### Course Home Page

- **Information Visualization**
- **CPSC 533C, Fall 2011**
- **Tamara Munzner**
- **UBC Computer Science**
- **Wed, 7 September 2011**

- **Course Home Page**
  - main source
  - readings, lecture slides, all information
  - reload frequently, updates common!
  - permanent URL

### Course Design

- **reading-intensive course**
- **reading front-loaded in first 9 weeks**
- **less than in past: using new textbook draft**
- **oral presentations**
- **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 or exams**
- **schedule**
  - **no classes week of VisWeek (Oct 24, 26)**

### Course Structure

- **lectures/reading**
  - weeks 1-9 (no class week 8)
  - 1 lecture
  - 2-3 core readings required, further readings optional
  - submit questions for each lecture (19%)
  - discussion (3%)
  - presentations (25%)
  - weeks 10-13
  - student presentations
  - only presenter does topic readings
  - discussion (3%)
  - **project (50%)**
    - weeks 6-14
    - meetings, proposal, update, final

### Course Mark Breakdown

- **class participation:** 25%
- **questions:** 75%, discussion 25%
- **presentation:** 25%
- **details later**
- **project:** 50%
- **presentation:** 25%
- **interim update presentation:** 10%
- **final presentation:** 10%
- **final written report:** 20%
- **project content:** 50%

### Required Readings

- **Munzner**
- **Information Visualization: Principles, Methods, and Practice**
- **pre-publication draft**
- **chapters posted one week before reading is due**
- **many papers**
- **color PDF downloads from page**
- **some are DL links; use library EZproxy**
- **no required textbook to buy**
- **optional reading:** Ware, Tufte

### Prerequisites

- **no courses required**
- **HCI very useful**
- **computer graphics useful**
- **no graphs background: constraint on project choices**
- **grads from other departments welcome**
  - if no programming background: do analysis/survey project

### Participation

- **6%:** discussions in class
  - both lectures and student presentations
  - **19%:** questions for each required reading
  - two for longer draft book chapters
  - one for shorter papers
  - due at 11am Mon/Wed for day’s reading
- **attendance expected**
  - tell me in advance if you know you’ll miss class
  - question credit still possible if submitted in advance
  - tell me when you recover if you were ill

### Questions

- **questions or comments**
- **fine to be less formal than written report**
- **correct grammar and spelling expected nevertheless**
  - be concise: a few sentences good, one paragraph max!
  - should be thoughtful, show you’ve read and reflected
- **poor to ask something trivial to look up**
- **ok to ask for clarification of genuinely confusing section**
- **book vs paper comments**
  - best: substantive comments on material
  - also useful: order of explanation, undefined words you didn’t know
  - not enough: typos/grammar (but fine to mention)
- **grading into buckets:**
  - great 100%, good 89%, ok 78%, poor 67%, zero 0%

### Question Examples: Poor

- **Well, what exactly Pad++ is? Is it a programming library or a set of API or a programming language? how can we use it in our systems, for sample may be programming in TCL or OpenGL may be?**
- **I learned some from this paper and got some ideas of my project.**

### Question Examples: OK

- **This seems like something fun to play around with, are there any real implementations of this? Has a good application for this type of zooming been found? Is there still a real need for this now that scroll wheels have become prevalent and most people don’t even use the scroll bar anymore?**
- **Playing with the applet, I find I like half of their approach. It’s nice to zoom out as my scroll speed increases, but then I don’t like the automatic zoom in when I stop scrolling. Searching the overview I found the location I wanted, but while I paused and looked at the overview, I fell back in to the closeup. I think they need to significantly dampen their curve.**

### Question Examples: Good

- **It would be interesting to compare the approach in this paper to some other less-mathematically-thought-out zoom and pan solutions to see if it is really better. Sometimes “faking it” is perceived to be just as good (or better) by users.**
- **The space-scale diagrams provided a clear intuition of why zooming out, panning then zooming in is a superior navigation technique. However, I found the diagram too cumbersome for practical use, especially for objects with zoom-dependent representations (Figure 11).**

### Presentations

- **second half of class**
  - sign up by Oct 21
- **material (exact numbers TBD, depending on enrollment)**
  - 1 paper from my suggested list
  - 2 papers your choice
- **talk**
  - slides required
  - summary important, but also have your own thoughts
  - critical points of papers
  - comparison and critique
- **grading**
  - per-paper: summary 70%, critique 30%
  - synthesis: critique/synthesis 100%
  - general: presentation style 50%, content prep 50%
  - balance between 3 pieces depends on num papers assigned

### Presentation Topics


### 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
  - particularly suitable for non-CS students
- **choice 3:** survey
  - very detailed domain survey
  - particularly suitable for non-CS students
## Information Visualization

- Visual representation of abstract data
- Computer-generated, often interactive
- Help human perform some task more effectively
- Reduces load on working memory
- Offload cognition
- Familiar example: multidigit multiplication

## Interactivity

- Static images
  - 10,000 years
  - Art, graphic design
- Moving images
  - 150 years
  - Cinematography
- Interactive graphics
  - 30 years
  - Computer graphics, human-computer interaction

## Course Goals and Feedback

- Twofold goal
  - Specific: teach you some infovis
  - Generic: teach you how to be a better researcher
- Detailed written comments on writing and presenting
  - Both context and style
  - At level of paper review for your final project
  - Goal: within a week or so
  - Before updates, for early presentations
- Fast grading for reading questions
  - Great 100%, good 89%, ok 78%, poor 67%, zero 0%
  - Goal: turn around by next class
  - One week at most

## Office Hours

- 5-6 Wed after class, or by appointment
- Office in X661, ICICS X-Wing

## Reserve Books

- Information Visualization: Perception for Design, Colin Ware (2nd ed)
- Readings in Information Visualization: Using Vision To Think, Card, Mackinlay, and Shneiderman, eds; Morgan Kaufmann 1999.
- The Visualization Toolkit, 3rd edition; Schroeder, Martin and Lorensen; Kitware Inc. 2004

## Projects: More

- Stages
  - Meetings with me for approval by Oct 11-21 (at latest)
  - Proposal due Fri Oct 28
  - Update presentations Nov 14/16/21
  - Final presentations Mon Dec 12-23
  - Final report Wed Dec 14 noon
- Resources
  - Software
  - Data
  - Project ideas

### External Representation: multiplication

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**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 psych: finding appropriate representation
- HCI: using task to guide design and evaluation
- external representation
- reduces load on working memory
- offload cognition
- familiar example: multidigit multiplication
- Infovis example: topic graphs

**External Representation: Topic Graphs**

- [Godel, Escher, Bach. Hofstadter 1979]

- Turing - Halting problem
- Halting problem - Infinity
- Paradoxes - Lewis Carroll
- Infinity - Lewis Carroll
- Infinity - Zeno
- Infinity - Paradoxes
- Lewis Carroll - Zeno
- Lewis Carroll - Wordplay

**Lecture Topics**

- manual: hours, days
- automatic: seconds

**Design Studies**

- paper mental buffer
- 456
- 228
- 2736
- (Godel, Escher, Bach. Hofstadter 79)
Visualization Design

Separating Design Into Levels

- multiple levels
- domain problem characterization
- data/operation abstraction design
- encoding/interaction technique design
- algorithm design

- three separate design problems
- not just the encoding level
- each level has unique threats to validity
- dependencies between levels
- outputs from level above are inputs to level below
- downstream levels required for validating some upstream threats

Data Principles

Visual Encoding Principles

Interaction Principles

View Composition Methods

Data Reduction Methods

Dimension Reduction Methods

Tabular Data

Graphs/Trees

Spatial Fields / SciVis

InfoVis vs. SciVis

- is spatialization given (sciVis) or chosen (infoVis)
- infoVis: how to represent
  - choosing, doing, evaluating
  - huge space of possibilities: random walk ineffective
  - need design guidelines
  - broad range of application domains
  - discrete math: static, graph theory, combinatorics, ...
- sciVis: heavy algorithms focus
  - small set of app domains
    - volume rendering (medical imaging)
    - flow (fluid dynamics)
  - continuous math: signal processing, flow topology, meshing, ...

Evaluation

Research Process/Papers

Reading For Next Time

- overview to show you spirit/content of this course
- Visual Exploration and Analysis of Historic Hotel Visits. Weaver et al.
- reading questions due 11am Monday by email
  - Subject: 533 submit Q02
  - plain text is best
  - PDF if you must
  - no RTF/DOC/etc...