Information Visualization
Lecture 1 CPSC 533C, Fall 2005
12 September 2005
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Course Home Page
permanent URL
- www.cs.ubc.ca/~tmm/courses/cpsc533c-05-fall
shortcut
- www.cs.ubc.ca/~tmm/courses/533
reload frequently, updates common!

Course Structure
first part
- professor lectures
- all do core readings
second part
- student presentations
- presenter does topic readings
requirements
- project: 50%
- proposal 10%, update 10%, report 20%,
- presentation 10%, content 50%
- presentation: 25%
- class participation: 22%
- questions 75%, discussion 25%
- small assignment: 3%

Projects
choice 1: programming
- common case
- I will only consider supervising students who do
  programming projects
choice 2: analysis
- use existing tools on dataset
- detailed domain survey
- suitable for non-CS students
stages
- meeting with me in person before proposal writeup
- proposal Nov 4
- update presentations Nov 16
- final present Dec 19
- final report Dec 20

Presentations
second half of class
sign up by Oct 20
material (exact numbers TBD, depending on
-enrollment)
- XX papers from my suggestions
- XX paper found on your own
talk
- chance to refine your public speaking skills
- slides required
- critical points of papers
- comparison and critique
- not just outline!

Participation
7%: discussions in class
- both lectures and student presentations
15%: 5 questions on required readings
- due at 10am Mon/Wed for afternoon's reading
- if you can't attend: credit for email by 10am
**Required Readings**

- Ware
  - Information Visualization: Perception for Design
    - 2nd edition

- Tufte
  - Envisioning Information

- many papers
  - most are color PDF downloads from page
  - a few handed out in class as hardcopy

**Reserve Books**

- Information Visualization: Perception for Design, Colin Ware
- Readings in Information Visualization: Using Vision To Think, Card, Mackinlay, and Shneiderman, eds; Morgan Kaufmann 1999.
- The Visualization Toolkit, 2nd edition; Schroeder, Martin and Lorensen; Prentice Hall 1998

**Course Design**

- reading-intensive course
- most of reading front-loaded in first 8 weeks
- oral presentations
- small assignment next class
- major presentation
- project update, project final writing
- questions, proposal, final report
- programming
  - project course (unless do analysis option)
  - time management critical: staged development
- no problem sets :) schedule
  - two weeks during term with no classes
  - run one week into final exam period

**Information Visualization**

- visual representation of abstract data
  - computer-generated, can be interactive

**Interactivity**

- static images
  - 10,000 years
  - art, graphic design

- moving images
  - 120 years
  - cinematography

- interactive graphics
  - 20 years
  - computer graphics, human-computer interaction

**Information Visualization**

- visual representation of abstract data
  - computer-generated, can be interactive
  - help human perform some task more effectively
External Representation: multiplication

\[ \frac{57}{48} \times \frac{57}{48} \]

External Representation: multiplication

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External Representation: multiplication

\[ \frac{57}{48} \times \frac{57}{48} \]
External Representation: multiplication

\[
\begin{array}{c}
57 \\
\times 48 \\
\hline
456 \\
228 \\
\end{array}
\]

\[5 \times 4 = 20 + 2 = 22\]

External Representation: multiplication

\[
\begin{array}{c}
57 \\
\times 48 \\
\hline
456 \\
228 \\
\end{array}
\]

\[5 \times 4 = 20 + 2 = 22\]

External Representation: multiplication

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\times 48 \\
\hline
456 \\
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\end{array}
\]

\[5 \times 4 = 20 + 2 = 22\]

External Representation: multiplication

\[
\begin{array}{c}
57 \\
\times 48 \\
\hline
456 \\
228 \\
\end{array}
\]

\[8 + 5 = 13\]
External Representation: multiplication

57
x 48
36

[8 + 5 = 13]

Information Visualization

visual representation of abstract data
- computer-generated, can be interactive
- help human perform some task more effectively

bridging many fields
- graphics, drawing in realtime
- cognitive psychology: finding appropriate representation
- HCI: using task to guide design and evaluation

external representation
- reduces load on working memory
- offline cognition
- familiar example: multiplication/division
- infovis example: topic graphs

External Representation: Topic Graphs

[Gödel, Escher, Bach: Hofstadter 1979]

Paradoxes – Lewis Carroll
Turing – Halting problem
Halting problem – Infinity
Paradoxes – Infinity
Infinity – Lewis Carroll
Infinity – Unpredictably long searches
Infinity – Recursion
Infinity – Zero
Infinity – Paradoxes
Lewis Carroll – Zero
Lewis Carroll – Wordplay

Halting problem = Decision procedures
BlooP and FlooP = At
Halting problem = Unpredictably long searches
BlooP and FlooP = Unpredictably long searches
BlooP and FlooP = Recursion
Tarski – Truth vs. provability
Tarski – Epimenides
Tarski – Undecidability
Paradoxes – Self-ref
**External Representation: Topic Graphs**
offload cognition to visual systems
minimal attention to read answer

**External Rep: Automatic Layout**
manual: hours, days
automatic: seconds

![Graph Example]

**InfoVis vs. SciVis**
is spatialization given (scientific visualization)
or chosen (information visualization)
- my definition
- names are unfortunate historical accidents:
  - not scivis iff data generated by scientists
  - infovis not unscientific
  - but too late to change
- infovis: how to represent:
  - choosing, doing, evaluating
  - huge space of possibilities: random walk ineffective
  - need design guidelines

**My Current Interests**
- domains:
  - evolutionary trees
  - genomic sequences
  - transaction logs
  - environmental sustainability
  - power grid control
- techniques/projects:
  - accordion drawing
  - multidimensional scaling
  - scalable graph drawing
  - evaluation
- InfoVis Symposium organization:
  - Program Co-Chair 2001, 2004
  - Posters Co-Chair 2001, 2002

**Lecture Topics**

**Design Studies**
Overviews/Context

Frameworks/Models

Color
Guest Lecturer: Maureen Stone

Perception

Space/Order

Depth/Occlusion
More Guest Lectures

stayed tuned, things may shuffle

Assignment 1

find and critique two images
  · one good visualization
  · one bad visualization

make web page, send me URL by 10am Wed
  · pictures, two paragraphs for each
  · first par: story
  · second par: specific critique
  · accessibility
  · clarity
  · accuracy
  · other important design criteria
  · send to tmm@cs.ubc.ca

be prepared to concisely present in class
  ≤ 5 min

Assignment 1

sources
  · textbook
  · journal
  · Journal of Applied Optics, ...
  · science magazine
  · Nature, Science, Scientific American, ...
  · news magazine or newspaper
  · Newsweek, Economist, NY Times, USA Today ...

domains
  · mathematics
  · physical sciences
  · astronomy, physics, chemistry, ...
  · biological sciences
  · ecology, medicine, bioinformatics, ...
  · social sciences
  · economics, crime statistics, ...