CSCI 4973
Introduction to Visualization
Spring 2012

http://www.cs.rpi.edu/~cutler/classes/visualization/S12/

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MRC 331A

“Introduction” to Visualization:
Where do we start?

Technology
how?

Computer Graphics
Computation

User Interface Design

Visualization
Simulation

Graphic Design

Visualization

Color Theory

Human Vision

Human Vision

Science
why?

Art
what?

Science
why?

Computer Graphics
Computation

User Interface Design

Visualization
Simulation

Technology
how?

“Introduction” to Visualization:
Where do we start?

Science
why?

Art
what?

Technology
how?
Introductions... my research:

And you? Major/Research Area? Skills & Strengths?
What do you hope to learn in this course?
Visualization of Tetrahedra Quality

1,050K tetras (133K faces)

good angle, but small-volume

zero-angle & zero-volume

near-equilateral & ideal-volume

Visualiza>on of Tetrahedra Quality

Octree or Adaptive Distance Field (ADF)

461K tetras (108K faces)
Visualization of Tetrahedra Quality

After Simplification & Mesh Improvement

10K tetras (3K faces)

Visualization of Simplification Algorithm
The Visualization Process

- Motivation & Problem Definition
  - e.g., audience, purpose, goals, interdisciplinary collaboration
- 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, 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?"

<table>
<thead>
<tr>
<th>CSCI 4530/6530 Advanced Computer Graphics</th>
<th>CSCI 4973 Introduction to Visualization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Established course</td>
<td>New course</td>
</tr>
<tr>
<td>traditional, technical lectures</td>
<td>will be different than Fall 2010 offering</td>
</tr>
<tr>
<td>instructor provides most of the content</td>
<td>instructor provides some of the content</td>
</tr>
<tr>
<td>lots of in class discussion</td>
<td>students provide some of the content</td>
</tr>
<tr>
<td>read 2 research papers a week</td>
<td>lots of in class discussion</td>
</tr>
<tr>
<td></td>
<td>some in class work time</td>
</tr>
<tr>
<td>Structured individual homeworks</td>
<td>read 1 research paper a week</td>
</tr>
<tr>
<td>lots of programming</td>
<td>Design-your-own homeworks</td>
</tr>
<tr>
<td>flexibility only in extra credit</td>
<td>design/art/creativity/thinking/revision/</td>
</tr>
<tr>
<td></td>
<td>presentation is focus</td>
</tr>
<tr>
<td>5 week final project</td>
<td>some programming for implementation</td>
</tr>
<tr>
<td>teams of 2 encouraged</td>
<td>some fiddling with visualization toolkits</td>
</tr>
<tr>
<td>topic of your choice</td>
<td>individual &amp; group work required</td>
</tr>
<tr>
<td>lots of graphics-related programming</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 units of credit</td>
</tr>
<tr>
<td></td>
<td>Counts only as “Free Elective” for CS majors</td>
</tr>
<tr>
<td></td>
<td>(Probably) an unreasonable time</td>
</tr>
<tr>
<td></td>
<td>commitment expected for a 2 credit course</td>
</tr>
<tr>
<td>4 units of credit (3 for grad version)</td>
<td></td>
</tr>
<tr>
<td>Counts as a “CS option” for CS majors</td>
<td></td>
</tr>
<tr>
<td>Huge time commitment</td>
<td></td>
</tr>
<tr>
<td>Prior graphics experience recommended</td>
<td>Passion for visual perfection recommended</td>
</tr>
</tbody>
</table>

Passion for visual perfection recommended
"Rules" for the course

- Participation is 15% of your grade:
  - Class starts at 10am promptly, don’t be late
  - 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
Readings for Next Week: *(pick one)*

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


– “Helping Engineers and Scientists Avoid PowerPoint Phluff”, John Mignot, IEEE Aerospace Conference, 2005

• Everyone must post a *non-trivial* comment or question on their chosen reading to the LMS discussion by Monday @ 11:59pm

Homework Assignment 1: *due Tuesday @ 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
• For each weekly homework assignment, estimate the number of hours (~5 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.

“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
http://www.facebook.com/philipkochpaintings