The Case for Space in the Social Sciences

Don Janelle

Center for Spatially Integrated Social Science

University of California, Santa Barbara

Roundtable on
"Geographical Voices and Geographical Analysis Methods"

Pontifica Universidade Católica de Minas Gerais
Universidade Católica de Salvador

August 2007

Center for Spatially Integrated Social Science

UCSB / Principal Investigator: M.F. Goodchild
Co-PI: R.P. Appelbaum
Program Director: D.G. Janelle

Building resources for spatial analysis in the social sciences

www.CSISS.org

- Internet Gateway to Spatial Analysis
- Resources for Researchers and Teachers
- Summer National Workshop Program
- Spatial Analytic Tools Development L. Anselin

Center for Spatially Integrated Social Science

Spatial Resources for the Social Sciences

The CSISS Mission recognizes the growing significance of space, spatiality, location, and place in social science research. It seeks to develop unrestricted access to tools and perspectives that will advance the spatial analytic capabilities of researchers throughout the social sciences. CSISS was funded in 1999 with support from the National Science Foundation under its program to promote research infrastructure in the social and behavioral sciences.

CSISS News

Core Programs	Learning Resources	Spatial Resources	Spatial Tools
2007 Workshop Programs: SPACE, Population GIS UCSB	These introductory materials include **CSISS Classics** and **select video clips** from the CSISS summer workshops.	CSISS has compiled e-journals, bibliographies, and other spatial resources for the social sciences.	Here's where you'll find information about software for the exploration and analysis of spatial data.

Search Engines	CSISS Events	Spatial Literature	About CSISS
Try out one of our custom search engines to find spatial analysis resources on the Internet.	Here's where you'll find information and registration for workshops, conferences and specialist meetings.	Bibliographies and publications related to spatial methods and their use in the social sciences.	CSISS presentations, news, personnel, and sitemap. Our Strategic Plan and Annual Reports are also found here.

The CSISS Strategy and Plan

Modeling a Center for Spatially Integrated Social Science

Critical Themes in Social Science

+

Tools and Concepts for Spatial Thinking

+

Infrastructure

=

Advances in Spatial Social Science

Some Critical Themes in the Social Sciences

- Space-time accessibility
- Equity
- Externality effects
- Risk assessment
- Small-area analysis
- Sense of place
- Cultural analysis
- Demographic processes
- Health and disease
- Crime mapping and law enforcement
- Community organization
- Governance
- Electoral processes
- Globalization
- International conflict
- Coupling human and environmental systems
- etc


Crime & Law Enforcement
Space-Time Accessibility
Urban & Regional Issues
Cultural Analysis
Health & Disease
Biophysical-Human Interface
Critical Themes in Social Science
Equity
Externalities
Globalization
International Conflict
Community Organization
Electoral Processes
Key Investigators
Risk Theory
Small-Area Analysis
Population & Demographic Issues
Governance
CSISS Specialist Meetings


Crime & Law Enforcement
Space-Time Accessibility
Urban & Regional Issues
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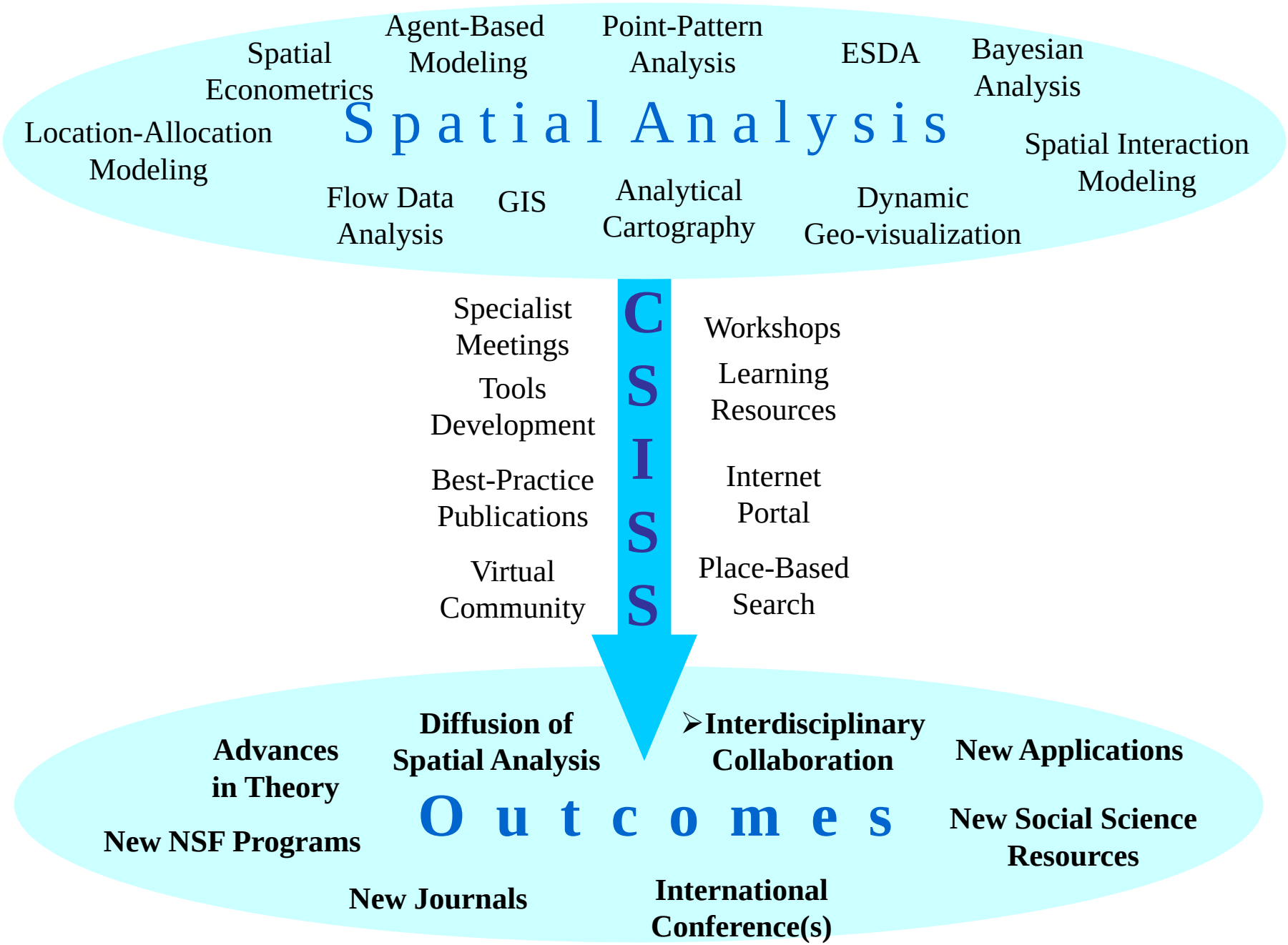
Community Organization
Electoral Processes
Key Investigators
Risk Theory
Small-Area Analysis
Population & Demographic Issues
Governance
CSISS Specialist Meetings
Tools Development
Workshops
Learning Resources
Best-Practice Publications


Spatial Econometrics
Agent-Based Modeling
Point-Pattern Analysis
ESDA
Bayesian Analysis
Location-Allocation Modeling
Spatial Analysis
Spatial Interaction Modeling
Flow Data Analysis
GIS
Analytical Cartography
Dynamic Geo-visualization
Specialist Meetings
Tools Development
Best-Practice Publications
Virtual Community
CSISS
Workshops
Learning Resources
Internet Portal
Place-Based Search
Diffusion of Spatial Analysis
Interdisciplinary Collaboration
New Applications
Advances in Theory
Outcomes
New Social Science Resources
New NSF Programs
New Journals
International Conference(s)

Questions from the Skeptics

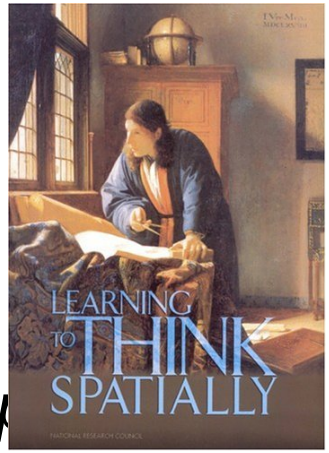
Spatial Social Science?

- Do spatial perspectives draw on and contribute to theory in the social sciences?
- Why should social scientists accept that variance across space really matters? And, is it worth the effort to incorporate space?
- Is there a tension between GIS (the technique) and “thinking spatially”?
- What structures in the social sciences have emerged in support of spatial analysis/thinking?
- Is there a community of spatial social science and can its growth be measured?

Documenting a Spatial Turn in the Social Sciences

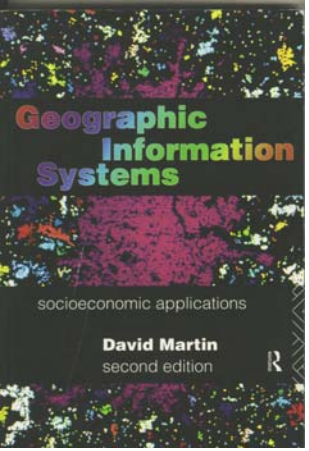
Interest in Spatial Perspectives

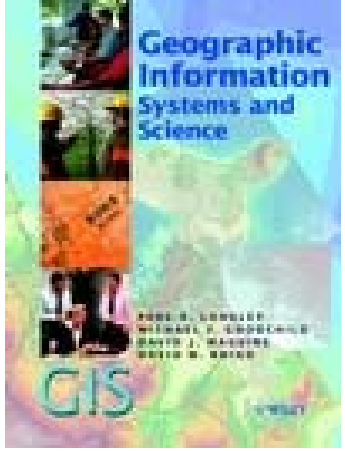
- New initiatives at leading universities and by science funding agencies
- A "spatial turn" in the social sciences
  - The New Economic Geography – adding space to social science theory (space impeding flows of information, operation of markets, transport costs)
- Popularization of Spatial technologies:
  - Google Earth, Google Maps, Microsoft Virtual Earth
  - geotagging in Wikimapia, Flikr, …
  - GIS, remote sensing, GPS
- geovisualization has impacted all science and media representation
- National Research Council report *Learning to Think Sp*

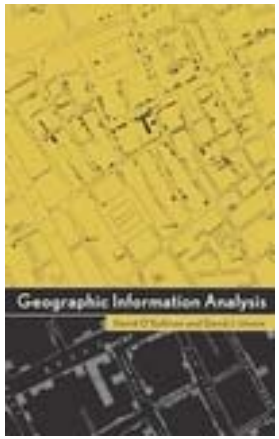


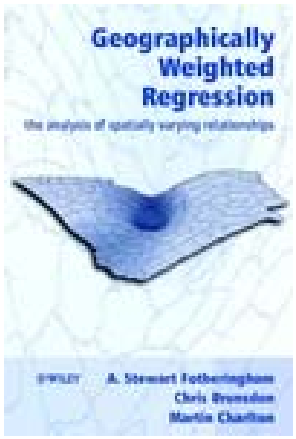
Building on the Numbers

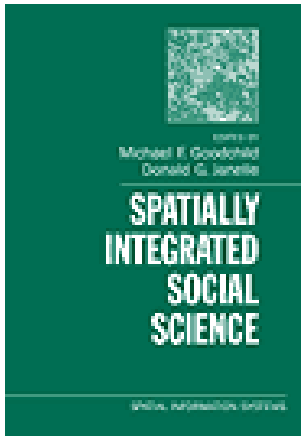
- Growth in scientific literature using spatial perspectives
- CSISS summer workshops (since 2000) >700 participants
- GeoDa (CSISS / Anselin) >20,000 downloads (May 2007)
- Need for documentation of the trends in literature, software adoption, and conference presence of spatial analysis across the sciences

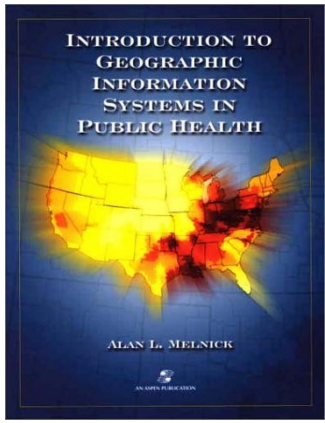

Geographic Information Systems
socioeconomic applications
David Martin
second edition

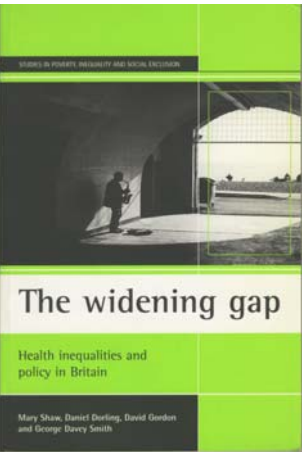

Geographic Information Systems and Science
GIS

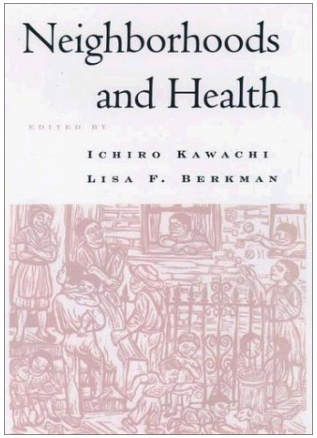

Geographic Information Analysis


Geographically Weighted Regression
the analysis of spatially varying relationships
A. Stewart Fotheringham
Chris Brunsdon
Martin Charlton

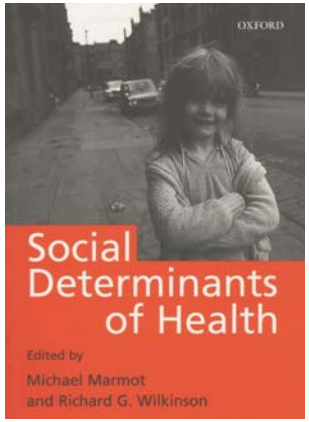

Michael F. Goodchild
Donald G. Janelle
SPATIALLY INTEGRATED SOCIAL SCIENCE

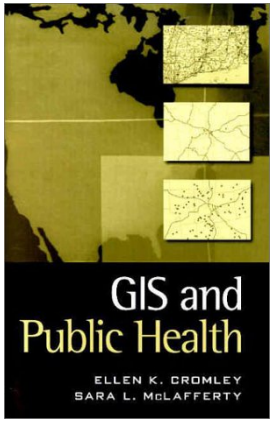

INTRODUCTION TO GEOGRAPHIC INFORMATION SYSTEMS IN PUBLIC HEALTH
ALAN L. MELNICK

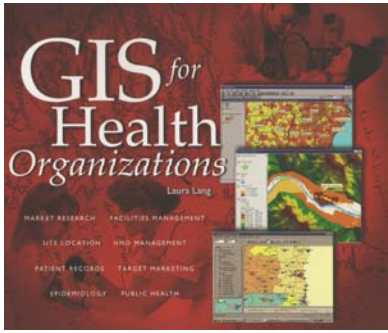

The widening gap
Health inequalities and policy in Britain
Mary Shaw, Daniel Dorling, David Gordon and George Davey Smith

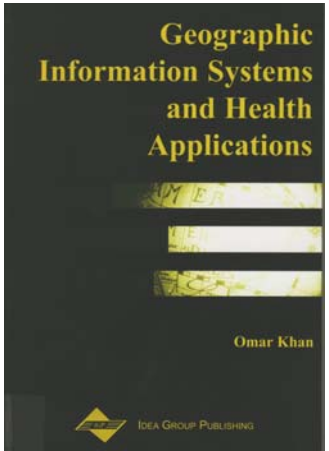

Neighborhoods and Health
ICHIRO KAWACHI
LISA F. BERKMAN

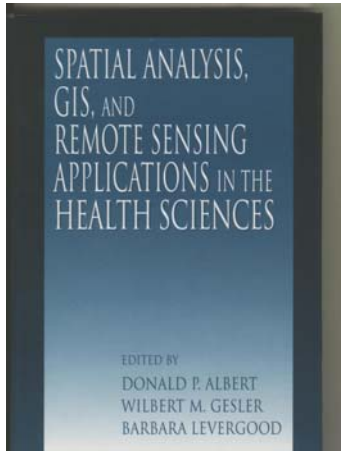

SOCIAL EPIDEMIOLOGY
LISA F. BERKMAN
ICHIRO KAWACHI

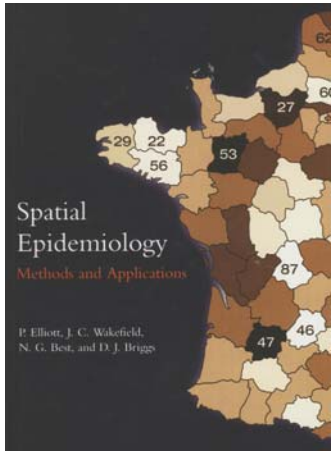

OXFORD
Social Determinants of Health
Edited by
Michael Marmot
and Richard G. Wilkinson

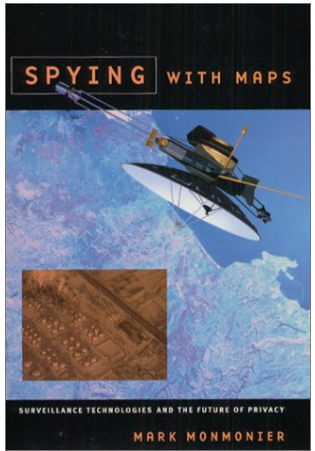

GIS and Public Health
ELLEN K. CROMLEY
SARA L. McLAFFERTY

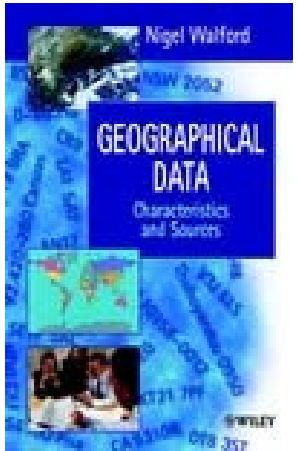

GIS for Health Organizations
Laura Lang


Geographic Information Systems and Health Applications
Omar Khan
IDEA GROUP PUBLISHING


SPATIAL ANALYSIS, GIS, AND REMOTE SENSING APPLICATIONS IN THE HEALTH SCIENCES
EDITED BY
DONALD P. ALBERT
WILBERT M. GESLER
BARBARA LEVERGOOD


Spatial Epidemiology
Methods and Applications
P. Elliott, J. C. Wakefield, N. G. Best, and D. J. Briggs


SPYING WITH MAPS
SURVEILLANCE TECHNOLOGIES AND THE FUTURE OF PRIVACY
MARK MONMONIER


Nigel Walford
GEOGRAPHICAL DATA
Characteristics and Sources


GIS DATA SOURCES
Drew Dockter

Political Geography

Volume 21 Number 2 February 2002

ISSN 0962-6298

Special Issue:
The Development and Application of Spatial Analysis for Political Methodology

POLITICAL ANALYSIS

VOL. 10 NO. 3 SUMMER 2002

SPECIAL ISSUE

Spatial Methods in Political Science

Spatial Processes and Political Methodology: Introduction to the Special Issue
Michael D. Ward and John O'Loughlin

The Electoral Geography of Weimar Germany: Exploratory Spatial Data Analyses (ESDA) of Protestant Support for the Nazi Party
John O'Loughlin

Location, Location, Location: An MCMC Approach to Modeling the Spatial Context of War and Peace
Michael D. Ward and Kristian Skrede Gleditsch

...endent Citizens: Connecting

...gregation Bias, and
...l Inference: Comment on

...ical Variance

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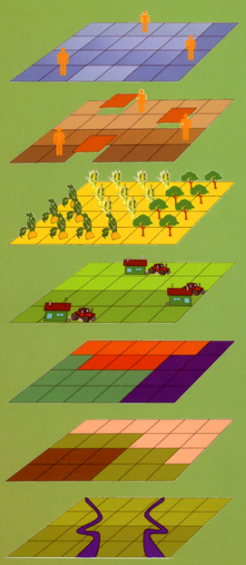
...ical Science Association

Agent-Based Models of Land-Use and Land-Cover Change

Report and Review of an International Workshop
Irvine, California, USA
October 4-7, 2001



LUCC Report Series No. 6

UNIVERSITY OF CALIFORNIA, SANTA BARBARA
Center for Spatially Integrated Social Science

EDITORS | MEETING OBJECTIVES | CONTRACTED PAPERS | WWW.CSISS.ORG

New Tools for Spatial Data Analysis:

ELSEVIER

Agricultural Economics 27 (2002) 197–200

AGRICULTURAL ECONOMICS

www.elsevier.com/locate/agecon

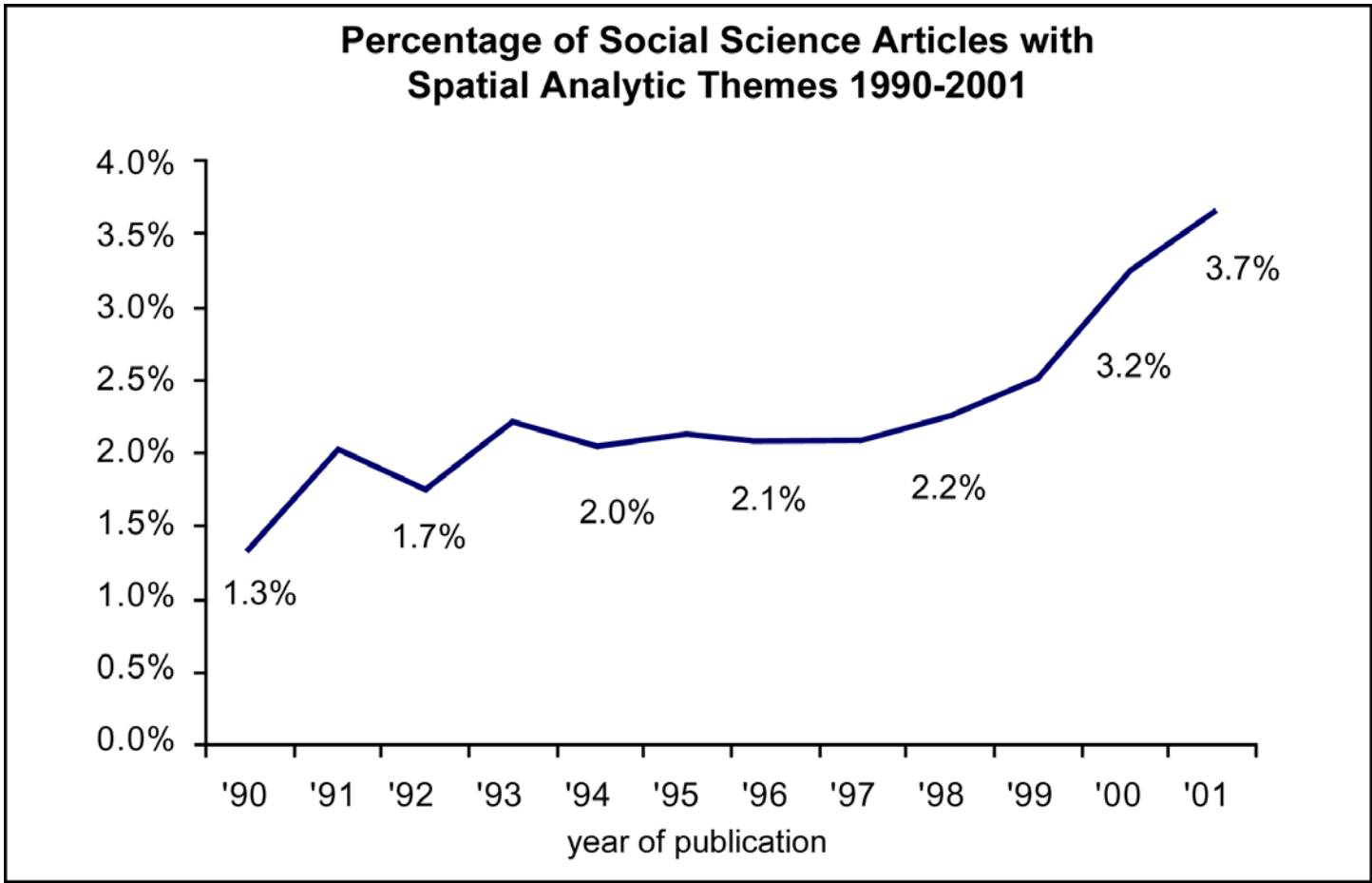
Introduction to the special issue on spatial analysis for agricultural economists

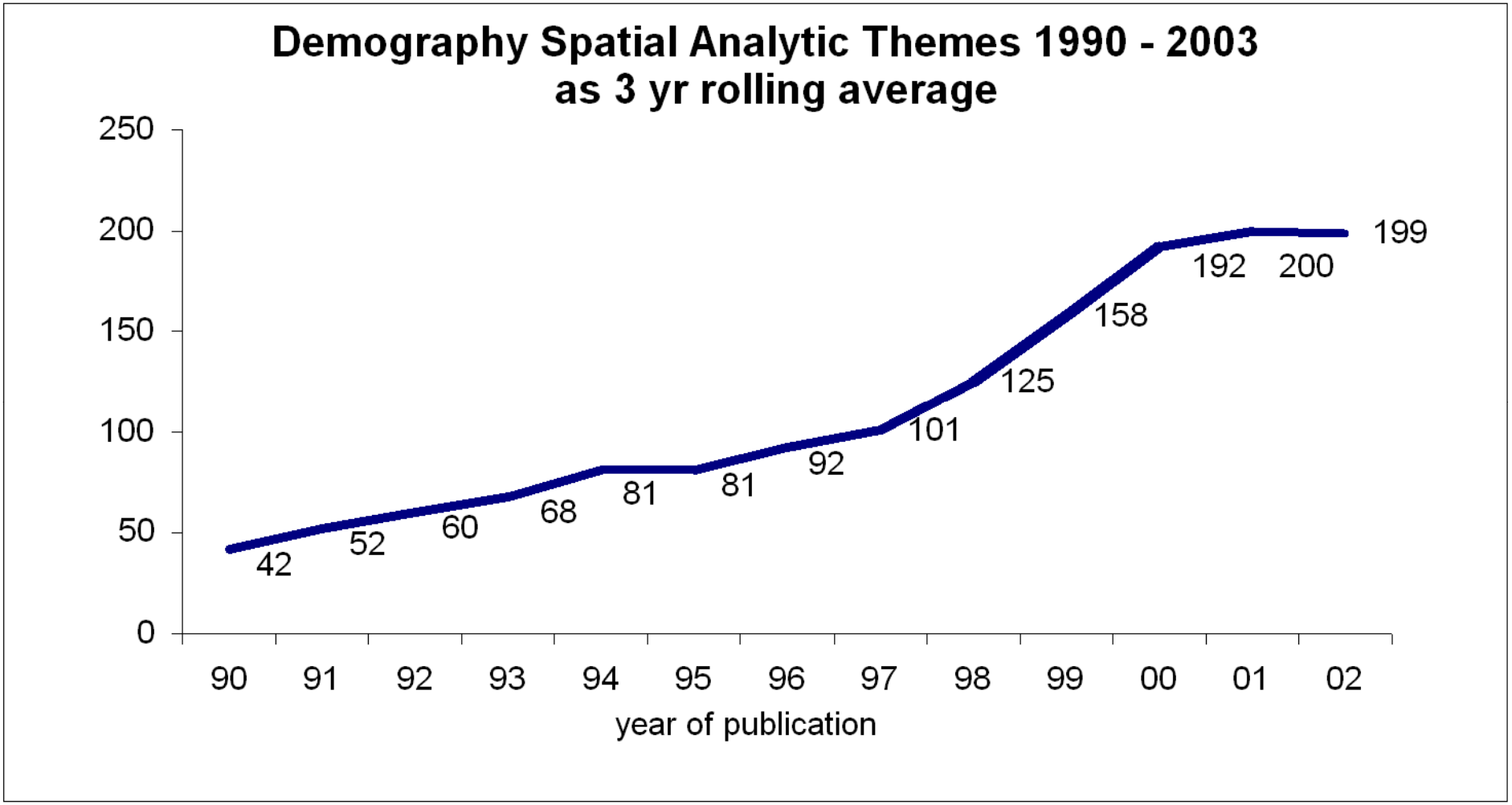
Gerald C. Nelson*

University of Illinois, Urbana-Champaign, 305 Mumford Hall, 1301 W. Gregory Drive, Urbana, IL 61801, USA

A Growing Literature

Spatially Integrated Social Science (Goodchild and Janelle, OUP, 2004) www.csiss.org/best_practices/siss





The database includes 2329 demography articles from 1956 through 2004 drawn from the CSISS database and from nearly one thousand articles from journals and online databases that specialize in demography and population studies.

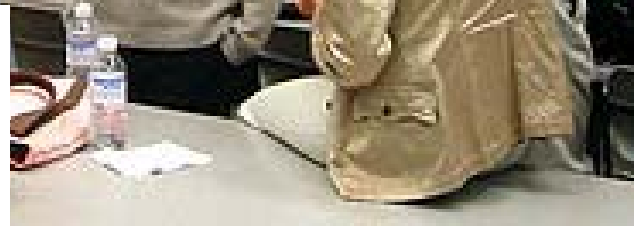
See http://www.csiss.org/GISPopSci/resources/bibliography/

CSISS Residential Workshops
GIS and Spatial Analysis (2000 – 2007)

(building expertise and capacity for spatial thinking in the social sciences)

	Attended	Applied
Anthropology / Archaeology	59	123
Criminology	21	45
Demography, Population & Health	98	227
Economics	63	192
Environmental Studies	18	33
Epidemiology	11	27
GIS	30	75
History	7	10
Human Geography	123	422
Political Science	55	95
Public Policy	17	80
Regional Science	5	6
Sociology	115	200
Statistics	9	22
Urban Studies & Urban Planning	44	133
Other	31	99
Totals:	706	1789

CSISS



CSISS Resources
for
Spatial Social Science

GeoDa Home | Downloads | Features | Documentation | News | Support | Workshops

GeoDa™ An Introduction to Spatial Data Analysis

developed by: Spatial Analysis Lab

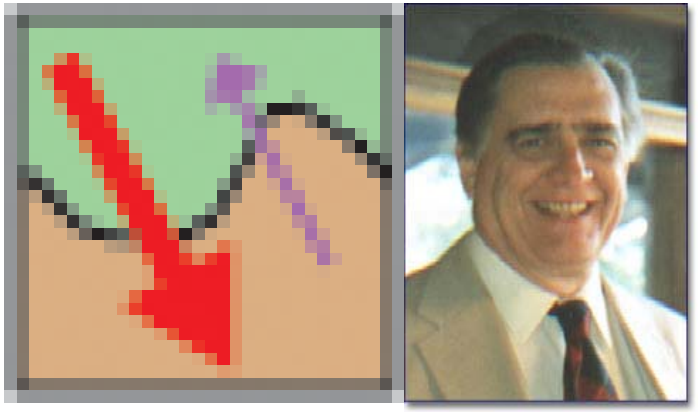
www.geoda.uiuc.edu

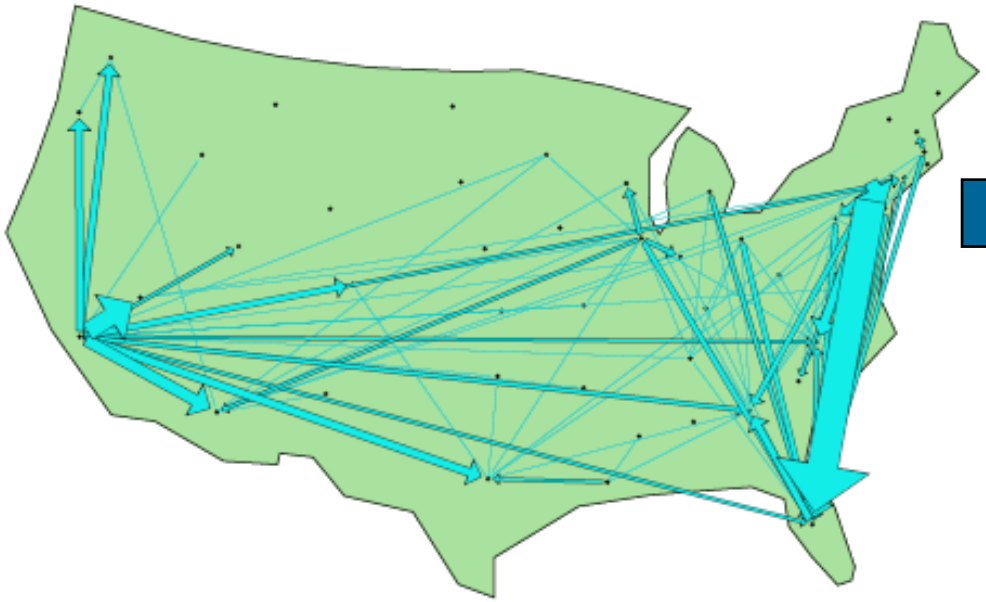
Download GeoDa 0.9.5-i

- **Tutorials**
- **Sample Data**
- **Workbook**
- **Openspace Mailing List**

Luc Anselin

Tobler's FlowMapper





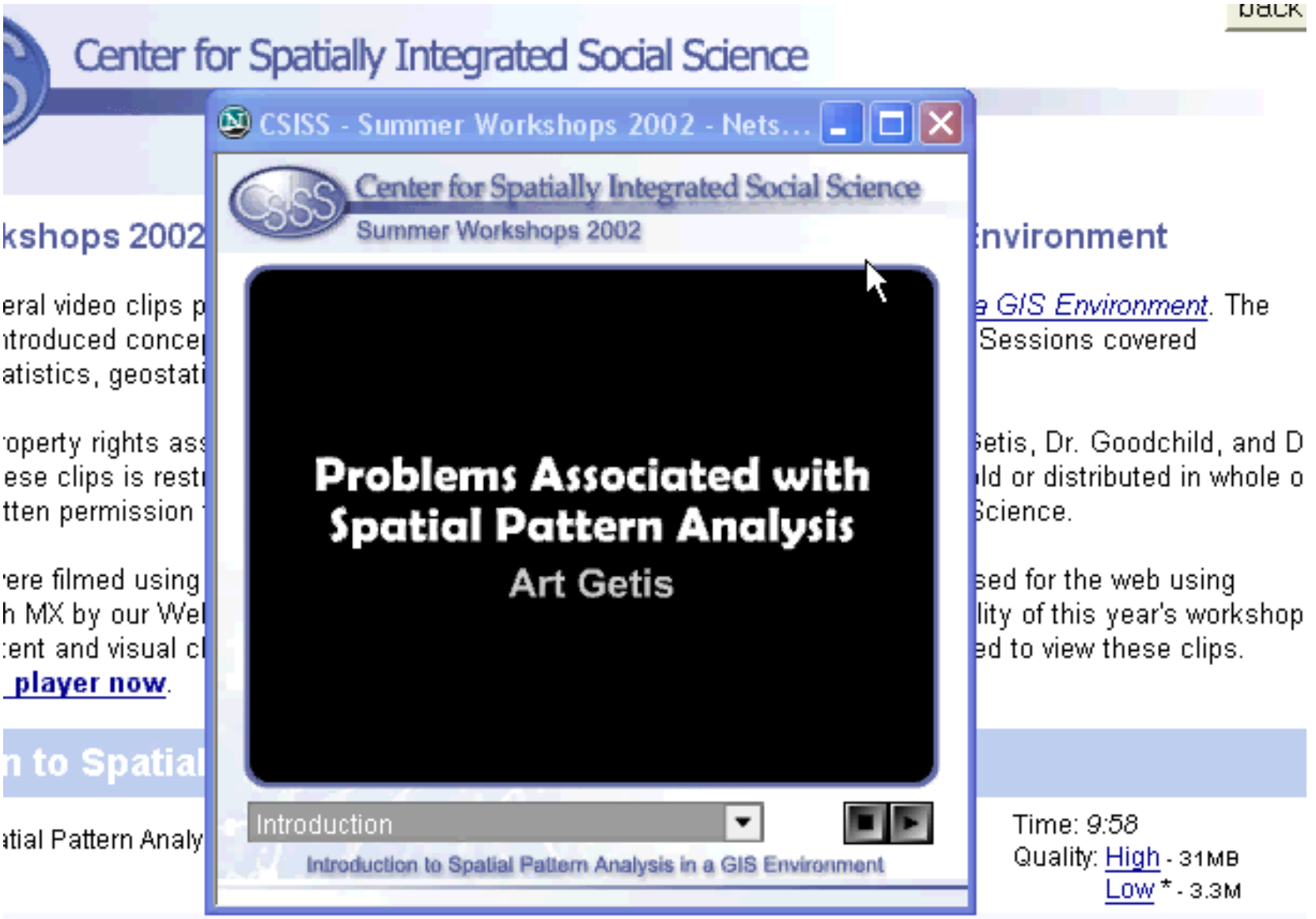
http://www.csiss.org/clearinghouse/FlowMapper

CSISS Video Clips of Summer Workshops

Download Flash player now.

Introduction to Spatial Pattern Analysis in a GIS Environment

The Nature of Spatial Pattern Analysis Art Getis	Time: *9:58* Quality: High - 31MB
Problems Associated with Spatial Pattern Analysis Art Getis	Time: *9:43* Quality: High - 31MB
An Introduction to GIS Mike Goodchild	Time: *7:29* Quality: Audio Only - 2MB
GIS Functionality Mike Goodchild	Time: *9:58* Quality: High - 33MB
Current Technologies in GIS Mike Goodchild	Time: *14:54* Quality: High - 48MB
Spatial Patterns of Birth Data John R. Weeks	Time: *15:42* Quality: Audio Only - 5MB
Spatial Patterns of Fertility in Egypt John R. Weeks	Time: *10:18* Quality: High - 32MB

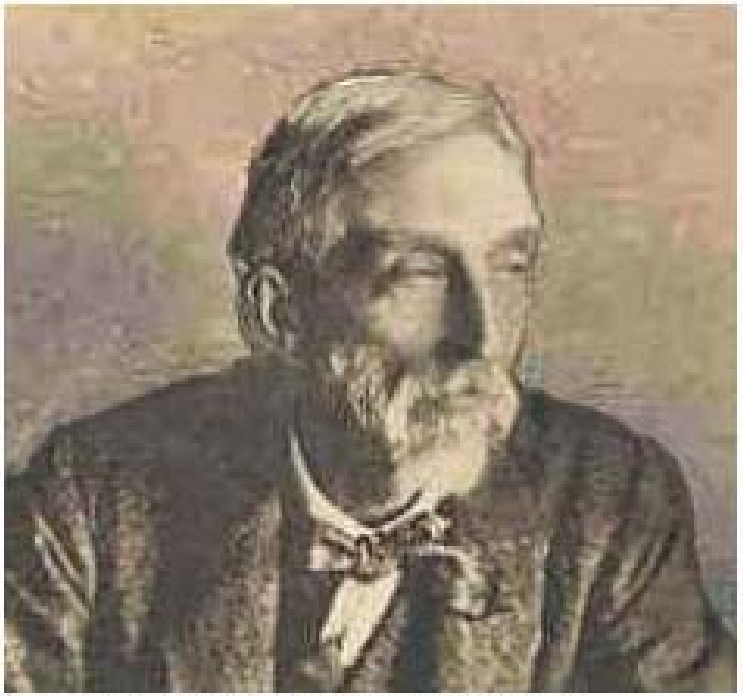


http://www.csiss.org/streaming_video/2002/

Charles Booth: Mapping London's Poverty, 1885-1903

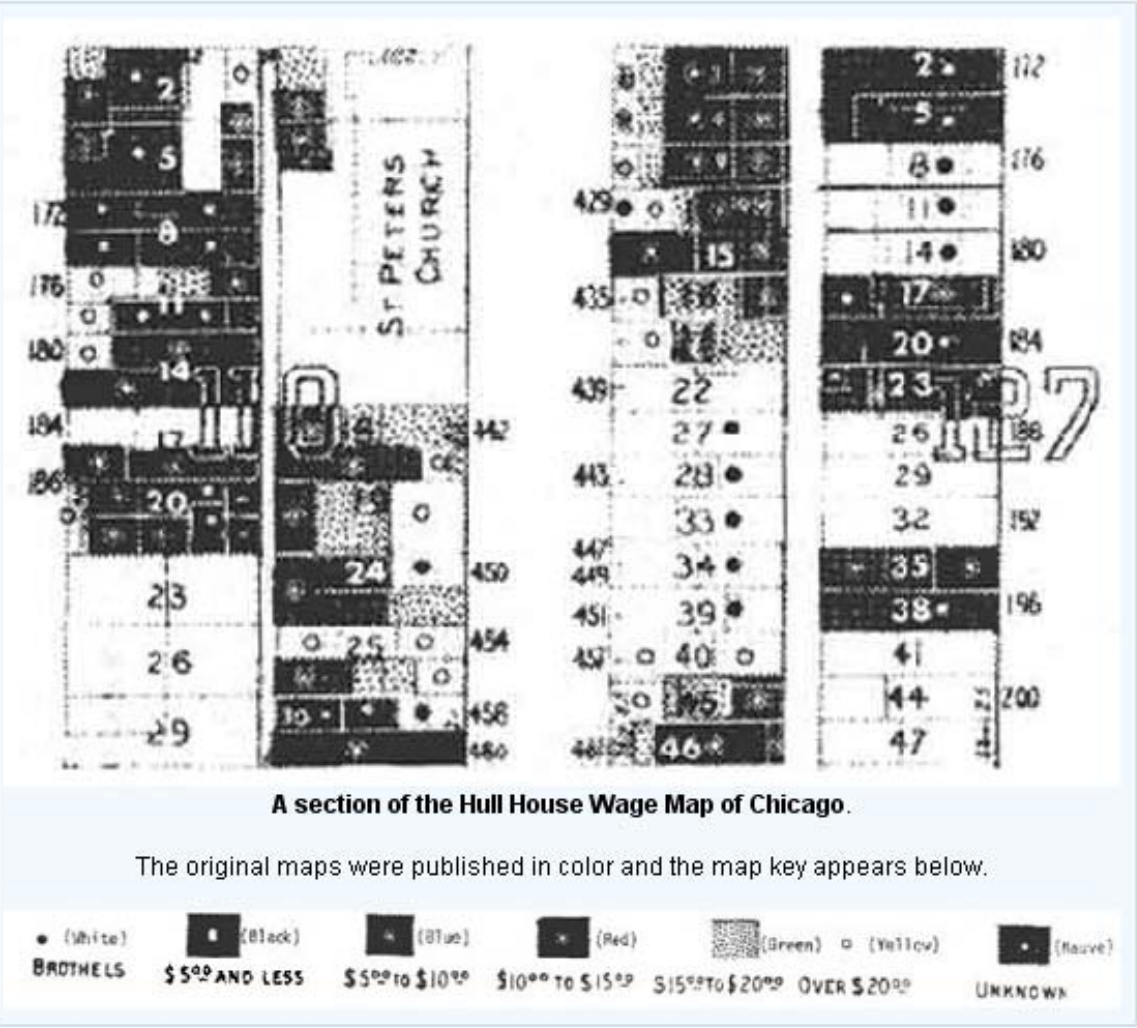
By David Fearon

Background



Between 1886 and 1903 Charles Booth produced a remarkable series of maps of London carefully coded for social class with data gathered by visiting, literally, every street in London. Equally remarkable, Booth devised, funded a research team, and conducted the study in his spare time while running a successful international leather trade and steamship company. In the 1880s, the question of increasing poverty in an increasingly wealthy Industrial-age Britain was becoming more central to citizens, politicians and philanthropists. A series of riots and sensational journalism sparked fears of social unrest. Booth encountered the squalid conditions of London neighborhoods while campaigning for an unsuccessful

Florence Kelley: Slums of the Great Cities Survey Maps, 1893 By Nina Brown



A section of the Hull House Wage Map of Chicago.

The original maps were published in color and the map key appears below.

Library of Congress, Washington D.C.

887) and corresponded with Engels returned to the United States she married a socialist labor leader, but the marriage was short lived. In 1891 Kelley divorced and moved to Chicago, where she became a resident of Hull House, the

http://www.csiss.org/classics/

Henry Mayhew: London Labour and the London Poor, 1861
By Nina Brown

Back to Classics

The Intensity of Criminality

Map showing the number of criminal offenders to every 10,000 of population in each county of England and Wales.

The Road to Universal Education in Spatial Thinking

Why *Spatial Thinking?*

- Spatial thinking should be one of the foundations for general undergraduate education (for informed citizenship and for general information analysis and assessment)
- Spatial perspectives provide a means of integrating theory within and across disciplines, and for matching it with evidence
- Spatial analysis can serve as a foundation for interdisciplinary cooperation (e.g., the coupling of environmental and social processes)

Identifying Foundation Concepts for Spatial Thinking

- Demonstrable at all levels of space & time
- Applicable to all of science
- Expandable from simple illustrations to advanced thought processes about scientific and social problems
- Expandable from a 5-minute explanation to a life-time career of research and/or application

Eight Foundation Concepts in Spatial Thinking	
1 Location	Places abstracted as points, lines, and areas, and represented as points, polylines, and polygons. Rasters and grid cells. Mathematical approximations to the geoid, map projections, coordinate systems. Measurement and tracking of location: GPS. Location in human discourse: place names, prepositions, and movement verbs. Positional accuracy. The characteristics or attributes of places: scales of measurement. Concepts of land ownership in different cultures, administrative hierarchies, postcodes, linear referencing.
2 Distance	Metrics of distance on the plane and globe. Travel cost, travel time, and impacts on interaction and spatial behavior by humans and other organisms. Distance decay and spatial interaction models. Buffers. Weights matrices and their applications in spatial analysis and modeling. Geodesics, potential fields, and optimum paths.
3 Network	Linear networks for transportation, communication, and social interaction. Network metrics. Models of network development and design. Small worlds and degrees of separation. Representation of networks in spatial databases. Models of network flow assignment.
4 Neighborhood and Region	Definitions of neighborhood based on human spatial behavior. Formal and functional regions and concepts of territory. Models of region design and political districting. The modifiable areal unit problem and the ecological fallacy. Techniques of areal interpolation. Metrics of fragmentation and shape.

5 Scale	Level of detail in spatial data sets. Definitions of scale: extent and resolution. Scale-related concepts: self-similarity (fractals), generalization and down-scaling, line and surface smoothing, recursive subdivision, variance decomposition, and multi-level analysis. The role of scale in process.
6 Spatial Heterogeneity	Heterogeneity as a fundamental characteristic of spatial data. First-order effects, non-stationarity, and uncontrolled variance. Implications of spatial heterogeneity for sampling and statistical inference. Place-based analysis, local indicators of spatial association, and geographically weighted regression.
7 Spatial Dependence	Metrics of spatial dependence: Moran and Geary indices. Getis and Ord G statistic. Geostatistics as a theoretical framework for spatial data. Spatial interpolation. Statistical inference in the presence of spatial dependence; explicit models of spatial dependence. Analysis of point patterns and cluster detection. The role of spatial dependence in uncertainty.
8 Objects and Fields	Discrete objects and continuous fields as fundamental conceptualizations of space and as the basis for models of process. The dichotomy as an underpinning of methods of representation and analysis. Spatial correlation. Concepts of uncertainty in both conceptualizations.

Linking Foundation Concepts of Spatial Thinking to the Theories and Themes of the Social Sciences

- Social inequality
- Concentrated disadvantage
  Uneven development
- Externalities
- Neighborhood
- Community
- Social networks
- Social capital
- Collective efficacy
- Trust
- Power
- Service optimization
- Etc.

Building Foundations for Spatial Thinking in the Social Sciences

Lessons from CSISS

- Recognize social science theoretic and thematic perspectives
- Emphasize added value of spatial thinking to social science theory and problem solving, re:
  - integration of information / disciplines
  - inference from form to process
  - organizing and retrieving information
  - links to policy

Challenges

- Leadership is needed to position spatial thinking as important (essential) to scientific understanding and to sound public policies
- Support resources need to be assembled, organized, and made easily accessible:
  - Course units, exercises, instruments for learning assessment, etc.
  - Networks of scholars / mentors
- GI Science tools need enhancement to meet the needs of science:
  - Technologies for space-time integration of data
  - Capabilities in analysis are needed that match the capabilities of micro-simulation methods to display space-time processes

Conclusions

- The relevance of spatial perspective in science is increasingly appreciated across disciplines – providing grounds for curriculum change
- A growing level of expertise exists across disciplines – allies and potential leaders in curriculum change (need for documentation)
- The ***necessary conditions*** to imbue science education with the powerful insights of the spatial perspective and visualization are now in place

Obrigado

Please visit www.csiss.org

Under development: www.spatial.ucsb.edu