Interrelationships between Web-GIS and E-Collaboration Research

Michele Masucci
Temple University, USA

INTRODUCTION

Geographic information systems (GIS) refers to the computer hardware and software that supports the management and analysis of spatial information. There has been a recent increase in the development of Internet accessible GIS applications, called Web-GIS (Al-Kodmany, 2001; Carver, Evans, Kingston, & Turton, 2000). Web-GIS facilitates participation among stakeholders through disseminating user interfaces for storing, accessing, and analyzing spatial information using the Internet (Al-Kodmany, 2001; Carver et al., 2000; Dragicevic & Balram, 2004). Participatory and community GIS approaches focus on system design that supports collaboration among organizations serving and representing interests of many constituent groups, including nontechnical users (Carver, 2003; Craig, Harris, & Weiner, 2002; Drew, 2003; Elwood & Ghose, 2004; Elwood & Leitner, 2003; Ghose, 2005; Ghose & Elwood, 2003; Kyem, 2004; Seiber, 2003).

The emphasis on participatory aspects of GIS is important for many decision processes, including community planning, environmental management, and citizen advocacy uses (Carver, 2003; Drew, 2003; Ghose, 2005). Improving the management of collaborative aspects GIS design, referred to as geocollaboration, has also been gaining attention among researchers (Al-Kodmany, 2001; Brewer, MacEachren, A. M., Abdo, H., Gundrum, J., & Otto, 2000; Carver et al., 2000; Churcher & Churcher, 1999; MacAcherin, 2001; Schafer, Ganoe, Xiao, Coch, & Carroll, 2005). The creation of virtual GIS environments encompasses both trends, fusing geovisualization and e-communication techniques to improve multiple user exchanges and experiences in GIS computing.

E-collaboration research has the potential to advance Web-GIS because of the focus on evidence-based strategies for using e-technologies to distribute tasks and access shared information resources. For instance, consideration of the use of groupware for managing the consolidation of field surveys that could comprise a spatial data set might involve (a) assessing e-technologies for tracking documents, (b) improving document portability, and (c) integrating spatial data with other information resources. The specific use of decision support-ware, e-communication applications, and database integration tools is often directly related to the overall computing environment within an organizational setting (Kock & Nosek, 2005; Markus, 2005). However, many organizational approaches for administrating computer support for all kinds of management tasks fail to account for specific collaborative frameworks used in conducting GIS enabled research (MacEachran, Gahegan, & Pike, 2004; Schafer et al., 2005).

THE NATURE OF SPATIAL INFORMATION

Information is geographic if it pertains to (a) a specific location on the Earth's surface, (b) to knowledge of *where* something is, or (c) knowledge about *what* is at a given location (Goodchild, 2000). Italics are used to emphasize the terms *where* and *what*. Both terms underscore the empirical roots of the field of geographic information science (GIScience). Geographic information technologies (GITs) consist of (a) global positioning systems (GPS), (b) remote sensing, and (c) geographic information systems (Goodchild, 2000). They are used for gathering, interpreting, managing, and analyzing geographic information. An important factor in examining how e-collaboration strategies are interrelated with GIS use is that the datasets involved are extremely large, often measured in gigabytes and terabytes (Goodchild, 2000). In addition, there are extensive hardware requirements for manipulating such datasets with embedded spatial analytical software due to the complexity of systems that may be modeled. Improvements in e-communications and computing infrastructure enabled GIS developers and users to collaborate across work environments, setting the conditions for the emergence of Web-GIS.

The current prevalence of Web-GIS applications reflects the extent of hybridization among spatial information resources, e-communication technologies, and analytical applications (Zook, Dodge, Aoyama, & Townsend, 2004). GPS capabilities are now integrated with handheld information technologies, such as cell phones and personal digital assistants (PDAs). PDAs and cell phones can display one's exact geographic position in real time. Such information can be integrated, along with descriptive characteristics of specified locations, directly into a GIS. This makes it possible to send, receive, and adapt spatial information from organizational settings or field locations, despite the fact that the datasets can be so large. These combined technologies are commonly used for tasks like (a) monitoring local environmental systems using remote sensing techniques, (b) assessing parcel characteristics in cities, and (c) managing emergency services (e.g., Haag & Haglund, 2002). Moreover, improvements in the ability to share and distribute spatial information resources among collaborators addresses the challenges associated with fostering participation in complex decision-making processes noted by Poore (2003).

A CASE STUDY OF WEB-GIS DEVELOPMENT AND USE

Technical experts guide many participatory models for information system design. This can result in what are sometimes referred to as *technocratic* participatory models for GIS development and use. Many GIS scholars and professionals have observed that such systems can quickly become the domain of GIS experts who may advocate on behalf of communities (Gilbert & Masucci, 2006; Harvey, 2001; Kyem, 2004; Masucci, 2000; McLafferty, 2002; Pipek, Märker, Rinner, & Schmidt-Belz, 2000; Schroeder, 1999). But this can result in the loss of an authentic community perspective because of the technological experience and expertise gaps that exist among GIS developers and nontechnical community users.

In 2004, the Information Technology and Society Research Group of Temple University (formerly called the E-Collaboration Research Center) initiated a program to develop a GIS that could be used by community partners and high school students. The aim was to draw on hybrid technologies to support participation in developing a GIS that would be of value to community participants. The approach taken for developing the system, called bITS-GIS, was to improve communication among all participants with the purpose of better aligning GIS resources with community management issues and spatial analysis at the local scale.

Partners in the project included local community serving organizations, residents, and students situated in North Philadelphia communities. Specifically, these included Asociación de Puertorriqueños en Marcha, United Way of Southeastern Pennsylvania, the School District of Philadelphia, the Temple University Telemedicine Research Center, and Delawarevalley.org. The partnership aimed to (a) facilitate collaboration among university professors and students, high school teachers and students, community organizations, and family members; (b) assess the viability of this collaborative approach for developing a GIS; and (c) use the geographic information technology resources developed through bITS for the analysis of environmental quality and community development.

The participatory design of the GIS was initiated through a series of meetings to discuss (a) the collaborative approach that would be undertaken for identifying spatial information needs of constituent partners, (b) how spatial information would be shared and how maps generated by the GIS would be used and disseminated, and (c) the relationship between developing a community GIS and advancing community educational goals for high school youth.

The criteria that guided the GIS development approach included (a) representing and reflecting the community in terms of its information needs and management goals in the design of the GIS, (b) representing and reflecting participation that advances community capacities in the realm of GIScience, and (c) providing the institutional capacity for conducting geospatial analysis of environmental quality, community development, and other local scale problems.

One of the most effective ways to accomplish these goals was to implement a Web-GIS approach. An important technical element needed to accomplish this was to facilitate the analysis of spatial patterns and associations at the most disaggregate community scale. This involved developing software that would integrate information resources provided by individuals using Web-enabled map applications such as Google Earth with advanced GIS applications such as ArcGIS.

This approach permitted the use of georeferenced and nongeoreferenced spatial information. One example