Expert Meeting on Inequality & Equity

Introduction and Position Papers

November 12-14, 2000
Santa Barbara, CA
Sponsored by the Center for Spatially Integrated Social Science
University of California, Santa Barbara

This meeting involves sociologists, economists, demographers, political scientists, criminologists, geographers, and epidemiologists who study such diverse topics as neighborhood transition and segregation, environmental change and risk, crime and criminal justice, social stratification, income inequality, racial and ethnic inequality, and health and illness. All of these topics implicitly or explicitly have spatial dimensions and involve spatial effects, and to various degrees may benefit from the use of spatial analysis models and techniques. At this meeting participants will share insights and questions regarding the role of space in their respective research areas, as well as the possibilities of strengthening and integrating research on inequality/equity issues through the spatial perspective.

Our purpose is to identify the ways in which CSISS can support the development and dissemination of spatial theories and concepts, tools and techniques (such as geographic information systems), and formal analytic methods that will support research efforts in the various social science disciplines.

Meeting Goals

- The identification of research questions related to inequality and equity, where consideration of the spatial dimensions of the issues has led to, or is most likely to lead to new insights.
- The identification of emerging issues in research on inequality and equity requiring new developments in spatial theory, methodology or technology, with an eye to developing future CSISS workshops (this would include identifying topics, target audiences, and potential workshop instructors).
- The identification and prioritization of specific learning materials that could be collected, developed, and disseminated by CSISS, to support research and instruction on the spatial aspects of inequality and equity w the identification and prioritization of specific software tools, including methods, platforms, and implementations, that CSISS could refine or further develop to support research and instruction on inequality and equity.
- The identification and prioritization of specific materials related to the study of inequality and equity that could be collected as part of CSISS' virtual community.

Steering Committee

Richard Appelbaum, co-chair, CSISS, University of California, Santa Barbara
John Logan, co-chair, SUNY–Albany
Helen Couclelis, CSISS, University of California, Santa Barbara
John Sprague, Washington University, St. Louis

Position Papers

Each invitee prepared a position statement related to one or more goals of the meeting to share with participants prior to assembly in Santa Barbara. These statements are attached in alphabetic order by authors' last names.

Appelbaum, R.
Bennett, B.
Conceicao, P.
Couclelis, H.
Darden, J.
Galbraith, J.
Gimpel, J.
Harthorn, B.
Jasso, G.
Kain, J.
LaVigne, N.
Leitner, H.
Logan, J.
Louis, T.
Mobley, L.
Mollenkopf, J.
O'Connor, A.
Priemus, H.
Rushton, G.
Sprague, J.
Wong, R.

Additional participants included Luc Anselin, Michael Goodchild, Donald Janelle, Barbara Walker, and Matt Rice.

For more information about this meeting,
see: http://csiss.ncgia.ucsb.edu/events/meetings/equity/equity.htm

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POSITION STATEMENT

What are your research interests in the areas of inequality and equity, and what spatial dimensions do you currently or potentially see in them?

My research focuses on the opposing processes of the global dispersion of production processes along global commodity chains, and the localization of production in industrial districts.

In buyer-driven commodity chains, labor costs are a prime determinant of industrial location. In labor-intensive, low-wage manufacturing such as apparel and consumer electronics, retailers and manufacturers place orders with independent contractors, in whose factories the goods are made. Businesses seek low-cost production sites, although the friction of space remains a consideration: longer shipping times, lower productivity, the absence of full-package production, and other logistical considerations may partly offset the labor cost differential. Retailers and manufacturers are able to utilize production sites on an as-needed basis: since they do not actually own the factories that make their goods, they are free to sign contracts with particular factories when it is economically desirable, and refrain from doing so when it is not. One consequence of this arrangement is a global competition for the cheapest wages and lowest labor and environmental standards possible – what critics have termed the "global race to the bottom." Economic inequality is the result: not only between low- and high-wage countries, but within the latter as well. For example, these dynamics have contributed to the growth of an enormous apparel manufacturing sector in Los Angeles, where sub-minimum wage apparel workers must compete with their counterparts across the border in Mexico, driving their wages downward.

Globalization is not the only dynamic that obtains in these industries, however. Although the inherent flexibility of buyer-driven commodity chains provides manufacturers with a competitive edge, it also entails costs: organizationally (and frequently geographically) dispersed commodity chains create problems of coordination and control. One way in which such problems are overcome is through the creation of geographically interdependent networks of small firms, factories, and specialized local labor markets. Geographically dense industrial concentrations minimize transaction costs by providing proximity to markets, the ability to quickly acquire producer goods and services, lowered transportation and communications costs, access to suppliers, and in general the rapid exchange of information and knowledge. The presence of a strong support infrastructure – for example, business associations, supplier clubs, and private or state-supported research and development facilities – can also contribute to globally competitive firms. There is also some evidence that small- and medium-sized enterprises may be better able to respond flexibly to changing market conditions than large ones, particularly if informally networked into strong business groupings.

Thus, the interesting questions are: How can segments of the commodity chain be "trapped in space" in a fashion which benefits localities? What are the particular spatial synergies of well-conceived industrial districts that would lessen, rather than increase, wage inequalities? How can the globalizing tendencies of buyer-driven commodity chains, with their competitive drive for cheap labor, be

offset by policies which promote local concentration? Which activities on the commodity chain are most likely to contribute value to the local economy, both directly and through forward and backward linkages, thereby contributing to a process of industrial upgrading (the reverse of the "race to the bottom")?

What kinds of spatial models, techniques, software, etc. do you use or have considered using in your research? Which of these work well for you? Where do you see problems and/or shortcomings?

Thus far my usage of GIS technology has been primarily heuristic – to visually capture global processes of trade flows (as a proxy for global commodity chains), as well as to map local patterns of industrial concentration. Thus, in one set of papers, I mapped trade flows between countries, scaling arrows to the relative size of the flow. This research was used to estimate a gravity model of trade (in apparel) as a function of the characteristics of trading countries: such factors as relative wages, market size, and distance between the countries. In another set of papers, I constructed a GIS of every garment factory in Los Angeles that was registered with the state of California (approximately 3,500 licenses factories at the time of the study), noting its location on a street map of Los Angeles county, as well as the ethnicity of the factory owner (this was accomplished by a combination of a computerized ethnic name look-up algorithm, and manual coding). The intention was to see whether or not factories of different ethnicities clustered in different ways (for example, Korean-owned factories, which are larger than average and employ half of Los Angeles' 120,000 garment workers, tend to be clustered in or near the downtown garment district; Latino-owned factories tend to be dispersed, often along lines of Latino residence).

The problems of using GIS to map global commodity chains are daunting. What are required ideally are data on internal transactions of firms; yet data are collected as trade data for countries. When a clothing retailer (like The Gap) contracts with factories in China to make shirts for sale to American consumers, the shirts are recorded as exports from China and imports to the US – even though they are in fact internal transactions to The Gap (this is important because only a small fraction of the export value recorded as a US trade deficit actually remains in China as direct labor payments). What would be useful would be to somehow think of the commodity chain as "touching down" geographically at different points, with different effects for the locale where it did so. For example, the decision to locate a design office or marketing agency in a particular locale has a very different impact on equality/inequality than the decision to source a garment factory in a particular locale. Modeling the commodity chain as a set of locational decisions, tracing the impact of such a decision on particular locales, then looking at the feedback effect on subsequent location decisions would go a long way towards simultaneously modeling the pressures for global production, localization, and the corresponding impact on inequality. But it is not clear how one would gather data to operationalize such a model.

Can you point out any "best practice examples" of spatially-oriented research in your field? Do you have any suggestions for learning resources CSISS might provide? Workshops we might offer?

How about a workshop on decision modeling from the standpoint of a firm trying to determine where to locate its design offices, marketing operation, and contract factories? The workshop would model dynamic feedback loops between firm locational decisions and characteristics of the local, considering the economic effects on both locale and firm of the decisions that are made. Identifying data that might be useful for this exercise would be especially helpful.

[TOP]

Robert Bennett

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POSITION STATEMENT

What are your research interests in the areas of inequality and equity, and what spatial dimensions do you currently or potentially see in them?

Our firm was developed to address issues of social and economic justice in urban communities. In pursuing that mission over the past 15 years we have come to focus on two areas:

Developing enhanced multidisciplinary human service systems serving high risk populations: Examples of the projects that I am currently directing include:

- Development/expansion of the Children's System of Care in San Francisco and Contra Costa Counties. (Children's Systems of Care integrate Juvenile Probation, Children's Mental Health, Child Protective Services, and special education into a single coordinated, outcome-focuses system of interventions.)

- Design of an organized health system—including health care, substance abuse, and mental health services—for indigent, uninsured adults in Solano County

- Reorganization of Adult Mental Health Services in Solano and Marin Counties into a recovery-focused, consumer-driven system of care.

- Developing more effective and sustained interventions for chronically mentally-ill offenders in San Joaquin, Solano, and Marin counties.

- Evaluation and organizational development of community-based juvenile justice interventions in Richmond, Ca.

- Working with a larger group in San Francisco to create a strategic response plan for children ages 0-6 who are victims of family violence.

Developing comprehensive community-building initiatives. Although our firm is currently working on a number of community building projects, I am more focused at the present time on the systems development aspects of our work. My work in the past has included development of Oakland's Empowerment Zone Strategic Plan, East Oakland Fighting Back (a community development initiative focusing on alcohol and drug demand reduction), Public Housing Revitalization and a variety of smaller community-oriented initiatives.

Our GIS work tends to be focused on questions related to the intersection of person and place in the distribution and causation of the problems we are addressing. These include:

- Geographic distribution of both the primary conditions and associated risk

factors. To accomplish this, our general approach is to obtain multiyear dumps of data from County and City MIS systems serving the target population. We then clean and geocode the data to map global and local distributions and trends, identify hot spots, determine co-occurrence of particular conditions, analyze periodicities and other regularities that may illuminate causal issues or identify opportunities for more effective interventions.

- Geographic distribution of assets, including public and community-based services, transportation grids, areas of expanding commercial activity, etc. We link these GIS analyses to client-flow models to identify areas in which service disjunctions or anomalies are occurring.

- Development and evaluation of logic models for service systems. A clear understanding of the location of critical events and conditions is critical for assessing the causal links in program logic models.

What kinds of spatial data, models, techniques, software, etc. do you use or have considered using in your research. Which of these work well for you? Where do you see problems and/or shortcomings?

Our areas of concern—human services and community development—are extremely information-impoverished compared to other areas of our society. Each planning process or program evaluation usually sets up its own ad hoc data collection process. Both the validity of the results and the power and scope of the analytical tools employed are limited by this "cottage industry" approach to data collection, which yields very time-limited data for small populations. This is not because no other data is collected. In fact, public institutions collect voluminous records on their target populations. However, this data is characteristically locked away in antiquated, categorically-isolated public MIS systems. Our community—researchers, policy makers, advocates, consumers, and concerned citizens—needs an information infrastructure that provides access to critical data while protecting individual confidentiality.

To address this issue, we have begun several projects to create multidisciplinary data warehouses that will bring together a broad range of public databases and make them accessible to policy makers, community members, evaluators, and researchers (with suitable confidentiality protections for individual records) with a goal to improving community responses to issues of poverty, inequity, and their social correlates. Out three major current projects are:

San Francisco System of Care Children's Information System: This system brings together 10 years of data from Juvenile Probation, Children's Mental Health, and Child Protective services in a system that is used on the service delivery, policy, and evaluation levels. A custom software package developed by my staff provides menu-driven access to the data. GIS components (written in MapBasic within an overall Visual Basic system) include analysis of trends, client characteristics, and outcomes at the city, neighborhood, census tract, or census block level. The system is uploaded monthly with new data from each departmental MIS. Many other San Francisco agencies are asking to join the system, including Public Health and the Family Court. Access to the system is overseen by a users group co-chaired by the Chief Probation Officer and the Children's Mental Health Director. This group is currently developing guidelines that will allow access to non-confidential subsets of the data by community members, non-profits, and researchers.

Contra Costa Futures: CC Futures has a concept similar to the San Francisco system, but a broader participation list, including three school districts, the County Health, Mental Health, CalWORKS, and Public

Benefits systems, the County Housing Authority, and Juvenile Probation. We are also anticipating that all—or most—automated crime reports from the County's 10 police departments will be included through court order. As we are currently working on the alpha version of this system, the users group has made no decision about who will be allowed to access this data.

Bay Area Public Policy Data Library: This an project that aims to assemble a broad array of publicly-available data related to social and economic conditions and to make it available to the public through a web-based mapping and analysis system.

Can you point out any "best practice examples" of spatially-oriented research in your field? Do you have any suggestions for Learning Resources CSISS might provide? Workshops we might offer?

I think that our field is generally methodologically backward. It would be extremely interesting to have a workshop to understand how we might adapt to our work methods including econometric modeling, data mining, and computer simulation. Such diverse disciplines as radio telemetry, weather forecasting, and ecological modeling may well have exciting insights to offer that would advance the state of our art.

[TOP]

What Lies Behind an Aggregate National Inequality Measure?
Wage Inequality Patterns in the US: A Dynamic Analysis
Across Counties and States
by Pedro Conceição

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POSITION STATEMENT

What Lies Behind an Aggregate National Inequality Measure? Wage Inequality Patterns in the US: A Dynamic Analysis Across Counties and States

The literature on economic inequality often considers countries as the unit of analysis. Many studies focus on the evolution of a single national inequality measure. Others compare national measures of inequality across countries. Looking at inequality beyond the national level can be useful in two ways. One is to aggregate countries into supra-national geographic regions. This is useful, for example, when one compares the US with Europe. While the standard practice is to compare the US with individual European countries, Galbraith, Conceição, Ferreira and (1999) show that when one takes Europe as a single region to be compared with the US, the pan-European measure of inequality is higher than the US inequality measure. US to single European country comparisons often conclude that the US is more unequal than "Europe", but these comparisons fail to take into account the cross-country dispersions in the distribution of income in Europe. The second way in which it may be important to analyze inequality considering geographic units different from the national level is to go in the opposite direction: analyzing sub-national geographic regions. Especially in large and diverse countries, such as the US, a national measure of inequality can hide different patterns of inequality and different dynamics within and across regions in the same country.

Exploring the geographic heterogeneity in the patterns and dynamics of inequality "hidden" by a national measure requires choosing an indicator of inequality that allows the partition of an aggregate inequality measure into the contributions of inequality within each of the sub-national regions and of inequality across all of the sub-national regions. Of all coefficients available to account for inequality, only the Theil index has the property of additive decomposability (meaning that the index is equal to inequality between different groups plus the sum of the weighted within-group inequality)[1].

The properties of the Theil index are particularly well suited for exercises intended to explore the relationship between inequality within and across groups at different levels of aggregation (see Conceição, Galbraith and Bradford (2000) for an analytical discussions of this statement). If we consider different levels of geographic aggregation (counties, states, census regions, all the way up to the national level) the Theil index provides a way to relate inequality at each level with inequality at any other level of aggregation.

We will illustrate these properties of the Theil index constructing several measures of economic inequality across US regions. At the most fundamental level we consider a national measure of inequality based on a cross-plant wage Theil restricted to manufacturing. Then we look at the dispersion in the distribution of wages within counties and between counties, and assess the relative contribution to US inequality of each of these two components. We move

up to the state level, and perform the same type of analysis, comparing the dynamics of inequality within selected states with the evolution of the national measure of inequality.

Another advantage of the Theil index is that it clearly specifies the level of inequality as a relationship between wage shares. Since we are considering groups, both quantities and wages are (equally) important determinants of inequality, that is, both the number of units in the group and the level of wages of the group are important. Thus, as an example, the contribution of a large state to US inequality will, in all likelihood, be large, both to the within-state component and to the between-state component. But the Theil index allows for a separation of the "size" effect from the "pure inequality" effect. Therefore, continuing with the example of a large state, we can determine the extent to which the contribution to US inequality is being driven the sheer size of the state or by the level of wage dispersion within the state.

In conclusion, the main objective is to show how the Theil index can be used as a tool of analysis when a geographic dimension is added to the study of economic inequality. As an "accounting" tool, intended to separate the relative contributions to inequality of different geographic units at different levels of aggregation, the Theil index is difficult to surpass. However, there is no known statistical distribution for the Theil index, which may limit its application when statistical inference is required. This is an area where new research may extend even further the potential of the Theil index as a tool to link economic inequality with spatial analysis.

References:

Pedro Conceição, James K. Galbraith, Peter Bradford (2000). *The Theil Index in Sequences of Nested and Hierarchic Grouping Structures*, University of Texas Inequality Project Working Paper No. 15; available on the Internet at: http://utip.gov.utexas.edu.

James K. Galbraith, Pedro Conceição, Pedro Ferreira (1999), "Inequality and Unemployment in Europe: The American Cure," New Left Review, 237(September/October): 28-51.

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[1] We are restricting the set of choices of coefficients to those that satisfy the three "standard" axioms of inequality measures: homogeneity, symmetry, and Pigou-Dalton. In fact, the Theil index is only the most commonly used indicator of the family of entropy-based inequality measures, all of which satisfy the three standard axioms plus additive decomposability.

[TOP]

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POSITION STATEMENT

I am interested in the new inequalities emerging in the post-industrial city as a result of the ongoing spatial re-organization of activities taking place in response to the spread of information and communication technologies. Commerce, manufacturing, office work, education and recreation in urban areas are increasingly supported and enabled by the evolving synergies among information, communication, and transportation technologies and networks. There is strong evidence that as conditions of access to work, services, shopping, etc. change in urban areas of the USA, the location of activities also changes. I am particularly interested in the direct and indirect implications of the rapid global spread of e-commerce, and the potential for jobs loss (or gain) in low-income urban communities. Clearly the issue of how e-commerce 'touches ground' has strong spatial dimensions, defined around the changing role of distance in the physical world.

Finding out what the aggregate impact of e-commerce may be on the land use structure (in particular, retail structure) of urban areas, especially regarding the retail employment structure of vulnerable neighborhoods, requires data and methods not readily available. It appears that the issue must be investigated at both the macro- and micro-levels, since studies of job displacement alone could not possibly isolate the role of e-commerce from a host of other factors. Micro-level data are needed on both consumer and firm decisions, in particular regarding the trade-offs made between physical and virtual access for each of the different sub-tasks involved in either purchasing a product or making it available to the consumer. Once such data have been collected, simulation and/or optimization models need to be developed to work out the aggregate spatial implications of these partial and individual-level choices. Only then can the land-use issues be tackled. Clearly GISs will be used at that stage but some of the other software required (e.g., to model the hybrid physical / virtual spaces within which individual decisions are made) may need to be developed from scratch.

The 'geography of the information society', the broader context of my research, is a new area and 'best practice' examples are still relatively few. A recent book edited by D. Janelle and D.C. Hodge (resulting from earlier NCGIA activities) contains a number of excellent papers, though few actually report on 'practice'. Others have carried out empirical research on telecommuting and its implications for transportation for several years now. An increasing number of interdisciplinary workshops examine related issues. Interest in this area appears to be growing rapidly as we get deeper into the information age, and CSISS could have a major role to play in focusing social science research on issues of space, place and the information society.

Reference

D. J. Janelle and D.C. Hodge (2000) Information, place, and cyberspace: issues in accessibility. Spinger: Berlin.

[TOP]

Racial Inequality and Unequal Access to Opportunities:
Racial Minorities in Predominantly White Societies
by Joe T. Darden

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POSITION STATEMENT

Racial Inequality and Unequal Access to Opportunities: Racial Minorities in Predominantly White Societies

Research Interests

My research interests in the areas of inequality and equity focus on (1) determining the extent of racial inequality and unequal access to opportunities in predominantly white societies, (2) determining the factors related to the inequality and unequal access, and (3) identifying effective policies that will address the issues.

Ideology

I begin with the premise that racial inequality and unequal access are best understood by first examining the ideology of the dominant group towards racial minorities. A core belief held by most members of the dominant group in predominantly white societies is the ideology of white supremacy. This ideology holds that in any relation involving people of color, the white race must have the superior positions (Rose & Associates, 1969, p. 68). Such an ideology provides a means by which the dominant group carves out a certain vision of how things are and ought to be (Reeves, 1983). It is the dominant racial group that makes most decisions and establishes the racial climate, policies, practices and the spatial and social structure of society (Darden, 2000). When the ideology of the dominant group is white supremacy, the structure of society will be racial residential segregation, racial inequality in the characteristics of neighborhoods, and unequal access to opportunities on the basis of race.

Theoretical Framework and Spatial Dimensions

The ideology of white supremacy influences two related models which describe the relationship between the white majority population and racial minorities.

Differential Incorporation Model

The first model is referred to as "differential incorporation." It means that the white majority differentially incorporates some groups into mainstream society to a greater extent than it does others. The groups least incorporated into the mainstream in white society are people of color, i.e., racial minorities (Henry, 1994, p. 13). However, some minorities are more incorporated into mainstream white society than others. Incorporation is conceptualized on the basis of equal access to the rewards that the economic and political systems

generate and distribute (Breton, et al., 1990).

Differential incorporation has been conceptualized as a two-way process. One process relates to the internal characteristics of the racial minority group in terms of its strengths and weaknesses, both economically and politically, and its cultural values. The other process involves external forces imposed on the minority group by the white majority despite the socioeconomic status of the minority (Gordon, 1964, p. 8; Lieberson, 1980). Racial discrimination is a major form of these external forces.

Place Stratification Model

A second model which describes the relationship between the white majority and racial minorities is referred to as place stratification. Place stratification for racial minorities implies that racial inequality is an integral part of the social structure reflected by the unequal spatial distribution of minority groups and their residential segregation from the white majority (Logan, Alba & Leung, 1996). The place stratification model further suggests that differential characteristics of neighborhoods are associated with the uneven distribution of minority groups (Darden & Kamel, 2000; Freeman, 2000).

Spatial Data, Techniques, Software

The ideology and models described above are tested using census data on population and housing characteristics. The universe consists of metropolitan areas. The smallest unit of analysis employed is the census tract which represents the neighborhood.

The techniques used include a variety of indexes. Among those most frequently used are the index of dissimilarity (Duncan & Duncan, 1955), the isolation index (Lieberson, 1981), and the Gini index (Darden & Tabachneck, 1980). A socioeconomic index has also been used (Darden & Kamel, 1999).

The use of software to map the data and determine the extent of unevenness in the spatial distribution of racial groups has been limited. To date, Map Info has been used most frequently. All of the indexes and Map Info have worked well for my research. My preference, however, is the index of dissimilarity.

There are shortcomings to using the indexes. All of the indexes are influenced by the size of the spatial units used (e.g., census tracts, wards, enumeration areas, blocks). This makes comparative research of residential segregation between countries more difficult. For example, how does one interpret the level of residential segregation of blacks in Britain at the ward level (Peach, 1996) with blacks in the United States at the tract level? In other words, the spatial units are not standardized.

Some Best Practice Examples

I prefer not to list these at this time, but will be willing to discuss such examples at the meeting.

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[TOP]

Some Current Uses of the Theil Statistic in Geographic Measures of Economic Inequality.

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The between-groups component of Theil's T statistic (T_N) provides a lower-bound estimate of inequality for populations on which economic data -- for instance on incomes, earnings, or wages -- are available only in grouped form. Where the groups or categories are consistently observed over time, changes in T_N will often provide a robust estimate of changes in the dispersion of the underlying distribution, even though micro-data are not directly observed. Where the groups are geographic in character, measures of inequality calculated in this way can be usefully displayed as maps, and the evolution of inequality through time displayed in sequences of maps. The work of the University of Texas Inequality Project has explored numerous variations on this theme, exploiting in various ways the decomposability and aggregability of the Theil statistic and the additive character of its components.

1. Inequality within geographic units

The simplest concept is the measurement of inequality within geographic units. Calculations of T_N for a region may be based on measures of income and population for sub-regions, or for industries or broadly defined economic sectors within the region. Using such data, long and dense time series of inequality may be computed. We have for instance monthly measures of inequality in manufacturing earnings for the United States, Canada, Mexico and Brazil. We also have a new data set of inequality measured across manufacturing plants within each county of the United States, at five year intervals from 1963 to 1992, for about half of all U.S. counties; this was computed for us by the U.S. Bureau of the Census.

Moreover, if data are collected across regions using conceptually consistent category structures – such as. harmonized standard industrial classification schemes – then T_N may also provide reasonable *cross-region* measures of levels of inequality. In this way UTIP has calculated annual measures of inequality at the country level for most of the global economy going back to the early 1960s, providing both time-series and cross-sectional comparability.

2. Contribution of geographic units to inequality across units.

T_N is computed by summing the "contribution to inequality" of component units, where the contribution of a component with above-average income is positive, that of a component with below-average income is negative, and the contributions are weighted by population size. Where the components are geographic units, one may usefully map these contributions to the larger measure of inequality. For instance, using Local Area Personal Income Statistics, we have computed a measure of income inequality across U.S. counties for each year from 1969 to 1996. Maps that divide counties into quantile bins according to the size of their contribution to this measure of inequality in a base year, and then track the movement of counties across bins through time, clearly show the changing patterns of regional polarization in income.

3. Aggregating across regions

The TN measure differs from the somewhat better-known Gini coefficient in that it can be summed: the inequality in a large region is equal to inequality within each sub-region, plus a measure of inequality computed from differences in average income across regions. Thus one may combine "inequality within countries" of (say) Europe, with the "inequality between-countries" to derive a measure of inequality for the European continent as a whole. In principle, any aggregation one might find theoretically interesting can be accomplished in this way.

4. Integrating geographic and non-geographic data.

Often grouped data on income, earnings or wages are available from (non-geographic) industrial classification schemes for national or sub-national geographic units of observation, while total income (or earnings or wages) and population are available for the geographic units themselves. So long as the underlying categories (industries, occupations, ethnic groupings, etc...) are fully nested within the geographic units (counties, states, etc...), and so long as the underlying category schemes are consistent with each other, it is legitimate to integrate the geographic and non-geographic data. In this way we have (for instance) measured inequality within counties of the state of Texas, using a ten-sector classification scheme from the state unemployment insurance records, and then integrated those measures with cross-county measures of employment and earnings to derive the movement of earnings inequality for the state as a whole.

5. Measuring the similarity of the evolution of inequality across time and space.

The existence of long and dense time series of inequality measured over the same time intervals makes possible the comparison of the paths of changing inequality across countries and through time. The Euclidean distance matrix between vectors of the rate of change of TN provides a way of assessing the degree of similarity of historical experience between every country in the data set and every other. Using the column representing these "distances from country X" as the reference case, maps can be constructed that show the degree of similarity through history between country X and all other countries.

When used with economic inequality data, this esoteric but interesting technique tends to show the core-periphery character of labor market integration for most regions of the developing world, as well as the high degree of mutual integration in Europe and the OECD.

References, working papers, data and maps may be found at http://utip.gov.utexas.edu , the web-site of the University of Texas Inequality Project. See also James K. Galbraith and Maureen Berner, *Inequality and Industrial Change: A Global View*, forthcoming from Cambridge University Press.

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POSITION STATEMENT

My field is political behavior, including the geography of voting and elections. I am particularly interested in how economic and social forces with clear spatial dimensions (re)shape the politics of places. On the theoretical side, I am working to understand the cognition of political environments. To this end, the work in social psychology and in the newer field of environmental psychology has been especially helpful.

Current Research

I have several projects underway, all of which integrate spatial and contextual analysis. One of my papers proposes to push the political participation literature in a new direction by using innovative methodologies to examine the geographic accessibility of precinct polling places. My argument is that commuting to and from precinct locations can be burdensome on potential voters, particularly on a busy weekday in congested metropolitan areas when many voters are pressed by the demands of everyday living: work, family and school. Some precinct locations are more accessible than others, and for the less accessible ones, at least some people will feel that the cost to get there outweighs any benefit they may reap in terms of personal satisfaction from having fulfilled a civic obligation.

Accessibility is a core concept in this study, but it is not normally a political science concept. The notion of accessibility originates mainly from the literature on transportation planning and engineering, and, to a lesser extent, economics. Accessibility is thought to be the reciprocal of the costs of moving people and goods between points in space. Travel costs are central because the less time and money spent in travel, the more places that can be reached within a certain budget, and the greater the accessibility. As defined by transportation planners, accessibility is a function of *distance* and *impedance*. Taken together, distance and impedance provide a measure of travel cost to and from a destination. And as these costs increase, turnout is hypothesized to diminish. Even after controlling for variables that account for the motivation of the precinct population, and the competitiveness of elections, I believe that accessibility will make a significant difference to turnout.

Spatial Data Analysis

For all of my ongoing work in geography, I use ESRI's Arcview software, along with relevant extensions and scripts. In order to calculate distance and impedance measures, I will be using the Network Analyst and Spatial Analyst extensions, along with several scripts that are available for free on ESRI's website for calculating distances between, say, points and polylines.

For spatial statistics and data analysis, I use Luc Anselin's SPACESTAT. It is exceedingly user friendly. I make use of SPACESTAT calculated spatially lagged dependent variables in the regressions reported in my book, *Separate Destinations: Migration, Immigration and the Politics of Places* (University of Michigan Press, 1999).

I am making increasing use of Gary King's ecological inference maximum likelihood technique, and its accompanying software. Given that so much spatial analysis is done using ecological data, I think it should go hand-in-hand with many spatial analytic applications.

In two books I have used Atlas GIS (also an ESRI product) to produce camera-ready chloropleth maps. (The publishers later ruined several of these through careless production mistakes). Although Atlas GIS is limited, it is simple to learn with minimum start-up costs. If you need to map your data fast, it is a good program.

Best Practices in Political Science

For best practices, the journal *Political Geography* is a good starting point, with mostly high standards. As for authors in political science, I think John Sprague and Carol Kohfeld (Washington University, St. Louis), and Robert Huckfeldt (Indiana University), and several of their students, are at the cutting edge. In the political science subfield of international relations, Michael Ward (University of Washington) comes readily to mind. There are others, and the number of us is growing.

Suggestions for Resources, Workshops

I think that training with the software is always a need, but often we can figure that out with help from local experts on our own campuses. I would like more effort focused on the theoretical underpinnings of empirical work with spatial data. For example, I could learn a lot from a workshop where environmental and social psychologists brought their insights to bear on matters relating to the cognition of political and social environments, with additional theorizing and hypothesis testing about how those cognitions are translated into attitudes and behavior. My interest in geographic and spatial patterns in my data far outpaces my ability to explain those patterns.

With the 2000 census data to be released within the next two years, it would be imminently reasonable to work up a series of conferences that use this data to highlight spatial patterns and processes.

[TOP]

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POSITION STATEMENT

What are your research interests in the areas of inequality and equity, and what spatial dimensions do you currently or potentially see in them?

My research in the past 5 years has centered on several issues surrounding the production of health inequality. I am involved in 3 separate but related research projects, 2 of which have significant spatial dimensions. The one most directly relevant is a collaborative project with my UCSB anthropology colleague, Susan Stonich, in which we are examining the possibilities for using Public Participation GIS (PPGIS) as a community capacity building tool in mediating community conflict over perceived health consequences of pesticide drift on the agricultural/urban interface. This ongoing study of the northern Santa Barbara Co. town of Lompoc is building a comprehensive GIS to share with the community; we plan to include time series analyses by census block group of ICD-9 diagnoses, sociodemographic data, pesticide application data, meteorological data, air quality data (as a measure of exposures), and other relevant information as it becomes available. This involves close and sometimes contentious work with the interagency working group of regulators and politicians that has formed to assess the conflict and to oversee the government's assessment process. The Lompoc Interagency Work Group includes: the federal EPA, Cal EPA and its Department of Pesticide Regulation and Office of Environmental Health Hazard Assessment, the state Department of Health and Human Services, county and local government health, air quality, agricultural, and other regulators, local legislators, and community organizations. As one component of the PPGIS project, we are developing a program to work w/ high school and junior high teachers in the community to enable them to access and manipulate the data files from our study so that students in the community can begin to develop their own GIS maps on the community. We are also conducting cultural-model analysis of this environmental problem to examine variation among residents' and experts' views about the problem. In addition, we are planning to seek more funding to pursue new primary data collection on perception of risk in the community and plan to use GIS statistics to examine the spatial relationships between exposure to risk and perception of risk.

My own ethnographic research for the past 5 years has focused on aspects of farmworker health in central coastal California using an environmental justice approach. This work has included a study of the public health system's and private nonprofit organizations' roles in the diagnosis and treatment of tuberculosis among farmworkers, and a prospective study of farmworker maternal and newborn health. Both studies examine links between farmworker living and working conditions, health care access, health care delivery practices, and particular health consequences and treatment outcomes. We have used GIS in one of these studies in a rudimentary way to look at the distribution of TB cases in the county. As an offshoot of these studies, I have also embarked on an historical study to track the emergence of racialized discourse in biomedicine and public health about the etiology and treatment of infectious disease among Latino immigrants in California in the first 3 decades of the 20th century. The purpose of this work is to demonstrate that recent efforts to deny care to Mexican-origin

immigrants (e.g., the passage of Prop. 187) reproduce historical xenophobic processes in California that have resulted in profound ethnic disparities in health and health care. There is not yet a GIS component to this work.

What kinds of spatial data, models, techniques, software, etc. do you use or have considered using in your research? Which of these work well for you? Where do you see problems and/or shortcomings?

The technical difficulties we have encountered in conducting our (limited) spatial analyses have been substantial. With CSISS and the NCGIA on campus, we have extraordinarily good access to tools and advice, but both of us, though solidly trained quantitative behavioral scientists, need to learn a lot to become capable users of spatial statistics. The learning curve for competent use of ArcInfo and even ArcView is particularly an impediment to dissemination at the community level, compounded by scarcity of resources (like accessible computers adequate to the task, inability to print GIS maps w/out access to expensive color printers, etc.). The third world contexts where we and many of our colleagues in anthropology work provide even more difficult access problems.

In the Lompoc pesticide drift case study, we have had significant problems with data management and incommensurate levels of analysis. We had difficulty both strategically and technically in accessing individual patient records with the address identifiers needed to geocode the diagnostic data. Our research assistant (UCSB geography graduate student Rebecca Powell) was compelled to aggregate the data to block group level on site (at the county) so that we would not have any data sets at the university with individual patient identifiers in it. This means we have no point data with which to conduct the sorts of statistical analyses more familiar to us. The GIS to date on the project has been compiled using ArcInfo. We're now (following colleague Stonich's participation in the August CSISS workshop) beginning spatial statistical analyses of particular diagnoses in order to better understand apparent clusters. We will probably use SpaceStat and tools provided at the workshop (which are not generally available) for these analyses. We are still not certain if census block group is the ideal level to aggregate to in terms of balancing invasion of privacy issues with community desires to know the spatial organization of risk in a fine-grained way. For low incidence, high severity disorders (e.g., childhood cancers), this level will probably not protect privacy very well in a community of 40,000 people, but going to census tract level loses much of the neighborhood level specificity that community members desire. We're also exploring possible use of ArcExplorer as a free tool that K-12 schools and teachers could use with the PPGIS.

In the second study, we used ArcInfo to develop a GIS on TB cases in SB Co. The data from the county were extremely difficult to manage for the purposes of this study--half of the county's data on TB at that time was not even digitized, much less in a database format we could work with--and we ended up w/ zip code level data (i.e., not very fine grained) that wasn't particularly useful—it simply confirmed what we already knew by then from our ethnographic work about where clusters of TB cases (among different ethnic groups) were located and their distance from care.

[TOP]

MAPPING THE EXACT RELATIONS BETWEEN INEQUALITY AND JUSTICE

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December 2000

Recent developments in **justice analysis** -- the scientific study of the operation of the human sense of justice -- both confirm the ancient suspicion that **(in)equality and (in)justice are intimately linked** and provide novel **theoretical and empirical manifestations** of that link.

This note provides an overview of the major developments linking inequality and justice. As will be seen, these developments are rooted in the **justice evaluation function**.

1. The Justice Evaluation, the Justice Evaluation Function, and the Justice Index

According to justice analysis, there are two fundamental justice-related human operations. First, humans form ideas about **what is just**. Second, humans judge the justice or injustice of actual situations, forming a **justice evaluation**. The justice evaluation is thought to be produced by comparison of an actual situation to a just situation, where "just" always means "just in the eyes of the observer making the judgment".

In the domains of distributive and retributive justice, the justice evaluation is represented by the full real-number line, with zero representing the point of perfect justice and negative and positive numbers representing unjust underreward and overreward, respectively. In these domains, the justice evaluation is generated by the comparison of an **actual reward** to a **just reward**. Thus, the resulting **justice evaluation function** links **what is** and **what ought to be** and as well connects two major, previously unconnected literatures, the literature on **ideas of justice** and the literature on **reactions to injustice**.

The justice evaluation function, besides appearing in general form, has also been given a specific form, a **logarithmic-ratio form**, whose properties are appealing and have been intensively studied (Jasso 1978, 1990):

$$J = \theta \ln\left(\frac{A}{C}\right), \qquad (1)$$

where J denotes the justice evaluation, A the actual reward, C the just reward, and θ is the signature constant which by its sign governs the observer's framing of the reward as a good or as a bad and by its absolute magnitude indicates the observer's expressiveness. The logarithmic-ratio form of the justice evaluation function has been proposed as a general **Law of Justice Evaluation**.

Among other things, the log-ratio form quantifies the common human opinion that deficiency is felt more keenly than comparable excess; and it has been shown to be the only form which satisfies both scale invariance (represented by zero degree homogeneity) and additivity (represented by a zero second-order mixed partial derivative). As well, the log-ratio form of the justice evaluation function predicts the gains-concave/losses-convex pattern that has been empirically documented (Kahneman and Tversky 1979).

In the years since its introduction (Jasso 1978), the justice evaluation function has been extended to cover bads as well as goods (Jasso 1990), has been generalized to all comparison processes and reference-level phenomena (Jasso 1990), and has been generalized to cover group characteristics as well as personal characteristics (Jasso 1994). To illustrate, justice evaluations about a group's mean and inequality may be written:

$$J = \ln\left(\frac{\textit{actual mean income}}{\textit{just mean income}}\right); \qquad J = -\ln\left(\frac{\textit{actual income inequality}}{\textit{just income inequality}}\right). \tag{2}$$

Further, the distribution of justice evaluations possesses parameters that themselves become useful new quantities, such as the mean, which becomes a justice index called JI1 (Jasso 1999):

$$\text{JI1} = E(J). \tag{3}$$

The justice index JI1 may assume positive, negative, or zero values. Its value is interpreted as the center of gravity of the distribution of justice evaluations. Thus, a JI1 of zero indicates that the center of gravity of the justice evaluations lies at perfect justice; negative and positive values indicate that the center of gravity lies in the underreward region and overreward region, respectively.

2. Inequality and the Justice Evaluation Function

It has been shown that, in justice situations involving goods and holding constant the just reward, as inequality in the distribution of actual rewards increases, the justice index decreases (e.g., from overreward to justice, or from justice to underreward). This result provides the first exact link between inequality and justice. We may say, for example:

Injustice is an increasing function of inequality.

Formally, this result can be expressed in two major ways: First, in any distribution, the justice index decreases as inequality increases, where inequality is measured by Atkinson's inequality (one minus the ratio of the geometric mean to the arithmetic mean). Second, in any two-parameter family of mathematically-specified distributions, the justice index decreases as inequality increases, where inequality is represented by the general inequality parameter (the parameter governing all measures of relative dispersion).

The justice index JI1 has been shown to equal the sum of two group-level justice evaluations, the justice evaluation about the reward's mean and the justice evaluation about the reward's inequality (Jasso 1999). JI1thus has the remarkable property that it links a parameter of the distribution of individual-level justice evaluations to the sum of two social-level justice evaluations. And this new expression provides a decomposition of overall injustice into a portion attributable to the mean (that is, to poverty or scarcity) and a portion attributable to inequality (where inequality is measured by Atkinson's inequality):

$$\text{JI1} = \text{JI1}_{\text{Mean}} + \text{JI1}_{\text{Ineq}}, \tag{4}$$

where $JI1_{Mean}$ denotes the mean-component of JI1 and $JI1_{Ineq}$ denotes the inequality-component of JI1.

The justice index yields a second decomposition, which, while not pertaining to inequality, captures a potentially useful insight:

$$JI1 = \ln(\textit{reality}) - \ln(\textit{ideology}) . \quad (5)$$

3. Inequality and Theoretical Justice Analysis

The justice evaluation function provides a useful first assumption for theories of the behavioral and social consequences of the experience of injustice. In company with two other individual-level postulates (a measurement rule that enables handling of ordinal as well as cardinal goods and bads; and an identity representation of the just reward, which introduces a parameter to cover individual variation in the just reward), the justice evaluation function makes it possible to deduce a large number of testable predictions for a wide range of behavioral and social domains. For example, predictions have been deduced for phenomena associated with war, disasters, giftgiving, marriage, theft, religious institutions, and other far-flung fields.

Theoretical predictions pertaining to inequality that have been deduced from justice theory include:

3.1. In situations involving conflict between two warring subgroups, conflict severity is an increasing function of overall economic inequality (Jasso 1993).

3.2. In materialistic societies, the public benefit of religious institutions is an increasing function of overall economic inequality (Jasso 1991).

3.3. In materialistic societies, the rate of out-migration is an increasing function of overall economic inequality (Jasso 1996).

In all of these predictions, derivation was accomplished by using mathematically-specified probability distributions; and overall economic inequality is represented by the distributional family's general inequality parameter.

4. Inequality and Empirical Justice Analysis

The justice evaluation function has also proved useful in a variety of empirical applications, ranging from estimation of the parameters of observer-specific justice evaluation functions (in which, for example, estimates can be obtained of person-specific framing and expressiveness coefficients) to estimation of justice indexes in large probability samples. As well, the justice evaluation function makes it possible to obtain indirect measures of respondents' ideas of what is just; these are thought to be superior to direct measures, which may incorporate socialization, rhetorical, and other response effects.

Empirical findings pertaining to inequality that have been obtained in justice studies include:

4.1. Earnings inequality too high and prison-time inequality too low. In studies in

which respondents judge the justice or injustice of the earnings and prison sentences of fictitious workers and convicted offenders, respectively, about 90 percent of U.S. respondents judge that, relative to their own ideas of the just inequality, the inequality put experimentally into the fictitious vignettes is too high in the earnings domain and too low in the punishment domain (Jasso 1998).

4.2. Interrespondent variation in ideas of the just inequality. In studies which obtain estimates of respondents' ideas of the just reward distribution for a set of rewardees, there are both individual differences in ideas of the just inequality and also differences in the amount of interrespondent variation across measures of inequality. Typically, the suite of measures estimated consists of the Gini coefficient, Theil's index, Atkinson's measure, Plato's ratio, the proportion below the mean, the relative minimum, and the relative maximum. Thus, for example, one study of the justice of earnings reports a high degree of interrespondent agreement on the just relative maximum but considerable disagreement concerning the just relative minimum (Jasso 1994).

4.3. If everyone earned what they think they deserve, earnings inequality would be higher in some countries, lower in others. Estimates of the decomposition of the justice index among respondents reflecting on their own earnings, in probability samples in 13 countries in 1991 and a subset of six countries in 1996, indicate (Jasso 1999, 2000):

4.3.1. In 1991, actual earnings inequality was

too low in
Bulgaria, Czechoslovakia, Estonia, East Germany, Hungary, Russia, West Germany, Great Britain

too high in
Poland, Slovenia,
Japan, Netherlands, United States

4.3.2. In 1996, actual earnings inequality was

too low in
Bulgaria, Czech Republic, Hungary, Russia

too high in
East Germany, West Germany

4.3.3. In both 1991 and 1996, the portion of overall injustice attributable to poverty/scarcity is substantially larger than the portion attributable to inequality.

4.4. Among junior high school students in Israel in 1986, if everyone earned the grade they think they deserve, grade inequality would be lower. That is, actual grade inequality is too high. The portion of overall injustice attributable to low mean grades is substantially larger than the portion attributable to grade inequality.

4.5. The gender gap in just earnings has closed. Evidence is accumulating that, among college students in the United States and the Netherlands (with data soon to be collected in other countries), the gender gap in just earnings has closed. Students' ideas of just earnings for fictitious workers appear to be blind to worker sex; however, the mechanisms by which just earnings are produced remain gender-attentive (Jasso and Webster 1999).

5. Linking the Recent Developments in Justice Analysis to Recent Developments in Spatial Analysis

Justice processes occur in groups of all sizes and types – in families, clubs, classrooms, offices, cockpits, assembly lines, orchestras, ballet companies, voluntary associations, geographic units, political units. Justice analysis is assembling a suite of protocols for assessing justice operations, and their connections to inequality, wherever they occur. Obviously, some of the groups in which justice processes occur are spatially defined.

Currently, the protocols for justice analysis include computational routines for estimating the justice evaluation function, the justice index, and the decomposition of the justice index into a mean-component and an inequality-component; these are written for STATA. It would be useful to incorporate these routines into spatial analysis software. It would then be possible to systematically explore the connections between these justice measures and other features of spatially-defined entities.

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POSITION STATEMENT

While I have done some work in regional economics and its implications for inequality and equity, the larger part of my research relating to the spatial dimensions of inequality and equity has been in three areas. The first has been research on housing market discrimination, the causes of high levels of racial, particularly black-white segregation, residential segregation and their contributions to high levels of unemployment and low earnings of African Americans. My (1965 and 1968) papers on what has come to be termed spatial mismatch were the first to provide systematic evidence that housing market segregation affected the geographic location of black employment and lowered black employment levels. The controversy and the extensive body of research spawned by my two original articles is reviewed in Kain (1992).

John Quigley's and my book, *Housing Markets and Racial Discrimination: A Micro-economic Analysis*, and earlier paper provided support for the widely contested view that housing market discrimination and segregation caused blacks to pay more than whites for comparable housing and limited the range of housing and residential opportunities available to them (Kain and Quigley 1972 and 1975). Perhaps the most important finding of this line of research were results demonstrating that housing market discrimination greatly reduced black access to home ownership, an outcome that increased their housing costs, and perhaps of even greater importance, was responsible for a large part of the gap in black and white wealth accumulation.

A third focus of my research over more than a decade was efforts to construct computer simulation models of urban housing markets (Ingram, Kain and Ginn 1972 and Kain and Apgar 1985). The resulting models, which were used to assess both housing allowances and neighborhood improvement programs, emphasized the role of specific workplace locations on household demand for both housing and residential locations. These models also explicitly represented the ways in which housing market discrimination/segregation affected the housing and residential choices of black households and their impacts on housing investment and neighborhood quality.

For the past decade my energies have been devoted to a large-scale research project on Texas public schools. The initial focus of this research was on the impacts of minority, principally black suburbanization, on the achievement of individual black children. Kain and O'Brien (2000) find that blacks attending higher quality suburban schools score significantly higher on standardized tests than otherwise identical blacks who attend lower quality inner city schools. Research on the determinants of individual achievement remains a focus of our research, but during the past two years we have increasingly been concerned with minority access to Texas public colleges and universities. A description of the UTD Texas Schools Project and a dozen or so working papers are available on the Green Center website, www.utdallas.edu/research/greenctr.

The UTD Texas Schools Project has developed an extensive an ambitious micro database, The Texas Schools Microdata Panel (TSMP) for use in its research. Phase I of this database consisted of up to 10 years of individual data for five

panels of Texas public school students and their teachers. The database included enrollment and attendance data for all students in these cohorts as well as their standardized tests. As long as these individuals attended any of the more than 6,000 public schools in Texas we were able to follow them. This feature of the panel and large samples sizes (more than 250,000 students per cohort) enabled us to examine a large number of issues that heretofore could not be studied effectively.

About two years ago a large grant from the Andrew Mellon Foundation to study minority access to public colleges and universities in Texas made it necessary for us to add six cohorts of older students to TSMP as well as data on all students that were enrolled in any Texas college or university between 1990 and 2001. The public school data obtained for the Texas Education Agency (TEA) and the higher education data obtained from the Texas Higher Education Coordinating Board (THECB) have common encrypted IDs, a feature that enables us to link the two data sources. We had always intended to obtain the THECB data for our original five cohorts. The Mellon grant forced us to accelerate our timetable. We have also asked the Texas Workforce Commission (TWC) to provide us with earnings data for individual Texas residents for the same period, again with the same encrypted ID so that we can link them to the TEA and THECB data. We are still waiting for a response.

Early this year, Rick Hanushek, Steve Rivkin and I obtained a grant from the Smith Richardson Foundation to use TSMP to study charter schools. To complete this work we had to add younger cohorts to TSMP. When data collection for both the Mellon and Smith Richardson studies have been completed TSMP will include individual data for all individuals to attended a Texas public school or Texas public college or university from 1990 to 2001. TSMP will then include individual data for more than 10 million persons. We hope, moreover, that TWC will agree to provide the earnings data we have requested in a form that will allow us to link them to the TEA and THECB data. A more extensive discussion of TSMP and the Mellon and Smith Richardson grants is available at: www.utdallas.edu/research/greenctr.

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[TOP]

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POSITION STATEMENT

What are your research interests in the areas of inequality and equity, and what spatial dimensions do you currently or potentially see in them?

From a criminological perspective, the issues of inequality and equity relate to the spatial dimensions of crime and criminal behavior and associated demographic and physical characteristics of the environment. Known patterns of the spatial distribution of crime and criminal behavior have been associated with three broad areas of inequality: (1) geographic concentrations of crimes affecting specific (disadvantaged) neighborhoods and populations over others; (2) social and economic inequalities resulting from the unequal distribution of criminal justice policies and services; and (3) the disparate impact on neighborhoods and communities due to both the incarceration of family members and the release of offenders back into these communities.

Spatial analyses examining the relationship between crime and socio-economic status date back to cartographers in France and England who, as early as 1830, were examining the influence of wealth and population density on crime (Quetelet, 1842). In the United States, social ecologists in the 1940s mapped juvenile delinquents and analyzed relationships between delinquency and various social conditions (Shaw and McKay, 1942). Today, countless research studies examining these relationships exist, although until recently, vary few were conducted with sound spatial-statistical methods (See answer to question 2 below).

A less studied but equally important application of spatial analysis to inequity issues associated with criminal justice is that of the distribution of criminal justice resources and services. Coined "spatial injustice" by Rengert (1989), this area of inquiry concerns a variety of ways in which criminal justice policy has a disparate impact on certain populations. Law enforcement, for example, might be less likely to respond to calls from places they perceive to be dangerous, leaving law-abiding residents in the area at higher risk of victimization. Likewise, police interventions targeted toward one location or "hot spot" may result in displacement to adjacent areas that are not targeted for crime reduction (see Rosenbaum, 1988). Sentencing decisions also can have a disparate impact on certain communities: a study of death penalty cases nationwide found that the death penalty was meted out disproportionately according to region, controlling for the nature of the homicide and the criminal history of the offender (Harries and Brunn, 1978).

Related to sentencing practices, the criminal justice system's decisions to incarcerate and release offenders can also have a disproportionate impact on certain geographic areas. Clear and Rose (1999), for example, examined the impact that incarceration of offenders has on neighborhoods. They found that high levels of incarceration of residents from certain neighborhoods suppressed reductions in crime. Other research has identified a detrimental impact on children and families whose fathers are incarcerated. These families often suffer economically and emotionally from removal of a breadwinner and caregiver/father figure from their daily lives (Clear and Rose, 1999; Gabel, 1992). The flip side to

this area of inquiry is the examination of the effect that the return of ex-offenders released from prison has on high-incarceration neighborhoods. A qualitative study of this question through interviews with residents suggests that high rates of offender reentry into an area can create economic and quality of life hardships for the community (Clear et al., 2000).

What kinds of spatial data, models, techniques, software, etc. do you use or have considered using in your research. Which of these works well for you? Where do you see problems and/or shortcomings?

Criminologists tend to be trained—in part—as traditional statisticians and therefore historically, criminological studies that had a spatial dimension were nonetheless conducted with an absence of knowledge or application of spatial statistics. This has changed over time, much due to the greater prominence that the role of place has had in criminological theory, as well as to the availability and dissemination of new methods and software.

On a very basic level, the advent of GIS in a user-friendly PC environment has enabled researchers to explore visualization techniques such as buffer, intersect, union, and measure. Buffering can be used to examine the potential geographic displacement of crime following an intervention. Intersect and union tools enable one to examine relationships that may indicate likely causal factors, guiding further exploration with more sophisticated spatial statistics. Measurement tools facilitate the examination of how offenders' journeys to crime differ by both crime type and characteristics of the physical environment (e.g., street networks, natural and man-made barriers, etc.). Spacestat's Exploratory Spatial Data Analysis (ESDA) functions have taken such visualization methods several steps forward by linking descriptive analysis results (such as outliers in boxplots) to geographic locations on a map, making the spatial identification of, for example, convenience stores with unusually high numbers of police calls-for-service extremely straightforward.

Complementing these exploratory visualization techniques, criminologists have begun to conduct regression analyses that include the all-important consideration of the complicating effects of spatial autocorrelation. Again, the use of SpaceStat for this purpose has helped promote more (and better) criminological research employing the spatial regression approach.

In addition, CrimeStat, a spatial statistics software program released in 1998 (with version 1.1. released in 2000) and designed specifically for the analysis of crime incident locations, has promoted greater rigor in spatial analyses of crime. CrimeStat includes: statistics for describing the spatial distribution of crime incidents (e.g., mean center, standard deviational ellipse, and Moran's I); statistics for describing properties of distances between incidents (e.g., nearest neighbor analysis); both statistical and kernel density routines for conducting "hot spot" analyses (e.g., hierarchical nearest neighbor clustering, K-means clustering, local Moran statistics, and surface or contour estimates of the density of incidents); and a journey to crime module for analyzing serial offenders. Perhaps the greatest contribution of CrimeStat is this last module, which calibrates a routine for identifying a travel distance function and an estimation routine for modeling the likely location of the offender using either the calibration function or a mathematical model. The ability to predict statistically the location of a serial offender based on past crimes has been welcomed by criminal justice practitioners and researchers alike.

Can you point out any "best practice examples" of spatially oriented research in your field? Do you have any suggestions for Learning Resources CSISS might provide? Workshops we might offer?

While great strides have been made in the spatial analysis of crime and criminal

behavior in recent years, the percentage of criminologists engaged in true spatial analysis remains relatively low. Best practices exist in the form of practitioner applications that have successfully reduced crime, identified suspects, and supported prosecutions (see

La Vigne and Wartell, 1998; 1999). Academic research in this area has begun to show great promise, with some "high end" applications combining GIS with neural networks, spatial econometrics, and the use of feature space analysis into space-time prediction (see Liu and Brown, 2000). These predictive modeling efforts represent the future of crime mapping and have the potential for bridging research and practice; predicting crime hot spots before they emerge (and thus focusing law enforcement efforts on prevention) can have a significant impact on crime.

In terms of training workshops, I recommend partnering with Dr. Ned Levine, creator of CrimeStat, to provide a series of training sessions on the mechanics of CrimeStat and its application to criminological research.

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POSITION STATEMENT

While I have worked on socio-spatial inequalities in urban areas and inequities in urban and regional development in the past, currently my research regarding issues of inequality and equity centers on questions of **environmental justice and equity in US cities**. Specifically, I am interested in 1) determining the extent of environmental inequity and injustice (both in terms of distributive as well as procedural justice), 2) identifying factors and conditions creating patterns of inequality and injustice, and 3) identifying ways to address environmental inequities.

In order to determine whether principles of environmental justice have been violated, a large number of empirical studies have been carried out to ascertain whether minority and low-income populations are disproportionately exposed to industrial pollution. Typically, such studies of environmental justice, focusing on the inequalities in exposure to toxic hazards among sub-populations, are cast within the tradition of distributive justice, addressing equity of outcomes.As a result, such studies are often referred to as environmental equity analysis. During the past few years I have been working with Eric Sheppard and Bob McMaster at the University of Minnesota investigating theoretical and methodological issues in environmental equity research, using the Twin Cities metropolitan area as a case study. As part of this research we have identified a number of problems and limitations of environmental equity analysis, some of which are detailed below.

Use of spatial data, models, techniques, software etc.

Studies of environmental equity are inherently spatial in nature: Debates have to do with who lives how far from toxic hazards, and why those hazards and communities are located where they are. Thus any analysis of environmental equity or inequity requires selection of a spatial methodology that measures as precisely as possible degrees of inequity in exposure among different sub-populations. During the past decade Geographic Information Systems (GIS) software combined with various correlation and multiple regression analyses has increasingly been utilized in environmental equity analysis. The findings of these studies often conflict with one another. They range from identifying strong associations between the location of minority populations and toxic facilities to those finding no association, and results suggesting that low income communities of color are less at risk than white and higher income communities. A close examination of these studies reveals that these different results are at least in part a consequence of differences in data used and in measures of potential exposure, applied to different kinds of places, at different geographic scales (city, county, metropolitan, state, national), using data with different levels of spatial resolution (blocks, block groups, census tracts).

In terms of the data used there is clearly a lack of consensus as to which variables are most meaningful for assessing environmental equity. To date much of the analysis has focused analyzing the relationship of a single variable (e.g. race, income, age) with risk of exposure. There exist, however, complex

relationships among different variables, specifically between race and income, which should be part of the analysis.

In terms of measures of potential exposure the most common GIS-based approaches are “spatial coincidence” and analytical buffering. The former estimates and compares the characteristics of the population in enumeration units (e.g. census tracts, block-groups) that contain environmental hazards (e.g. industrial toxic emissions, toxic waste sites) with characteristics of the population in enumeration units which do not contain such environmental hazards**.** In analytical buffering, GIS is used to compute circular buffers of varying radiuses around hazardous sites, or to make zonal calculations along major highways.Differences in population characteristics within and outside buffers and zones are measured in order to ascertain whether vulnerable populations are disproportionately located within buffers and zones close to hazardous sites and routes.Thus far little attention has been paid to the impact of different sizes of buffers, or to the significance of the differences identified using such GIS-based measures of environmental equity.In our research we used a geographic randomization methodology for assessing whether observed inequities are unusually high by comparison to those that might have resulted by chance. Our findings suggest that simulations of sampling distributions are necessary to make reasonable judgments about the ‘significance’ of observed environmental equity results.

Most studies also treat the simple existence of a hazardous site as a surrogate for potential exposure, ignoring important differences in the toxicity and quantity of chemicals and the spatial diffusion of toxic releases. The application of plume dispersion models within GIS is an attempt to account for these differences, by integrating the toxicological characteristics of the chemicals emitted or stored, physical characteristics of the sites, and atmospheric conditions to identify the geographic area and population likely to be affected by a plume. Such models frequently also entail simplifying assumptions, for example about average wind direction in an area and about topography, which often is assumed to be flat, which can lead to erroneous results. Plume models are also much more time consuming to apply, and it may be that under certain circumstances reasonable approximations can be gained from the use of simpler buffers. This suggests a need for sensitivity analysis to determine, for example, whether geometric approximations of analytical buffers are close enough to accurately specified physical diffusion models, at desired levels of data resolution, to act as less labor and time intensive surrogates.

In spatial analysis of environmental equity, it has now become clear that the choice of the geographic scale of the study area (e.g. states, metropolitan areas, counties, municipalities) and of the spatial resolution of data within that study area (e.g. zip codes, census tracts, block-groups) influence the results of the analysis. For example, in our work at the county scale we identified a strong relationship between persons of color and TRI sites, whereas at the scale of the city of Minneapolis, we observed a stronger income-based rather than race-based pattern of inequity. This suggests the need for a discussion of what constitutes the most appropriate scale and resolution in environmental equity analysis. Another limitation of most environmental equity analyses is their restriction to measuring risk of exposure to toxic chemicals, rather than also incorporating health measures.

Most environmental equity analyses are static in nature, documenting the degree of geographic association between risk of exposure and population characteristics at a particular point in time. These do not allow the analyst to draw any conclusions about factors causing the association, because patterns may reveal little about the underlying processes. For example, in the case of studies documenting a close geographical association between risk of exposure and communities of color, the community of color may have occupied the area

before the noxious facility moved in, but it is equally possible that the prior presence of the facility depressed property prices, encouraging subsequent in-migration of a community of color to take advantage of affordable housing. In the former instance, a legally actionable case of environmental racism exists if it can be shown that race was a factor in the facility location decision. In the latter instance there can be no legally actionable case, although race may still be a factor as a result of discrimination in labor and housing markets. This suggests the need for historical geographical analysis to ascertain reasons behind environmental inequity.

In terms of addressing environmental inequities, we have worked at the micro-scale, helping inner city neighborhood organizations explore the potential relevance of GIS-based neighborhood environmental inventories for mitigating environmental hazards at the neighborhood level. We see this as one way to promote procedural justice in the dynamics of toxic facilities.

“Best practices,” “Learning Resources,” and Workshops

As I have suggested above, there are numerous methodological issues that need to be addressed in order to improve environmental equity analysis. A workshop on environmental equity analysis bringing together social scientists and experts on spatial data analysis would be highly advantageous for this purpose.

[TOP]

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POSITION STATEMENT

Research interests

My principal interest in urban development processes is their implications for stratification: for racial and class segregation, for unequal access to resources (employment, schools, health care), and for disparities in exposure to crime and public health problems. I investigate these partly by research on the political economy of land development – what creates and sustains inequalities between places? – and partly by research on locational processes – what people get concentrated in the worst places, and why?

Originally my attention focused mainly on black-white differences. I now give increasing attention to issues of immigration, particularly the phenomena of assimilation and persistent ethnic boundaries. My work has taken on a strong historical dimension, looking at New York and Chicago as far back as 1880. And I have also added some comparative perspective, primarily through research on contemporary Chinese cities.

Data and techniques

I rely almost entirely on census data, supplemented by diverse sources on employment, crime, health, and public services at the local level. I estimate two kinds of multivariate models. The first type is traditional ecological analyses of the relationships among various characteristics of places, sometimes longitudinally. The second is what I call locational attainment models: models that link characteristics of individuals (such as their income, family composition, or race), as predictors, to characteristics of places where they live, as outcomes. For references to this work, see:

http://www.albany.edu/sociology/jlogan/jlogan.html

I use GIS packages (MapInfo and ArcView) to provide a visual representation of spatial patterns. I also use these as working tools:

a. To deal with data using different spatial units, such as crime data for precincts and population data for census tracts. Such boundary problems are well known.

b. To identify neighborhoods, based on geographic contiguity of areas with similar aggregate characteristics, such as a set of adjacent census tracts that have high proportions of Chinese residents.

c. To create geographic variables, such as when we add transit lines to a city map and ask how close a given city block is to a subway station.

There are many difficulties in these applications. Many source maps are in libraries with limited reproduction facilities, and we don't have equipment or skills to make high resolution photographs ourselves. The methods for creating GIS maps, even when paper maps are in hand, are cumbersome: scanning and digitizing turn out not to be as straightforward as expected. Boundary

discrepancies almost always require forcing incomplete matches. Our most skilled GIS consultants (in geography) are unfamiliar with social science applications, so we usually start by doing things the wrong way. And of course there are great limitations in availability of spatial data.

Best practices

I believe one of the biggest gaps is in basic cartography – how to design maps that will communicate to the viewer. This is a problem for social scientists in general, that we are not good at devising tables or charts or figures for presentation. Maps are more difficult than these other media. When we map social characteristics, we often leave out other features (parks, roads, institutions) that would help make sense of the spatial pattern.

One publication in which we used simple maps to identify Russian, Italian, and Irish neighborhoods is: Richard D. Alba, John R. Logan, and Kyle Crowder. 1997. "White Neighborhoods and Assimilation: The Greater New York Region, 1980-1990" *Social Forces* 75: 883-909.

An innovative project by Phil Ethington (History, USC) is described on the following web page: http://www.usc.edu/isd/locations/cst/IDA. Ethington is building a digital archive for the LA metropolitan region that includes aerial photographs, current and historical census data, building records, and other sources. These are overlaid on a map grid. The archive is not yet functional, however.

[TOP]

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POSITION STATEMENT

Legislative mandates, programmatic requirements and research studies intending to achieve societal goals require that estimates of population size, income, demographic indicators exposures (to pollutants, stress, social "goods") and outcomes (such as health status and inequity measures) have a fine geographic, temporal and demographic resolution. Therefore, estimates for small areas and for narrow time windows are needed to inform policy. However, direct estimates generally are statistically unstable and must be stabilized while the required spatio-temporal resolution. Furthermore, financial, practical, political and ethical constraints limit the spatio-temporal resolution and alignment of direct estimates. Information on the quantity of interest may be spatially direct, but temporally mis-aligned (e.g., Census information used for a non-census year; historic disease outcomes); temporally aligned, but not direct (e.g., Current Population Survey [CPS] information used for non-sampled regions; aggregated health outcomes) or related to, but not a measurement of the attribute (e.g., administrative records). Such syntheses are necessary to produce valid maps, Geographic Information System (GIS) displays, regulatory or policy assessments. They require careful construction and valid statistical analysis, especially in a world where GIS systems link information and produce high-impact graphical displays.

Therefore, small-area estimates and other inferences require synthesizing evidence from many data bases and "borrowing information" from indirect geographic, temporal and covariate domains. The Census Bureau's Small Area Income and Poverty Estimates (SAIPE) program provides a case in point. Title I allocates more than $7 billion per year to school districts based on their estimated of the number of children in poverty and the poverty rate. Census Bureau estimates integrate information from the Census, the CPS and administrative records such as tax returns via a mixed-effects, hierarchical model.

Hierarchical models are absolutely necessary when dealing with such multiple sources of information and complicated spatio-temporal relations and Bayesian approaches have proven very effective. For example, mapping region-specific posterior means (or other feature of the posterior distribution) smoothes a crude map. The beauty of the Bayesian approach is its ability to structure complicated assessments and to guide development of valid statistical models and inferences that properly account for stochastic and modeling uncertainties. Properly developed, the Bayesian approach produces objectively valid designs and analyses, commonly more effective than traditional methods. Computing innovations such as Markov Chain Monte Carlo (MCMC) enable implementation of complex, relevant models and applications, burgeon.

A few examples illustrate the power of a Bayesian approach. Measurement error permeates observed information and can substantially influence conclusions. For example, if a covariate of interest follows a standard measurement error model in which the observed value is a random deviation from the true value, the estimated covariate effect will be attenuated and its impact underestimated. Many measurement error processes are hybrid forms and require sophisticated modeling; all can alter the functional form of relations. A Bayesian model treats

the true values as missing data. Observed values come into the model via the posterior distribution of the true values conditional on the observed. This approach maintains focus on the unobserved, structural relation and thereby automatically de-attenuates slopes in an intended functional form. Studies with different measurement error processes can produce heterogeneous results. Appropriate measurement error modeling has the potential to "line up" the studies.

Building models that link misaligned information (health outcomes, exposures and demographics) at a common spatial resolution gives models a stable focus, unlinked from aggregation (e.g., by aggregating a Poisson, log-linear model rather than using a Poisson log-linear model for the aggregated information). The approach ensures that assessments from different studies address the same question, can be "`exported" and are potentially combinable. Maintaining focus requires a hierarchical model and Bayesian processing sorts out the relational thicket.

Estimates and other evaluations should be face-valid, for example sum of within-county block-group estimated counts should equal county-level estimates. More generally, estimates should be "conformable" both in their value and uncertainty. That is, analyses at a coarser geographic, temporal or demographic resolution should be consistent with a finer-grained analysis and vice-versa. Conformability implies that the coarser-grained estimate be a weighted average of the finer-grained, with ``logical" weights (e.g., population size).

The growing list of important issues and goals that benefit from a Bayesian approach also includes accommodation of missing data, research synthesis (e.g., meta-analysis), addressing non-standard goals such as estimating histograms and ranks and development of causal models that forge links between science and policy.

Bayesian structuring and analysis produces many benefits, however the approach has been criticized for being too fragile in its dependence on a specific prior distribution, for being too subjective to have a role in formulating policy. But, computing advances have enabled robust, objectively valid procedures. Of course, the Bayesian approach is by no means a panacea, it is by no means "plug and play." Considerable care and sophistication is essential for valid application and a multidisciplinary, team approach is absolutely necessary.

Statistical procedures cannot substitute for scientific and policy insights or for relevant, reliable and sufficient information. Indeed, the Bayesian approach demands that the relevance and characteristics of all inputs be documented and captured by the model, that goals be explicit and that uncertainty be fully taken into account. Though statistical cures are available for some data shortcomings, such cures are far less effective than improving inputs. Space-age techniques cannot rescue stone-age data. Therefore, we need to advocate and create improved information systems, improved understanding of the stochastic basis of observed information and improved alignment of statistical designs and analyses with societal goals.

[TOP]

Spatial Modeling in Health Economics
by Lee Rivers Mobley

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Spatial Modeling in Health Economics

What are my research interests in the areas of inequality and equity, and what spatial dimensions do I currently or potentially see in them?

My healthcare research interests in the areas of inequality and equity include: 1) examination of impacts from policy reforms on access to healthcare, via their impacts on hospital and medical services availability; 2) integrating spatial modeling into examination of medical treatment utilization and effectiveness, in order to develop heterogeneous, population-based protocols for treatments and services; 3) analysis of the cost-effectiveness of medical treatments, with explicit consideration of costs to the patient in obtaining care (time, transportation, travel, work release, day care for dependents, etc.).

Current: In my published work, I have examined how policy changes which affect hospital markets have impacted access to care. One paper focused on public hospital closures in California following MediCal reforms, looking at how this impacted distances traveled by the poor for hospital care. This paper used unconditional analysis comparing mean distances traveled before and after reforms (Mobley, 1998). Another series of papers models space explicitly, using a competing-destinations model, to determine whether the penetration of managed care insurance plans has affected distance traveled for hospital inpatients. There are two effects from managed care penetration: the direct effect on constituents of managed care plans, and an indirect effect on market extent via impact on hospital services offerings and adoption of technology. We find that both direct and indirect effects are significant and economically meaningful, but are surprised to find that managed care apparently shrinks markets. We conclude that managed care plans apparently place high priority on convenience, and contrary to mainstream theoretical expectations, have apparently revived the medical arms race rather than stimulated specialization into (fewer, more widely dispersed) centers of excellence (Mobley and Frech, 2000). A third body of research in progress tests this latter supposition directly. We examine how managed care has impacted the so-called 'medical arms race', i.e. the broad availability of services and technologies. Preliminary results suggest that managed care has increased the overall breadth of services offered by competing hospitals, while encouraging greater homogeneity (less specialization) in services offered among them. This is consistent with the notion that managed care favors 'one-stop-shopping' convenience for constituents over specialization, which is surprising, because better outcomes are known to occur in more specialized, higher-volume settings (see Chernew, Scanlon, and Hayward, 1996, and Grossman and Banks, 1998 for evidence from open heart surgery, and Tilford et. al., 2000, for pediatric intensive care services).

Potential: There is tremendous potential from integrating spatial modeling into examination of medical treatment utilization and effectiveness, and analysis of the cost-effectiveness of medical treatments. Many medical research studies include demographic characteristics of patients, either directly from patient records or interpolated from the U.S. Census based on patient zipcode, but few actually include geographic dimensions in their models. For example, in examination of medical treatment utilization (screening mammography use), researchers have

included household income based on zipcode from the U.S. Census as a partial determinant of inadequate follow-up, in order to better understand the shortcomings of existing delivery systems (McCarthy et. al., 1996, 1997). Another study looks at strategies for reducing potentially avoidable hospital admissions among home-care clients, including demographic characteristics (race, income) as partial determinants of the odds of avoidable admissions (Weissert et. al., 1997). Burgess and DeFiore (1994) examine the impact of distance in patient choice among various VA outpatient facilities, but the patient geo-demographic characteristics included are scant.

Integrating the spatial dimension and spatially-referenced information into medical research can be extremely important, although to my knowledge, this is rarely done. An exception which illustrates the importance of this integration is a recent cost-effectiveness analysis of different management strategies for an ongoing, chronic-disease therapy (the three strategies include in-hospital, in-clinic, or in-home therapy). This study includes patient-related costs, such as time and travel costs, in estimating the relative benefits of the three treatment strategies. Not surprisingly, in-home treatment was most effective from the patient's perspective (when patient time and travel costs were included) while the clinical delivery site was most effective from an institutional perspective (ignoring patient time and travel costs) (Lafata et. al., 2000). This study illustrates the importance of including geographic factors when doing cost-effectiveness analysis of competing delivery mechanisms. Failure to model geography in a system where space clearly matters in explaining observed outcomes is shortsighted, and can yield misleading policy conclusions.

Currently, there is funding available from the National Institutes of Health for medical studies in cancer surveillance, cancer prevention, cancer screening, and cancer care (http://www.ahrq.gov/fund/99014.htm; http://www.ahrq.gov/fund/99015.htm).

In my opinion, these areas of medical research could be enhanced by integration of spatial modeling into the analyses. For example, neighborhood effects - such as lack of good private or public transportation, exposure to environmental contaminants, prevalence of low-income jobs, low educational attainment, many single-headed households with children, low rates of health insurance and/or prevalence of insurance with narrow coverage (high co-payments and deductibles), distance to available hospitals or clinics - can contribute to poor utilization and outcomes even when the best possible services are available. Because of patient confidentiality, many of these dimensions are not available from patient records, and are sometimes obtained via expensive surveys. With the Census 2000 available soon, some of these factors can be modeled directly using data from the Census matched to patient's zipcode or neighborhood. Similarly, GIS software can be used to measure distance (travel time) between patient address and hospital/clinic for direct inclusion in the model. An alternative modeling strategy (rather than direct inclusion of many geo-referenced demographic variables) is to estimate a spatial regression model on patient-level data, which exploits geographic location (of patients) via a distance matrix, to filter out omitted neighborhood effects which might otherwise bias policy-variable parameter estimates (Anselin and Bera, 1998). To my knowledge, this alternative strategy has not been exploited in medical research. If we ignore these spatial dimensions, we are ignoring information that helps determine patient outcomes, and information about potential data complexities. This can affect efficiency, sufficiency, bias, and consistency - the four properties of statistical estimators.

What kind of spatial data, models, techniques, software, etc. do you use or have considered using in your research. Which of these work well for you? Where do you see problems and/or shortcomings?

Data I have used: census data, hospital and patient data by zipcode, EPA data

on air quality by city, Area Resource File data by county. Models and techniques: I have modeled space directly using spatial interaction models (competing destinations models), and I have modeled space indirectly using spatial regression with lattice data, and some ad-hoc combinations of these two methods. I have used ArcView with SpaceStat software, and Atlas GIS software. These work well enough in combination: ArcView has limited database capabilities that can be bypassed using Atlas GIS and Excel. SpaceStat works well with ArcView, but would be improved if the regression residuals could be mapped directly in ArcView.

Can you point out any "best practice examples" of spatially-oriented research in your field?

My paper with Frech regarding impact of managed care on distance traveled by hospital inpatients is the best example I know about which directly applies spatial modeling to healthcare markets (Mobley and Frech, 2000). No other research by health economists that I know of explicitly uses spatial interaction models, or spatial regression techniques. In general, economists are slow to embrace rigorous spatial modeling. Health policy analysts have used GIS to do simple things, like map univariate health characteristics and distributions of health professionals and disease clusters (Murray et. al., 1998; Rickets et. al., 1994). Others have computed simple access measures and compared them by disparate groups across regions such as cities, MSAs, counties, and states (i.e., see regularly disseminated policy reports from the UCLA Center for Health Policy Research, and the Public Policy Institute of California; Rickets et. al., 1994). Some health economists are using distance between hospitals and patients as explanatory variables. Some are modeling hospital (destination) choice, with simple hospital-patient distance as a partial determinant. However, most use conditional logit-type models (Burns and Wholey, 1992; others cited in Mobley and Frech, 2000) rather than spatial interaction models, despite the demonstrated shortcomings in these logit models due to their IIA properties (Fotheringham and O'Kelley, 1989, pp 78-80). To my knowledge, competing-destinations-type models, which do not suffer from IIA, are rarely used to predict hospital choice. Some exceptions are work by Burgess and DeFiore (1994) and Kessler and McClellan (2000).

Do you have any suggestions for Learning Resources that CSISS might provide? Workshops we might offer?

Please continue subsidizing tuition for the spatial modeling and spatial regression workshops with Luc Anselin. I have attended two, and both were excellent. I am not as familiar with your other workshops, but tuition subsidies are helpful to academics (like myself) whose fiscal gatekeepers may be skeptical about these "new" methods.

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[TOP]

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POSITION STATEMENT

Research interests in inequality and equity.

My research focuses on how economic restructuring has interacted with social and demographic change to produce new forms of inequality, segmentation, conflict, and cooperation in major urban areas, particularly New York City. This work has been both theoretical--conceptualizing, interpreting, and explaining the various dimensions of inequality, especially political inequality--and empirical--analyzing and mapping Census and electoral data among others. Settings for this work have been both academic (an edited volume Dual City published by Russell Sage, an atlas of New York City published by Simon and Schuster academic reference books) and applied. A particularly interesting project involved working with the New York City Council to understand patterns of income distribution over time

(http://www.council.nyc.ny.us/finance/middleclass.htm).

My current project, understanding the educational and labor market experiences of five second generation immigrant groups in metropolitan New York in comparison with native whites, blacks, and Puerto Ricans, also bears strongly on this topic.

Actual trends in the New York metro area are complex. It is clear that income distribution has become more unequal, with a few "masters of the universe" at the top end claiming most of the earnings rewards, while the bottom several deciles have experienced absolute as well as relative downward mobility. It is also clear that the middle has tended to decrease its share of earnings. But New York is not exactly turning into an hourglass, because much of the middle has shifted upward, with a significant rise in real median household income, at least in the economic upturns. From a racial perspective, whites have gained most, blacks earn less than whites, have not deteriorated too much relative to them, and Hispanics have experienced downward mobility. In New York, Hispanics fit Wilson's model of the negative impact of deindustrialization better than do blacks.

My view is that place and spatial context play critically important roles in creating and sustaining various forms of inequality. (This is the central claim of a forthcoming book, Place Matters, co-authored with Peter Dreier and Todd Swanstrom). Mapping Census and other data via GIS and applying the statistical tools of spatial analysis are central to helping us understand these processes, but we have a long way to go in integrating these tools with other forms of social science analysis.

Use of spatial data, models, techniques, software etc.

I have done extensive ecological regression analysis (both linear regression and King's EI method) using a longitudinal database of political participation by election district (N=5,400) in New York City. I have also mapped both raw distributions and the results of these statistical analyses. This has involved going

back and forth between SPSS and EI and Atlas-GIS and MapInfo. With colleagues at the Hunter Geography program, I have also analyzed crime patterns in New York City using ArcView and spatial analyst (Go to http://web.gc.cuny.edu/Cur/Frames/home2.htm, click on Mapping Crime Hotspots, then look at the figures for Chapter 7.) A number of us at the Center for Urban Research have mapped 1990 Census data (for results, go to the CUR web site and click on "maps" in the frame. You may be interested in the map of people with graduate degrees!) The basic mapping and statistical analysis programs work well for us, but no package seamlessly combines social statistics, spatial statistics, and mapping. We are planning to offer analytic access to the 2000 Census on the web and are now exploring data mining and display tools for that.

"Best practices," "Learning Resources," and Workshops.

On the methodological level, we need to integrate ecological analysis and spatial statistics into the social sciences, specifically political science and sociology. We also need to get people who know about spatial autocorrelation and spatial statistics to talk with those who are measuring and modeling neighborhood effects or who are doing hierarchical linear modeling. On a theoretical, we need to spatialize the discussions about urban poverty, neighborhood change, etc. On an empirical level, we need to develop better data sets relating 1980 - 1990 - 2000 tract level Census data and integrate it with other agency operating data. On an applications level, we need better software tools linking statistical and spatial analysis and cartographic display (though the market may not be big enough for commercial firms to develop them). We need to encourage those who gather individual level data (like presidential election exit polls) to make it possible to situate them in spatial context (by attaching some identifiers).

There are many ways in which CSISS could help us progress in these directions. A workshop on spatial analysis for social scientists might be a good way to begin.

[TOP]

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POSITION STATEMENT

As an historian of poverty, social science, and social welfare policy, I encounter the spatial dimensions of inequality in several aspects of my work. Space is also a key variable in a large-scale interdisciplinary project I have been involved with for several years, the **Multi-City Study of Urban Inequality**, which has just culminated in a 7-volume series published by the Russell Sage Foundation. The multi-city study is based on linked household and employer surveys fielded in Atlanta, Boston, Detroit, and Los Angeles in the early 1990s, which explore racial attitudes, residential segregation, and labor markets. Drawing on this experience as well as on my historical research, I would highlight the following:

1.)Historical shifts in the spatial configuration of poverty and, equally important, how those shifts affect the popular imagery of poverty and political support for anti-poverty programs.While heavily stigmatized as culturally backward and dependent, the rural poor have traditionally been pictured as white, working, in 2-parent families, and benign.The urban poor, in contrast, are pictured as "dangerous," unemployed, morally deviant, racially "other," and, especially in the wake of post-World War II migrations, black and brown.Place, that is, sets off a series of associations that alternately play on pity and fear about the poor.I raise this as a way of drawing our attention to the symbolic as well as the real significance of space—and to the political and economic consequences of space as a "signifier." Witness the dramatic shift in the imagery of the "other America" as political backlash to the War on Poverty (and the subsequent war on welfare) set in.Evidence of the economic consequences can be found in the employer surveys conducted as part of the multi-city study (and in other, similar surveys as well): employers use space (neighborhoods, an inner city zip code) as a way of screening out potential workers, sometimes by not hiring particular applicants, but more often by simply not recruiting from or even considering locating in certain areas.

2.)The historical processes and institutional mechanisms through which space is stratified—by class, gender, and most prominently, in the 20th-century U.S., by race—and in turn becomes a factor in generating (and maintaining) social stratification.Racial residential segregation, as Massey and Denton and many others have pointed out, has been a key structural underpinning of racial inequality—regulating, as it does, access to education, employment, a whole range of services, political representation, and opportunities to accumulate capital and wealth.It is also a product of public policies, laws, legally-sanctioned real estate practices, and violence—and not simply, as some social scientific theories would have it, a reflection of migration patterns and residential choice.Historians have also begun to pay more attention to the segmentation of space by gender as a key issue in inequality, focusing especially on how traditional divisions of labor (and citizenship) are reinforced by sharp divisions (until recently) between domestic (female) and civic (male) space.Moreover, findings from the multi-city study suggest that "spatial mismatch" as a barrier to employment works differently across gender lines: women, who continue to carry the burden of household/child care responsibilities, feel more constrained to find paid employment close to home.

3.)The conceptualization of space in social scientific theories of poverty and inequality.Space has been a core component of social scientific writing and theorizing about inequality since at least the pioneering social surveys (featuring color-coded maps of poverty, wage-earning, and ethnicity) of the mid-late 19th century, and the emergence of a whole series of ecological theories ranging from the idea of “contagion” to the enormously influential models of ethnic succession, social isolation, and community disorganization associated with the Chicago school (and recently revived as part of the “underclass” debate).But space has also been the source of conflict and tension within the social sciences: over the Chicago school’s tendency to naturalize social geography, for example; and also about whether space “matters” in terms of its impact on social outcomes (as in the debate over “neighborhood effects.”)Having been eclipsed by the turn to economic methods and national-level datasets, spatial theorizing has been revived, (most prominently in ideas such as “spatial mismatch” and “neighborhood effects”) but remains underconceptualized, and often confined to what can be assessed in measurable outcomes.In qualitative evidence gathered from the multi-city surveys, however, it became clear that students of inequality need to do much more to explore the social and political meaning of space, as well as the cognitive “maps” of local geography that behavior and institutional practice.

4.)Similarly, there is a long history of “place-based” policies, principally aimed at “revitalizing” impoverished or “depressed” urban and rural communities, that have been the subject of controversy (to oversimplify: should anti-poverty policies target people or places?).What often goes unnoticed in these debates is that government policies (and politics) have themselves played a major role in creating spatial inequality—subsidizing suburbanization, industrial relocation, globalization, and other structural shifts that have undermined central city and rural areas.

As for spatial methods and models, I would point especially to the importance of qualitative, contextual, and, of course, historical analysis for getting at the spatial dimension.It is absolutely worth re-visiting the community studies tradition for insights (DuBois’ Philadelphia Negro; Davis and Gardner’s Deep South ; Drake and Cayton’s Black Metropolis as well as more recent studies such as Cynthia Duncan’s Worlds Apart, all of which draw on a combination of quantitative and qualitative methods, and all of which are very much place-based).Some of the most valuable insights in the multi-city study come from the link between employer telephone and in-depth face-to-face interviews we conducted with a smaller subsample of the employers, in which we were able to find out more about how space figured into their labor market-shaping practices and attitudes.A workshop on combining methods would be very useful.

[TOP]

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SPATIAL IMPACTS OF ICT ON HOME AND WORK: CHANGING INEQUALITIES

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1. Introduction

Dutch national government and local governments have laid down in regional implementation agreements that between 1995 and 2005 some 600,000 dwellings will be constructed on so-called VINEX locations in or close to the cities. Industrial estates will also be developed. Housing construction and setting out industrial estates are perceived to be separate tasks: there are different actors, working on different locations, with different purposes. All this development is completely in the spirit of the *Chartes d'Athènes* of the CIAM that marked its 50th anniversary in 1998.
The restructuring task in Dutch cities is also huge. It involves mostly post-war residential districts with a high proportion of social rented dwellings in middle and high rise buildings; these districts are ripe for redifferentiation and improved urban design. They are usually characterized by a modest level of services and facilities and shopping provision that flourishes with moderate success. Business activity and employment are hardly to be found in these districts: for those you must search on the industrial estates outside the city, or in the inner city.

Information & Communication Technology (ICT) is the collective term for all the technologies used in communication and information. So perceived, ICT includes the newspaper, radio, television, and telephone. In practice the term usually refers to those techniques which are interactive, where communication and information are intertwined, and use is made of chips and computers. Communication can run via personal computers (internet), via interactive digital television (iDTV), and via Wireless Application Protocol (WAP) telephones. These modern ICT applications are currently soaring and will doubtless have consequences for people's time space budgeting (Louw, 1991). Computers and telephones can be linked to a person (laptop, cellular, telephone), or used in a specifically designed work location, or can be found in the home. The location of the television set is predominantly the home.
Directly and indirectly, the ICT explosion which is currently underway will influence our way of life, our homes, and the residential environment. This contribution explores the spatial impacts on housing and employment. The exploration has been based on lit-

erature sources and common sense, but the observations have no more significance than pictures conjured up by tea leaves lying at the bottom of an empty cup. Setting up a research agenda centred around this theme of the influence of ICT applications on the home, the residential environment, the location of business and the city would seem to be extremely worthwhile.
Section 2 deals with the spatial relation between home and work over time. The vision of Toffler on the future of the home-centred society is explained in section 3. In section 4 we present some empirical evidence on the development of ICT and internet use in the Netherlands. The opportunities for working at home are dealt with in section 5. The economic vitality of the city is threatened as a result of the spatial impacts of the old economy (section 6). In section 7 we consider the possibilities to strengthen employment in residential districts. We conclude with a sketch of possible future developments in section 8.

2. Home and work: separation in time and space

In the past we knew how to keep home and work entirely separate - not only in space, but also in time. For decades we had a razor-sharp distinction between working hours and free time. The opening hours of shops and offices with a service counter function harmonized with that. Holidays were not spread out: either we were all at work, or we were all free.
This sharp geographic and temporal distinction between home and work is not something inherent in the human existence, but is a typical consequence of the industrial age. If business activity and employment predominate in industry it is sensible to separate the clean, fresh air of the residential areas from the noisy work environment with its unsavoury emissions. And if it only makes sense to work when the machine park is in operation, with all the wheels in the production apparatus turning, it is logical that working hours should be sharply separated from free time.
In the pre-industrial age this was quite different. The farm is typically the place where work and living are intertwined. That is also true for the shopkeeper's family living over the shop, or the tradesman whose house and work are bound strongly together in time and space. The labour market and the housing market used to be integrated in a distinctive manner (Vance, 1966). Only since the nineteenth century has a more or less independent housing market marked itself off and now we take it for granted that this is how it should be. But, in the information age this is very much the question. In the following we examine critically the assumed self-evident nature of the division of home and work in space and time.

3. The vision of Toffler

The idea that ICT applications could have radical consequence for our way of life and our homes is not new. Twenty years ago Toffler announced that the new computer assisted production techniques would lead to a new function for the home. Toffler asserts (1980: 204): '…. we are about to revolutionize our homes as well'.

Toffler describes how at the time of the industrialization (The Second Wave) millions of jobs were moved from the home to the factory and the office. The third wave will bring these jobs back from factory and office to the home. The third wave marks the transition from an industrial society to a knowledge based society. The new production techniques bring *'…a return to cottage industry on a new, higher, electronic basis, and with it a new emphasis on the home as the centre of society'* (Toffler, 1980: 204). That marks not so much a new formula, but the return to honour of a pattern that served humankind for roughly 10,000 years and was only broken relatively briefly for three centuries before and after the industrialization (see: Vance, 1966). But now another sort of production is involved: knowledge and services are pivotal; goods come in the second place.

Toffler concluded in 1980 that many people were already carrying out their work wholly, or to a large extent at home: sales representatives, architects, designers, consultants, psychologists, therapists, music teachers, insurance agents, researchers, and so forth. These groups form the advance guard in the transformation from centralized work to the 'electronic cottage'. Toffler is not blind to the barriers which will be encountered here, such as the need for face-to-face contacts with colleagues, but nevertheless he sees an irresistible shift from office and factory to the home, partly as a result of the rapidly changing trade-off between transport and telecommunication. Commuting is becoming more expensive in time and money, while telecommunication is becoming cheaper and faster. The transport of information is much more simple and environmentally friendly than the transport of people or goods.

Toffler expects households to function increasingly not just as a living unit, but also as a work unit. Toffler states (1980: 213): *'… it is worth observing that one of the things that has bound families tightly together through history has been shared work.'* Toffler anticipates increasing pressure from citizens demanding that if work **can** be done at home, then it **ought** to be done at home. Toffler (1980: 214 217) foresees the 'home-centred society' taking shape around the 'electronic society', with a number of striking consequences:

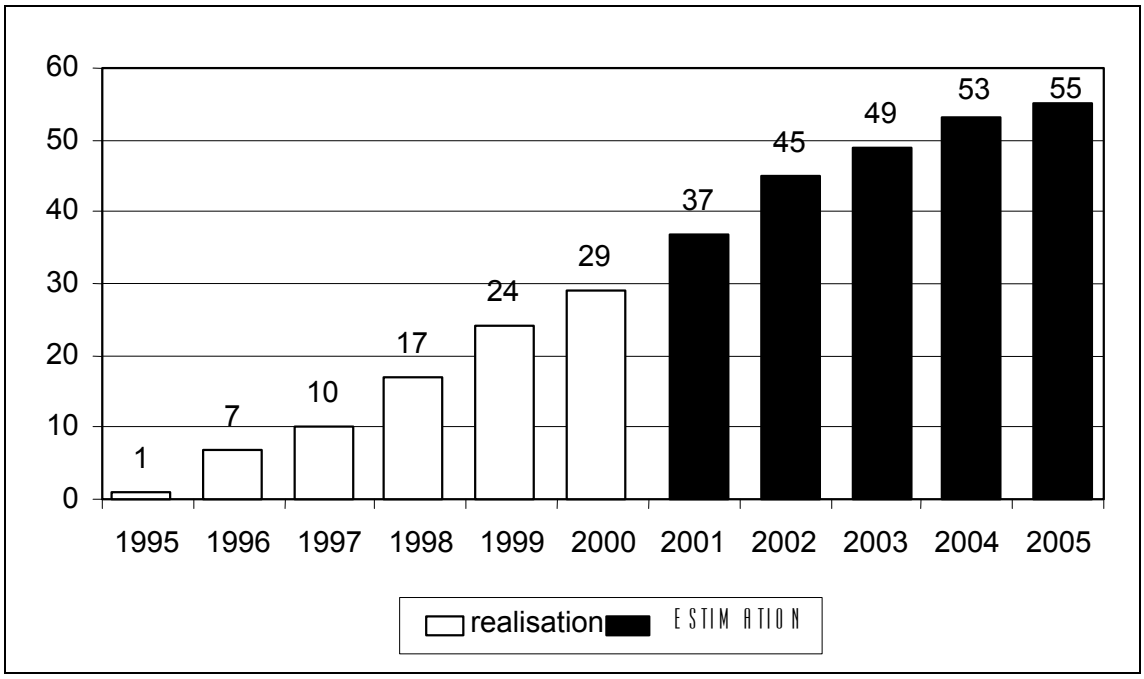
1. *Community impact*: As more people work at home, greater stability of communities will accrue. Home to work mobility will decline.
2. *Environmental impact:* Working at home facilitates the decentralization of energy production (sun, wind) and reduces the emissions from commuter traffic.
3. *Economic impact*: Shifts will occur in the production structure. Oil companies, the auto industry, the paper sector and the commercial real estate sector will fall back. The computer, communication, services and knowledge sectors will see their share grow. Toffler expects a growth of small businesses, with entrepreneurs who themselves own the means of production and only offer their services as independent producers, or in small groups.
4. *Psychological impact*: People will increasingly have to deal with two worlds: the real world and the virtual world. Toffler expects that many people will work part-time at home and part-time somewhere else.

All in all Toffler expects changes in the 'techno-sphere' to lead to a revolution in the 'info-sphere' and the 'socio-sphere'.

4. What happened since Toffler presented his vision?

Recently in the Netherlands there has been considerable attention paid to the development of E-commerce: the sale of products on the internet. ABN-AMRO (1999) describes E-commerce as the exchange of information, services, products, and payments via an electronic medium. The electronic media include not only the internet, but also the digital telephone network and cable television.
An important distinction within E-business is drawn between Business to Consumer (B2C) and Business to Business (B2B). B2C relates to sales by businesses to consumers via the electronic highway. B2B refers to transactions between companies via the digital network, including internet, in the support and implementation of business transactions (Stec Group, 2000: 11).

Figure 1 Internet use in the Netherlands (as a percentage of the total population)



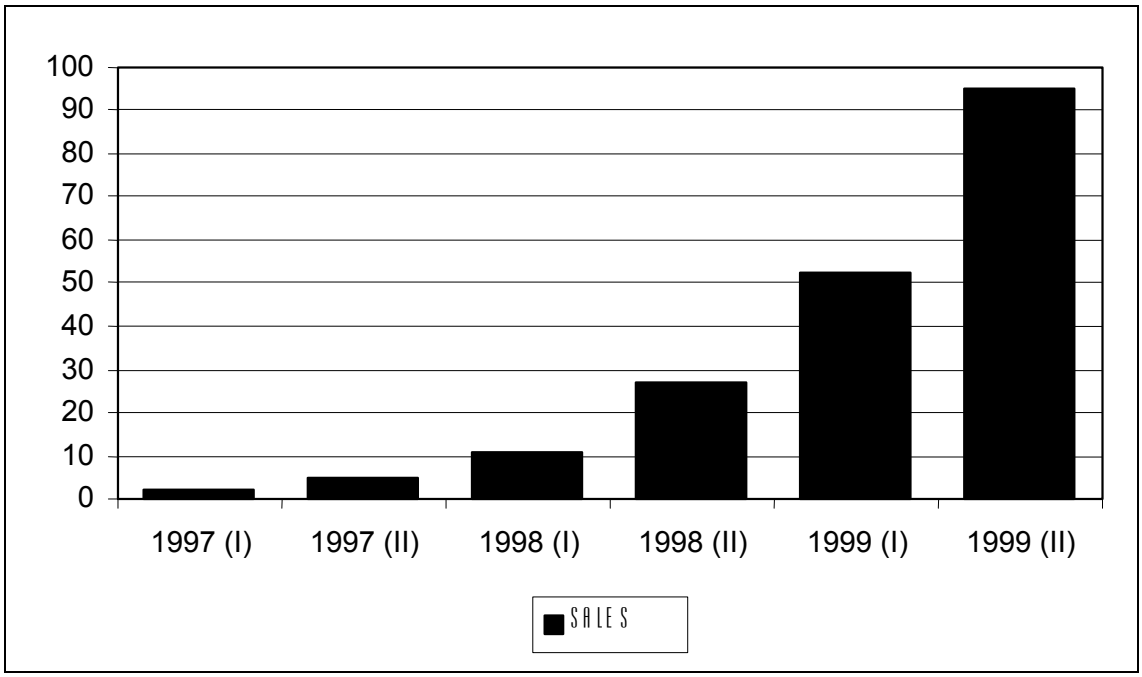
Source: Heliview 2000; EIM 1999; Booz, Allen & Hamilton 1999, Pro Activ International 2000; processed by Stec Group.

At the end of 1998, ninety million people in the world were connected to the internet. This number is rising fast. In 1998, six out of ten households in the Netherlands had a computer. The higher the income, the greater the computer ownership.
Figure 1 shows the rapid growth in the use of the internet in the Netherlands since 1995. In 1997, 10% of the Dutch had internet access. In 2000, this share has risen to 29%. A share of 55% is expected for 2005.

Forrester Research (2000) expects that in 2005 more Europeans will go on-line via the television set than via the computer. Booz, Allen & Hamilton (2000) expect 80 million

mobile telephones in Europe to be equipped with internet in 2003, partly through the development of ADSL (Asymmetric Digital Subscriber Line).
Netherlands households use internet mostly for e-mail (85%), looking for information (62%), surfing (61%), downloading (57%), and reading the news (50%). For business purposes the Dutch use the internet for e-mail (75%), information gathering (62%), downloading(39%), reading the news (38%) and searching for information (32%) (Pro Active International 2000, Stec Groep, 2000: 13).
Figure 2 shows how the on-line sale of products has grown in the Netherlands since 1997.

Figure 2 On-line sales in millions of euros, per half year in the Netherlands



Source: Blauw New Media Consulting in NRC, 2000, quoted in Stec Groep, 2000.

This growth is closely linked with the growth of the number of active internetters. In June 1999 this group of active internetters amounted to 1.5 million people, of whom 400,000 were on-line shoppers.
An important target group of E-business directed to the consumer (B2C), is consumers with lots of money and little time. The *Woongemak* [Housing Comfort] system introduced into 700 dwellings on the Java island in Amsterdam is directed particularly on to this group. The heart of this system is the *Bode*, a dedicated piece of equipment with a television screen and a printer that can be linked to a camera at the front door. The participating residents order their shopping and services via the television screen. In the near future thousands of dwellings in fifteen cities will be provided with *Woongemak*.

The real estate investor Vesteda has acquired a majority interest in the company (Stec Groep, 2000: 61).
Most of the Dutch who have made purchases via the internet are young, male, and well educated. According to Blauw New Media Consulting, in 1999 Netherlands consumers spent 147 million euros via the internet. In particular hardware and software is sold via the internet: this makes up 33% of all expenditure via the internet. Travel follows with 25%; entertainment (books, CDs) form 20% of the spending via the internet (Stec Groep, 2000: 14).
Forrester Research (2000) expects the business carried out in Europe via the internet to grow by an average of 98% per year for the next five years. The on-line sales would then rise from 2.9 billion euros in 1999 to 175 billion euros in 2005, which would be 7% of the total retail trade. Experts anticipate this share reaching 15% in the long term.
Homework is defined in various ways; that largely accounts for the substantial differences in numbers of homeworkers estimated or registered. Homework always involves carrying out work at home, at a distance from the work organization. De Vries (1998) lists four items which can determine the definition:

- the place where work is carried out: the home, or some location which is different from the employer's establishment;
- the legal status of the homeworker: employee, freelancer, or independent;
- the nature of the activities: traditional or telehomework;
- the quantity of working time spent on work at home: duration and frequency.

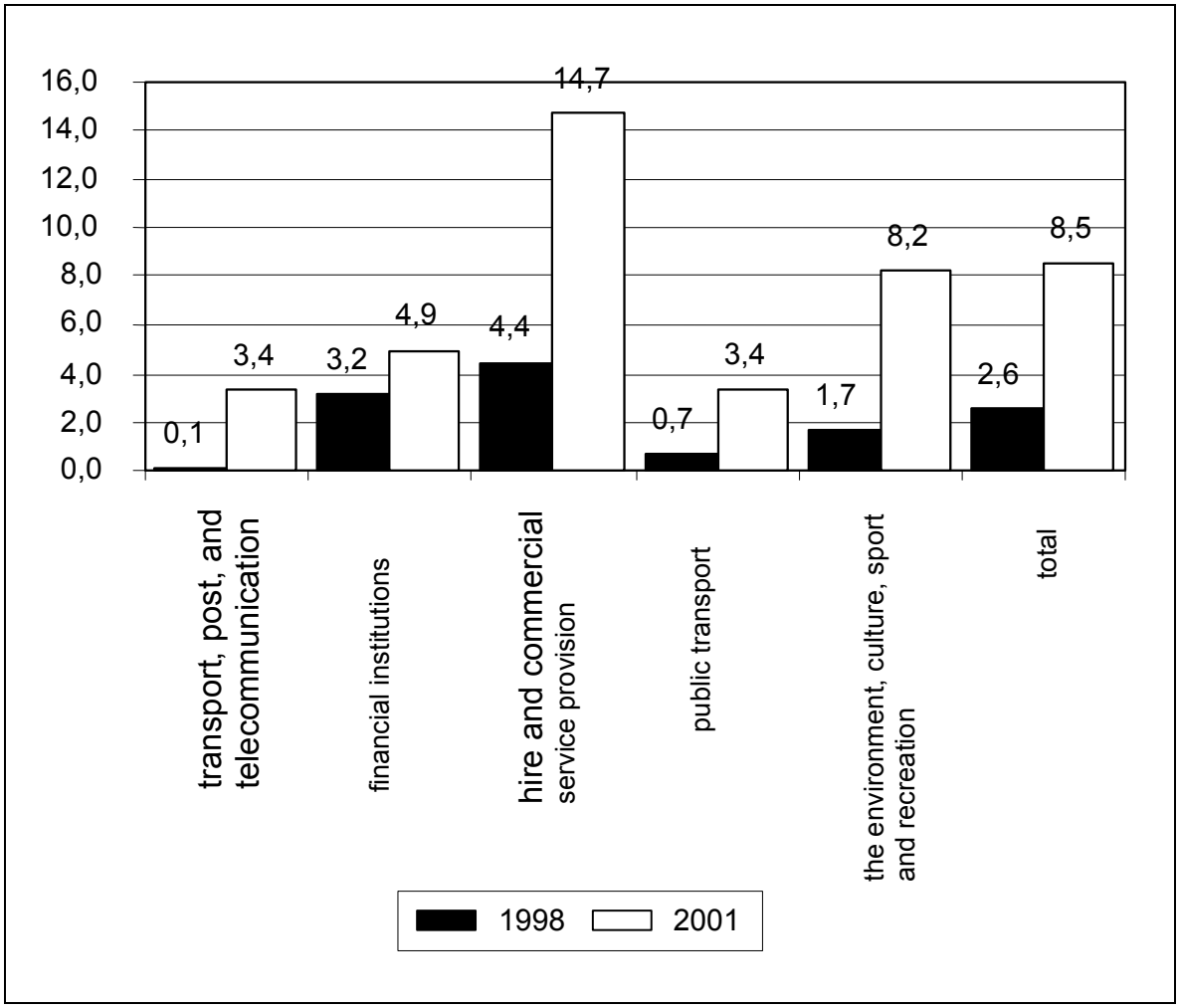
The information concerning the current number of teleworkers in the Netherlands is conflicting. The *Stichting Telewerk Forum* speaks of 600,000 teleworkers (10 to 14% of the working population). Teleworkers comprise 250,000 homeworkers and 350,000 mobile workers. Homeworkers are people who used to work the whole week at the office, but currently spend a minimum of one day per week working at home. Mobile workers are people who used to work 'on the road' and now organize their work activities for a substantial part of the time from home (such as service engineers) (Stec Groep, 2000: 56). In the middle of 1998 in the United States, 12.9% of the working population were teleworkers (European Commission, 1999).

Felstead & Jewson (1997) distinguish three categories of homework:

- work conducted at home (homeworker);
- work conducted from home (house as work base; compare the mobile worker);
- work conducted in the same grounds and buildings as the home (not in the house, but within the 'domestic living area'), such as a shopkeeper who lives over the shop.

We concentrate particularly on the first two categories, but the third category is also of importance in the evaluation of opportunities for a blending of functions in the residential environment.
Figure 3 gives a picture of the share of teleworkers per sector.

Figure 3 Share of teleworkers per sector, 1998 and 2001 (in %)



Source: Research voor Beleid [Research for Policy], 1999.

Certain sectors, such as hotels and restaurants, care and construction, do not lend themselves to teleworking. The share of teleworkers in commercial service provision is high. On the basis of E-business developments, The Stec Groep (2000: 53) expects in the long term an increase in the demand for residential space in an attractive residential environment. The Stec Groep does not specify this concept further. Such a residential environment can be found just as well in a big city as on a suburban or rural location. The distance between home and work is already increasing and in future it will become even greater. Thanks to E-business, the decision of where to live will be determined more than is now the case by the desire to live in an attractive residential environment than by the work location, according to the Stec Groep (2000: 53). The Stec Groep (2000: 55) is of the opinion that the number of teleworkers will grow strongly in future and as a result the South and East Netherlands will score higher as residential areas. Moving house will occur over larger distances which will often cross the boundaries of one's own housing market area.

Since E-business leads people to spend more time in their homes, the need for a spacious house is strengthened (for example, with one or two office or study rooms), as is the need for flexible lay-out, services (such as messaging services) and better telematics provision (such as ISDN) (Vlek, 1986; 1987; Stec Groep, 2000: 58). In short: the intelligent home is the future (Caso, 1991; Wilkström et al, 1998).
One increasingly hears it said that homes ought to be provided with a separate work space. A limited share of house seekers specifically want a living-working house (Louw, 1999). Ahrentzen (1989) gives indications for the design of a living-working house (see: Caso, 1991; Louw, 1999). Space and flexibility are the core themes.
Everything seems to indicate that Toffler's theory is now taking root in practical terms, even though the signalled changes are only at an early stage. The significance of the home is increasing, but for the community impact, the environmental impact, the economic impact, and the psychological impact it is clear, just as Toffler predicted, that much remains to be seen.

5. Working at home

It is clear that the home is not only the place for consumption and sleep, but work is done there too. In the traditional sense it is the housewife who works in the house: cleaning, washing, drying, cooking, sewing, ironing and bringing up children: unpaid activities which add value and as a result are productive. In modern families, in which the two income families predominate, these productive tasks are shared between the both partners, although the man's share usually still remains a modest one. The work function in the home can be seen more clearly if the household employs household help, paid cash in hand and often part-time, for their (usually her) activities (like cleaning and childcare).
The work functions which have been considered to this point are not new and have in general been provided for by the developer or the architect. But traditional house designs are only geared to these activities to a modest extent. However, everything points to the fact that it is no longer just these household activities that are concerned. The razor-sharp distinction between work time and free time is tearing us apart. The strict division leads to traffic-jams in the morning and at the end of the afternoon. It restricts the earning capacity of shopkeepers, proprietors of inns and restaurants and other service providers who have to close when their customers are free. No wonder that in the Netherlands the Shopping Hours Act is up for review and that working hours in offices and firms is becoming increasingly more flexible. According to some we are on the way to the 24 hour economy, but as a general picture of social life in the Netherlands that is somewhat exaggerated. Transport is becoming increasingly more difficult through the congestion, the prospect of pay as you drive and the unrelenting parking problems. At the same time the information technology revolution is developing at an enormous pace, generating more and more substitutions for actual transport. Thanks to the personal computer, the fax and the cellular phone we are always within reach, we can carry out our knowledge-intensive work wherever we wish and can put our contributions into the system anywhere. Our equipment is situated increasingly less often at a fixed place (machine, documentation, telephone), but is attached to the person instead (PC, cellular phone). As a result productive activities can be fragmented in time and space with in-

creasing ease. Employers are increasingly setting up their offices as buildings with flexible work places. The next step is for the employees to carry out their work for one or more days per week at workspaces set up in or near their homes (Vlek, 1986; 1987). Many cars are beginning to take on the form and function of a workspace. The same is true for hotels and airport lounges; only public transport does not accommodate the transformation very well until now.

For employers and employees, particularly in the commercial services, it is becoming increasingly more important for the home to be suitable for carrying out work in a workspace which in the eyes of the Labour Law Inspectorate satisfies the appropriate requirements. The question is, what are these requirements. A place for a computer? A modem? An Internet connection? An extra telephone connection? A fax? Space to sit down, to do word processing and search databases? Space to store records and files? And most of all: a quiet environment without noise hindrance and with reasonable privacy? That all sounds very reasonable, but the Dutch Building Decree has not yet reached that stage. Increasingly often we hear that the ground floor of a family house must not only have a living room and a kitchen, but also a separate work space. How many family houses can provide this facility? To what extent are efforts being made to meet this wish? What can the employee and possibly the employer afford for such provision at home which saves on commuting from home to work, and transfers computer and telephone costs from the business to the home?
And then there is probably a small, specific, but very interesting group which sets much higher demands on their houses in order to be able to work at home. In the Netherlands roughly 80% of beginning entrepreneurs start their businesses in their own homes. Think of Hewlett and Packard who set up their embryo high-tech business in a garage in Silicon Valley. And in the Netherlands, the Philips brothers, who did much the same. Think of the workshops, ateliers, practice space for the physiotherapist or speech therapist, a wine tasting business, a business administration bureau, an outside catering firm, or a repair business. And that takes no account of moonshine distilleries, hash cultivation, or XTC laboratories.
What would happen if we built more houses with attached garages on the VINEX locations, mentioned in section 1? Would that promote car mobility? The households which are currently established on a VINEX location have on average just over one car per household. And you don't think that the residents would use such a beautiful garage just for storing the car? A garage is a marvellous extra space which can be equipped as a workshop, as a recreation room, or for extra storage. Attics and (now less often) cellars can also have such a function. It is far from always the case that it is high-tech and other post-modern business activities which take place at home. Not infrequently it is still a matter of more traditional activities such as shelling shrimps, making lampshades, or sorting out second-hand clothes.
There are some home workers who set very specific demands on their work space. They can indicate with exact precision what requirements their atelier or practice space must meet. The question is rather whether these requirements will remain unchanged for a whole century. In the Netherlands a dwelling lasts on average for more than 110 years. We must therefore take into account the changing business requirements accompanying a changing range of trades and businesses. Requirements for flexibility and adaptation

must be to the fore in such cases. If the demand for workspaces at home is brought carefully into the picture there could be a certain proportion of houses suitable for working at home both on VINEX locations as in renewal districts. In Louw (1999) an overview is given of recently built and designed working at home houses.

6. The economic vitality of the city threatened

The argument above was put forward from the perspective of the dwelling, but we can also a build up an argument starting from the city viewpoint. Then the question which stands to the fore is: what is the situation with regard to the economic vitality of the city? Table 1 reveals how in the Netherlands as a whole employment is growing by 2.5% per year (1980 - 1995) and in the last five years (1990 - 1995) by as much as 2.7%. Urban employment has however stagnated. In 31 cities (G31) with a large urban renewal task, the growth rate was 1.4% per year in the period 1980 - 1995, while in the last five years (1990 - 1995) the growth rate fell to 0.9% per year.

Table 1 Development of urban employment in index figures and average annual growth rate in percentages, 1980 – 1995

	Index 1980-1995 (1980 = 100)	Annual rate of growth 1980-1995	Index 1990-1995 (1990 = 100)	Annual rate of growth 1990-1995
Total G 31	123	1.4	105	0.9
Rest of the Netherlands	166	3.4	122	4.1
Total for the Netherlands	145	2.5	114	2.7

Source: Central Bureau for Statistics (Priemus et al., 1998: I - 65).

Table 2 Sectoral distribution of employment in the cities in percentages of total employment in 1995

	Industry	Building	Business, hotels and restaurants	Traffic and communication	Financial and commercial services	Government and other services
Total G 31	12.8	4.0	17.3	7.2	22.3	35.3
Total for the Netherlands	18.2	6.2	19.7	6.6	16.7	32.6

Source: Central Bureau for Statistics (Priemus et al., 1998: I - 68).

Table 2 shows that urban employment (G 31) is characterized by a low share of industrial employment and a relatively high share of financial and commercial services.

Table 3 Growth of the Gross Regional Product (GRP) of the urbanized districts (1970 - 1995)

	City growth in GRP in % per annum (1970-95)	City Environs growth in GRP in % per annum (1970-95)	Urban district growth in GRP in % per annum (1970-95)
Cities G 27	2.0	3.7	2.8
Rest of the Netherlands	-	-	3.2
Total for the Netherlands	-	-	2.8

Source: Van der Vegt & Manshanden, 1996 : 31; Priemus et al, 1997 : 54.

In the period 1970 - 1995 the Gross National Product in the Netherlands grew by an average of 2.8% per year (see Table 3). This was also the rate of growth in the urbanized districts of 27 cities with a large urban renewal task (G 27). In the 27 cities the growth of the growth of the Gross Regional product in the city environs was much higher (3.7%) than the gross product of the cities themselves (2.0%).
The employment development in the central cities has lagged behind that of the surrounding region (Van der Vegt & Manshanden, 1996 : 60). If we consider the development of the Gross Regional Product and the development of employment, then we must conclude that the economy in cities in the Netherlands is not going well and that the central cities lag economically behind the surrounding regions. The urban development via VINEX locations and urban renewal must thus be directed not only to housing, but also to employment and business activity.
The spatial integration of home and work as a result of the growing role of ICT could reduce the economic backlog of central cities and could contribute to a better social equity between city and suburb.

7. Employment in the residential district

It is encouraging that increasingly more municipalities, housing associations and the business world can look at the developments sketched here straight in the eye. Perhaps images of their experiences of the classic urban renewal remain in their memories; then, pre-war districts were renovated for the sake of the public housing function at the cost of commercial activities and employment, which often disappeared with the demolition and renovation. Employment in the districts undergoing renovation must not suffer as a result, but should rather emerge as the victor, with the urban vitality and economy of the district receiving a substantial boost. Moreover, the differentiation and liveliness in the urban renewal districts and on VINEX locations would be well served with a far-going integration of commercial activity in individual houses and the residential area.
In this context one can think of small scale employment in the district which would not fit into a single house. A fitness centre, the back-office of an administration bureau, or the workshop of a housing association. Such facilities could be given a place in the

basement of an apartment building, so that the ground floor would immediately get a lively aura. One can also imagine facilities being constructed so that they are linked to a local shopping centre.
If the housing associations were to listen to their residents, they would be able to grasp the enormous demand for various residential services, welfare services and care arrangements, varying from the demand for household help, security firms, prepared meals to delivery services for medication, pizzas and other products, crèches and help with DIY. Meeting this demand fits on the one hand with the drive to maintain the legendary customer friendliness of the housing associations and can on the other hand contribute to a more differentiated and lively residential environment with facilities for business activity, employment and voluntary services.
Little is known as yet with respect to the background and the nature of the demand for workspaces in districts undergoing renovation and on VINEX locations. We may assume that the rapid rise of telematics in combination with the increasing congestion on the roads will strongly stimulate this demand. Everything points to us having to get hold of a lever which can help us to promote the economic vitality of the cities. For the development of VINEX locations and the restructuring of city districts that is an important prospect.

8. Looking at the tea leaves

If the ICT-revolution continues and if resources such as the telephone, PC and television become more individualized, increased individualization within the household is to be expected. There will be increasing pressure on the almost tautological equation: number of households = number of (inhabited) dwellings. The home is taking on more productive tasks: teleworking, telebanking, telelearning, teleshopping, and telemeetings. Some of these functions still fit into the domain of home consumption (such as telebanking and teleshopping), while others are associated primarily with the productive side of society (teleworking, telemeetings). The question still applies: Do people work at home, or do they live in the office? (Vlek, 1986: 41). Increasingly, both consumer and productive aspects will be recognized in a particular function (for example, telelearning). The home is being transformed into a centre of consumption and production. That is also increasingly the case for the car and public transport over a longer distance. On the one hand the consumer function of the home will lose ground to the production function, while on the other hand households, if they have the financial resources, will increasingly want to the have more residential locations at their disposal. The digital distinction between place of residence and place of work will lapse. The distinction between place of residence and holiday home will also become blurred. Households no longer just have a house from which they commute to some fixed workplace, but move increasingly often between a collective place of work (per household member), the conference centre (as quasi workplace), the home as home-workplace, and the second home/place of recreation where the work function is usually less strongly present. An increasing spatial fragmentation arises in the behaviour of households and individuals in which the demarcation between working hours and free time becomes more pluriform and diffuse. Physical mobility increases further, but the criss-cross movements will take the upper hand so that the travel peaks will be flattened out. The loss of time, the cost and the irri-

tation of sitting in a traffic jam forms in this dynamic a tremendous push factor; the increasing opportunities and internalization of ICT-applications by households and companies form the most important pull factor.
The spatial and temporal demarcation of living and working is becoming more pluriform and dynamic. The productive activities increase in and around the home, while companies direct their human resource management to the strengthening of the bond holding the personnel to the company through the introduction of consumer activities "in the time and at the expense of the boss": birthday celebrations, excursions, incentive journeys, survival expeditions, cultural events, fitness facilities.
For the home these developments imply: space, flexibility, good connections on ICT nets, the integration of legal conditions of employment requirements and functional residential requirements, the close availability of pluriform service and care arrangements, opportunities for differentiation in home and work activities, both individual and collective activities, ample facilities for the delivery of products (box or safe) and adequate parking accommodation for cars and bicycles. The interaction between residents, home, and urban services will increase spectacularly (Caso, 1991).
For the city these developments imply a much greater pressure on the multiple use of space inside buildings and at the level of district and neighbourhood, increasing employment opportunities in the district, differentiated services and facilities in district and neighbourhood, and hierarchical, finely branched infrastructures for ICT and physical traffic. Moreover, opportunities for outdoor recreation from the home must also be within easy reach, which suggests a network of water- and green structures in the city. This calls up a picture of a network city with a greater density around the traffic infrastructure and in particular the transfer points, and a lower density in the areas bordering on the water- and green structures. Sharper contrasts will be created in the cities, which in the Netherlands also include the growth centres and the VINEX-locations and which are being transformed from single core cities to multi core urbanized regions. This perspective has consequences not only for the development of new areas, but also particularly for the redevelopment and renewal of existing areas. Moreover, in this perspective there is a greater freedom of choice in place of business or residence (Vlek, 1987) and a reduction in the transaction costs when moving (costs for the solicitor, estate agent, stamp duty). If urban renewal, the restructuring of both residential and industrial areas is developed along these lines, then a glorious future awaits the network cities.

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Improvements in Health with GIS: Inequality Issues
by Gerard Rushton

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Improvements in Health with GIS: Inequality Issues

Research Interests

I'm interested in modeling the effects of personal behavioral factors and geographic/contextual factors on inequalities in the burden of disease among different populations. Spatial dimensions include:

- spatial variations in age-adjusted rates of disease incidence and mortality,
- the reliability of small-area rates based on small populations and rare events,
- spatial patterns of preventive health services,
- spatial patterns of key measures of disease severity—e.g. stage of cancer at first diagnosis.

Spatial Data Models and Techniques

New opportunities for researching this question with GIS have recently emerged. Regional, population-based, disease registers are rapidly being developed in most U.S. states and in many countries. Records in these registers are being geocoded. Large, national, behavioral-health surveys are increasingly being geocoded and, at a minimum, census IDs are being attached to each record. Many service outlets are becoming geocoded (e.g. Yellow Pages) and record linkages between population-based, disease surveillance registries and health systems utilization records (Medicare, Medicaid, Insurers, etc.) are revealing both the context of available health-related services as well as their actual use, and, ultimately, their effect on health. A large and interesting literature is emerging.

The techniques I have used so far are based on kernel density estimation techniques, (Bithell, 1990; Lolonis and Rushton, 1996) and, more recently, on general linear models to set up as priors, spatial rates of cancer incidences adjusted for age and some other demographic factors. These "residual" maps provide a better basis for examining spatial patterns of incidences not explained by known factors. I am now considering moving toward the use of geographic feature extraction algorithms, possibly based on the headbanging algorithms that have recently appeared in the public health literature.

Best Practice Examples of Spatially-Oriented Research

I regard Bithell (1990) and Gatrell et al. (1996) as excellent examples of methodological research on disease data geocoded to the individual level. Gelman and Price (1999) examine and shed considerable light on the problems of many currently used methods that attempt to adjust small-area disease rates for the small-number problem. Gelman et al. (2000) and Jacquez et al. (2000) introduce the application of geographic feature extraction methods to the field of disease pattern analysis. Yen and Kaplan (1999) model the effects of both individual and geographic contextual factors on risk of death. Finally, I like the spatially-oriented research of Wallace and Wallace (1998) in their study of the spread of two infectious diseases in New York.

Learning Resources that CSISS might Provide or Workshops that it Might Offer

- Subjects include: Methods for disease mapping at the small-area geographic scale.
- Multi-level modeling at the individual level of health outcomes.
- Appending geocodes to survey data and using them to add geographic contextual variables for subsequent analysis.

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[TOP]

Race, Space, Homicide, and Demographic Correlations
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Race, Space, Homicide, and Demographic Correlations

My research interests relevant to this workshop have focused on crime distributions as structured by demography including race, especially the spatial distribution of homicide. Space plays a central role for both methodological and substantive reasons. Methodologically, the spatial organization of homicide as a point process can be aggregated to polygon coverages for which detailed demographic information, including race, can be obtained. Thus spatial organization enables the systematic statistical modeling of homicide distributions in space and the further study of their behavior over time. The data used in these analyses (in collaborative work with Carol Kohfeld, University of Missouri - St. Louis) have been assembled from police and census records for the City of St. Louis for a period of over 30 years. And the analyses have been conducted at coverages varying in detail from block groups (about 550) through voting precincts (about 350) to census tracts (about 111). St. Louis is nearly evenly divided between blacks and whites and because homicide occurs disproportionately within the black population a strong spatial correlation between homicide and race is observed corresponding to the strong individual level correlation between race and homicide. Many demographic predictors of homicide are also strongly correlated with race and the substantive and methodological problem becomes one of sorting out the separate influences of demographic predictors other than race compared with racial effects. Race has a bimodal distribution in these data at any level of aggregation and this frequently carries over into its correlates thus undermining the usual distribution assumptions of statistical models. Spatial analysis techniques allow some alternative structuring of these data in an attempt to isolate the separate effect of race when compared with other demographic predictors. An initial attempt to pursue this strategy is Kohfeld, Sprague, and Walker (1999) "Objective Bases for Racial Stereotypes: The Fundamental Irrelevance of the Correlation between Race and Homicide" (available as paper number 370 from http://artsci.wustl.edu/~polisci/papers.html).

In our research we have made extensive use of choropleth maps and somewhat less use of point maps, although point maps are crucial for assessing the stability in time of the spatial homicide distributions. We have also made extensive use of spatial correlograms based on Moran's I to assess spatial structure of homicides and predictors as polygons become removed from each other in space. Analysis of the spatial structure of model residuals using such correlograms and comparing these correlograms with the original correlograms of homicide rates has been a valuable strategy in analysis. The statistical packages we have used include, in recent years, ArcView with the Anselin enhancements, Anselin's SpaceStat, S-PLUS, and STATA. Of these programs the Anselin utilities for constructing contiguity matrices (now available in ArcView) for ***k*** nearest neighbors, and especially using the queen algorithm for our particular data, have been crucial. I have written a number of S-PLUS programs to facilitate the preparation of visual displays, to construct higher order contiguity matrices from first order matrices, to compute and display Moran's I correlograms, and to aid in the communication between the output from the spatial programs and statistical analyses in either STATA or S-PLUS. Because of the mechanism by which the

basic measure of the dependent behavior, homicide, is generated, the principal statistical modeling strategy has been with multivariate event count models. Increasingly our written output has emphasized visualization. A presentation of our use of point process maps, multivariate graphs (Trellis graphs), spatial correlograms, choropleth maps, and multivariate statistical event count models is Kohfeld and Sprague (2000) "Visualizing Homicide" (available as paper number 392 from http://artsci.wustl.edu/~polisci/papers.html).

A superb example of statistical spatial analysis that touches on the interests of political scientists comes from William S. Cleveland's masterwork **Visualizing Data** (1993) at pages 304-319. At this point in his narrative Cleveland takes up a multiway analysis of count data on livestock distributions in European countries and concludes the analysis with a map display of residuals for the distribution of sheep showing their dependence on geographical location. That book, of course, belongs on every social scientist's shelf and I find this analysis of multiway data with fundamental visualization techniques particularly compelling.

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POSITION STATEMENT

What are your research interests in the areas of inequality and equity, and what spatial dimensions do you currently or potentially see in them?

I am interested to understand the underlying patterns and changes of inequality over time and across different contexts (national and sub-group variations). One of my new areas of research that explicitly utilizes the spatial dimension is a study of the changes of urban neighborhoods in the United States in the past few decades. In general, past studies by demographers and urban sociologists have not considered how spatial configurations may aid our understanding of urban neighborhood patterns and their changes over time. Although there are some recent interests in spatial arrangements, for example, the relationship between poverty and place and the geographic concentration of urban poverty, the concept of space is still only vaguely incorporated into its theoretical and empirical framework. My plan is to situate the study of changes in poor neighborhoods and the concentration of urban poverty in a broader context of the ecological transformations and realignments of urban neighborhoods, which are affected by changes in social, economic, demographic, and political forces over time. I believe that a mapping of which neighborhoods become gentrified or downgraded to slums over time in major urban areas, and an analysis of the characteristics of these neighborhoods and factors that contribute to such ecological transformations promise a new and fruitful way of understanding urban inequality.

What kinds of spatial data, models, techniques, software, etc. do you use or have considered using in your research. Which of these work well for you? Where do you see problems and/or shortcomings?

A wide variety of statistical techniques can be utilized, including log-linear models, multinomial models, poisson regression models, and spatial regression models. Each is useful for particular types of data, but only the last incorporates the spatial dimension explicitly in statistical modeling.

Can you point out any "best practice examples" of spatially-oriented research in your field? Do you have any suggestions for Learning Resources CSISS might provide? Workshops we might offer?

I am not aware of any empirical work in inequality and stratification that incorporates the spatial dimension in statistical modeling. I strongly believe that a wider dissemination of the appropriate spatial statistical techniques would be extremely helpful. I would like the CSISS to consider offering a one-day or two-days workshop that would teach beginners the necessary skills to handle and analyze spatial data.

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