What is NPR?

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Define Photorealistic Rendering

Photo:

- Comes from the Greek *phos*, meaning light or produced by light
Define Photorealistic Rendering

Realistic:
• Dictionary definition:
  – fidelity in art and literature to nature or to real life and to accurate representation without idealization

Rendering:
• Convert a representation of a virtual scene into an image for viewing

Understand Photorealistic Rendering
• Light, material properties, reflections & refraction
• Radiosity, ray tracing, & image-based rendering
Example: Art of Jan Vermeer

Example: Photorealistic Rendering

From Lightscape
Define Non-Photorealistic Rendering

Descriptors:
- expressive
- artistic
- painterly
- interpretative

Approach

Photorealistic rendering:
- Simulation, usually physically based

Non-photorealistic rendering:
- Stylization, driven by human perception
- Brings together art and science
- Concentrates less on the process and more on the results
Characteristic

Photorealistic rendering:
  • Objective

Non-photorealistic rendering:
  • Subjective

Influences

Photorealistic rendering:
  • Simulation of physical processes

Non-photorealistic rendering:
  • Artistic processes
  • Perceptual-based
Level of detail

Photorealistic rendering:
- High level of detail, hard to neglect detail

Non-photorealistic rendering:
- Runs the range
- Adapt level of detail across the image to focus the viewers attention

Level of Abstraction

From Understanding Comics, by Scott McCloud, 1993
Illustrators Use of Lines

Wire frame versus Edge Lines

Are Real Edges Sufficient For Object Recognition?
Sanocki et al.
Silhouettes

Submitted to The Journal of Graphics Tools:
Evaluating Silhouette Algorithms for Polygonal Models, Hartner et al.
A Top-Down Approach to Normal Cone Hierarchies, Hartner et al.
Evaluating Object Space Methods for Silhouette Rendering, Beddes et al.

Creases
Surface boundaries

Silhouettes in Black, Creases in White

Gooch et al., I3D 1999
Artistic Silhouettes

Gooch et al., I3D 1999

Shading Used by Artists

Complementary Shading

Final image

The Book of Color, by Jose Parramon, 1993
Tone Shading on a Gray Model

Gooch et al., ACM Siggraph 1998

Tone Shading

Phong Shading

Tone Shading

Gooch et al., ACM Siggraph 1998
Imitating Material Properties

- Phong shaded
- Metal shaded

Illustrators Use of Shadows
Soft Colored Shadow

Gooch et al., ACM I3D 1999

Mayan Temple Example

Potter et al.
Motivation for Computer Scientists

Provide tools for:

• artists
• non-artists

Categorizing NPR

Hard to categorize NPR

• Natural media emulation
  – pen-an-ink
  – watercolor
  – oil

Winzenbach et al. 1994

Hertzmann 1997

Curtis et al. 1997
Line and Stipple Drawing

Secord et al. 2002

Deussen et al.

Way et al. 2002

Sousa et al. 2003

Figure 14: Rendering the landscape scene in different viewing positions.

Hatching

Webb et al. 2002

Praun et al. 2001

Hertzmann 2000
Cartoon Rendering

Markosian et al.

Kaplan et al.

Lake et al.

Simulating materials

Wax Crayons, Rudolf et al. 2003

Rudolf et al. 2003
Embossing

Categorizing NPR

- Image and video enhancement

From www.revisionfx.com
Categorizing NPR

- Image and video enhancement

From www.revisionfx.com

Categorizing NPR

- User interface, like a paint program (2D & 3D)

Haeberli 1990

Cohen 2000

Gooch et al. 2002

Salisbury et al. 1997
Categorizing NPR

- Process applied to geometric models

Meier 1996

Saito et al. 1990  Dooley et al. 1990

Categorizing NPR

- Process applied to geometric models

Gooch et al. 1998
Creating Models

Takeo Igarashi
http://www-ui.is.s.u-tokyo.ac.jp/~takeo/java/smoothteddy/

Sketch From Brown U.

What NPR can & can't/shouldn't do

• It is difficult to imitate the decisions of a real artist

• Can we give computer programs inventiveness?

• Can programs be expressive in themselves, or do we depend on the user?
It’s not all automatic

You can't just apply NPR to any image or scene & get a work of art

Think about:

• Subject matter
• Scene composition
• Conveying emotion or purpose

Benefits of NPR

• Communication
• Change user focus
• Eliminate unnecessary details
• Create details not seen in the geometric model