SPATIAL SOCIAL SCIENCE

FOR RESEARCH, TEACHING, APPLICATION, AND POLICY

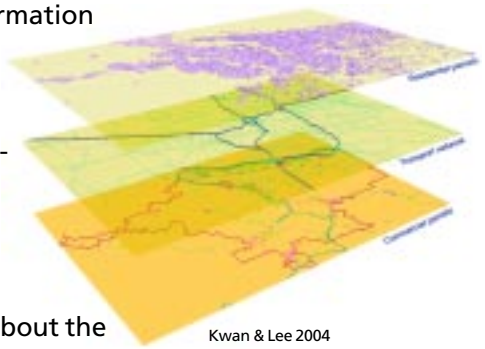
WHAT IS

Spatial Social Science?

Spatial Social Science recognizes the key role that spatial concepts, such as distance, location, proximity, neighborhood, and region play in human society; promotes research that advances the understanding of spatial patterns and processes; and invokes powerful principles of spatial thinking.

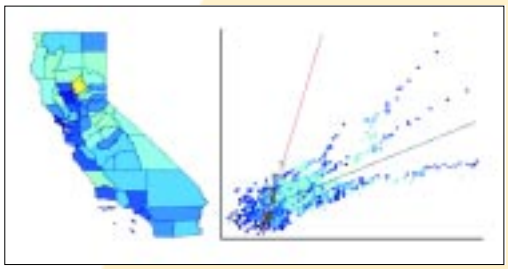
Principles of Spatial Thinking

Spatial thinking offers logic for interpreting the world, a well established set of models, and a rich set of tools for visualizing, analyzing, and integrating diverse sources of information (O'Sullivan and Unwin 2002). The basic principles include:



Kwan & Lee 2004

Integration. Location provides an essential linkage between disparate forms of information and between the distinct processes studied by different disciplines. For example, maps of environmental quality and human health can be overlaid to examine correlations that may suggest clues for guiding future research.



Data visualizations from STARS (Space Time Analysis of Regional Systems) software. See http://stars-py.sourceforge.net.

Spatio-Temporal Context. Information about the areas surrounding observations in time and space can assist the interpretation social processes. Thus, instances of crime may be better understood when mapped to reflect the order and timing of occurrences in relationship to surrounding neighborhoods.

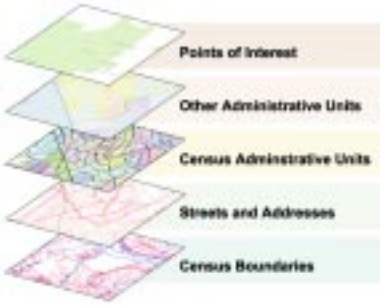
Spatially Explicit Modeling. Theory and model building in the social sciences are often more solidly grounded when the importance of space and distance are treated explicitly as facilitators or hindrances to human interactions.

Place-Based Organization of Information. Location is a valuable basis for organizing and searching the vast but disorganized information resources of the WWW. Using geographical location as a primary key, new search technologies provide a basis for linking diverse data sources.

Science and Policy. Scientific knowledge is most usefully applied when it is combined with specific knowledge of local and regional conditions. Societal applications are enhanced when geographic information systems (GIS) link local knowledge in the form of digital maps stored in databases with general principles in the form of algorithms, models, and methods of analysis. See Clarke 2001.

Methods of Spatial Social Science

GIS, cartographic visualization, pattern recognition, spatially sensitive statistical analysis, and place-based search methods are the tools of spatial social science used to integrate knowledge across disciplines and paradigms. From research design to the interpretation of research findings, spatial thinking and the use of spatial methods help advance understanding in nearly every domain of the social and behavioral sciences.



Census data model, ESRI, 2003.

Geographic Information Systems. GIS is a powerful tool for analyzing data about locations on the earth's surface. These geographic data are widely used in the management of land and natural resources, in local community planning and government, in responding to emergencies, in criminal investigation, and in scientific research. Disciplines that consider questions about patterns and processes on the surface of the earth benefit significantly from the use of GIS. See Clarke 2001.

Spatial Variability in Fertility in Greater Cairo, 1996. Weeks et al. 2000.

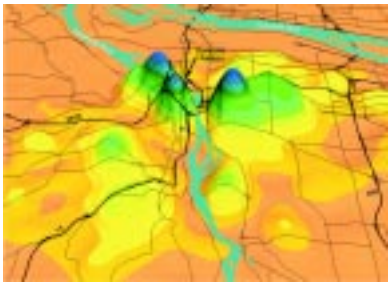
Spatial Pattern Analysis. Many problems faced by society and by social scientists require analysis of complex patterns of interrelated social, behavioral, economic, and environmental phenomena. Spatial statistics can improve the understanding of relationships among variables in geo-referenced data for resolving societal issues of, for example, crime incidence in urban environments or the diffusion of fertility decline in third world settings. See O'Sullivan and Unwin 2002.

Spatial Econometrics. Because of the complexity of interactions that occur in space and the somewhat arbitrary spatial units used by agencies (e.g., the Census) to report statistics, the explanations of spatial patterns and processes are often hard to unravel. Spatial econometrics is a collection of tools, models, and theories that explicitly incorporate space for dealing with these complexities and for facilitating inferential judgments. See Anselin et al. 2004.

$$I_i = \frac{(x_i - x^*)\sum_j w_{ij}(x_j - x^*)}{\sum_i (x_i - x^*)^2 / n}$$

Localized Version of Moran's 1

Map Making and Cartographic Visualization. Maps and visualization techniques are important tools for exploratory analysis and communication (Tufte 1997). Principles of visualization and graphic design can assist in the thematic mapping of statistical data over space and time for exploratory spatial data analysis and for knowledge construction.



A density surface of home locations in Portland, Oregon. Kwan & Lee 2004.

Spatial Interaction. Accessibility is a fundamental concept that relates to the equitable and efficient provision of opportunities and public services (e.g., jobs and healthcare). Spatial methods for analyzing and resolving such issues include network analysis, time-geographic modeling, spatial optimization techniques, and spatial interaction modeling. See Kwan et al. 2004.

$$T_{ij} = kW_iW_j/d_{ij}^{a}$$

A spatial interaction model

Agent-Based Spatial Modeling. A new class of models for studying complex social and environmental systems attempts to replicate the behavior of individuals and groups. Grounded in scientific understanding of behavior, these models are often explicitly spatial. For example, agent models are used to simulate processes of land use change in relationship to the fragmentation of natural wildlife habitat. See Parker et al. 2002.

Place-Based Search. Geographic location is used to explore digital geolibraries and the Internet for data to use in spatial analysis. The Alexandria Digital Library *(www.adl.ucsb.edu)* is an outstanding example of a geolibrary. Such services use metadata to search and retrieve information from digital catalogs that are reliant on new data standards. Examples include the Content Standard for Digital Geospatial Metadata (Federal Geographic Data Committee) and the Data Documentation Initiative *(http://www.icpsr.umich.edu/DDI)*.

Spatial analysis has allowed me to stress, in both research and teaching, the ways that connections between locations have affected historical processes within them, and it has permitted me to treat the complexity of these processes within a much richer multivariate and multidimensional approach than was possible earlier. I am referring here specifically to the use of geographic information systems to combine layers of distinct data types for a visualization of these processes.

J. B. 'Jack' Owens, History,
Idaho State University

Within economics, spatial perspectives have led to better modeling of human/environment interaction, better understanding of spatial dynamics, and new thinking about the relationships between micro elements and macro outcomes.

Dawn Parker
Center for Social Complexity
George Mason University

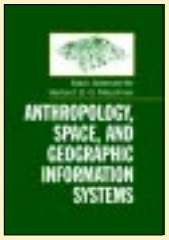
I have used cluster analysis to look at the clustering of sites within river valleys in Mesoamerica. I have used the information from the CSISS summer course to teach students the basics of spatial patterning analysis in my courses in archaeology and sustainable international development.

Ryan Arp, Anthropology,
Brandeis University

Applications of Spatial Social Science

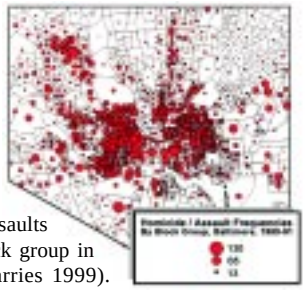
Examples for different disciplines highlight how spatial perspectives add value to research across the social sciences.

Anthropology is pioneering uses of GIS and remote sensing to augment traditional ethnographic approaches. For instance, a study in the Amazon rainforest features these techniques to study household behavior in relationship to land cover changes (Moran, Brondizio, and McCracken 2002).



Archaeology has seen a rapidly growing research literature that makes use of analytic mapping and GIS (Aldenderfer and Maschner 1996; Lock 2000). The new *Journal of GIS in Archaeology* describes a UNESCO effort to use GIS as a cultural resource management tool to plan for the protection of significant heritage sites amidst unexploded ordinance in the Plain of Jars. Situated in northern Laos, more than 3,000 large stone urns are scattered over 300 jar fields that date back 2,000 years or more (Box 2003).

Criminology is benefiting from the rapid infusion of spatial technologies based on concepts of pattern detection. Cohen and Tita (1999) illustrate the integration of spatial diffusion modeling in the analysis of homicide patterns in Pittsburgh.



Aggravated assaults by census block group in Baltimore (Harries 1999).

Economics has invoked space to add a robust theoretical context to the 'new' economic geography (Fujita, Krugman, and Venables 1999). Environmental economics, land market studies, and other research areas benefit significantly from spatial econometrics, as documented in *Advances in Spatial Econometric Modeling: Methodology, Tools, and Applications* (Anselin, Florax, and Rey 2004).

History. GIS technologies are enabling new interpretations of past events – the American Dust Bowl, the Salem witch trials, and Civil War battles – see *Past Time, Past Place: GIS for History* (Knowles 2002).

Demography is now using spatially referenced data to study issues in fertility, family planning, mortality, urbanization, density changes, migration, and related topics (Entwisle, et al. 1997; Weeks, et al. 2000).

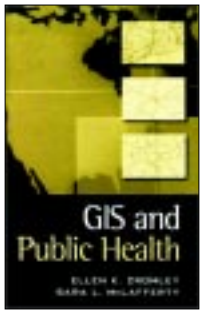
Human Geography imputes fundamental significance to spatial perspectives in seeking to understand the origins and functions of humanized landscapes. GIS, cartographic visualization, and other spatial tools provide the basis for gathering and analyzing data, and presenting research results (Robinson 1998).

Migration from California, 1995-2000. Output from Tobler's Flow Mapper program using U.S. Census data.

Political Science. Spatial methods and place-based thinking are invigorating work in political science, as seen in the research of Huckfeldt and Sprague (1995) on the role of communication in election processes, King (1997) on how to handle ecological inference, and Gimple and Schuknecht (2003) on accessibility to voting stations.

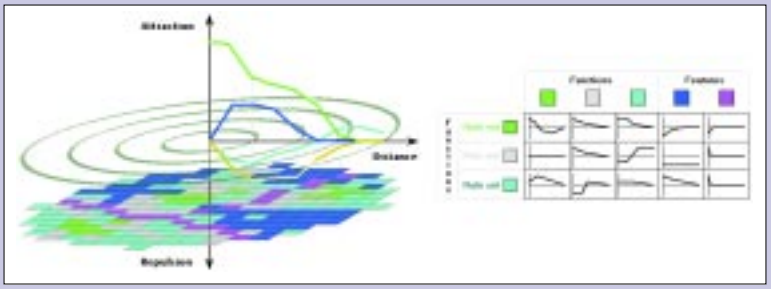
Regional Science provides interdisciplinary perspective on changes in regional economies and their policy dimensions. Spatial interaction and optimization modeling, spatial decision support systems, and simulation approaches are hallmarks of regional science, aided greatly by new tools for GIS and spatial econometrics (Nijkamp and Poon 1998, Rey 2004).

Public Health researchers have drawn on spatial theory and methods from statisticians Knorr-Held and Besag (1998) and geographer Openshaw (1990) in the detection of disease clusters, supplemented more recently with GIS technologies, illustrated in *GIS and Public Health* (Cromley and McLafferty 2002).



Sociology, with a long history of spatial thinking and analysis, has shifted from earlier impressionistic ecological associations of socio-economic phenomena to more critical and analytically sophisticated approaches, such as those featured in the rigorous analyses of neighborhood effects on social processes in Chicago (Sampson, Raudenbush, and Earls 1997).

Urban and Regional Planning has a long tradition of spatial thinking, as represented in the work of F. Stuart Chapin and Kevin Lynch. Today, GIS has become a standard tool for both academic and practicing planners. Shen's (1998) work on unemployment in inner cities is illustrative.



Schematic representation of the calculation of the neighborhood effect. White et al. 2004.

WHAT IS

CSISS?

The Center for Spatially Integrated Social Science was established in 1999 with support from the National Science Foundation's Directorate for Social, Behavioral, and Economic Research (NSF BCS 9978058) to build research infrastructure for the social and behavioral sciences. The Center is affiliated with the Institute for Social, Behavioral, and Economic Research and the National Center for Geographic Information and Analysis at the University of California, Santa Barbara and maintains a spatial tools development program at the University of Illinois, Urbana-Champaign.

CSISS programs seek to (1) encourage the use of spatial analytic technologies and geographically referenced data in social science research; (2) foster collaborative interdisciplinary networks that use spatial analysis to address core issues in the social sciences; and (3) develop a clearinghouse for the tools, case studies, educational opportunities, and other resources needed by this approach. Full descriptions of these programs and access to related resources are available at *www.csiss.org.*

Programs and Resources

National Workshops. More than 350 scholars from two dozen disciplines and study areas and from more than 200 different institutions have benefited from weeklong workshops on the latest methods and tools of spatially integrated social science. Workshops at UCSB, UCLA, the University of Washington, Pennsylvania State University, and Ohio State University have explored spatial pattern analysis, map making and the visualization of spatial data, agent-based spatial models, network analysis, geographically weighted regression, and accessibility in space and time. Other researchers have benefited from CSISS support to ICPSR workshops on spatial data analysis and spatial regression and to shorter demonstrations at individual universities and at academic conferences.

Mei-Po Kwan (foreground in black) and the participants of the CSISS 2003 summer workshop *Accessibility in Space and Time: A GIS Approach.*

Specialist Meetings. CSISS-sponsored meetings of leading researchers have explored core issues that cut across traditional disciplinary boundaries to focus on gaps in knowledge that can be addressed through a spatial perspective. Themes have included spatial inequality, spatial interactions and externalities in economics, location-based services, spatial tools software development, health risk perception, and the mapping of globalization flows.

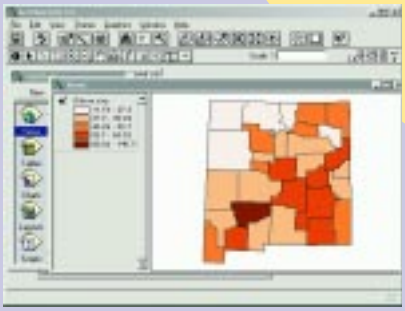
I am teaching a course right now that would not have occurred without my participation in the CSISS workshops. Teaching a course in the use of GIS is pretty straightforward; teaching a course in spatial analysis is far more challenging, but the intellectual rewards are far greater.

Brady Baybeck,
Political Science, University of Missouri – St. Louis

Learning Resources. The CSISS website features resources to assist in the understanding of core spatial concepts and exemplary research practices. In addition to course syllabi that feature lecture outlines and exercises, there are interactive learning modules and video clips from workshops. Innovative resources developed explicitly for the social sciences include:

CSISS Classics illustrate spatial thinking in the social sciences over the last few centuries. Summaries of innovative research, along with key references, outline some of the intellectual inheritance from previous generations.

The ***GIS Cookbook*** is a collection of descriptions and illustrations of GIS methods written with minimal GIS jargon, intended for first-time GIS users.



Best Practices. *Spatially Integrated Social Science* (Goodchild and Janelle 2004) includes 21 chapters by leading social and behavioral scientists that document how spatial analysis fosters theoretical understanding and empirical testing of social processes. All of the methods and many of the applications noted in this brochure are illustrated in this book.

Spatial Tools Development. Under the direction of Luc Anselin (Spatial Analysis Laboratory, Department of Agricultural and Consumer Economics, University of Illinois, Urbana-Champaign), this program aims to develop and disseminate a powerful and easy-to-use suite of software for spatial data analysis that accounts for spatial effects and that integrates spatial statistics with GIS capabilities. Important outcomes of this program include:


Screenshot from GeoDa application

- **GeoDa™**, a new interactive software environment that combines maps with statistical graphics and spatial econometric measures and that uses the technology of dynamically linked windows. The latest beta version of GeoDa is available free for non-commercial use at *http://sal.agecon.uiuc.edu/csiss/geoda.html.*
- **CSISS Tools Clearinghouse**, with links to information about tools for spatial analysis, at *http://www.csiss.org/clearinghouse.*

Virtual Community. CSISS is positioning its website as the primary port-of-call for researchers and students of spatial analysis in the social sciences. As a special feature, CSISS offers customized Internet search engines (such as its tools search engine) to identify relevant resources on the World Wide Web.

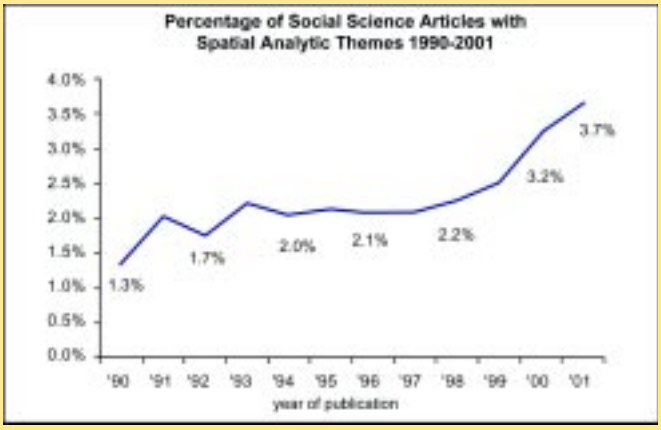
Place-Based Search is a CSISS program to develop a Social Science Archive Search Tool to enable a search of multiple archival sources for spatially referenced data by geographical locations.

***SPACE* (Spatial Perspectives for Analysis in Curriculum Enhancement).** CSISS contends that spatial information analysis needs to be integrated within undergraduate education in the social, behavioral, and economic sciences. To this end, NSF is funding a new CSISS initiative to provide workshops for instructors of undergraduate students to assist the national dissemination of spatial methodologies in the undergraduate curriculum and to provide supportive professional development to undergraduate instructors to help make this a reality. Workshops will be offered at the University of California, Santa Barbara, Ohio State University, and selected universities that participate in the University Consortium for Geographic Information Science. See *www.csiss.org/SPACE/*.

Spatial Awareness in the Social Sciences

Trends

Spatial analysis is growing as a proportion of the total scientific activity in the social sciences. The share of research articles on spatial analysis in social science journals has increased roughly from 1.3 percent in 1990 to 3.7 percent in 2001. This finding is based on use of a standard set of search terms to identify nearly 8900 articles indexed by the following online services: *EconLit*, *Social Sciences Citation Index*, *Sociological Abstracts*, *Historical Abstracts*, *America: History and Life*, and *Anthropological Literature*. For details, see *www.csiss.org/resources/litsearch.html.*



In addition, responses to a survey by CSISS program applicants and participants resulted in 88 percent agreeing or strongly agreeing to the statement that there was "increasing evidence of spatial thinking and analysis in my discipline over the last decade." This was also true across disciplines, from 83 percent in economics to 93 percent in planning/public policy and geography. For full details on the complete survey, see *www.csiss.org/survey.*

Needs

When asked to identify the most significant programmatic or resource needs for spatial social science research and teaching over the next decade, the basic themes, repeated almost universally by respondents to the CSISS survey, included:

- **Accessibility** – to data at a variety of scales, cheaply and easily, making use of Web technologies when possible.
- **Software** – inexpensive, easy-to-use, and integrating a variety of spatial and statistical tools for analysis and modeling. Software should facilitate research across dimensions of time and space, at multiple scales, and with multiple theoretical approaches.
- **Training** – the need for workshops and courses oriented to specific research communities, and the inclusion of spatial analysis among standard social science methodologies.
- **Course Resources** – syllabi, student-friendly exercises and related data sets, and comprehensive textbooks with examples of relevant applications are high on the priority lists for university social science instructors.

I strongly believe that major demography centers should have regular classes on what could be called spatial demography. This would certainly launch the interest for a much larger number of students.

Marcia Caldas de Castro, Demography, Princeton University

WHAT IS

The Future of Spatial Social Science

The increasing availability of geo-referenced data, advances in theory, and the expanded availability of specialized software have established a momentum of change in academic research and teaching and in related applications of spatial science that benefit society and inform policy makers. Consider the following statements from the Foreword and Epilogue of *Spatially Integrated Social Science*:

In his Foreword, Norman M. Bradburn, Assistant Director for the Social, Behavioral and Economic Sciences Directorate of the National Science Foundation, notes how

> The advent of geographic information systems (GIS) has enabled an explosion of interest in and ability to study the spatial patterns of behavior. GIS not only makes it possible to store in digital form vast amounts of spatial data, it makes possible statistical analysis, modeling, and visual display of geographical data. It provides a powerful new tool that has stimulated new and exciting social science research using geographical concepts and data. At last, long-held but unverified hypotheses about the importance of locational and spatial variables can be tested. We are at the dawn of a revolution in a spatially oriented social science.

In his Epilogue, Brian J. L. Berry, one of the leading spatial scientists of the past half-century, sees a future that will depend on continued innovation.

> There clearly is need for new rounds of spatial theory that will be as dramatic in their consequences over the decades to come as have been the changes in technology over the past 40 years. This theory cannot be static, a limitation of the strictly geographical approach, but must be fully spatio-temporal and positioned so as to enhance the creative tension that should exist between theory and practice. It must be multidimensional and therefore multidisciplinary, transcending the constraints of traditional disciplinary agendas and casting light on the interstices where today's important problems are located. And it must involve not simply the human sciences, but all those sciences that meet at the human-environmental interface. There is much that has been achieved. Yet in a world that is never static, there is yet more to be accomplished, and what is most exciting is that there is the momentum to get there.

REFERENCES CITED

Aldenderfer, M. S., and H. D. G. Maschner, eds. 1996. *Anthropology, Space, and Geographic Information Systems*. Oxford: Oxford University Press.

Anselin, L., J.G.M. Florax, and S. Rey, eds. 2004. *Advances in Spatial Econometric Modeling: Methodology, Tools, and Applications*. Heidelberg: Springer-Verlag.

Box, P. 2003. Safeguarding the Plain of Jars: Megaliths and unexploded ordinance in Lao People's Democratic Republic. *Journal of GIS in Archaeology* 1: 91-102.

Clarke, K. C. 2001. *Getting Started with Geographic Information Systems, 3rd ed*. Upper Saddle River, NJ: Prentice Hall.

Cohen, J., and G. Tita. 1999. Diffusion in homicide: Exploring a general method for detecting spatial diffusion processes. *Journal of Quantitative Criminology* 15: 451-494.

Cromley, E. K., and S. L. McLafferty. 2002. *GIS and Public Health*. New York: The Guilford Press.

Entwisle, B., R. R. Rindfuss, S. J. Walsh, T. P. Evans, and S. R. Curran. 1997. Geographic information systems, spatial network analysis, and contraceptive choice. *Demography* 34: 171-188.

Fujita, M., P. Krugman, and A. Venables. 1999. *The Spatial Economy. Cities, Regions and International Trade*. Cambridge: The MIT Press.

Gimple, J. G., and J. E. Schuknecht. 2003. Political participation and the accessibility of the ballot box. *Political Geography* 20:1-18.

Goodchild, M. F., and D. G. Janelle. 2004. Thinking spatially in the social sciences. In M. F. Goodchild, and D. G. Janelle, eds. *Spatially Integrated Social Science.* New York: Oxford University Press, 3-21.

Harries, K. 1999. *Mapping Crime: Principle and Practice*. Washington D.C.: Crime Mapping Research Center, U.S. Department of Justice.

Huckfeldt, R. R., and J. Sprague. 1995. *Citizens, Contexts, and Social Communication: Information and Influence in an Election Campaign*. New York: Cambridge University Press.

King, G. 1997. *A Solution to the Ecological Inference Problem: Reconstructing Individual Behavior from Aggregate Data*. Princeton, NJ: Princeton University Press.

Knorr-Held, L., and J. Besag. 1998. Modelling risk from a disease in time and space. *Statistics in Medicine* 15: 2045-2060.

Knowles, A. K., ed. 2002. *Past Time, Past Place. GIS for History.* Redlands, CA: ESRI Press.

Kwan, M-P., D.G. Janelle, and M.F. Goodchild, eds. 2003. Accessibility in space and time: A special issue. *Journal of Geographical Systems* 5(1).

Kwan M-P., and J. Lee, 2004. Geovisualization of human activity patterns using 3-D GIS: A time-geographic approach. In M. F. Goodchild and D. G. Janelle, eds. *Spatially Integrated Social Science*. New York: Oxford University Press, 48-66.

Lock, G., ed. 2000. *Beyond the Map: Archaeology and Spatial Technologies*. Amsterdam: IOS Press.

Nijkamp, P., and J. Poon. 1998. Spatial perspectives on new theories of economic growth. *Annals of Regional Science* 32: 407-437.

Openshaw, S. 1990. Automating the search for cancer clusters: A review of problems, progress and opportunities. In R. W. Thomas, ed. *Spatial Epidemiology*. London: Pion, 48-78.

O'Sullivan, D., and D. Unwin, 2002. *Geographic Information Analysis*. Hoboken, NJ: John Wiley & Sons, Inc.

Moran, E. F., E. S. Brondizio, and S. McCracken. 2002. Trajectories of land use: Soils, succession, and crop choice. In C. Wood and R. Porro, eds. *Deforestation and Land Use in the Amazon*. Gainesville: University of Florida Press, 193-217.

Parker, D. C., T. Berger, and S. M. Manson. 2002. *Agent-Based Models of Land-Use and Land-Cover Change. LUCC Report Series* No. 6. Bloomington IN: Anthropological Center for Training and Research on Global Environmental Change, Indiana University.

Rey, S. J. 2004. Spatial analysis of regional income inequality. In M. F. Goodchild and D. G. Janelle, eds. *Spatially Integrated Social Science*. New York: Oxford University Press, 280-299.

Robinson, G. M. 1998. *Methods and Techniques in Human Geography*. Chichester, UK: John Wiley & Sons.

Sampson, R. J., S. Raudenbush, and F. Earls. 1997. Neighborhoods and violent crime: A multilevel study of collective efficacy. *Science* 277: 918-924.

Shen, Q. 1998. Location characteristics of inner-city neighborhoods and employment accessibility in low-wage workers. *Environment and Planning B: Planning and Design* 25: 345-365.

Tufte, E. R. 1997. *Visual Explanations: Images and Quantities, Evidence and Narrative*. Cheshire, CT: Graphics Press.

Weeks, J. R., M. S. Gadalla, T. Rashed, J. Stanforth, and A. G. Hill. 2000. Spatial variability in fertility in Menoufia, Egypt, assessed through the application of remote sensing and GIS technologies. *Environment and Planning A* 32: 695-714.

White, R., B. Straatman, and G. Engelen. 2004. Planning scenario visualization and assessment: A cellular automata based integrated spatial decision support system. In M. Goodchild, and D. Janelle, eds. *Spatially Integrated Social Science*. New York: Oxford University Press, 420-442.

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