SSCI 589 (35723D and 35724D), Cartography and Visualization

Syllabus

Units: 4

Term Day Time: Fall 2025, Monday & Wednesday 2:00 – 3:50 pm

Location: AHF145D and DEN@Dornsife

Instructor: Guoping Huang, D.Des.
Office: AHF B57B
Regular Office Hours: Thursday 9:30-11:30am. Also available by appointment via email.
Contact Info: guopingh@usc.edu, (213) 740-5192

Library Help: Andy Rutkowski
Office: LIPA B40-A
Office Hours: By appointment via email
Contact Info: arutkows@usc.edu

IT Help: Spatial Support
Contact Info: spatial_support@usc.edu

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 geo-visualization.

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.

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 (choropleth, proportional symbol, isarithmic, dot density, etc.).
- Apply ones 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 all 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): None
Co-requisite(s): None
Concurrent Enrollment: None
Recommended Preparation: SSCI 581: Concepts for Spatial Thinking

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)

Diversity and Inclusion – It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful to everyone, and you are also expected to respect of others regardless of their race, ethnicity, gender identity and expressions, cultural beliefs, religion, sexual orientation, national origin, age, abilities, ideas and perspectives, or socioeconomic status. Your suggestions are encouraged and appreciated. Feel free to let me know ways to improve the effectiveness of the course for you personally or for other students.

Course Structure

As a graduate level course, you should expect this class to be both academically robust and intellectually challenging. As a graduate student, you are expected to engage with the information you are learning and to explore the heady cauldron of ideas, opinion, and analysis that describe our collective effort to thoroughly interrogate the subject at hand. Learning arises from active engagement with the knowledge found in the reading materials and with one another. As in any graduate level class, the instructor's role is that of a guide who keeps you on path of discovery and you will find that you will learn much from your fellow classmates. The main theoretical concepts will be provided through class presentations and assigned readings, and at times recorded video presentations. Hands-on practical exercises will use various software products accessible over the Internet. Assignments will give you an opportunity to internalize and apply the concepts and theory learned from readings. Some assignments require student interaction; all will benefit from it.

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

Course Content Distribution and Synchronous Session Recordings Policies

USC has policies that prohibit recording and distribution of any synchronous and asynchronous course content outside of the learning environment.

Recording a university class without the express permission of the instructor and announcement to the class, or unless conducted pursuant to an Office of Accessibility Services (OSAS) accommodation. Recording can inhibit free discussion in the future, and thus infringe on the academic freedom of other students as well as the instructor. ([Living our Unifying Values: The USC Student Handbook](), page 13).

Distribution or use of notes, recordings, exams, or other intellectual property, based on university classes or lectures without the express permission of the instructor for purposed other than individual or group study is prohibited. This includes but is not limited to providing materials for distribution by services publishing course materials. This restriction on

unauthorized use also applies to all information, which has been distributed to students or in any way has been displayed for use in relationship to the class, whether obtained in class, via email, on the internet, or via any other media. ([Living our Unifying Values: The USC Student Handbook](#), page 13).

Technological Proficiency and Hardware/Software Required

ArcGIS is provided online via the SSI 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/

A limited number of computers with all the necessary software is available in the SSI Suite (AHF B55) during regular business hours, Monday through Friday 9 am to 5 pm. To reserve a computer, please use this linkhttps://calendly.com/usc-ssi/the-ssi-suite-ahf-b55-student-computers-1. These computers are available to any student in an SSCI or GSEC course and can be used as a resource if you experience difficulties in accessing the SSI server or using the GIS software on your personal computer.

Brightspace – This course will utilize the Brightspace learning management system which allows students to access course content, upload assignments, participate in discussion forms, among other learning experiences. The Brightspace platform provides flexibility in the learning experience where students can participate in the course residentially or remotely, synchronously (meeting together at the same time) or asynchronously (accessing videos and course content outside of class).

SSI Server and Tech Support – This course utilizes the SSI Server which is a virtual desktop giving access to many different professional software. If you are unable to connect to the server or experience any type of technical issues, send an email using your USC account to SSI Tech Support at spatial_support@usc.edu, making sure to copy (cc) me on the email.

Communications – All assignments given and all materials to be handed in will be submitted via Brightspace. The instructor will also create and monitor discussion forums through which students can discuss issues and assignments as needed. Students should read all email sent from Brightspace or from course instructor(s) as soon as possible. Also, students who do not regularly use their USC email accounts should double-check to be sure that mail sent from both the Brightspace accounts and the instructor's account (noted above) to your USC

account is forwarded to an address used regularly and does not go into junk mail. The instructor will endeavor to respond to all email within 24 hours of receipt, aiming for no more than 72 hours delay. In the rare case that an instructor is off-line for an extended period of time, an announcement will be posted to the class Brightspace site. Due to the synchronous and asynchronous nature of this course, it is each student's responsibility to stay informed and connected with others in our course. In addition to email, students are expected to login to Brightspace regularly to check for announcements.

Discussion forums – On the Brightspace site, I will post a series of discussion threads relevant to various sections of the course. Discussions provide a key means for student-to-student discussion and collaboration. Here students can provide support to each other while working on your assignments, sharing hints and helpful tips, as you would in a classroom laboratory. Please post your questions about assignments there, as you would ask them publicly in the classroom. I monitor the discussion threads and offer comments when necessary, but more importantly, consider the discussion board a key way to connect with your classmates and share your discoveries.

Required Readings and Supplementary Materials

The required textbooks for this course is:

- Brewer, Cynthia. (2016). *Designing ℬetter Maps: A Guide for GIS users*, (2nd Edition. Redlands, CA: Esri Press.
- Kimerling, A., Buckley, A., Muehrcke, P. and Muehrcke, J. (2016). Map Use: Reading, Analysis, Interpretation. 8th Edition. Redlands, CA: Esri Press. (e-book available at USC Library)

Supplementary readings will be assigned from various sources including:

- 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., Ressl, 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.
- Monmonier, M. 2018. How to Lie with Maps. 3rd Edition. University of Chicago Press.
- 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).
- Tufte, E.R., Goeler, N.H, Benson, R. 1990. Envisioning information. Cheshire, CT: Graphics press.

- Wright, D.J. 2017. Swells, Soundings, and Sustainability, but…"Here Be Monsters" Oceanography. 30 (2).

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 values 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.

Mapping Exercises – 4 worth a total of 20 points. Mapping exercises are designed for students to follow tutorials and learn specific mapping techniques in GIS.

Mapping Projects - 3 worth a total of 30 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 representation 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 Assignments – 2 worth a total of 8 points. These discussion 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.

Final Mapping Project – 1 worth a total of 15 points. The final project will be your opportunity to integrate all that you have learned in the semester by conducting an original mapping project. This mapping project will build upon the various map-making skills that you will develop during the semester.

Peer Review – 1 worth a total of 5 points. Students are asked to review their classmates' intermediate products of the final project, and provide constructive comments and suggestions for improvement.

Midterm Exam - 1 worth 15 points. The midterm exam will cover material learned in the first 4 modules. It may be mixed format and may consist of mapping questions and short essay questions. Students are expected to take the exam within an indicated time window.

Show and Tell - 1 worth 5 points. Student will showcase a chosen map or visualization and

demonstrate understanding of its significance in the realm of cartography in a presentation in class.

Grading Breakdown

Assessment	Number	Points Each	Total Points
Resume Assignment	1	2	2
Mapping Exercises	4	5	20
Mapping Projects	3	10	30
Reading and Research Assignments	2	4	8
Final Mapping Project	1	15	15
Peer review	1	5	5
Midterm Exam	1	15	15
Show and tell	1	5	5
Total	14	-	100 points

In addition, it is important to note from the outset that:

- You are expected to attend and participate in every class session and to complete and upload all assignments before the deadlines documented in the Course Schedule. The move of this SSCI 589 course to the DEN model means that you may participate in-person or remotely and synchronously or asynchronously – you will choose the modalities to best fit your own circumstances and therefore participate in each class session in one or other of the following combinations of these modalities (i.e., in-person and synchronous, remote and synchronous, or remote and asynchronous).

- I will deduct one letter grade for late postings and assignments, and no credit will be assigned for postings or assignments turned in more than one week late.

Grading Scale

Assignments in this and other SSCI courses, are graded on the letter grade scale where A is exemplary, B is very good, C is satisfactory, D is unsatisfactory, and F needs improvement. Final grades use the same letter grade scale with C being the minimum passing grade for credit at the graduate level. The grading scale follows:

A	> 93 points	B-	80-82 points	D+	67-69 points
A-	90-92 points	C+	77-79 points	D	63-66 points
B+	87-89 points	C	73-76 points	D-	60-62 points
B	83-86 points	C-	70-72 points	F	<60 points

Assignment Submission Policy

Assignments must be submitted via Brightspace by the due dates specified in the Course Schedule. Attention to on-time assignment submission is essential. The instructor will aim to return feedback before the next assignment is due.

Strict penalties apply for late assignments as follows:

- All assignments will be penalized 2 points up to four days late. No points will be given for submissions more than four days late.
- Additionally, no written work will be accepted for grading after 5 p.m. PT on the last day of classes.

Grading Timeline

My goal is to provide grading and feedback no later than one week on small assignment and two weeks on major mapping project after the assignment was submitted.

Learning Experience Evaluations

Please note Learning Experience Evaluations for the course take place at the end of the semester and are facilitated by the University. These evaluations provide an important review of student experiences in the course.

SSI Policy on the Creation of Original Work and Use of Generative AI

All students are expected to submit assignments that represent their own original work, and that have been prepared specifically for the course or section for which they have been submitted. Students may not have another person or entity complete any substantive portion of an assignment or reuse work prepare for courses without obtaining written permission from the instructor(s). Developing strong competencies in research, writing, and the technical execution of geospatial technologies are foundational to SSI academic programs that are

designed to prepare you for success in the workplace. Therefore, using generative AI tools – unless explicitly specified otherwise – is strictly prohibited in this course, will be identified as plagiarism, and will be reported to the Office of Academic Integrity.

Course Schedule

	Topic	Readings and Assignments	Deliverables
Module 1: Basics			
Week 1 8/25 & 8/27	Introduction Overview of Cartography	DBM: Chapter 1 Resume Assignment (Wright, 2017) (Robinson, 2017) Resume Assignment	
Week 2 9/3 *Monday, 9/1 is university holiday (Labor Day)	Basic principles	DBM: Chapter 1, 2 MU: Chapter 1-5 (Monmonier, 2018) Exercise 1	Resume Assignment
Module 2: General maps			
Week 3 9/8 & 9/10	Map projections Base maps	DBM: Chapter 2 MU: Chapter 9 Exercise 2	Exercise 1
Week 4 9/15 & 9/17	Terrain Representation Typography	DBM: Chapter 5, 6 Project 1	Exercise 2
Module 3: Thematic maps			
Week 5 9/22 & 9/24	Marginalia Colors & Choropleth Mapping	DBM: Chapter 7 & 8 (Battersby, S.E., Goldsberry, K.P. 2010)	
Week 6 9/29 & 10/1	Symbolization Visual variables	DBM: Chapter 9 (Hegarty, et al., 2009) Exercise 3 Project 2	Project 1
Module 4: Interactive and Multi-dimensional Maps			
Week 7 10/6 & 10/8 *10/9-10/10 is university holiday (Fall	Spatial Representations 3D Visualization	DBM: Chapter 3 Reading Assignment 1	Exercise 3

Recess)			
Week 8 10/13 & 10/15	Space-time Visualization Guest Lecture		Reading Assignment 1 Project 2
Week 9 10/20 & 10/22	Midterm Review Midterm Exam		
Module 5: Other visualizations			
Week 10 10/27 & 10/29	Web Cartography Basics 3D and time on the web	Exercise 4 Project 3	
Week 11 11/3 & 11/5	VR and AR Map Series	(Hruby, et al., 2019)	Exercise 4
Week 12 11/12 *Monday, 11/10 is university holiday (Veterans Day)	Schematic map	Peer Review	Project 3 Initial Submission
Week 13 11/17 & 11/19	Cartogram QGIS	Reading Assignment 2	Project 3
Week 14 11/24 *11/26-11/28 is a university holiday (Thanksgiving)	Final project workshop	Final Project	
Week 15 12/1 & 12/3 Friday, 12/5 is the last day of class, 12/6-12/9 study days	Summary		Reading Assignment 2
Final Project (TBD)			

Statement on Academic Conduct and Support Systems

Academic Integrity:

The University of Southern California is a learning community committed to developing successful scholars and researchers dedicated to the pursuit of knowledge and the dissemination of ideas. Academic misconduct, which includes any act of dishonesty in the production or submission of academic work, comprises the integrity of the person who commits the act and can impugn the perceived integrity of the entire university community. It stands in opposition to the university's mission to research, educate, and contribute productively to our community and the world.

All students are expected to submit assignments that represent their own original work, and that have been prepared specifically for the course or section for which they have been submitted. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s).

Other violations of academic integrity include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), collusion, knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university. All incidences of academic misconduct will be reported to the Office of Academic Integrity and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see the student handbook or the Office of Academic Integrity's website, and university policies on Research and Scholarship Misconduct.

Please ask your instructor if you are unsure what constitutes unauthorized assistance on an exam or assignment, or what information requires citation and/or attribution.

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*

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

988 Suicide and Crisis Lifeline - *988 for both calls and text messages – 24/7 on call*

The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The Lifeline is comprised of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number makes it easier for people to remember and access mental health crisis services (though the previous 1 (800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL) – 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

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

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

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 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) 740-0411

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

Culture Journey - (213) 740-2101

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

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) 442-1200 – 24/7 on call

Non-emergency assistance or information.

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

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) 442-2850 or* otfp@med.usc.edu

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 Brightspace page and the SSI Student Hub on Brightspace 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.