

LIS9721/9821 & CS9639: Information Visualization

Course Information

Number: LIS9721/LIS9821 & CS9639 (This is a cross-listed course)

Prerequisites: None

Term: Fall 2023

Time: Mondays, 1:30pm to 4:20pm

Instructor

Name: Dr. Kamran Sedig

Course Description

One of the most important things in information science is figuring out how to represent data to help people access it and work with it. Information can be represented in different ways. In the past, text was the main method of representing information. That has changed. New visual techniques have been developed for encoding and communicating all kinds of data. Information visualization is the study of how to create interactive visual representations of data. These interactive representations are intended to help people make sense of large amounts of data, discover their underlying patterns, and use data to perform higher-order tasks (e.g., decision making and planning). Because of its novel concepts and techniques, information visualization holds much promise in improving the usability of all kinds of information technologies.

In this course, we will study what information visualization is, how information/data can be represented and presented, how to interact with information to perform tasks, what the applications of information visualization are, how humans process visual information, how people navigate information spaces, and what activities and environments can benefit from information visualization techniques. Information visualization has applications in library and information science, health sciences, computer science, digital humanities, journalism, history, and media studies—to name a few—(examples include: social networks, text visualization, search engines, business analysis, digital libraries, digital games, learning tools, geographic visualization tools, health analytics, scientific discovery, data journalism, data analytics tools, and decision support tools). Students can also apply what they learn in this course to usability design of web sites, as well as human-computer interaction.

This is primarily a *design-oriented course* and is very open and flexible. *You do not need to have any specific technical background to take this course.* However, you need to have some general knowledge of data and computers (e.g., databases, information systems). We will refer to these in the course of our study of information visualization. Additionally, you should be comfortable with a course that has an interdisciplinary approach. Who will benefit from this course? If you are interested to know how to present massive amounts of data and understand how to design information systems that allow people to perform intensive data-driven tasks and activities, you will benefit from this course greatly.

Course Objectives

- Learn the principles and key concepts involved in information visualization
- Learn a variety of existing techniques and systems in information visualization
- Become familiarized with some of the literature in the area
- Become prepared, if desired, to pursue a Ph.D. or future research in the area
- Gain a background that will aid in the design of new, innovative visualizations
- Learn how to design and evaluate different types of visually-based information systems and interfaces

Structure and Method of Evaluation

This course is based on the experiential learning model. It will have both a theoretical component as well as a practical component. The theoretical component will include notes, videos, and readings whereby students learn concepts, principles, and techniques. The practical component will include design practices, as well as a term-long project through which students apply the concepts and principles and get to reflect on their own and other people's practice. In the practical component, students will get to design different information visualization elements. Study materials will provide students with the foundation to work on their designs and projects. Students are expected to study and understand the theoretical principles and concepts carefully. The project and design practices provide opportunities to see how theoretical concepts have practical applications. Another component, system slideshow, will deepen this understanding by allowing reflection on other systems and tools and how they have been designed. This is a participatory course. You are expected to attend all classes, be on time, study course notes and reading materials every week, and engage and participate in class discussions and presentations. Finally, the experiential learning model requires a reflective practice—that is, students will write a reflective report on the evolution of their understanding of the studied materials and the class discussions and presentations.

Study Materials

There are **four materials** that every student in the course must study. You DO NOT need to buy M1, M2 & M3.

1. **(M1)** Sedig, K (2023). Course notes/slides. (Available online through OWL)
2. **(M2)** Sedig, K & Parsons, P (2016). *Design of visualizations for human-information interaction: A pattern-based framework*. Synthesis Lectures on Visualization. Morgan & Claypool Publishers. (available as eBook through Western Library)
3. **(M3)** Sedig, K & Parsons, P (2013). Interaction design for complex cognitive activities with visual representations: A pattern-based approach. *AIS Transactions on Human-Computer Interaction*, 5 (2):84–133. (Available online: <http://aisel.aisnet.org/thci/vol5/iss2/1/>)
4. **(M4)** Meirelles, I (2013). *Design for information*. Rockport. (available through Amazon.ca--Paperback or Kindle)

Method of Evaluation

Your final mark will be based on 6 components (see **Course Schedule** section).

1. **Summaries (10%)**: Ten short summaries of the study materials
2. **Design Practice (14%)**: Two design practices
3. **System Slideshow (12%)**: Research, identification, and comparison of two recently developed visualization systems
4. **Project (30%)**: A team-based project to design a visualization system to solve a real-world problem
5. **Participation (24%)**: Regular, informed participation in class discussions
6. **Reflection Report (10%)**: A report on the evolution of your understanding of the course materials

Marking scheme for each and every component and element of the course

Your mark will be based on a Likert scale, as follows:

1.Extremely good: quality of work is exceptional; demonstrates great depth and breadth of understanding; there are absolutely no flaws in the work; beyond the call of duty.	100%
2.Very good: quality of work is very good; almost no flaws; demonstrates very good understanding.	90%
3.Good: quality of work is good; there are some aspects of the work which can improve.	80%
4.Acceptable: quality of work is acceptable or fair; not much thought has been put into some parts.	70%
5.Poor: quality of work is not acceptable; poorly based on any materials studied in the course.	60%
6.Very poor: component is very poorly done; many flaws; not based on materials studied in the course.	50%
7.Not delivered: component not completed.	0%

Course Website

Students should check OWL (<http://owl.uwo.ca>) on a regular basis for news and updates. This is the primary method by which 1) information will be disseminated to all students in the class, 2) assignments will be submitted, and 3) all email communications will take place. Students are responsible for checking OWL on a regular basis.

Summaries (S)

Course notes (M1 - PDF PowerPoint slides) provide an overall formal framework for an understanding the course materials. The first few weeks of the course will cover a *great deal of material* to prepare you for working on your projects. The notes are shared with you through the OWL system. You need to study them carefully, as they provide you with the fundamental information visualization concepts you need to know to do well in the course. You also have weekly study materials from M2, M3, and M4 (see **Study Materials**). A thorough and deep understanding of the readings is essential if you want to do well in your projects and the course. These readings will help you contribute to and participate in class discussions knowledgeably and effectively. Additionally, keeping up with the readings is critical to how well you will do on your projects. To help you keep up with the reading materials, you are required to submit a *two-page summary* of the assigned study materials every week (see **Course Schedule**). This summary should *highlight and present the main issues or concepts* discussed in the readings. You can do these summaries in whatever manner you think helps you understand the concepts. Those who do not submit their summaries will receive a zero mark for that reading summary. Those who submit their summaries will receive a full mark. These summaries *will not be returned* to you. You can calculate your mark for this component based on the number of summaries that you submit.

Design Practice (DP)

To help you apply the concepts and principles and reflect on design principles and techniques, you will work on two design practices. In this assignment, you will have to demonstrate a deep understanding of the studied materials when conceptualizing and analyzing design scenarios. To do well on these, students should have kept up with and studied the readings and course notes carefully.

You will be given a design problem. You will create one or more visualizations, interactions, and/or systems, or analyze and design tasks. You will do some hand-drawn or digital designs and generate a set of slides for a random in-class presentation to occur using PowerPoint. This presentation will cover two parts: First, you will present an analysis of the assigned problem. Second, you will

present a fast prototype which provides your solution to the design problem. You will need to justify your decisions—i.e., how and why of your design during this presentation. Make sure to have drawing tools (e.g., paper and pencil) and digitizing tools (e.g., a camera) so that you can share your designs. One or more individuals, depending on how much time we have, will be randomly selected to present their design in allotted time slots.

Breakdown of the Design Practice marks (adds up to 7% * 2).

- | | |
|---|----|
| • Analysis and understanding of the design problem | 2% |
| • Incorporation of concepts, principles, and techniques covered in the course | 2% |
| • Correctness of the solution and/or design | 2% |
| • Quality of PowerPoint presentation | 1% |

System Slideshow (SS)

To develop a better understanding of information visualization, its systems/tools, and its techniques, you will *research, find, and create* a slideshow of two *similar-in-purpose* information visualization systems that embody some of the concepts and techniques that you have studied in the course. The two systems you find must not be from the readings, nor the course notes. This assignment requires some research and investigation. This will help you reflect on different information visualization systems and how other people would design them. Prepare a PowerPoint slideshow of the selected information visualization systems.

Breakdown of the System Slideshow marks (adds up to 12%).

- | | |
|---|----|
| • Demonstrating the functionality of the systems
You can do this by either embedding videos of functionality or screen shots with recorded audio | 3% |
| • Describing the activities and tasks supported by the systems | 2% |
| • Analyzing the systems in terms of the main themes of the course (e.g., patterns, techniques, ...) | 3% |
| • Contrasting the features & techniques of the systems | 1% |
| • Novelty and complexity of the systems | 2% |
| • Coherence of the presentation & quality of the slides (no dark and/or black slides) | 1% |

Project (PR)

This component of the course is structured to make you gain experience in designing new visualization systems by applying the theoretical concepts learnt in the course to solve a concrete problem. We will form a few teams, made of several people. Each team will select a problem. Each team will try to solve a problem by designing a visualization system using the concepts, techniques, and strategies studied in the course. The design does not need to be implemented, but *your design should contain enough detail to allow another independent group to implement it. Remember: the selection of your project should be problem-driven.*

Teams: There will be a few teams, each consisting of 4 to 6 people. Each team will decide on their own what problem to solve. Teams will be created in the first two weeks of the course. Each team will be assigned a number. Once teams are formed, there will be no movement of students from one team to another. If a student drops the course, that student’s team will continue to exist, minus one member. In this event, the other members should talk to the instructor if they think they need to re-adjust the scope of their project. Final project presentations are according to team numbers. That is, Team 1 will present first, Team 2 will present next, and so on.

Team Profile: In this component, you will provide a list of the members of the team and a brief description of their academic and professional backgrounds.

Initial Proposal: You will *identify a problem* (not a solution or technique) that exists out there that you want to solve. An example of a problem is: People have difficulty making sense of stock market fluctuations; you decide to design an information visualization system that helps support people in this activity, along with all its attendant tasks. In the proposal, you will provide an executive summary of the problem (search online to find good examples of executive summaries), analyze the domain of the application (e.g., finance, health, libraries, social, sports, ...), specify the scope (i.e., the extent and size of the problem) of what you are trying to do, analyze the information space with which you will be working (this can be real data or made-up data), and discuss the activities and tasks that your system will support. *This is a very important stage of your project and needs to be inspired by an in-depth study of the course materials.* You need to discuss this part of the project carefully as a team for several weeks. *Remember: Your understanding of the problem, its depth and breadth, as well as how to solve it through a concepts and principles of this course will evolve gradually. Do not try to come up with a solution when you select your problem.*

Final Interactive Prototype: Instead of creating an actual, implemented visualization system, you will create an interactive PowerPoint look-alike system. This prototype looks and behaves similar to an actual implemented system. However, it is not really processing any data in the background and involves no programming. This prototype will have high-fidelity visualizations, simulated interactive buttons, navigation from one screen to another, and so on, all simulating how a real tool would look like and work.

Remember: the more thoroughly you have considered the concepts and techniques in the course, the better your design will be. Since the purpose of the project is for you to learn how to apply the design concepts you learn, *the more visualization and interaction techniques and strategies you incorporate in your design, the higher your mark will be.*

Final Report: The purpose of this final report is to help me understand your project. It has three main parts: a brief executive summary, an itemized list of components of the system, and a flow diagram of your system. Your executive summary should be no more than 300 words. The flow diagram of your system is a kind of navigation map or storyboard that helps me know how different

visualizations, screens, and interactions are related and how one moves through your system--that is, what is what, what is where, and how to get from one element to another. Finally, the itemized list will provide a listing of all the pattern blendings, techniques, strategies, and so on that you have used in your system, their purpose, and why.

Final Project Presentation: You should not be stressed over this presentation, as *it will be very informal*. To make it easier for yourselves, this presentation should be based on your final design and report. This will be a maximum 15-minute PowerPoint presentation (presentation + questions and discussion). The main purpose of this presentation is to share with your classmates what you have done and why. For the benefit of your classmates, you will describe the evolution of the design: your motivation for choosing the project, your design, etc. Everyone is encouraged to ask questions from the team. Presenting teams are encouraged to bring sweets and share them with your classmates to celebrate the completion of their projects.

Peer Evaluation: During the course of the project, you will have to keep track of your team-mates or peers in terms of how cooperative they are, how much effort they put into the project, whether they attend your meetings, and so on. If several people in the team report that a student has not contributed to the project, then I will ask them to evaluate that student. The project mark of students whose peer evaluation is *below 80%* will be adjusted to reflect their lack of participation in the project. That is, someone who gets 70% on peer evaluation will receive 70% of the total project mark for the group. Each student should get *at least 50%* on this component of the project to pass the course. **NOTE:** Students who fail on their peer evaluation will automatically fail the course, unless, based on justifiable reasons provided by the student, the instructor judges otherwise.

Breakdown of the Project marks (adds up to **30%**). Please pay careful attention to the distribution of the marks:

Component	Mark
Team profile	
Proposal	5%
<i>Executive summary of the problem</i>	<i>(1)</i>
<i>Domain of application & scope of the problem</i>	<i>(1)</i>
<i>Analysis of information space + data-driven activities/tasks to be supported</i>	<i>(3)</i>
Final interactive (PowerPoint) prototype	20%
<i>Logical consistency, interconnectedness of components, and task flow</i>	<i>(2)</i>
<i>Number, diversity, and suitability of visualizations</i>	<i>(5)</i>
<i>Novelty (or pattern blending) of visualizations</i>	<i>(3)</i>
<i>Number, diversity, and suitability of interactions & tasks</i>	<i>(3)</i>
<i>Interactivity of system--i.e., user-system fit and coupling</i>	<i>(2)</i>
<i>Number, diversity, and suitability of presentation techniques</i>	<i>(3)</i>
<i>Visual encodings/marks/variables</i>	<i>(2)</i>
Brief final report	3%
<i>Executive summary of the design</i>	<i>(1)</i>
<i>Flow diagram (like storyboard) of the system and explanation of how to navigate it</i>	<i>(1)</i>
<i>Catalogue of visualization, interaction, and presentation techniques in your system</i>	<i>(1)</i>
Informal presentation of the design	2%
Peer evaluation	

Participation

You are expected to attend classes and keep up with course notes and readings. You must study all suggested readings in order to engage in class discussions and presentations. *Class hours will be used to discuss your questions about the course notes*. Your participation mark will depend on your *thoughtful, intelligent, informative, critical, and regular* questions, answers, ideas, and contributions to class discussions. This means that you have to keep up with and study the assigned readings carefully, systematically, and critically. When asked questions in the class, you should give well-considered answers based on the materials being studied in the course. You should generate discussions in the class, pose questions, answer questions, bring new ideas to class, etc. In other words, you should fully participate in the course and not be a passive observer. **NOTE:** *You should be in class at least 5 minutes before we start*. Late arrival is a sign of disrespect to others and will affect your final participation mark.

Reflections Report (RR)

In this component of the course, you write your reflections (both analysis and synthesis) about all the study materials and discussions in the course: your initial conception of ideas, what you learned as we went through the different topics and discussions, how your understanding evolved through the course, how you think IV impacts information science, what the future holds, challenges ahead, and the like. This will be a 1500-word (max. 1600-word) report. You should include your word count on the cover sheet of the report. It may help if you keep a running diary during the course.

Breakdown of the Reflection Report marks (adds up to **10%**):

- Analysis of the studied materials and concepts 3%
- Synthesis and relationship of all concepts 2%
- Reflections about past, future, trends, speculations, etc. 2%
- Logical flow and connectedness of ideas throughout the report 1%
- Quality of writing, grammar, and punctuation 1%
- Organization (including division of concepts, headings, sub-headings, etc.) 1%

Course Schedule

The table below contains the schedule of this course. To do well in this course, you are required to comprehend the study materials and be able to apply them intelligently to your designs. These materials contain references to hundreds of other articles which, should you wish, you can read for further insight (see their reference sections). It is *imperative that you keep up with the following schedule*. M1, M2, M3, and M4 refer to the readings (see **Study Materials** section).

Class Date ¹	Week#	Study Notes#	Summaries due	DP, SS, & PR
9/11	Week1: 9/11-17	M1.1	M2.1 & M2.2	
9/18	Week2: 9/18-24	M1.2	M2.3	PR formations
9/25	Week3: 9/25-10/1	M1.3	M2.4 & M2.5	
10/2	Week4: 10/2-15	M1.4	M3	
10/16	Week5: 10/16-22	M1.5	M2.6 & M2.7	PR proposals due
10/23	Week6: 10/23-29	M1.6	M2.8 & M2.9	DP#1 due; DP#1 random presentations
10/30	Week7: 10/30-11/5		M4.Intro & M4.1	SS due; SS presentations
11/6	Week8: 11/6-12		M4.2 & M4.3	SS presentations
11/13	Week9: 11/13-19		M4.4, M4.5	DP#2 due; DP#2 random presentations
11/20	Week10: 11/20-26		M4.6	
11/27	Week11: 11/27-12/3			
12/4	Week12: 12/4-10	M1.7		PR presentations
12/11				PR presentations; PR final reports & prototypes due; RR due

Assignments

All submissions will be through your OWL Drop Box. *All assignments must be submitted by 11:59pm of the night before the class date when they are due.* Each submission should include a cover sheet. The cover sheet must include the following: heading (e.g., Project Proposal), title (e.g., name of assignment), course number, date, and *alphabetical* list of names (last name, first name) of all students in the team. Make sure you do NOT include your ID numbers. *The second page/slide of all submissions should include a blank page where I will record my mark.* The file names should follow the following protocol:

Summaries: Under your Drop Box, you should *create a folder called "SUM"* and drop your summaries there--S1, S2, S3,

Design Practice Design: Under the Drop Box, you should *create a folder called "DP"* and drop your design studio PowerPoint slides there. Use this naming convention: LASTNAME_FIRSTNAME_DP#.pptx (e.g., Smith_Joe_DP1 & Smith_Joe_DP2).

System Slideshows: Under your Drop Box, you should *create a folder called "SS"* and drop your slideshow there. Use this naming convention: LASTNAME_FIRSTNAME_SS.pptx (e.g., Smith_Joe_SS).

Reflection Reports: Under your Drop Box, you should *create a folder called "RR"* and drop your slideshow there. Use this naming convention: LASTNAME_FIRSTNAME_RR.pptx (e.g., Smith_Joe_RR).

Projects: Under the Drop Box of one of your group members, you should *create a folder called "Project"* and drop your project components there. Only one person from your group will upload all the components of your project. Since there are several components to the project and there are groups, you should name your files as: PTP_# (e.g., PTP_3, for Project Team Profile, Group #3), PIP_# (e.g., PIP_4, for Project Initial Proposal, Group #4), PFIP_# (Project Final Interactive Prototype, PFR_#, and PFPP_#). Your group should send me a message through the message system to let me know under whose Drop Box your project components are placed.

If the above naming format is not followed, your assignment will be discarded. Please make sure that whoever uploads the files follows the above naming scheme. There will be a deduction of 10% per day for late assignments.

¹ Class time will be for discussion of studied materials. NOTE: There is no class on October 9.

Email Policy

*All course-related emails should come from OWL's Messages system. No emails from other accounts will be read or accepted. Also, any email you send should have a specific subject title in the subject line: e.g., Project Initial Proposal or Question re RR. Otherwise, you may not receive a reply. If you do send me an email, I generally answer within 5 days, depending on the volume of emails I have received during that week. However, I always try my best to reply to your emails as soon as I can. *Please do not expect replies to emails during weekends.**

Academic Offences

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_grad.pdf

Support Services

Students who are in emotional/mental distress should refer to Mental Health@Western

<http://www.uwo.ca/uwocom/mentalhealth/> for a complete list of options about how to obtain help.

Accessibility

Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.