SSCI 581 (Section 35892), Concepts for Spatial Thinking

Syllabus

Units: 4

Term — Day — Time: Fall, 2016, Wednesdays and Fridays, 10:00 a.m. – 11:50 a.m.

Location: AHF 145D

Instructor: Katsuhiko “Kirk” Oda
Office: AHF B56B
Office Hours: Mondays 10-11 a.m. (PT), and Wednesdays 12-1 p.m. (PT), or by appointment
Contact Info: katsuhio@usc.edu, 213-740-2868 (office), https://bluejeans.com/2137402868 (Bluejeans).

GIS Librarian Help: Katharin Peter
Office: VKC B40a
Office Hours: By appointment
Contact Info: kpeter@usc.edu, 213-740-1700 (office)

IT Help: Richard Tsung.
Office: AHF 146
Office Hours: Mondays to Fridays, 9:00 a.m.-5:00 p.m.
Contact Info: ctsung@usc.edu, 213-821-4415 (office)
Course Description
This course is designed as an introduction to geographic information science, and more importantly, to the cartographic and spatial concepts underlying spatial thinking and the associated geospatial technologies. It is the entrée course for the GIST M.S. and Graduate Certificate programs, the M.S. in Spatial Informatics program, the Geospatial Intelligence Graduate Certificate program, and the GeoHealth track in the Keck School of Medicine’s Master of Public Health program. This is also a good course for those who want to improve their GIS skills and for those who wish to first understand the underlying concepts. In this course, you will gain an understanding of the fundamentals of geographic information science, including geodesy, the evolving role of maps in science, policy and our everyday lives, and the ways in which various forms of spatial analysis, modeling and visualization can be performed using Esri’s ArcGIS ecosystem. We will cover five major topics:

Spatial thinking – 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 among working professionals, citizens and most of all, students of all ages. We will use a series of readings and case studies to show how spatial thinking permeates and supports various kinds of problem solving.

Geodesy – We will next turn our attention to geodesy, which is the branch of science most concerned with positioning and determining what is where on Earth. The major topics to be covered – geodetic datums, geoids, coordinate systems, and map projections – are fundamental building blocks for all that follows in our online courses and programs and of course, in the successful deployment and use of geospatial technologies.

Fundamentals of GIS – We will explore the evolving field of geographic information science and the relationships between this and other disciplines or fields spread across the natural and social sciences, the humanities, engineering and the applied sciences, and the professions (architecture, health, journalism and social work, among others).

The ArcGIS Ecosystem – We will also begin to explore how the ArcGIS software ecosystem can be used to represent the world around us using a series of tutorials that cover the various forms of geospatial data, the raster and vector data models, coordinate systems and map projections, and selected forms of geographic analysis, including geoprocessing and raster analysis.

Maps – Maps have been used for hundreds and possibly thousands of years to compile and communicate geographic concepts and relationships. Once the more or less exclusive domain of professional cartographers, maps can be authored and shared in new and wonderful ways using GIS and the Web. We will review past, present and future uses of maps and how these can be generated and used to depict and communicate geographic knowledge in a digital age.

This is a graduate level course, so you should expect this class to be intellectually challenging. As graduate students 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 our reading materials and with one another. As in any graduate class, the instructor’s role is that of a guide who keeps you on this path of discovery and you will find that you will learn much from your fellow classmates. The challenge for the instructor is to replicate such an academic experience within the milieu of learning in a digital era.

All course materials will be organized through Blackboard. The main theoretical concepts will be provided through course notes and assigned 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 10.3.1, which is accessible via the GIST Servers.

**Learning Objectives**
When you have completed this course, you will be able to:

- Explain the role and importance of geodesy and how the various components – geodetic datums, geoids, coordinate systems, and map projections – can be used to position and locate things (i.e. places, people, features) on the Earth’s surface.
- Specify how the various elements of spatial thinking can enable us to identify, describe, analyze and visualize spatial phenomena.
- Define the fundamental spatial concepts and terms such as arrangement, orientation, diffusion, dispersion and pattern.
- Explain cartographic excellence and how maps and geographic understanding have been used throughout history to organize and empower different groups of people.
- Speculate on how maps might be used by various people in the next few decades.
- Describe one or more compelling applications of spatial thinking and why these kinds of workflows and/or solutions are important.
- Specify how the spatial analysis, modeling, and visualization tools included in geographic information systems and other geospatial technologies might be used to advance knowledge creation and communication across a variety of disciplines.

**Prerequisite(s):** None

**Co-Requisite(s):** None

**Concurrent Enrollment:** None

**Recommended Preparation:** None

**Technological Proficiency and Hardware/Software Required**
We have several technologies that will facilitate our course work and our interactions, despite our dispersed locations. These include:

**Blackboard** – All course materials and correspondence will be posted on the course Blackboard site. As a registered student, you will find this course will show up in your available classes no later than 12:00 noon, PT on the first day of classes. It is here that the day-to-day flow of the course will be recorded.

**Discussion boards** – On the Blackboard site, we will post a number of discussion threads related to various course topics. These threads are very important in terms of providing support to each other while working on class exercises to share hints and helpful tips, as you would do in a classroom setting. I will check the discussion threads periodically and offer occasional comments. Please send your course instructor an email directly if you have a question or concern that requires my immediate attention.

**GIST server and technology support** – This course will utilize the GIST Servers to provide you with your own virtual desktop. You can access the GIST Server at: http://gis-gateway.usc.edu. If you are unable to connect to the server or experience any type of technical issue, send an email to GIST Technology Support at gistsupport@dornsife.usc.edu and make sure to copy (cc) me on the email. ArcGIS is provided online via the GIST Server; hence, you do not need to install it on your own computer. Instead, every student must satisfy 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.
- A modern web browser, Firefox recommended, to access the GIST Server.

**Required Readings and Supplementary Materials**

**Textbooks** – There are seven texts for this course. We encourage you to purchase the first and the sixth of these books early since you will need these materials from the opening day of class. Please make sure to obtain the correct editions of the texts. 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](http://www.paulbolstad.net/gisbook.html). Please note that the NRC Report can be downloaded free-of-charge from the web and that a portion of the second, third and fourth texts will be posted on Blackboard, and the Wilson and Fotheringham book is available through the USC Libraries as an e-Book.


The aforementioned textbooks will be supplemented with Course Notes and a mixture of readings from academic journals, professional reports and authoritative websites.

**Readings** – To be posted to Blackboard under Course Documents:


**Description and Assessment of Assignments**

Your grade in this class will be determined on the basis of several different assessment tools:

**Resume Assignment** (2%) – 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.

**Access GIST Server Tutorial** (1%) – The GIST Server will be used frequently throughout the semester. Therefore, you must ensure the access to the server on the first week. To complete the exercise, you will refer to the Access GIST Server document.

**Discussion Forums** (12%) – These will focus on varying combinations of theory and practice and anticipate that you will post a minimum of six new messages (i.e. one per forum) and 12 replies to messages posted by your classmates (i.e. two per forum) at designated times throughout the semester.

**Written Assignments** (15%) – Each student is required to complete five written assignments for this class. These assignments will focus on the theory portion of the course as presented in weekly readings. The objective is to help you evaluate and integrate the information you have acquired from the course readings. Three of these assignments are required (for more detail, see the course schedule table at the end of this syllabus), and you are free to choose any two from the remaining assignments but you must complete and submit them for grading in the weeks specified at the end of this syllabus. If you complete more than five reading assignments, I will use your highest two scores for the remaining assignments to calculate your course grade.

**Geodesy Quiz** (4%) – One quiz will be administered towards the end of the geodesy module and will afford each of you the opportunity to demonstrate your knowledge and understanding of geodetic datums, coordinate systems, and map projections.

**ArcGIS Tutorials** (30%) – 10 for a total of 30 points. Most weeks you will be expected to work through one chapter in Price’s Mastering ArcGIS workbook. To demonstrate that you have completed each chapter, you will turn in brief text answers and/or a copy of some digital output from the final part of the exercise such as a map. In addition, you will be expected to offer each other advice and assistance on tutorials through Blackboard.
**Reading Self Check Assignments** (10%) – 25 for a total of 10 points. These assignments are reading assignments consisting typically of four questions. The questions serve as a guide to you in your reading and as a basis for class discussion and GIS tutorials. The goal of the reading self check assignments is to have informed class activity, and to use class time to focus on applying, analyzing, and evaluating the material with the aid of fellow students and with your instructor’s guidance. You are required to submit your answers before you come to the classroom.

**Final Project** (26%) – The final project will be your opportunity to integrate all that you have learned in the semester by framing a site suitability question, collecting the appropriate spatial and non-spatial data, importing the data into ArcGIS, producing and interpreting a series of maps that represent geographic phenomena related to your site suitability analysis, and indicating how you would proceed if you were to complete the site suitability analysis and what you anticipate would be the final results. To help facilitate this work, the final project will be broken up into three distinct components with their own points and deadlines as follows: (1) a single paragraph (300 word maximum) that describes the site suitability question and one or more tables summarizing criteria for your site suitability analysis (5 points); (2) a data report documenting the data you have identified and acquired for your project (5 points); and (3) the final report itself which must not exceed 10-12 single-spaced and typed pages plus figures, maps, tables and references and will count 16 points towards your final grade for the course.

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:

### Grading Breakdown

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Number</th>
<th>% of Grade</th>
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</thead>
<tbody>
<tr>
<td>Resume Assignment</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Access GIST Server Tutorial</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Discussion Forums</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Written Assignments</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Geodesy Quiz</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>ArcGIS Tutorials</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Reading Self Check Assignments</td>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td>Final Project</td>
<td>3</td>
<td>26</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td>52</td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

**Assignment Submission Policy**

Assignments will be submitted for grading via Blackboard using the due dates specified in the Course Schedule below. And finally, it is important to note from the outset that: (1) late postings and assignments will be docked one letter grade and no grade will be given for postings or assignments turned in more than one week late; and (2) no written work will be accepted for grading after 5:00 p.m. PT on the last day of classes (see the Course Schedule section).

**Additional Policies**

**Communications** – All materials to be handed in will be submitted via Blackboard. This allows you to engage in reading and Reading Self Check Assignments individually. In the classroom, you will discuss your learnt
concepts and theory with your classmates and work with them to complete course assignments, exercises, and projects as the need arises.

In addition, I will send via email through Blackboard any notices that are time sensitive. Please be sure that you read as soon as possible all email sent from Blackboard or from me. Check now to make sure that mail sent from both the USC blackboard accounts and my private domain (katsuhio@usc.edu) does not go into your junk mail!

While I am usually online and will probably respond to emails from students relatively quickly, I will endeavor to respond to all email within 24 hours of receipt, aiming for no more than 72 hours delay. In the rare case when I expect to be offline for more than 72 hours, I will post an announcement on the Blackboard site. That said, 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.

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

<table>
<thead>
<tr>
<th>Week 1</th>
<th>Topics/Daily Activities</th>
<th>Readings and Homework</th>
<th>Deliverables/Due Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/22</td>
<td>Introduction</td>
<td><strong>NRC (2006) Learning to Think Spatially.</strong> Washington, DC: National Academies Press (Ch. 1: Introduction and Ch. 2: The Nature of Spatial Thinking) Resume Assignment Access GIST Server Assignment Discussion Forum 1 Reading Self Check Assignment 1 Reading Self Check Assignment 2</td>
<td>Submit Reading Self Check Assignment 1 no later than 5:00 p.m. on Tuesday, 8/23. Complete Discussion Forum 1 in class on Wednesday, 8/24. Submit Reading Self Check Assignment 2 and Resume Assignment no later than 5:00 p.m. on Thursday, 8/25. Complete Access GIST Server Assignments in class on Friday, 8/26.</td>
</tr>
</tbody>
</table>
Written Assignment 1 (Required)  
Price Chapter 1  
Discussion Forum 2  
Reading Self Check Assignment 3  
Reading Self Check Assignment 4 | Submit Reading Self Check Assignment 3 no later than 5:00 p.m. on Tuesday, 8/30.  
Complete Discussion Forum 2 and Written Assignment 1 in class on Wednesday, 8/31.  
Submit Reading Self Check Assignment 4 no later than 5:00 p.m. on Thursday, 9/1.  
Complete Price Chapter 1 in class on Friday, 9/2. |
| Week 3 9/5 | Spatial Primitive | **DeMers (2009)** *Fundamentals of Geographic Information Systems*, 4th edition, John Wiley & Sons, Inc. (Ch. 0: Spatial Learner’s Permit and Ch. 2: Basic Geographic Concepts)  
Price Chapter 2  
Discussion Forum 3  
Reading Self Check Assignment 5  
Reading Self Check Assignment 6 | Submit Reading Self Check Assignment 5 no later than 5:00 p.m. on Tuesday, 9/6.  
Complete Discussion Forum 3 in class on Wednesday, 9/7.  
Submit Reading Self Check Assignment 6 no later than 5:00 p.m. on Thursday, 9/8.  
Complete Price Chapter 2 in class on Friday, 9/9. |
Ch. 3: Geodesy, Projections, and Coordinate Systems  
Written Assignment 2 (Elective)  
Price Chapter 3  
Reading Self Check Assignment 7  
Reading Self Check Assignment 8 | Submit Reading Self Check Assignment 7 no later than 5:00 p.m. on Tuesday, 9/13.  
Submit Reading Self Check Assignment 8 no later than 5:00 p.m. on Thursday, 9/15.  
Complete Price Chapter 3 in class on Friday, 9/16. |
Price Chapter 4  
Final Project: Written Proposal  
Reading Self Check Assignment 9  
Reading Self Check Assignment 10 | Submit Written Assignment 2, Reading Self Check Assignment 9 and Written Proposal no later than 5:00 p.m. on Tuesday, 9/20.  
Submit Reading Self Check Assignment 10 no later than 5:00 p.m. on Thursday, 9/22.  
Complete Price Chapter 4 in class on Friday, 9/23. |
|---|---|---|---|
Geodesy Quiz  
Price Chapter 5  
Reading Self Check Assignment 11 | Submit Geodesy Quiz no later than 5:00 p.m. on Tuesday, 9/27.  
Submit Reading Self Check Assignment 11 no later than 5:00 p.m. on Thursday, 9/29.  
Complete Price Chapter 5 in class on Friday, 9/30. |
| Week 7 10/3 | GIST Domains | Duckham (2015) GI Expertise  
*Transactions in GIS* 19: 499-515  
Written Assignment 3 (Required)  
Price Chapter 6  
Reading Self Check Assignment 12  
Reading Self Check Assignment 13 | Submit Reading Self Check Assignment 12 no later than 5:00 p.m. on Tuesday, 10/4.  
Complete Written Assignment 3 in class on Wednesday, 10/5.  
Submit Reading Self Check Assignment 13 no later than 5:00 p.m. on Thursday, 10/6.  
Complete Price Chapter 6 in class on Friday, 10/7. |
**Written Assignment 4 (Required)**  
**Discussion Forum 4**  
**Reading Self Check Assignment 14** | Submit Reading Self Check Assignment 14 no later than 5:00 p.m. on Tuesday, 10/11.  
Complete Written Assignment 4 and Discussion Forum 4 in class on Wednesday, 10/12. |
|---|---|---|---|
**Wright et al. (1997)** Demystifying the persistent ambiguity of GIS as "tool" versus "science". *Annals of the Association of American Geographers* 87(2): 346-362  
**Written Assignment 5 (Elective)**  
**Price Chapter 8**  
**Discussion Forum 5**  
**Reading Self Check Assignment 15**  
**Reading Self Check Assignment 16** | Submit Reading Self Check Assignment 15 no later than 5:00 p.m. on Tuesday, 10/18.  
Complete Discussion Forum 5 in class on Wednesday, 10/19.  
Submit Reading Self Check Assignment 16 no later than 5:00 p.m. on Thursday, 10/20.  
Complete Price Chapter 8 in class on Friday, 10/21. |
Price (2015) *Mastering ArcGIS* (7th Ed.). New York, McGraw-Hill (Ch. 9: Spatial Join) | Submit Written Assignment 5, Price Chapter 8 and Reading Self Check Assignment 17 no later than 5:00 p.m. on Tuesday, 10/25.  
Submit Reading Self Check Assignment 18 no later than 5:00 p.m. on Thursday, 10/27.  
Complete Price Chapter 9 in class on Friday, 10/28. |
| --- | --- | --- | --- |
Price (2015) *Mastering ArcGIS* (7th Ed.). New York, McGraw-Hill (Ch. 10: Map Overlay and Geoprocessing) | Submit Written Assignment 6 and Reading Self Check Assignment 19 no later than 5:00 p.m. on Tuesday, 11/1.  
Submit Reading Self Check Assignment 20 no later than 5:00 p.m. on Thursday, 11/3.  
Complete Price Chapter 10 in class on Friday, 11/4. |
Price (2015) *Mastering ArcGIS* (7th Ed.). New York, McGraw-Hill (Ch. 11: Raster Analysis) | Submit Written Assignment 7 and Reading Self Check Assignment 21 no later than 5:00 p.m. on Tuesday, 11/8.  
Submit Reading Self Check Assignment 22 no later than 5:00 p.m. on Thursday, 11/9.  
Complete Price Chapter 11 in class on Friday, 11/8. |
Written Assignment 9 (Elective)  
Reading Self Check Assignment 23 | Submit Written Assignment 8 and Reading Self Check Assignment 23 no later than 5:00 p.m. on Tuesday, 11/15. |
|---|---|---|---|
Slocum et al. (2009) *Thematic Cartography and Geovisualization* (3rd Ed.). Pearson / Prentice-Hall. (Ch. 2: A Historical Perspective on Thematic Cartography)  
Written Assignment 10 (Elective)  
Reading Self Check Assignment 24 | Submit Written Assignment 9 and Reading Self Check Assignment 24 no later than 5:00 p.m. on Tuesday, 11/22. |
Discussion Forum 6  
Final Project: Final Report  
Reading Self Check Assignment 25 | Submit Written Assignment 10 and Reading Self Check Assignment 25 no later than 5:00 p.m. on Tuesday, 11/29.  
Complete Discussion Forum 6 in class on Wednesday, 11/30.  
Submit a final version of your final report no later than 5:00 p.m. on Friday, 12/2. |
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 Section 11, Behavior Violating University Standards https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions. 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.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the Office of Equity and Diversity http://equity.usc.edu or to the Department of Public Safety http://adminopsnet.usc.edu/department/department-public-safety. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. The Center for Women and Men http://www.usc.edu/student-affairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage http://sarc.usc.edu describes reporting options and other resources.

Support Systems
A number of USC’s schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the American Language Institute http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. The Office of Disability Services and Programs http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, USC Emergency Information http://emergency.usc.edu will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.