# LIS9721/9821 & CS9639: Information Visualization

## Course Information
Number: LIS9721/LIS9821/CS9639 (This is a cross-listed course)
Term: Winter 2017
Location: MC 320
Lectures: Mondays, 9:00am to 11:55am

## Instructor
Name: Dr. Kamran Sedig
Contact Email: sedig@uwo.ca
Office: MC 420
Bio: My research is quite interdisciplinary, dealing with such areas as information science, human-information interaction, visualization, health informatics, 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—(example 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

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**) Parsons, P & Sedig, K (2014). Adjustable properties of visual representations: Improving the quality of human-information interaction. *Journal of the Association for Information Science and Technology (JASIST)*, 65(3), 455-482. (Available online: http://insight.uwo.ca/publications)

## Reading Schedule

This course requires you to comprehend the readings and be able to apply them intelligently to your designs. To help you keep up with the reading material, you are required to follow the following schedule. 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 reading schedule**.

| Date | Readings |
| --- | --- |
| Jan. 9 | (none) First lecture |
| Jan. 16 | R1, Chapters 1, 2, 3 |
| Jan. 23 | R1, Chapter 4 |
| Jan. 30 | R1, Chapter 5 |
| Feb. 6 | R2 |
| Feb. 13 | R3 |
| Feb. 20 | (none) Reading week |
| Feb. 27 | R1, Chapters 6, 7 |
| Mar. 6 | R1, Chapters 8, 9 |

## Structure and Method of Evaluation

Through a combination of lectures, analysis and design assignments, presentations, projects, and classroom discussions, you will gain a critical understanding of a wide range of issues involved in visualization of data and interactive visualizations.

1. Lectures
2. Analysis and design exercises
3. System/tool presentation
4. Design project
5. Class discussions and participation

**Method of Evaluation**

Your final mark will be based on 4 components:

1. **Analysis & Design (16%)**: Based on material studied in the course, you will do 4 analysis and design activities in class. This exercise is to help you learn how to apply the different techniques covered in the course.
2. **System/Tool Presentation (14%)**: You will do research to find 2 information visualization systems (7% for each system), present them in class, and analyze and critique them in terms of their visualization, interaction, and task design & utility.
3. **Project (50%)**: 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.
4. **Participation (20%)**: You are expected to attend classes, study lecture notes, engage in class presentations, and participate in class discussions and presentations. Your participation mark will depend on your *intelligent, informative,* and *regular* contribution to and engagement in class discussions.

## All 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. The file names should follow the general protocol: SUBMISSION_IV_Group# (e.g., ProjectProposal_IV_Group3).

## Lectures

The first portion of the course is comprised of lectures. Lectures will provide an overall formal framework for an understanding of IV. 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 IV concepts you need to know.

## Analysis & Design

There will be 4 analysis and design activities in class. These will be based on readings and lecture notes. You should keep with the reading schedule and lecture notes to do well on these exercises. You will do these in groups of 4 to 5 (depending on the number of registered students), give a demo in class, and upload your designs to OWL. The details of these exercises will be explained in the class. Each exercise is worth 4% of your total grade. Only one person from your group will upload your designs. The file will have the following name: Design#_IV_Group# (e.g., Design#2_IV_Group#3). If this naming format is not followed, your file will be discarded. The schedule for these is as follows:

| Date | Exercise |
| --- | --- |
| Jan. 23 | #1: Information space & visual marks |
| Feb. 6 | #2: Patterns and pattern instantiation |
| Feb. 27 | #3: Pattern blending & visualization techniques |
| Mar. 6 | #4: Human-data interaction |

## System/Tool Presentation

There will be 8 presentations (total of 16 systems). In groups of 4 (depending on the number of registered students), you will do research to find 2 visualization systems in a particular area of application (e.g., information search, health informatics, genomics, cyber security, digital library, music library, data journalism, business analysis, etc.), present them in class, and analyze, compare, and critique them in terms of their utility and design based on some of the concepts discussed in the lectures. *Each group's presentation will be no more than **35** minutes*.

*Presentation marks will be based on the following criteria/components*
• Rational for selection of each system (2%)
• Degree of complexity and novelty of each system (2%)
• Applications and domain of use of each system (2%)
• Use of visualization techniques/patterns in each system (2%)
• Use of interaction techniques/patterns in each system (2%)
• Visual and cognitive tasks that each system can support (2%)
• Oral clarity, preparedness, engagement of others, and handling of questions (2%)

You will do a PowerPoint presentation along with a live presentation of the systems. All the above components must be included in the PowerPoint slides and labelled. After your presentation, your PowerPoint slides must be placed in your dropbox in OWL. Only one person from your group will upload your designs. The file will have the following name: SysPresentation_IV_Group#. If this naming format is not followed, your file will be discarded.

Your mark for each component of the presentation will be based on a Likert scale, as follows:

1. Very good:    2%
2. Good: 1.5%

3. So-so:1%
4. Poor:           .75%
5. Very poor:     .5%

The schedule for these is as follows:

| Date | System presentation |
|------|---------------------|
| Mar. 20 | 1$^{st}$ set of presentations |
| Mar. 27 | 2$^{nd}$ set of presentations |

## Projects

The third portion of the course is comprised of project presentations. This component of the course is structured to make you gain experience in designing new IV 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, which you try to solve by designing an IV 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, its content, 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, why you think this problem is worth solving, how and why you think that using IV will address the problem. 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_IV_Group#. 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_IV_Group#. 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 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 ideas 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_IV_Group#. 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, 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_IV_Group#. 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 30-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 and make suggestions for the improvement of the design. Presenting groups are encouraged to bring goodies 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_IV_Group#. If this naming format is not followed, your file will be discarded.

**Peer evaluation**

On the last day of classes, you will evaluate your team-mates or peers in terms of how cooperative they were, how much effort they put into the project, whether they attended your meetings, and so on. 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. Each student will upload a peer evaluation form in their OWL dropbox. This form will contain the name of your teammates, excluding yourself, and a score ranging from 0 to 100% for each peer. The file will have the following name: ProjectPeer_IV_Group#_LastName_FirstName. If this naming format is not followed, your file will be discarded.

Breakdown of the project marks (adds up to **50%**):

| Component | Value |
|---|---|
| Team profile and high-level problem proposal | **1%** |
| Midway report | **8%** |
| *Executive summary* | *(1)* |
| *Domain of application* | *(1)* |
| *Scope of problem* | *(1)* |
| *Breakdown of supported activities/tasks/sub-tasks & Justifications* | *(5)* |
| Final interactive PowerPoint prototype | **30%** |
| *Degree of complexity of tasks* | *(3)* |
| *Diversity of visualizations* | *(10)* |
| *Visual encodings/marks/variables* | *(3)* |
| *Interaction and interactivity of system* | *(8)* |
| *Number of screens* | *(3)* |
| *Novelty and innovation* | *(3)* |
| Final report | **7%** |
| *Executive summary* | *(1)* |
| *Roadmap (like storyboard) of the system and explanations of how to navigate the visuals* | *(3)* |
| *Breakdown and list of all patterns, pattern blendings, visualizations, encodings, interactions, etc. used in the system & their locations in the system* | *(3)* |

| Informal presentation | **3%** |
|---|---|
| Peer evaluation | **1%** |
| Best project (Bonus mark) | **3%** |

**Project component marking scheme**
Your mark for each component of the project 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; team has gone beyond the call of duty | 100% |
| **2.Very good**: quality of work is very good; almost no flaws; team has worked very hard and demonstrates very good understanding of the studied material | 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; team did not put much thought into some parts | 70% |
| **5.Poor**:  quality of work  is not acceptable; poorly based on any material studied in the course | 60% |
| **6.Very poor**: component is very poorly done; many flaws; not based on material studied in the course | 50% |
| **7.Not delivered**: component not completed | 0% |

Policy for late delivery of project components:
24 hrs:  -10%; 48 hrs: -20%; 72 hrs: -30%; 96 hrs: -40%; 96 hrs+: -100%

Extensions may be granted only by the course instructor. If you have serious medical or compassionate grounds for an extension, you should follow the procedure for Academic Accommodation for Medical Illness as given below.

## 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, and regular participation in class discussions. When asked questions in the class, you should give well-considered answers based on the material 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.

## Important Dates (tentative)
| *Date* | *What is due* |
|---|---|
| 1/23 | Project proposal |
| 2/17 | Midway project report |
| 2/20 | Reading week (no classes) |
| 3/20&27 | System presentations |
| 4/3&10 | Start of in-class presentations of the projects |
| 4/10 | Final project reports and prototypes due |

## 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 "LIS9721/CS9639: <subject>" in the subject line (**e.g., LIS9721/CS9639: Project 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.

## Plagiarism

Students must write their essays and assignments in their own words. Whenever students take an idea, or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence (see Scholastic Discipline for Graduate Students at http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_grad.pdf)

Research papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (http://www.turnitin.com).

## 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.