Today

- What is Interaction? Camera vs. Data Manipulation
- Interaction Devices
- Object Selection & 3D “Picking”
- Papers for Today
  - "D3: Data-Driven Documents"
  - "Interaction Techniques for Selecting and Manipulating Subgraphs in Network Visualizations"
- HW4 Preview
- Readings for Tuesday
- Storyboarding & Wizard of Oz Interface Testing
- Storyboarding Interaction Worksheet
What is Interaction?

- Manipulating objects in a scene
  - Moving
  - Rotating
  - Selecting
  - Deleting
- Manipulating your view of the scene (manipulating the camera)
  - Pan
  - Tilt
  - Zoom

Berkeley Soda Hall walkthrough

Manipulating the Camera  Choose the right camera model!

Are you selling an object?
- What is the scale of object?
- Is this the natural viewpoint?
→ **Fixed camera,**
  manipulate the object

Are you selling an immersive experience?
- E.g., 1st person video game navigation?
→ **Move the camera**
  within the scene
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Interaction Devices

- Keyboard
  - Press a key
  - Hold a key
- Mouse
  - Left button
  - Middle button
  - Right button
  - Single click
  - Double click
  - Scroll wheel
  - Trackball?
- Joystick
  - vibration
- “3D mouse”
  (e.g. 3D Connexions Space Navigator)
- Pen (Wacom)
- Touch or Multi-Touch
- Haptics
  - 3D position
  - 3D direction
  - Directional force feedback

At brainstorming phase… be creative, open-minded, consider all possibilities
Haptic Device

- “3D mouse” + force feedback
- 6 DOF (position & orientation)
- *requires 1000 Hz refresh*
  (visual only requires ~30 Hz)

More Interaction Devices

- Application-specific input devices
  (musical instruments, steering wheel, light gun, etc.)
- Microphone (voice control, translation)
- Brain computer interface, stress sensor, muscle sensors
- General video input, tracking (kinect)

Sensible’s Phantom
http://www.sensible.com/
Choosing the Right Device

• 2D vs. 3D
• Visual and/or Haptic Feedback
• Intuitive, most similar to natural (non digital/virtual) interface
• Availability/expense/learning curve, overall practicality
• Resolution/accuracy
• Robustness/noise
  – If requires reset/recalibration, is that acceptable?
  – Frames per second requirements of haptics
• Comfort/exercise/overuse injuries

During prototyping phase…
focus on your target
audience & eventual deployment

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What is “Picking”?  
- Get the (3D) world coordinates of a (2D) mouse click  
- Identify which object was selected and the point on the object closest to the click  
- As users take this for granted  
  - How is it implemented?  
  - What are the performance bottlenecks?  
  - What are the usability concerns?

“Picking” by Ray Tracing  
- Construct a ray from the eye through the image plane into the scene  
- Loop over and intersect ray with every object in the scene  
- Keep the closest intersection  
- Concerns:  
  - Performance: $O(n)$, for a scene with $n$ objects  
  - How often are you asking?  
    On a click? Continuously, as the mouse moves?  
  - Positional imprecision/noise?
“Picking” by the Framebuffer

• Color each object a different, unique color (no lighting/shading)
  – Are there enough colors??

• Grab the color of the pixel from the framebuffer (object id)

• Grab the z-value (depth) from the depth buffer

White, Crane, & Forsyth, "Capturing and Animating Occluded Cloth" SIGGRAPH 2007

Using 3D Painting  
http://www-ui.is.s.u-tokyo.ac.jp/~takeo/gallery/chameleon.png
Painting by Picking a Picket Fence?

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"D3: Data-Driven Documents" by Bostock, Ogievetsky, & Heer, TVCG 2011

**Reading for Friday** _pick one_

"D3: Data-Driven Documents", Bostock, Ogievetsky, & Heer, TVCG 2011

- **Authors have a prior visualization system/language: Protovis**
  - D3 is an iteration / improvement on the design
  - Have 2 years of experience and a variety of user visualizations with Protovis for comparison
- **Motivation / Objectives: Compatibility, Debugging, & Performance**
- **Transformations facilitation implementation of:**
  - Dynamic visualizations & Animated transitions
  - Also iterative debugging is easier
- **Have you taken Programming Languages?**
  - Case study design of custom / domain-specific language
- **Protovis’ language facilitated inheritance.**
  D3 is not a language, so it does not allow this feature.
Is this a “Systems Paper”?

Many conferences/journals have different types/tracks for papers. E.g.:

• “Technical Research Paper”
• “Experience Paper”
• “Computing Education Paper”
• “Experience Reports and Tools”
• “Position and Curricula Initiative”
• “Survey Paper”
• “Short Paper”
• “Poster/Abstract”

Read the submission guidelines for the conference/journal and ensure your paper idea is within the scope and determine what type/track is appropriate.

Is this a “Systems Paper”?

• Systems papers can be challenging to get published. “Implementation” and “Development” alone is deemed insufficient for publication in an academic Research conference/journal. Writing software is not enough, you need to evaluate the software, that’s the research angle.
• Systems papers often have a big author team.
• Systems paper can be more challenging for a new person to read
• Technical details from older systems papers may be outdated
  – Hardware / libraries (e.g., Flash) may be deprecated
  – Absolute performance (even relative / % of whole) performance stats may no longer be accurate
  – Is there any value in reading older systems papers?
• Systems paper typically requires more documentation, more examples, more supplemental material
• Often prior work is the author’s work. It can be challenging to cite prior work anonymously to satisfy a double-blind conference/journal review process.
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Reading for Friday  pick one

"Interaction Techniques for Selecting and Manipulating Subgraphs in Network Visualizations",

- Customization & selection is necessary to effectively visualize bigger datasets
- Advanced interaction techniques: lasso, gestural, radial menu, hotbox, keyboard shortcuts, etc.
- Force directed initial layout
- Ability to select subgraph
- Option to fix position and other properties, such as: color, size, shape, label, etc
- Option to optimize layout of selected subgraph in a line (PCA based) or circle

"Interaction Techniques for Selecting and Manipulating Subgraphs in Network Visualizations",

- Aim to minimize keyboard & mouse clicks
- Auto-detect rectangular lasso vs circular lasso (length of pen stroke relative to distance between start & end points)
- User Testing / Interface Evaluation
- “However, the interface took a non-negligible amount of time to learn, and we suspect the users did not have time within a 2-hour session to converge to expert-level performance.”
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HW 4: Make Something Interactive

- Explore and learn D3.js: Data Driven Documents
- Make something new & interactive
- (open-ended)
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Reading for Tuesday pick one

Reading for Tuesday pick one


(a) low rank  (b) medium rank  (c) high rank
(d) low rank  (e) medium rank  (f) high rank

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Animated Movie “Storyboarding”

http://pixar-animation.weebly.com/storyboard.html
“Wizard-of-Oz” for Interface Testing

http://courses.cs.washington.edu/courses/cse440/12wi/projects/pocketdoctor/medfi.html
“Wizard-of-Oz” for Interface Testing


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