Introduction to Computer Graphics
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Lecture 18: Scene Graphs & Trees in OpenGL
Outline

- Hierarchical Objects
- Scene graphs
- Trees
Hierarchical Objects

• Consider a robot
• Composed of head, torso, arms and legs
• Still further break down
  – arms: upper & lower & hands
  – Legs: upper & lower & feet
Describe attributes

- Head, hands, feet might have material property alike skin
- Upper & lower arms and legs, torso may have material alike clothing
Describe valid motion:

- Head rotates around y
- Upper arm rotates around shoulder -> elbow translates
- Lower arm rotates around elbow -> hand translates
- Upper leg rotates at hip -> knee translates
- Lower leg rotates at knee -> foot translates
Represent Part motion hierarchically

- Shoulder position (or top of upper arm) w/ respect to torso
- Elbow position (or bottom of upper arm) w/ respect to shoulder & rotation
- Hand (or lower arm bottom) w/ respect to elbow & rotation
Scene graphs

- Data structure to represent hierarchical nature of object or scene
- Allows an explicit representation of where to place separators
- In OpenGL this means where to place `glPushMatrix()/glPopMatrix()` or `glPushAttrib()/glPopAttrib()`
Node properties

Robot Body (Torso)  Material properties

- Head
  - Material properties, Translate, Rotate

- Arm 1
  - Material properties, Translate
  - Shoulder pos, elbow pos

- Arm 2

- Leg 1
  - Material properties, Translate
  - Hip pos
  - Knee pos

- Leg 2

- Upper
  - Translate
  - Rotate1
  - Rotate2

- Lower
  - Translate
  - Rotate1
  - Rotate2