Visualization
and
Nonphotorealistic Rendering

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• Visualization
• Non-photorealistic Rendering
• Cutaway Illustration
• Contour Drawing
• Good photographs.
• Map Drawing
Visualization

- **Goal:** Use computer graphics to understand data.

- **For virtual every data type there is a corresponding visualization.**

- **The importance of graphics!**
Numerical Data

http://www.manifold.net/news/ft-through.jpg
Graphs

http://www.wandora.org/wandora/wiki/images/froe_graph_example.gif
3D Volume Data

http://medvis.vrvis.at/fileadmin/hwr/images/headsphere.jpg
Figure 2.4: An example of a visualization of a single respiratory phase of a 4DCT visualization showing lung, bone, and skin.
Volume Rendering

- Visualize large dataset for scientific / medical application.
- Generally do not start with a 3D model.

**INPUT**

CT Scan - White means higher radiodensity.

**OUTPUT**
Large Datasets

INPUT
CT Scan - White means higher radiodensity.

OUTPUT
• CT or MRI:
  - e.g. 512×512×200 ≈ 50MB
• Visible Human:
  - 512×512×1734 ≈ 433MB
Two Options

- Surface Rendering
- Volume Rendering
Surface Rendering

- Threshold volume data.
- Then run our favorite algorithm....
- Hint: rhymes with “starching dudes”
Volume Rendering

- Some data better visualized as a volume, not a surface.
- **Idea:** Use voxels and transparency.
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Basic Idea

• Which best conveys “reality?”

Photograph.

Painting.
A Rough Sea at a Jetty, 1650.
Jacob van Ruysdael.

Computer Graphics
Duncan Brinsmead

source: Jos Stam. *Photography changes what we think “reality” looks like.*
Reality

- A Rough Sea at a Jetty, 1650. - Jacob van Ruysdael.

- This instance in time never happened!
- Perhaps a better match of “subjective reality.”
- Better illustration of “what was going on.”
• Perhaps we can do better graphics...
• By doing non-photorealistic graphics!
NPR Pipeline

- NPR Research often follows this pipeline...

1. Study Existing Rendering or Illustration Technique
2. Extract General Aesthetic Rules
3. “Algorithmicize” These Rules
Outline

- Visualization
- Non-photorealistic Rendering
- Cutaway Illustration
- Contour Drawing
- Good photographs.
- Map Drawing
Goal
Box Cut
Box Cut

Object-aligned box cut
Window Cut

Window cut
Wedge Cut
Wedge Cut

Wedge cut
Transverse Tube Cut

Transverse tube cut
Results

Interactive Cutaway Illustrations of Complex 3D Models

Wilmot Li¹  Lincoln Ritter¹  Maneesh Agrawala²  Brian Curless¹  David Salesin¹,³

¹University of Washington  ²University of California, Berkeley  ³Adobe Systems

(Source: Li et al. InteractiveCutawayIllustrationsofComplex3DModels)
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$n(p) \cdot v(p) = 0$
Suggestive Contours

\[ \min \; n(p) \cdot v(p) \]
Examples

Suggestive Contours for Conveying Shape

Saturday, February 27, 2010
More Examples

(a) Drawing likelihood
(b) User composite
(c) Suggestive contours
(d) Extracted lines
(e) Sample drawing
(f) Canny edges

Where Do People Draw Lines?
Forrester Cole, Alexey Golovniov, Alex Lempach, Heather Goddard Barros, Adam Pinkelstein, Thomas Funkhouser, and Gzyman Rusinkiewicz

Saturday, February 27, 2010
Depth Edge Camera
Depth Discontinuities

Internal and external
Shape boundaries, Occluding contour, Silhouettes
Our Method

Canny Intensity Edge Detection
Shadows
Clutter
Many Colors

Highlight Shape Edges
Mark moving parts
Basic colors
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Goal
Reality
MapBlast / LineDrive

[Rendering effective route maps:..., Agrawala and Stolte]
Figure 2: The LineDrive system. (a) Given a route as a sequence of roads, LineDrive designs a route map by processing the route through five consecutive stages. (b) The resulting LineDrive map. (c) The same map rendered without applying the generalization techniques performed by LineDrive. The constant scale factor and retention of detailed road shape make it difficult to identify many of the roads.
Practice Problem

Of all of the NPR examples you saw in class today, which did you think was most effective for what it was trying to do and why?