



Enabling spatial demography: Concepts, tools, and resources

DEMSEM Seminar
University of Madison, Wisconsin
December 2002

Stuart Sweeney
Assistant Professor of Geography
University of California at Santa Barbara

Overview

- Spatial demography: present and future
- Spatial demography: applications
- CSISS: history, mission, and programs
- Tools and resources for demographers
 - workshops
 - tools development, testing, and dissemination

Spatial demography: present and future

- The demographic perspective
 - topics / sub-fields ('events')
 - methodological approach (Shyrock et. al.)
 - research perspective/inclination
 - *age-period-cohort, obsession with measurement, exploration/description*
 - *demographic theory*
- The spatial perspective
 - more than mapping / visualization
 - human experience is a space-time path marked by events
 - *time: strong dependence*
 - *space: weak dependence*
 - abstraction and reduction in social science theory
 - *space is too complex*
 - conceptualizing space (and 'place')
 - *scale, generalized proximity, connectivity, discontinuities*

Spatial demography: present and future

Ted Mouw – NICHD panel report

- “Because of increased computer capabilities, it is now easy to map demographic data. A basic descriptive tool of all demographers should be looking at maps depicting spatial relationships; insight on patterns of relationships that can often be gleaned from maps is lost when geographic data is presented in tables. Basic geographic analysis, then, connects to most of the other topics being presented at this meeting.

That said, however, the role of ‘spatial analysis’ in demographic research is still difficult because the lack of theories depicting why geography matters for demographic outcomes.”

- “If spatial demography is going to assume more of an analytical role in research, than it is important to develop clear theoretical models where space plays a causal role in demographic outcomes.”

Spatial demography: present and future

Ted Mouw – NICHD panel report (cont.)

- “The growth of GIS software now makes it possible to easily map demographic data and look at spatial relationships. GIS software allows us to exercise our demographic reflex by looking at descriptive population statistics spatially.
...while GIS is an important descriptive tool in demographic research, it is more difficult to actually take the step of incorporating space into the analysis.”
- “... the lack of population level behavioral models in which space plays a causal role means that in many cases it is difficult to argue why space should be an explanatory factor—despite descriptive evidence of spatial heterogeneity.”
- “... difficulty of going from population maps as a descriptive tool for demographers, and geographic variation as an explanation for demographic outcomes. “

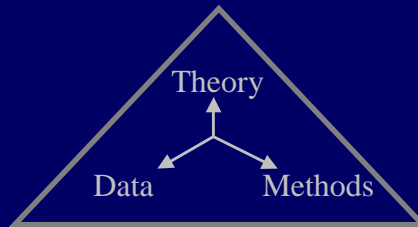
Spatial demography: present and future

Entwisle/Gutmann – NICHD panel report (cont.)

- Importance of spatial data and integration of spatially-referenced human/physical data with contextual data.
- “...we note the theorization of space as a possible area for creative thinking and research. On the one hand, some might argue that space is nothing more than a cost surface, whose relevance has declined due to improvements in transportation and communication. On the other hand, there is great interest in local contexts and their potential relevance to a wide range of social demographic outcomes. **Demographers have made much of time, conceptualizing it variously in terms of age, period, and cohort; individual, family, and historical time; and the like. There is no analogy in demographic thinking for space.**”

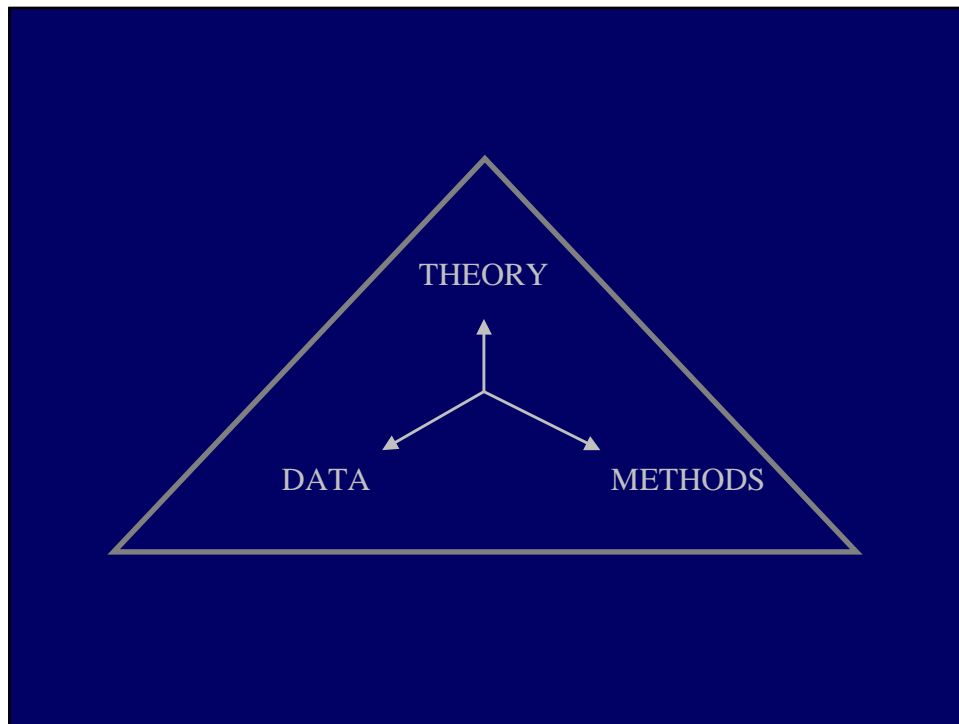
Spatial demography: present and future

- **Spatial awakening**
 - NSF / NICHD funding priorities
 - Census Bureau / Bureau of Labor Statistics
 - Spatial Demography at NIH population centers (Wisconsin, UNC, Penn State, Brown)
 - Developments in spatial statistics and spatial econometrics: theory, computation, and software
 - Spatially referenced data (geo-coding), emerging sources of data (LBS)
- **Self-reinforcing cycle**



Spatial demography: applications

- Interregional connectivity and population forecasting ▶
- Stochastic constraints in small area population forecasts (tomorrow)
- Exploring space-time dynamics
 - depopulation in the Midwest ▶ ▶ ▶ ▶
 - industry employment patterns ▶



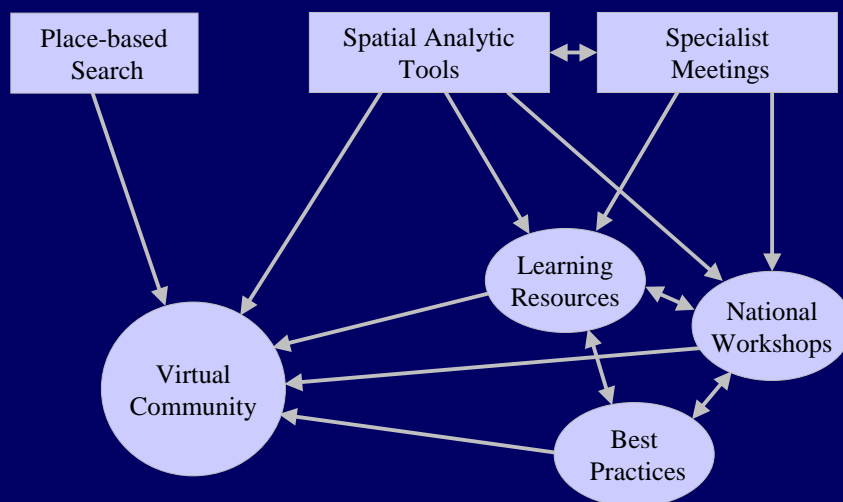
CSISS: history

- NSF Social Science Infrastructure award
 - *Enhancing shared resources for research and learning*
 - Data and tools
 - Human resources - training, education
 - Communication - linkages, networks, collaboration
 - Outreach - accessibility and dissemination
- Oct 1999 to Sept 2004 (~\$4.5 million)
- University of California, Santa Barbara
- PI – M.F. Goodchild, Co-PI – R.P. Appelbaum
- PI – tools development, Luc Anselin, UIUC

CSISS: objectives

1. Encourage applications of geographic information technologies and geographically referenced data in social science.
2. Introduce the next generation of scholars to spatially integrated social science.
3. Foster collaborative interdisciplinary networks to address core issues in the social sciences
4. Develop clearinghouses for tools, case studies, educational opportunities, and other resources

CSISS: programs



CSISS: Virtual community (www.csiss.org)



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 is funded by the [National Science Foundation](#) under its program of support for infrastructure in the social and behavioral sciences.

[CSISS News](#)

[GIScience 2002 Call for Participation](#)

Core Programs	Learning Resources	Spatial Resources	Spatial Tools
These six infrastructure programs form the core of the Center's activities.	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	Community Center	About CSISS
Try CSISS's custom search engine to find spatial analysis resources on the Internet.	Here's where you'll find information and registration for workshops, conferences and specialist meetings.	Join one of the forums on topics such as spatial equity, spatial externalities, and spatial econometrics.	CSISS people, programs and the original NSF proposal are described here.

CSISS: Specialist meetings

- **2003 (planning stage)**
 - Community risk and health (Barbara Herr-Hawthorne)
 - Globalization (Richard Applebaum)
 - Spatial economics (Peter Kuhn)
- **2002**
 - Spatial data analysis software tools (May 10-11)
- **2001**
 - Location-based services (December 14-15)
 - Externalities (January 11-13)
- **2000**
 - Inequality and equity (November 12-14)



CSISS: Learning resources

Learning Resources

CSISS Classics

ARGUS Activities & Readings

NCGIA Core Curriculum ▶

Course Syllabi ▶

Workshop Video Clips ▶

Papers & Presentations ▶

CSISS CLASSICS: SPATIAL INNOVATORS AND INNOVATIONS BEFORE 1980

Kelley, Florence

Title: Slums of the Great Cities Survey Maps, 1893

Spatial Concept: pattern analysis mapping of social conditions, maps for social advocacy

Discipline: Demography, Public Health, Sociology, Urban Studies, Womens Studies

Kurath, Hans

Title: Linguistic Atlas of the United States

Spatial Concept: geographical linguistics, isogloss mapping, speech areas and speech boundaries

Discipline: Anthropology & Archaeology, Area Studies, Linguistics

Mayhew, Henry

Title: London Labour and the London Poor, 1861

Spatial Concept: choropleth mapping, ecological relationship

Discipline: Criminology, Sociology, Other



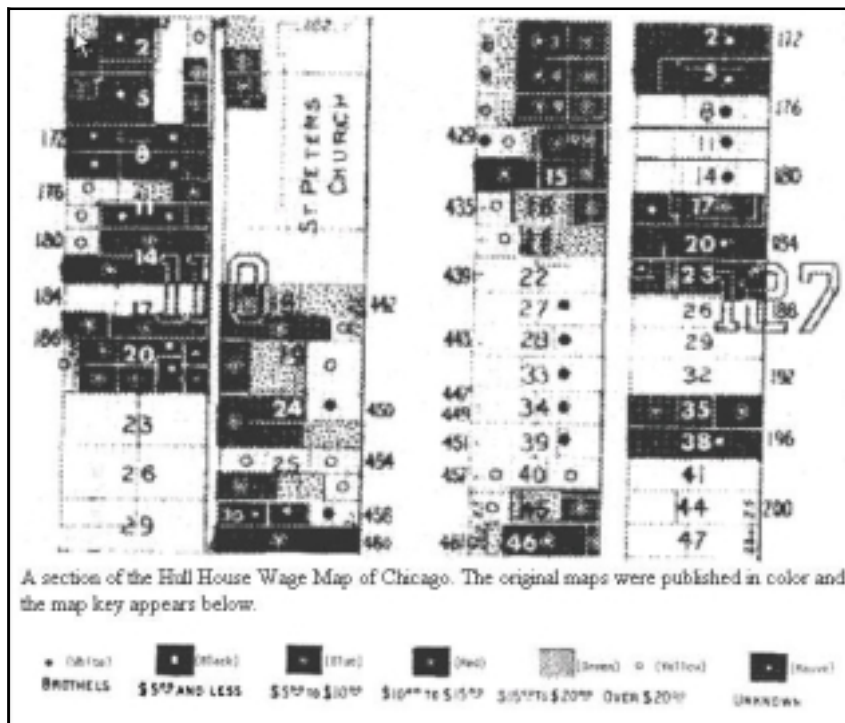
Florence Kelley, Slums of the Great Cities Survey Maps, 1893

Background Kelley, Florence (1859-1932)

Florence Kelley, the daughter of Congressman William D. Kelley, was one of the most dedicated social activists of the Progressive Era. A graduate of Cornell University and Northwestern University Law School, Florence Kelley was drawn into social activism after studying for a short period at the University of Zurich. In Europe she read the work of Karl Marx (1818-1881) and Friedrich Engels (1820-1896) and became an ardent socialist. She later translated into English Engels' *The Condition of the Working Class in London* (1887) and corresponded with Engels for the remainder of his life. When Kelley 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 activist organization led by Jane Addams. In a community filled with impoverished families, many of them recent immigrants from Italy, Poland, Russia, Ireland and the American south, Hull House provided essential education, employment, health and child care services. Hull House was also a base for radical political activities including union organizing.



Library of Congress, Washington D.C.



Return Home	Core Programs	Learning Resources	Spatial Resources	Spatial Tools	Search Engines	CSISS Events	Community Center	About CSISS
-----------------------------	-------------------------------	------------------------------------	-----------------------------------	-------------------------------	--------------------------------	------------------------------	----------------------------------	-----------------------------

 **Center for Spatially Integrated Social Science** [back](#)

Course Syllabi From Leading Researchers in Spatial Social Science

Anthropology • Archaeology • Criminology • Demography • Economics
 Environment & Resources • Public Health • Geographical Information Science
 History • Political Science • Spatially Integrated Social Science
 Sociology • Urban Studies & Urban Planning

This page provides links to reading lists of courses taught by leading researchers in spatial social science, organized by discipline. The links are provided with the permission of the researchers themselves. In most cases these researchers are not directly affiliated with CSISS; in all cases the researchers are considered by CSISS to be leaders in the analysis of space within their discipline.



[Economics](#)

CSISS: Search engines

Search Engines

[Internet Search](#)

[Site Search](#)

[Social Science Data Search](#)

[Spatial Tools Search Engine](#)

[Literature Search](#)

CSISS: 2002 Summer Workshops

[Accessibility in Space and Time: A GIS Approach](#)

Columbus, OH

July 22-26, 2002

Selected participants will receive a \$500 scholarship towards expenses

TAKE ME TO THE APPLICATION FORM

[Map Making and Visualization of Spatial Data in the Social Sciences](#)

Santa Barbara, CA

July 22-26, 2002

Selected participants will receive a \$500 scholarship towards expenses

TAKE ME TO THE APPLICATION FORM

[Introduction to Spatial Pattern Analysis in a GIS Environment](#)

Santa Barbara, CA

July 29 - August 2, 2002

CSISS: Best practice publications

- M.F. Goodchild and D.G. Janelle, eds. *Spatially Integrated Social Science: Examples in Best Practice* Oxford University Press, 2003
- L. Anselin, R.J.G.M. Florax and S.J. Rey eds. *Advances in Spatial Econometric Modeling: Methodology, Tools, and Applications* Springer-Verlag, 2003



CSISS: Spatial Tools (*Luc Anselin, UIUC*)

- Facilitate dissemination of spatial analysis software tools to social scientists
 - *Workshops and Tools Clearinghouse*
- Initiate and nurture a community of open source developers
 - *Develop standards, facilitate interaction, pool resources*
- Develop libraries of spatial data analysis modules
- Rapid development/prototyping environment for state of the art methods

CSISS: Spatial Tools – Tools Clearinghouse

Return Home Core Programs Learning Resources Spatial Resources Spatial Tools Search Engines CSISS Events Community Center About CSISS

Center for Spatially Integrated Social Science

CSISS Tools Clearinghouse

The **CSISS Tools Clearinghouse** is intended to grow into a robust collection of spatial analysis software, software links, and links to information about tools for spatial analysis. The development of these tools is a lively research area and the goal of this clearinghouse is to provide up-to-date information on available tools. The clearinghouse is comprised of:

- Search Engine**
Search a continuously updated, comprehensive index of the CSISS Select Tools and Links to Portals.
- Select Tools**
Browse through tools particularly suited to the analysis of spatial phenomena.
- Portal Links**
A listing of useful collections of software tools for anyone interested in Spatial Analysis, or those looking for specific tools.

Your help is requested in suggesting tools, collections of tools, other portals, and methods that should be represented in this collection - please send these to the Tools Manager, Luc Anselin at anselin@uiuc.edu.

CSISS: Spatial Tools – Tools Clearinghouse

Spatial Tools Search Engine

disease cluster detection

Submit

What exact disease cluster detection: 44
Documents 1 - 10 of about 44 matching the query, best matches first.

[GIS for Health and the Environment: Spatial and Temporal Analysis](#)

Marshall 1991, Scholten and de Lepper 1991, Walter 1993). Of major interest has been detecting clusters of rare diseases, such as leukemia near nuclear installations, methods for mapping and estimating patterns of disease, and health care location/allocation problems...

<http://www.cibrc.ca/books/focus765/vol9e.html> - size 27K -

[Spatial and Temporal Analysis of Epidemiological Data](#)

Marshall 1991, Scholten and de Lepper 1991, Walter 1993). Of major interest has been detecting clusters of rare diseases, such as leukemia near nuclear installations, methods for mapping and estimating patterns of disease, and health care location/allocation problems...

<http://www.cibrc.ca/books/focus765/vol9e.html> - size 27K -

[GIS for Health and the Environment: Spatial Analysis of Malaria Risk](#)

Udaya Kumara, Tikak Sumanayaka, P. Kumar Koma, A.B. Wickremasinghe, Richard Carter, and Elanisi N. Mendis Introduction Malaria is a major public health problem being reported yearly in a population of 16 million. As much...

<http://www.cibrc.ca/books/focus765/vol9e.html> - size 27K -

[Nearest Neighbor Analysis](#)

The input file name. This file should contain X, Y coordinates and the time associated with each event (for example, hours, days). The time interval of the analysis. Low P-values indicate significant space-time...

<http://www.mpi.nyu.edu/~3333/ana/doc/nearest/Nearest.htm> - size 27K -

[ATSDR - Software: CLUSTER version 3.1](#)

Selection of method of analysis may be based on the type of data available. Methods can be grouped into two categories based on whether individual counts or rates are used: PEARSON, REMSA, POISSON, SETS, and CUSTOM or just population rates of...

<http://www.atsdr.cdc.gov/HQ/cluster.htm> - size 27K -

CSISS: Spatial Tools – Tools Clearinghouse

CSISS Select Tools

Below is a list of Spatial Analysis Tools. CSISS researchers have chosen these tools for their usefulness in aiding the exploration and analysis of spatial phenomena in the social sciences. This list is by no means complete and, it is hoped, will continue to grow with input from the research community. Inclusion in this list is not an endorsement by CSISS. If you have comments, have found an error, or would like to nominate a tool for inclusion please contact Luc Anselin at luc.anselin@ciiss.org

All websites on this page have been comprehensively indexed by the [CSISS Spatial Tools Search Engine](#).

[Cartographic Data Visualizer \(CDV\)](#)

<http://www.geogebra.org/m/jan2010/cdv/>

A visual, interactive graphic front end for exploratory spatial data analysis.



[ClusterSeer](#)

http://www.temasek.com.sg/ciiss/clusterseer_features.html

ClusterSeer provides statistics for evaluating disease clusters in space and time.

[CrimeStat](#)

<http://www.lspc.smith.edu/NAC/D/crimestat.html>

A spatial statistics program for the analysis of crime incident locations.

[FragStats](#)

<http://www.umass.edu/landsat/research/fragstats/fragstats.html>

Computation of a wide variety of landscape metrics for categorical map patterns.

[GeoWhite Studio Project](#)

<http://www.geowhitestudio.psu.edu/gw/index.jsp>

An open software development environment for geospatial data analysis, exploratory spatial data analysis and knowledge discovery.

[GSLIB](#)

<http://www.gslib.com/>

Geostatistical software LIBrary written in Fortran.

CSISS: Spatial Tools – Tools Clearinghouse

Spatial Tools Links to Portals

Below is a list of portals, i.e., collections of links, found useful to researchers of spatial phenomena in the social sciences. All portals listed here have been comprehensively indexed and are searchable at the [CSISS Spatial Tools Search Engine](#).

If you have comments, have found an error, or would like to nominate a portal for inclusion please contact Luc Anselin at toolsmanager@csss.org.

Spatial Analysis Tools

[AI Geospatial Software FAQ](#) - The starting point for any search for general GIS and spatial analysis software, maintained by Ursgoire Dubois.



[SATools](#) - Collection of links to freeware for spatial data analysis at the Spatial Analysis Laboratory of the University of Tokyo.

[Social Science Statistical Lab](#) - Spatial Analysis links for social scientists from Yale University.

[Spatial Analysis Starting Points](#) - Additional GIS and Spatial Analysis links from the University of Georgia.

Math and Statistics archives with spatial content

[StatLib](#) - Perhaps the largest statistical site on the web.

[StatCodes](#) - Links to spatial statistics codes from Penn State University.

[Median Chain Monte Carlo Site](#) - from the Cambridge stats lab.

[Statistical Software](#) - A list of statistical software producers.

[Clustering Links](#) - from the classification society of Math America.

CSISS: Spatial Tools – Software development

- dynESDA2 (dynamic exploratory spatial data analysis)
- OpenSpace – spatial regression in Java; GeoVista Studio
- Web Spatial Analysis – basic ESDA in Java applet
- Large data SAR (1,000,000 ~ 7min., 100,000 ~ 23 sec.)
- PySpace – Open source spatial econometrics development environment.

CSISS: Spatial Tools – dynESDA2

Exploratory Spatial Data Analysis (ESDA)

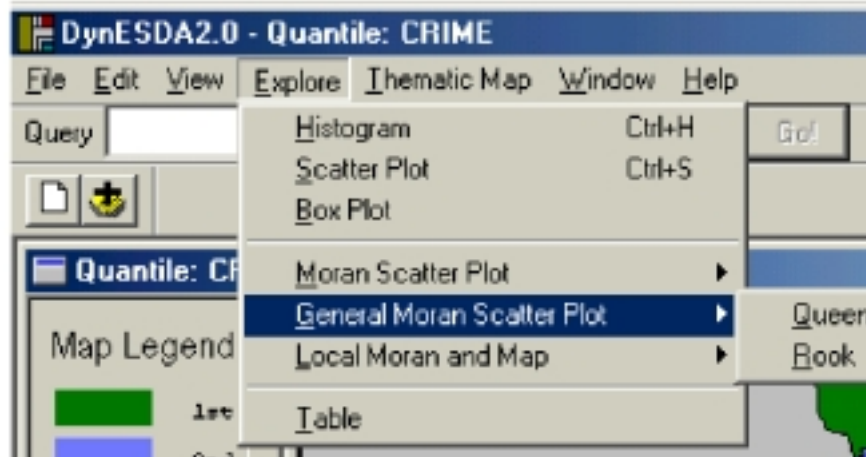
- EDA+
- Describe spatial distributions
- Identify spatial outliers
- Discover patterns of spatial association
- Suggest spatial regimes

• Install program: <ftp://geog55.geog.uiuc.edu/pub/SETUP.EXE>

• Manual: <ftp://geog55.geog.uiuc.edu/pub/esda.pdf>

CSISS: Spatial Tools – dynESDA2

Explore Menu



CSISS: Spatial Tools – dynESDA2

Mapping Functionality

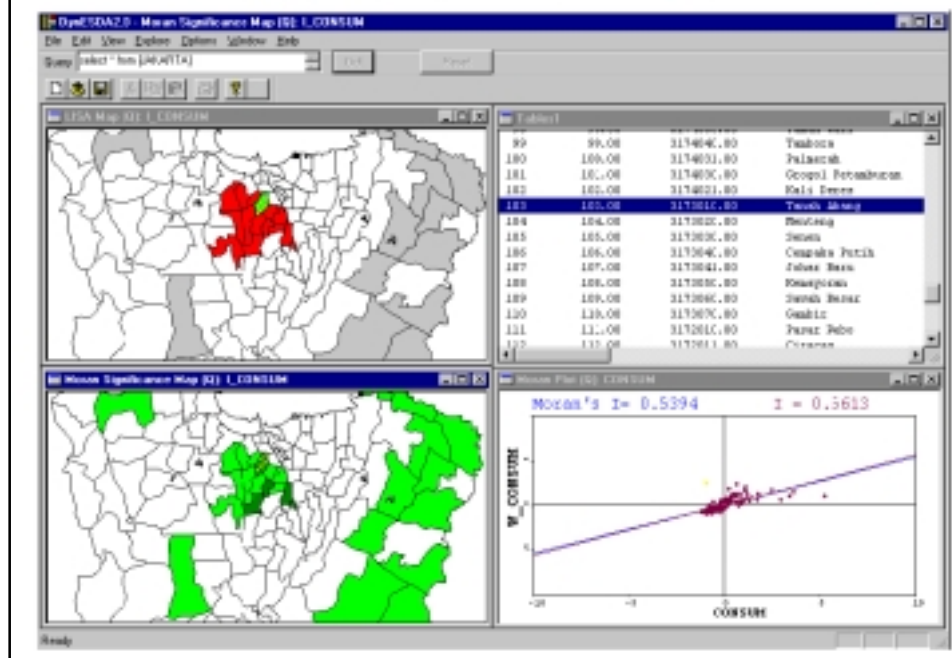


CSISS: Spatial Tools – dynESDA2

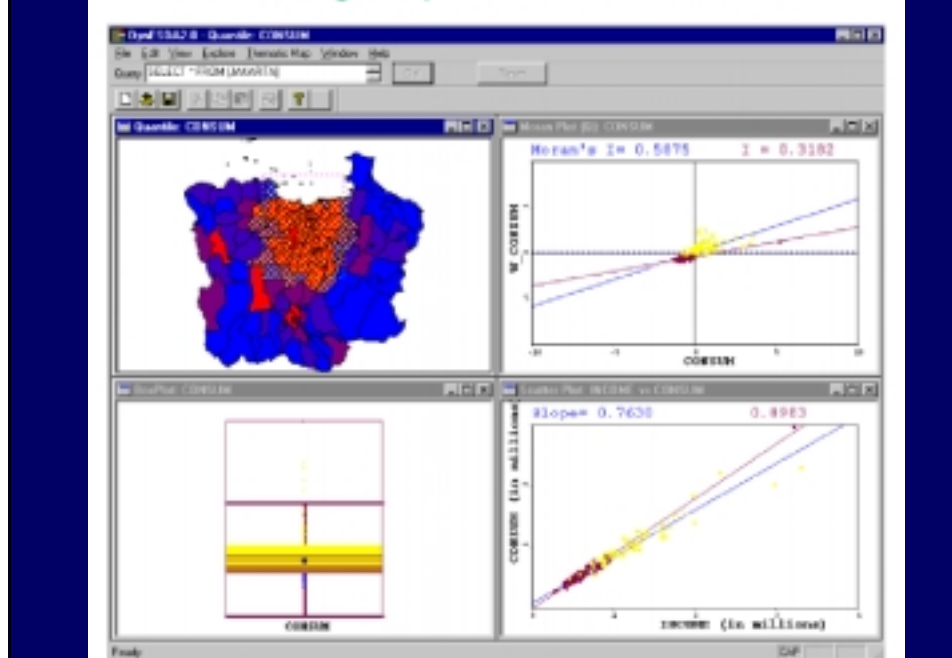
Select Tool Geometries

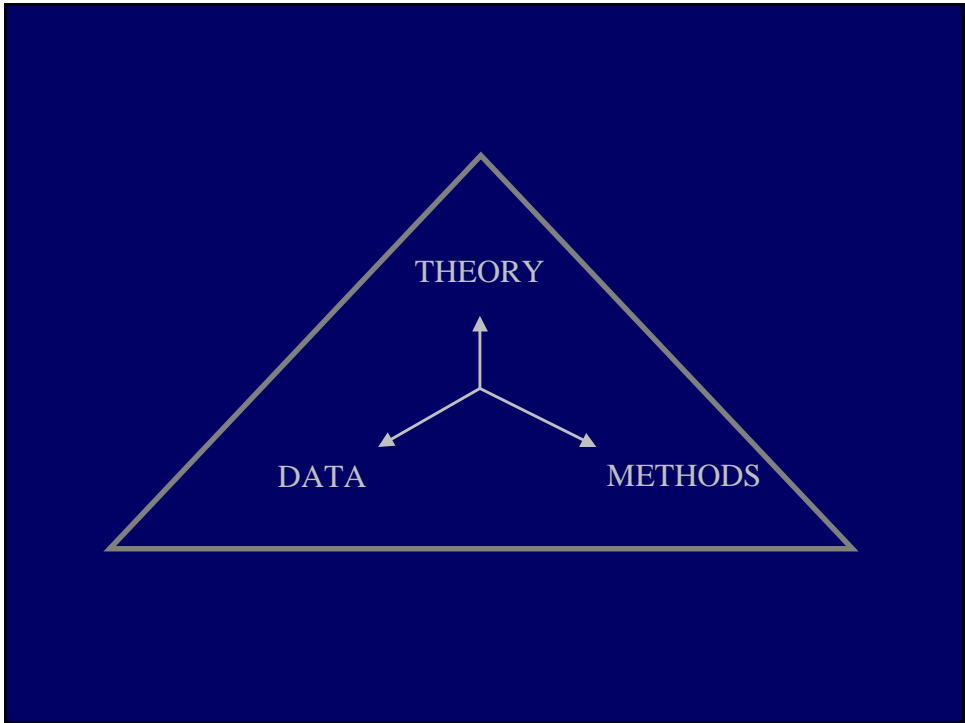
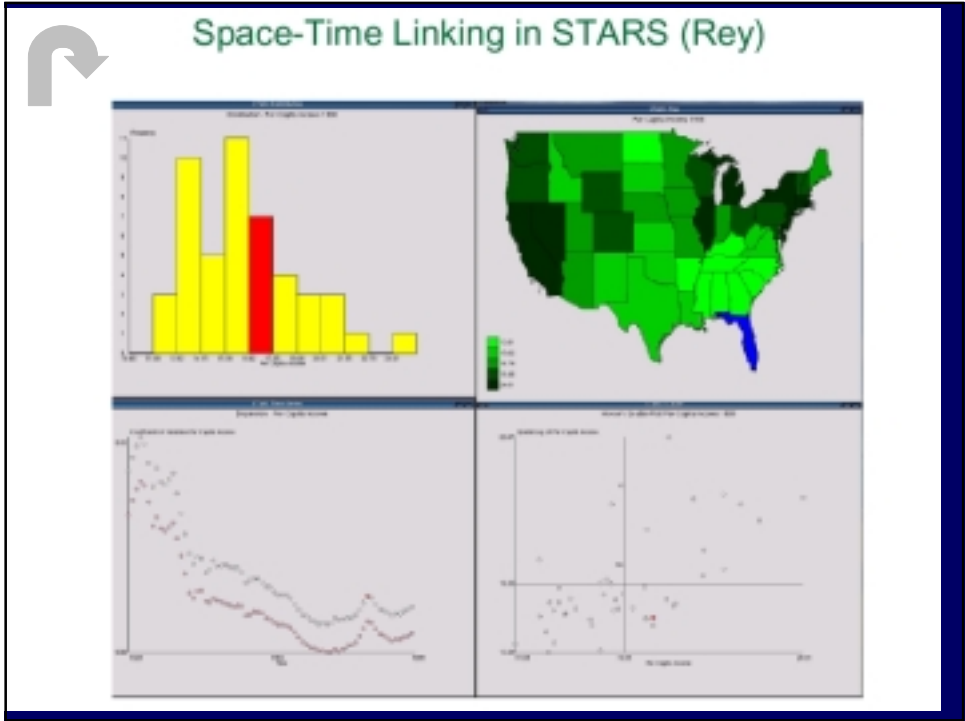


Selection from LISA Maps



Brushing Maps and Linked Views







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
- Virtual Community for Spatial Social Science
- Learning Resources for Researchers
- Summer National Workshop Program
- Spatial Analytic Tools Development L. Anselin

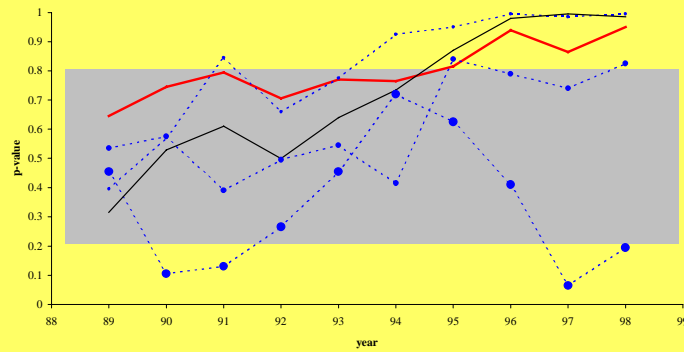
Spatial demography applications

Simple MC tests of spatial pattern

- Application:

Establishments

1. Petroleum and chemicals

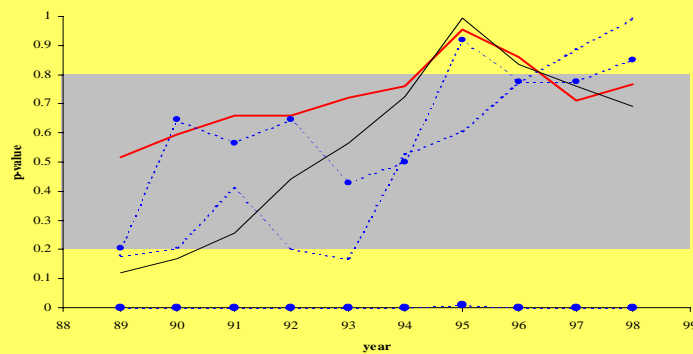


Simple MC tests of spatial pattern

- Application:

Employment

1. Petroleum and chemicals

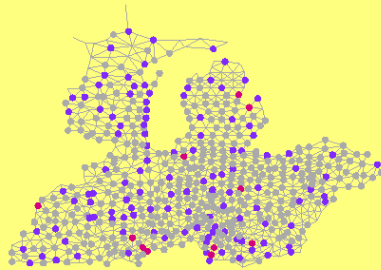


Simple MC tests of spatial pattern

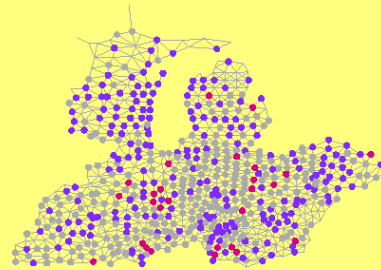
- Application:

Petroleum and chemicals – 1989

employment



establishments



Migration models

System structure:

- decomposition/reduction
- interpretation
- visualization

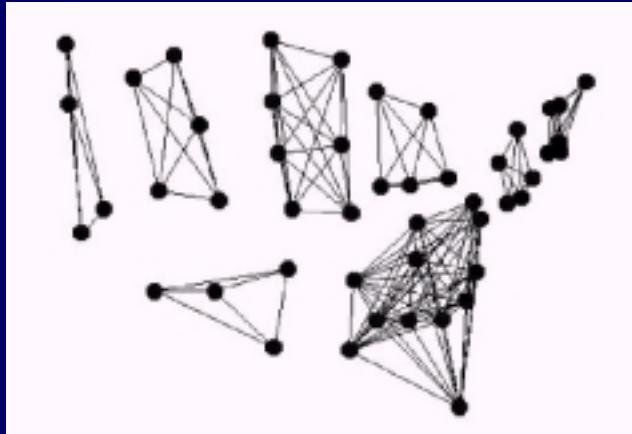
Forecasting:

- multiregional projections
- migration flows
- impact analysis

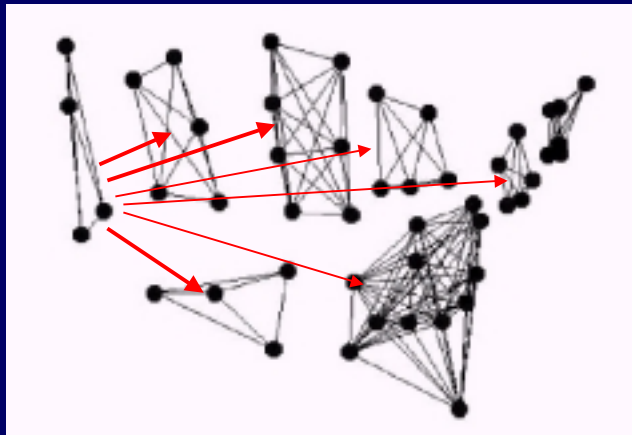
Model-based estimates:

- point/interval estimates
- data combination

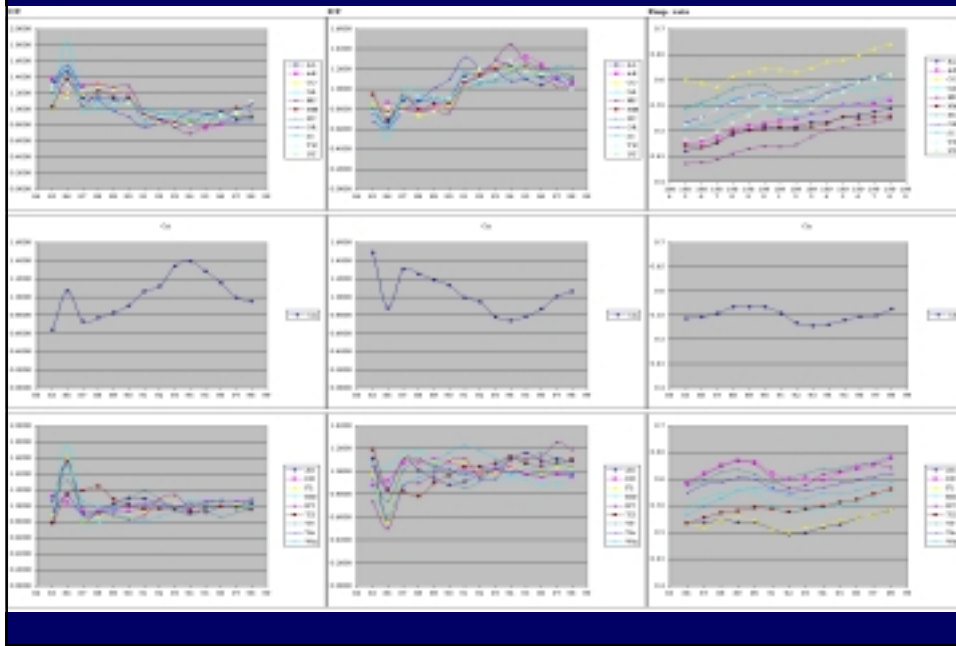
- Linked regionalization and categorical modeling
- “Optimal” hierarchies



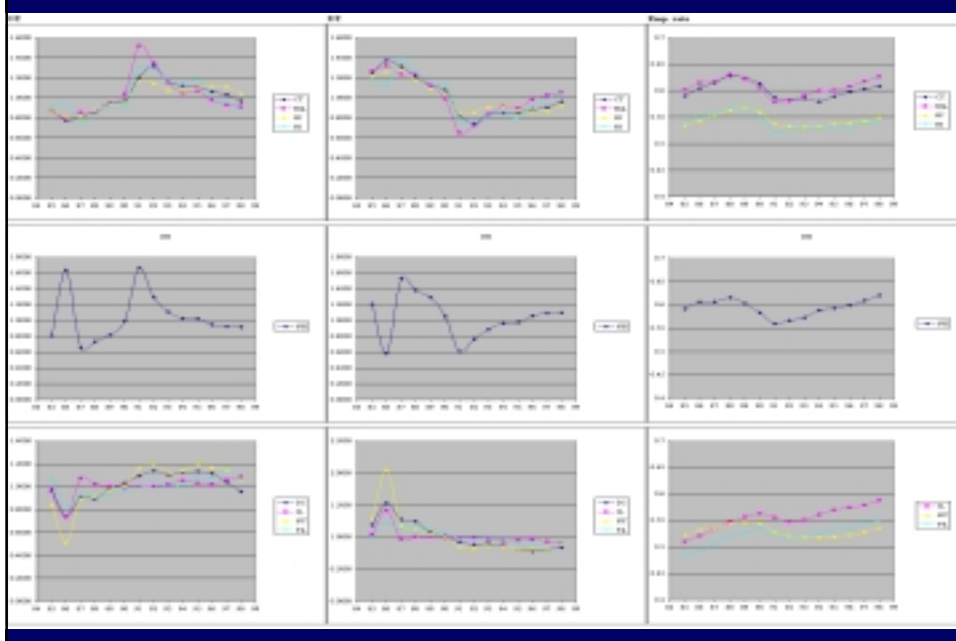
- Linked regionalization and categorical modeling
- “Optimal” hierarchies



U.S. interstate migration, 1985-1998



U.S. interstate migration, 1985-1998



U.S. interstate migration, 1985-1998

