

SSCI 589, Cartography and Visualization

Syllabus

Units: 4

Term Day Time: Spring 2022, Online

Location: Online

Instructor: Jennifer Bernstein, PhD

Office: Remote from Colorado

Office Hours: Tuesday 11:00 a.m. to 12:00 p.m. PT and
Wednesday 01:00 to 02:00 p.m. PT via Zoom

Please contact the Instructor via email in advance to ensure they will be online. Instructors are also available most days and times by appointment.

Contact Info: bernstjm@usc.edu

<https://usc.zoom.us/j/6651478877>

Library Help: Andy Rutkowski

Office: VKC 36B

Office Hours: Tue 10 a.m. to 12 p.m. and Thu 4:30 p.m. to 5:30 p.m. PT

Contact Info: arutkows@usc.edu, 213-740-6390

<http://bit.ly/andyhangout>

IT Help: Richard Tsung

Office: AHF 145D

Office Hours: By appointment

Contact Info: spatial_support@usc.edu, 213-821-4415

Course Scope and Purpose

This course covers visual perception, spatial cognition, and cartographic design, and their contributions to the maps, animations, virtual reality, and multimedia displays produced with modern GIS. There are three critical components of mapping: (1) the understanding of how to best design a map to communicate the map's objectives, (2) acquiring the technical skills required to create visualizations, and (3) creating clear maps which recognize the needs of the map's audience. By understanding these three principles and how they work together, students will leave with a highly marketable skill set applicable to a number of research areas. This course will improve a student's ability to communicate their understanding and research in all other courses they take at the Spatial Sciences Institute.

At its core, cartography is about the visual representation of space and place, and subsequently cartographers must make a number of carefully-considered choices. In addition, contemporary mapmakers have a greater variety and a much greater volume of data to leverage. Further, the possibilities for mapmaking have expanded considerably alongside advancements in digital mapping. Because maps are tools for communication, cartographers must be able to assess spatial data, determine its relevance to a map's objective, and decide upon the best way to showcase that information. Furthermore, visual design skills are essential to displaying the appropriate information in a user-friendly manner and to make the information easily understood by viewers.

This course will introduce students to the principles of cartography, including the history of the field and the fundamental principles of cartographic design. These include data classification, projection choice, symbolization, generalization, color, and labeling. While many of these principles are timeless, this course will emphasize the present and future of mapping, including mapping terrain in 3D, fly-through and stop-motion animation, virtual reality, cybercartography, mobile mapping, and geovisualization. Maps will be explored as an interactive tool for decision-making. Ultimately, students will complete the course with the technical and conceptual skills needed to create clear, communicative maps that are tailored to a defined task and audience, and anticipate the needs of cartographers in the future.

This a graduate level course, so students should expect this class to be both academically robust and intellectually challenging. Graduate students are expected to engage with and to explore the ideas, opinions, and analysis that describe our collective effort to thoroughly interrogate the subject at hand. Learning arises from active engagement with the knowledge found in reading materials and through collaboration. As in any graduate-level class, the instructor's role is that of a guide who keeps students on a path of discovery, and students will find that they learn much from their fellow classmates.

Learning Outcomes

On completion of this course, students should be able to:

- Design and develop cartographic and other data visualizations for a multimedia, internet-enabled world
- Understand the history of mapmaking and cartographic design, and how this history influences contemporary design decision making
- Understand the principles of exemplary cartographic design, including projections, symbology, scale, fonts/typography, etc.
- Become familiar with different types of maps and their appropriateness to different types of questions and data (chloropleth, proportional symbol, isarithmic, dot density, etc.).

- Apply one's understanding of cartographic design principles to evaluating maps
- Become well-versed in selecting, transforming, projecting, and visualizing data within ArcGIS and other platforms
- Understand human psychology as it applies to map interpretation; optimize the way in which users interact with web-based maps
- Create finished maps according to industry-standard design principles

Students may vary in their competency levels on these abilities. Students can expect to acquire these abilities only if you honor course policies, complete all assigned work in good faith and on time, and meet all other course expectations of you as a student.

Prerequisite(s): SSCI 581 (Recommended)

Co-Requisite(s): None

Class Conduct

Harassment, sexual misconduct, interpersonal violence, and stalking are not tolerated by the university. All faculty and most staff are considered Responsible Employees by the university and must forward all information they receive about these types of situations to the Title IX Coordinator. The Title IX Coordinator is responsible for assisting students with supportive accommodations, including academic accommodations, as well as investigating these incidents if the reporting student wants an investigation. The Title IX office is also responsible for coordinating supportive measures for transgender and nonbinary students such as faculty notifications, and more. If you need supportive accommodations you may contact the Title IX Coordinator directly (titleix@usc.edu or 213-821-8298) without sharing any personal information with me. If you would like to speak with a confidential counselor, Relationship and Sexual Violence Prevention Services (RSVP) provides 24/7 confidential support for students (213-740-9355 (WELL); press 0 after hours).

Course Structure

The main theoretical concepts are provided through a directed reading of the text, *Designing better Maps: A Guide for GIS users*. Additional readings will regularly be assigned to expand on the text. When possible, assignments will be given in advance, but they will typically be posted on or before Sunday.

Workload – This is a four credit, one semester course. Students should expect to spend 10-15 hours per week completing the work in this course.

Technological and Communication Requirements

ArcGIS is provided online via the GIST Server; hence, you do not need to install it on your own computer. Instead, every student must have the following technology requirements:

- A computer with a fast Internet connection.
- A functional webcam and a microphone for use whenever a presentation or meeting is scheduled.
- An up-to-date web browser to access the Server

If a student does not have access to any of these, please speak with the instructor at the start of the semester. Also, see the USC ITS Student Toolkit here: <https://keepteaching.usc.edu/students/student-toolkit/>

SSI server and tech support – Students in this course will utilize the Spatial Sciences Institute Server for independent thesis work as needed. If a student is unable to connect to the server or experiences technical issues, an email should be sent to SSI Tech Support at spatial_support@usc.edu and the instructor should be copied (cc). The email sent to SSI Support should be specific with respect to the problem being experienced.

Zoom – Zoom is a browser-based service that facilitates synchronous, interactive sessions with voice/video and shared desktop capabilities between two or more people. This is the primary forum for individual meetings and presentations. To use Zoom, each student needs a web cam on a computer with a fast internet connection. It is useful also to have a phone on hand in case there are issues with the web cam audio.

Communications – This is a distance learning course, so interactions will be asynchronous (not at the same time). All materials to be handed in will be submitted via Blackboard or via email. Students should check to make sure that mail sent from both the USC Blackboard accounts and directly from the instructors usc.edu account does not go into junk mail. Students should read as soon as possible all email sent from Blackboard or from the instructor.

Required Readings and Supplementary Materials

The required textbook for this course is:

- Brewer, Cynthia. 2016. *Designing better Maps: A Guide for GIS users* (2nd Ed.). Redlands, CA: Esri Press.

Supplementary readings will be assigned from various sources, and may include the following. More direction will be given on a weekly basis.

- Battersby, S.E., Goldsberry, K.P. 2010. "Considerations in design of transition behaviors for dynamic thematic maps." *Cartographic Perspectives* 65: 16-32.
- Hegarty, M., Smallman, H.S., Stull, A.T., Canham, M.S. 2009. "Naïve Cartography: How intuitions about display configuration can hurt performance." *Cartographica: The International Journal for Geographic Information and Geovisualization* 44, no. 3: 171-186.
- Hruby, F., Ressler, R., de la Borbolla Del Valle, G. 2019. "Geovisualization with immersive virtual environments in theory and practice." *International Journal of Digital Earth* 12, no. 2: 123-136.
- Johnson, S. 2006. *The Ghost Map: The story of London's most terrifying epidemic and how it changed science, cities, and the modern world*. Penguin Press.
- Misra, R.P, Ramesh, A. 1989. *Fundamentals of Cartography*. Concept Publishing Company.
- Monmonier, Mark. *How to Lie with Maps*. University of Chicago Press.
- Rao, J., Qiao, Y., Ren, F., Wang, J, Du, Q. 2017. "A mobile outdoor augmented reality method combining deep learning object detection and spatial relationships for geovisualization." *Sensors* 17, no. 9: 1951.
- Robinson, A. 2017. Geovisual analytics. *The Geographic Information Science & Technology Body of Knowledge*, edited by John Wilson. UCGIS. <https://doi.org/10.22224/gistbok/2017.3.6> (2017).
- Taylor, D.R., Anonby, E., and Murasugi, K., eds. 2019. *Further Developments in the Theory and Practice of Cybercartography: International Dimensions and Language Mapping*. Elsevier.
- Tufte, E.R., Goeler, N.H, Benson, R. 1990. *Envisioning information*. Cheshire, CT: Graphics press.
- Wilmott, C. 2020. *Mobile Mapping: Space, Cartography and the Digital*. Amsterdam University Press.
- Wright, D.J. 2017. "Here Be Monsters." *Oceanography*. 30 (2).

- Yan, Y., Feng, C., Huang, W., Fan, H., Wang, Y., Zipf, A. 2020. "Volunteered geographic information research in the first decade: a narrative review of selected journal articles in GIScience." *International Journal of Geographical Information Science*. 1 (27).

Description and Assessment of Assignments

This course includes a diversity of assessments that allow students to gain knowledge and experience and to show their mastery of the material in a variety of ways. The different types of assessments are described below and their overall point value to are summarized in the following Grading Breakdown section.

Resume Assignment - 1 worth 2 points. We require all current students to post and maintain a public resume, short biography, and recent photo on our shared SSI Student Community Blackboard site. Please prepare your resume in the SSI template which will be provided to you. Unless you opt out, your resume will be included in the Spatial Sciences Institute Graduate Programs Resume Book. This resume book is compiled annually and, along with our web presence, is used to promote our programs, and more importantly, your skills, experience and professional aspirations.

Projects - 5 worth a total of 50 points. These assignments will require students to develop a cartographic workflow, evaluate sources of error, decide on projections, and generalize their data. They will cover the principles of color, symbolization, and labeling. Differences in map output will be discussed, with an emphasis on web and mobile technologies and publishing across multiple platforms. Three-dimensional rendering and animation will be covered. Each project will result in map (print, web, mobile, or multi-platform) that can be included in one's portfolio.

Reading and Research Discussions - 5 worth a total of 15 points. These assignments will consist of a combination of academic articles, book excerpts, and the critical evaluation of existing maps. Students will be expected to engage in discussions about these materials.

Quizzes – Each module will conclude with a quiz covering the main principles of the unit. The quiz will be timed and administered on Blackboard.

Final Exam - 1 worth 18 points. The final exam will cover material learned throughout the duration of the semester. It may be mixed format and may consist of multiple choice, short answer, and simple problem questions. Students are expected to take the exam within an indicated time window.

Grading Breakdown

The table below shows the breakdown of the assessments and their weight in the final grade. The emphasis is on regularly completing a number of labs that apply exemplary cartographic principles and a variety of visualization methods, as well as gain a mastery of the principles of cartographic design.

Assessment	Number	Points Each	Total Points
Weekly Assignments			
Resume Assignment	1	2	2
Projects	5	9	45
Reading and Research Assignments	5	3	15
Quizzes	5	3	15
Final Exam	1	18	18
Total			95

Schedule

Week	Topic	Assignments	Deliverables: Due Dates
Module 1 The Fundamentals of Map-making I			
Week 1: 1/10	Introduction to course; Conceptual and critical cartography, Overview of the principles of contemporary cartographic design	Resume Assignment Reading & Research Discussion (RRD) 1	Resume Assignment
Week 2: 1/17* *Monday, 1/27 is university holiday		RRD1 - Discussion RRD2 Project 1 is assigned	RRD1 – Assignment and 1 st discussion post RRD1 – Discussion: Response to classmates
Week 3: 1/24		RRD2 - Discussion	RRD2 – Assignment and 1 st discussion post RRD2 – Discussion: Response to classmates
Module 2 The Fundamentals of Map-making II			
Week 4: 1/31	Data management and classification; Map Typologies I: Chloropleth, Proportional symbol Map Typologies II: Isoline, Isarithmic, dot density	RRD3 - Choice of case study RRD3 - Discussion	Project 1 Module 1 Quiz
Week 5: 2/7		RRD4 - Choice of case study Project 2 is assigned	RRD3- Assignment and 1 st discussion post RRD3 - Discussion: Response to classmates
Week 6: 2/14		RRD4 - Discussion	RRD4 - Assignment and 1 st discussion post RRD4 - Response to classmates Module 2 Quiz

Week	Topic	Assignments	Deliverables: Due Dates
Module 3 Visualization and Cognition			
Week 7: 2/21* *Monday, 2/21 is university holiday	Use of colorization schemes, contrast, and patterns; Map animation and temporal scales; Human perception, cognition, and behavior	RRD5 - Choice of case study	RRD5 - Assignment and 1 st discussion post RRD5 - Response to classmates due
Week 8: 2/28		RRD5 - Discussion RRD6 - Choice of case study	Project 2
Week 9: 3/7		RRD6 - Discussion RRD7 - Choice of case study Project 3 is assigned	RRD6 - Assignment and 1 st discussion post RRD6 - Response to classmates
Week 10: 3/14 *3/13-3/20 is Spring Recess		RRD7 - Discussion	RRD7- Assignment and 1 st discussion post RRD7 - Response to classmates Module 3 Quiz
Module 4 Data Exploration and Interactivity			
Week 11 3/28	User Interface design (UI); Volunteered Geographic Information (VGI)	RRD8 - Choice of case study Project 4 is assigned	Project 3
Week 12 4/4		RRD8 – Discussion RRD9 - Choice of case study Project 5 is assigned	RRD8 - Assignment and 1 st discussion post RRD8 – Discussion RRD9 - Assignment and 1 st discussion post RRD9 - Discussion Project 4 Module 4 Quiz
Module 5 The Future of Cartography			
Week 13 4/11	Virtual reality/3D and the future of maps; Exam Week	RRD9 – Discussion	RRD10 - Assignment and 1 st discussion post
Week 14 4/18		RRD – 10 Choice of Case Study and Discussion	RRD10 – Slides and class presentations Project 5 Module 5 Quiz

Week	Topic	Assignments	Deliverables: Due Dates
Week 15 4/25 * Friday, 4/29 is the last day of class			Final Exam

Statement on Academic Conduct and Support Systems

Academic Conduct

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on [Research and Scholarship Misconduct](#).

Students and Disability Accommodations

USC welcomes students with disabilities into all of the University’s educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu

Support Systems

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
studenthealth.usc.edu/counseling

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL), press “0” after hours – 24/7 on call
studenthealth.usc.edu/sexual-assault

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office for Equity, Equal Opportunity, and Title IX (EEO-TIX) - (213) 740-5086
eetix.usc.edu

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298

usc-advocate.symplicity.com/care_report

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services (OSAS) - (213) 740-0776

osas.usc.edu

OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

USC Campus Support and Intervention - (213) 821-4710

campussupport.usc.edu

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity, Equity, and Inclusion - (213) 740-2101

diversity.usc.edu

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call

dps.usc.edu, emergency.usc.edu

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call

dps.usc.edu

Non-emergency assistance or information.

Office of the Ombuds - (213) 821-9556 (UPC) / (323-442-0382 (HSC)

ombuds.usc.edu

A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

Occupational Therapy Faculty Practice - (323) 442-3340 or otfp@med.usc.edu

chan.usc.edu/otfp

Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.

Resources for Online Students

The Course Blackboard page and the GIST Community Blackboard page have many resources available for distance students enrolled in our graduate programs. In addition, all registered students can access electronic library resources through the link <https://libraries.usc.edu/>. Also, the USC Libraries have many important resources available for distance students through the link: <https://libraries.usc.edu/faculty-students/distance-learners>. These include instructional videos, remote access to university resources, and other key contact information for distance students.