02.221: Making Maps I
Introduction to spatial analysis, data visualization and map design

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Semester 1 2017
Section 1: Mon/Thu 3.00-4.30pm iDiA Lab (2.605)
Section 2: Mon/Thu 4.30-6.00pm iDiA Lab (2.605)
Office Hours: By appointment

On Exactitude in Science
Jorge Luis Borges, Collected Fictions, translated by Andrew Hurley.

…In that Empire, the Art of Cartography attained such Perfection that the map of a single Province occupied the entirety of a City, and the map of the Empire, the entirety of a Province. In time, those Unconscionable Maps no longer satisfied, and the Cartographers Guilds struck a Map of the Empire whose size was that of the Empire, and which coincided point for point with it. The following Generations, who were not so fond of the Study of Cartography as their Forebears had been, saw that that vast Map was Useless, and not without some Pitilessness was it, that they delivered it up to the Inclemencies of Sun and Winters. In the Deserts of the West, still today, there are Tattered Ruins of that Map, inhabited by Animals and Beggars; in all the Land there is no other Relic of the Disciplines of Geography.

—Suarez Miranda,Viajes devarones prudentes, Libro IV,Cap. XLV, Lerida, 1658

Course Description
This subject introduces students to the basic aspects of spatial data analysis, visualization and map design using a variety of tools including Geographic Information Systems (GIS). It will guide students in how to use spatial data analysis and visualization to gain insight from (geographic) data and help understand complex social, urban or scientific questions. Students will gain a sound understanding of both fundamental concepts and methods in cartography and GIS specifically and data analysis and visualization more generally, as well as a variety of software for the analysis and visualization of geographic data, specifically desktop GIS software and the R programming language for statistics and visualization. These are tools that are industry-standard and used in multiple disciplines, including the emerging field of data science. As such, this subject prepares students to apply data analysis and visualization as a method of problem-solving in practical situations that abound in both commercial fields (e.g. market research, location analysis) and governments (e.g. demographics, city planning). Students will get a thorough hands-on experience by applying methods and techniques in a series of lab-based assignments. Interactive

lectures and group discussions will additionally reflect on the use and application of maps in different disciplines and society in general. The subject will conclude with a group-based project that brings together the entire mapping workflow from initial question to the collection and analysis of data to the final visual presentation of results.

Format

The subject is structured around two 1.5 hour classes per week held in a lab setting that incorporate both lecture and lab in an integrated, interactive manner. Each class roughly consists of 30 minutes of lecture and class discussion around the core concepts and techniques that are part of that week's topic and 60 minutes for hands-on experience working through the week's lab material and in-class assignments. During this time, students will work through the material and engage with other students and the instructor. Where appropriate, the instructor will also use this time to work with groups of students or the entire class to address or explain in more detail particularly difficult methods and concepts, effectively switching back and forth between the 'lecture' and the 'lab' parts of the class.

Expectations

Students are expected to be present and actively participate in each class, as well as on the class online forum. A foundational understanding of core concepts is assessed through a written test. The lab and in-class assignments test student's proficiency with the use and appropriate application of methods and techniques. Finally, the implementation of concepts, methods and techniques in a comprehensive mapping project is assessed through a final group project. The final project is started early in the semester in order to allow students to work on their project in an iterative manner, similar to how mapping projects are conducted in practice. The instructor will provide continuous feedback as well as clear parameters for student self- and peer-evaluation.

Assessment

There will be a variety of assignments and exams throughout the semester. Emphasis is on your performance overall, with relatively low weight placed on individual items. Continued participation throughout the semester will enable you to do well in this course. Assessment is distributed in the following way, for a total of 100 points:

Assignment	Points
Class Participation	15
Lab Assignments	30
Exam I	15
Final Project Proposal	10
Final Project Presentation & Report	30
TOTAL	100

You will need to complete all assignments in order to pass the class.

Lab Assignments/Homework
There are 11 labs in the course. There is a small 'homework' assignment attached to each lab that tests your understanding of the material. At the end of the semester, you can choose to drop one of the 11 labs from your grade.

Written Exam
There will be a written exam that focuses primarily on the lecture material, class reading/discussion and some core concepts from the labs. The best preparation for this exam is to participate actively in the course. The open book exam will be made available online and can be taken from anywhere.

Final Project
For the final project you will be asked to develop a research question, find applicable data, analyze data and map & communicate the results of your analysis. You are allowed to form teams of 3-4 students. Each group will be asked to hand in a project proposal of maximum 400 words, in which you explain your tentative research question and how you propose to analyze said question. The last two weeks of the semester are set aside to work on your project in a studio format. You will present your preliminary results at the end of week 13 and hand in a final report at the end of week 14. Completing a project is an iterative process. Your grade for the project will not only be determined by the final result but also how you incorporated the feedback on your initial proposal and the presentation.

Deadlines

Deadlines are as noted in the course syllabus or on the specific assignment. If something is due on a specific date, you have until midnight on that day to submit the assignment. If the deadline is missed, a 20% grade deduction will be applied per 12 hour period. All assignments should be submitted through the class website.

Required Readings

The course will use one required text book (referenced below). Each week will also include a one or two cornerstone readings and a discussion on how maps relate to other disciplines and society in general, along the following dimensions 'Maps &

Art'; 'Maps & Science'; 'Maps & Storytelling'; 'Maps & Society'; 'Maps & Urban Planning & Design'; and 'Maps & Internet'. Each week's readings can be found on the course website.

Krygier, J. & Wood, D., 2016 (3rd edition, 2nd edition also OK). *Making Maps: A Visual Guide to Map Design for GIS*, New York: The Guilford Press.

Detailed Outline

Week 1 – Introduction
What is mapping and what are its different uses?
Map Types (Thematic versus Reference)
Lab 1: Making Your First Map
Krygier & Wood pp. I-40

Week 2 – Data I
Geographic Data (Representation & Types)
Lab 2: Creating and Using Spatial Data
Krygier & Wood pp. 41-64

Week 3 – Data II
Spatial Joins, Querying & Geocoding
Lab 3: Spatial Queries & Joins

Week 4 – Cartographic Concepts I
Projections
Lab 4: Map Post-Production & Projections
Krygier & Wood pp. 79-106

Week 5 – Cartographic Concepts II
Visual Variables, Color Theory & Data Classification
Lab 5: Data Classification
Krygier & Wood pp. 107-144

Week 6 – Spatial Analysis I
Spatial Buffers, Unions and Intersects
Lab 6: Spatial Analysis
Krygier & Wood pp. 145-204
EXAM

Week 7
BREAK

Week 8 – Data Visualization I
Non-spatial data visualization
Lab 7: Data Analysis Workflow in RStudio
FINAL PROJECT PROPOSAL

Week 9 – Data Visualization II
Lab 8: Grammar of Graphic & ggplot2

Week 10 – Spatial Analysis II
Lab 9: Exploratory Spatial Data Analysis in R

Week 11 – Spatial Statistics I
Spatial Statistics
Lab 10: Spatial Autocorrelation in ArcMap
Krygier & Wood pp. 205-248

Week 12 – Spatial Statistics II
Map Production and Critique
Lab 11: Location Analysis in Arcmap

Week 13 – Final Project I
Final Project Studio
PROJECT PRESENTATIONS

Week 14 – Final Project II
Final Project Studio
FINAL PROJECT DUE