# LIS9721/9821 & CS9639: Information Visualization

## Course Information

Number: LIS9721/LIS9821 & CS9639 (This is a cross-listed course)
Term: Winter 2019
Location: MC 320
Lectures: Mondays, 9:00am to 11:55am

## Instructor

Name: Dr. Kamran Sedig
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Bio: I have a joint position between Computer Science and Faculty of Information and Media Studies. My research is quite interdisciplinary, dealing with such areas as information science, human-data interaction, visualization, health informatics, visual data analytics, big data, knowledge work, cognitive technologies, interface design, information systems, and digital games.

## 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 large amounts of information to make sense of it. Because of its novel concepts and techniques, information visualization holds much promise in improving the interface and utility of digital libraries, 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. All students will benefit from taking this course, particularly those who are interested in learning about the role of new technology when trying to creatively solve problems and challenges in dealing with the massive volumes of existing data.

## 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 any of these.

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**) Spence, R (2013, 3rd ed.) *Information visualization: An introduction*. Springer. (available as eBook through Western Library)
3. (**R3**) 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/)

## 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 lectures and readings whereby students learn concepts, principles, and techniques. The practical component will include in-class design practices and 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 class lectures 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. Two other components, tool presentations and case study presentations, will deepen this understanding by allowing reflection on other tools and how they have been designed.

## Method of Evaluation

Your final mark will be based on 6 components, following the course schedule in the following section.

1. **Summaries (8%):** You will submit 8 short summaries of the reading materials.
2. **Design Studios (20%):** You will do 4 in-class design practices.
3. **Tool Presentation (8%):** You will find and present a recently developed IV tool.
4. **Case Study Presentation (10%):** You will study and present a design case study from the assigned readings.
5. **Project (34%)**: 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.
6. **Participation (20%)**: You are expected to attend classes, be on time, study lecture notes, engage in class presentations, and participate in class discussions and presentations. Your participation mark will depend on your *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; there are absolutely no flaws in the work. | 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 information will be disseminated to all students in the class, and by which assignments will be submitted. Students are responsible for checking OWL on a regular basis.

## Lectures (LEC)

The first portion of the course is comprised of lectures. Lectures will 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. Lecture notes will be shared with you after each class. You need to study them carefully, as they provide you with the fundamental information visualization concepts you need to know.

## Summaries (SUM)

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.

## Design Studios (DS)

To help apply the concepts and principles and get to reflect on design principles and techniques, you will work in small 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 studied the readings and lecture notes carefully and be able to participate in group activities.

For this component, you will work in a randomly assigned group. You will be given a design problem. As a group, you will create one or more visualizations, interactions, and/or tools, or analyze and design tasks. You will do some hand-drawn 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 design problem. Secondly, you will present a fast prototype which provides your solution to the design problem. You need to justify your decisions as how and why of your design during this presentation. Make sure to have computers that have display (VGA) ports or bring an adapter.

*Marks for this component of the course will be based on the following criteria:*

- Analysis of the problem: **1%**
- Correctness of the solution/design: **3%**
- Quality of PowerPoint presentation: **1%**

## Tool Presentation (TP)

To develop a better understanding of information visualization, its tools, and its techniques, you (either individually or in teams) will research, find, and demo/show a recently developed information visualization tool that embodies some of the concepts and techniques that you have studied in the course. There will be a total of 12 of these presentations (see **Course Schedule**).

*Marks for this component of the course will be based on the following criteria:*

- Presentation of the tool that embodies the studied concepts and techniques: **4%**
- Oral clarity, preparedness, and delivery as well as handling of questions: **2%**
- Quality of PowerPoint presentation: **1%**
- Timing (pacing of the presentation to finish on time): **1%**

At least 24 hours before each presentation, the presenting team must upload their PowerPoint presentation in OWL.

## Case Study Presentation (CSP)

In this component of the course, to help deepen your understanding, you will study and present a design case study from the assigned readings. This will help you reflect on different tools and how other people would design them. There will be a total of 8 of these presentations (see **Course Schedule**).

*Marks for this component of the course will be based on the following criteria:*

- Degree of understanding of the material: **4%**
- Quality of facilitation of class discussions and engaging others in the discussions: **2%**
- Oral clarity, preparedness, and delivery as well as handling of questions: **2%**
- Quality of PowerPoint presentation: **1%**
- Timing (pacing of the presentation to finish on time): **1%**

## Project

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 a concrete problem. In consultation with me, you will form teams of several people. Each team will select a problem. You will try to solve this problem by designing an 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, depending on the number of registered students. Each team will decide what project to do in consultation with me. Teams will be created in the first two weeks of the course. Each team will be assigned a number. Once project 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.

**Scope**

In order to make these projects realistic, the problem your team identifies will, most probably, be too large to solve in its entirety; therefore, your team will not be able to address all its aspects before the end of the term. One of your first tasks, and the major purpose of the proposal, is to identify the key problem and its features, and what it is that you want to solve through your design. Your team will need to figure out what the major issues are that you want to solve and narrow the scope of the project. However, you should be aware that you will not get this right the first time. Your understanding of the depth and breadth of the problem will evolve.

**Team profile and proposal**

In this component, you will provide a list of the members of the team and a brief description of their backgrounds. Furthermore, you will **identify a problem** (not a solution or technique) that exists out there and that you want to solve. The proposal is a brief document that describes the problem you have identified to solve, and why you think this problem is worth solving. In order to develop your proposal, do some brainstorming to identify an existing problem. Problems can be from any domain. Generate a list of issues that you think users would want addressed. Only one person from your group will upload this file. The file will have the following name: ProjectProposal_Team# (e.g., ProjectProposal_Team#3). If this naming format is not followed, your file will be discarded.

**Midway report**

In this component, you will expand your proposal, decide what the scope of your project is, and identify the tasks and activities that your system should support. *This is a very important stage of your project and needs to be inspired by an in-depth study of the readings and lecture notes*. Only one person from your group will upload this file. The file will have the following name: MidwayReport_Team#. If this naming format is not followed, your file will be discarded.

**Final 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 tool. However, it is not really processing any data in the background and involves no programming. This prototype will have high-fidelity visualizations, interactive buttons, navigation from one screen to another, and so on, all simulating how an implemented 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. Only one person from your group will upload this file. The file will have the following name: FinalPrototype_Team#. If this naming format is not followed, your file will be discarded.

**Final report**

The purpose of this report is to help me understand your project. It has three main parts: an executive summary, a roadmap of your system, and an itemized list of components of the system. Your executive summary should be no more than 300 words. The roadmap of your system is a kind of navigation map or storyboard that helps me know what is what, what is where, and how to get from what to what and where to where. Finally, the itemized list will provide a listing of all the patterns, blendings, techniques, strategies, and so on that you have used in your system, their purpose, and why. Only one person from your group will upload this file. The file will have the following name: FinalReport_Team#. If this naming format is not followed, your file will be discarded.

**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 20-minute long 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. Only one person from your group will upload this file. The file will have the following name: FinalPresentation_Team#. If this naming format is not followed, your file will be discarded.

**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.

**Best project**

On the last day of classes, we will vote for the best project. The team that wins will get a 2% bonus mark. Each individual will rank projects, except for their own. The project with the highest score wins.

Breakdown of the project marks (adds up to **34% + 2% bonus**):

| **Component** | **Value** |
|---|---|
| Team profile and high-level problem proposal | **1%** |
| Midway report | **6%** |
| *Executive summary* | *(1)* |
| *Domain of application & scope of problem* | *(1)* |
| *Analysis of information space + breakdown of supported activities/tasks + justifications* | *(4)* |
| Final interactive PowerPoint prototype | **19%** |
| *Degree of complexity of the design* | *(2)* |
| *Number and diversity of visualizations* | *(7)* |
| *Number and diversity of interactions and interactivity of system* | *(6)* |
| *Visual encodings/marks/variables* | *(2)* |
| *Novelty and innovation of the design* | *(2)* |
| Final report | **5%** |
| *Executive summary* | *(1)* |
| *Roadmap (like storyboard) of the system and explanations of how to navigate the visuals* | *(2)* |
| *Breakdown and list of all patterns, pattern blendings, visualizations, encodings, interactions, etc. used in the system & their locations in the system* | *(2)* |
| Informal presentation | **3%** |
| Peer evaluation | |
| Best project (Bonus mark) | **2%** |

## Participation

Not only are you supposed to attend lectures, but also you are expected to keep up with lecture notes. 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. **Additionally**, computers during lectures should *only* be used for the purpose of note taking. Checking of one's email, chatting with friends, browsing websites on the Internet, and similar activities will result in deduction of the participation mark. Additionally, the use of other electronic devices (e.g., cell phones) is not allowed during lectures. **NOTE**: *You are to arrive to class at least 5 minutes before we start*. Late arrival is a sign of disrespect to others and will affect your final participation mark.

## Assignment Submissions

Each submission should include a cover sheet which includes: heading (e.g., Project Proposal), title (e.g., name of your project), 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. All submissions are also to include a blank page where I will record my mark. You will give me all your submissions in electronic form through the OWL system and will receive them back through the OWL system. Your submission should be made

through your dropbox in OWL. The file names should follow the following protocol: SUBMISSION_LASTNAME_FIRSTNAME (e.g., Summary#1_Smith_Joe.pdf). If the submission is from a certain team, then only ONE submission by one of the team members is enough; however, you need to send an email for me to know where it is. The file names for such assignments should follow the general protocol: SUBMISSION_Team# (e.g., ProjectProposal_Team3).

## Late Assignments

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

## Email Policy

**All course-related emails should come from OWL**. **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 Proposal**). Otherwise, you may not receive a reply. Make sure to check-mark the "Send a copy of this message to recipients' email address(es)" when you send me an email. 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.

## Course Schedule

The table below contains the schedule of the lectures, reading summariess, design studios, tool presentations, and project components in this course. To do well in this course, you are required to comprehend the 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 refer to the Reading Materials. DS refers to Design Studios, TP refers to Tool Presentations, and CSP refers to Case Study Presentations.

| Date | Activity |
|---|---|
| Jan. 8 | LEC#1 |
| Jan. 15 | LEC#2; [SUM#1 (R2: 1, 2)] |
| Jan. 22 | LEC#3; [SUM#2 (R1: 1, 2, & 3)]; Project proposals due |
| Jan. 29 | LEC#4; [SUM#3 (R2: 3)] |
| Feb. 5 | LEC#5; [SUM#4 (R1: 4 & 5)] |
| Feb. 12 | DS#1; TP#1; TP#2; TP#3; [SUM#5 (R1: 6 & 7; R2: 6)] |
| Feb. 19 | (none) Reading week |
| Feb. 26 | DS#2; TP#4; TP#5; TP#6; [SUM#6 (R3)]; Project midway reports due |
| Mar. 5 | DS#3; TP#7; TP#8; TP#9; [SUM#7 (R2: 5)] |
| Mar. 12 | DS#4; TP#10; TP#11; TP#12; [SUM#8 (R2: 4)] |
| Mar. 19 | CSP#1 (R1: 8.1); CSP#2 (R1: 8.2); CSP#3 (R1: 8.3); CSP#4 (R2: 7.1) |
| Mar. 26 | CSP#5 (R2: 7.2); CSP#6 (R2: 7.3); CSP#7 (R2: 7.4); CSP#8 (R2: 7.5) |
| Apr. 2 | LEC#6 (Course Review) + Project presentations |
| Apr. 9 | Project presentations + Project final reports and prototypes due |

## 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.