

LIS9721/9821 & CS9639: Information Visualization

Course Information

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

Prerequisites: None

Term: Winter 2021

Meeting Place: Zoom

Time: Mondays, 9:30am to 11:30am (Zoom)

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, use it, and work with it. Information can be represented in different ways. In the past, text has been the main method for encoding information. That is changing. Researchers are developing techniques for encoding and communicating all kinds of data visually (i.e., graphically). Indeed, humans grasp visual information much faster than textual information. Information visualization is the study of how to represent data/information in a visual form to help people perceive its shape, make sense of its elements and their properties, discover its underlying patterns and trends, and be able to access it and use it to perform higher-order tasks such as decision making and planning. Information can be visually displayed on paper or other static media. However, as computers have become more powerful, researchers have discovered that not only information need not always be represented textually, but also it does not always need to be presented in a static form. Indeed, massive amounts of data can be represented visually and dynamically. Computer-based information visualizations can create a coupling between the human mind and interactive, dynamic information. Well-designed information visualization tools allow people to access and interact with and make sense of large amounts of information. Because of its novel concepts and techniques, information visualization holds much promise in improving the interface and utility of financial tools, scientific tools, search tools, web sites, and other similar information tools and interfaces.

In this course, we will study what information visualization is, how information/data can be presented visually, 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 information science, 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 usability design of web sites, as well as human-computer interaction. This is primarily a **design 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 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

Reading Materials

There are **three required readings** that every student in the course must study. You DO NOT need to buy R1 & R2.

1. **(R1)** 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)
2. **(R2)** 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/>)
3. **(R3)** Meirelles, I (2013). *Design for information*. Rockport. (available through Amazon.ca--Paperback or Kindle)

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 in-class 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 work in teams. Teams will get to design different information visualization elements. Assigned readings as well as notes 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 studios 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.

Method of Evaluation

Your final mark will be based on 5 components, following the course schedule in the following section.

1. **Summaries (8%)**: You will submit 8 short summaries of the reading materials.
2. **Practice Design Studios (16%)**: You will do 4 in-class practice design studios.
3. **System Slideshow (18%)**: You will research, identify, and create a slideshow presentation of two recently developed IV systems.
4. **Project (36%)**: You will do a design project to learn how to apply the concepts and techniques that you learn in the course to solve a real-world problem. You choose your own problem and work in a team comprised of 4 to 6 people, depending on the number of students registered in the course.
5. **Participation (22%)**: You are expected to attend all classes, be on time, study course slides and reading materials every week, and engage and participate in class discussions and presentations. 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.

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.

Course Notes (CN)

The first portion of the course is comprised of course notes (PDF PowerPoint slides). Course notes 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.

Summaries (S)

You have weekly readings from R1, R2, & R3 (see **Reading 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 **one-page summary** of the assigned readings 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.

Practice Design Studios (PDS)

To help you apply the concepts and principles and get to reflect on design principles and techniques, you will work in randomly assigned teams to do 4 in-class design practices (see **Course Schedule**). In these studios, you will have to demonstrate a deep understanding of the studied materials when conceptualizing and analyzing design scenarios. For these studios, all members of the team should have kept up with and studied the readings and course notes carefully and be able to participate in group activities.

You will be given a design problem. As a group, you will create one or more visualizations, interactions, and/or systems, or analyze and design tasks. As a group, you will do some hand-drawn or digital designs and generate a set of slides for a presentation to occur at the end of the lecture time 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 with one another through Zoom. One of the PDS groups, randomly selected, will present their design at the end of each the session.

Marks for this component will follow the general marking scheme (see above) and will be based on at least the following criteria:

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

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.

Marks for this component will follow the general marking scheme (see above) and will be based on at least the following criteria:

- | | |
|---|----|
| • Demonstrating the functionality of the systems | |
| You can do this by either embedding videos of functionality or screen shots with recorded audio | 4% |
| • 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, ...) | 4% |
| • Contrasting the features & techniques of the systems | 4% |
| • Novelty and complexity of the systems | 3% |
| • Coherence of the presentation & quality of the slides (no dark and black slides) | 1% |

Project (P)

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, ...), 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 readings and course notes.* 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. **Please 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 **36%**). Please pay careful attention to the distribution of the marks:

Component	Value
Team profile	1%
Proposal	5%
<i>Executive summary of the problem</i>	(1)
<i>Domain of application & scope of the problem</i>	(1)
<i>Analysis of information space + data-driven activities/tasks to be supported</i>	(3)
Final interactive (PowerPoint) prototype	22%
<i>Logical consistency, interconnectedness of components, and task flow</i>	(2)
<i>Number, diversity, and suitability of visualizations</i>	(5)
<i>Novelty (or pattern blending) of visualizations</i>	(3)
<i>Number, diversity, and suitability of interactions & tasks</i>	(4)
<i>Interactivity of system--i.e., user-system fit and coupling</i>	(2)
<i>Number, diversity, and suitability of presentation techniques</i>	(4)
<i>Visual encodings/marks/variables</i>	(2)
Brief final report	5%
<i>Executive summary of the design</i>	(1)
<i>Flow diagram (like storyboard) of the system and explanation of how to navigate it</i>	(2)
<i>Catalogue of visualization, interaction, and presentation techniques in your system</i>	(2)
Informal presentation of the design	3%
Peer evaluation	

Participation

Not only are you supposed to attend classes, but also you are expected to keep up with course notes and readings. You must study all suggested readings in order to engage in class discussions and presentations. Your participation mark will depend on your *intelligent, informative, critical, and regular* participation in class discussions. 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 log into Zoom at least 5 minutes before we start.* Late arrival is a sign of disrespect to others and will affect your final participation mark.

Course Schedule

The table below contains the schedule of the course slides, reading summaries, practice design studios, system slideshows, and project components in this course. To do well in this course, you are required to comprehend the course notes and readings and be able to apply them intelligently to your designs. These readings 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**. R1, R2, and R3 refer to the Reading Materials.

Date	Course Notes #	Summaries	Practice Design Studio #	Projects & System Slideshows
1/11	1			
1/18	2	R1: 1, 2, 3		Project team formations
1/25	3	R1: 4, 5		
2/1	4	R2	1	
2/8	5	R1: 6, 7		Project proposals due
2/15				
2/22	6	R1: 8, 9	2	
3/1		R3: Intro, 1	3	System Slideshows due
3/8		R3: 2, 3		
3/15		R3: 4, 5, 6	4	
3/22				

3/29	7			Project presentations: 1, 2, 3
4/5				Project presentations: 4, 5, 6, 7 Project final reports and prototypes due

Assignment Submissions

All submissions will be through your OWL Drop Box.

Each submission should include a cover sheet which includes: heading (e.g., Project Proposal), title (e.g., name of assignment), course number, date, and **alphabetical** list of names (Last, First) 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 "Summaries" and drop your summaries there--S1, S2, S3, ..., S8.

Practice Design Studios

Under the Drop Box of one of your group members, you should create a folder called "PDS" and drop your design studio PowerPoint slides there. Since there are 4 design studios and there are groups, you should name your files as: PDS1_# (e.g., PDS1_3, for Practice Design Studio #1, Group #3), PDS2_#, PDS3_#, and PDS4_#. Your group should send me a message through the message system to let me know under whose Drop Box your PDS is placed.

System Slideshows

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

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.

Late Assignments

There will be a deduction of 10% per day for late assignments.

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 "<subject>" in the subject line (e.g., **Project Initial Proposal**). 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.