USC Dornsife
Dana and David Dornsife
College of Letters, Arts and Sciences
Spatial Sciences Institute

SSCI 581 (Section 35892), Concepts for Spatial Thinking

Syllabus

Units: 4

Term — Day — Time: Spring 2018, Wednesdays and Fridays, 10 a.m. – 11:50 a.m. PT

Location: AHF 145D

Instructor: Katsuhiko "Kirk" Oda, PhD GISP
Office: AHF B56B
Regular Office Hours: Wed 12 pm-1 pm PT and Fri 9-10 am PT Also available most days and times by appointment via email.

Contact Info: katsuhio@usc.edu, 213-740-2868 (office)

Library Help: Andy Rutkowski
Office: VKC 36B
Office Hours: Tuesdays 10 a.m.-12 noon PT and Thursdays 4:30-5:30 p.m PT
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IT Help: Richard Tsung
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Office Hours: By appointment
Contact Info: ctsung@usc.edu, 213-821-4415 (office)

Course Scope and Purpose

This course is an introduction to geographic information science and the cartographic and geographic concepts underlying spatial thinking and technology.

The course is designed to serve several audiences given its role as a required entrée course for four distance learning programs – the GIST M.S. and Graduate Certificate, the Geospatial Intelligence Graduate Certificate, and the GeoHealth track in the Keck School of Medicine's Master of Public Health program – and one residential program, the M.S. in Spatial Informatics. Students are provided with a variety of options in the assignments so they can align the geospatial data, analysis, and visualization tasks with their own academic interests and objectives.

Beyond these specific audiences, this is a course designed for those who wish to improve their GIS skills and understand the underlying concepts. In addition to the theoretical underpinnings, students will gain an understanding of the fundamentals of geographic information science including spatial analysis, coordinate systems, and cartography, and the ways in Esri's ArcGIS ecosystem enables analysis, modeling and visualization.

Spatial thinking – Despite Thomas Friedman's argument that "the world is flat", place remains critically important, perhaps more than ever, in contemporary society. We will start by exploring why spatial thinking is important for describing, analyzing, modeling and visualizing our world and how the "habit" of spatial thinking can be encouraged and cultivated. We will use a series of readings, self-directed activities, and case studies that show how spatial thinking permeates and supports various kinds of problem solving.

Geodesy – Geodesy is the branch of science concerned with the size and shape of the Earth and determining precise locations on its surface. The major topics to be covered – geodetic datums, geoids, coordinate systems, and map projections – underlie all that follows in our programs and the successful deployment and use of geospatial technologies.

Fundamentals of GIS – The evolving field of geographic information science is a core component of the course. We will explore the relationships between geographic information science and other disciplines in the natural and social sciences, humanities, engineering, economics, and professions (e.g., architecture, health, journalism, and social work).

The ArcGIS Ecosystem – We will explore how ArcGIS software can be used to represent space and analyze spatial questions through a series of tutorials that cover different types of geospatial data, raster and vector data models, coordinate systems, map projections, geoprocessing, and raster analysis.

Maps – Maps have been used throughout history to aggregate and communicate geographic concepts and relationships. Once domain of professional cartographers, maps can now be authored and shared by nearly anyone through GIS and the internet. We will review past, present, and future map use and how maps can depict and communicate geographic knowledge in a digital age.

Spatial Data– The ability to understand and analyze data sets is an essential component of GIS. We will investigate fundamental geospatial datasets (e.g. the US Census) and attain the knowledge and skills necessary for processing, interpreting, and analyzing GIS data.

This is a graduate level course, and at the graduate level you are responsible for your own learning. The instructor's role is as a guide on the path of academic exploration, and you will be rewarded by deeply engaging with your fellow classmates. You will be intellectually challenged throughout the term, as you engage with the course content and explore ideas, opinions, and analysis, perhaps different from those you held coming in. Learning arises from active participation with the reading materials and with one another. The challenge for the instructor is to provide a robust, challenging, and stimulating academic experience within the milieu of the digital era.

All course materials will be organized through Blackboard. The main theoretical concepts will be provided through course notes and assigned readings. Written assignments will give students an opportunity to internalize and apply the concepts and theory learned from readings. Presenting the course notes and assigned readings again in class would simply consume your precious time. Instead, you are required to read the texts and course notes before you come to the classroom and discuss what concepts you thought the most challenging to understand. This allows you to engage in internalizing and applying the concepts and theory learned from readings for a deeper understanding of our course materials. In addition, you will work with your classmates together and actively interact by sharing experiences through collaborative learning. All will benefit from the aforementioned course format. In addition, hands-on practical exercises will mainly use ArcGIS Pro.

Learning Outcomes

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

- Acknowledge and utilize spatial thinking for a geospatial visualization and analysis.
- Understand and be able to apply fundamental spatial concepts such as arrangement, orientation, diffusion, dispersion, and pattern.
- Explain and apply exemplary cartographic principles. Demonstrate how maps have been used throughout history to organize and empower different groups of people. Anticipate the evolution of maps in the future.
- Explain the role and importance of geodetic datums, geoids, coordinate systems, and map projections can be used to identify position and location of places, people, and features on the Earth's surface.
- Gain an in-depth understanding of how spatial analysis, modeling, and visualization tools included in geographic information systems and other geospatial technologies can be used to advance knowledge creation and communication across a variety of disciplines.
- Process, assess, and describe core geospatial datasets such as census data.

- Conduct a GIS project for real-world decision-making through the geographic inquiry processes.

Prerequisite(s): None
Co-Requisite(s): None
Recommended Preparation: None

Technological and Communication Requirements

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 (DSL at a minimum).
- A functional webcam for use whenever a presentation or meeting is scheduled.

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 technical issues, send an email using your USC account to SSI Tech Support at spatial_support@usc.edu, making sure to copy (cc) your instructor on the email.

Communications – All materials to be handed in will be submitted via Blackboard. This allows you to engage in reading and class preparation assignments individually before you come to the classroom. It is each student's responsibility to stay informed about what is going on in our course. In addition to email about time-sensitive topics, any important announcements will be posted on the Announcement page in Blackboard. Be sure to check these each time you log onto Blackboard.

Your instructor is regularly on-line and will respond to student emails quickly. All email will be responded to within 24 hours of receipt, with no more than 72 hours delay. In the rare case when your instructor will be off-line for 72 hours or more, an announcement will be posted on the Blackboard site.

Required Readings and Supplementary Materials

Textbooks – There are seven texts for this course, though you are not required to purchase all of them. They are available from the USC Bookstore or online outlets such as Amazon. For further information on the Bolstad text, visit the following page: http://www.paulbolstad.net/gisbook.html. Make sure to obtain the correct editions of the texts. Textbooks will be supplemented with Course Notes and readings from academic journals, professional reports and reputable websites.

Course texts (Must purchase):

1. Bolstad, Paul. 2016. *GIS Fundamentals: A First Text on Geographic Information Systems* (5th Edition). Ann Arbor, MI: XanEdu Inc.
2. Law, Michael, and Amy Collins. 2016. Getting to Know ArcGIS Pro (1st edition). Redlands, CA: Esri Press.

Other readings (Excerpts will be supplied or available for download)

1. Harder, Christian. 2015. *The ArcGIS Book: 10 Big Ideas about Applying Geography to Your World*. Redlands, CA: Esri Press.
2. Kimerling, A. Jon, Aileen R. Buckley, Phillip C. Muehrcke, and Juliana O. Muehrcke. 2016. *Map Use: Reading, Analysis, Interpretation* (8th edition). Redlands, CA: Esri Press.
3. Mitchell, Andy. 2012. *The Esri Guide to GIS Analysis Volume 3: Modeling Suitability, Movement, and Interaction.* Redlands, CA: Esri Press.
4. National Research Council. 2006. *Learning to Think Spatially: GIS as a Support System in the K-12 Curriculum.* Washington, DC: National Academies Press (available at http://www.nap.edu/catalog.php?record_id=11019).
5. Wilson, John. P. and A. Stewart Fotheringham, (editors). 2008. *The Handbook of Geographic Information Science.* Oxford, Blackwell (Available through the USC Libraries as an e-Book.)

Readings – Additional readings that focus on topics relevant to course themes will be provided through Blackboard. These include, but ARE NOT LIMITED TO:

Batty, Michael, Andrew Hudson-Smith, Richard Milton, and Andrew Crooks. 2010. Map mashups, Web 2 and the GIS revolution. *Annals of the Association of American Geographers* 16: 1-13.

Cebrecos, Alba, Julia Díez, Pedro Gullón, Usama Bilal, Manuel Franco, and Francisco Escobar. 2016. Characterizing physical activity and food urban environments: a GIS-based multicomponent proposal. *International Journal of Health Geographics* 15(1).

Downs, Roger M. 1997. The geographic eye: Seeing through GIS? *Transactions in GIS* 2: 111-121.

DiBiase, David W., Michael DeMers, Ann Johnson, Karen Kemp, Ann T. Luck, Brandon Plewe, and Elizabeth Wentz. 2007. Introducing the first edition of Geographic Information Science and Technology Body of Knowledge. *Cartography and Geographic Information Science* 34: 113-118.

Duckham, Matt. 2015. GI Expertise *Transactions in GIS* 19: 499-515.

Goodchild, Michael F. 1992. Geographical information science. *International Journal of Geographical Information Systems* 1: 31-45.

Goodchild, Michael F. 2012. "GIScience in the 21st century." In *Advances in Geo-Spatial Information Science,* edited by Shi, W., Michael F. Goodchild, Brian Lees, and Yee Leung. Leiden, The Netherlands, CRC Press: 3-10.

Kitchin, Rob and Martin Dodge. 2007. Rethinking maps. *Progress in Human Geography* 31: 331-334.

Reitsma, Femke. 2013. Revisiting the 'Is GIScience a science?' debate (or quite possibly scientific gerrymandering). *International Journal of Geographical Information Science* 2: 211-221.

Wright, Dawn J., Michael F. Goodchild and James D. Proctor. 1997. Demystifying the persistent ambiguity of GIS as "tool" versus "science." *Annals of the Association of American Geographers* 87(2): 346-362.

Zheng, Siqi, Weizeng Sun, Jianfeng Wu, and Matthew E. Kahn. 2016. Urban Agglomeration and Local Economic Growth in China: The Role of New Industrial Parks. SSRN Electronic Journal. 10.2139/ssrn.2746711.

Description and Assessment of Assignments

Weekly Assignments

There are several different types of weekly assignments, which are further described in the "Weekly Assignments" folders on Blackboard.

Resume Assignment – 1 worth 1 point. All students are required to post and maintain a public resume, biography, and headshot on our SSI Student Community Blackboard site. Unless you opt out, your resume will be included in the Spatial Sciences Institute Graduate Programs Resume Book. This resume book is used to both promote our program and your skills, experience and professional aspirations.

Access SSI Server Tutorial – 1 worth 1 point. The SSI Server will be used frequently throughout the semester, so you must ensure access during the first week.

Discussion Forums – 3 worth a total of 6 points. Discussions will include an introduction, a spatial thinking activity, and an opportunity to reflect on and evaluate selected aspects of the course. All students are expected to engage in these elements with their classmates.

Reading Quizzes – 10 worth of a total of 4 points. These short open-book quizzes emphasize key points from the readings.

Written Assignments – 5 worth of a total of 15 points. It is critical that graduate students be well-versed in the discussions, debates, and normative frameworks that define their field. Five written assignments will be included in this course, focused on the theoretical aspects of spatial thinking and reasoning, with the objective of enabling students to critically examine and reflect on the course readings. All of the assignments are required. In each of the written assignments except the first one, students will select one article from a set of readings to review for their submission.

Geodesy Quiz – 1 worth of 5 points. A quiz will be administered at the end of the geodesy module and allow you to demonstrate your knowledge and understanding of geodetic datums, coordinate systems, and map projections.

ArcGIS Tutorials – 5 worth of a total of 15 points. The ArcGIS tutorials are intended to familiarize students with using ArcGIS Pro, and apply their skills to problem scenarios. Students will work through Law and Collins' Getting to Know ArcGIS Pro workbook and Esri web courses, and then be asked to solve basic research problems by using the skills acquired from each module. A written report will be required for each tutorial. A student-led discussion forum will allow students to ask questions and share information with one another.

GIS Data Tutorials – 3 worth of a total of 15 points. In this set of tutorials, students study, collect, and learn techniques for processing spatial data. Data sets include U.S. Census data,

elevation, hydrography, land cover, and transportation networks. Students will describe the properties of the obtained data suitability for including the spatial and temporal granularity, measurement scales, sample design, and future applications.

Final Project

The Final Project is the opportunity to integrate the theoretical concepts and technical skills learned throughout the semester by framing a geospatial question for decision support in a topic connected with each student's academic path. This includes, but is not limited to, GeoHealth, Landscape Architecture, Historical Preservation, Economic geography, Spatial Informatics, GeoIntelligence, Engineering, and general topics related to natural and social sciences. Students will identify and locate the appropriate spatial and non-spatial data sources, import data into ArcGIS, and produce and interpret maps answering spatial analysis questions. To help facilitate this work, the workflow is broken up into five distinct components:

Annotated Bibliography – 4 points. While this is an individual project, students will begin by forming groups based on their academic interests. From there, the groups will develop an Annotated Bibliography to attain a broad understanding of the core theoretical concepts in their field and share resources with one another. This builds a strong intellectual cohort and sets the foundation for an informed and sophisticated project proposal.

Proposal – 7 points. Once a student has a solid foundation in their field of interest, he or she proposes a research question, as well as a table summarizing criteria for spatial analysis. An individual online meeting with the instructor to discuss the proposal is required.

Data Report – 4 points. A report documenting the complete set of data identified and acquired for the project.

Final Report – 20 points. A final report of your project (10-12 single-spaced pages including figures, maps, tables and references). More information on specifics will be included in the Final Project description.

Final Presentation – 3 points. Each student will deliver a presentation of the Final Project and attend the other students' presentations during our scheduled final exam. With student consent, these will be captured and shared with the broader spatial science community.

Grading Breakdown

Careful planning and a serious, consistent commitment will be required for you to successfully navigate the various deliverables in this and other SSCI courses. The table below summarizes the SSCI 581 course assignments and their point distribution:

Assessment	Number	Points Each	Total Points
Weekly Assignments			
Resume Assignment	1	1	1
Access SSI Server Tutorial	1	1	1
Discussion Forums	3	2	6
Written Assignments	5	3	15
Geodesy Quiz	1	5	5
ArcGIS Tutorials	5	3	15
Reading Quizzes	10	0.4	4
GIS Data Tutorials	3	5	15
Project Components			
Annotated Bibliography	1	4	4
Proposal	1	7	7
Data Report	1	4	4
Final Report	1	20	20
Final Presentation	1	3	3
Total	34	-	100

Assignment Submission Policy

Assignments must be submitted via Blackboard by the due dates specified in the Course Schedule. Attention to on-time assignment submission is essential. Your instructor will aim to return comments on your submitted assignments before the next one 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. Note that all assignments worth 2 points will receive 0 points if submitted late.
- Additionally, no written work will be accepted for grading after 5 p.m. PT on the last day of classes.

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.

Course Schedule: A Weekly Breakdown

		Topic	Readings and Assignments	Deliverables and Due Dates
Week 1	1/10	**Introduction**	Harder: Ch 1 - 4 Discussion Forum 1	Discussion Forum 1: Wednesday, 1/10
	1/12	**Introduction Cont.**	Course Syllabus Resume Assignment Access SSI Server Assignment Reading Quiz 1	Reading Quiz 1: Friday, 1/12 Access SSI Server Assignment: Friday, 1/12
Week 2	1/17	**Why Location Matters**	Harder: Ch 5 - 10 Reading Quiz 2 Discussion Forum 2	Resume Assignment: Tuesday, 1/16 Reading Quiz 2: Wednesday, 1/16 Discussion Forum 2: Wednesday, 1/16
	1/19	**Introduction to ArcGIS**	Law: Ch 1&2 ArcGIS Tutorial 1	No deliverables
Week 3	1/24	**Spatial Thinking**	NRC: Ch 1-3 Downs 1997 Written Assignment 1	ArcGIS Tutorial 1: Tuesday, 1/23
	1/26	**Processing Attributes**	Law: Ch 3&10 ArcGIS Tutorial 2	No deliverables
Week 4	1/31	**GIS in Decision Support**	Cebrecos 2016 Zheng 2016 Written Assignment 2 Final Project Annotated Bibliography	Written Assignment 1: Tuesday, 1/30 ArcGIS Tutorial 2: Tuesday, 1/30
	2/2	**Geoprocess-ing Tools**	Law: Ch 5&7 ArcGIS Tutorial 3	No deliverables

Week 5	2/7	**GIS Data Models**	Bolstad: Ch 2 Reading Quiz 3	Written Assignment 2: Tuesday, 2/6 ArcGIS Tutorial 3: Tuesday, 2/6 Reading Quiz 3: Wednesday, 2/7
	2/9	**Tools for Raster Data**	Law: Ch 9 ArcGIS Tutorial 4	No deliverables
Week 6	2/14	**Geodesy and Datums**	Bolstad: Ch 3 Reading Quiz 4	ArcGIS Tutorial 4: Tuesday, 2/13 Final Project Annotated Bibliography: Tuesday, 2/13 Reading Quiz 4: Wednesday, 2/14
	2/16	**Spatial Analysis for Decision Making**	ArcGIS Tutorial 5	No deliverables
Week 7	2/21	**Coordinate Systems & Map Projections**	Bolstad: Ch 3 Reading Quiz 5 Geodesy Quiz	ArcGIS Tutorial 5: Tuesday, 2/20 Reading Quiz 5: Wednesday, 2/21
	2/23	**Final Project Proposal**	Final Project Proposal	Final Project Proposal: Thursday, 2/22
Week 8	2/28	**Vector Analysis**	Bolstad: Ch 9 Reading Quiz 6	Geodesy Quiz: Tuesday, 2/27 Reading Quiz 6: Wednesday, 3/28
	3/2	**GIS Data 1: Census Data**	GIS Data Tutorial 1	No deliverables
Week 9	3/7	**Raster Analysis**	Bolstad: Ch 10 Reading Quiz 7	GIS Data Tutorial 1: Tuesday, 3/6 Reading Quiz 7: Wednesday, 3/7
	3/9	**GIS Data 2**	GIS Data Tutorial 2	No deliverables

Week 10	3/21	**GIST Domains**	Duckham 2015 DiBiase et al. 2007 Reading Quiz 8	GIS Data Tutorial 2: Tuesday, 3/20 Reading Quiz 8: Wednesday, 3/21
	3/23	**GIS Data 3**	GIS Data Tutorial 3	No deliverables
Week 11	3/28	**Geographic Information Systems**	Bolstad: Ch 1 Reading Quiz 9 Written Assignment 3	GIS Data Tutorial 3: Tuesday, 3/27 Written Assignment 3: Tuesday, 3/27 Reading Quiz 9: Wednesday, 3/28
	3/30	**Final Project Data Report**	Final Project Data Report	Final Project Data Report: Thursday, 3/29
Week 12	4/4	**Geographic Information Science**	Wilson & Fotheringham eds.: An Introduction Goodchild 1992 Wright et al. 1997 Reitsma 2013 Written Assignment 4	No deliverables
	4/6	**Final Project**	Final Project Final Report	No deliverables
Week 13	4/11	**Maps and Spatial Analysis**	Bolstad: Ch 13 Mitchell: Ch 2 Kitchin & Dodge 2007 Batty et al. 2010 Goodchild 2012 Written Assignment 5	Written Assignment 4: Tuesday, 4/10
	4/13	**Final Project Cont.**	Final Project Final Report	No deliverables
Week 14	4/18	**Cartography and the History of Maps**	Kimerling et al.: Introduction Slocum et al.: Ch 2 Reading Quiz 10	Written Assignment 5: Tuesday, 4/17 Reading Quiz 10: Wednesday, 4/18

	4/20	**Final Project Cont.**	Final Project Final Report	No deliverables
Week 15	4/25	**Future Trends of Maps and GIS**	Bolstad: Ch 15 Wilson & Fotheringham eds.: Ch 33&34 Discussion Forum 3	Discussion Forum 3: Wednesday, 4/25
	4/27	**Final Project Cont.**	Final Project Final Report	Final Project Final Report: Due no later than 05:00 pm PT on Friday, 4/27
Final Exam			Final Project Presentation	Final Project Presentation: TBA

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 academic offense with serious consequences. Familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, "Behavior Violating University Standards" https://policy.usc.edu/scampus-part-b/. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Support Systems

Student Counseling Services (SCS) - (213) 740-7711 – 24/7 on call
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. https://engemannshc.usc.edu/counseling/.

National Suicide Prevention Lifeline - 1-800-273-8255
Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. http://www.suicidepreventionlifeline.org.

Relationship & Sexual Violence Prevention Services (RSVP) - (213) 740-4900 - 24/7 on call
Free and confidential therapy services, workshops, and training for situations related to gender-based harm. https://engemannshc.usc.edu/rsvp/.

Sexual Assault Resource Center
For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: http://sarc.usc.edu/.

Office of Equity and Diversity (OED)/Title IX compliance – (213) 740-5086
Works with faculty, staff, visitors, applicants, and students around issues of protected class. https://equity.usc.edu/.

Bias Assessment Response and Support
Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. https://studentaffairs.usc.edu/bias-assessment-response-support/.

Student Support & Advocacy – (213) 821-4710
Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. https://studentaffairs.usc.edu/ssa/.

Diversity at USC – https://diversity.usc.edu/
Tabs for Events, Programs and Training, Task Force (including representatives for each school), Chronology, Participate, Resources for Students.

Online Resources

The Course Blackboard page and the GIST Community Blackboard page have many resources available for students enrolled in our graduate programs. In addition, all registered students can access electronic library resources through the link https://libraries.usc.edu/.