348

INT. J. GEOGRAPHICAL INFORMATION SCIENCE, 2001, VOL. 15, NO. 5, 387–390

Guest Editorial

GIS as media?

DANIEL Z. SUI
Department of Geography, Texas A&M University, College Station, TX 77843-3147, USA; e-mail: D-Sui@tamu.edu.

and MICHAEL F. GOODCHILD
National Center for Geographic Information and Analysis, and Department of Geography, University of California, Santa Barbara, CA 93106-4060, USA

The dazzling development of GIS technology in recent years has rendered each of the traditional, mostly instrumental, views of GIS—as spatial database, mapping tool, and spatial analytical tool—inadequate to capture the fundamental essence of this technology and its social implications. Each year brings new software packages from innovative developers that are easier to use, more powerful, and more easily adopted by users with minimal training. GIS and mapping tools are increasingly available on the World Wide Web (WWW), and an increasing number of sites offer advanced GIS services such as route finding and geocoding. In-vehicle navigation systems using GIS technology are becoming part of our daily lives (Cowen 1994). In the next two years cellphones in the US will be required to be geographically enabled—to be able to report their current location to an accuracy of 100 m—in the interests of accurate response to emergency calls. New imagery is becoming available from commercial sources with spatial resolutions as fine as 1 m, and is being distributed through new mechanisms such as distributed geolibraries and spatial data clearinghouses (NRC 1993, 1999). New methods of data documentation are being used to support widespread sharing of spatial data via the Internet. These new trends contrast sharply with the earlier view of GIS that prevailed into the early 1990s, as tools contained within a standalone computing system, serving the needs of their professional users by performing various forms of analysis that were too tedious, time-consuming, or expensive to perform by hand, on data collected and assembled for the purpose. These latest new developments in GIS have convinced us of the need for new conceptualizations (or metaphors, for lack of a better term) for what GIS actually is and will become in the near future. We believe that the complex relationship between GIS and society can be better understood if one conceives of GIS as new media.

Media are generally understood as means of sending messages or communicating information to the general public, and mass media are the instruments by which mass communication takes place in modern societies. Mass media are also the most effective means of broadcasting information to large numbers of people in a short period of time. In a very general sense, GIS can be understood as a new technological

International Journal of Geographical Information Science
ISSN 1365-8816 print/ISSN 1362-3087 online © 2001 Taylor & Francis Ltd
http://www.tandf.co.uk/journals
DOI: 10.1080/13658810110038924

species in an already crowded media jungle, specifically focused on the communication of geographical information. The fact that GIS communicates geographical information in digital form merely illustrates its consistency with contemporary media, which now make widespread use of digital encoding at various stages.

Specifically, the meaning of 'GIS as new media' can be broadly understood at least in the following dual senses. First, GIS have increasingly become a means to communicate certain aspects of the real world to the general public. ESRI (Environmental Systems Research Institute, Redlands, California) advertises its GIS software products as a 'common language' for speaking about and 'discovering' the world, while Intergraph (Huntsville, Alabama) goes so far as to name its products 'GeoMedia'. The role of communication is superseding the three traditional conceptualizations of GIS noted above (as tools for database management, mapping, and spatial analysis) because the impacts of GIS are realized only when results are presented to people on screens or on paper. Thus communication in its broadest sense must be put at the center when we discuss relationships between GIS and society—software vendors may have recognized this role of GIS better than many customers. Although data inventory and database management, automated mapping, and spatial analysis are still predominant tasks of most GIS projects, the goal of all GIS operations in the end is to communicate information to an audience in society. All GIS-related activities serve this final purpose—to communicate; the rest are intermediate steps serving primarily as means to communicative ends.

Second, significant changes have occurred in the past decade in the part played by digital geographical information in people's lives. Sites such as Mapquest (http://www.mapquest.com) provide millions of users every day with customized maps of routes and destinations, and sites such as Terraserver (http://www.terraserver.com) offer digital remote sensing imagery for sale to the general public. The Weather Channel and local television stations present forecasts that incorporate geographical information from satellite images, and display maps of forecasts from advanced computational models (Monmonier 1996). Airline passengers are presented with dynamic maps of the flight's progress. Humans have always needed to communicate geographic information, in describing discoveries, giving directions, or registering ownership. But recent technological developments appear to have opened a range of new possibilities. Indeed, with the emergence of digital places and digital individuals (Curry 1998), we are witnessing not only Arnold Toynbee's etherization of history but also the etherization of geography.

The dual trends discussed above are consistent with GIS communities' growing interest in spatial multimedia and virtual reality (Camara and Raper 1999). However, it should be pointed out that the emphasis on the communication aspect of GIS has its parallels in cartography. Robinson and Petchenik (1975) first introduced Shannon's communication theory to understand the map making process. Bertin (1978) made further elaborations on the linkages between the theory of communication and the theory of graphics. Martin (1996) tried to apply the Robinson-Petchenik communication model of cartography to understand GIS. By reconceptualizing cartography as a language for communication, Tobler (1979) introduced Chomsky's (1957) linguistic theory to develop a 'transformation theory' of the cartographic process. Nyerges (1980) further explored Chomsky's 'deep structure' versus 'surface structure' in both the cartographic and GIS contexts. Indeed, the communication paradigm even dominated the cartographic research literature in the 1970s and the 1980s (MacEachren 1995). The recent literature on the basic issues of geographical

information science (GISci.) also invoked various linguistic metaphors to study geographical information processing from the perspectives of communication and linguistics (Frank and Mark 1991, Goodchild 2000).

However all these previous works have engaged us in discussing technically oriented syntax issues (rules and grammars governing the relationships among signifiers); few have touched the complex and problematic semantic issues in GIS (the relationship between the signifier and the signified). Using communication theorist James Carey's words (Carey 1989), all these previous works are dominated by the 'transmission view' of communication at the technical level (how information is transmitted across space). What is lacking in the current literature is the 'ritual view' of communication (how information is preserved in time) at the cultural and philosophical levels.

While we applaud Raper's (2000) recent effort to extend GIS in both space and time from a broad philosophical perspective, reconceptualizing GIS as media opens some new avenues for future research. As the impacts of media are much better understood today as a result of years of interdisciplinary research, GIS researchers can gain new insights on the social implications of GIS through the media perspective. For example, the tetradic analysis of GIS as media we conducted using McLuhan's framework has revealed some interesting hidden messages of GIS which defy their frequent dichotomous characterization as either good or bad (Sui and Goodchild 2001). Instead, GIS transmit a very complex set of messages of simultaneous enhancement, obsolescence, retrieval, and reversal in society. By reconceiving GIS as media, we can transcend the instrumental rationality currently rampant among both GIS developers and GIS practitioners and cultivate a more holistic approach to the nonlinear relationships between GIS and society. The clear and present danger is not GIS or information technologies but our blissful ignorance of the implications of what they are going to do TO us, because we have concentrated too much on what GIS can do FOR us (Pickles 1995, Curry 1998). The only sensible way of dealing with this inherently technological ambivalence is to treat GIS media always as means to higher social ends.

Acknowledgments

We are grateful for the encouragement by Harvey Miller and Peter Fisher. Helen Couclelis, Jonathan Phillips, Paul Adams, and Daniel Overton provided critical comments on an earlier version of this paper. The Varenius project and the Alexandria Digital Library are supported through cooperative agreements between the University of California, Santa Barbara, and the US National Science Foundation.

References

BERTIN, J., 1978, Theory of communication and theory of the graphic. *International Yearbook of Cartography*, **28**, 118–26.

CAMARA, A. S., and RAPER, J., editors, 1999, *Spatial Multimedia and Virtual Reality* (London: Taylor & Francis).

CAREY, J. W., 1989, *Communication as Culture: Essays on Media and Society* (Boston: Unwin Hyman).

CHOMSKY, N., 1957, *Syntactic Structures* (The Hague: Mouton).

COWEN, D. J., 1994, The importance of GIS for the average person. In *Proceedings of First Federal Geographic Technology Conference* (Washington, DC: National Research Council), pp. 7–11.

CURRY, M. R., 1998, *Digital Places: Living with Geographic Information Technologies* (London: Blackwell).

FRANK, A. U., and MARK, D. M., 1991, Language issues for GIS. In *Geographical Information Systems: Principles and Applications*, edited by D. J. Maguire, M. F. Goodchild and D. W. Rhind (Harlow, UK: Longman Scientific and Technical), pp. 147–163.

GOODCHILD, M. F., 2000, Communicating geographic information in a digital age. *Annals of the Association of American Geographers*, **90**, 344–355.

MACEACHREN, A. M., 1995, *How Maps Work: Representation, Visualization, and Design* (New York: Guilford Press).

MARTIN, D., 1996, *Geographic Information Systems: Socioeconomic Applications*, second edition (London: Routledge).

MONMONIER, M., 1996, Electronic weather maps. In *Ten Geographic Ideas that Changed the World*, edited by S. Hanson (New Brunswick, NJ: Rutgers University Press), pp. 56–69.

NATIONAL RESEARCH COUNCIL (NRC), 1993, *Toward a Coordinated Spatial Data Infrastructure for the Nation* (Washington, DC: National Academy Press).

NATIONAL RESEARCH COUNCIL (NRC), 1999, *Distributed Geolibraries: Spatial Information Resources* (Washington, DC: National Academy Press).

NYERGES, T. L., 1980, Modeling the Structure of Cartographic Information for Query Processing, Unpublished Ph.D dissertation (Columbus: Ohio State University).

PICKLES, J., editor, 1995, *Ground Truth: The Social Implications of Geographic Information Systems* (New York: Guildford).

RAPER, J., 2000, *Multidimensional GIS : Extending GIS in Space and Time* (London: Taylor & Francis).

ROBINSON, A. H., and PETCHENICK, B. B., 1975, The map as a communication system. *The Cartographic Journal*, **12**, 7–14

SUI, D. Z., and GOODCHILD, M. F., 2001, A tetradic analysis of GIS and society using McLuhan's law of the media. *Canadian Geographer* (forthcoming).

TOBLER, W. R., 1979, A transformational view of cartography. *The American Cartographer*, **6**, 101–106.