

INFO-424: Information Visualization and Aesthetics

Autumn 2005
B.S. Informatics
Information School
University of Washington

Examines the visualization of information: the effects of human perception, the aesthetics of information design, the mechanics of visual display, and the semiotics of iconography. Examples may include census, epidemiological, crime, earth satellite, and medical data in the contexts of special computer applications, user populations, and cultures. Prerequisite: CSE 143.

Course website & Listserv

<http://courses.washington.edu/info424>

info424a_au05@u.washington.edu

Registered students are subscribed automatically using their UW mail account.

Credit Hours

5 (3 lecture hours; 2 lab hours; 10 outside hours)

Meeting times

<i>Lecture</i>	Tuesday/Thursday 11:00 – 12:20, MGH 254
<i>Lab</i>	Friday 1:30 – 3:20, MGH 430

Instructor

David Hendry, Assistant Professor
330J Mary Gates Hall

Office hours: Thursdays, 3:30 – 5:00 or by appointment.

dhendry@u.washington.edu | <http://faculty.washington.edu/dhendry>
Tel: 206-616-2316 (Please use for urgent matters only)

Student services

Mariko Navin, Student Services Administrator
470E Mary Gates Hall
mnavin@u.washington.edu
Tel: (206) 616-1197

Please note: If you have any concerns about a course or the TA, please see the TA about these issues as soon as possible. If you are not comfortable talking with the TA or not satisfied with the response that you receive, you may contact the instructor of the course.

If you are still not satisfied with the response that you receive, you may contact Joseph Janes, the Associate Dean for Academics in 370 Mary Gates Hall, by phone at : (206) 616-0987, or by e-mail at jwj@u.washington.edu.

You may also contact the Graduate School at G-1 Communications Building, by phone at (206) 543-5900, or by e-mail at efeetham@u.washington.edu

Overview

For hundreds of years visual displays have been invented to clarify and communicate know facts and to discover new facts latent within a data set. Interactive computing systems are the most recent medium for depicting and interacting with visual information.

The aim of this class is to introduce the field of Information Visualization, which is defined as:

The use of computer-supported, interactive visual representations of abstract data to amply cognition (Card, Mackinlay & Shneiderman, 1999).

We shall examine how graphic aids—sketches, graphs, charts, maps, diagrams, and visualizations—enable problem solving and discover that, depending on the user task, some displays are more effective than others.

The class covers some key principles of human perception and key techniques for visualizing information. You will explore large data sets with tools for visualization, invent new information visualizations, and learn to evaluate and critically discuss information displays.

Textbooks and readings

The required textbook, which is available at the University Bookstore, is:

- Spence, R. (2001). *Information Visualization*. New York: Addison-Wesley.

Occasionally, we will draw upon:

- Card, S. K., J. D. Mackinlay & B. Shneiderman (eds.) (1999). *Readings in Information Visualization: Using Vision to Think*. New York: Morgan Kaufmann.
- Hoffman, D. D. (1998). *Visual Intelligence*. New York: W. W. Norton.
- Horton, W. (1994). *The Icon Book: Visual Symbols for Computer Systems and Documentation*. New York: John Wiley.
- Tufte, E. R. (1983). *The Visual Display of Quantitative Information*. Cheshire, CT: Graphics Press.
- Tufte, E. R. (1990). *Envisioning Information*. Cheshire, CT: Graphics Press.
- Tufte, E. R. (1997). *Visual Explanations*. Cheshire, CT: Graphics Press.
- Ware, C. (2004). *Information Visualization: Perception for Design* (2nd Edition). New York: Morgan Kaufmann.
- Wurman, S. (2001). *Information Anxiety 2*. Indianapolis, IN: QUE.

Additional readings are cited in the course schedule below. These readings are generally available at the ACM and IEEE Digital Libraries. Depart to these resources from:

- <http://lib.washington.edu/subject/ComputerSci/dr/eljnl.html>

Assignment sheets, software, data sets, and other materials will be posted on the course website.

Learning

Aims

The aims of this course are to:

- Develop an understanding for the issues, principles, and techniques of Information Visualization;
- Improve skills in visual literacy, ideation, and critical thinking about visual materials;
- Improve skills in prototyping, writing reports, and giving presentations.

Objectives

On the successful completion of this course, you will be able to:

1. Name and identify the major types and roles of visual information, including images, symbols, icons, diagrams, scientific visualizations, and information visualizations;
2. Critically discuss information displays in terms of Tufte's theory of *maximizing the density of useful information* and characterize information displays with his vocabulary;
3. Name and describe the Gestalt principles of perception;
4. Explain "pop out", define pre-attentive cognition, and construct an experiment to demonstrate it;
5. Outline a reference model for information visualization and describe data types, data tables, visual structures, and views;
6. Outline the knowledge crystallization model and describe standard information extraction and use tasks;
7. Deconstruct visual structures into their basic elements, including points, links, areas, space, color and so on, and use such features to communicate abstract concepts;
8. Describe appropriate mappings between data types and visual elements and analyze displays for inappropriate mappings;
9. Discuss methods and tools for the presentation and exploration of: a) Univariate, bivariate, trivariate, and hypervariate data sets; d) Network and tree structures; and c) Document collections.
10. Develop visualizations that employ distortion, zoom and pan, and semantic zoom techniques;
11. Discuss methods and tools for the dynamic exploration of data sets;
12. Employ the reference model for information visualization and the knowledge crystallization model to analyze visualizations and reason about new visualizations;
13. Prototype and evaluate information visualizations of moderate complexity using existing applications and scripting languages.

Academic accommodations

To request academic accommodations due to a disability, please contact Disabled Student Services: 448 Schmitz, 206-543-8924 (V/TTY). If you have a letter from DSS indicating that you have a disability which requires academic accommodations, please present the letter to me so we can discuss the accommodations you might need in the class.

Academic accommodations due to disability will not be made unless the student has a letter from DSS specifying the type and nature of accommodations needed.

For additional information, see *Statements to Ensure Equal Opportunity and Reasonable Accommodation*, downloaded March 5, 2003, <http://www.washington.edu/admin/eoo/eoost.html>

Academic honesty

The essence of academic life revolves around respect not only for the ideas of others, but also their rights to those ideas and their promulgation. It is therefore essential that all of us engaged in the life of the mind take the utmost care that the ideas and expressions of ideas of other people always be appropriately handled, and, where necessary, cited. For writing assignments, when ideas or materials of others are used, they must be cited. The format is not that important—as long as the source material can be located and the citation verified, it's OK. What is important is that the material be cited. In any situation, if you have a question, please feel free to ask. Such attention to ideas and acknowledgment of their sources is central not only to academic life, but life in general.

Please acquaint yourself with the University of Washington's resources on academic honesty: <http://depts.washington.edu/grading/issue1/honesty.htm>

Students are encouraged to take drafts of their writing assignments to the Writing Center for assistance with using citations ethically and effectively. Information on scheduling an appointment can be found at:

<http://www.uwtc.washington.edu/resources/eiwc/>

Copyright

All of the expressions of ideas in this class that are fixed in any tangible medium such as digital and physical documents are protected by copyright law as embodied in title 17 of the United States Code. These expressions include the work product of both: (1) your student colleagues (e.g., any assignments published here in the course environment or statements committed to text in a discussion forum); and, (2) your instructors (e.g., the syllabus, assignments, reading lists, and lectures). Within the constraints of "fair use", you may copy these copyrighted expressions for your personal intellectual use in support of your education here in the iSchool. Such fair use by you does not include further distribution by any means of copying, performance or presentation beyond the circle of your close acquaintances, student colleagues in this class and your family. If you have any questions regarding whether a use to which you wish to put one of these expressions violates the creator's copyright interests, please feel free to ask the instructor for guidance.

Privacy

To support an academic environment of rigorous discussion and open expression of personal thoughts and feelings, we, as members of the academic community, must be committed to the inviolate right of privacy of our student and instructor colleagues. As a result, we must forego sharing personally identifiable information about any member of our community including information about the ideas they express, their families, life styles and their political and social affiliations. If you have any questions regarding whether a disclosure you wish to make regarding anyone in this course or in the iSchool community violates that person's privacy interests, please feel free to ask the instructor for guidance.

Knowing violations of these principles of academic conduct, privacy or copyright may result in University disciplinary action under the Student Code of Conduct.

Student Code of Conduct

Good student conduct is important for maintaining a healthy course environment. Please familiarize yourself with the University of Washington's Student Code of Conduct at:

<http://www.washington.edu/students/handbook/conduct.html>

Assessment

Assessment	% Grade
Class spirit and participation	10%
Exercises and Discussion Questions	30%
Individual Assignments	30%
Project	30%

Class spirit and participation

INFO-424 should be fun, interesting, and challenging. With spirit and friendship, we can all create a supportive and rewarding learning environment. These values are important to the instructor. Here are some ways to contribute:

1. Read carefully and critically prior to class
2. Ask challenging questions in class and labs
3. Comment, build on, or clarify what others have done or said
4. Be an active listener
5. Help your classmates use development tools and technologies
6. Post useful information to the class discussion list, on Wiki's etc.
7. Help configure or administrator servers or software
8. Visit the instructor during office hours
9. Ask questions or give feedback about the course before/after class
10. Tell a joke at an appropriate time.

Please write a 2 or 3 paragraph reflective statement on how your participation in the class improved our learning. You might note the number of classes and labs attended, how you participated in class, how you helped the class with technical issues, etc.

This statement is due at the beginning of the last class, **December 8**.

Exercises and Discussion Questions

The schedule for Exercises and Discussion Questions is available on a separate sheet on the website. As explained on that sheet, you may submit up to 8 responses. The 6 highest grades will make up your final grade for this component of the class. Thus, each response is worth 5% of your final grade.

The aim of exercises and discussion questions is to give you an opportunity to reflect upon the readings for the week. As well, these responses will be read by the instructor prior to class, allowing class discussions to be better aligned with your questions and interests.

Individual Assignments

You will submit 3 individual assignments.

Assignment	DUE
A1: Visual Expression	Oct 13
A2: Revealing Relationships and Presentation	Nov 3
A3: Connectivity	Nov 17

Each assignment is worth 10% of your final grade. Assignments are due at the beginning of class. Assignment sheets are available on the website.

Project

Working in groups of 3 or 4, you will develop and evaluate a system for information system visualization.

Deliverable	DUE
P1: Project Topic and Team Members	Oct 14
P2: Project Description and Plan	Nov 4
P3: Class Poster Presentation	Nov 28 – Dec 2
P4: Final Report	Dec 8

The details of the project are contained on a separate project sheet.

Grading criteria

Work in this course will be graded to criteria. In other words, you won't be graded on a curve. Each deliverable is designed to test your achievement against one or more of the learning objectives. Different assignments emphasize different learning objectives. The meanings of grades are described below.

General grading information for the University of Washington is available at:

- http://www.washington.edu/students/genclat/front/Grading_Sys.html

The iSchool has adopted its own criteria for grading graduate courses. The grading criteria used by the iSchool is available at:

- <http://depts.washington.edu/grading/practices/guidelin.htm>

Grade	Performance Quality*
3.9 - 4.0	Superior performance in all aspects of the course with work exemplifying the highest quality. Unquestionably prepared for subsequent courses in field.
3.5 - 3.8	Superior performance in most aspects of the course; high quality work in the remainder. Unquestionably prepared for subsequent courses in field.
3.2 - 3.4	High quality performance in all or most aspects of the course. Very good chance of success in subsequent courses in field.
2.9 - 3.1	High quality performance in some of the course; satisfactory performance in the remainder. Good chance of success in subsequent courses in field.
2.5 - 2.8	Satisfactory performance in the course. Evidence of sufficient learning to succeed in subsequent courses in field.
2.2 - 2.4	Satisfactory performance in most of the course, with the remainder being somewhat substandard. Evidence of sufficient learning to succeed in subsequent courses in field with effort.
1.9 - 2.1	Evidence of some learning but generally marginal performance. Marginal chance of success in subsequent courses in field.

*Taken from Faculty Resource on Grading, downloaded March 5, 2003, <http://depts.washington.edu/grading/practices/guidelin.htm>

Standard cover sheet

To protect your privacy when exercises are returned and to facilitate communication, submitted work must have a cover sheet. The cover sheet must include the following information and be formatted nicely:

- Course name
- Quarter, program, department, and university
- Assignment name
- Your name and e-mail address
- A date
- A web site address (if relevant).

Staple the exercise pages to the cover sheet.

Late policy

1. If you will miss the deadline, you should inform the instructor as soon as you can, indicating when you will submit the work. The instructor will try to accommodate your needs. You should use this clause only for extraordinary personal reasons.
2. It is at the instructor's discretion to accept late work or assign late penalties (see 1 above). For any late assignment, 10% will be taken off your work per day. After five days, your work will not be accepted.
3. Late work must be handed to the instructor or teaching assistant in person. You may also be able to hand work in at the front desk of the Information School and at student services but this cannot be guaranteed.

Work that is handed in late is penalized for two reasons. First, to be fair, all students should be given the same time limits. Second, if you spend too much time on one assignment, it is quite likely that you will have insufficient time to spend on subsequent assignments.

Right to revise

The instructor reserves the right to revise this syllabus.

Re-grading policy

To have work re-graded, you must submit a Re-grade Request within five days of when your work was returned. The request must be a single page document printed on paper or sent by e-mail. It should contain the following information:

- Re-grade Request
- The information contained on the standard cover sheet
- An explanation for why you believe you deserve a higher grade.

The instructor, possibly in collaboration with the teaching assistant, will consider your request. If the instructor is convinced by your argument, your work will be re-graded. If not, the instructor will send you e-mail explaining why. No re-grades will be considered for late work.

Class Schedule

Week 1: Introduction (Sep 29 – 30)

Read

L1: Introductory Exercise

Lab: Design By Numbers, Self-directed (please see course website)

Week 2: Perspectives on Information Visualization (Oct 3 – 7)

Read: Spence, Chapters 1 – 2

L1: Greetings & Class Overview

L2: Semiotics and Perceptual Psychology

Lab: Design By Numbers, II

Week 3: Visual Communication (Oct 10 – 14)

Read: See course website for links to readings

L1: Basic Visual Elements

L2: Tufte's Design Strategies

Lab: Scalable Vector Graphics, I

Week 4: Cognitive and Engineering Models (Oct 17 – 21)

Read: Spence, Chapter 6

L1: Three Stage Information Processing Model

L2: Engineering Models

Lab: Scalable Vector Graphics, II

Week 5: Quantitative Data (Oct 24 – 28)

Read: Spence, Chapter 3 – 4

L1: Univariate & Bivariate Data Presentations

L2: Trivariate & Hypervariate Data Presentations

Lab: Evaluating Information Visualizations

Week 6: Data Exploration (Oct 31 – Nov 4)

Read: Spence, Chapter 5 & 7

L1: Dynamic Queries, Contextual & Sensitivity Information

L2: Focus and Context, Suppression, Zoom & Pan

Lab: Scalable Vector Graphics, III

Week 7: Connectivity (Nov 7 – 11)

Read: Spence, Chapter 8

L1: Network Visualizations

L2: Tree Visualizations

Lab: Cancelled for Veteran's Day

Week 8: Documents, Information & Social Spaces (Nov 14 – 18)

Read: Spence, Chapter 10

L1: Representing Documents

L2: Representing People and Crowds

Lab: Project Work

Week 9: Continued ... (Nov 21 – 25)

Read: Fernanda B. V. & M. Smith. "Newsgroup Crowds and AuthorLines: Visualizing the Activity of Individuals in Conversational Cyberspaces," *hicss*, vol. 04, no. 4, p. 40109b, Proceedings 2004.[Retrieved 09/05/05 from

<http://doi.ieeeecomputersociety.org/10.1109/HICSS.2004.1265288>]

L1: Applications

L2: Cancelled for Thanksgiving

Lab: Cancelled for Thanksgiving

Week 10: Poster Presentations (Nov 28 – Dec 2)

L1: Session #1

L2: Session #2

Lab: Session #3

Week 11: Future Directions (Dec 5 – Dec 9)

L1: Conceptual Opportunities & New Inventions

L2: Visual Literacy

Lab: Demonstrations (Optional)