CS 428: Fall 2010

Introduction to Computer Graphics

Realism (overview)

Topic overview

- Image formation and OpenGL

- Transformations and viewing

- Polygons and polygon meshes

  - Programmable pipelines

- **Modeling and animation**

  - **Parametric curves (and surfaces)**

  - **Procedural modeling**

  - **Traditional and procedural animation**

- Rendering

Topic overview

- Image formation and OpenGL

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  - Programmable pipelines

- Modeling and animation

- **Rendering**
  - **Object space hidden surface removal, bump mapping and other texture tricks**
  - **Raytracing and radiosity**

Next few lectures…

- Visibility (a.k.a. hidden surface removal)
  - Object space algorithms: BSP trees, traversal, etc.

- Illumination and shading (recap, etc.)
  - Bump mapping, shadows, reflection, refraction, antialising, etc.

- Rendering for realism
  - Raytracing (forward, backward, distributed)
  - Radiosity (gathering, shooting)

Methods for *realism*

- Ensure properties of images of visual scenes are enforced → **many categories!**
  - Computational models of lighting + illumination (shadows, reflections, caustics)
  - Computational models of surface properties (color, texture, fuzziness, roughness)
  - Geometric representations (surfaces)
  - Behavior (simulation, motion capture)
  - Consistency of scene (global illumination)
  - Interaction (frame rate lag, etc.)

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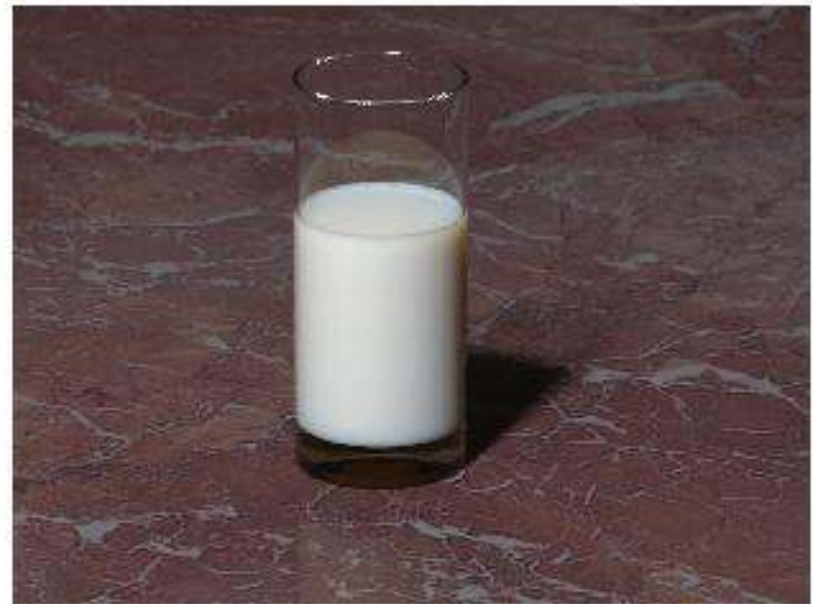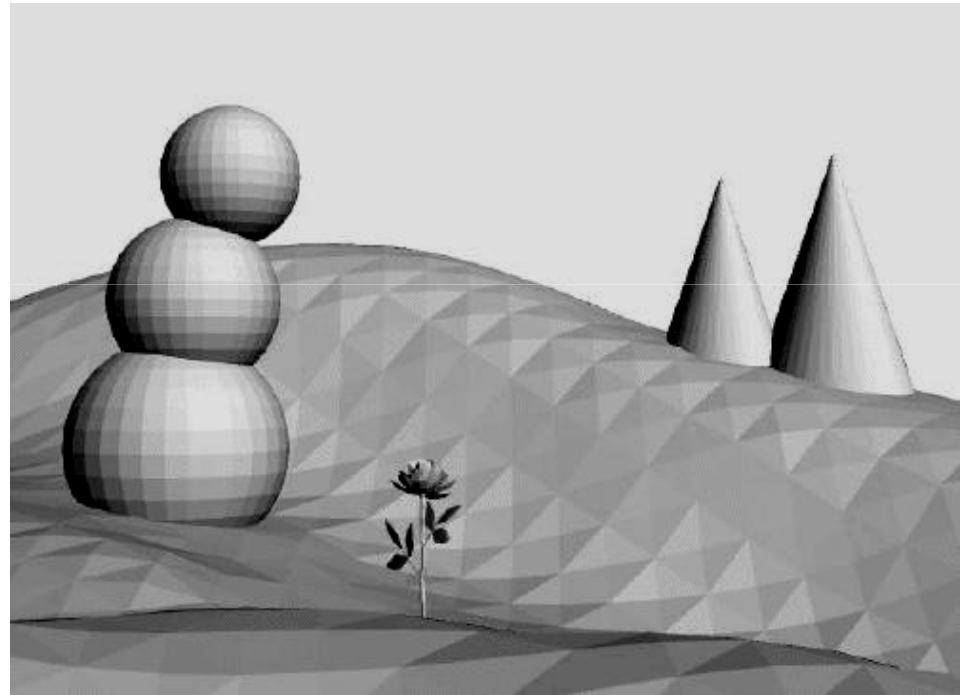
Temporal and spatial anti-aliasing
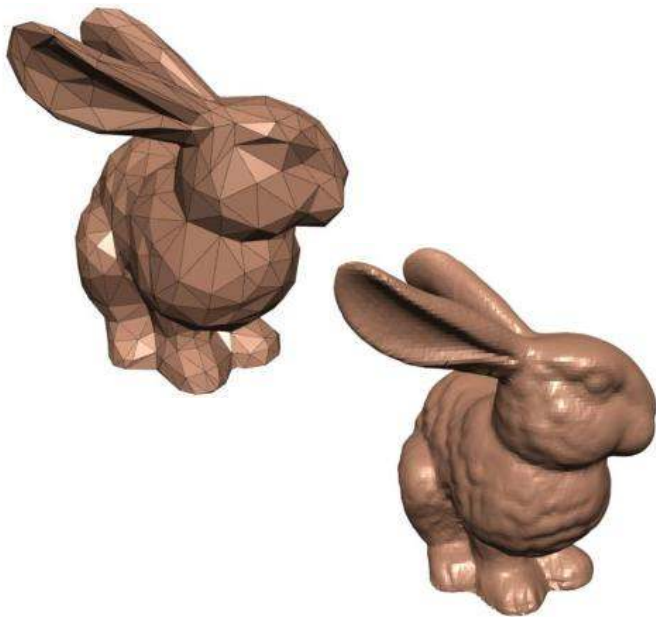
Photorealism

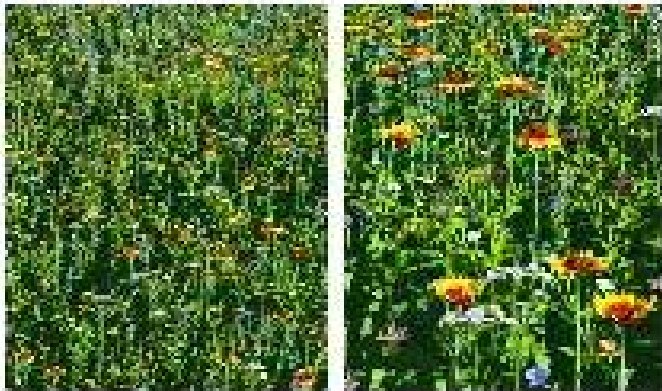# Photorealism

Photorealism

Non-photorealism

Polygons vs. Smooth surfaces

Level of detail

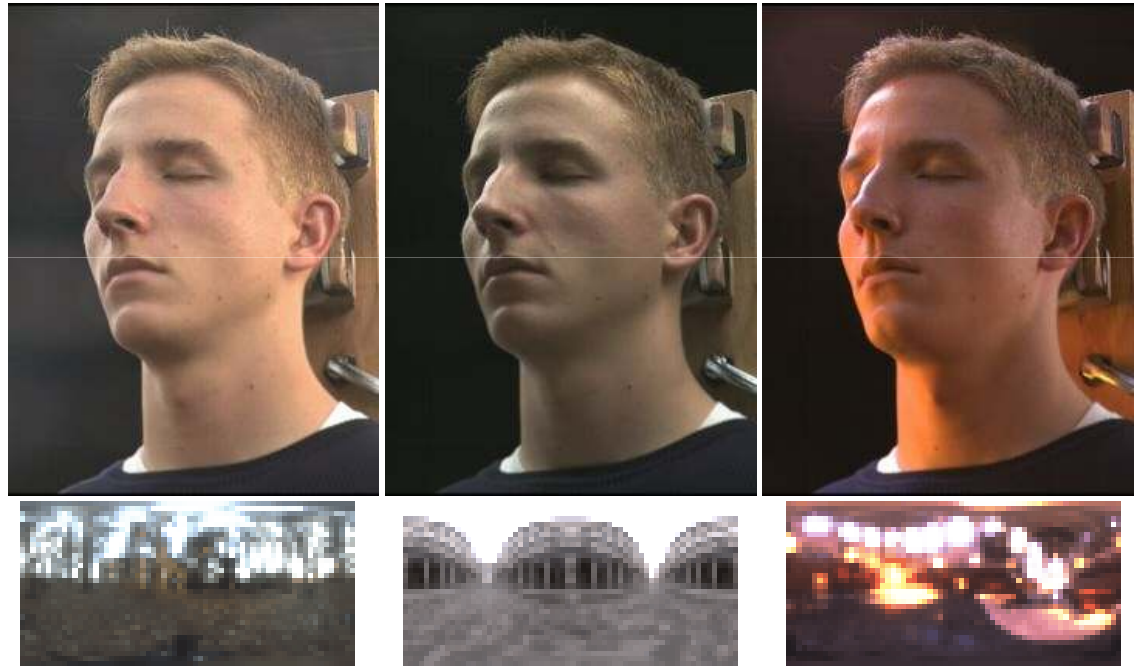# Level of detail

Texture mapping

Environment mapping

Bump mapping

Image-based rendering

Motion capture

Simulation

Trade-off(s)

- **Lots** of computation to do

- Trade-off(s)
    - Quality vs. computation time
    - Quality vs. [cost, staff of artists, etc.]
    - Quality vs. [**insert some resource here**]

- **Real-time** vs. **off-line**
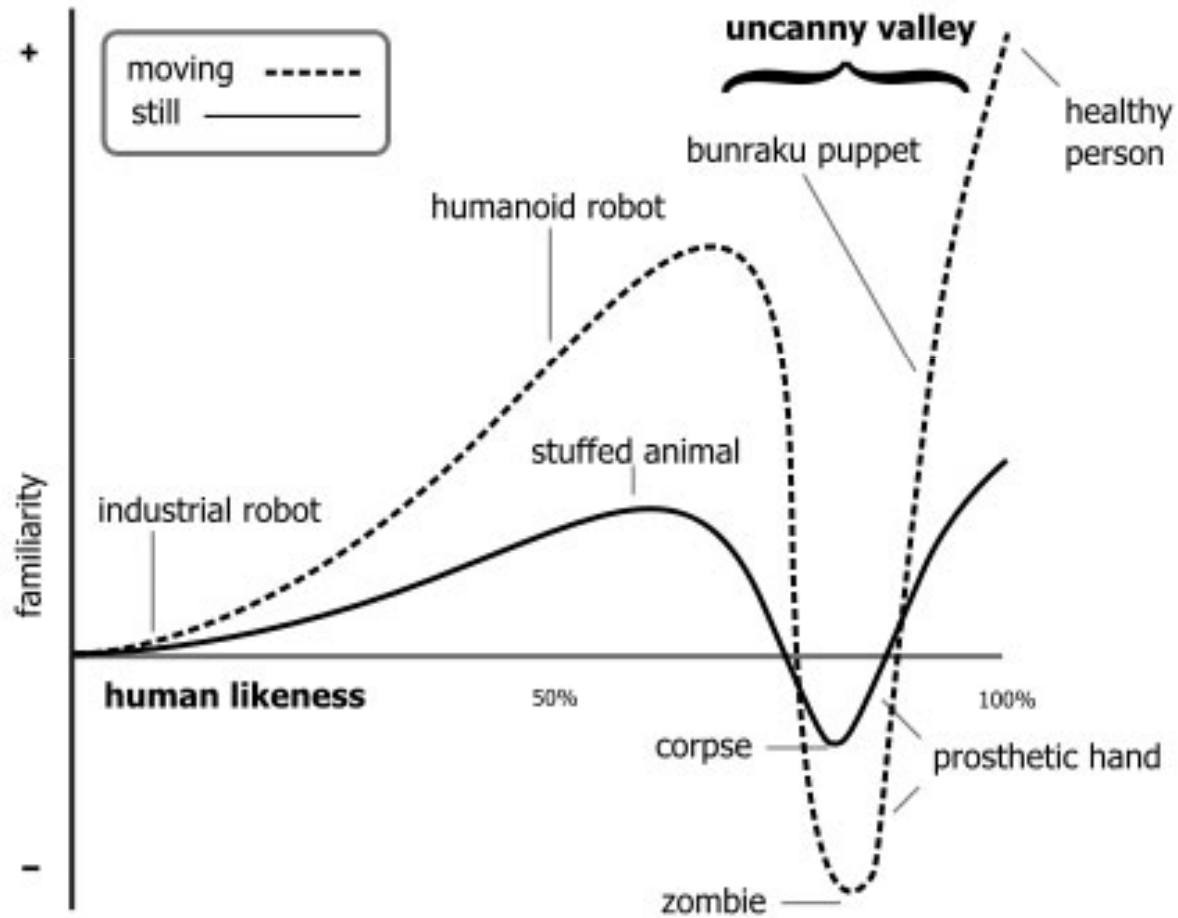
Sweet spot

- Highly application dependent
    - Special effects
    - Games
    - Virtual reality
    - Computer aided design (CAD)

- Desired effect
    - "non-photorealistic" rendering

(Extreme) visual abstraction

Uncanny valley

Bukimi no tani The uncanny valley. Masahiro Mori 1970

Uncanny valley
Solved?

Uncanny valley

Solved?

Uncanny valley

- Still images are continuously improving
  - Just a matter of time. **Potentially solvable.**

- Problem is exacerbated in human animation
  - Motion capture works for film.
    Infeasible for physical interaction in games.
  - Much research effort. **Potentially solvable.**

- **But what about digital interaction?**

Historical development
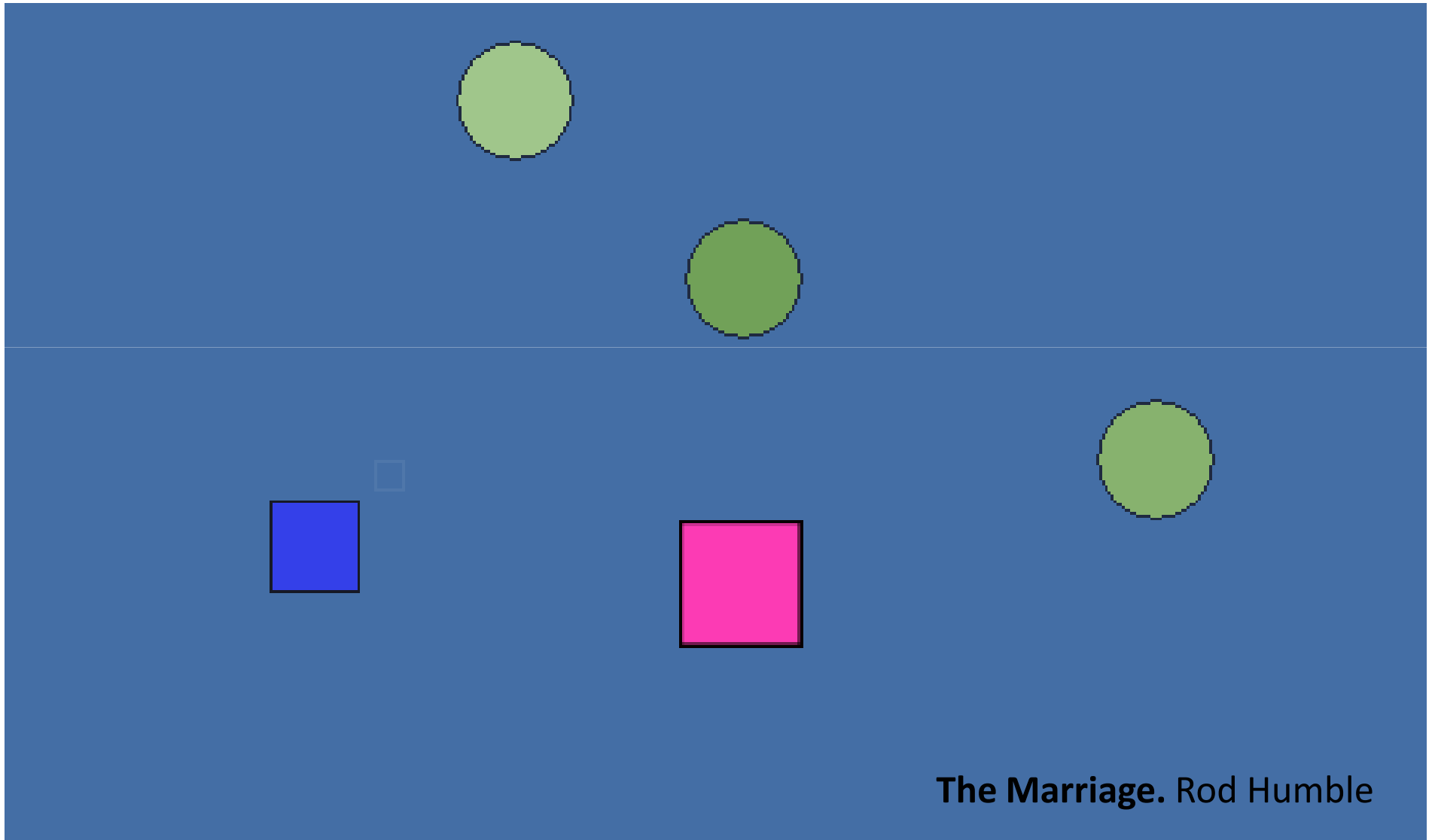

[Rendering.]   **[Animation.]**   **[Interaction.]**

Uncanny valley of **Interaction**

- Currently, meaningful interaction in **photorealistic environments** is quasi non-existent.

- Limited to. Destruction. Shooting. Etc.

- Notable example. **Exploration.**
  - Sense-pleasure as a goal is possible. Explicit interaction goals other than the most primitive kind are generally **absent.**

- Other Direct interactions ?
Indirect interactions/simulations ?

Visual interaction Abstraction

The Marriage. Rod Humble

Simulated Reality Abstraction

Gravitation. Jason Rohrer

Realism

- What is **real** lies in the eye of the beholder
- In order of increasing difficulty to *get right*
  - Still images
  - Animations
  - Interactions

- No **fixed rules**
  - It's all simulated anyway, and the sky is the limit

Innovation in representation allows us to point at and devote our shared attention to things that were invisible or unshared before..

Ceci n'est pas une pipe.