Introduction to Deep Media

FDI Track R
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Inexorable climb

• Hardware power & speed
• Commodity platforms
• Informatics integration
• Compelling Content
Once upon a time

4D: a first-class citizen

What’s new?
• Networked 3D digital assets
  – Objects and components
  – Appearances & materials
  – Environments
• Animation and Timeseries databases
• Metadata & web-aware referencing
• Interaction semantics
Deep Media

- Interactive spaces that evolve over time
- Contain spatially-located media resources
  - Audio
  - Video
  - Vector animations
- Hyperlinked worlds
Big Picture: Convergence & Utility

- Unified environment for analysis & learning
- Scalability for heterogeneous data types (spatial, abstract, temporal)
- Represent real world objects and systems
  - Reduce cognitive distance by putting information in familiar context
  - Leverage spatial abilities of users

Who am I

- CS / HCI doctorate – perception and action in information-rich virtual environments
- Environment and interface developer of deep media for research and education
- Web3D Consortium: Director, Co-author X3D Specification
- Working with Research Computing to advance visualization capabilities @ VT
Who are you?

Goals of this Workshop

- Familiarity with tools and technologies
- Basic competence in authoring and production
- Pathway to utilize VT’s Visualization expertise and facilities
Visualization: definition

- Generally:
  - The use of computer-supported, interactive, visual representations of data to amplify cognition
  Card, McKinlay and Schneiderman
  - Scientific Visualization
  - Information Visualization
  - Virtual Environments

Visual Thinking

- Many of the great scientists were good at visual thinking:
  - Leonardo da Vinci
  - James Clerk Maxwell
  - Michael Faraday
  - Albert Einstein
  - Tom West: “In the Mind’s Eye”
  - See also http://www.krasnow.gmu.edu/twest/maxwell_visual.html

Maxwell’s clay model now in New Cavendish Laboratory, Cambridge (picture by Tom West)
Recent Research – Display Venues

- VT Computer Science, Center for HCI
- Show high-res and immersive display venues CAN improve task performance:
  - Analyze 22x more data in only 3x more time while maintaining accuracy
  - Reduce virtual navigation actions by 75%
  - Reduce frustration by 50%
  - Short initial learning time

New Opportunities – Display Techniques

- Spatial, Abstract, and Temporal data can be combined, delivered and presented in an ‘integrated information space’
- Attributes and annotations plus objects and groups can be rendered with a variety of (in)consistent perceptual cues
The Challenge

- The real digital divide is the last ten feet between the interface and the mind.

<table>
<thead>
<tr>
<th>Perception</th>
<th>Interpretation</th>
<th>Making Sense</th>
</tr>
</thead>
<tbody>
<tr>
<td>color, shading, lines, characters, squares, spatial organization</td>
<td>(Working Memory) Excel worksheet; a part is selected, formula is displayed at top</td>
<td>Proposed design will cost too much in long term maintenance</td>
</tr>
</tbody>
</table>

Why Learn This?

- Integrated visualization capabilities are necessary for users to gain a full understanding of complex relationships in their heterogeneous data.
- Application designers must take account of how humans build their cognitive models and what perceptual predispositions and biases are in play.
- With such knowledge, designers can take steps to minimize or leverage their effect and create advantageous research, design, and decision-support applications.
State of the Art

• Successive layers of abstraction allow developers to design and build at higher levels
• Shaders and new rendering algorithms improve realism & performance
• Concrete benefits of large format, high-res, and immersive displays

Graphics Engines

• Games
  – e.g. Unreal, Delta3D, …
• Consumer solutions
  – e.g. Cortona, Bitmanagement, Octaga, FreeWrl, Xj3D, Flux, H3D…
• Multi-User spaces
  – e.g. ActiveWorlds, Blaxxun, BeThere, SecondLife, …
• Industrial grade toolkits
  – e.g. DIVERSE, Paraview & VTK, …
Services & Servers

- Integrated databases
- Interoperable file formats
- Referenced resources across the web
- Visualization middleware services
- Multi-user & persistent worlds

Proprietary vs. Opensource

- Who owns the data?
- Who owns the tools to access that data?
- How are bugs/new features accomplished?
- How much does it cost?

Games, Google, Second Life vs. open standards
Data Formats

- VRML & X3D:
  - expressive data and runtime behavior
  - Interoperation with WWW
- Import and export from many commercial and free tools
- A capable ‘common denominator’

Open Standards

www.web3d.org

- Portability
- Durability
- IP independence
- International recognition and support
Foundations

- ISO standard, openly published
- Multiple implementations including open source codebases
- X3D includes Transformation graph and behavior graph

<table>
<thead>
<tr>
<th>Application</th>
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</thead>
<tbody>
<tr>
<td>VRML, X3D</td>
</tr>
<tr>
<td>Open GL, etc</td>
</tr>
<tr>
<td>Operating System</td>
</tr>
</tbody>
</table>

Source of Specs, Models, Links, Bulleting boards, Blogs, Mailing lists, …

http://www.web3d.org
Immersion

- Technology that helps you ‘be there’ … to ‘be present’
  - Display surround
  - Stereoscopic rendering
  - Head and input tracking
Base Install (Windows)

- Drag the ‘Classroom files’ /npolys folder to a folder with you name on the local Project drive
  - Install Flux Studio authoring IDE
  - Install Cortona viewer (select OpenGL renderer)
  - Fix IE security settings in Internet Options:
    - Medium; allow Active X
    - Point IE to http://www.parallelgraphics.com/products/cortona/best
  - Flux player will work in Firefox; see:
Bonus Installs (Win)

- Chisel: opensource optimizer & translator
  - http://www2.hrp.no/vr/tools/chisel/install.htm
- Paraview: opensource full-featured Vis app
  - http://www.paraview.org
- X3D Edit: opensource structured editor & translator
  - http://www.web3d.org/x3d/content/README.X3D-Edit.html
- Xj3D: opensource jogl rendering engine
  - http://www.xj3d.org/snapshots.html

Base Install (Mac)

All opensource:

- White Dune: opensource VRML authoring IDE
  - http://vrml.cip.ica.uni-stuttgart.de/dune/
- FreeWrl: opensource viewer
  - http://freewrl.sourceforge.net/
Bonus Install (Mac)

- Chisel: optimizer & translator
  - [http://www2.hrp.no/vr/tools/chisel/install.htm](http://www2.hrp.no/vr/tools/chisel/install.htm)
- Paraview: full-featured Vis app
  - [http://www.paraview.org](http://www.paraview.org)
- Xj3D: opensource jogl rendering engine
  - [http://www.xj3d.org/snapshots.html](http://www.xj3d.org/snapshots.html)

Deep Media

Examples:
Other tool links

- Ask me about it!
- Linux platforms supported in VT Vis

Viewers

<table>
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<th>Description</th>
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<tr>
<td>Cortona (Win)</td>
<td>Stable and easy to use; VRML only <a href="http://www.parallelgraphics.com/products/cortona">http://www.parallelgraphics.com/products/cortona</a></td>
</tr>
<tr>
<td>Contact (Win)</td>
<td>Great rendering speed, expert interface; VRML and X3D <a href="http://www.bitmanagement.de/download/playerdownload.en.html">http://www.bitmanagement.de/download/playerdownload.en.html</a></td>
</tr>
<tr>
<td>Octaga (Win, Linux)</td>
<td>Nice rendering features, VRML and X3D <a href="http://www.octaga.com">http://www.octaga.com</a></td>
</tr>
<tr>
<td>FreeWrl (Mac, Linux)</td>
<td>A robust and compliant opensource viewer, Canadian Gov’t. opensource project; VRML and X3D <a href="http://freewrl.sourceforge.net">http://freewrl.sourceforge.net</a></td>
</tr>
<tr>
<td>Xj3D (Win, Mac, Linux)</td>
<td>A robust and compliant opensource engine written over Java and OpenGL. You’ll be surprised! VRML and X3D <a href="http://www.xj3d.org/snapshots.html">http://www.xj3d.org/snapshots.html</a></td>
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### VRML / X3D Authoring Tools

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<tr>
<th>Tool</th>
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<tr>
<td>VizX3D</td>
<td>Free beta of a mature product; Win only</td>
<td><a href="http://mediamachines.com/make.php">http://mediamachines.com/make.php</a></td>
</tr>
<tr>
<td>Blender</td>
<td>Opensource; animation can be exported; Win, Mac, Linux (C++)</td>
<td><a href="http://www.blender.org/cms/Home.2.0.html">http://www.blender.org/cms/Home.2.0.html</a></td>
</tr>
<tr>
<td>ArtofIllusion</td>
<td>Opensource; Win, Mac, Linux (Java)</td>
<td><a href="http://www.artofillusion.org/">http://www.artofillusion.org/</a></td>
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### Authoring / translation

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<tr>
<td>X3D-Edit</td>
<td></td>
<td><a href="http://www.web3d.org/x3d/content/X3D-EditAutoInstall/Web_Installers/install.htm">http://www.web3d.org/x3d/content/X3D-EditAutoInstall/Web_Installers/install.htm</a></td>
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[http://www.bitbucket.ca/~acheater/blender/](http://www.bitbucket.ca/~acheater/blender/) |
| 3D Object Converter | Shareware, Win only                                                          | [http://web.axelero.hu/karpo/](http://web.axelero.hu/karpo/) |
## Toolkits

<table>
<thead>
<tr>
<th>Toolkit</th>
<th>Website or Details</th>
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<tr>
<td>OpenVRML</td>
<td>Included in FedoraExtras <a href="http://www.openvrml.org">http://www.openvrml.org</a></td>
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<td>VisIT</td>
<td><a href="http://www.llnl.gov/VisIt/executables.html">http://www.llnl.gov/VisIt/executables.html</a></td>
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