/) holds an annual conference and publishes a regular newsletter. MetroGIS (http://www.metrogis.org/) works to enhance data sharing and access in the Twin Cities metropolitan area. All three organizations provide many opportunities for people from different organizations to work together. All three also have awards programs to honor the contributions of key individuals or projects. The Land Management Information Center (LMIC, http://www.lmic.state.mn.us/) works to coordinate state data activities and provide access to data and technology. Except for MetroGIS, most states have similar organizations. The most unique state organization is the Legislative Commission on Minnesota Resources (LCMR, http://www.commissions.leg.state.mn.us/lcmr/lcmr.htm), which has provided nearly $20 million for land use and natural resource information since 1991, using proceeds from the state lottery and cigarette tax. Details about these organizations can be obtained from their Websites or from an earlier article about coordinating data in Minnesota by Craig, Baker, and Yaeger (1996).

Some components of the Minnesota Spatial Data Infrastructure are presented in Table 2. The table shows the major data access sites and examples of data themes that illustrate the completeness and currency of available data. The table briefly describes the sites and themes, documents the value they have to the Minnesota GIS community, and lists responsible agencies and key individuals. A bit more is said about each later in this paper.

Each of these resources is provided by an agency that is listed in Table 2 as well. MetroGIS and LMIC both have mandates to develop and distribute GIS databases; as with similar organizations elsewhere, neither has the sufficient financial resources to deliver all they would like. The state departments of Transportation and Natural Resources need data for their internal operations, but have taken steps to share their data with others. Dakota County has also chosen to share its data—sometimes, but not always, with a license and fee. Even The Lawrence Group, a for-profit company, has decided to share an unlimited amount of its data with the public sector and academia at no cost to those units under an arrangement with regional government, the Metropolitan Council.

In every one of those agencies, the initiative to develop and share data was taken by key individuals. Table 2 identifies one or more of these individuals for each initiative, people who went beyond the normal expectations for their job to deliver a component of Minnesota's Spatial Data Infrastructure. The next section explores the nature of their projects, their experiences, and their motivation.

## Key Individuals in the Minnesota SDI

In documenting some of the components of the Minnesota Spatial Data Infrastructure, Table 2 lists nine individuals who were key in the development of that component. Although others played major roles as well, nine are identified as leaders and informants.[4] They represent different sectors and levels of government. Because they were mid-level managers or above, they could effect change. The fact that they are all white males probably reflects the times during which they entered the field. Today, people of color and women across the country play similar roles.

I interviewed each of the nine and asked for a detailed history of their contribution, along with obstacles they had to overcome to achieve their goals.[5] Most important, I asked them about their motivation: Why did they make the extra effort to develop data and share them with others? Here are their stories.

**Chris Cialek** is a champion for standards and data access. He is responsible for the development of GeoGateway, a clearinghouse that provides good access to documentation and data for some 500 data sets developed and maintained by state and local governments in Minnesota, as well as more than 1,600 Minnesota-related data sets maintained elsewhere. He worked for the USGS before coming to LMIC, managing special data projects for the National Mapping program. At USGS, he glimpsed the vision of sharing spatial data, but at LMIC (with a mission of providing state data coordination and access) he found a home where he could work on his dream. He helped spearhead the development and implementation of a state standard for metadata—a streamlined version of the federal standard. Metadata allowed LMIC staff to more easily disseminate its own data by saving time in answering questions. He works hard on standards because they make it possible to work with data from multiple sources. Cialek's work with the Governor's

**Table 2.** Some components of the Minnesota Spatial Data Infrastructure

| Data Access Site | Description | Indication of Value | Agency | Key Individuals |
|---|---|---|---|---|
| GeoGateway http://geogateway.state.mn.us | Clearinghouse for 2,100 data sets about Minnesota from more than 50 providers; searchable by keyword, date, location, or source | A single point of access to Minnesota data from many sources. In FY2004, more thanover 12,000 users previewed 78,000 metadata records; at LMIC alone, that resulted in almost 19,000 data sets downloaded. | Land Management Information Center http://www.lmic.state.mn.us | Chris Cialek<br>David Arbeit |
| DataFinder http://www.datafinder.org | Documents 169 data sets with full metadata; 131 data sets directly accessible; integrated with GeoGateway. Café option allows extraction of specific geographic areas | 670 downloads per month | MetroGIS http://www.metrogis.org | Randall Johnson |
| DataDeli http://deli.dnr.state.mn.us | 120 data sets of natural resource and related data; all with full metadata; tiled for targeted downloads. | >2,500 downloads per month | Minnesotan Department of Natural Resources http://www.dnr.state.mn.us | Les Maki |
| Dakota County GIS http://www.co.dakota.mn.us/gis/ | Parcel maps and data, plats, elevation contours, control points, etc. | Used by 11 cities, electric utility, 86% of county offices. Online real estate inquiry has ¾ million user sessions annually. | Dakota County http://www.co.dakota.mn.us | Gary Stevenson |
| **Unique Data Themes** | **Description** | **Indication of Value** | **Agency** | **Key Individuals** |
| Orthophotos (see GeoGateway) | State was early partner with USGS and NRCS;[3] in 2003, it updated orthos in partnership with the Farm Service Agency. | In 2004, more than 2 terabytes of orthoimagery data were downloaded. | Land Management Information Center http://www.lmic.state.mn.us | Don Yaeger<br>David Arbeit |
| TLG Street Centerline (see DataFinder) | Similar to TIGER, but geometrically correct and updated quarterly from local sources; covers 20 counties in Minnesota and 3 in Wisconsin | 157 licensed users in the Twin Cities area | MetroGIS Endorsed Regional Data Solution; Metropolitan Council purchases access for public agencies and academiac from The Lawrence Group (private) http://www.metrocouncil.org http://www.lawrencegroup.com | Larry Charboneau<br>Randall Johnson |
| Transportation Base-Map http://www.dot.state.mn.us/tda/basemap/index.html | 1:24, 000 public road centerlines covering state; maps contain road name(s); route type/number; dividedness; also political boundaries and other geo-reference data (PLSS, lakes, streams, etc.). | Avg. monthly Website site hits for first half of 2004: 275 for statewide data; 1,919 for individual county data; 1,309 for metadata. | Minnesotan Department of Transportation http://www.dot.state.mn.us | Denny Brott<br>Tom Glancy |
| Parcel Data (see DataFinder) | Integrates 925,000 parcels, each with 25 attributes normalized across the 7seven counties, increasing to 55 in 2005. | 49 licensed users | MetroGIS Endorsed Regional Data Solution: primary producers are 7seven metropolitan counties; regional custodian is Metropolitan Council | Randall Johnson<br>Gary Stevenson |

Council on Geographic Information enhanced his contacts with state and local participants and provided the incubator within which a recommended approach to developing the clearinghouse was developed (GCGI 1997).

**Randall Johnson**[6] is the staff director and prime mover behind MetroGIS, the award-winning, stakeholder-governed organization working to share data in the Twin Cities region. MetroGIS is supported financially and technically by the regional government (Metropolitan Council) and substantively by the seven counties and hundreds of local governments that make up the region. These partners are working together because they need data from the others to fulfill their own information needs. Two unique data sets, formerly available only for a fee (street centerlines and parcels), can now be licensed gratis by public agencies and academic institutions. As a former municipal planning director, Johnson understands the need for data to get the work done and says he is driven by a passion to institutionalize data sharing so that sharing is both equitable and sustainable. He believes strongly in the NSDI vision and has worked to convince people locally that GIS professionals in the Twin Cities are part of something bigger at the state and national levels. Johnson holds that sharing generally results in higher quality data because of feedback from the wider variety of users, and that those who institutionalize their data sharing benefit in turn by getting data they need from others thereby improving their own internal efficiencies.

**Les Maki**[7] was the driving force behind creation of DataDeli and the data infrastructure supporting it. GIS plays a major role in the planning and operations of the state Department of Natural Resources (DNR), but the many divisions had data that were incompatible with each other. As GIS manager, Maki brought together the staff and led the charge to create a well-documented, standardized departmental spatial data infrastructure. Then he fought to share that infrastructure with others outside the department. Maki gives five reasons why he believes the DNR was willing to share its data with others:

- DNR needs data from others. Sharing DNR data helps reduce mistrust and sets a positive tone for working together even beyond data sharing.
- Better data lead to better decisions and DNR data are of good quality.
- Maturity—the DNR has been into GIS so long that it feels less proprietary about its data.
- Once the data are well documented and on the Web, DNR staff is freed from filling outside requests.
- DNR Metadata and a state-recognized disclaimer eliminated fears about data liability.

**Gary Stevenson**[8] was the leading force behind the most productive county GIS operation in the state (Craig 1997). His biggest hurdle, as county surveyor, was getting the Dakota County Board to invest in a parcel-based GIS. Driven by his conviction that government could be better if it used GIS, Stevenson overcame the board's reticence by partnering with 11 cities and a local electric utility who shared the development costs and whose expectations pushed the county forward. He started by developing a GIS for his own department and subsequently expanded this capability to other departments and units of government in the county. Data on the Web saves his staff time responding to citizens and professionals looking for information; conversely, people looking for information can access it 24 hours a day. Stevenson was active in MetroGIS, providing the organizational and technical expertise that created the seven-county parcel map. He never encountered a major barrier to his efforts, neither did anyone have telling him he should develop GIS capacity. He was driven by a vision of better government.

**Don Yaeger**[9] was the force behind *BaseMaps for the 90s,* a state partnership with USGS and NRCS that made Minnesota the first state of any size to have complete orthophotos, plus statewide DEMs and DRGs. He was relentless securing funds, communicating with the contractor, evaluating the product, and promoting the data—he did it all. A 33-year employee of the Land Management Information Center, Yaeger continually created partnerships that made more data available to potential users, public and private, by securing state matching money from the LCMR and other sources. At times, support for his work was stronger from people outside his own agency. He pushed this work to the top of his agenda, sometimes to the detriment of his regular assignments and to his own professional advancement. Early in his career, he brought Minnesota access to statewide high-altitude aerial photography and organized a 14-year effort to complete 1:24,000 USGS topographic mapping for the state. When asked why he constantly worked to secure new and better data about the state, Yaeger shrugged and said, "People seem to find all kinds of uses for it and someone had to organize the effort to get it done." He recalled an early career experience of seeing the intense interest state and local agencies had in a set of late 1960s, centrally distributed air photos—some 300,000 hard copies were distributed and used just in government. That set the tone for his career. He also spent the past 13 years working on various functions for the Minnesota GIS/LIS Consortium, including serving as chair in 1993, and he still edits the *GIS/LIS News,* the newsletter of the consortium, which discusses data and application issues (www.mngislis.org).

**David Arbeit** is the Director of LMIC and a longtime proponent of making data available to users. His most recent accomplishment was coordinating an effort across four state agencies to match funds from the U.S. Department of Agriculture—providing complete, up-to-date color orthophotography for the state. He and other agency representatives had heard about the local need for such data at outstate meetings of the Governor's Council where local users were invited to talk about their activities and needs. Arbeit took the lead, organizing the partnership. It had not always been easy for LMIC to take the initiative in delivering free data to those who needed them because state rules required cost recovery. Arbeit heard the frustration of his constituents and has taken steps (like GeoGateway) to improve data delivery. Arbeit had been GIS coordinator in a major city that sold data to recover costs and had seen that approach fail both in recovering those costs and in making data available to the user community. He observed, "There's little point to developing data with public funds and then making it hard for the public to get it."

**Larry Charboneau** is President and CEO of The Lawrence Group, a mapping and GIS company. TLG publishes a street atlas of the Twin Cities from a GIS database. Under an agreement with the Metropolitan Council, it makes that database available free to public agencies and academic institutions. Charboneau is a dynamic leader who is current chair of the Minnesota Governor's Council on Geographic Information and former chair of the annual state GIS/LIS conference, and has been active with the MetroGIS Coordinating Committee. When asked why he is making his data available, he gave several answers. First, having worked in the public sector, he knows the value of the data to local government. Through this arrangement, even smaller and poorer units of government can obtain the data they need. Second, he gets updates from these local governments and giving them free access to the data makes them more enthusiastic about sharing their information with him. Those updates make his street atlas the most up-to-date product available.

**Denny Brott and Tom Glancy** are the forces behind free distribution of the Minnesota Department of Transportation (MnDOT) BaseMap. That series of files was originally developed from USGS 7½ Minute Quadrangle maps and was used as a cartographic base for the MnDOT County Map Series and to assist departmental field offices and consultants. The data layers include highways and streets, hydrography, county and municipal boundaries, and the Public Land Survey. Other state and federal offices provided technical assistance in developing the files (advice from LMIC and DNR as well as cooperation from USGS), which developed positive relationships and a willingness to share. Brott and Glancy knew from attempts by MnDOT to sell cartographic map data that sales were rare, income was negligible, and relationships were sometimes strained. They had seen local government and other transportation data users digitizing their own data, duplicating efforts, and wasting time and tax dollars. Brott and Glancy saw the value of reducing duplication and working off a common base. They pushed to release the hydrography data to DNR where it would be maintained and updated. They also pushed MnDOT to widely distribute the BaseMap to government agencies, academic institutions, and the public in a standard package for little or no fee. Technical breakthroughs made data distribution easier: first peer-to-peer ftp, then CD-ROM publishing, and finally the development of high-capacity Web distribution.

Going back to the beginning of this article and the White Knight analogy, does it really apply? Knights are defined by three characteristics—passion, skill, and a code of honor. They have the passion to do the right thing, which motivates them to overcome any obstacles. Skills allow them to accomplish difficult tasks. A code of honor controls how their passion and skills are applied in the real world. The knights' code of honor is based on chivalry and gallantry and requires them to be loyal to their home organization, but to also have the courage to reach beyond self-serving goals to achieve the greater good. The code requires them to put their "professional" lives at risk for the greater good —not expecting personal gain in return. The nine people described previously clearly have shown such passion, skills, and honor, thus the title of *White Knight* seems entirely appropriate.

## Summary of Motivating Factors

Look at the stories of these nine individuals who made a difference in the development of the spatial data infrastructure in the state. In all cases, they had to push hard to make their data widely available. They were inspired middle managers who worked hard to convince top managers to make the organization's data widely available. Their home organizations had reasons for not distributing the data, but the men won out—at least for now.

## Three common themes can be seen in their stories

1. *Idealism*. This is first and foremost for our *White Knights.* They hold that better information makes for better decisions and that an open government is a better government. They state that GIS is a good tool for management and decision making, and they believe in data synergy: that bringing together more data makes for more informed decisions. Charging for data reduces the utility of the data. Those closest to the data source can produce and maintain the best data sets. They believe that their own instincts about sharing are correct and their actions can bring about change. Idealism is a major theme in the Niemann and Niemann series.
2. *Enlightened self-interest.* They know they need to document and standardize their own data, so they can make good use of the data themselves. They believe in sharing that data because they need data from other people and want to be viewed as a cooperative partner. They need to join a coalition to get the data they need, and they save staff time from filling custom orders by putting their data on the Web. They prevent confusion and lawsuits by providing good documentation. They know that politicians support valued organizations and work hard to get such a reputation. They believe their data are superior and want to drive out the bad data.
3. *Involvement in a professional culture.* Involvement that engenders participation, cooperation, and trust is a theme

originally described by Niemann and Niemann and later by Harvey (2001, 2003). Sometimes that culture is based on one-on-one experiences, as in the case of creating MnDOT's BaseMap. Other times, the culture is grown from being part of a national professional organization like URISA or a national experience like an FGDC project or event. For many of the individuals described here, that culture was grown by working together on task forces and committees that spanned agency boundaries. All are members of the Minnesota GIS/LIS Consortium and have participated in annual conferences, both at formal sessions and at the various social events that bring people together.

## Conclusion and Recommendations

Most of what has been written about institutional relationships is probably true and can provide valuable guidelines for enhancing our spatial data infrastructure. But it is *people* who make it happen. That proved to be the case in Minnesota, where some of the most useful components of the spatial data infrastructure are available because of the work of a few key people. They come from different sectors, but they share the same passion and they are motivated by the same kind of forces. This commonality implies that they can be replicated, that there is some kind of training and socialization that can yield similarly passionate and successful people.

The question is how do we replicate our *White Knights?* We know there are others like them across the country and around the world—covering a broad demographic spectrum. But there is a larger body of people who do not have the passion or skills to be champions. What can be done to convert them? My recommendations are speculative and incomplete, but based on the findings about what motivates the *knights* interviewed in this study.

**Encourage their idealism.** The recently adopted GIS Code of Ethics (URISA 2003) contains several ideas that encourage sharing: strive to do what is right, share data widely, document data, work respectfully with colleagues, and contribute to the discipline. There are numerous good case studies of the benefits of GIS and these need to be widely shared. Articles in trade magazines and presentations at conferences show the benefits of data sharing that should be available to all in the field. Gillespie (2000) and Tulloch and Epstein (2002) have generalized the benefits of GIS as efficiency, effectiveness, and equity. This is certainly true, but professionals need to know more. The University Consortium for Geographic Information Science (UCGIS 2002) has listed numerous specific items on its research agenda that could help practitioners understand the value of their work and the need to share data: GIS and Society, Institutional Aspects of Spatial Data Infrastructures, and Geographic Information Partnering. Idealism is a primary motivator.

**Document the benefits accruing to the sharing organization.** Individual stories like those in this article may help people see how they can help themselves while helping others. The literature is weak in documenting benefits accruing to the organization sharing its data with others. The UCGIS research agenda, if addressed properly, could document the benefits of sharing data. It would be very useful to document the negative effects of restricting access to data. Self-interest is an excellent vehicle to convince the rest of the organization to cooperate in data sharing.

**Encourage professional acculturation.** Take advantage of opportunities for bringing professionals together; process is more important for building communities than the products that we often cherish. Use committees, conferences, workshops, and user-groups to build networks and a sense of common purpose. Encourage organizations to celebrate good work because it encourages others to follow with good work. Most of the people or projects listed in Table 2 have received a commendation from the Governor's Council for outstanding contribution to the state or a Lifetime Achievement Award for a career of exceptional service. In 2003, the Minnesota GIS/LIS Consortium gave out a new Polaris Award to those midcareer GIS professionals who demonstrated a beacon of energy and creativity that inspired and guided others in the field.

The research in this article is limited by looking at only one state at one point in time. It is reassuring that the findings held across three levels of government and the private sector. It is reassuring that the data sharing was not significantly reduced because of homeland security concerns following the attacks on the United States on September 11, 2001; clearly, most people agree with the findings of RAND (Baker et al. 2004) that publicly available geospatial data is generally not a unique and useful source of information for terrorists. Nevertheless, it would be useful to repeat this research in other places to see if the findings are robust or need modification. What, for example, would be the impact of a strong institutional policy or a key individual opposed to sharing data. That research is important, but beyond the scope of this article.

## About the Author

**William J. Craig** has been involved in GIS since the late 1960s when he was one of the pioneers developing the Minnesota Land Management Information System. Besides his involvement in his home state, he has been president of URISA (1986–1987) and the University Consortium for Geographic Information Science (UCGIS–1996). He holds a Ph.D. in geography and works as Associate Director of the Center for Urban and Regional Affairs, University of Minnesota. He chaired the committee that drafted the recently adopted GIS Code of Ethics.

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## Footnotes

[1] An earlier version of this paper was presented at the International Symposium on Spatial Data Infrastructure (http://www.sli.unimelb.edu.au/SDI/) and at the 2001 AURISA conference, – both held in Melbourne, Australia.

[2] Federal data are often inadequate for local needs because the scale is too small for them. Data development partnerships could account for the needs of all stakeholders if state and local governments could pay for enhancements such as increased resolution and attribute characteristics.

[3] USGS and NRCS are the U. S. Geological Survey (U.S. Department of Interior) and the Natural Resources Conservation Service (U.S. Department of Agriculture). These two agencies led a federal effort through the 1990s to create digital orthophotos for the nation. When the program first started, NRCS went by its original name, the Soil Conservation Service.

[4] Two other people were mentioned frequently in my investigation: John Borchert and Al Robinette. Both were strong proponents of good data for good land-use planning and received the Lifetime Achievement Award from the Min-

nesota GIS/LIS Consortium —— as well as other awards from their peers around the country. Neither is alive to be interviewed for this article, but their lives influenced me and many others.

[5] I am limited in what I say about the institutional obstacles, because most still work for those same organizations.

[6] Johnson feels uncomfortable being singled out. He feels it is important to also recognize members of the superb GIS staff at the Metropolitan Council who have contributed greatly to the efforts described in this paper: Rick Gelbman, Tanya Mayer, Alison Slaats, and Mark Kotz. MetroGIS is successful because of the effort of hundreds of individuals working to share data across the metropolitan area.

[7] Maki retired in 2003, but the DataDeli continues under the DNR staff he hired and trained. To learn more about Maki's contributions as a GIS iInnovator, see Niemann and Niemann (1997).

[8] Stevenson now works in the private sector, but the Dakota County GIS Office continues to provide leadership for the county and to others in the state. Randy Knippel is current head of that office and the person who handled most of the technical work in knitting together the seven counties.

[9] Yaeger retired in 2002, but he continues as editor of the GIS/LIS News. It is not clear who will take over his successful relationship with LCMR.


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# Delineating "Public" and "Participation" in PPGIS

*Marc Schlossberg and Elliot Shuford*

**Abstract:** *PPGIS is often presented and promoted as a more people-centered GIS compared to a traditional technocratic, expert-driven tool or methodology. Yet, the umbrella of PPGIS is quite broad. Within such a wide context, it may be helpful for practitioners and scholars of PPGIS to better understand exactly what PPGIS is. Or, in other words, having a clearer conception of what "public" and "participation" are, and how they relate to expected outcomes and outputs within a GIS context, is very important as the ideas and ideals of PPGIS continue to gain momentum. Understanding the variations in the types of "public," cross-referencing them against the distinctions in "participation" and linking the intersection of types of "public" and "participation" to expected GIS outcomes and outputs would greatly enrich the field. Moreover, such delineation would allow PPGIS practitioners and those considering PPGIS approaches to appreciate the linkages of certain types of participation processes, specific elements of the public, and particular types of expected project results. This paper offers a review of key literature relevant to public participation and presents potential integrated matrices to guide future PPGIS thought.*

## Introduction

PPGIS is emerging as a distinct subset of two previously separate activities: technology-based spatial analysis and participatory democracy. With its roots in the GIS and society events in the mid-1990s, PPGIS has matured to a level where in 2002, *Community Participation and GIS,* a book exploring various avenues for GIS to be used in citizen- and organization-based empowerment activities, was released, and the third national conference on PPGIS was held. Clearly, there is a range of researchers, practitioners, developers, and activists who share a somewhat common vision that the use of GIS' visual language along with its spatial analysis capacities present a new and unique opportunity for community change and influence.

As this new field emerges, it is important to be clear on its parameters, its definitions, and its implied meanings. Central to this idea is an understanding of exactly what "public" and "participation" mean and how the different variations of these terms impact our conceptions of PPGIS. The book referenced previously, the PPGIS conferences, journals, and various trade publications offer a variety of case studies of when PPGIS was used, but the more one looks to find a common thread or meaning about what PPGIS exactly means, one quickly realizes that guiding definitions are not to be found and that utilizating the term "PPGIS" is inconsistent across applications and uses. For example, in providing context for their recent book, Weiner et al. (2002) define public participation as "grassroots community engagement" (5), but who exactly is included in the grassroots community and what does their engagement look like? Understanding the range of publics and the range of participation can help all involved in PPGIS more accurately identify and achieve the project outcomes they desire.

It is not surprising that PPGIS practitioners, scholars, and advocates have not developed clearer definitions of "public" and "participation," given that there appears to be a substantial gap in delineating these domains even among those who work in the more traditional realm of public or citizen participation. In this area, public participation generally falls into two broad areas: 1) characterizations of public participation along some broad type of power spectra (e.g., Arnstein) or 2) delineations of types of participation techniques. Who the public is in "public participation" is less defined and often overlooked in favor of such broad categories as "all affected stakeholders." For PPGIS, the public can range from every resident in a neighborhood engaged in community asset mapping to every U.S. citizen interested in viewing census data spatially online.

Understanding how specific publics are linked to certain types of participation is thus an important effort to undertake so that users of PPGIS ideas can appropriately characterize, utilize, implement, and evaluate their PPGIS efforts. For example, when a local public health official wants to use GIS in a community-oriented, participatory way, how can that official identify both an appropriate public and a type of participation that will yield the type of programmatic goals that he or she wishes to achieve?

To illustrate the potential utility of a more detailed delineation of these domains in the context of PPGIS, one could imagine a simple matrix with various types of "public" along one axis and various types of "participation" along the other. The cells that link various points along each axis could contain expected PPGIS project outcomes. So, for example, suppose a project conceived of the public as all city residents and desired the participation technique of World Wide Web–based mapping of various city services. The expected outcome of such an endeavor may be to provide general education to the population as a whole. The process could work in reverse as well, starting with a goal to achieve and then cross-referencing the axes to identify an appropriate type of "public" and "participation."

The remainder of this paper explores the components of this matrix notion in depth, drawing on a diverse set of theories and conceptions about public participation with the goal to bring some clarity to these complex notions so that PPGIS can be utilized with greater impact as a practice and can continue to evolve as an independent line of inquiry and investigation. A simple two-plane matrix will be presented, and although it is not likely to be able to properly capture the entire complexity of the public participation notion, such an all-encompassing effort is not the goal. Rather, the main goal of this proposed matrix is to provide a basic context for users and researchers of PPGIS ideas to be clearer about what they are doing and hoping to achieve by integrating GIS into a public participation process.

### PPGIS

Spatial planning and public participation have recently begun to be thought of in an integrated fashion. As such, PPGIS represents a broad notion that the spatial visualization and analysis capacities inherent in GIS present a unique opportunity for enhanced citizen involvement in public policy and planning issues. The focus of PPGIS remains quite undefined (Jankowski et al. 2003; Tulloch 2003), ranging from issues of "grassroots community engagement" (Craig et al. 2002, 5) to making public data such as parcel and property tax records more public through maps on the Internet. What scholars and practitioners do see in common in PPGIS is that spatial issues are best addressed with spatial approaches and that GIS can facilitate a broader set of participants in the planning process due to its visual orientation (Al-Kodmany 2001). In this sense, a map can facilitate mutual understanding and common agreement about basic facts, and can be used to develop trusting relationships across a diverse set of participants.

It is important to note that although we think of GIS as a tool to create maps, the process that leads to final map creation may be more appropriate in terms of collaborative planning. Maps can be a key component in grassroots change efforts (Elwood and Leitner 1998; English and Feaster 2003; Mitchell 1998; Talen 2000), can be an important component in the work of human service organizations (Hoefer et al. 1994; Kellogg 1999; Queralt and Witte 1998), and can help illuminate issues of equity and community condition upon which a community may organize and take action (Harris 1998; O'Looney 2000; Schlossberg 1998; Spade 1996; Talen 1998). Similar to participatory- or community-based research methods, where joint expert-community problem definition and research is as much about building trust and social capital through the research process (Israel et al. 1998), PPGIS offers the ability for the process of spatially investigating an issue to yield positive returns in terms of group dynamics, consensus building, and joint planning.

Some recent efforts helped create context for this wide range of participatory GIS applications. In 1998, an issue of Cartography and Geographic Information Systems focused on community and participatory uses of GIS, laying out a variety of contexts of such applications (e.g., Craig and Elwood 1998; Elwood and Leitner 1998; Harris 1998). The recent book, Community Participation and Geographic Information Systems (Craig et al. 2002), is itself a context creating work, providing a variety of perspectives on the applications, opportunities, and limitations associated with PPGIS ideas. And two recent editions of the URISA Journal focus on GIS access and participation, with articles ranging from developing frameworks to better understanding how people, cultural situations, and technology interact in terms of participatory GIS (Jankowski and Nyerges 2003) to a future research agenda for the integration of spatial analysis and community participation (Carver 2003). These efforts, while invaluable in many ways, often fail in being explicit about what public participation GIS means within the context of their effort, and, more specifically, who the "public" is and what form their "participation" is taking. In fact, such a deficiency was in part highlighted by a 2003 international workshop on PPGIS: "Public participation is not a unique and shared construct. It is a complicated process with multiple meanings that lead to numerous expectations" (Craglia and Onsrud 2003, 13).

Jankowski and Nyerges (2003) suggest there is a lack of operational knowledge about PPGIS and they present eight constructs that inform how decisions are made within a participatory GIS context. These constructs include important project-oriented elements such as how social-institutional influence, group influence, and social outcomes may affect or direct particular projects. These constructs, however, remain at a more conceptual and theoretical level and are not easily accessible to one who is thinking about using GIS in an applied, public process way.

Tulloch and Shapiro (2003) also try to add some context to the complexity of the PPGIS notion by looking at access to information in a more nuanced way. In their analysis, there are various levels of access (I–IV), with each type loosely linked to a different user population or "public." The paper then spends a bulk of its content on creating a 2 x 2 matrix that provides structure for simultaneously understanding the intersection between low and high levels of participation on one axis and low and high levels of information access on the other axis. This matrix approach seems to be useful in understanding the complexities inherent when different types of public and different modes of participation are pursued. While Tulloch and Shapiro's article does provide a good initial approach, its expansion is warranted in at least two main ways: 1) to be more focused on public rather than access and 2) to flesh out participation and public into more than just low/high categories. The remainder of this paper works to build on and expand Tulloch and Shapiro's original matrix.

## Domain of Participation

"Participation" can be thought of in (at least) two core ways: as specific activities that individuals engage in or in the broader purposes that participation is supposed to achieve. For the discussion here, this latter component—the broad notions of why participatory approaches are often pursued—will be the focus.

The participation domain, then, focuses on the motivation for utilizing participation as a planning and policy approach. Perhaps the most well-known examination of citizen participation is Arnstein's Ladder of Citizen Participation (1969), which frames participation in terms of citizen power. Arnstein defines citizen participation as "the redistribution of power that enables the have-not citizens, presently excluded from the political and economic processes, to be deliberately included in the future" (351). The central tenet of this model revolves around using participation to

**Figure 1.** "Ladders" of Public Involvement

| Arnstein (1969) | Wiedemann and Femers (1993) | Dorcey et al. (1994) | Conner (1988) | |
|---|---|---|---|---|
| Degrees of Citizen Power<br>■ Citizen control<br>■ Delegated power<br>■ Partnership<br><br>Degrees of Tokenism<br>■ Placation<br>■ Consultation<br>■ Informing<br><br>Nonparticipation<br>■ Therapy<br>■ Manipulation | ■ Public participation in final decision<br>■ Public participation in assessing risks and recommending solutions<br>■ Public participation in defining interests andactors and determining agenda<br>■ Public right to object<br>■ Informing the public<br>■ Public right to know | ■ Ongoing involvement<br>■ Seek consensus<br>■ Task ideas, seek advice<br>■ Consult on reactions<br>■ Define issues<br>■ Gather information, perspectives<br>■ Educate<br>■ Inform | Leaders<br>■ Resolution/ prevention<br>■ Litigation<br>■ Mediation<br>■ Joint planning<br><br>General Public<br>■ Consultation<br>■ Information feedback<br>■ Education | Increasing Public Involvement or Citizen Control ↑ |

increase the relative level of citizen power. Eight rungs of citizen participation that corresponded to different purposes ranging from manipulation of the public to citizen control of the decision-making process are included in this ladder ( Figure 1). At one end is the rung of citizen control, which corresponds to a level of participation where the disenfranchised become responsible for an entire effort, including planning, policy making, and program implementation. The bottom rung of the ladder is manipulation, where the purpose of a participation process is for those in power to remain in power by eliciting public support through education and public relations approaches. Rungs are also grouped into three subsections, representing different degrees of participation, including "nonparticipation," "degrees of tokenism," and "degrees of citizen power." Thus, it is clear that Arnstein's ladder frames public participation in terms of a power orientation existing along a spectrum of manipulation to citizen control.

Wiedemann and Femers (1993) present an alternative ladder of citizen participation. In their ladder, public participation ranges from general education with little direct influence on decision making to public participation in the final decision-making processes (Figure 1). Wiedemann and Femers differ from Arnstein in that their focus is much more aligned with conceptions of public participation that are found within the mandates of large governmental agencies. In such environments, public participation is often a requirement of a decision-making process, although what constitutes the public or participation is often undefined. Therefore, a government agency that provides data in response to a Freedom of Information Act (FOIA) request may consider its work to be that of public participation. Or such an agency may seek close consultation by knowledgeable experts from within and outside of government to help influence and shape new policies—a different, yet typical form of administrative-oriented public participation.

Similar to Wiedemann and Femer, Dorcey et al. (1994) frame public involvement along a spectrum from informing the public to some state of ongoing involvement between the public and decision makers (Figure 1). Dorcey's approach parallels typical stages in many planning processes, rather than focusing on distinct, and separate, approaches to public participation. The stages along the spectrum progress from a general advertisement of an issue to a more involved set of activities as the processes progress. In this way, Dorcey recognizes that the nature of public participation can change over time within a single decision-making process; that certain public participation approaches may be necessary at the beginning of a process, while other public participation methods may be more appropriate toward the final stages. Conner (1988) and Jackson (2001) echo this dynamic nature of participation as well.

Conner, in his New Ladder of Citizen Participation, frames public participation in terms of "preventing and resolving public controversy" (250). In this ladder, there is a range of public participation techniques to be used for dispute resolution, from education of the general public to preventive activities that leaders can take (Figure 1). Other rungs along the ladder include consultation, mediation, and litigation, implying that decision making is inherently confrontational and that there are various participatory methods that the public can use to resolve disputes. So rather than Arnstein's frame of citizen empowerment and Wiedemann and Femers' frame of government-oriented mandates of public participation, Conner frames citizen participation in terms of avoiding or resolving disputes that arise in the public policy decision-making process.

## Comparing Participation Purposes

Even with the brief review of a limited set of scholarly work on participation, it is clear that there are fundamentally different approaches or orientations to the basic idea of participation. The purpose of each public participation framework mentioned previously differs along both the general objective of each approach and by the spectrums each includes (see Figure 2). Specifically,

**Figure 2.** Comparison of Public Participation Purposes

| Author | Orientation | Spectrum | |
|---|---|---|---|
| Arnstein | Power Orientation | Manipulation → | Citizen control |
| Wiedemann and Femer | Administrative Orientation | Education → | Joint decision making |
| Conner | Conflict Resolution | Education → | Prevention |
| Dorcey et al. | Planning Process | Inform → | Ongoing involvement |

the orientations can be thought of as a power orientation (Arnstein), an administrative orientation (Wiedmann and Femer), a conflict resolution orientation (Conner), or a planning process orientation (Dorcey et al.).

Simply mentioning that one wants public participation in his or her GIS effort can imply radically different interpretations of what that participation is supposed to achieve. That is, without clearly identifying and defining the orientation and objective of "participation," there is ample room for confusion and disjointed expectations between the multiple actors who are governing, administering, or participating in a participatory process. Clearly, the adoption of a particular frame of reference or orientation impacts both how public participation is conceived and how it is implemented and evaluated.

Moreover, each orientation may imply a different set of goals and expected outcomes when applied to PPGIS projects. For example, is PPGIS about continuous involvement throughout ongoing planning processes (aka Dorcey et al.); should PPGIS be conceived as a means to enhance citizen power and control over decision making (aka Arnstein); or should PPGIS be about conflict resolution (aka Conner)—using a visual language to enhance multiparty problem solving before the need of hard tactics such as litigation becomes necessary?

## Domain of Public

Just as in the domain of participation, one can think of "public" in two distinct ways: as actual people organized in some type of grouping (e.g., decision makers) or in terms of methods for identifying and selecting such people. The former will be more of the focus here because understanding who the public is will help place a PPGIS project into an appropriate context. It is also important to note that we do not place the public as an entity in contrast to elected officials, but rather view elected officials either as a type of public themselves or as potential participants in a public otherwise defined.

With regards to the "public" in public participation, many researchers have asked "Who should be involved?" (Day 1997; Langton 1978; Thomas 1995). Unfortunately, the question largely goes unanswered or is answered ambiguously. A classic definition within the management literature of who a stakeholder is demonstrates a concurrent lack of specificity to this question: "Any group or individual who can affect or is affected by the achievement of the organization's objectives" (Freeman 1984). Sewell and Coppock (1977) state that those who have a legitimate interest should be included in decision making. Exactly who this would be for a given process is unclear, yet defining the very participants in a public participation process is a fundamental element with clear linkages to the types of goals and outcomes a particular process hopes to achieve.

There are, of course, some scholars who go deeper into the question of who the public is. Answers to the question of "Who?" can be grouped into at least three general categories:

1. *Those affected by a decision or program.* Sanhoff (2000) claims those who are most affected by a decision should have the greatest voice in the decision. Despite the fact that the general public should be informed about opportunities to participate, the people who have the most at stake should have the greatest level of involvement. Part of what defines a stakeholder is those individuals or groups affected by an organization's activities (Jackson 2001).

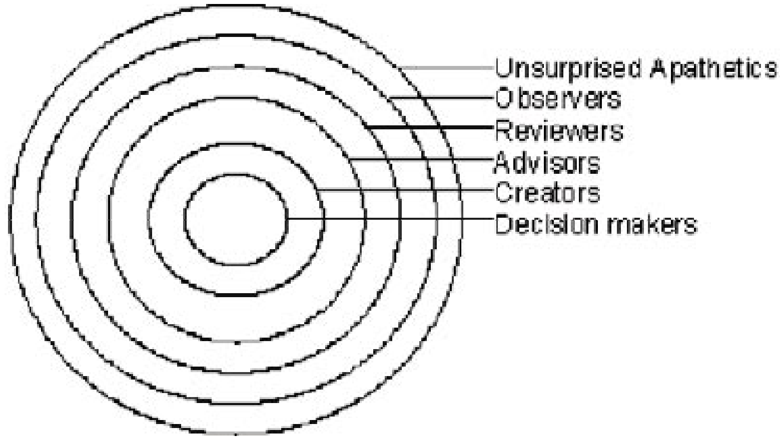
2. *Those who can bring important knowledge or information to a decision or program.* The participating public should include those with technical expertise (Sanoff 2000). These individuals may offer assistance in data collection or contribute essential information if the process has technical components. In general, public participation should include participants who have information that is helpful in solving the issue (Thomas 1995).

3. *Those who have power to influence and/or affect implementation of a decision or program.* Thomas (1995) describes members of the public "who could affect the ability to implement a decision by accepting or facilitating implementation" (56). Mitchell et al. (1997) describes stakeholders who possess power. These stakeholders have the potential to help or hinder an organization achieve its goals. Jackson's (2001) definition of a stakeholder also includes those who can affect "the activities of an organization."

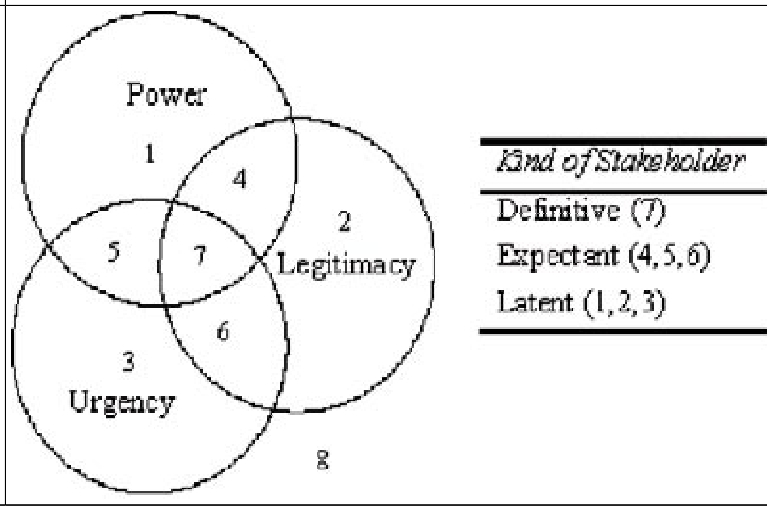
These scholars' answers to the "Who?" in public participation certainly offer more information for deciding whom to involve when compared with the federal government's generalist and vague mandate of "maximum feasible participation." However,

**Figure 3.** Circles of Public

Aggens' (1983) Orbits of Public Involvement Activity




Mitchell's (1997) Stakeholder Typology




involving the public can be a more complicated endeavor than identifying a single, static set of stakeholders. For instance, the composition of relevant publics or stakeholders can change over time (Aggens 1983; Mitchell et al. 1997); publics may be geographic, economic, professional, social, or political (Creighton 1983); and conceptions of a relevant public may differ according to agency goals and the desires of other interests (Thomas 1995). Aggens (1983) states some of the difficulty: "There is no single public, but different levels of public based on differing levels of interest and ability" (189). It is clear that more specificity is required if planners, policy makers, and adherents to PPGIS ideas are to effectively involve an expanded set of people in decision-making or program implementation processes.

One way to identify a relevant public is by adopting processes by which the public can be appropriately defined. Rietbergen-McCracken and Narayan-Parker (1998), for example, describe a stakeholder identification process by asking and answering the following five questions:

1. Who are potential beneficiaries?
2. Who might be adversely affected?
3. Have vulnerable groups been identified?
4. Have supporters and opponents been identified?
5. What is the relationship among stakeholders?

Answering these questions prods decision makers into thinking broadly about who should be involved in a particular public participation process. Willeke (1974) goes into more detail with a three-pronged approach to identify relevant publics by using: 1) self-selection, 2) staff selection, and 3) third-party selection. Self-selection includes those who identify themselves through means such as public hearings, letter writing to public officials, etc. Staff selection includes any techniques internal staff may use to identify publics such as geographic, demographic, or historical analyses. Staff may also administer a user survey or consult with other agencies. Third-party identification involves asking councils and representatives of known interest groups for people who could or should be involved.

Thomas (1995) uses the Effective Decision Model of Public Involvement to delineate the public, focusing on the acceptability of public decisions. Relevant publics are defined as either those who have information or knowledge useful for the decision or those who have the ability to affect implementation. These relevant publics are further divided or placed into three categories: 1) one organized group, 2) multiple organized groups, and 3) unorganized publics or complex publics (Thomas, 1995). However, Thomas's focus on acceptability would eliminate relevant groups of the public if they do not possess at least one of the aforemen-

**Figure 4.** Comparison of the Conception of "Public"

| Author | Dimension | Typologies of the Public<br>Focused | | Amorphous |
|---|---|---|---|---|
| Aggens | Energy and interest, time and resources | Decision makers | → | Unsurprised apathetics |
| Mitchell et al. | Power, legitimacy, and urgency | Definitive | → | Latent stakeholders |
| Thomas | Organizational complexity | One group | → | Complex public |
| | | | | |
| | | Selection of the Public | | |
| Willeke | Relevant publics | Self-selection | → | 3rd party |
| Creighton | Affected publics | Spatial proximity | → | Values alignment |

tioned criteria. For example, a group that may be affected by a particular decision may well indeed be a relevant stakeholder to a decision-making process, but may not be included in the Effective Decision Model.

Aggens (1983) provides another typology of who the public is, which delineates different publics based on two factors: 1) the varying amounts of time, interest, and energy a segment of the public has to work on an issue; and 2) the corresponding amount of commitment and resources an agency has to facilitate their involvement. In this model, the public is differentiated between: unsurprised apathetics, observers, reviewers, advisors, creators, and decision makers ( Figure 3). Aggens then groups these publics in concentric circles, implying a hierarchy of influence and importance in decision making, with the core circle representing the final "decision makers" and the outer circle representing "unsurprised apathetics."

Aggens goes on to characterize each of these circles in a variety of ways. For example, involvement of the core circle of "decision makers" implies the need for a substantial increase in energy committed by both participants and organizers of a public participation process. On the other hand, inclusion of "unsurprised apathetics" implies only the need for one-way communication between the participation leaders and the public that is involved. An important feature of this model is the fact that it is dynamic for a public may change its "orbit" at any time given certain circumstances. This model is also similar to the typology offered by Thomas (1995) because its focus on commitment in terms of time, interest, and energy (or what participants have to offer the process toward success) may leave out certain publics who have a legitimate right to participate, but who do not possess these attributes.

Mitchell et al. (1997) present a sophisticated stakeholder typology, delineating three major attributes of stakeholders: power, legitimacy, and urgency. Power is defined as the ability of one social actor to get another social actor to do something he or she otherwise would not have done. Legitimacy is "the perceptions or assumptions that the actions of an entity are desirable, proper, or appropriate" (869). Urgency is the urgency of a stakeholder's claim. These attributes are then used to plot stakeholders on a Venn diagram as seen in Figure 3.

This figure shows three major zones. One is in the center where stakeholders possess all three attributes of urgency, power, and legitimacy. These stakeholders are said to have a high degree of salience and are called "definitive stakeholders." The second zone is stakeholders who possess two attributes. They have a moderate degree of salience and are called "expectant" stakeholders, stressing the fact that they may easily move into the zone of high salience as circumstances change. The third zone is "latent stakeholders" with one attribute and a low degree of salience (Mitchell et al. 1997).

Creighton (1983) developed a different set of ways to identify affected publics, including:

- Proximity: A group lives near where a project is implemented.
- Economic: Some segments of the population may stand to gain or lose financially.
- Use: A program or policy may limit some people's use of a resource or facility.
- Social: A project or policy may threaten a tradition or culture, or it may significantly alter a community's demographics.
- Values: A group may be affected only in terms of how an action relates to its values (e.g., the abortion issue or gun control).

## Comparing "Public" Framings

So, just as "participation" can be thought of in substantively different frames of reference, so, too, can the ideas of "public." Figure 4 presents a comparison of the notions of public described previously, divided into two sections: typologies and selection of the public. Within typologies, one can conceive of the public along a variety of different means, sharing continuums that range from some sort of narrowly focused, small in number conception of public to a more amorphous, ill-defined concept. The different models of selecting the public follow a looser continuum ranging from a more clearly identifiable public selected by personal closeness to an issue, project, or decision maker, to a public that is less obvious and more tangentially connected.

In terms of pursuing a PPGIS endeavor, one must be clear about who the public is because how the public is defined relates to the types of outcomes and goals one can achieve. More concretely, being clear on who the public is will make it easier to include them in the PPGIS effort. For example, decision makers are often a group that is desired to be included in a planning or policy-making endeavor, but who are decision makers? Are they elected officials who are defined by legal power and legitimacy? Are they neighborhood leaders who are defined by their relevance and urgency to a particular issue? Participatory decision making is more than deciding if the public should be included or not; the type of "public" needs to be explicitly defined based on the goals and outcomes that are desired for a public process.

## Integrating the Conceptions of Public and Participation

While it is helpful to understand the separate domains of "participation" and "public," for PPGIS purposes, understanding the intersection is crucial for project planning, because it directly impacts both front-end and back-end decisions. On the front end, different PPGIS techniques may be possible or relevant depending on exactly who is targeted and what the participation goal is. For example, are all citizens targeted? Only voters? Only people likely to be impacted by a policy or plan? Only decision makers? And what is the goal—citizen power, placation, public education, or conflict prevention?

Joining the domains of "public" and "participation" in a more explicit way can also help at the evaluation stage of PPGIS projects. With each intersection of a particular type of "public" and "participation," expected goals and outcomes can be developed for each intersection node. For example, a project goal may be "to educate the public by representing complex data in map form with the hope that more citizens will become part of the public debate." Alternatively, a goal might be to "develop increased social networks in specific neighborhoods through the use of community-based, GIS-oriented data gathering." Explicitly understanding the idealized outcomes directly leads to the capacity to evaluate projects, thereby understanding whether PPGIS endeavors truly achieve their desired results. Such an integration of public and participation would certainly aid planners and administrators in designing PPGIS projects or events.

A few authors have made connections between typologies of the public and participation, although the link may be a bit circuitous. Thomas (1995), for example, created a matrix with a typology of the public on one axis and a decision-making style on the other. In this matrix, different decision-making styles are related to various groupings of the public, so that one can either look at one decision-making style across a variety of types of public or look at a single type of public across a variety of decision-making styles. In this way, a manager or project planner can conceptualize different sets of strategies and approaches to public participation (or effective decision making as Thomas frames his work) depending on what type of decision-making style and what type of public is either appropriate or desired.

Konisky and Bierle (2000) create a similar framework to compare several innovations in public participation. Their model relates participation processes to participants, intended outcomes, and decision-making authority, linking specific types of participation processes with a type of public and expected outcomes. Including expected outcomes in the mix adds a level of sophistication and guidance to their model that can be helpful for PPGIS users.

Jackson (2001) goes a step further by using a matrix to create something of a guide for administrators or planners to make decisions about public participation. In this model, the objectives of participation are made primary, and then combined with a broad categorization of the public. Starting with the project objective is a useful evolution of these models because public participation in general, and PPGIS more specifically, should exist to meet certain goals. Users of these approaches to decision making should be explicit about the goals they are trying to achieve, and it stands to reason that the type of participation and the type of public one chooses should flow out of specific goals that a project is trying to achieve. Jackson goes on to offer guidelines for when to use and when to avoid such approaches, providing guidance for practitioners who may or may not be familiar with public participation approaches toward planning, policy making, and decision making. Starting with the project goals in mind, then, one can use Jackson's model to subsequently identify the appropriate "public" that may be most applicable and relevant to reach those goals. Accordingly, once the overall project goals are understood, it may be easier to recognize situations in which certain public participation approaches are likely to succeed or fail.

## Synthesizing Domains "Public" and "Participation" for PPGIS

Jackson's integrated matrix presents a good model for the PPGIS community to emulate and build upon. PPGIS represents varied types of endeavors, and providing some definition, guidance, and expectations with certain PPGIS goals and objectives will benefit PPGIS practitioners, researchers, and others who come in contact with PPGIS projects.

Figure 5 and Figure 6 present two potential approaches to begin integrating these notions into some sort of reasonable order that can be used to reflect upon PPGIS more diligently. The first matrix (Figure 5) is constructed around more general conceptions of "public" and "participation." Along the horizontal axis are broad types of "public," ranging from simple to complex. In this case, a simple public is one in which the actors are relatively well defined and relatively small in numbers. That is, identifying and engaging this group of people is a relatively simple endeavor. A complex public is one that is either less well defined or one of such a substantive size and/or heterogeneity that any efforts of

**Figure 5.** Metadomain Matrix of Public and Participation

Domain of Public (simple → complex); Domain of Participation (simple → complex)

| Domain of Participation | Decision Makers | Implementers | Affected Individuals | Interested Observers | Random Public |
|---|---|---|---|---|---|
| Inform | | | | | 4 |
| Educate | 1 | | | | |
| Consult | | | | | |
| Define Issues | | | | | |
| Joint Planning | | 2 | | | |
| Consensus | | | | | |
| Partnership | | | 3 | | |
| Citizen Control | | | | | |

engagement become more difficult, both logistically and financially (Thomas 1995).

Domains of participation are along the vertical axis and also range from simple to complex. On this axis, however, a simple variable refers to a type of participation that is relatively easy to carry out and tends more toward methods of one-way communication intended for simple education or informing a certain population. A complex variable is one that requires much more in-depth and ongoing interaction, takes longer to develop and carry out, and shares power across parties.

It should be noted that the range of the categories are deliberately minimized for presentation clarity, but could be considerably expanded building on notions presented earlier in this paper. Likewise, some may find that the categories as presented are already too nuanced and could be combined. The goal of assembling these matrices, then, is to provide enough nuances in the domains to reflect real differences in the types of public and participation, while still maintaining a relatively clean conceptual framework. So, although the categories do represent a broad and diverse set of factors, the matrix may be adapted as seems applicable or reasonable.

Each cell of the matrix can then contain certain attributes, based on its location on both axes. It is important to note that PPGIS activities need not reside solely in a single cell; there can be fluidity between cells, and some projects may move from cell to cell during the life span of the project as the needs and objectives evolve over time. The cells therefore, and the entire matrix in general, should be conceived as a way to conceptualize the primary or individual aspects of a particular PPGIS project, providing some initial guidance and context upon which a PPGIS endeavor can proceed thoughtfully and deliberately. In Figure 5, four cells have been numbered to provide examples of the use of the matrix. Each numbered cell represents a particular PPGIS project and in addition to the "public" and "participation" identified on the axes, it is also possible to examine the expected output and expected outcome of a PPGIS activity. Each numbered cell is described in the following scenarios:

**Scenario #1: Poverty Mapping**

Public: Decision Makers (city council)

Participation: Educate

Expected Output: thematic maps by city council district

Expected Outcome: increased political support for local human-service agencies

Description: In this case, a local nonprofit organization that works on poverty issues is interested in utilizing GIS to increase the political support of the organization and its larger poverty-oriented goals. The public in this case is the local city council, and static maps of poverty are to be produced by council district to help educate each city councilor about the poverty situation within his or her geographical area of responsibility. Participation is rather simple—simple education. Likewise, the identification of the public is rather simple because the political decision makers are easy to identify.

**Scenario #2: Regional Conservation Planning**

Public: Implementers (agency staff)

Participation: Joint Planning

Expected Output: maps of conservation criteria and conservation priorities

Expected Outcome: more efficient conservation implementation

Description: In this case, a number of government staff from across agencies within a region want to identify and prioritize conservation projects. Using GIS to visualize the effects of different conservation criteria will help this collaborative

**Figure 6.** Goal-oriented PPGIS Matrix

| Domain of Participation (simple → complex) / Domain of Public (simple → complex) | Decision Makers | Implementers | Affected Individuals | Interested Observers | Random Public |
|---|---|---|---|---|---|
| Inform | | | | | greater spatial knowledge |
| Educate | increased political support | | | | |
| Consult | | | | | |
| Define Issues | | | | | |
| Joint Planning | | efficient implementation | | | |
| Consensus | | | | | |
| Partnership | | | community buy-in | | |
| Citizen Control | | | | | |

effort to prioritize projects, with the goal of increasing the efficiency and effectiveness of the regional conservation strategy.

**Scenario #3: Community-based Stream Restoration**
Public: Affected Individuals (neighborhood residents)
Participation: Partnership
Expected Output: restoration progress reports (with maps)
Expected Outcome: restored stream environment and sustainable community buy in
Description: In this case, a local neighborhood is interested in restoring a local stream that city resources will not be able to address. Working in loose partnership with the city, local residents want to build local capacity and interest for an initial restoration of the stream as well as continued monitoring and upkeep. The neighborhood citizens will create a series of quarterly progress reports to continue to educate the surrounding neighbors (and the city) about the progress being made. Perhaps more importantly, the community-based data collection for the maps and the maps themselves are to be used as ways to seek local volunteers and to build a sustainable streambed-monitoring capacity.

**Scenario #4: Museum of Technology Exhibit**
Public: Random Public (paying museum customers)
Participation: Inform
Expected Output: interactive maps and models
Expected Outcome: greater understanding of spatial relationships
Description: In this case, the local museum of technology has created a GIS-based exhibit that allows the general public to "see" its region in new ways, allowing the public to turn on and off spatial layers of parks, transit, and use, etc. Local GPS-equipped buses are also shown moving about on a large map projected on one wall of the museum, allowing museum patrons to gauge the pulse of their city. The public's participation is quite passive, and thus simple in nature, although the public itself is a diverse set of people from both within and outside the region.

These scenarios represent a few of the types of PPGIS activities that currently take place in a variety of places. Filling out the rest of the cells could provide an even more diverse set of PPGIS applications. What is apparent even in this small set of scenarios is that each project has clearly different participants, ways of participating, and differing project goals. Thus, when one talks about PPGIS as a means to an end, it is important to remember that PPGIS itself represents a multitude of possible realizations.

Also, while these scenarios represent the locations in the matrix of projects that have already happened, a potential project in the planning phase could utilize this matrix approach as well. By extracting the desired outcome from each scenario and placing it in the corresponding cell, those wanting to use PPGIS could locate the type of goal or outcome they would like to achieve, and then scan the axes to get a sense of the type of public and the level of participation that is necessary to reach their goals. For example, using Figure 6 as a basis, one could decide that "community buy in" was the primary goal for a PPGIS project and in order to receive that level of community commitment, a partnership of affected individuals must take place. Of course, it is then critical to have a sense of how to develop partnerships, but the first step in the PPGIS planning process has taken place. It is, of course, possible to have similar goals and outcomes (e.g., increased community buy in) in multiple cells. Therefore, it may be difficult to cleanly work in this backwards fashion—starting with the goal and then identifying a public and a participation to target. Nonetheless, it may be possible to use this goals-first approach to at least focus the discussion at the PPGIS project planning phase and to understand that goals and outcomes can

**Figure 7.** Techniques-oriented Matrix of Public and Participation

| Participation Techniques (simple → complex) | Domain of Public (simple → complex): Decision Makers | Implementers | Affected Individuals | Interested Observers | Random Public |
|---|---|---|---|---|---|
| Static Web Page | | | | | |
| Interactive Web Page | | | | | |
| Mail Survey | | | | | |
| Personal Survey | | | | | |
| Public Meeting | | | | | |
| Charrettes | | | | | |
| Citizen Juries | | | | | |
| Collaboration | | | | | |

differ depending on the type of public and participation that is included.

An alternative and complementary way of more fully integrating the notions of "public" and "participation" in PPGIS is presented in Figure 7. In this model, the domains of public along the horizontal axis remain the same as in Figure 5, but the vertical axis is now organized around specific techniques of participation. The techniques range in a similar fashion of simple to complex, with a static Web page representing a simple technique of participation and collaborative decision-making processes representing the complex end of the spectrum. A static Web page can be considered a simple participation technique because it represents one-way communication with the hope that viewers of the Web page will then be educated or take some action simply by viewing data in map form. A collaborative process is complex because it requires consensus building of participants and a considerable amount of time to work effectively.

Clearly, there are scores of more participation techniques, which can and should be augmented to this simplified representation. And, as in Figure 5, individual cells of this table can be fleshed out with specific applications of PPGIS, including the goals and objectives that such endeavors encompass. As mentioned previously, when these cells are filled with such information, a PPGIS user then can scan the types of public and participation that is desired or possible and get a sense of what outcomes can be expected. Alternatively, the cell containing desired outcomes can be found, which would then inform a PPGIS user about what type of public and what type of participation need to be used. (Although, as noted before, similar goals or outcomes may be present in multiple cells.)

## Conclusions

As the uses of GIS continue to expand beyond technician-oriented, scientific applications and it is recognized as a potential tool to facilitate public participation and decision making, it is important that we become sophisticated in how we think about it. Linking a GIS project to notions of public participation seems arbitrary in the absence of an understanding or consciousness about the domain in which the project takes place. Simply labeling a GIS endeavor as PPGIS because a nontechnician is involved is disingenuous to the many efforts of non-GIS public participation that seek to enhance the democratic process. On the contrary, being explicit about the domain within which a particular PPGIS endeavor falls can enhance the credibility, efficacy, and theoretical foundation of such a project.

As mentioned previously, it is important for PPGIS practitioners and scholars to be conscious and explicit about their conceptions of "public" and how such a public is selected. While the notion of public involvement may seem intuitive at first and easy to understand, clearly there are different biases, opportunities, and limitations to how a public is selected and incorporated into a PPGIS project depending on the frame of reference one uses. Providing a good contextual starting point, as presented in the matrix here, can be an invaluable resource to the administrators and staff throughout a range of government, private, and nonprofit organizations as they seek ways to pursue collaborative, engaged, and spatially-based approaches toward their work.

Clear understanding of the unique and varied domains of "public" and "participation" will help PPGIS users, researchers, and scholars more clearly place their work into specific contexts as well. This paper has attempted to: 1) review the literature on public participation; 2) illuminate the importance of paying attention to these foundational elements of PPGIS; and 3) present a potential model to guide further delineation and exploration of these important concepts. The matrices presented here are not meant to represent the authoritative domains of "public" and "participation," nor are they necessarily a cookbook approach to doing PPGIS. Rather, these PPGIS matrices are designed to provide a conceptual starting point for PPGIS endeavors and a way for those interested in PPGIS to appropriately conceptualize, plan, carry out, and evaluate their efforts from a more informed beginning place. The visual nature of GIS presents a great opportunity for increased public participation; we just must be clear on exactly what we mean by both "public" and "participation" in a GIS context.

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# Ten Ways to Support GIS Without Selling Data

*Bruce Joffe*

***Abstract:*** *Controversy has been raging for more than a decade on the appropriateness, legality, and effectiveness of public agencies selling their digital geodata. Recent discussions among professionals from both government and private sectors, representing a wide spectrum of opinion on whether public geodata should be sold or given away freely, have yielded some interesting experiences and useful advice on effective ways for public agencies to support their GIS operations.*

## Core Issue: Data Sales Versus Free Access

As more local governments develop their maps into GIS-based, digital geographic information, more and more are receiving requests for their geodata from people outside of their own agencies. They are discovering that beyond fulfilling internal agency needs, geodata is seen as a "strategic asset" and as a commodity. Many need to develop or to revise their data distribution policies. One of the central data policy issues is whether to charge the public for the data or to distribute it at no cost.[1] The significant legal, political, and economic reasons for selling public data or distributing it freely have been written and argued about for more than a decade.[2] They may be summarized as "the public's right to public data versus a public agency's need to fund its GIS operations."

- On one side, the truth is that access to public information is necessary to ensure government accountability. The Freedom of Information Act (5 U.S.C. § 522) assures free public access for federal data, and most states have laws that complement the principle regarding their state and local government data, as does California, for example, with its Public Record Act (§ 6250) that states:

  . . . the Legislature, mindful of the right of individuals to privacy, finds and declares that access to information concerning the conduct of the people's business is a fundamental and necessary right of every person in this state.
- The truth on the other side is that public agencies need to fund their ability to create, maintain, and disseminate data, and that geodata capture and maintenance are particularly expensive. The current economy has reduced tax revenues for local government, which, along with political impediments to raising taxes, have caused more than one GIS manager to say: "Yipes! Our department was cut!"

While other rationales are given for a government agency's sale of public geodata,[3] financial maintenance of GIS operations is the strongest reason used to justify abridgment of free public access to data. Funding for this public service can come through taxes, fees, sale of the data, or capturing the added value from the use of geodata. How effective have these methods been, and what is their prospect for the future?

## Open Data Consortium Project Findings

This question was examined by the Open Data Consortium (ODC) project (http://www.OpenDataConsortium.org) and funded by the USGS through the GeoData Alliance (http://www.GeoAll.net) to formulate a model data distribution policy for guiding local governments throughout the country. For 6 months, 67 ODC participants discussed data sales and other methods of supporting local GIS operations, along with several issues that define a public data distribution policy.[4]

The participants, who were self-selected from an invitation list of more than 264 GIS professionals, represented city, county, metropolitan, and regional governments with a wide range of current data sales policies. State and federal government agencies, universities, private sector consultants, and data resellers were included as well.[5] We conducted 24 teleconferences to discuss these issues in an open attitude of sharing experience and information, using active listening techniques, with the intention of formulating a policy model that represents the largest possible consensus of this representative group. During this process, we learned two interesting facts:

1. Most government agencies that sell public data have not realized significant revenues; in many cases, they have actually lost revenues.
2. There are better ways of raising funds to support GIS operations.

Every local government GIS manager whose agency sells its data has told me that he or she would prefer to distribute the data freely, if there were another way to fund GIS operations.

## Data Sales Effectiveness

The ODC participants shared the results their agencies have had from their data sales operations. Few have made money. None have raised significant revenues compared with their costs to maintain their GIS and geodata assets. Some have lost money.

- During the recent five-year period that Ventura County sold its data for $1 per parcel, it raised $15,000 per year, compared with the annual cost of nearly $1 million to maintain a ten-person team that updates geodata and creates GIS applications. The county has now lowered its price for the entire countywide geodatabase to $3,000, which provides quarterly updates, and includes 20 annual subscribers, producing a revenue of $60,000 per year.
- Kern County didn't make any money selling its geodata; it now makes all its data available free on the Web.
- Glendale was selling its data for $1 per parcel, and sold nothing.
- San Francisco (city and county) reports that it cost more in staff time to sell their geodata than the revenues they received.
- San Joaquin County said the revenues "didn't even come close" to paying for GIS in the county.
- Staff on Nashville's Metropolitan Commission opined that "Map sales are a pain; none of us are set up to deal with it efficiently."
- Both San Diego and Los Angeles counties have reduced their geodata prices to one-tenth of their previous levels in an attempt to generate more sales. Several geodata managers in Los Angeles County are now advocating for free data. Los Angeles appears to be spending more on marketing data than it receives from sales, and it sees data resale companies, such as Digital Map Products, as adding value by offering online services to view and download Los Angeles' data.
- California's Department of Fish & Game maintains the Natural Diversity Data Base that collects and distributes information about protected species and habitats for property administrators, natural resource stewards and regulators, and developers. Their success depends on the number of subscribers. Since reducing the subscription fee by a factor of eight, the number of subscribers has increased threefold.
- San Mateo County charges slightly higher prices to make copies of its paper maps than local reprographics companies charge, so that citizens will go to private service providers. It distributes its entire geodatabase freely, so that data resellers can provide GIS data products to citizens, rather than having to expend county staff time to fulfill requests for data.

A study by KPMG Consulting, Inc., in March of 2001, reported that "U.S. agencies reporting data income had revenues equal to 2 percent of their expenses."[6] Surveying 33 government agencies in Canada, KPMG found that on average, the federal government's costs of data dissemination break even with the fees generated, but for provincial and municipal governments, the net fee impacts were negative.[7] KPMG also cites a 1999 report[8] that found "cost recovery" was having the opposite effect on its stated goals:

- The consequences for businesses are higher costs, lower research and development investments, and threatened marginal products.
- The results for consumers are negative: higher prices and reduced products and services.
- The overall economic consequences are 23,000 fewer jobs, reduced economic output (by almost $2.6 billion), and a lower gross domestic product.

Despite these experiences with selling geodata, many participants reported that the appearance of bringing in revenue, even if it was but a trickle of the cost of GIS operations, created a very positive impression with highest-level budget approvers. A revenue stream, even perhaps at the expense of more valuable staff time, fostered credibility and protection from GIS staffing cuts.

## Capturing the Value of Geodata

Through deliberations among the ODC project participants, agreement was attained on several competing principles. We agreed that public information is a necessary component of open government and the democratic process. We also agreed that public agencies need funding to develop, maintain, and distribute their geodata. Importantly, the participants recognized that the value of geospatial data is realized through its usage, and that widespread distribution and use of public geodata benefits the entire jurisdiction as well as the government agency responsible for that geodata.

The key to resolving the "free data versus fee data" controversy, therefore, will be found by capturing the value of the geodata, its value both to the public and to the governmental custodian. Because GIS data creates more value the more it is used, capturing that value will motivate local government to distribute it as widely and as inexpensively as possible. How, then, can local government—the creator, maintainer, and "steward" of local geodata—actually "capture" that value?

While sharing their experiences and intentions for data policy, the ODC participants uncovered ten productive methods of supporting their GIS operations that do not include selling public geodata. They are organized into four categories:

- Revenue produced from existing taxes
- Revenue produced from service fees
- Cost savings
- Internal budgeting

These methods, which are explained in the following section, do not include the cost savings accrued through multiagency, cost-sharing, or data-sharing cooperation. While such actions result in hugely significant savings in the cost of creating and maintaining geodata, they do not derive from the actual usage of the geodata.

## Revenue Produced from Existing Taxes

1. Allocate a portion of the increased revenues that come from increased economic activity and new economic development to GIS operations.

   Cities and counties know that information about available land, buildings, zoning, transportation, environmental conditions, support facilities, ownership, and property value is critical to attract investment for economic development. Many have discovered that putting their data on the Web has captured interest and activity from investors as far away as Asia and Europe, because their local information is as close as the nearest computer.

   - The cities of Ontario, Vallejo, San Francisco, Rancho Cucamonga, Tucson, and Honolulu report increased economic activity after creating Web-based economic development applications that enable anyone to query their data for property with specific qualities of interest.[9]
     - Vallejo reduced its retail vacancy rate by 46 percent.
     - Rancho Cucamonga reduced its retail vacancy rate by 44 percent.
     - Tucson reports a return on investment of $400,000 in the first two years.
   - The city of Carson, California, observes that it receives more money from taxes after the opening of a new 7-11 store than it would from data sales.
   - In Ohio, the cities of Cincinnati, Cleveland, and Columbus made their data freely available after a new auto factory opened in a competing city that freely provided its information. The company completed its on-site review in just one day because the data had been easily acquired and preanalyzed.

   Increased economic development generates jobs, sales tax, property tax, and many other revenues for local government. Currently, the increased revenues go into the general fund. A portion of these increased revenues could be and should be allocated to maintaining the geodata operations that helped bring the new economic development to town. Accounting procedures could be modified to include a heuristic estimate of the percentage of new revenues that can be attributed to the availability of accurate, up-to-date geospatial data, and that portion could be specifically allocated to maintain GIS operations.

2. Allocate a portion of the increased revenues that have come from a more accurate determination of facility locations for taxation purposes, or from the geoanalysis of undertaxed property assessments, to GIS operations. (Bounty fee)

   GIS data and geoprocessing enable the precise determination of which special districts, city, and county contain facilities such as cell phone towers, point-of-sale businesses, and property parcels. Most jurisdictions have complex and frequently changing boundary lines, and each jurisdictional boundary may have a different tax rate. GIS-based analysis can determine location much more accurately than postal address, and results in significant revenue increases, for example:

   - Orange County, Florida, increased revenues from cellular telephone franchise fees by using GIS to determine which cell towers were in its tax jurisdiction. The postal address put some towers in other counties. It now collects an additional $650,000 every year.
   - Los Angeles County recovered $3 million in sales tax after geoanalyzing the location of point-of-sale businesses that were mislocated by their postal address. By performing the geoanalysis in-house, it saved an additional $375,000 a year that had been slated for external data analysis services.
   - Using GIS to identify properties with certain characteristics and proximity to Disney World, Orange County identified condominium owners who were renting their units informally for tourist accommodations without paying the required resort tax. Tax revenues were increased by $700,000 in a single year, and continue to come in at the new level every year.

     More accurate assessment and collection of existing taxes increase the revenue to local government without raising the tax rate. It makes current taxation more fair to all the citizens. Usually, the increased tax revenues go into the general fund. A portion of these increased revenues could be and should be allocated to maintaining the geodata operations that helped identify previously undertaxed properties. Accounting procedures could be modified to assign a percentage of such increased tax revenues specifically to maintaining GIS data and operations.

3. Allocate revenues from specific taxes and fees for services that rely on the collection and maintenance of accurate location-based information.

   Land-records maintenance and management relies heavily on accurate geodata. GIS greatly improves the efficiency of land-records operations, and if built as an enterprise resource, the investment in GIS brings benefits to many other operations as well.

   - California's so-called Section 818 program allowed county governments to allocate property tax and recording fees to the "modernization of land records." The San Mateo County Assessor saw this as an opportunity to develop a consistent, countywide GIS-based parcel map to make tax assessment more efficient. These funds, approximately $800,000 over three years, substantially financed development of the county's GIS.

- Chester County, Pennsylvania, instituted a $5-per-parcel property transfer fee to create a Uniform Parcel Identifier that became the foundation of the county's GIS basemap and its emergency dispatch system. The fee is but a tiny part of a typical property owner's transfer costs, and has not engendered any political opposition. It has raised $696,000 for GIS operations in 2002.

4. Allocate a portion of the funding for specific programs to GIS data collection and maintenance.

   Homeland security and emergency preparedness are the current focus of special-funding programs from federal and state sources (i.e., taxes), as had been flood control and sewer improvement programs prior to 9/11. All these programs require accurate and up-to-date basemaps that not only show local facilities, but also show relationships to nearby facilities and environments, such as watersheds, infrastructure, and public buildings.

   While a small portion of these programs typically is allocated to "data collection," a slight increase in the investment by farsighted officials has produced an enterprise-wide GIS base for many local governments.

   - Somerset County, New Jersey, Planning Division received grants for Smart Growth and Strategic Planning, which required using GIS data to support its model forecasting. Some of those grant monies were used to develop data attributes for its enterprisewide GIS.
   - Alameda County, California, used National Pollutant Discharge Elimination System (NPDES) storm-drain pollution-control funds to map the storm drainage and watershed system, which essentially built a countywide GIS basemap.

   Performance of these programs and projects could and should include financial support for ongoing geodata maintenance and GIS applications that increase their efficiency.

## Revenue Produced from Service Fees

5. Usage fees and subscription fees for customer-specific online applications can help support GIS operations.
   - Six Southern California counties license their geodata to Digital Map Products[10] that redistributes it via Web-based query applications and data sales to subscribers. The counties receive a substantial portion of the subscription revenues. Other companies are similarly licensed as well.
   - The city of Carson is developing an online property locator application for a 15-city consortium, to be maintained on a subscription-fee basis by Realtors®.

6. Sell geoprocessing and management services to other agencies.

   The city of Carson, California, has developed GIS capabilities far in advance of many of its neighboring cities. It is now proposing to manage a data-maintenance consortium for these cities, saving them the time and the cost of developing their own in-house expertise, and enabling each city to focus its GIS resources on its own specific projects. This service will help support Carson's GIS department.

Cost Savings

7. Allocate a portion of the increased savings that come from geospatial analysis of public service programs to support the GIS department's geodata and operations.
   - Los Angeles County's court system started saving $300,000 per year in mileage payment to jurors and witnesses after using GIS to calculate the most direct distance.
   - Another county's Health and Human Services department began using GIS to cross-check the location of recipients of health and welfare services and eliminated 7 percent duplicate or fraudulent addresses in the first year.
   - The city of Visalia used GIS to plan the location of new fire stations based on specific requirements for response time to populated areas. The analysis enabled it to reduce the number of planned fire stations while also reducing the overall response time. In addition to the cost saving to the city, the fire insurance cost to many of its citizens was reduced.

   The money saved by using GIS did not go to these agencies' GIS departments. It was used in other ways by the services departments, or it remained in the general fund to be spent for other purposes. Internal accounting procedures should be changed to identify these savings with GIS so as to allocate a portion towards the ongoing maintenance and operation of this valuable geodata.

8. Allocate a portion of the increased savings that come from coordinated management of public works infrastructure and facilities to GIS operations and data maintenance.
   - San Jose uses GIS to coordinate the priority assigned to maintenance projects for sewer, water, storm drains, and streets. Preventing multiple digs and repairs on the same street is saving 5 percent of its capital improvement budget—approximately $700,000 per year.
   - Another city canceled the planned purchase of an $85,000 street-sweeping machine after using GIS to route its existing machines more efficiently.
   - Palo Alto used GIS with its high-accuracy elevation data to reconfigure flood-risk boundaries. Some citizens received the benefit of lower flood insurance costs. Others, who were required to modify the construction of their homes, were saved from ruin when two 100-year floods occurred in a three-year period.

   The money saved by using GIS did not go to these agencies' GIS departments. Internal accounting procedures should be changed to tag these savings to GIS so as to allocate a portion towards supporting its ongoing operation.

### Internal Budgeting

9. Allocate a portion of each department's operating budget to support GIS services.
   - Ventura County has implemented an Internal Service Fund practice in which each of the county's 32 agencies pays for a negotiated level of GIS services, based on their perceived benefit to the agency. The Geographic Information Officer meets regularly with departmental managers to assess their satisfaction and need for basemap updates, technical support, applications, map production projects, and Web-based services that support their duties and functions. The departmental managers have been willing to pay the GIS department for the value they perceive from these services, which now accounts for 80 percent of the costs of the county's GIS operation—$800,000.
   - The water department in the city of Lomita has funded nearly the entire GIS operation from its need to create inventory maps. It reports that the benefits from "simple" GIS applications, such as water valve closure notification, have been worth the investment.
   - The cities of Anaheim and Palo Alto also funded their GIS operations from utility rates. The benefit from current and accurate basemaps for maintaining infrastructure inventory more than balances the cost of the GIS, while also being used for nonutility municipal functions. A relatively insignificant part of the utility rate structure, GIS support has more political acceptance than if it were a municipal tax.

   There are many success stories in which one or two departments carry most of the GIS cost for the entire city, or (as in the case of Ventura County) all the departments willingly contribute their fair share to maintain the GIS.

10. Allocate a portion of the agency's general fund to enterprisewide GIS services.

    In some organizations, departmental financing of GIS is contentious. Consensus exists that the agency needs GIS, but a "don't take it from my budget" attitude prevails. Strong leadership from top management can resolve this frustration by making GIS an enterprisewide responsibility, to be budgeted before departments fight over their own slice of the pie.
    - Pima County, Arizona, started its GIS development with a $5 million capital-improvement bond, thereby building an enterprise system as a coordinated, master-planned effort.
    - The cities of Fremont, Palo Alto, Roseville, and Visalia developed, and continue to maintain, their GIS operations as enterprisewide services, supported as line items from the general fund.

## The Value Is in the Usage, not in the Data

Local governments are seeing more and more financial benefits accrue from using GIS data, both to their organizations and to the citizens in their jurisdictions. As accounting mechanisms are put in place to allocate a portion of those benefits back toward the ongoing support of GIS operations and the maintenance of their geodata assets, fewer agencies will need to sell their data. There will be fewer access barriers between the public and the government's public information. The following actions are recommended in order to achieve this objective:

1. Recognize that the value of geodata is realized through its usage. The more it is distributed, the more it is used. The more usage, the more value.
2. Change governmental accounting practices to identify and measure the revenues that come from GIS-based information and analysis.
3. Change governmental accounting practices to identify and measure the savings that result from NOT spending money, due to geospatial analysis.
4. Allocate a portion of these benefits back to support the GIS operations that made them possible.

One ODC participant, a stalwart advocate of selling his county's data to users who were not taxpayers or citizens of his county, asked during our deliberations, "Why should a national map company have free access to our data when it sells digital tourist maps for profit?"

"And when those tourists use our maps to guide their vacation," the data reseller answered, "where do they go to spend their money?"

## Summary and Next Steps

Public information is a necessary component of open government and the democratic process. It helps us keep our government accountable. Concurrently, public agencies need funding to develop, maintain, and distribute their geodata. Attempts by public agencies to raise funding through the sale of geodata have not been financially successful, and have created impediments to the free accessibility to their geodata.

The key to resolving this dilemma will be found by measuring the value of the geodata, as it is used by both the general public and its governmental (public agency) custodian, and then allocating some part of that value to the agency's department that creates and maintains the public geodata. New revenues from existing taxes generally go directly into the agency's general fund; therefore, an accounting procedure must be developed to tag (identify) those revenues. Cost savings from the use of geodata present an even more difficult problem of identification because allocated money that does not need to be spent on the original purpose is usually spent on another worthwhile purpose instead. The regular assessment and reporting of geodata-assisted savings by public agency operational departments may be the most direct method of tagging such cost savings.

The ODC project is continuing its work by explaining the model data distribution policy to local government agencies and assisting them to use the model to define, or redefine, their policies. The ODC project is also organizing another series of working groups to formulate recommendations for modifying governmental accounting methods to enable the benefits of geodata usage to be tracked more thoroughly. Readers who are interested in participating and want to contribute support to the ODC's ongoing efforts are encouraged to contact http://www.OpenDataConsortium.org.

## Acknowledgments

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## About the Author

**Bruce Joffe,** founder of GIS Consultants in Oakland, California, has provided GIS implementation planning and management assistance to local governments and utilities for more than 26 years. He organized the Open Data Consortium project, http://www.OpenDataConsortium.org, to resolve the many contentious issues surrounding geodata distribution, through consensus-building communication among government, business, and academia. GIS Consultants continues assisting public agencies to develop their geodata distribution policies.

Joffe has a Master's degree in City Planning and a Master's degree in Architecture, both from M.I.T. He is a Certified GIS Professional, a past member (and Secretary) of the URISA Board of Directors, past Chair of the California Geographic Information Association, and continuing board member of the Bay Area Automated Mapping Association, the California Spatial Reference Center, and the GreenInfo Network.

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Sears, Gary. "Geospatial Data Policy Study" (Ottawa, Ontario, Canada: KPMG Consulting, Inc., March 28, 2001).

Where Does the Buck Stop? (Quebec, Canada: The Blair Consulting Group and Canadian Manufacturers and Exporters, January 1999).

## Additional References

A list of links to data policy articles and some data distribution Websites is maintained on the Open Data Consortium Website, at http://www.OpenDataConsortium.org; click on "News/Links" and then click on "Web Links." Links to local government data policies are at http://www.OpenDataConsortium.org; click on "Information Repository."

The following article links relate to GIS data policy:

Link to most state and federal statutes: http://www.law.cornell.edu/statutes.html.

Online compendium of state open record laws: http://www.rcfp.org/cgi-local/tapping/index.cgi.

Adelaide City Council: http://www.adelaidecitycouncil.com/council/publications/Policies/Spatial_Data_Policy.pdf;

http://www.adelaide.sa.gov.au/council/publications/Policies/Spatial_Data_Policy.pdf.

ANZLIC: http://www.anzlic.org.au/policies.html.

Florida National Areas Inventory: http://www.fnai.org/PDF/GIS_policy.pdf.

Office of Spatial Data Management: http://www.osdm.gov.au/osdm/policy.html.

West Virginia Department of Environmental Protection data policy: http://129.71.240.42/gps/geospatial.html.

## Additional Articles Researched by Amirali Shaerzade

Boulder County CO pricing policy: http://www.co.boulder.co.us/gis/cost_recovery/cost_pricing.htm.
Canadian data policy study by KPMG: http://cgdi.gc.ca/english/supportive/KPMG/KPMG.pdf.
Critique of Canadian data sales policy in Geo Place magazine: http://www.geoplace.com/gw/1999/0699/699can.asp.
Digital Earth Site policy study: http://www.digitalearth.ca/pdf/DE_A_227.PDF.
Durham NC data sales policy: http://www.ci.durham.nc.us/forms/gis_commercial_data_policy.pdf.
Netherlands study of data policies: http://wwwlmu.jrc.it/Workshops/8ec-gis/cd/papers/3_p_uw.pdf.
New York State Office for Technology policy recommendations: http://www.oft.state.ny.us/policy/tp_976.htm.
Revisions to U.S. A-16 policy in GIS Monitor: http://www.gis-monitor.com/news/newsletter/archive/082902.php.
University of Maine research agenda for spatial databases: http://www.spatial.maine.edu/tempe/onsrud_2.html.
West Virginia Department of Environmental Protection data policy: http://129.71.240.42/gps/geospatial.html.

## Footnotes

1 For purposes of this discussion, ““free”” or ““no-cost”” data means data provided at no more than the direct cost of distribution (e.g., staff time and materials used to reproduce the data from the agency”s existing GIS database system).

2 Two of the author”s summaries of the issue may be found at “To:
To Sell or Not to Sell: GIS”s Budgetary Dilemma,.” GeoInfo Systems magazine, (September 1995). , Advanstar Communications, Eugene, OR. (Also available at http://www.opendataconsortium.org/article_gis_data_sales_dilemma.htm htm.)

“GIS Data Sharing: Public Policy Supports and Impediments.” Presented with Patrick DeTemple, Michael Stevens, Scott McAfee, and Eric Waldman. ESRI International User Conference,. July, 1999.

3 Prominent reasons for local governments to sell geodata include:

- Defense by cost-sharing consortia against ““free riders””
- Feeling a proprietary value after the long development process
- Desire for ““control”” of ““our”” data
- Resistance to profiteer windfalls from public investment. Interestingly, taxpayer concerns lead to two, opposing arguments: “Taxpayers already paid for the GIS, they shouldn’t have to buy it again,” or “Taxpayer investment should be reimbursed.”

Interestingly, taxpayer concerns lead to two, opposing arguments:

- “Taxpayers already paid for the GIS, they shouldn’t have to buy it again,” or
- “Taxpayer investment should be reimbursed”

4 More information about the ODC project, as well as a review copy of the model Data Distribution Policy document, may be obtained from the Website, http://www.OpenDataConsortium.org .

Other critical data distribution issues include: purpose, legal authority, data recipients and distribution methods, copyright and licensing, disclaimers, privacy and security restrictions, data update and metadata maintenance requirements.

5 Of 264 people invited to participate, 117 reviewed the final data distribution model policy developed by 67 active participants who work in federal (4), state (6), and local (32) government;, private enterprises (21); and universities (4). The full range of opinions were represented, from ““free data”” to ““full cost recovery through sales.””

6 Gary Sears, ““Geospatial Data Policy Study.”” by Garry Sears, (Ottawa, Ontario, Canada: KPMG Consulting, Inc., Ottawa, Ontario, Canada, March 28, 2001), 18. p. 18

7 Ibid., p. 12.

8 ““Where Does the Buck Stop?””, (Quebec, Canada: The Blair Consulting Group and Canadian Manufacturers and Exporters,. Quebec, Canada, January 1999).

9 See http://www.gisplanning.com.

10 See http://www.digmap.com.

# Emergent Commercial and Organizational Charging Strategies for Geostatistical Data: Experiences Disseminating United Kingdom Official Labor Market Information

*Michael Blakemore and Sinclair Sutherland*

***Abstract:*** *A 15-year experience of developing and marketing an online geostatistical database of United Kingdom official statistics is used to evaluate the impact of charging strategies for geographical information and services, and to explore the relative cost benefits of charging and not charging for information. The experience of charging is set first within the policy frameworks for access to Public Sector Information (PSI) and conceptual frameworks for information charging. The historical development of the system and its user market is then detailed in the context of changing technologies, emerging user requirements, and government policy shifts. Conceptual frameworks from the strategy literature are then used to identify the emerging charging strategies.*

## Introduction and Context

This paper investigates some of the paradoxes of charging for geographic information (GI). We all want a "free lunch," and would prefer that someone else pay. If the free lunch is not to our liking, however, what recourse do we have with the restaurant, for the standard capitalist society reaction is to withhold all or part of the payment? If the restaurant is government-funded, and our taxes have paid for the physical infrastructure and training and salaries of the staff, should we expect the lunch to be free to us as taxpayers? If the same price is charged for all lunches in the restaurant, how does the chef find the resources to experiment with new recipes and foods, and does the restaurant have to charge the same flat price if a more expensive recipe is created?

GI is more than a recipe—it often is promoted as the fundamental ingredients of most recipes. Many of the studies over the past decade argue that its role in the functioning of society is almost ubiquitous—the regularly cited statistic is that GI is used in 70 percent of all governmental information applications, and that it contributes significant value adding to an economy (Clinton 1994; Coopers & Lybrand 1999; Craglia and Masser 1997; CSDC 2001; Europe 1998; KPMG 2001; OXERA 1999; PIRA 2000). This paper will review access and charging experience over 15 years in a UK online labor market dissemination service that provides detailed access to official UK labor market geostatistics. A key aim of the paper is to evaluate the impact of pricing of data on usage, to place that within the frameworks provided by the literature, and to extend the discussion from access (i.e., volume extraction of data) given price or no price to the consideration of effective and efficient usage, the overhead costs of user support, and the extent to which policy contexts and shifts themselves influence charging, access, and use. There is a range of conceptual frameworks within which the pricing of information can be structured, although it must be stressed that these are not mutually exclusive frameworks:

- Rights. The basis here is that information is fundamental for the functioning of a democracy (Article 19 2001) and should be regarded as a human right (Ostergard 1999); the taxpayers have already funded the collection of information and therefore GI should be readily available within an "information commons" (Onsrud 1998). An information commons may also be constructed for altruistic reasons such as international development, as with the free provision of research literature (Anon. 2004). Even with an information commons there can be, however, the potential for commercial sales, as was experienced by the U.S. Government 9/11 Report—while freely available on the World Wide Web (the Web), it sold significant copies commercially (Glasner 2004). Even Freedom of Information is freedom with a cost restriction, and new legislation in the UK will focus on a fee policy where "There will be no charge for information that costs public bodies less than £450 to produce. And for central government, the cost ceiling will be set at £600" (Falconer 2004).
- Regulatory interventions—integration and agglomeration. Here the existence of government GI is not enough, for it is produced in disparate formats, contexts, and geographies. There are significant overhead costs in making GI useful, and Government intervenes to provide a compulsory mandate, or a collaborative framework, within which GI can be organized and delivered to users (Europe 2003). The broad context here is the recent promotion of information infrastructures (Europe 2004).
- Information society—inclusions and exclusions. This goes beyond rights, supply, and even infrastructures, to the role of information in globalization and the postindustrial society and the uneven distribution of knowledge spatially and structurally within society (Bonfadelli 2002). Delivering integrated and structured GI is of little use unless the recipients have the skills, knowledge, and technological contexts (Garnham 2000) to interpret and add value to the

information. Contexts here are universal service, government interventions to overcome digital divides, and the emphasis on "lifelong learning" that stresses the responsibility of citizens to keep their skills up-to-date as they experience many jobs in a turbulent economy.

- Governmental risk management—charging for access and reuse. Here we encounter the practices such as marginal cost charging and cost recovery. A primary motivation for Government here is to move away from potentially accumulating costs that arise from an accretion over time of centrally funded initiatives to provide GI. Existing initiatives can only continue to be funded if taxation income is adequate to meet the demands of supply, update, and innovation. However, there is no causal link between tax income and societal demand for GI, and in the postindustrial society with a reducing direct tax base and increasing demands for social and health services, Government needs to reduce as many funding commitments as possible. Hence the focus here on "user pays," whether for using roads or public sector information (PSI) such as topographic mapping.
- Capacity management. Can GI be provided free at the point of use and still meet the demands of the "market"? In the context of USA Federal Mapping, this clearly is not assured, as the "Weaving the National Map" review identified, noting the significantly outdated GI within copyright-free, free-at-the-point-of-use federal mapping (NRC 2003). In a review of these issues, Longhorn and Blakemore conclude that in the context of stretched supply chains and complex reuse of GI, charging of some sort enables essential capacity management (2004). Furthermore, the experience of information markets is that the exchange value (sale value) of information is less than the use value (value adding), and that use value is both dispersed and complex, placing significant demands on data suppliers to innovate ever more quickly in an environment of "stretched productive relations" (Lash 2002, 207).
- Profit. GI here is simply a business, or a means to a business goal, but in reality it can be conceptualized as capacity management that generates a financial surplus that is not reinvested in product development. The commercial geodemographics sector is the archetypal commercial GI with direct sales dominating the revenue stream, but the widespread availability of Web mapping services such as Multimap and Mapquest also show the complex strategic interrelationship in providing some GI free as a means of marketing other services and encouraging users to spend on those services. News media sites have, as Schiff notes, focused revenue generation around eight themes: "1. Advertising revenue; 2. Online traffic; 3. Infant industry profits and stock values; 4. Digital content delivery; 5. Continuous breaking news; 6. Information retrieval and storage; 7. Portal conduit; and 8. Interactive networking" (2003). Themes two and four to six are dominantly direct income, whereas the others are from indirect funding or from add-on services.
- Business strategy and competitive forces. This is a turbulent extension of profit, where pricing strategies are reflexive in the context of competition from other GI services, combined with the uncertainties of globalization and information markets. The recent experiences of the mass media newspapers illustrate this process, where in the late 1990s there was a rush to build online Websites that were richly populated with content and archives, but which were largely free to use. The assumption of most media companies was that the cost of maintaining the sites would be met by advertising revenues, an assumption that was not met, and the information consumption strategies of new users also would be changing (Penenberg 2004). Competition between major market players also results in complex pricing strategies, such as that between Hotmail and Googlemail—Microsoft promoting charging in 2003, and retreating from aggressive pricing in 2004 with the advent of the competitive e-mail service from Google (Asaravala 2004).
- Pricing through enforced absorption of costs by the consumer. Within this category spam e-mails are an example of information that is forced onto a consumer, and where the cost of avoiding it or removing it requires consumer investment in software tools or in his or her own time (BBC 2003). This clearly is a highly unlikely strategy for PSI.

## Nomis, the Policy and Commercial Contexts

These frameworks provide some context within which to evaluate Nomis[1], the official labor market dissemination database of UK National Statistics. Nomis is an online database comprising, mid-2004, some 550 gigabytes of geographically disaggregated time series of data on unemployment, employment, job vacancies, and demographics. Nomis disseminates both presupplied aggregate data and also processes some anonymized microdata within customized software for the real-time creation of aggregate data series. The aggregate series are then restructured into a consistent geographical base, validated, documented, and put online for dissemination purposes. The service has been in existence since the late 1970s and has functioned as an operational official system for disseminating UK labor market data since 1983. During this period, the system has experienced a highly turbulent period in governmental attitudes toward the role of data within policy, economy, and society.

The Nomis service has "lived through" mainframe, distributed network, and Internet technologies, and through major UK political and policy shifts in charging and dissemination strategies, in particular when direct user charges were abolished through a policy change in 2000. Before 2000, Nomis needed to find customer strategies that cope with fluctuating user communities where, over time, it became increasingly difficult, for example, to differentiate between academic research that can be commodified as consultancy, and commercial research and development activities that have policy and research roles. Furthermore, charging models needed to provide a reasonable continuity of overall user payment levels, while often having to change the fundamental basis of charging as a result of changes in IT platform and associated software capabilities.

For most of its existence, Nomis has applied direct charges to users, but within a charging environment of government agency policy on the nature and levels of costs to be recovered. The charging policy has emerged during a period of considerable turbulence over the acceptability of charging for PSI. Charges may be indirectly levied, through the provision of taxation income to fund statistical agencies—that is as much as is levied by the U.S. federal statistical system (Wattenberg 1976)—or they can be levied directly by setting an up-front price to information. Controversy usually emerges once direct charges are levied on the supply of the data to users of data, whether it is all users or only some users. Charging may be set only to recover the onward costs of data distribution (Van Velzen 2003, 9), but that method provides no income stream to reinvest in new and improved PSI.

Cost recovery, where the full operating costs of the agency in collecting, creating, and disseminating the data are charged to users, in effect recovers the "large fixed and sunk costs" of information products (Varian 1996). Semicommercial pricing can involve "a government-owned public limited company" of the form proposed by the UK Government for the Ordnance Survey mapping agency (Survey 2003; Survey 2004), where income beyond the agency cost recovery can be retained. A further option is to transform an agency into a commercially tendered agency or privatized profit-driven service (BBC 2001; Dembeck 2000; Webb 2001). In all of these forms, however, there is a substantive difference between public sector and commercial approaches to charging. In PSI charging, there usually is some acknowledgment to a universal service requirement (Muir and Oppenheim 2002) that mandates data must be collected throughout the nation to the same standards irrespective of whether the resulting data will be used. Second, there usually is a commitment to product stability that acknowledges the need for analysis over time that then informs policy development.

The policy regarding the imposition of costs is a crucial influence on the actual level of costs, but it is not the only one. Agency dissemination and marketing strategies, and the changing nature of technologies also exert strong influence. For example, a policy that mandates no end-user costs can impose significant resource overheads on an agency unless specific dissemination resources are provided, and it is not enough to argue just that Internet dissemination incurs little replication costs (Shapiro and Varian 1999, 21), because the costs of data maintenance and metadata creation are significant. Furthermore, a shift in policy can be internally generated within government, be externally stimulated as in the case of the destabilization of the dominance of the Encyclopaedia Britannica in the commercial encyclopedia market in the late 1990s, and also can be exacerbated by a failure of corporate ability to confront rapid change (Evans and Wurster 2000, 5).

Radical changes to computing architectures can have dramatic implications for information services. Britannica's historical dominance in the encyclopedia market was based on the high sunk-cost investment required to reach its levels of coverage, consistency, accuracy, and market prestige. Microsoft's Encarta product was, however, launched on the basis of addressing a lower-cost global mass market that generated large revenues that would then go into sunk-cost investment (Shapiro and Varian 1999). The low start-up and distribution costs of the Internet had by then encouraged new information sources to compete with the established encyclopedias (Frauenfelder 2000). Britannica attempted to maintain its status by reducing costs until, in 1999, it went free online with the business model being the characteristic one of that time—advertising revenue would underwrite the costs. Apart from being a single income–source business plan, it did not foresee corporate embarrassment when the demand from nonpaying customers seriously exceeded IT capacity (Raspberry 1999). When the advertising model collapsed in 2000, Britannica attempted coventuring strategies with other portals and distributors (Scasny 2001), reduced the cost base by sacking staff (Anon. 2001), and by March 2001 it had gone almost full circle by reintroducing fees (DiSabatino 2001). Only the first few sentences of an entry were still free, and there was a charge to view the full entry. In July 2001. the cost of online access was set at $5 a month, or $50 a year (Bellandi 2001). In December 2001, a new 32-volume paper edition was being promoted, so paper-based information is hardly moribund (Rynkiewicz 2001). During 2003, new forms of encyclopedias were emerging, such as Wikipedia (Mayfield 2003), that added further turbulence to the previously stable encyclopedia market.

A policy requirement to recover costs can lead to a focus on those customers who have to use the data, with the costs divided among them. This was the case with New Zealand in the late 1980s when the Government imposed an aggressive cost-recovery mandate on the mapping agency (DOSLI) and in "1989 the number of sales was only 60 percent of 1984, although income was 25 percent greater in real terms, indicating that a smaller number of users tolerated (or did they simply have no alternative?) higher prices" (Rhind 1992, 26). A policy that mandates the widest possible dissemination can therefore lead to a more sectoral approach to cost setting, or the need for subsidies.

Policy shifts can force quantum shifts in charging strategies that perturb existing business models. New Zealand national mapping (LINZ) went from a public-service orientation to a marketing orientation in the 1990s, only to return through a further policy shift when the Minister, John Luxton, admitted that "The copyright charge meant that very few organizations could afford to use the data. Access to affordable topographic data will greatly assist New Zealand's participation in the information age" (Anon. 1999). Nevertheless, that did not mean that data would be free in any format, because the strategy for LINZ now would be to "only supply raw data. Private sector data resellers and major users would need to reprocess this into formats required by the various geographic information systems" (Robson 2000). However, even the 1999 policy shift itself was shifted in 2003 with the announcement that fees are to be revised "in the alignment of transaction charges with the real costs involved in providing the services" (LINZ 2003).

The UK Thatcher Government in 1981 articulated an ideologically driven charging approach (HMSO 1981), known as the "Rayner doctrine," of full cost recovery (Hoinville and Smith 1982), a doctrine that was only changed towards a softer public-need approach in 1992 (Treasury 1992). Charging policy here was mostly about expanding the capacity of an agency to cope with changes in market demand, and to reprioritize information activities without constant recourse to renegotiating central Treasury budgets. This has become seriously evident in the state of USA Federal Mapping, provided by the U.S. Geological Survey (USGS) through central funding, with no copyright containment and no user charges. The lack of financial flexibility has seriously impaired product development and:

As USGS' priorities shifted toward scientific research, however, its mapping program languished. As a result, while towns went boom and bust and landmarks such as airports, buildings, and parks spread and dwindled, the topo maps lagged further and further behind the landscape they represented. Today, the maps are only sporadically updated, and some are 57 years old (Brown 2002).

A new "National Map" strategy aims to work on a partnership basis with "updated information gathered from state and local authorities, then integrated into a new, up-to-date map series" (NRC 2003). Even the U.S. Bureau of the Census aims to create "Geographic Partnerships" with state and local government bodies in a strategy to build capacity for the urgent maintenance of basic geographical data for census use (Census 2003). Consequently, the discourse of data charging has a complex language. The term free does not mean free in any user-demanded format, and New Zealand demonstrates that "free" often tends to relate to "raw" or basically formatted data. There is even a potential debate as to whether government agencies are the best suited to construct information dissemination platforms, as in the case of the U.S. federal system where "money, technology, and competition, combined with an inconsistent Congress and the initiatives of individual agencies . . . lead to inconsistency, inefficiency, or duplication of effort" (Cocklin 1998, 409).

To overcome organizational friction and inefficiency, mandates to share and integrate data exist in the context of information infrastructure strategy, such as in U.S. Circular No. A-16 (Revised) where "the Circular affirms and describes the National Spatial Data Infrastructure (NSDI) as the technology, policies, standards, human resources, and related activities necessary to acquire, process, distribute, use, maintain, and preserve spatial data" (OMB 2002). From these instances, an observation can be made that increasing levels of "free" access can be generated by efficiency gains, the mantra being "Creating a Government that Works Better and Costs Less" (Gore 1993). Cost reduction and a flexible and reduced civil service (Flynn 1999) was at the heart of reinventing government initiatives during the 1990s, in the United States coordinated by the Reinventing Government task force (GAO 2000), and in the UK was labeled as "modernizing government" (Cabinet 1999), although the process of modernization was not effectively handled in the face of competitive departmental behavior between "ministers and mandarins" (Kavanagh and Richards 2001).

Even an information product set at a zero cost, therefore, has no definitive stability unless the funding/income stream is stable and assured for a medium to long term. A product that goes from free to fee also is highly susceptible to the uncertainties of demand: while the "distribution" costs across the Internet are minimal, the server-resourcing costs have a direct relationship to volume of demand, hence the popularity of denial-of-service hacking mechanisms to bring down an Internet site (Cabinet 2001, 20). The Internet and the expected flourishing online advertising market (Gallaugher, Auger, and BarNir 2001) led to a rich vein of free content until 2001, much of it being online archives of the mass media. Reducing income streams and increasing archival maintenance costs led to rapid returns to charging for access to information (Smith 2002), with The New York Times Digital Chief Executive Officer Martin Nisenholtz quoted as saying, "We shouldn't be talking about free versus paid content. It's over, end of debate" (Pruitt 2002). Similar endings of free content have occurred for the Atlantic Monthly (Murphy 2004) and the Far Eastern Economic Review (Wern 2004), and even the UK Guardian site that strongly retains free content is looking to raise extra revenue through premium services (Bell 2004). It is debatable whether these experiences underpin the argument of Lash that use value is more significant than exchange/sale value of basic data (Lash 2002). In part it does, but in part it also shows how information sites have to react rapidly and unexpectedly to uncertain market developments.

Using the experiences of Nomis, this paper will explore whether sudden adverse changes in charging policy suppress levels of use and therefore diminish the potential use of data in all sectors, leading to a reduction in potential revenue for the government agency. Conversely, does the abolition of charges stimulate a previously suppressed data market?

## Nomis, Its Recent History and the Charging Contexts

The Nomis system has been "owned" by a succession of UK government agencies. It was originally developed in the early 1980s for the Manpower Services Commission (MSC). MSC was later incorporated into the Employment Department (Blakemore 1991), which itself was closed (through merger) in 1996, leading to the acquisition of Nomis by the Central Statistical Office. The CSO then merged with the Office for Population Censuses and Surveys to create the Office for National Statistics. The system was resourced historically (prior to 1986) as a fully funded service where income was used to build development capacity beyond the core grant from MSC. From 1986 to 2000, the contractual emphasis was much more on open competition to develop and run a service that was funded primarily for government agency needs. Therefore, income was needed to underwrite the additional costs of delivering the service to other user sectors. Within that period, a more direct mandate to cost-recover (through apportioning nongovernment income) was required, with the direct usage costs (beyond system development) to government users being zero.

During the period 1986 to 2000, the challenge to Nomis was to develop charging strategies that both generated income and also maximized the use of the database. The charging strategies were contingent not only on the ability of users to pay, but also were strongly influenced by the technological platforms on which the system was designed and delivered. These consist of three major periods of mainframe, to distributed Unix servers, and recently to a Web-delivered service[2]. Each of these transitions has placed significant demands on developing new charging regimes that were acceptable to users, that as far as possible were cost-neutral or even delivered cost reductions (on the assumption that efficiency gains should be evident with new developments), and did not perturb the overall income stream. The latter point was important because the contract did not allow risk sharing. If a new charging regime was implemented that led to income reductions, the contractor would have to bear the impact, while any increase in income would be shared.

The early years (the beginning of the 1980s) of academic charging were largely "seat-of-the-pants" for no other existing charging models were available for a mainframe service accessed through 300-baud acoustic modems. The charges were low enough to encourage use by a cohort of about 20 academic research groups active in UK local labor market research. These researchers made a conscious decision to pay-for-use on the basis of the speed, integration, and customer support provided by Nomis. They could, as others did, acquire most of the data held on Nomis free of charge from the University of Essex Data Archive, with limited data customization, documentation, and support[3]. On that basis, academic researchers made conscious decisions about the cost assigned to their own time. They could pay money to acquire data from Nomis or incur time costs developing their own software, etc.

Nevertheless, the early experiences with the reaction to charges from academic researchers indicated a number of key considerations. First, there was a widespread inability (coupled often with a reluctance in principle) to pay for data by academics. In part, this is a view held that data collected using taxpayer revenues should not then be recharged to the taxpayer. More realistically, the inability to pay lies in the fact that academic salaries are largely "written-off" investments. Few academics cost their time by the hour when carrying out a task; therefore, the cost-benefit assessment balancing off purchase of a customized service versus self-developed software is seldom carried out. Indeed, the way in which research is funded, with funds allocated for the purchase of staff time such as research assistants, actually tends to encourage localized development of software rather than purchase of customized data services.

Second, much research and teaching requires significant experimentation with data, and the implication of this is a need to have the widest possible access to data. Third, there are resource implications in supporting users of statistical data, particularly in training, documentation, metadata, and support services (Blakemore and McKeever 2001). Constructing a database is only one, relatively modest component of a data service. Simply making data available in the original formats from the data owners does not necessarily inform potential researchers. They are best served through advice on methodologies, on definitions, and on geographical issues. Fourth, academics also are likely to engage in commercial consultancy, so would the widespread provision of free data give unfair competition to the commercial sector that pays full costs?

Fifth, academia has a long-established behavior of sharing information, so is there a danger that intellectual property will leak? This is much more of a risk for topographic data (only a small proportion is volatile) than it is for statistical data, where frequent updates and revisions encourage users to return to the original source. Hence the Ordnance Survey of GB required significant levels of audit and security in the system designed for UK academic access to digital map information (EDINA 2001).

## The Transition to Semicommercialism: Changing Business Cases

In the years between the Rayner doctrine (HMSO 1981) and its revocation (Treasury 1992), the UK Department for Trade and Industry had published guidelines in its Tradeable Information Initiative (DTI 1986; DTI 1990). Manpower Services Commission (MSC) decided in 1986 to start offsetting some of the development costs of Nomis by making it available to all users, grouping them into sectors of Government, Government Agencies, Local Government, Academia, and Commerce. A joining cost was imposed to cover the considerable production costs of documentation, metadata, and updates. A yearly renewal cost also was introduced, again to provide continued capacity for documentation updates. The main basis for online charging remained the elapsed time online plus the amount of the Central Processing Unit (CPU) used—a surrogate for the volume of information being processed. Two user levels were assigned—academic and nonacademic. On top of the computing charge, a surcharge was imposed, for example, 20 percent for local authorities, 40 percent for academics, and 50 percent for commerce. This surcharge was used partially to recover the staff costs.

There was no "prior knowledge" on which to construct these charging bands. It was largely influenced by MSC's perception of user groups (it was felt possible to substantively differentiate between commercial, government, and research), coupled with a strong belief by the Agency that maximizing the dissemination and use of local labor market statistics was desirable. There was never any contractual demand that this charging strategy would recover the entire costs of Nomis, but more an expectation that an increasing absolute surcharge income would arise from increased usage, thus offsetting increasing proportions of staff salaries and also providing capacity to employ staff whose core tasks were not directed at MSC user requirements and who could not therefore be funded from the core contract.

The justification for not pursuing full-cost recovery was written within the Business Case that MSC produced for HM Treasury to justify the funding for Nomis. To the mid-1980s, it was based on a comparison of the costs that would be incurred at the MSC Head Office and at Regional Intelligence Units. What would the costs be if the data preparation was undertaken manually by clerical staff, balanced against the cost of Nomis being developed and run by an internal or external contractor? From 1986 onwards, the awarding of the Nomis contract was also subject to full competitive tender and Durham had to compete for the contract every four to five years, and the Government Department IT services were able to compete for the contract.

Three processes influenced the development of charging over the next ten years: confusion over user groupings; new IT infrastructures at the University of Durham, and the differential imposition of data charging by parts of the Government Statistical Service. Confusion over user groupings emerged quickly over how academic users could operationally discriminate over data extracted for bona fide academic research projects or for consultancy use that would generate fees and profits. The response was to ask them to take out supplementary commercial accounts for consultancy use, with the full knowledge that every Nomis user session was fully logged and could be audited retrospectively in detail.

The second area of confusion was created when local authorities started to engage in commercial or bureau activities. This was a way local government research sections gained extra income and increased their research capacity. The lower surcharge level for local authorities (20 percent as opposed to 50 percent for commerce) then created unfair competition with commercial companies. The solution was to adopt a goal of ideally bringing all charging down to the lowest level. This ideal was tempered by the pragmatic assumption that lower charges would encourage more users and more usage, thus resulting in greater gross revenue. Early in the 1990s, commercial charges were reduced to those of the local government. Another revision to charging strategies was encouraged by further confusion over commercial activities by government agencies, or for work undertaken on behalf of government agencies by commercial companies. This led to the simplification of the charging policy to a joining fee (plus yearly renewal), computing costs based on academic research or non-academic (with two subgroups of Central Government and other users), and surcharges of 40 percent on academic costs and 20 percent on commercial. The ratio of academic to commercial computing costs was maintained as before at approximately 1:3.

## Mainframe to Distributed Network

From 1992 onwards, a new IT infrastructure at the University of Durham mandated further radical attention to charging. The existing CPU charge had for long been a deterrent to users processing large time series of data: the software architecture of Nomis was predicated on complex geographical selection of data rather than time series. A migration from MTS and mainframe to a Unix server in 1992 was an opportunity to revisit CPU. However, it was considered too risky to address CPU immediately, because the software transition during 1992 had to focus mainly on ensuring a transparent implementation of Nomis functionality onto Unix, retaining the interface and characteristics familiar to the users at about 300 sites at that stage. The challenge of transferring users, their files, and their usage characteristics from one IT infrastructure to another was a major challenge in itself. With Nomis there was no possibility of "freezing" the system, because monthly unemployment and job vacancy statistics had to be released on time each month on the published day of national release (known as "Press Notice"). Once the transfer was complete, user consultation indicated a willingness to move to a single elapsed time charge that was the norm in a growing number of commercial database systems.

There was also, it must be admitted, a real financial disincentive to risk too much at that stage. First, those funding Nomis expected increasing cost-recovery levels each year, so the University would be forced to underwrite any shortfall. Second, the nature of the user sectors indicated that only one sector would have flexibility to increase income, and that was commerce, although its usage was not strategic but was more reactive, based on projects and tasks at hand. All other user sectors were budget-driven in their use of Nomis. Research units in local government had preset data budgets that were calculated long ahead. Their only actual "capacity management" was to ensure that if their current yearly budget was being underspent, that they pay in advance for usage in the next financial year. A separate escrow process was operated for payment-in-advance using underspend from a current budget, but in general the user base has little financial flexibility.

In 1996, a full review of charging options was undertaken with the view of developing a new, simple, elapsed-time charge for implementation in 1997. Two key considerations were addressed in setting the costing levels of a price-per-minute online. First, the level had to be set so that a "broad basket" of user extractions did not cost more than before. A target was set at 10 percent below the existing aggregate price within a principle of delivering price reductions through IT innovation and efficiency. Second, Durham still had to accept the business risk that even if gross income declined, the net offset of costs to the Employment Department would not go below existing levels. In fact, the fear was unfounded and gross revenue rose as users felt more at ease with elapsed time charges.

During the following years, the revised elapsed-time charge was reviewed in the light of usage patterns. It became apparent that the revenue distribution by user was rather skewed. There were a number of users who never actually used their account online, but who seemed willing to pay the £75 joining fee and £40 yearly renewal for subscription to Nomis. In return, they received detailed manuals containing metadata and technical documentation, with updates and newsletters. Even with proactive reminders

**Table 1.** Nomis income per sector in 1995

| Nomis Computing Income 1995 | | | | |
|---|---|---|---|---|
| | | | | |
| User Accounts | Total | Average use | Median | Standard deviation |
| | | | | |
| Head Office Core Accounts | £36,075 | £1,127 | £464 | £1,453 |
| Employment Service | £48,702 | £3,247 | £3,021 | £2,025 |
| Employment Service Secondary use | £2,841 | £284 | £127 | £277 |
| Central Government | £15,282 | £804 | £344 | £975 |
| Enterprise Companies | £44,148 | £496 | £390 | £453 |
| Other Government Agencies | £13,345 | £1,027 | £306 | £1,150 |
| Local Government | £52,959 | £411 | £292 | £388 |
| Commerce | £66,533 | £559 | £137 | £1,095 |
| Academic Researchers | £10,925 | £98 | £29 | £212 |
| Postgraduate academic researchers | £128 | £18 | £16 | £18 |

**Table 2.** Nomis price simulation for 1996

| Nomis Charging Simulations 1996 | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| User Accounts | Users | Original | Estimates | Difference | % change |
| Employment Department Group | 29 | £48,046.50 | £55,775.45 | £7,729 | 16.09% |
| Employment Service | 14 | £52,961.52 | £56,962.00 | £4,000 | 7.55% |
| Central Government | 19 | £16,122.50 | £16,956.55 | £834 | 5.17% |
| Enterprise Companies | 88 | £60,188.82 | £63,987.25 | £3,798 | 6.31% |
| Other Government Agencies | 21 | £13,127.72 | £15,762.40 | £2,635 | 20.07% |
| Local Government | 152 | £64,371.49 | £64,839.40 | £468 | 0.73% |
| Commerce | 129 | £66,144.24 | £46,912.90 | -£19,231 | -29.07% |
| Academic Researchers | 107 | £8,084.16 | £7,669.20 | -£415 | -5.13% |
| TOTAL USERS | 559 | £329,046.94 | £328,865.15 | -£182 | -0.06% |

to users that they had not used the system, a number continued to renew subscriptions, presumably regarding it as worthwhile just to acquire the documentation.

At the other end of the spectrum, a small number of business users were high volume–usage customers, often carrying out complex data extractions that were just the types of processes penalized by the CPU charge. Usage also differed according to user sector, with the summary statistics in £UK (Table 1) showing the dispersion:

The setting of a new "elapsed time"–only price involved simulations of levels using one year's total usage online for all 559 existing Nomis accounts. The objective was to reach a level that 1) was below the important perceptual level of £1 per minute; 2) would deliver cost savings to high-volume users; and 3) would result in an overall impact of zero on revenue. This was still in line with a policy of delivering efficiency gains to users, but this time favoring the most important customers. Also taken into account was the unknown "chaos" elements that exist in the introduction of a new charging regime. Usage may change in unpredictable ways, because user perception of new charges can be very different from supplier perception. For that reason, the process of change was undertaken in close consultation with a broad group of users, and the principle of changing to elapsed time only has been accepted by the majority of users following a general request for views.

The overall simulation identified a potential level of £0.95 per minute, which on the basis of 559 usage profiles resulted in an income projection decline of a mere -0.0552 percent. The overall summary table (Table 2) by users showed the differential impacts that would occur if broad usage patterns did not change.

One clear concern with this simulation was that the core Office for National Statistics user group, the group that funds the system development, was showing a predicted increase of just over 16 percent. However, the move to elapsed-only charges also coincided with a new contract agreement to provide usage to the core group at no cost. The projected variations in individual use were considerable. One academic customer was showing a predicted cost saving of 96.6 percent on a previous payment of £221,34. The top 12 commercial users would see costs varying between–11 percent and–70 percent, the top 12 local authorities would be plus to –36 percent, and academic users +73 percent to –96 percent.

Broadly speaking, the top local authority and commercial users could expect to obtain big cost savings by moving to a more predictable cost base. These two groups were expected to increase their gross usage overall in the future, and also a wider range of users would be recruited from the sectors. The key elements of future income streams were now strongly concentrated in the enterprise company, local government, and commercial sectors. Even here, potential instabilities were emerging. The local government sector was undergoing significant realignment with the move to unitary authorities in Britain. There would be a finite number of local authorities and enterprise companies, while there was considerable opportunity to expand the commercial sector user base.

Even following the implementation of the new charges, it was felt that more was needed to reward highly active customers for their volume of use. This led to the introduction of subscription bands. By subscribing at the beginning of a year for a set price, the net cost per minute for usage would be reduced. The advantage for Nomis would be a much more predictable income stream. As before, the Office for National Statistics was concerned that offset costs would not be reduced. Durham accepted the business risk, and the overall impact was neutral.

## Embedding Relationships with Core Users, and onto the Web

Throughout these charging revisions we also had to cope with the imposition of data-charging regimes by areas of the Statistical Service (the Government Statistical Service, GSS, includes ONS). The Chief Executive of ONS, now the "National Statistician," is also the Registrar General for England and Wales (Scotland and Northern Ireland are autonomous), and is also "Head of Profession" for all Government statisticians. Each government department has a Director of Statistics and staff who have a high degree of autonomy in decisions they have been able to make on the interpretation of confidentiality rules, dissemination, and pricing strategies.

Most data-charging regimes were loosely based on a cell-charging matrix established for the 1981 and 1991 Censuses of Population. In 1981, the data charges for the census were set and not changed. The 1991 census charges differed from 1981 on the basis that the Census Agency made a decision to revise prices upwards each year following publication of data by the retail price index. That policy argued that even though the data "decay" continuously away from the April 1991 count date, they still are as "valuable" as when they were first released. Where applicable, users incur data charges in addition to the elapsed-time cost online. The Nomis approach to the Census of Population, with online availability of some 20,000 variables by 13,000 geographies, was to design special software to advise users of the data costs per extraction, requesting that they confirm the cost before the query is executed. This positive confirmation of costs was to prove a useful procedure when a Web interface was developed.

By 1998, it was clear that the Web was the dissemination platform of the future. The Web had started to mature well beyond the domain of academia, and connectivity was increasing in government and commercial sectors. Early in 1998, some other factors would also influence the move to the Web. First, there was a need to overcome the relative inefficiency of time-series extraction versus geographical extraction. Second, some proposed new data series broke the database design model, particularly an analysis of unemployment by ward, by gender, by age, and by occupation. Therefore, a complete redesign of the system was undertaken.

The Web was the main stimulus for a major reconsideration of charging. "Old Nomis"—as the original system became known—on a Unix server could charge by the minute. With the Web, however, there is no concept of elapsed time. A user may think that he or she is fully online and connected when his or her browser displays a page, but that is not the case. The Web interface to Nomis constructs a query in the URL line and then transmits it to the database, receiving output once the query is processed. There was no problem retaining elapsed-time charging for the "New Nomis" command-driven interface because the new database was still on a Unix server. Testing during development showed that there were dramatic cost savings for time-series processing. Overall, there was likely to be a small increase in net costs for users, however, because the new interface contained a lot more intelligence and metadata to guide users through data selection and extraction. This concern was actually unfounded, because a new, more powerful server was purchased and there was a real reduction in user costs, as before compensated by increased use.

The issue of Web "timelessness" was a real challenge. No matter what metric was evaluated, we were increasingly forced towards one of two unpalatable options. First was to make it all free, which is wonderful in principle and a good democratic statement, but nothing in the Nomis contract would permit this move, and those responsible for Nomis in ONS were not in a position to make Nomis free. The other option was to go back to charging by data volume. As a result, the charging matrix would have to be a lot more sophisticated than the cell regimes for some data, and it would need to be carefully calibrated against known costs for a large series of trial runs.

In the end, the cell-based charge was tried out with test users, with the session cost being displayed to users for confirmation before data were extracted. We were uneasy about this, but user feedback was positive and it did seem that varying charging regimes can be implemented so long as users understand the basis of the charges and they have the opportunity to abandon the session if the charge is too high. Furthermore, the Web proved to be a very useful tool for self-training and experimentation.

## From Fee to Free

"The Internet is transforming almost every aspect of the way we live and work today. It's central to the development of our economy and our society. That's why I announced at the launch of National Statistics that the most important government facts and figures will now be available to the public free of charge on the new National Statistics Website" (Cook 2000).

This statement, by the new National Statistician, Len Cook, marked a fundamental shift in UK statistical policy away from commodification to a more marked concept of an information commons. Having worked since 1986 on building a charging base to expand capacity, the contractual focus changed dramatically to a single core contract to develop and run a free service for all users.

From July of 2001, Nomis became a free service. The literature on charging would indicate that a significant rise should then occur in both users and overall usage, but the cautionary context would also be provided by the concern over how financial flexibility could be maintained to manage capacity (Longhorn and Blakemore 2004) and to meet the new and diverse demands of the users. The move to a free service had a dramatic effect on both the number of persons using the service and the level of use. The most immediate effect was that existing users tended to download larger amounts of data. The average number of data cells downloaded per query in the year prior to the system becoming free was approximately 450, which doubled to 900 in the year following the move to a free service.

The number of users joining the system also rose rapidly. During the charged service, five to ten new accounts joined per month. Once the service was free, this figure rose to approximately 500 per month. Several factors contributed to this. First, there were shifts in organizational behavior and moves to disintermediating data from users. Some County Council users who had previously supplied data to customers changed their policy. As Nomis was now free, they ceased using their own staff resources to provide Nomis data and instead told District Councils they should now access the data for themselves; quite perversely, the move to a free service resulted in behavior changes by users where they saw their own activities as costs that could be reallocated. Second, customers in sectors previously cut off because of the charges no longer had this deterrent. Over the first year, more than 1,000 new customers signed up as "personal" users. Prior to the free service, there were no customers of this type.

It became apparent, however, that many of these users were casual users who only wanted to obtain data from Nomis on a one-time basis. Of the 5,000 accounts who joined during the first year, 700 had used Nomis to download data on only one occasion. Based on this, a "guest" log-in facility was introduced in December of 2002 that allowed users to access the data without having to first register. Although it is still early to fully evaluate the success of this, initial results were very positive. The new account sign-up rate was reduced by half, from nearly 500 per month to under 250 per month, and the guest account has been responsible for about 10 percent of all queries.

## Discussion and Conclusion

The Nomis charging strategies developed over nearly 20 years have been interplays of strategy types (Mintzberg and Waters 1998). There was no exclusively "deliberate" strategy, which requires control over three key elements: clear organizational intentions, a common acceptance of the intentions throughout the organization, and a lack of external forces that could interfere with the execution of the strategy (Mintzberg and Waters 1998, 21). The owners of Nomis (MSC, DE, ONS) set the targets for cost recovery, but they also had control over the supply chain of statistics for Nomis. Furthermore, the changes in IT infrastructure were planned not by the Nomis team, but were driven by the IT strategy of the University of Durham, thus ruling out a "planned" strategy [Mintzberg, 1998, #714, 22).

The strategy became "ideological" in 2000 when the charging philosophy of National Statistics changed to one of free access, but before that Nomis exhibited several strategic patterns. It has been partly "imposed" by the policy of the agencies that have owned the system. It was partly a "process" strategy in that the role of the project management at Durham was to negotiate conditions that were mutually advantageous both to the contract awarder and to the University, while the actual design of the software was left to the development team with the condition that the resulting system had to perform to agreed criteria. It was partly a "consensus" strategy, because developments in the system had to meet strategic statistical needs of government agencies, while also appealing to local government, academia, and private sector users. It also was an "entrepreneurial" strategy, where the Durham management needed to develop charging strategies that met three key conditions: to maintain the overall contractual requirements in statistical dissemination; to maintain the University income stream; and, most important, to maintain the confidence of the user base by not imposing new charging regimes that destabilized their use by radically modifying their costs—many users needed to estimate usage costs over a year ahead for planning and budgeting reasons.

Overall, then, Nomis charging has been an "emergent" strategy where:

> strategy formation walks on two feet, one deliberate, the other emergent. As noted earlier, managing requires a deft touch—to direct in order to realize intentions while at the same time responding to an unfolding pattern of action (Mintzberg and Waters 1998, 33).

The strategy has been a complex balance of charges imposed by data owners, policy mandates from Government, understanding organizational behavior within user groups and watching user groups fracture over time, and in monitoring budgeting trends in government. Also strongly influencing the strategy was the extent to which software innovation and new hardware could deliver a more efficient service, and modeling the resulting cost savings to users against possible overall increase in usage.

The experience between 1983 (when the system became available to nongovernment users on a charging basis) and 2000 (when the system became free at the point of access) demonstrates that it is possible to develop charging strategies that as far as possible meet requirements of statistical dissemination goals, contractor income, and user expenditure. However, a crucial element in all of the charging changes was a combination of reflexivity and dialogue. Reflexivity was evident in continual internal review and criticism of the charging regimes where the development team was constantly challenged to take a user viewpoint. Indeed, it was policy that all members of the team, from management to programmers, had to work the telephone help desk each week, because it is dangerous for developers to be remote from customers. Dialogue was a crucial component in negotiating charging changes with users, often in a process exceeding 12 months in which their individual spending profiles were modeled against new scenarios. That meant the level of user attrition was very low, indeed, once the new regime was operational.

The most interesting outcome has been the move from "fee to free." While there was a dramatic increase in the number of registered users in the first year (tenfold from 800 to 5,900), the actual levels of use did not increase commensurately, and the numbers of active regular users of Nomis did not markedly increase. A glib observation could be that making something free does not necessarily increase overall use, but the picture is not that simple. The success of Nomis between 1983 and 2000 had covered the potential market well, and the potential to service significant new areas of use was limited. However, some 5,000 new accounts were registered in the first year after the abolition of charges. Usage patterns may also be linked to the decline in data usage within UK Social Science. Quantitative research has been substantially replaced by qualitative and theoretical approaches in the social sciences, and "There is a further apparent rejection of the fundamental role of metrics in contemporary mass society, of which by far the most important is the financial metric" (Johnston 2000, 132). Therefore, the data delivered by Nomis do not service many of the recent research priorities in UK higher education.

Lastly, the needs in the commercial sector have changed fundamentally over the past decade. For many years, the legal liability law sector purchased detailed job vacancy statistics to help build legal arguments for loss-of-earnings cases. Degradation of the quality of the vacancy series in the late 1990s, with a cessation of the supply of the statistics for nearly a year, encouraged the sector to use other information with a more reliable supply chain. The geodemographics sector, historically grounded on Census of Population small area data, has been enriched with new flows of detailed customer loyalty-card data and is moving away from a spatial base to a behavioral basis (Kempiak and Fox 2002). Furthermore, there is increasing sophistication in geodemographics, ranging from user access to users' own confidential information (a form of proactive audit) (BBC 2004) to de facto creation of pan-national information infrastructures through strategic acquisition (Anon. 2004). There is, therefore, a final paradox in the dissemination of official geostatistics in the turbulent environment of the global information society. Lessons from commerce show that nearness to customers is critical in ensuring that use value translates back into product development, and users who pay money are generally listened to more intently by suppliers. However, the move to free information leads to a larger, but more extended user community, and it becomes difficult and costly both to listen to them and to respond to their needs. Such a paradox is worthy of further research.

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## Footnotes

1 Nomis is the trademark of the Office for National Statistics, http://www.statistics.gov.uk.

2 See http://www.nomisweb.co.uk.

3 See http://www.data-archive.ac.uk/.

# Policy Review: Blocking Public Geospatial Data Access Is Not Only a Homeland Security Risk

*R. Bradley Tombs*

***Abstract:*** *This is a policy review of current public geospatial data dissemination practices and the Federal Geographic Data Committee (May 2004) guidelines for geospatial data access. It evaluates if the federal guidelines give proper weight to the societal benefits of record dissemination, the importance of informed citizenry, and its strong Constitutional connection to petition government to redress grievances. Practical examples of state and local policies are exposed, disclosing the conflicts with the federal National Map progam objectives. Homeland security and other public risks associated with nondisclosure of public record geospatial records are identified. The review shows that slow progress is being made in bringing order to public geospatial records disclourse, but ill-informed record holders unduly delay access, causing weakness in homeland security preparedness.*

## Current Public Geospatial Data Dissemination and Access

Is an informed citizenry important to a homeland security defense to vigilantly protect resources, facilities, and freedoms? If the foundation of a democracy is to have an informed citizenry, it is important to question efforts that block access to nonclassified geospatial data. There is concern that current record access policies and practices are a precursor to secrecy legislation, an uninformed citizenry, and increased homeland security risks. This is a policy review of current public geospatial data dissemination practices and the Federal Geographic Data Committee (FGDC) guidelines for geospatial data access.

After terrorists attacked the Pentagon and the World Trade Center buildings, most government agencies hastily withheld map data and other records from the public, thus curtailing citizens' ability to inform themselves. Everything from hazardous-waste sites to water-main locations are now being considered "possible terrorist targets" by record custodians and map data showing their locations are subjectively deemed a "homeland security" risk. Indeed, impeding federal Freedom of Information Act (FOIA) and State Public Record Act access significantly affect citizens' ability to inform themselves and "to petition the Government for a redress of grievances" afforded by the U.S. Constitution.

Some agencies still attempt to assert that geospatial data are not even public records. Legal cases at both the federal and state levels have nearly ended that assertion, which is now codified by many state public record acts and the FOIA. Key legal cases and documents include: Petroleum Information Corporation v. U.S. Department of Interior, 1992; Delorme Publishing v. NOAA, 1995; Higg-a-rella v. Essex County, 1995; Drummond v. City of Belleview, 1996; and Office of Management and Budget Circular A-130. Improper practices include attempts to charge a fee for a government record beyond the cost of reproduction, which impedes access by diminishing one's ability to redress government on public matters. Federal agencies are even denied state and local records by agencies seeking to improperly recoup geospatial data development costs.

Three years after the 9/11 attacks, geospatial public records access remains uncertain. Rand Corporation's National Defense Research Institute published Mapping the Risks, Assessing the Homeland Security Implications of Publicly Available Geospatial Information (2004). The FGDC Homeland Security Working Group, administered by the Office of Management and Budget (OMB), published Guidelines for Providing Appropriate Access to Geospatial Data in Response to Homeland Security Concerns. Although these titles may imply efforts aimed toward restricting nonclassified geospatial record access for fear of use by nefarious individuals, they expose that most data sets do not pose a homeland security risk. The FGDC guidelines generally define "sensitive information" or more precisely what is not sensitive. Secondarily, the process considers the "societal costs of limiting public access." Notwithstanding, record custodians are ambiguously placing emphasis on undefined "potential" and "possible" risks to "sensitive" or "critical infrastructure" in prohibiting public spatial data access. While deliberating what records are "sensitive" and "who" should be prohibited access, record custodians are improperly using the "homeland security" excuse to ignore record access laws.

For example, New Jersey's Executive Order #21 seeks regulations to exempt records from the Open Public Record Act that would "substantially interfere" with the state's ability to protect against acts of terrorism or materially "increase the risk" of "potential acts" of sabotage. Inasmuch as the range of potential risks is more or less unlimited, the executive order's indefinite language would lead to ambiguous record restrictions. Should this allow a water utility agency to assert that its water mains are "critical infrastructure" and be entitled to block access to its entire map data although the information is customarily accessible? It would be plausible for Machiavellian officials to route a pipeline through a political friend's farmland, funnel inflated property acquisition money, and use the spurious "homeland security" excuse as the reason to avoid public scrutiny. The opportunity for public officials to use the terrorism and homeland security excuse as a shield to block records access becomes a dangerous risk itself.

## Misused Terminology

This broad executive order language is already used by record custodians to thwart public spatial data access, despite no evidence of any spatial data use risk. The New Jersey's Domestic Security Preparedness Task Force 2003 annual report uses the term critical infrastructure 40 times, with select examples (e.g., oil/chemical facilities, bridges, tunnels, power plants, national monuments, airport, Hudson River crossings, and "other critical infrastructure sites"). In all cases, the protection of critical infrastructure is stated in a context of assessing a "site's specific vulnerabilities," "increasing physical security of the facility," "developing capacity and specific plans to respond to a crisis," and "preparing contingency and continuity plans." Not once does the report specify any restrictions to spatial map data or identify maps or map data as critical infrastructure, at-risk documents, classified, or confidential. Also, the report uses the term Geographical Information Systems (GIS) seven times in the context of integrating GIS into all homeland security efforts for response preparedness.

The misuse of the term critical infrastructure is the default excuse from state and local agencies in the withholding of spatial map records ordinarily available to the public. This spurious excuse perhaps originated with the passing of the Critical Infrastructure Information Act (2002), a subtitle of the Homeland Security Act. At issue are the definitions of critical infrastructure, voluntary, and confidential. Critical infrastructure as defined in the Patriot Act involved "systems and assets" "so vital" that their "incapacity or destruction would have a debilitating impact" on "national economic security." The Homeland Security Act clarified "critical infrastructure information" as "not customarily in the public domain," nor information otherwise required for a federal license, permit, grant, etc. Critical infrastructure information does include "voluntary" submissions to the Department of Homeland Security when accompanied by an "express statement" expecting protection from disclosure. It also requires the record holder to certify that the record is "confidential" and not customarily made available to the public.

## Critical Infrastructure

Whether the Homeland Security Act created a new or perceived "critical infrastructure," FOIA exemption is debatable. FOIA exemption 4 already protected against trade secrets and confidential disclosures, which could include "voluntary" critical infrastructure material. Critical Mass Energy Project v. NRC is recognized as establishing the test to determine "confidential" information, ruling that voluntarily submitted information is exempt from disclosure under FOIA if the submitter can show that it does not customarily release the information to the public (Stevens February 2003). The Procedures for Handling Critical Infrastructure Information, Interim Rule, requires that "The information is of a type not customarily in the public domain" (6 CFR Section 29.5 (a)(iv), February 20, 2004).

The Presidential Directive on Critical Infrastructure Identification, Prioritization, and Protection (December 17, 2003) recognizes that most critical infrastructures resources are owned by private sector and state or local governments. The policy in carrying out this directive requires the appropriate handling of "voluntarily" provided information that would facilitate terrorist targeting of critical infrastructure, and directs policy implementation in a manner consistent with applicable provisions of the law, "including those protecting the rights of U.S. persons." The Homeland Security Act does not preempt state disclosure laws. Although it could be technically argued that there is a new FOIA "critical infrastructure" exemption relating to homeland security, the change appears relatively immaterial for records in general, and not material to geospatial data from a practical records access perspective.

At the same time that many government record holders are strategizing how to conceal public records, the state and federal agencies are working on the federal National Map program to compile GIS geospatial data for public disclosure as a means of response preparedness. Michael Domaratz, Cochair of the Federal Geographic Data Committee (FGDC) Homeland Security Working Group, said, "The map will be in the public domain, and the public will have round-the-clock access" (Sietzen 2004). Presidential Executive Order 12906 stipulates public access to geospatial data, and it is currently available at http://www.nationalmap.usgs.gov/. But local public agencies are withholding GIS information. Domaratz questions, "In the event an incident happens . . . how can we access the [local] data?" Denying local map data to the federal government and public could cause delays in responding to catastrophic attacks, a problem noted on 9/11. Unmistakably, local governments that cloak spatial data records can create a public and homeland security risk.

At the same time New Jersey's executive order language is being used to block public access to spatial data, the New Jersey's Office of Geographic Information Systems (OGIS) has agreed to provide its spatial data to the FGDC for the National Map program. The OGIS, in the Office of Information Technology, is part of the Domestic Security Preparedness Task Force. One can reasonably deduce that if the federal government's FGDC and state's specially created task force are working together to make geospatial data available to the public, local agencies are logically remiss in withholding their records.

## Societal Benefits

Prior to 9/11, the societal benefits of government records were not in question. Now, even the Rand report in asserting that "assessing the societal benefits and costs of restricting public access to geospatial information is not straightforward" subtly understates a fundamental principle of our democracy. Citizens' constitutional right to redress their government is materially weakened if citizens are denied government records on matters of public concern. Congress recognized its obligation to make government information accessible to citizens by establishing the Government Printing Office (GPO) in accordance with Congressional Joint Resolution 25 of June 23, 1860. OMB Document A-130 details FOIA objectives and procedures, indicating that other nations "do not share [our] values" concerning freedom of information and government records access. The purpose of government in "disseminating the information in the public interest" is straightforward and unambiguous. Understating the importance of records access as integral to our fundamental democracy principle, the need for an informed citizenry, and its close Constitutional connection to citizens' right to redress government of grievances would be a significant material omission.

Perhaps not as highly prioritized as warranted, the Rand report and FGDC guidelines do integrate the legal principles of our Constitution by weighing "societal benefits and costs." In presupposing that a data set is "conceivably sensitive" and whether "public access should be curtailed in some way" gives undue credence to an unnecessary analytical process that can delay records access. Most, if not all, nonclassified "conceivably sensitive" records lack the teeth to stand up to legal scrutiny of the "societal [Constitutional] benefits" test. But use of an analytical process by ill-informed (or pressured) record custodians can delay access by gumming to death citizens seeking to be informed. A more than minor delay in records access is a legal defeat of our fundamental democracy principle. Conversely, a timely informed citizenry will best enable homeland security agencies to thwart potential attacks and be responsive in the event of an attack.

Denying spatial record access poses risks beyond diminished public vigilance and response preparedness. It is almost unbelievable that the importance of public record access and free speech rights on matters of public concern is being ignored at many government levels. The Rand report and FGDC guidelines should significantly help to restore some semblance of logic to the hastily withdrawn data by many government agencies. The FGDC rationally indicates that most geospatial data is not sensitive; "sensitive information does not include the fact of the existence of a facility at a particular place or the general layout of a facility." Rather, it suggests that "attribute data are more likely to be sensitive than geospatial data." But even the argument that attribute data might be sensitive must withstand the "societal benefit" test that obligates citizens to be informed and redress government of grievances on matters of public concern. In a legal and practical context, public spatial data should either be federally "classified" or made publicly accessible. The FGDC guidelines are a good first step in making that case.

## About the Author

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