CSCI 4960/6960
Interactive Visualization
Fall 2014

http://www.cs.rpi.edu/~cutler/classes/visualization/F14/

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“Introduction” to Visualization:
Where do we start?

Art
what?

Technology
how?

Science
why?

Computer Graphics
User Interface Design
Visualization
Color Theory
Human Vision

Perception
Simulation
Computation

Layout
Graphic Design

"Introduc4on" to Visualiza4on:
Where do we start?
Introductions... my research:

Visualization of Tetrahedra Quality

1,050K tetras (133K faces)

- Good angle, but small-volume
- Near-equilateral & ideal-volume
- Zero-angle & zero-volume

Visualization of Tetrahedra Quality

461K tetras (108K faces)

Octree or Adaptive Distance Field (ADF)
Visualization of Tetrahedra Quality

After Simplification & Mesh Improvement

10K tetras (3K faces)

Visualization of Simplification Algorithm

- no action available
- vertex smoothing
- edge collapse
- swap
- already modified
- not in block
The Visualization Process

- Motivation & Problem Definition
- Visualization Design
- Data Collection
- Visualization Execution
- Analysis & Validation
- Visualization Revision
- Presentation
The Visualization Process

- Motivation & Problem Definition
- Visualization Design
  - e.g., media, color, organization, layout, static vs. dynamic, creativity
- Data Collection
- Visualization Execution
- Analysis & Validation
- Visualization Revision
- Presentation
The Visualization Process

• Motivation & Problem Definition
• Visualization Design
• Data Collection
  – e.g., data structures, file formats, parsing, performance & efficiency, databases, very large datasets, interdisciplinary collaboration
• Visualization Execution
• Analysis & Validation
• Visualization Revision
• Presentation
“ITP Student List Conversations is a visualization of the e-mail conversations that have occurred on the ITP student e-mail list. The amount of conversation between two people is determined by how much they participate in the same discussion threads. The strength of the connection between two people is determined by multiplying the number of e-mails they each send to the same thread and adding together these numbers for each thread.”

http://www.auscillate.com/itp/listview/

The Visualization Process

- Motivation & Problem Definition
- Visualization Design
- Data Collection
- Visualization Execution
  - e.g., data structures, implementation details, visualization toolkits/environments (VTK, OpenGL, d3.js, etc.), performance & efficiency
- Analysis & Validation
- Visualization Revision
- Presentation
The Visualization Process

• Motivation & Problem Definition
• Visualization Design
• Data Collection
• Visualization Execution
• Analysis & Validation
  – e.g., debugging, drawing conclusions from data, accuracy, precision, interpretation, useability
• Visualization Revision
• Presentation
The Visualization Process

- Motivation & Problem Definition
- Visualization Design
- Data Collection
- Visualization Execution
- Analysis & Validation
- Visualization Revision
  - e.g., prototype & revise, iterated design, comparing before & after, solicit user feedback, formal user studies
- Presentation
The Visualization Process

• Motivation & Problem Definition
• Visualization Design
• Data Collection
• Visualization Execution
• Analysis & Validation
• Visualization Revision
• Presentation
  — e.g., mixed media, descriptive titles/labels, concise and complete captions/companion text, elevator pitch, documentation
“The Color Strata includes the 200 most common color names (excluding black-white-grayish tones), organized by hue horizontally and relative usage vertically, stacked by overall popularity, shaded representatively, and labeled where possible. Besides filtering spam, ignoring cruft, normalizing grey to gray, and correcting the most egregious misspellings (here’s looking at you, fuchsia), the results are otherwise unadulterated. As such, similar color names, like sea green, seafoam green, and seafoam, each appear separately. They’re synonymous… or are they?”

Course Structure

- Monday @ 11:59pm: Homework due
- Tuesday: short lecture + mini-presentations
- Thursday @ 11:59pm: Reading + LMS post due
- Friday: short lecture + in-class exercise
- Final Project
  - Focus of (at least) last month of weekly homeworks
  - Produce some sort of lasting “document”
  - Presentation during last week of class
- No Quizzes, Final exam
• For each weekly homework assignment, estimate the number of hours (~5-10 hours total / week) you spent on each stage of the Visualization Process:
  – Motivation & Problem Definition
  – Visualization Design
  – Data Collection
  – Visualization Execution
  – Analysis & Validation
  – Visualization Revision
  – Presentation

• Each week will probably only practice 1-3 stages. By the end of the semester you should have accumulated a “reasonable” amount of time in every stage.

“Rules” for the course

• Participation is 15% of your grade:
  – Use of laptops for reference during paper discussion and general note-taking is allowed
  – If you are likely to be distracted by your laptop (email, web-surfing, games), please close the lid

• Sit in a different seat, next to different people, each week
  – To facilitate mixing for feedback and brainstorming during in-class exercises
Reading for Friday:

• "Eenie, Meenie, Minie, Moe: Selecting the Right Graph for Your Message”, Stephen Few, Intelligent Enterprise, 2004

• Everyone must post a non-trivial comment or question on the reading (~200 words) to the LMS discussion by Thursday @ 11:59pm

Homework Assignment 1: due Monday @ 11:59pm

Inspirational Visualization Images

• Find two example visualization images:
  – one great visualization
  – one example that needs revision to be effective
• For each example write a paragraph or two describing:
  – the author, context, audience, original media format and purpose of the visualization
  – your analysis of the positive and negative aspects of each example and how it could be improved, and
  – any generalizations you can make about what makes for a compelling, high-quality visualization
Is this a Visualization?

“Been wondering for years where it is cats put their feet when they settle down into this pose”
“whoa, so that’s how they do it!”
From somewhere else on Facebook

Criteria for label “(good) Visualization”

• Notes from class (work in progress):
  – Reveals something you didn’t know (about cats)
  – Needs to have an X & Y axis (not really?) instead... Needs to exist in a space
  – Should be clear in meaning & purpose
  – Just enough information and no more
  – Intentional
  – If the thing can be quantified, must indicate precision & accuracy
  – Shouldn’t be trying to mislead you but ok to have busy-ness to express the complexity
  – Be a scientist, have a hypothesis but look at the data with fresh eyes – don’t bias your conclusions, allow for interpretation