What is a Scene?

- A space we want to depict (render) on our screen
- Can be 3D or 2D
- What can a scene include?
  - Objects
  - Lights
  - Camera
Scenes in Games and Movies

- Much like a movie set:
  - Agents (actors)
  - Scripted
  - Player-controlled
  - Props for interactions
  - Lights for shading
  - Camera for rendering

Maya scene (Parik Gulati)
Scenes for Visualization

- Still involve agents, props, lights and cameras
- Same overall structure

Protein rotation
(structuralbioinformatician.wordpress.com)
An Object-Oriented Approach

❖ Object-oriented is a natural fit for scenes!
❖ Everything in a scene can be considered an object
  ❖ Actors, props, lights and camera all have unique properties and behaviors
❖ We can model these properties and behaviors using OOP
How Do We Define Shape?

- Vertices form edges
- Edges form faces
- Faces form meshes
Vertices

- A vertex is a point that provides geometric information
  \[ \text{point}(x, y); \]
- Multiple vertices can define a polygon or shape
  \[ \text{quad}(0, 0, 10, 0, 20, 10, 5, 10); \]
- Polygons and vertices represent an object in \textit{world space} rather than just \textit{screen space}
Polygons

- Common representation for objects in graphics
Consider...

- What are some of the ways objects in a scene can relate to each other?
Scene Graphs

- Graph (tree) hierarchy representing the relationship between objects in a scene

Scene graph example (JMonkeyEngine)
Another scene graph example
(http://hadva.blogspot.com/)
Scene graphs can represent (and facilitate) object interactions at varying levels of granularity:

- Object Animations
- Polygon transformations
- Vertex transformations

We’ll get to low-level transformations later, but let’s start with animation!
3D Modeling and Animation

- Consider Atlas from Portal 2…
• His joint movements are in some way relative to each other
• Bending the elbow changes the wrist position…
• Turning the wrist changes the finger orientation…
Hierarchical Modeling

- Hierarchical structure avoids moving each “piece” of the object individually
- This structure is based on the object’s design — not haphazard or random

What is a hierarchical model that captures the Pixar lamp?
From Modeling to Animation

- Modeling (set shape and form)
- Rigging (set underlying bone structure)
- Skinning (mapping the shape to bone)
- Animating (position the bones to move the shape)
Hands-on: Creating Scene Hierarchies

Today’s activities:

1. Design a scene hierarchy based on your Assignment 4 animation

2. Create the shapes of the overall object in one color and the subpiece(s) that will have their animations in another color

Note that each group member will work on their own object with its own complete animation hierarchy (including the main object and its subobjects)