

# **Spatial Demography**

## **Sociology & Anthropology 579 Spring 2013**

**Course Credits = 3**

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### Course Basics

#### Time and Location:

Scheduled Class: Tuesday & Thursday 1.00pm – 2.15pm  
006 Life Sciences

Office Hours: Thursday 3.00pm – 5.00pm  
507 Oswald Tower

All materials will come from required course texts or from resources and materials made available on ANGEL <https://cms.psu.edu/>. All PowerPoint™ slides will usually be made available on ANGEL with 24-hours of the class meeting.

Assignments: 3 main assignments (due Feb 28, March 28, April 26);  
small weekly assignments based on readings (There is no  
final exam)

Grade: based on assignments, reading summaries and course  
participation (see below for details)

Teaching Assistant: None Assigned

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## General Introduction

This graduate seminar is part lecture, part demonstration, part discussion, and part lab.

Many social sciences have already accepted spatial analysis as a part of their various methodological arsenals and the spatial perspective can serve as a potential incubator for innovative social science and interdisciplinary research. While interest in spatial demography is evident throughout the history of the core discipline of demography, the degree to which spatial thinking and different forms of spatial analysis have been utilized has been very uneven. Adopting a spatial perspective requires the careful reconsideration of some fundamental conceptual and theoretical issues in aspatial social science. I will try to cover all such issues in this graduate seminar.

The goal of this seminar is to expose sociologists, anthropologists and demographers to the vast array of geospatial data that are available, encourage them to think critically and creatively about how different forms of geospatial data can be integrated in their research, and introduce them to the spatial analytical methods that are increasingly encountered in demographic inquiry. More specifically the course will examine the characteristics of geospatial data (represented as points, lines, areas and surfaces), discuss the implications of choices regarding scale, aggregation, and spatial weights as well as focus on techniques for identifying spatial autocorrelation, spatial heterogeneity, and non-stationarity and the methods appropriate for modeling such data.

The emphasis in the course will be on area (or lattice) data though spatial point pattern analysis and geostatistics methods will be discussed. I will focus on applications and demonstrations drawn from a wide array of topics such as urban poverty, neighborhood research, racial/ethnic diversity, maternal and child health and wellbeing, and population-environment relations.

***There are many ways in which this course could have been designed (GIS software driven, spatial statistics, geospatial data and application driven, a review of the field of spatial demography). I have tried to draw on all possible designs and provide a balanced overview of spatial demography/spatial social science.***

***Note that I have not designed this as a GIS course*** but throughout the semester you will have plenty of opportunity to learn *ArcGIS 10.x* and other software, namely *GeoDa* (and *OpenGeoDa*) and *Geographically Weighted Regression 3.x.*, (and also exposure to *CrimeStat* and perhaps *R [spdep]* for spatial analysis). *OpenGeoDa* is a program that facilitates exploratory spatial data analysis and can be used for spatial regression modeling, while *GWR* facilitates an exploration of spatially varying relationships and 'local' models.

Participants will learn practical techniques associated with the analysis and visualization of demographic data ranging from how to communicate with maps and create maps for use in PowerPoint, the use of address-matching (geocoding), data integration tools, use of ethnographic data, and statistical measures for area analysis (e.g. spatial regression models and spatial autocorrelation tests). Throughout the seminar we will discuss GIS in academic, government, and applied demographic settings and new directions and challenges associated with GIS technologies.

## Summary Outline

This is a seminar course that will cover classic and contemporary articles and texts on how spatial thinking and spatial analysis has and will continue to transform research practice in demography and related disciplines. The semester will begin by focusing on the re-emergence of spatial demography in the early 21<sup>st</sup> century. We will then spend several weeks focusing on understanding key spatial concepts so as to lay the foundation for the application of spatial analysis that will follow. This discussion of spatial concepts will include a discussion of geospatial data, measurement and visualization, and cover issues such as geospatial privacy and emergent forms of spatial data. Once the foundation has been laid we will utilize exploratory spatial data analysis (ESDA) and pattern analysis methods before moving on up to provide overviews of some of the advanced spatial analytic methods now available to demographers; specifically, spatial econometrics and geographically weighted regression. The course does not aim to be comprehensive in methodological coverage and it is not a seminar in spatial statistics but rather a course on how spatial thinking, data and analysis can help inform demographic research. Throughout the course I will endeavor to provide empirical examples from a diverse selection of demographic research areas.

## Course Objectives & Outcomes

**The primary objectives are to:**

- (1) gain a better understanding of the potentials and pitfalls of using geospatial data;
- (2) enhance spatial thinking as applied to demographic, social, behavioral and health research (and to better understand the intellectual history of spatial thinking and spatial methods, and especially as applied to the field of demography).
- (3) develop skills and understanding of exploratory spatial data analysis and spatial econometric approaches (testing for the presence of spatial dependence and estimating models with spatial dependence).

**A primary outcome is to: make significant steps towards producing a publishable paper by the end of the semester (see Exemplar papers on page 18)**

**In addition to these primary objectives/outcomes I want you to have fun.**

Along the way you will gain a better understanding of the potentials of spatial analysis and become familiar with methods for using GIS-related technologies at multiple stages of a research process – from study design and data collection strategies through to data visualization and spatial analysis. **This is important as GIS and spatial analysis is not a panacea.**

Lastly, spatial data and forms of analysis are huge and rapidly changing fields so if you find something of potential value to others in the class please share this information (via ANGEL, class discussions and/or e-mail).

## Assignments: Titles, due dates, and grade points

There are **THREE** assignments totaling **SIXTY percent** of the course grade. These assignments are for you to complete **outside** of class hours. A description of each assignment is posted on **ANGEL**. Brief descriptions appear below.

**All assignments are to be submitted by 11.59pm EST on the dates specified below to the ANGEL – drop box.**

Students are encouraged to work with – and learn from - one another but each student is required to prepare and submit their own assignments. If you receive significant assistance in preparing an assignment you are expected to acknowledge this assistance in an acknowledgement section. ***No changes in due dates for any assignments are anticipated. Any change can only be made by me and will not be official unless it is revealed in an e-mail to the entire class.***

**FORTY** percent is assigned for weekly reading assignments, in-class labs, e-mail questions/summaries, class participation and leading one class discussion. Note, that each week (Weeks 1-14) all participants will submit short 1-page commentaries on at least one reading (Note: you are encouraged to read 3-4 articles minimum per week). In addition between Week 2 and Week 10 groups of 2 students will be assigned to lead a 30-minute class discussion (on each Thursday).

Below is a listing of assignment titles, due dates and percentage of grade allocated to each assignment.

Titles	Due Date	Points
1. Spatial Demography 'Classic' (the subject of the 'classic' must be approved by me by February 14, 2013).	In-class 3-4 minute presentation on February 28, 2013 and the written assignment handed in February 28, 2013	15
2. ESDA/Spatial Regression Project	March 28, 2013	15
3: Final Project (this includes grades for a draft proposal and the final paper).	April 4, 2013 – draft ideas shared (5%) April 23, 2013 – presentation (10%) April 26, 2013 – term paper (15%)	30
Weekly assignments, Participation/Class Discussion	Once - Discussion of readings (5%)  Weekly (weeks 1-14) – a) Reading summary (21%), and b) E-mail/class discussion (14%)	40
<b>Total</b>		<b>100</b>

### **Assignment #1:**

For the **spatial demography classic (15% of course grade)** you are expected to identify the person or research team you will focus on for the subject of your report and receive approval from me before **February 14, 2013**. This is a written assignment of approximately 2,500 words. This assignment is due on **February 28, 2013**. You will make a brief 3-5-minute presentation on your selected spatial demography classic on **February 28, 2013**.

### **Assignment #2:**

For the **ESDA/Spatial Regression assignment (15% of course grade)** you are expected to use the ESDA and OLS/spatial regression options in OpenGeoDa (and ArcGIS) to complete an analysis of a data set of your choice (excluding any OpenGeoDa sample data sets). This is a report/short paper format assignment of approximately 3,000 – 3,500 words, including no more than a combined total of 6 figures and tables. The assignment is due on **March 28, 2013**.

### **Assignment #3:**

For the **final project (30% of course grade)** you are encouraged to **find a data set** early in the semester (before Spring Break). This final project has several components – all of which contribute to the grade. I would like to see a 2-page draft outline of your proposed project by no later than **April 14, 2013**, a copy of your PowerPoint (presentation) file before Noon on **April 23, 2013** and the written term paper by **April 26, 2013**. The term paper will be no more than 6,000 words in length in the format of a 'publishable' research paper.

**Ongoing activities: Reading summaries, e-mail question submission, in-class labs, participation and discussion** are all an important component of your 'participation' grade (**40% overall**).

You will lead discussion of readings as least once (5%) and submit weekly 1-page short reports on one reading (**21% = 1.5% x 14 weeks**) – though **you are expected to read a minimum of 3 articles per week**. Each one-page report must be single-spaced and in font size 11 or 12.

You will also raise questions via e-mail (one per week) and in class settings based on labs, lectures and readings (**14% = 1% x 14 weeks**). Please note that throughout the course I expect to use e-mail as the primary mode of communication outside of the class meeting times (see below under "Communication" p.7).

I expect that all **in-class labs** will be completed, if not within the class meeting time than at a later date (on your own time). In the past I have incorporated a small grade percent for each in-class lab assignment but I decided to do away with this. The in-class assignments/lab times will be used for discussing progress through workbooks (especially prior to Spring Break) and for supplemental labs designed to introduce you to selected data extraction, integration and analysis tasks. I maintain that it is in your own best interests to complete workbooks and in-class labs as they will provide hands-on experience, tips, and analysis options to help you throughout the semester and specifically the final project.

## **Grading & Examination Policy**

Each assignment will be graded on a scale of 0-10. That is, a score of 8 for an assignment worth 20 percent of the course grade will be worth 16% of the overall grade. A score of 7 is a good competent piece of work. Scores of 8 would represent very good, 9 excellent, and 10 is reserved for outstanding work (where extra initiative/innovation clearly sets the work apart). Late assignments will be reduced by a score of 1 (10%) for each day they are late. A grade of zero will be assigned to assignments not turned in.

This is a work intensive course. There is no final exam.

## **Attendance Policy**

Please note 40 percent of the grade is assigned for weekly reading assignments, e-mail reports and question submission, in-class discussion and overall course/class participation.

## **Communication**

By far the best way to communicate with me is via e-mail; I check e-mail several times a day and as often as practicable when traveling.

As much as possible I will communicate with the class through E-mail ([matthews@pop.psu.edu](mailto:matthews@pop.psu.edu) or [sxm27@psu.edu](mailto:sxm27@psu.edu) or ANGEL e-mail). All students are encouraged to send questions or comments on lectures, texts, readings or exercises. Where appropriate I will send responses to questions to all students enrolled in the course, redacting individual identifiers when necessary. If you raise a question but do not want a reply sending to the class please put SOC 579 - PRIVATE in the subject line of the e-mail.

Please note that some e-mails relating directly to the course content may count towards the 'participation' grade.

## **Assumption regarding Prior Knowledge**

It is assumed that all participants in this course have very good file management skills, are familiar with basic data manipulation skills (e.g., recoding), univariate data analysis using continuous and categorical data, and the use of various statistical packages for multivariate statistics (e.g., OLS regression and logistic regression modeling). If you feel that you may not have sufficient grounding in statistics please see the instructor ASAP.

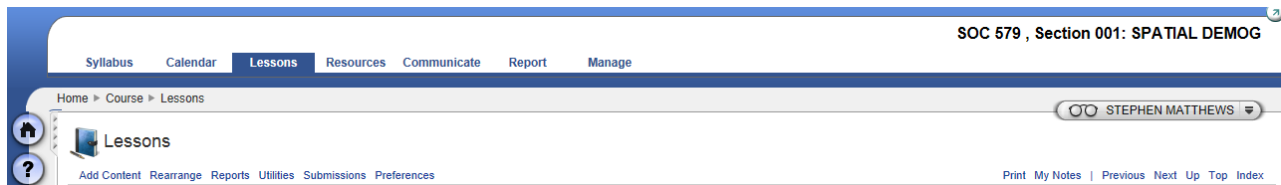
As noted we will focus on ArcGIS 10.x, OpenGeoda and GWR software packages. No GIS knowledge is assumed but you are expected to invest time learning basic GIS skills using ArcGIS 10.x. Students familiar with other GIS and statistical software may use those tools – and indeed will be encouraged to share their skills with the class.

# ANGEL

All Course readings, handouts, lab section materials and related data will be distributed via ANGEL. The basic layout is as shown below (subject to minor changes).



To get a complete listing or map of the course content on ANGEL go to Lessons tab and click on **index** (far right of screen) and then you have the option to print (to printer or file). As of Jan 1, 2013 this would be an 8 page listing or map.





## Technical Needs and Recommendations

Since the scheduling of this course and ordering of textbooks both Windows operating systems and the leading GIS software (ArcGIS, OpenGeoDa, etc.) have been upgraded. The version of ArcGIS installed in Life Sciences 006 is currently ArcGIS 10.x (as of Jan 3, 2013). The installation of software in the lab is beyond my control and hopefully any problems will be glitches not major concerns. As needed, and to the extent possible, I will schedule some labs in 806 Oswald Tower (PRI's Computer Lab) and I encourage all of you to also work of a laptop if possible (Windows or machine that can emulate Windows).

The course is not intended as a GIS software course, though of course you will have plenty of exposure to packages, including but not limited to ArcGIS and GeoDa.

### ArcGIS

I am expecting you to work on your own a great deal on GIS exercises and to come up to speed within on ArcGIS 10.x by working through the material in *GIS Tutorial for Health* by early-February. The assigned texts come with a time-limited single-use site license for ArcGIS 10.x. Please note that the single-use ArcGIS license requires the Microsoft Windows XP, Windows 2000, or Windows NT (Service Pack 6a) operating system.

Hardware requirements: A minimum 800 MHz processing speed; 256 MB RAM; 800 MB hard disk space, including 50 MB on the operating system drive; an additional 225 MB hard disk space is required for the exercise data. If you do not have your own laptop that meets these specifications not to worry as ArcGIS 10.x is installed in all public labs on Penn State's University Park campus (and in PRI's 806 lab for those with access).

Other supplemental ArcGIS training materials are available via the PRI GIA Core webpage and the GIS Council webpage at Penn State as well as the ESRI Virtual campus webpage (see page 13 below).

### Other recommendations

Other recommendations include that you become comfortable with generic file management issues and that you consider purchasing a high-capacity flash-drive.

## Semester at a Glance (by week)

Week	Date	Lecture themes
<b>Part I: Background and Context</b>		
Week 1	January 8/10	Introduction & Overview of the Course
Week 2	January 15/17	Demography as a Spatial Science
Week 3	January 29/31	New Spatial Demography & Basic Cartography
<b>Part II: Potentials and Pitfalls of Spatial Data</b>		
Week 4	January 22/24	Defining Spatial Units & Measurement Issues
Week 5	February 5/7	GPS, Activity Space Research & Principles of GIS/Privacy and Confidentiality
Week 6	February 12/14	Modifiable Areal Unit Problem (MAUP)
Week 7	February 19/21	Spatial Autocorrelation & Spatial Weights
Week 8	February 26/28	Exploratory Spatial Data Analysis (ESDA) & Local Spatial Analysis
<i>Spring Break</i>		
<b>Part III: Spatial Modeling</b>		
Week 9	March 12/14	OLS Modeling and Mapping Residuals
Week 10	March 19/21	Spatial Lag Regression Models
Week 11	March 26/28	Spatial Error Regression Models
Week 12	April 2/4	Non-stationarity and Geographically Weighted Regression
Week 13	April 9/11	Geographically Weighted Regression
Week 14	April 16/18	Overview of Spatial Analysis Methods
<b>Part IV: Presentations</b>		
Week 15	April 23/25	Class Presentations

### Other key dates

#### Assignments

1: Spatial Demography Classic (15%)	February 28, 2013 (+short in-class discussion March 28)
2: ESDA/Spatial Regression project (15%)	March 28, 2013
3: Final term paper (30%)	April 4, 2013 (draft) April 23 & 25, 2013 (in-class presentation) April 26, 2013 (term paper)
4: Reading/presentation/participation (40%)	Ongoing

## Course Resources/Materials

### 1: Assignments:

For more detail see page 6, and especially pages 28-30.

### 2: Readings:

Please note currently no “demography” text covers spatial thinking, geospatial data issues, GIS or spatial analysis. Similarly, few GIS or spatial analysis texts focus on demographic themes. As such the readings for this course are based on published articles and reports. All of these readings will be posted on ANGEL (and if not should be available via the University Libraries).

During the semester all participants will provide a 1-page (single-spaced) summary of one of the readings assigned for each week (14 weeks). These short reports should focus on four issues (as relevant): significance of the paper, innovation in the paper, limitations; and a discussion of any surprises.

In addition, at least once during the semester each participant will be required to discuss readings associated with a specific week (because of class size this will be in small groups). Note that, all week-by-week readings are referenced in this syllabus and most will be posted in PDF format to ANGEL. I have created folders for each LESSONS/ PART x/ Week xx/ Readings.

NOTE: A series of extensive literature searches on substantive applications of GIS and spatial analysis were completed in 2008 and later in 2010. These reference lists can be found on the ANGEL site under Lessons – General Course Resources. A new active website with GIS and demography readings can also be found at: <http://gispopsci.org/>

### 3: Workbooks:

I have assigned one required ArcGIS workbook (focusing on health applications) and several free workbooks specific to software such as GeoDa and GWR.

**Kurland KS, Gorr WL. 2012. *GIS Tutorial for Health*. ESRI: Redlands, CA. (\$79.95 new – though on Amazon on Dec 30, 2012 was available for around \$50).**

The primary *GIS Tutorial for Health* (4<sup>th</sup> Edition) workbook is designed to help you gain familiarity with ArcGIS (the workbook also provides time-limited software license – 180-days). The material in the workbook is primarily intended as a guide to some fundamental GIS-like data manipulation, mapping and some basic analysis operations. Working through this workbook, over the first 4-5 weeks of the semester on your own time, will improve your confidence level for handling geospatial data in other packages and provide a foundation for using more advanced spatial analysis software introduced later in the course (e.g., GeoDa and GWR). You will complete some of the *GIS Tutorial for Health* tutorial sessions in preparation for class and I will reserve time for in-class discussion. Lab sessions will be supplemented with additional exercises.

Other **free workbooks** we will use in preparation for and during class hours include:

**Anselin L. 2005. *Exploring Spatial Data with GeoDa: A Workbook***  
**UC Santa Barbara, CA: Center for Spatially Integrated Social Science.**  
The workbook, software and many related materials are available online at the current GeoDa homepage: <http://geodacenter.asu.edu/>.

This is a 244-page workbook on GeoDa, a freeware statistical package that supports a mapping, exploratory spatial data analysis and spatial regression modeling. An extensive set of supporting materials for GeoDa and other software are freely available from the Geoda Center.

**Fortheringham, AS, Charlton M, Brunson C. 2008. *GWR Workbook*.**  
**National Center for Geocomputation, National University of Ireland.**  
Selected materials will be made available on ANGEL.

And **three free texts/edited collections** that you will consult/read include:

**Goodchild M.F. and Janelle D.G. (Editors). 2004. *Spatially integrated social science*. Oxford University Press,** Electronic Resource available through Penn State University Libraries: [Bibliographic record display - Click here to access this electronic book provided through the Access Pennsylvania Database project](#).

This is an outstanding collection of applications of spatial analysis and spatial thinking in the social sciences colloquially referred to as the “Best Practices” book. Chapters are grouped on the basis of four levels of analysis: individual/household, neighborhood, region, and multi-scale. Contributors are leading scholars with sociologists, criminologists, and demographers well represented.

**de Smith MJ, Goodchild MF, Longley PA. 2006-2008. *Geospatial Analysis: A Comprehensive Guide to Principles, Techniques and Software Tools*.**

The 4<sup>th</sup> edition (November 2012) is available online at <http://www.spatialanalysisonline.com/>. This is perhaps the most comprehensive single on-line source for material on both concepts and methods available. It includes links to several excellent resources such as software (<http://www.spatialanalysisonline.com/software.html>).

Some relevant sections include:

Software	Section 1.3
Definitions	Section 1.4.1
MAUP	Section 4.2.11
ESDA	Section 5.2
Spatial Autocorrelation	Section 5.5
Spatial Regression	Section 5.6
GWR	Section 5.6.3

Additional online resources will be made available throughout the semester

#### 4: Resources and Online Materials:

My syllabi as a rule are often VERY long. This is because I include a great deal of background material on spatial thinking, GIS, and spatial analysis.

I have tried to limit the content of the syllabi and rely more on the ANGEL site to promote relevant resources. I will often the resources available on the web at other several key sites:

#### **Selected Internet Resources for spatial data mapping, analysis and training resources** (All links checked December 31, 2012)

GIS and Advanced Spatial Analysis workshops

- <http://csiss.ncgia.ucsb.edu/GISPopSci> and <http://gispopsci.org/>

Future Directions in Spatial Demography

- <http://ncgia.ucsb.edu/projects/spatial-demography>

Matthews, S.A., Janelle, D.G., and Goodchild, M.F. (2012). Future directions in spatial demography: Final report. Report available at <http://ncgia.ucsb.edu/projects/spatial-demography/>. Also many interesting 2-3 page position papers by leading researchers in spatial demography.

Teach Spatial – <http://www.teachspatial.org>

The Geoda Center, Arizona State University – <http://geodacenter.asu.edu>

Geospatial Analysis Online – <http://www.spatialanalysisonline.com/>

Color Brewer – <http://colorbrewer2.org>

R spatial tools – <http://cran.r-project.org/web/views/Spatial.html>

Geostatistics website – <http://www.ai-geostats.org>

Institute of British Geographers Quantitative Methods Research Group (Concepts and Techniques in Modern Geography series) – <http://qmrq.org.uk/catmog/>

*International Journal of Health Geographics* – <http://www.ij-healthgeographics.com>

*Spatial Demography* (a new e-journal) – <http://spatialdemography.org/>

Others:

PRI's GIA Core *Spatial Demography* (a new e-journal)

- <http://www.pop.psu.edu/services/GIA> (and associated links)

ESRI Virtual Campus <http://training.esri.com/gateway/index.cfm>

ESRI Podcast series [http://www.esri.com/news/podcasts/instructional\\_series.html](http://www.esri.com/news/podcasts/instructional_series.html)

US Census Bureau <http://www.census.gov>

In addition you should find the following valuable resources

Special issues of the following three journals (among others):

*Demographic Research* (2012-2013) Edited by Matthews, S.A. see  
<http://www.demographic-research.org/volumes/vol26/>  
<http://www.demographic-research.org/volumes/vol27/>  
(All papers are on ANGEL)

*Population Research and Policy Review* (2007) Edited by Voss, P. 2007. Introduction to the special issue on spatial demography. *Population Research and Policy Review* 26(5):455-456.  
(Several articles from this special issue are included in class reading and are on ANGEL)

*Proceedings of the National Academy of Sciences* (2005) Edited by Wachter, K.W. (2005). Spatial demography. *Proceedings of the National Academy of Sciences* 102(43):15299-15300.  
(All papers are on ANGEL)

Matthews, S.A. 2011. Spatial Analysis. *Oxford Online Bibliographies – Sociology*

Matthews, S.A., Janelle, D.G., and Goodchild, M.F. (2007). Advanced Spatial Analysis Training for Population Scientists. R25 NIH grant application available at:  
<http://www.pop.psu.edu/services/GIA/training-resources>

Rezaeian, M., Dunn, G., St. Leger, S., and Appleby, L. 2007. Geographical epidemiology, spatial analysis and geographic information systems: A multidisciplinary glossary. *Journal of Epidemiology and Community Health*. 61:98-102.

**I will add resources to ANGEL throughout the semester.**

## Required Work: Workbooks and Readings by Week

All materials comes from required course texts or from materials made available on ANGEL

I will also provide a listing of important Books and Journals and other resources on ANGEL. These are not required readings but are meant to serve as general resources that you may utilize depending on your own needs during the course and afterwards.

Some good books for a 'starting point' to many issues covered in this course include

**Cromley E.K., and McLafferty S.L. 2012. *GIS and Public Health* (second edition). New York, NY: Guilford Press.**

While targeted at a public health audience, social scientists using geospatial data can benefit from this book as an introduction to GIS technologies, data, and methods of analysis. This is a well-written text balancing the applied and the academic, the conceptual and the technical. The second edition includes new material on health disparities and more explicit focus on neighborhoods and health.

**O'Sullivan, D., and Unwin, D.J. 2010. *Geographic Information Analysis* (Second Edition) Hoboken, NJ: Wiley and Sons.**

The first edition was a well-received overview of geographic information analysis. It provided a strong conceptual and theoretical introduction to a wide array of spatial methods. The second edition includes new material on mapping, geovisualization, local statistics, and Geographically Weighted Regression. The book includes excellent examples and a useful reference list.

NOTE: My reading lists are nearly always long – I like to think of them as extensive. In part this is because I try to find empirical examples from across a wide variety of disciplines (demography, sociology, geography, public health, epidemiology, rural sociology, anthropology, and economics).

You should aim to read at least 3 articles per week. I have identified those that I strongly encourage you to read with asterisks (\* = highly recommended readings). In some weeks or for some topics I occasionally identify more than 3 readings with asterisks.

If you have questions about any other readings please contact me – I have a broad and eclectic interests and usually I am able to recommend articles, authors, journals that may be of interest/relevance to your own work. Don't be afraid to ask.

**Week 1      January 8 & 10      Introduction and Overview of Course  
Discussion of all Assignments  
Demography as a Spatial Science**

**Lab: Introduction to Spatial Demography  
Resources and Geospatial Data**

Required Before Class on January 10

Complete a pre-seminar questionnaire.

Suggestion: Work through at least GIS & Health Tutorial 1 & 2

Readings:

Background setting papers

- \*Entwisle, B. 2007. Putting people into place. *Demography*, 44(4):687-703.
- \*Glass, T.A., & McAtee, M.J. 2006. Behavioral science at the crossroads in public health: extending horizons, envisioning the future. *Social Science & Medicine* 62:1650-1671.
- Goodchild, M.F., Anselin, L., Applebaum, R.P., and Herr Harthorn, B. (2000). Toward spatially integrated social science. *International Regional Science Review* 23:139-159.
- Goodchild M.F. and Janelle D.G. (Editors). 2004. Thinking spatially in the social sciences. Chapter 1 in in Goodchild M.F., and Janelle D.G. (eds) *Spatially integrated social science*. Oxford University Press **(also Electronic Resource via University Libraries)**.
- \*Goodchild, M.F., & Janelle, D.G. 2010. Toward critical spatial thinking in the social sciences and humanities. *GeoJournal* 75:3-13.
- Logan, J.R. 2012. Making a place for space: spatial thinking in social science. *Annual Reviews of Sociology*.38:507-524.

Important reviews of spatial demography

- \*Castro, M.C. 2007. Spatial demography: an opportunity to improve policy making at diverse decision levels. *Population Research and Policy Review* 26: 477-509.
- \*Logan, J.R., Zhang, W., and Xu, H. 2010. Applying spatial thinking in social science research. *GeoJournal* 75(1):15-27.
- \*Voss, P. 2007. Demography as a spatial social science. *Population Research and Policy Review* 26: 457-476. (plus Introduction to the special issue of *PRPR* on 'Spatial Demography' pp. 455-456).
- \*Weeks, J.R. 2004. The role of spatial analysis in demographic research. Chapter 19 (pp. 381-399) in M.F. Goodchild and D.G. Janelle (eds.) (2004) *Spatially Integrated Social Science* New York, NY: Oxford University Press **(also Electronic Resource via University Libraries)**.



**Week 2      January 15 & 17      Demography as a Spatial Science (continued)**  
**Review of Assignment 1**  
**Reading Group A:**  
**Lab: GIS & Health Tutorial discussions**

Required Before Class on January 17

Reading Group A: 30 minutes

Suggestion: Work thorough at least GIS and Health Tutorial 3 & 4

Readings

Examples of demography, GIS and spatial analysis papers during 1990s-early 2000s

- Anderton, D.L., Anderson, A.B., Oakes, J.M., and Fraser, M.R. 1994. Environmental equity: the demographics of dumping. *Demography* 31, 229-48.
- Baller, Robert D., Luc Anselin, Steven F. Messner, Glenn Deane and Darnell F. Hawkins 2001. Structural covariates of U.S. county homicide rates: incorporating spatial effects. *Criminology* 39 (3), 561-590.
- \* Entwisle, B., Rindfuss, R.R., Walsh, S.J., Evans, T.P., and Curran, S.R. 1997. Geographic Information Systems, spatial network analysis, and contraceptive choice. *Demography* 34 (2): 171-187.
- \* Guilmoto, C.Z., and Ragan, S.I. 2001. Spatial patterns of fertility transition in Indian districts. *Population and Development Review* 27 (4), 713-738.
- \* Voss, P., Long, D.D., Hammer, R.B., and Friedman, S. 2006. County child poverty rates in the U.S.: A spatial regression approach. *Population Research and Policy Review* 25:369-391.

Early classics (we will return to some of these in Weeks 8-12)

- Doreian, P. 1980. Linear models with spatially distributed data: Spatial disturbances or spatial effects? *Sociological Methods & Research* 9, 29-60.
- Doreian, P. 1981. Estimating linear models with spatially distributed data. *Sociological Methodology* 12, 359-388.
- Gehlke, C.E. and Biehl, K. 1934. Certain effects of grouping upon the size of the correlation coefficient in census tract material, *Journal of American Statistical Association*, 29:169-170.
- Loftin, C., and Ward, S.K. 1983. A spatial autocorrelation model of the effects of population density on fertility, *American Journal of Sociology* 48, 121-128.
- Nephrash, J. 1934. Problems in the correlation of spatially distributed variables. *Journal of the American Statistical Association*, 29(185), Supplement: Proceedings of the American Statistical Journal (Mar., 1934), pp. 167-168.
- Stephan, F.F. 1934. Sampling errors and interpretations of social data ordered in time and space. *Journal of the American Statistical Association*, 29(185), Supplement: Proceedings of the American Statistical Journal (Mar., 1934), pp. 165-166.

And see all citations referred to in Matthews, S.A. (2011) *Spatial Analysis. Oxford Online Bibliographies – Sociology (especially individual articles listed under: Spatial Inequality, Residential Segregation, Demography and Crime)*

### “Exemplars” (relevant to Assignment 3)

These papers are all examples of short empirical studies that use GIS and spatial analytical tools such as ESDA, spatial regression and geographically weighted regression. Of course many others are also listed in the syllabus but these are all very accessible readings.

- Block, J.P., Scribner, R.A. and DeSalvo, K.B.. 2004. Fast food, race/ethnicity, and income: a geographical analysis. *American Journal of Preventive Medicine* 27 (3), 211-217.
- Brown, L.A., and Chung, S-Y. 2006. Spatial segregation, segregation indices and the geographical perspective. *Population, Space and Place* 12:125-143.
- Chalkias, C., et al. 2013. Geographical heterogeneity of the relationship between childhood obesity and socio-environmental status: Empirical evidence from Athens, Greece. *Applied Geography*. 37:34-43.
- Deller, S., and Deller, M. 2012. Spatial heterogeneity, social capital, and rural larceny and burglary. *Rural Sociology* 77 (2):225-253.
- De Oliveira, R.R., da Costa, J.R., and de Freitas Mathias, T.A., 2012. Spatial distribution and autocorrelation of infant mortality for three cities in Paraná state, Brazil. *Geospatial Health* 6(2):257-262.
- Frank, A.I. 2003. Using measures of spatial autocorrelation to describe socio-economic and racial residential patterns in US urban areas. Pp. 147-162. In David Kidner, Gary Higgs, and Sean White [Editors] *Socio-Economic Applications of Geographic information Science (Innovations in GIS 9)*. London, UK: Taylor and Francis.
- Frick, M., and Castro, M.C. 2013. Tobacco retail clustering around schools in New York City: Examining ‘place’ and ‘space.’ *Health and Place* 19:15-34.
- Jankowska, M.M., Weeks, J.R., and Engstrom, R. 2011. Do the most vulnerable people live in the worst slums? A spatial analysis of Accra, Ghana. *Annals of GIS* 17(4):221-235.
- Kepple, N.J., and Freisthler, B.2012. Exploring the ecological association between crime and medical marijuana dispensaries. *Journal of Studies on Alcohol and Drugs* 73:523-530.
- Luke, D., Esmundo, E., and Bllom, Y. 2000. Smoke signs: Patterns of tobacco billboard advertizing in a metropolitan region. *Tobacco Control* 9:16-23.
- Messner, S.F., Teske, R.H.C. Jr., Baller, R.D., and Thome H. 2012. Structural covariates of violent crime rates in Germany: Exploratory spatial data analyses of Kreise. *Justice Quarterly*
- Ng., I-C., Wen, T-H., Wang J-Y., and Fang, C-T. 2012. Spatial dependence of tuberculosis incidence in Taiwan. *PLoS One* 7:11:e50740.
- Schuurman, N., Peters, P.A., and Oliver, L.N. 2009. Are obesity and physical activity clustered? A spatial analysis linked to residential density? *Obesity* 17:2202-2209.
- Sridharan, S., et al. 2007. An exploratory spatial data analysis approach to understanding the relationship between deprivation and mortality in Scotland. *Social Science and Medicine* 65: 1942-1952.
- Zenk, S.N., Schulz A.J., Israel B.A., James, S.A., Bao., S, and Wilson, M.L. 2005. Neighborhood racial composition, neighborhood poverty, and the spatial access of supermarkets in metropolitan Detroit. *American Journal of Public Health* 95.4: 660–667.

**Week 3      January 22 & 24      New Spatial Demography**  
**Reading Group B**  
**Lab: Cartography and ColorBrewer**

Required Before January 24

Suggestion: Work thorough at least GIS and Health Tutorial 5 & 6

Readings

- Chang, A.Y. et al. 2009. Combining Google Earth and GIS mapping technologies in a dengue surveillance system for developing countries. *International Journal of Health Geographics* 8:49. <http://www.ij-healthgeographics.com/content/8/1/49>
- Dwolatzky, B. et al. 2006. Linking the global positioning system (GPS) to a personal digital assistant (PDA) to support tuberculosis control in South Africa: A pilot study. *International Journal of Health Geographics* 5:34. <http://www.ij-healthgeographics.com/content/5/1/34>
- \* Goodchild, M.F. 2007. Citizens as sensors: the world of volunteered geography. *GeoJournal* 69(4):211-221.
- Matthews SA. 2012. Thinking about place, spatial behavior, and spatial processes in childhood obesity. *American Journal of Preventive Medicine* 42(5):516-520.
- Matthews, S.A., and Parker, D.M. 2013/forthcoming. Progress in spatial demography. *Demographic Research*
- Nawrotzki, R., Dickinson, T.W., and Hunter, L.M. 2012. Natural resources and natural livelihoods: Differences between migrants and non-migrants in Madagascar. *Demographic Research* 26: Article 24, 661-700.
- \* Palmer, J.R.B., Espenshade T.J., Bartumeus F., Chung, C.Y., Ozgencil N.E., and Li, K. (Forthcoming). New approaches to human mobility: Using mobile phones for demographic research. *Demography*.
- \* Raento, M., Oulasvirta, A., & Eagle, N. 2009. Smartphones: An emerging tool for social scientists. *Sociological Methods and Research* 37(3):426-454.
- Rose, K.M. et al. 2004. Historical measures of social context in life course studies: retrospective linkage of addresses to decennial censuses. *International Journal of Health Geographics* 3:27 (available online at: <http://www.ij-healthgeographics.com/content/3/1/27>).
- \* Salathe, M. et al. 2012. Digital epidemiology. *PLoS Computational Biology* 8:7:e1002616.
- \* Spielman, S.E., and Logan, J.R. 2013. Using high-resolution population data to identify neighborhoods and establish their boundaries. *Annals of the Association of American Geographers* 103(1):67-84.
- State, B., Weber, I., and Zagheni, E. 2013. Studying international mobility through IP geolocation. WebScience conference 2013.
- Zagheni, E., and Weber, I. 2012. You are where you e-mail: Using e-mail data to estimate international migration rates. WebScience conference 2012.
- Matthews, S.A. 1999. *Working with PopMap: integration of population, reproductive health and geographic databases*. United Nations Statistics Division, United Nations. (Chapter 4).
- NOTE: There are 100s of texts available in PSU libraries on map design/cartography. I'll post a list of good texts on ANGEL.

**Week 4      January 29 & 31      Defining Spatial Units & Measurement Issues**  
**Reading Group C**  
**Discussion of Assignment 2 and 3**  
**Lab: GIS Data Sources and Data Integration**

Required Before January 31

Suggestion: Work thorough at least GIS and Health Tutorial 7, 8 and 9

Readings

Neighborhoods

Foley, D.L. 1953. Census tracts and urban research. *Journal of the American Statistical Association* 48(264):733-742.

Hatt, P. 1946. The concept of natural area. *American Sociological Review* 11(4):423-427.

\* Chaix, B., Merlo, J., Evans, D., Leal, C., & Havard, S. 2009. Neighborhoods in eco-epidemiologic research: Delimiting personal exposure areas. A response to Riva, Gauvin, Apparicio and Brodeur. *Social Science & Medicine* 69:1306-1310.

Chaskin, R.J. 1997. Perspectives on neighborhood and community: a review of the literature. *The Social Service Review* 71 (4):521-547.

\* Cummins, S., Curtis, S., Diez-Roux, A. V., & Macintyre, S. 2007. Understanding and representing 'place' in health research: A relational approach. *Social Science & Medicine* 65:1825-1838.

Diez Roux, A.V. 2003. The examination of neighborhood effects on health: conceptual and methodological issues related to the presence of multiple levels of organization. In Kawachi, I., & Berkman, L.F. (eds) *Neighborhoods and Health*. Pp. 45-64. New York, NY: Oxford University Press.

Goodchild, Michael F. 2011. Formalizing place in geographic information systems. Chapter 2 in L Burton, S Kemp, M Leung, SA Matthews and D Takeuchi (editors) *Communities, Neighborhoods, and Health: Expanding the Boundaries of Place* (Springer).

\* Matthews SA. 2008. The salience of neighborhoods: lessons from early Sociology? *American Journal of Preventive Medicine* 34(3):257-259.

\* Matthews, S.A. 2011. Spatial polygamy and the heterogeneity of place: studying people and place via egocentric methods. (Pp. 35-55) In Burton, L.M., et al (eds.) *Communities, neighborhoods, and health: expanding the boundaries of place*. New York NY: Springer.

Papachristos, A.V., Smith, C.M., Scherer, M.L., and Fugiero, M.A. 2011. More coffee, less crime? The relationship between gentrification and neighborhood crime rates in Chicago, 1991 to 2005. *City and Community* 10(3):215-240.

Sastry, N., Pebley, A., & Zonta, M. 2002. Neighborhood definitions and the spatial dimensions of daily lives in Los Angeles. *CCPR Working Paper* 033-04. Los Angeles, CA: California Center for Population Research, UCLA.

Wodtke, G.T., Harding D.J., & Elwert F. 2011. Neighborhood effects in temporal perspective. *American Sociological Review* 76(5):713-736.

## Measurement

- \* Brownson, R.C., Hoehner, C.M., Day, K., Forsyth, A. and Sallis, J. 2009. Measuring the built environment for physical activity: State of the science. *American Journal of Preventive Medicine* 36(4s): S99-S123.
- Downey, Liam. 2006. Using geographic information systems to reconceptualize spatial relationships and ecological contexts. *American Journal of Sociology* 112(2):567–612.
- \* Feng, J., Glass, T.A., Curriero, F.C., Stewart, W.F., Schwartz, B.S. 2010. The built environment and obesity; A systematic review of the epidemiological evidence. *Health and Place* 16:175-190.
- Leal, C., & Chaix, B. 2010. The influence of geographic life environments on cardiometabolic risk factors: A systematic review, a methodological assessment and a research agenda. *Obesity Reviews* 12:217-230.
- \* Lioy, P.J. et al. 2009. Using national and local extent data to characterize environmental exposures in the National Children’s Study: Queens County, New York. *Environmental Health Perspectives* 117(10):1494-1504.

## International Examples using DHS data

- Mansour, S., Martin, D., and Wright, J. 2012. Problems of spatial linkage of a geo-referenced Demographic and Health Surveys (DHS) dataset to a population census: A case study of Egypt. *Computers, Environment and Urban Systems* 36:350-358. Plus editorial response by Burgert, C.R., Zachary, B., and Way, A.
- Matthews SA, Gubhaju B (2004) *Contextual influences on the use of antenatal care in Nepal*. DHS Geographic Studies report #2 ORC/Macro, Calverton, Maryland. <http://www.measuredhs.com/publications/publication-SAR6-Spatial-Analysis-Reports.cfm> (also look up other SAR1-SAR5 reports).
- Stoler, J. et al. 2012. When urban taps run dry: Sachet water consumption and health effects in low income neighborhoods in Accra, Ghana. *Health and Place* 18:250-262. (also see: Stoler, J., Weeks, J.R., and Fink, G. 2012. Sachet drinking water in Ghana’s Accra-Tema metropolitan area: past, present, and future. *Journal of Water, Sanitation and Hygiene for Development* 2(4):223-240).

**Week 5      February 5 & 7      GPS and Activity Space Research**  
**Principles of GIS/Privacy & Confidentiality**  
**Reading Group D**  
**Lab: International Data**

Required Before February 7

Suggestion: Finish up GIS and Health Tutorial

Readings

GPS and Activity Space

- \* Chaix, B., Kestens, Y., Perchoux, C., Karusisi, N., Merlo, J. & Labadi, K. 2012. An interactive mapping tool to assess individual mobility patterns in neighborhood studies. *American Journal of Preventive Medicine* 43(4):440-450.
- Chen, J., Shaw, S-L., Yu, H., Lu, F., Chai, Y. & Jia, Q. 2011. Exploratory data analysis of activity diary data: a space-time GIS approach. *Journal of Transport Geography* 19(3):394-404.
- \* Inagani, S., Cohen, D.A., Finch, B.K., & Asch, S.M. 2006. You are where you shop: grocery store locations, weight, and neighborhoods. *American Journal of Preventive Medicine* 31(1):10-17.
- Rainham, D.G., Bates, C.J., Blanchard, C.M., Dummer, T.J., Kirk, S.F., & Shearer, C.L. 2012. Spatial classification of youth physical activity patterns. *American Journal of Preventive Medicine* 42(5):e87-e96.
- Wiehe, S.E., et al 2008. Using GPS-enabled cell phones to track the travel patterns of adolescents *International Journal of Health Geographics* 7:22 (available online at: <http://www.ij-healthgeographics.com/content/7/1/22>).
- Wong, D.W.S., & Shaw, S-L. 2011. Measuring segregation: an active-space approach. *Journal of Geographical Systems* 13(2):127-145.
- \* Zenk, S.N., Schulz, A.J., Matthews, S.A., Odoms-Young, A., Wilbur, J., Wegrzyn, L., Gibbs, K., Braunschweig, C., & Stokes, C. 2011. Activity space environment and eating and physical activity behaviors: a pilot study. *Health & Place* 17:1150-1161.

Privacy

- \* Armstrong, M.P. 2002. Geographic information technologies and their potentially erosive effects on personal privacy. *Studies in the Social Science* 27:19-28.
- Armstrong, M.P., Rushton, G., and Zimmerman, D.L. 1999. Geographically masking health data to preserve confidentiality. *Statistics in Medicine* 18:497-525.
- Curtis, A.J., Mills, J.W., and Leitner, M. 2006. Spatial confidentiality and GIS: re-engineering mortality locations from published maps about Hurricane Katrina. *International Journal of Health Geographics* 7:22 (available online at: <http://www.ij-healthgeographics.com/content/5/1/244>).
- Gutmann, M.P., Witkowski, K., Colyer, C., et al. 2008. Providing spatial data for secondary analysis: issues and current practices relating to confidentiality. *Population Research and Policy Review* 27:639-665.
- \* VanWey, L.K., Rindfuss, R.R., Gutmann, M.P., Entwisle, B., and Balk, D.L. 2005. Confidentiality and spatially explicit data: concerns and challenges. *PNAS* October 2005 102 (43), 15337-15342.

**Week 6      February 12 & 14      Modifiable Areal Unit Problem (MAUP)**  
**Brief Discussion of Assignment #1**  
**Reading Group E**  
**Lab: MAUP**

Required Before February 14

Readings

MAUP classics

- \* Fotheringham, A.S. and Wong, D.W.S. 1991. The modifiable areal unit problem in multivariate statistical analysis. *Environment and Planning A* 23, 1025-1044.
- \* Openshaw, S. 1984. *The Modifiable Areal Unit Problem*. CATMOG Series #38 GeoBooks: Norwich, UK. <http://qmrg.org.uk/files/2008/11/38-maup-openshaw.pdf>
- \* Openshaw, S., & Taylor, P.J. 1979. A million or so correlation coefficients: three experiments on the modifiable areal unit problem (pp. 127-44). In N. Wrigley (ed.) *Statistical Methods in the Spatial Sciences*. Pion: London.

MAUP-related in recent scholarship

- Downey, L. 2006. Using geographic information systems to reconceptualize spatial relationships and ecological contexts. *American Journal of Sociology* 112(2):567–612.
- Flowerdew, R., Manley, D.J., & Sabel, C.E. 2008. Neighborhood effects on health: Does it matter where you draw the boundaries. *Social Science & Medicine* 66:1241-1255.
- \* Hipp, J. R. 2007. Block, tract, and levels of aggregation: Neighborhood structure and crime and disorder as a case in point. *American Sociological Review* 72(5):659-680.
  - \* Kwan, M-P. 2012. The uncertain geographic context problem. *Annals of the Association of American Geographers*, 102(5):958–968.
- Mobley, L.R., Kuo, T., & Andrews, L.S. 2008. How sensitive are multilevel regression findings to defined area of context? A case study of mammography use in California. *Medical Care Research and Review* 65:315-337.
- Parenteau, M-P., and Sawada, M.C. 2011. The modifiable areal unit problem (MAUP) in the relationship between exposure to NO<sub>2</sub> and respiratory health. *International Journal of Health Geographics* 10:58 (available online at: <http://www.ij-healthgeographics.com/content/10/1/58>).
- Riva, M., Apparicio, P., Gauvin, L., & Brodeur, J-M. 2008. Establishing the soundness of administrative spatial units for operationalizing the active living potential of residential environments; an exemplar for designing optimal zones. *International Journal of Health Geographics* 7:43 (available online at: <http://www.ij-healthgeographics.com/content/7/1/43>).
- Spielman, S.E. & Yoo, E.H. 2009. The spatial dimensions of neighborhood effects. *Social Science and Medicine* 68(6):1098-1105.

**Week 7      February 19/21      Spatial Autocorrelation & Spatial Weights**  
**Reading Group F**  
**Lab: Introduction to GeoDa**

Required Before February 21

**Workbook**

Luc Anselin. 2005. *Exploring Spatial Data with GeoDa: A Workbook* (Chapters 1-6)  
This workbook is used over the next 5-6 weeks. See <http://geodacenter.asu.edu/>

**Readings**

- \* Anselin, L., Syabri, I., and Kho, Y. 2006. GeoDa: An Introduction to Spatial Analysis. *Geographical Analysis* 38 (1), 5-22.
- \* Darmofal, D. (forthcoming). Defining neighbors via a spatial weights matrix. Chapter 2 in a forthcoming book on *Spatial Analysis for the Social Sciences* (under contract at CUP)
- Beck, N. et al. 2006. Space is more than geography: using spatial econometrics in the study of political economy. *International Studies Quarterly* 50, 27-44.
- \* Dall'erba, S. 2005. Distribution of regional income and regional funds in Europe 1989–1999: An exploratory spatial data analysis. *Annals of Regional Science* 39:121–148.
- \* Getis, A. 2010. Spatial autocorrelation. In Fischer, M.M., and Getis, A. (Editors.) *Handbook of applied spatial analysis: Software tools, methods and applications*. Springer, Berlin Heidelberg. 255-278.
- Getis, A., and Ord, J.K. 1992. The analysis of spatial association by the use of distance statistics. *Geographical Analysis* 24.3: 189–206.
- \* Goodchild, M.F. 1986. *Spatial Autocorrelation*. CATMOG Series #47 GeoBooks: Norwich, UK. <http://qmr.org.uk/files/2008/11/47-spatial-aurocorrelation.pdf>



**Week 8      February 26 & 28    Exploratory Spatial Data Analysis (ESDA)  
& Local Spatial Analysis**

**Brief Presentations Assignment #1  
Brief discussion of Assignments #2 & #3**

Required Before February 28

Workbook

Luc Anselin. 2005. *Exploring Spatial Data with GeoDa: A Workbook* (Chapters 7-19)

Readings

- \* Aldstadt, J. 2010. Spatial clustering. In Fischer, M.M., and Getis, A. (Editors.) *Handbook of applied spatial analysis: Software tools, methods and applications*. Springer, Berlin Heidelberg. 279-300.
- \* Anselin, L. 1995. Local Indicators of Spatial Association – LISA. *Geographical Analysis* 27 (2), 93-115.
- Anselin, L. 1996. The Moran scatterplot as an ESDA tool to assess local instability in spatial association. Chapter 8 in Fischer, M. (Ed.) *Spatial analysis perspectives on GIS*. Taylor and Francis, Bristol, PA. 111-125.
- \* Bivand, R. 2010. Exploratory spatial data analysis. In Fischer, M.M., and Getis, A. (Editors.) *Handbook of applied spatial analysis: Software tools, methods and applications*. Springer, Berlin Heidelberg. 219-254.
- \* Logan, J.R. and Zhang, W. 2004. Identifying ethnic neighborhoods with census data. Group concentration and spatial clustering. Chapter 6 in Goodchild M.F., and Janelle D.G. (eds) *Spatially integrated social science*. Oxford University Press, **Electronic Resource via University Libraries**
- Messner, S.F., Teske, R.H.C. Jr., Baller, R.D., and Thome H. 2012. Structural covariates of violent crime rates in Germany: Exploratory spatial data analyses of Kreise. *Justice Quarterly*
- Messner, S.F. and Anselin, L. 2004. Spatial analysis of homicide with areal data. Chapter 7 in Goodchild M.F., and Janelle D.G. (eds) *Spatially integrated social science*. Oxford University Press, **Electronic Resource via University Libraries**
- \* Tita, G. and Cohen. J. 2004. Measuring spatial diffusion of shots fired activity across city neighborhoods. Chapter 9 in Goodchild M.F., and Janelle D.G. (eds) *Spatially integrated social science*. Oxford University Press, **Electronic Resource via University Libraries**

**Assignment #1 due February 28, 2013**

**SPRING BREAK**

<b>Week 9</b>	<b>March 12 &amp; 14</b>	<b>OLS Modeling and Mapping Residuals</b> <b>Further Discussion of Assignment #2 and #3</b> <b>Reading Group G</b> <b>Lab: OLS Regression in ArcGIS and GeoDa</b>
<b>Week 10</b>	<b>March 19 &amp; 21</b>	<b>Spatial Lag Regression Models</b> <b>Reading Group H</b> <b>Lab: Spatial Lag Regression</b>
<b>Week 11</b>	<b>March 26 &amp; 28</b>	<b>Spatial Error Regression Models</b> <b>Lab: Spatial Error Regression</b>

Required Before March 14

Workbook: Luc Anselin. 2005. *Exploring Spatial Data with GeoDa: A Workbook* (review Chapters 15-23)

Readings

- \* Baller, R.D., Anselin, L., Messner, S.F., Deane, G. and Hawkins, D.F. 2001. Structural covariates of U.S. County homicide rates: incorporating spatial effects. *Criminology*, 39(3), 561-590.
- Baller, R.D., and Richardson, K.K. 2002. Social integration, imitation, and the geographic patterning of suicide. *American Sociological Review* 67(6):873–888.
- Brasier, K.J. 2005. Spatial Analysis of Changes in the number of farms during the farm crisis. *Rural Sociology* 70 (4), 540-560.
- Chi, G. and Zhu, J. 2008. Spatial regression models for demographic analysis. *Population Research and Policy Review* 27: 17-42.
- DeJong, G.F., Graefe, D.R., Irving, S.K., and St. Pierre, T.. 2006. Measuring state TANF policy variations and change after reform. *Social Science Quarterly* 87 (4), 755-781.
- LeSage, J.P, and Pace, R.K. 2010. Spatial econometric models. In Fischer, M.M., and Getis, A. (Editors.) *Handbook of applied spatial analysis: Software tools, methods and applications*. Springer, Berlin Heidelberg. 355-376.
- \* Morenoff, J.D. 2003. Neighborhood mechanisms and the spatial dynamics of birth weight. *American Journal of Sociology* 108(5):976-1017.
- Pais, J.F., and Elliott, J.R. 2008. Places as recovery machines: Vulnerability and neighborhood change after major hurricanes. *Social Forces* 86(4)1415–1453.
- \* Sampson, R.J., Morenoff, J.D., and Earls, F. 1999. Beyond social capital: spatial dynamics of collective efficacy for children. *American Sociological Review* 64:633-660. (see also: Sampson, R.J. and Morenoff, J.D. 2004. Spatial (dis)advantage and homicide in Chicago neighborhoods Chapter 8 in Goodchild M.F., and Janelle D.G. (eds) *Spatially integrated social science*. Oxford University Press. **Electronic Resource via University Libraries**).
- Sparks, P.J. and Sparks, C.S. 2009. An application of spatially autoregressive models to the study of US county mortality rates. *Population, Space and Place* 16(6):465-481.
- Tolnay, S.E., Deane, G., and Beck, E.M. 1996. Vicarious violence: Spatial effects on southern lynchings, 1890–1919. *American Journal of Sociology* 102.3: 788–815.
- \* Voss, P., Long, D.D., Hammer, R.B., and Friedman, S. 2006. County child poverty rates in the U.S.: A spatial regression approach. *Population Research and Policy Review* 25:369-391.
- Ward, M.D., and Gleditsch, K.S. 2008. *Spatial Regression Models*. Sage Publications: Thousand Oaks, CA.

**Assignment #2 due March 28, 2013**

<b>Week 12</b>	<b>April 2 &amp; 4</b>	<b>Non-stationarity and GWR</b> <b>Lab: GWR in ArcGIS</b> <b>Draft ideas for Assignment #3 (due April 4)</b> <b>Reading Group 1</b>
<b>Week 13</b>	<b>April 9 &amp; 11</b>	<b>Geographically Weighted Regression</b> <b>Lab: GWR software (Oswald 806?)</b>

Required Before April 11

Workbook

ArcGIS Workbook on OLS and GWR.

Fotheringham, AS, Charlton M, Brunson C. 2008. GWR Workbook. National Center for Geocomputation, National University of Ireland. Sections 1-4 (by April 4) Sections 5-8 (by April 11)

Readings

- Arnio A.N, and Baumer, E.P. 2012. Demography, foreclosure, and crime: Assessing spatial heterogeneity in contemporary models of neighborhood crime rates. *Demographic Research* 26: Article 18, 449-488.
- \* Chalkias, C., et al. 2013. Geographical heterogeneity of the relationship between childhood obesity and socio-environmental status: Empirical evidence from Athens, Greece. *Applied Geography*. 37:34-43.
- Chen, V.Y-J., Den, W-S., Yang, T-C., and Matthews, S.A. 2012. Geographically weighted quantile regression (GWQR): An application to US mortality data. *Geographical Analysis* 44(2):134-150.
- Deller, S., and Deller, M. 2012. Spatial heterogeneity, social capital, and rural larceny and burglary. *Rural Sociology* 77(2):225-253.
- \* Edwards, K., Clarke, G., Ransley, J.K., and Cade, J. 2010. The neighbourhood matters: studying exposures relevant to childhood obesity and the policy implications in Leeds, UK. *Journal of Epidemiology and Community Health* 64(3):194-201.
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- Gregory, I.N., and Ell, P.S. 2005. Analyzing spatiotemporal change by use of National Historical Geographical Information Systems: Population change during and after the Great Irish Famine. *Historical Methods* 38(4):149-167.
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- Light M.T., and Harris, C.T. 2012. Race, space, and violence: Exploring spatial dependence in structural covariates of white and black violent crime in US counties. *Journal of Quantitative Criminology* 28(4):559-586.

- Lopez-Carr et al. 2012. Space versus place in complex human-natural systems: spatial and multi-level models of tropical land use and cover change (LUCC) in Guatemala. *Ecological Modeling* 229:64-75.
- Matthews, S.A., and Yang, T-C. 2012. Mapping the results of local statistics: using geographically weighted regression. *Demographic Research* 26: Article 6, 151-166.
- Mennis, J.L. 2006. Mapping the results of geographically weighted regression. *The Cartographic Journal* 43(2):171-179.
- \* Mennis, J.L. and Jordan, L.M. 2005. The distribution of environmental equity: exploring spatial nonstationarity in multivariate models of air toxic releases. *Annals, Association of American Geographers* 95(2):249-268.
- Páez, A., Farber, S., and Wheeler, D.C. 2011. A simulation-based study of geographically weighted regression as a method for investigating spatially varying relationships. *Environment and Planning A* 43(12):2992-3010.
- Shoff, C., and Yang, T.C. 2012. Spatially varying predictors of teenage birth rates among counties in the United States. *Demographic Research* 27: Article 14, 377-418.
- Shoff, C., Yang, T.C., and Matthews, S.A. 2012. What has geography got to do with it? Using GWR to explore place-specific associations with prenatal care utilization. *GeoJournal* 77(3):331-341.
- \* Wheeler, D.C., and Páez, A. 2010. Geographically weighted regression. In Fischer, M.M., and Getis, A. (Editors.) *Handbook of applied spatial analysis: Software tools, methods and applications*. Springer, Berlin Heidelberg. 461-486.
- Wheeler, D.C, and Tiefelsdorf, M. 2005. Multicollinearity and correlation among local regression coefficients in geographically weighted regression. *Journal of Geographical Systems* 7(2):161-187.
- Yang, T-C., and Matthews, S.A. 2012. Understanding the non-stationarity associations between distrust of the health care system, health conditions, and self-rated health in the elderly: A geographically weighted regression approach. *Health & Place* 18:576-585.

**Additional readings and resources will be placed on ANGEL.**

Resources worth checking out

See ANGEL site for Resource Links associated with GWR

GWR site: <http://ncg.nuim.ie/ncg/GWR/software.htm>

**Week 14      April 16 & 18      New Directions, Methods and Challenges in  
Spatial Demography and Spatial Science  
Lab: Open lab for work on final project**

- Bruch, E.E., and Mare, R.D. 2006. Neighborhood choice and neighborhood change. *American Journal of Sociology* 112(3):667-709.
- Chaix, B., Merlo, J., Subramanian, S.V., Lynch, J. and Chauvin, P. 2005. Comparison of a spatial perspective with a multilevel analytical approach in neighborhood studies: the case of mental and behavioral disorders due to psychoactive substance use in Malmö, Sweden, 2001. *American Journal of Epidemiology* 162(2):171-182.
- \* Chaix, B., Merlo, J., and Chauvin, P. 2005. Comparison of a spatial approach with the multilevel approach for investigating place effects on health: the example of healthcare utilization in France. *Journal of Epidemiology and Community Health* 59:517-526.
- \* Diez Roux, A.V. 2011. Complex systems thinking and current impasses in health disparities research. *American Journal of Public Health* 101(9):1627-1634.
- Faust, K., et al. 1999. Spatial arrangement of social and economic networks among villages in Nang Rong District, Thailand. *Social Networks* 21:311-337.
- \* Martin, D., Cockings, S., and Leung S. 2009. Population 24/7: building time-specific population grid models. Paper presented at the European Forum for Geostatistics Conference 2009, The Hague, Netherlands, 5-7 October 2009.
- \* McCarty, C., et al. 2007. A comparison of social network mapping and personal network visualization." *Field Methods* 19(2):145-162.
- O'Sullivan, D. 2008. Geographic information science: Agent based models. *Progress in Human Geography* 32(4):541-550.
- Reardon, S.F., Matthews, S.A., O'Sullivan, D., Lee, B.A., Firebaugh, G., Farrell, C.R., and Bischoff, K. 2008. The geographic scale of metropolitan racial segregation. *Demography* 45.3: 489–514.
- Schmertmann, C.P., Potter, J.E., and Assunção. 2011. An innovative methodology for space-time analysis with an application to the 1960-2000 Brazilian mortality transition. Chapter 2 in Gutmann M.P., et al. (eds.), *Navigating Time and Space in Population Studies*. Springer. 19-36.
- Wong, D.W.S., & Shaw, S-L. 2011. Measuring segregation: an active-space approach. *Journal of Geographical Systems* 13(2):127-145.

**Week 15      April 23 & 25      Class Presentations**

**Final PowerPoint™ due before class April 23, 2013**

**Assignment #3 Presentations April 23 & 25**

**Final Project (Assignment #3) due April 26, 2013**

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## Descriptions of Primary Assignments

### Assignment 1: Spatial Demography Classic

**Due Date: February 28, 2013**

**Worth 15% of the course grade**

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#### Overview

Start by consulting the CSISS Classics website at <http://www.csiss.org/classics/>. This site includes reference to 50+ scholars from across the social sciences and their unique contributions to spatial thinking and analysis. Usually each “CSISS Classic” is a short document of approximately 2,500 words plus images and references. Please read at least 3-4 of these CSISS Classics to get a sense of their structure and content. Note, the definition of a “spatial” component varies quite widely across the examples. Also note that the emphasis in the CSISS classics is on research prior to 1980.

#### Task

To identify a leading social science scholar, **preferably a demographer**, who has demonstrated innovative approaches to substantive research questions based on a spatial perspective. Develop a 2,500-word document with a synthesis of the scholar’s work, their key spatial ideas, and their contribution to demographic science. There are no restrictions on the research idea/having to be based on pre-1980 work (as on the CSISS site).

By **February 14, 2013** – approximately two weeks before the assignment is due – please provide me with the name of the scholar you identified as a “spatial demography classic” and brief (250-500 word) justification for their selection. This can be done over e-mail.

The best CSISS Classics will, with the permission of the student, be forwarded to Donald Janelle at CSISS for consideration for inclusion on the CSISS website. Don Janelle is aware of this project assignment at Penn State and looks forward to receiving suggestions and worked examples from this course.

#### Things to bear in mind

While not an obligation please try to identify scholars whose work is demographic, who are researchers from your own discipline, whose work is well known, and who are women (there are very few women on the CSISS Classic list). Also, please try to avoid using copyrighted material (this is a general rule but happens to be particularly important if the materials are to be considered for inclusion on the CSISS website).

The CSISS Spatial Demography Classic is to be completed by **February 28**.

## Assignment 2: ESDA and OLS/Spatial Regression

**Due Date: March 28, 2013**

**Worth 15% of the course grade**

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### Overview

For the **ESDA assignment** you are expected to use the ESDA and basic OLS/spatial regression options in OpenGeoDa (and ArcGIS) to complete an analysis of a data set of your choice (hopefully excluding OpenGeoDa sample data sets). OpenGeoDa is freeware available for download from URL: <http://geodacenter.asu.edu/>.

### Task

This assignment is a report/short paper of approximately 3,000 – 4,000 words, including figures and tables. Models for such a short paper are included on page 16 of this syllabus. A paper using GeoDa is:

Sanjeev Sridharan et al. 2007. An exploratory spatial data analysis approach to understanding the relationship between deprivation and mortality in Scotland. *Social Science and Medicine* 65: 1942-1952. (more on this paper in class).

Other suggestions of format are at the end of this assignment description. The assignment is due on **March 28, 2013 and is worth 15% of the course grade.**

### Things to bear in mind

Preparation for this assignment will require that you are familiar with the basic operations of GeoDa. A good way to prepare will be to work through several parts of *Exploring Spatial Data with GeoDa: A Workbook* by Luc Anselin (2005). You will be exposed to this workbook in class especially during weeks 7-11 and I will cover many of the fundamentals of GeoDa in my own lectures. In addition, I will be happy to discuss GeoDa and/or the assignment during scheduled office hours. If you do not have access to a laptop and cannot install the software on your own machine you can still work through and complete all the exercises by using the data files with any machine in the PRI computer lab in 806 Oswald Tower (Please get a PRI Windows NT PopNet account ASAP) and with special arrangement in the 801 GIA Core lab..

### Tips

First, find or generate a data set ASAP and certainly no later than Spring Break. Second, GeoDa has many ESDA tools. You might think about analysis using GeoDa that includes use (and justification for) of some of the following:

- a) the creation of a distance and a proximity spatial weights matrix
- b) the characteristics of these spatial weights matrix (histogram of weights)
- c) simultaneous use of a maps, tables and graphs
- d) use of Moran's I and or use LISA measures, LISA clusters and significance maps
- e) showing the map of the dependent variable, explanatory variables
- f) a basic OLS model output and a map of the OLS model residuals
- g) a spatial OLS model output for spatial diagnostics
- h) a spatial lag and a spatial error model output

Ideally the same data set will be used in all parts of the analysis.

### Assignment 3: Research Paper

<b>Due Date</b>	<b>Draft ideas to be shared by April 4, 2013</b>	<b>(5% of course grade)</b>
	<b>Presentations on April 23 (or 25), 2013</b>	<b>(10% of course grade)</b>
	<b>Research Paper due April 29, 2013</b>	<b>(15% of course grade)</b>

**Overall**

**Worth 30% of course grade**

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#### Overview

This “Final” project is about pulling it all together. In this project you will be expected to demonstrate some of the many techniques and skills you have acquired during the semester drawing on ArcGIS, GeoDa or GWR (or even CrimeStat, STARS, R, etc).

It is never too early to think about the substantive emphasis of your final project and your data needs as well as the software and skill sets you would likely use. You are likely to work in earnest on this project in bits and pieces, with greater emphasis after Spring Break. Around this time you will be comfortable using and mapping geographic data and have begun to encounter more sophisticated spatial analysis tools such as exploratory spatial data analysis and spatial regression statistics within GeoDa. For the final project (presentation and term/research paper) you are encouraged to **find a data set** early in the semester.

You can use any GIS software and the substantive focus can be on any demographic research question, for anywhere in the world, and at any spatial scale (i.e., from a study of a single village all the way up to an investigation of global demographic patterns and trends). I will be there to help if you have no ideas.

#### Tasks

The three end products will be

1: a **draft** of the “research paper.” The draft should be approximately 2 pages, with some of the material presented in bullet form as necessary. The draft should describe the “research question,” identify both the data sources and the proposed analysis technique(s) that will be used. **Please share this material by April 4, 2013.** This part of the assignment is worth 5% of the course grade.

2: a conference length paper **presentation** in PowerPoint to be delivered to the class during Week 15 (April 23 or 25, 2013). NOTE: Conference papers are typically 15 minutes. The presentations will occur on April 23 or 25, 2013 during the regular class meeting. You will **submit your PowerPoint™ file by Noon on Tuesday April 23, 2013.** This part of the assignment is worth 10% of the course grade.

3: a final “**research paper.**” The term paper will be no more than 5,000 words in length plus embedded maps/images/tables as necessary. The paper will be submitted in the format of a ‘publishable’ research paper. **The paper is due on April 26, 2013** and worth 15% of course grade.



## Academic Integrity Policy

As suggested by the College of the Liberal Arts "Penn State defines academic integrity as the pursuit of scholarly activity in an open, honest and responsible manner. All students should act with personal integrity, respect other students' dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts (Faculty Senate Policy 49-20).

Dishonesty of any kind will not be tolerated in this course. Dishonesty includes, but is not limited to, cheating, plagiarizing, fabricating information or citations, facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students. Students who are found to be dishonest will receive academic sanctions and will be reported to the University's Judicial Affairs office for possible further disciplinary sanction."

Faculty and students alike are part of an academic community in which the sharing and advancement of knowledge are core values. High standards of academic integrity must be in place to ensure that this intellectual enterprise functions smoothly. Honoring the principles of academic integrity is a fundamental responsibility of all scholars, and the College of the Liberal Arts and the University is firmly dedicated to maintaining an environment in which practicing academic integrity is the norm.

Additional information about Academic Integrity can be found at the Liberal Arts Policies and Procedures: Academic Integrity and Teaching Guidelines

[https://intranet.la.psu.edu/forms\\_letters\\_open/docList.aspx?level1ID=7&level2ID=10](https://intranet.la.psu.edu/forms_letters_open/docList.aspx?level1ID=7&level2ID=10)  
and <http://laus.la.psu.edu/current-students/academics/academic-integrity>

**University Statement of Academic Integrity (Policy 49-20):** Academic integrity is the pursuit of scholarly activity in an open, honest and responsible manner. Academic integrity is a basic guiding principle for all academic activity at The Pennsylvania State University, and all members of the University community are expected to act in accordance with this principle. Consistent with this expectation, the University's Code of Conduct states that all students should act with personal integrity, respect other students' dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts. Academic integrity includes a commitment not to engage in or tolerate acts of falsification, misrepresentation or deception. Such acts of dishonesty violate the fundamental ethical principles of the University community and compromise the worth of work completed by others.

**Class and Exam Attendance (Policies 42-27, 44-35):** Class attendance recognizes that on occasion, students may opt to miss a class meeting in order to participate in a regularly scheduled university-approved curricular or extracurricular activity, or due to unavoidable or other legitimate circumstances such as illness, injury, family emergency, or religious observance. As professionals, regular attendance is considered the norm. Therefore, your attendance and participation is expected in all classes. In addition, this class relies heavily upon student participation. Therefore, any absence or late arrival to class should be discussed with the instructor prior to their occurrence to prevent grade disturbance.

**Policy on Academic Freedom (Policy HR64):** The faculty member is entitled to freedom in the classroom in discussing his/her subject. The faculty member is, however, responsible for the maintenance of appropriate standards of scholarship and teaching ability. It is not the

function of a faculty member in a democracy to indoctrinate his/her students with ready-made conclusions on controversial subjects. The faculty member is expected to train students to think for themselves, and to provide them access to those materials which they need if they are to think intelligently. Hence, in giving instruction upon controversial matters the faculty member is expected to be of a fair and judicial mind, and to set forth justly, without supersession or innuendo, the divergent opinions of other investigators. If a student wishes to file a complaint, please review the procedures that should be followed, at this link:  
<http://www.psu.edu/dept/oue/aappm/R-6.html>.

**Emergency Preparedness Information:** Students are encouraged to sign up for the PSU text messaging service, PSUTXT, at: <http://newswires.psu.edu/?cmd=psutxt-register>.

**Statement of Non-Discrimination:** The Pennsylvania State University is committed to the policy that all persons shall have equal access to programs, facilities, admission, and employment without regard to personal characteristics not related to ability, performance, or qualifications as determined by University policy or by state or federal authorities. The Pennsylvania State University does not discriminate against any person because of age, ancestry, color, disability or handicap, national origin, race, religious creed, sex, sexual orientation, or veteran status.

## Students with Disabilities

Penn State welcomes students with disabilities into the University's educational programs. If you have a disability-related need for reasonable academic adjustments in this course, contact the Office for Disability Services (ODS) at 814-863-1807 (V/TTY). For further information regarding ODS, please visit the Office for Disability Services Web site at <http://equity.psu.edu/ods/>. In order to receive consideration for course accommodations, you must contact ODS and provide documentation (see the documentation guidelines at <http://equity.psu.edu/ods/guidelines/documentation-guidelines>). If the documentation supports the need for academic adjustments, ODS will provide a letter identifying appropriate academic adjustments. Please share this letter and discuss the adjustments with your instructor as early in the course as possible. You must contact ODS and request academic adjustment letters at the beginning of each semester.