

CP 8853 & CS 8803 Syllabus

Interactive Maps & Geovisualization, CA/GIS, and 3 Credits
Fall 2026

Instructor Information

Instructor **Email**

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Office

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General Course Information

Description

This special topics course will walk students through the principles of geovisualization and geovisual analytic systems, with a focus on interactive components, digital cartographic design, geostatistical functionalities and display, and software UI configuration.

Readings and activities in this class will substantially depend on the set of students who enroll and what will best suit their geovisualization-related studies. We will seek suggestions and input throughout the semester as a class on the software we evaluate and explore and the articles we read.

Pre- &/or Co-Requisites

Students should have either a geographic information systems (GIS) class earning a B or higher; or a data visualization class (e.g. CS 4460, CS 6730, CS 7450) / HCI class earning a B or higher at either the undergraduate or graduate level. Students who have had an official GIS class tend to find the assignments more manageable than those who have not. Because of the prerequisite skills required for interactive discussions and self-guided explorations, no exceptions will be made.

Course Learning Outcomes

1. Develop a command of geovisualization literature.
2. Describe different geospatial map types and map displays and interactive techniques.
3. List and explain key paradigms needed for effective interactive geovisualization. Relatedly, describe how and why “spatial is special” and what this means for software developers and users.
4. Examine map functionalities of commercial software such as ArcGIS Online, Tableau, SocialExplorer, etc.
5. Examine different geovisual analytic software systems such as GeoDA, GeoVISTA Toolkit, VIS-STAMP, Flowmapper and Kepler GL.
6. Describe functionality, tasks, and design goals inherent to geovisualization and geovisual analytics.
7. Learn about user perception and user studies using maps and visual variables in geovisualization.
8. Define the types of aspatial (e.g. self-organizing maps or force directed networks) AND spatial statistical methods (e.g., local indicators of spatial autocorrelation) that are ‘linked’ to maps either through similar symbology or through linking and brushing.

9. Evaluate systems (by listing pros and cons, etc.) based on best practices learned in this class.
10. Complete a project related to geovisualization or geovisual analytic systems.
11. Help fellow students learn about new software and develop concrete, written exercises (“lab exercises”) to help a group step through software and learn how to use it.

Required Course Materials

Materials: Laptop computer with administrative privileges is recommended. Please see the instructor before class if you need a laptop to use.

Textbook: We use the [GIS-T Body of Knowledge](#) for various assignments.

Grading Policy

Students are expected to attend all lectures, read readings, and complete all assignments. There will be no official final exam. Late submissions will be graded down by 10% for each day of delay past the due time. All assignments should be handed in on Canvas. We follow the Georgia Tech grading scale.

Content	Number of Assignments	Total Points
Attendance (pair work)	In Class Work	20
Assignments	8 (5 pts each)	40
Quizzes (mostly multiple choice)	N=2 (will be announced)	20
Final project (Design & Usability (10), User Study (10), Presentation (5))	1 (Tool, Writeup, Presentation)	20

Description of Graded Components

Assignments are graded based on correct answers to questions asked in the labs, and effectiveness of maps, and evidence of creativity.

Final Project is graded based on completion of a project pitch, ability to build a usable map visualization with at least one linked component. It includes a user study with at least 3 users, that includes a clear protocol and research questions.

Attendance is graded based on coming to class, participation, and ability to work with a partner. **This is a *workshop-type* class where students who attend class regularly and come prepared tend to do well. Hands-on assignments and instruction is completed in class—the class emphasizes work in class over homework.**

Quizzes will be administered in person, and they are closed-book.

Tentative Schedule

Calendar (some items are subject to change and will move around a bit. Please check Canvas for all due dates)

Week	Topic	Please Read for Class	Due Today
1	Lecture: Introduction to Geovisualization Activity: Social Explorer	Go over GIS-T Body of Knowledge [BoK] https://gistbok-topics.ucgis.org/CV (read after class)	Please fill out survey (check announcements on Canvas).

2	<p>Lecture: Data Binning & Resiliency</p> <p>Sharing: Social Explorer</p> <p>Activity: Exploropleth</p>	<p>[Exploropleth (CaGIS)] https://www.tandfonline.com/doi/full/10.1080/15230406.2025.2543483#abstract</p> <p>Narechania, A., et al (2023). Resiliency: A Consensus Data Binning Method (Short Paper). In 12th International Conference on Geographic Information Science (GIScience 2023).</p> <p>[CV-03-005] Statistical Mapping (Enumeration, Normalization, Classification)</p>	<p><i>Social Explorer</i> worksheet. (1)</p>
3	<p>Lecture: Thematic Mapping; Symbolization and Perception</p> <p>Sharing: Exploropleth</p> <p>Demo: Making a Simple Map (ArcGIS Online)</p> <p>Activity: ArcGIS Online</p>	<p>Brewer, C, & A. Campbell. (1998) Beyond graduated circles: Varied point symbols for representing quantitative data on maps. <i>Cartographic Perspectives</i> 29: 6-25.</p> <p>[CV-03-008] Symbolization and the Visual Variables</p>	<p><i>Exploropleth</i> worksheet. (2)</p>
4	<p>Lecture: Data Visualization Types</p> <p>Sharing: ArcGIS Online</p> <p>Activity: Tableau</p>	<p>[CV-05-013] User Interface and User Experience (UI/UX) Design</p> <p>Heer, J., Bostock, M., & Ogievetsky, V. (2010). A tour through the visualization zoo. <i>Communications of the ACM</i>, 53(6), 59-67.</p>	<p>ArcGIS online <i>Dot Map</i> and put a (a) screencap (b) insights (c) public link on your worksheet. (3)</p>
5	<p>Lecture: Tasks & Interaction</p> <p>Sharing: Tableau</p> <p>Activity: Reference Maps or Tableau Public.</p>	<p>Anselin, Luc, Interactive Techniques and Exploratory Spatial Data Analysis (1996). Regional Research Institute Working Papers. 200.</p> <p>Roth, R. E. (2013). Interactive maps: What we know and what we need to know. <i>Journal of Spatial Information Science</i>, (6), 59-115.</p> <p>Roth, R. E et al. (2017). User studies in cartography: opportunities for empirical research on interactive maps and visualizations. <i>International Journal of Cartography</i>, 3(sup1), 61-89.</p>	<p><i>Tableau</i> worksheet. (4a)</p>
6	<p><i>Hands On User Study</i></p> <p>Lecture: User Study with SNoMaN</p> <p>Activity: SNoMaN</p>	<p>Jin, S., et al (2025). SNoMaN: a visual analytic tool for spatial social network mapping and analysis. <i>Cartography and Geographic Information Science</i>, 52(4), 441-459.</p>	<p><i>Evaluating Tableau</i>. Given your tableau visualization, write 5 questions that you would ask in a user study. (4b)</p>
7	<p>Lecture: Mapping spatial networks and origin/destination data.</p>	<p>Koylu, C., Tian, G., & Windsor, M. (2023). Flowmapper.org: a web-based framework for designing origin–destination flow maps. <i>Journal of Maps</i>, 19(1), 1996479.</p>	<p><i>SNOMAN</i> lab answers (worksheet). (5)</p>

	Activity: Kepler.gl and Flowmapper		
8	<p>Lecture: Geovisual Analytics and Geovisual Analytic Systems</p> <p>Activity: VIS-STAMP / GeoVISTA Studio / Geovis Toolkit / SOM-VIS.</p>	<p>Guo, D. (2017) Geovisual Analytics. The International Encyclopedia of Geography. John Wiley & Sons, Ltd. [CV-05-036] Geovisual Analytics</p> <p>Guo, D., Chen, J., MacEachren, A. M., & Liao, K. (2006). A visualization system for space-time and multivariate patterns (vis-stamp). IEEE transactions on visualization and computer graphics, 12(6), 1461-1474.</p> <p>Guo, D., Gahegan, M., MacEachren, A. M., & Zhou, B. (2005). Multivariate analysis and geovisualization with an integrated geographic knowledge discovery approach. Cartography and Geographic Information Science, 32(2), 113-132.</p>	FlowMapper/Robin worksheet. (6)
9	No Class ~Our Fall Break~ (clio-cscw)	NO READINGS REQUIRED	NOTHING DUE
10	<p>Lecture: Spatial Statistics and GeoDA</p> <p>Activity: GeoDA Part 1</p>	<p>Statistical Data Exploration and Geographical Information Visualization Martin Theus, Exploring Geovisualization J. Dykes, A.M. MacEachren, M.-J. Kraak (Editors) 2005 Elsevier Ltd.</p> <p>Anselin, L., Syabri, I., & Kho, Y. (2009). GeoDa: an introduction to spatial data analysis. In Handbook of applied spatial analysis: Software tools, methods and applications (pp. 73-89). Berlin, Heidelberg: Springer Berlin Heidelberg.</p> <p>Statistical Data Exploration and Geographical Information Visualization Martin Theus, Exploring Geovisualization J. Dykes, A.M. MacEachren, M.-J. Kraak (Editors) 2005 Elsevier Ltd.</p>	Geovisual Analytics Tool worksheet. (e.g. VIS-STAMP etc.). (7)
11	<p>Lecture: Evaluation</p> <p>Activity: GeoDA Part 2</p>	Stasko, John. "Value-driven evaluation of visualizations." In Proceedings of the Fifth Workshop on Beyond Time and Errors: Novel Evaluation Methods for Visualization, pp. 46-53. 2014.	NOTHING DUE (GeoDA in progress)
12	<p>Lecture: User Study Examples & Real-World Cartography</p> <p>Activity: Project Part A: Data search + technology choice</p>	<p>Narechania, A., et al. (2025). Cartographers in Cubicles: How Training and Preferences of Mapmakers Interplay with Structures and Norms in Not-for-Profit Organizations. arXiv preprint arXiv:2504.09438.</p> <p>Houtman, L. (2025). Techniques, challenges, and opportunities in mobile thematic map design for data journalism. Cartography and Geographic Information Science, 1-20. (may swap this!!)</p>	GeoDA worksheet. (8)
13	<p>Lecture: Challenges and Usability Issues</p> <p>Sandbox Session:</p>	MacEachren, A. M., & Kraak, M. J. (2001). Research challenges in geovisualization. Cartography and geographic information science, 28(1), 3-12.	Data Report: Find and download data for your project.

	Project Part B (Proof of Life): and develop user testing.	Slocum, T. A., Blok, C., Jiang, B., Koussoulakou, A., Montello, D. R., Fuhrmann, S., & Hedley, N. R. (2001). Cognitive and usability issues in geovisualization. Cartography and geographic information science, 28(1), 61-75.	Take a screenshot of your data in a software system.
14	Beta Testing: Project Part C: Test drive your project with classmates.	NO READINGS REQUIRED	Project interface screenshot and your user study design.
15	Thanksgiving – No Class	NO READINGS REQUIRED	NOTHING DUE
	Project Presentations (Open to friends)		User study write up.

At Georgia Tech, final course grades are awarded on a scale of A-F with no +/- grades permitted.

Knowledge Topics

Below are [GIS-T Body of Knowledge](#) topics.

First, students who do not have knowledge in the prerequisite topics below are required to read about these topics in the second week of class.

Data Considerations

Vector Formats and Sources
Raster Formats and Sources

Map Design Fundamentals

Scale and Generalization
Map Projections
Visual Hierarchy and Layout
Design and Aesthetics
(be aware of: Color Theory; Typography)

Second, we learn about these GIS-T Body of Knowledge topics in class.

Interactive Design Techniques

User Interface and User Experience (UI/UX) Design
Web Mapping
Virtual and Immersive Environments
Big Data Visualization
Geovisualization
Geovisual Analytics
Usability Engineering & Evaluation
Mobile Maps and Responsive Design

Map Design Fundamentals

Statistical Mapping (Enumeration, Normalization, Classification)
Symbolization and the Visual Variables

Map Use

Map Reading

Map interpretation

Map analysis

Cartography Ecosystem

Cartography and Power

Lesson Design in Cartography Education

Map Production and Management

Map Design Techniques

Common Thematic Map Types

Multivariate Mapping

Terrain Representation

Spatiotemporal Representation

Representing Uncertainty

Flow Maps

Cartograms

Narrative and Storytelling

Map Icon Design

Collaborative Cartography

USG Required Course Policies

Attendance and/or Participation

This is an in-person class. Lectures will be in person and will include hands-on lab times to give students more experience with geographic information systems and science. All lectures, readings, assignments are to be accessed through Canvas. Canvas is for general messaging, discussions, and file retrieval. Students will need to attend the final project days.

Please engage in class. This means showing your fellow students that you are paying attention and that class time and instruction is important to you. Be present in the lectures and do the readings (Information about information visualization comes in sentence form!). While slides give key points and high-level topics discussed, much of the content of the course comes through the discussion, and other in-class activities. If you want to do well, attending class is important.

Laptops should be used only for notetaking and in-class activities.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review [Georgia Tech's Honor Code](#) and the student [Code of Conduct](#).

Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Core IMPACTS

Not applicable

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, [contact the Office of Disability Services](#) (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. [The Student-Faculty Expectations](#) articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

How to be Successful

Please engage in class. This means showing your fellow students that you are paying attention and that class time and instruction is important to you. Be present in the lectures and do the readings. While slides give key points and high-level topics discussed, much of the content of the course comes through the discussion, and other in-class activities. If you want to do well, attending class is important.

AI Policy

For GIS: All materials turned in should be completed by the student without the use of ChatGPT or another AI tool. This course is designed to be very hands-on, and if you have a question on a lab and you don't know the answer, please ask an instructor or a fellow student. Answers you get from an LLM may not be correct and do not show your critical thinking or abilities, and a wrong answer from you is better than a canned answer from an LLM. **Students who answer lab questions or turn in writing or other materials (e.g., code) that were generated with AI will receive a 0 for the assignment.**

AI can only be used **with explicit permission** (meaning the instructor approved it with you) and for tasks such as data cleaning.

Graduate Student Academic and Professional Success Resources

A list of resources for graduate students is given on the [Office of Graduate and Postdoctoral Education](#) website. Specific information for [current graduate students](#) includes

- [Academic Resources](#) such as the Communications Center, Language Institute, Library, Catalog, Registrar, resources for conducting research, Advocacy and Conflict Resolution resources, and how to manage unexpected situations that may impact your academic performance;
- [Student Resources](#) such as Campus Services, Child Care/Family programs, Health & Wellness, Career Services, and the Student Resource Guide; and
- [Professional Development](#) such as the programming from the Career Center and other professional development resources and events”]

At Georgia Tech, we are concerned about your overall physical, social, and mental well-being. A [comprehensive list](#) of wellness related resources has been compiled and maintained by the Office of the Vice President for Student Engagement and Well-being.