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

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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 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 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 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 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 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.