



WPI

CS 543: Computer Graphics

3D Modeling

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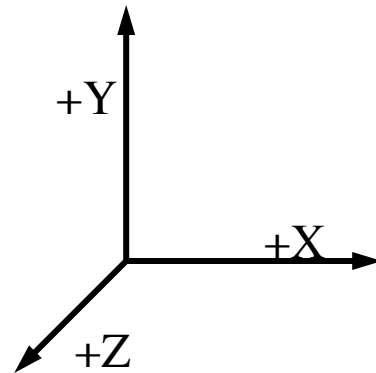
(with lots of help from Prof. Emmanuel Agu :-)

Overview of 3D Modeling

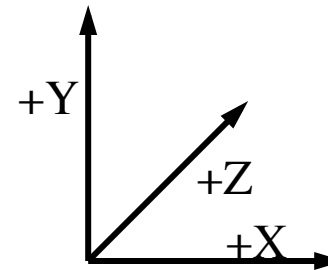
- Modeling
 - Create 3D model of scene/objects
- Coordinate systems (left hand, right hand)
- Basic shapes (cone, cylinder, *etc.*)
- Transformations/Matrices
- Lighting/Materials
- Synthetic camera basics
- View volume
- Projection

Coordinate Systems

- Right-handed and left-handed coordinate systems
 - Make an "L" with index finger and thumb
 - Right-handed is used in OpenGL
 - Converting from one to the other is a simple transformation



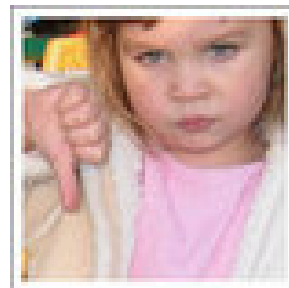
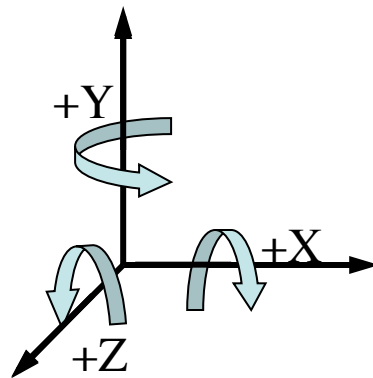
Right-Handed Coordinate
System



Left-Handed Coordinate
System

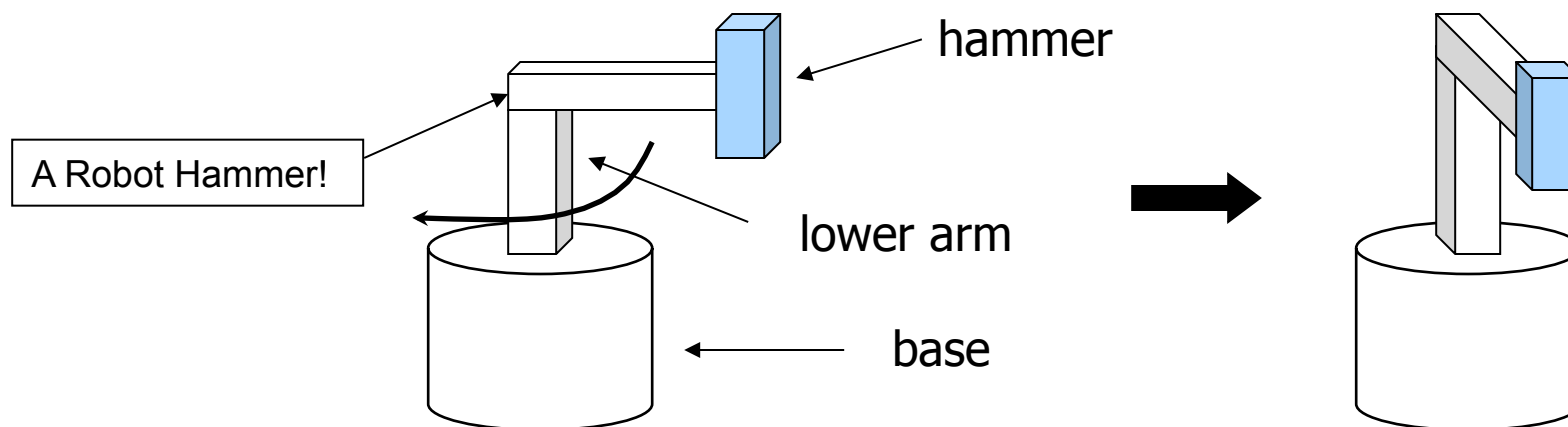
Right-Handed Coordinates

- To determine positive rotations
 - Make a fist with your right hand, and stick thumb up in the air (CCW)



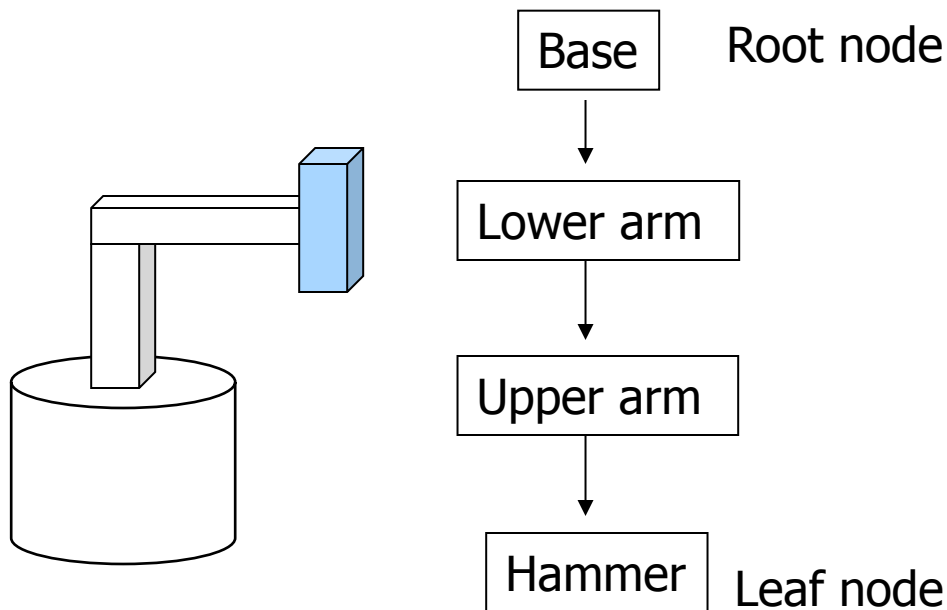
Hierarchical Transformations

- Graphical scenes have object dependencies
- Many small objects
- Attributes (position, orientation, *etc.*) depend on each other



Hierarchical Transformations **WPI** (cont.)

- Object dependency description using tree structure

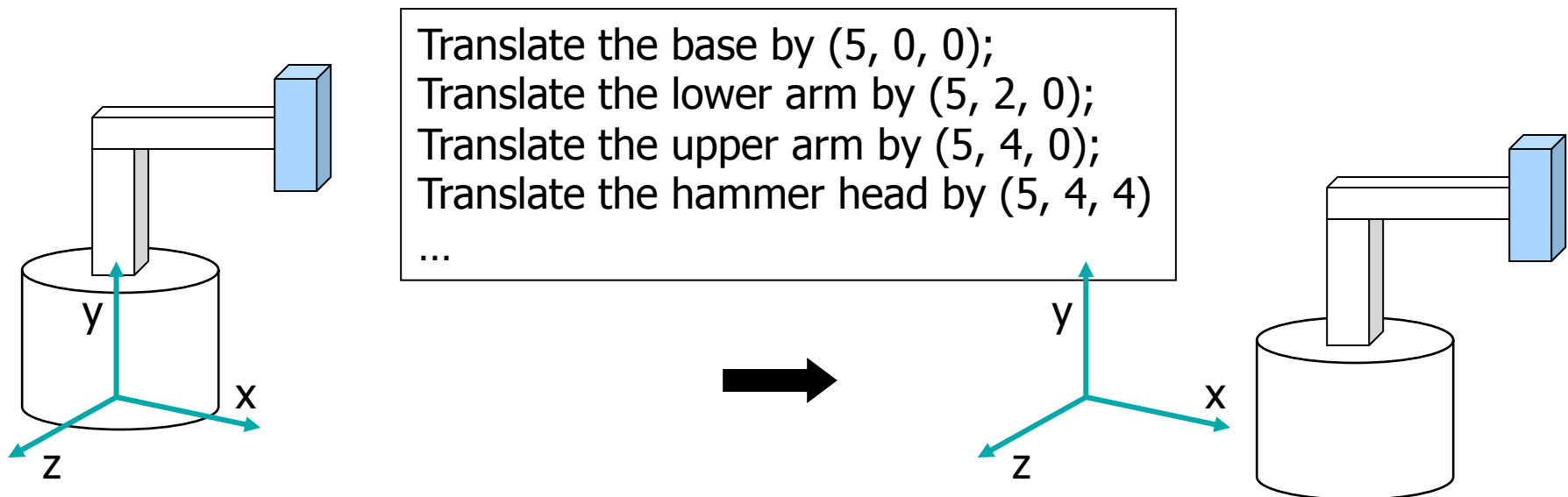


Object position and orientation can be affected by its parent, grand-parent, grand-grand-parent, ... nodes

Hierarchical representation is known as **Scene Graph**

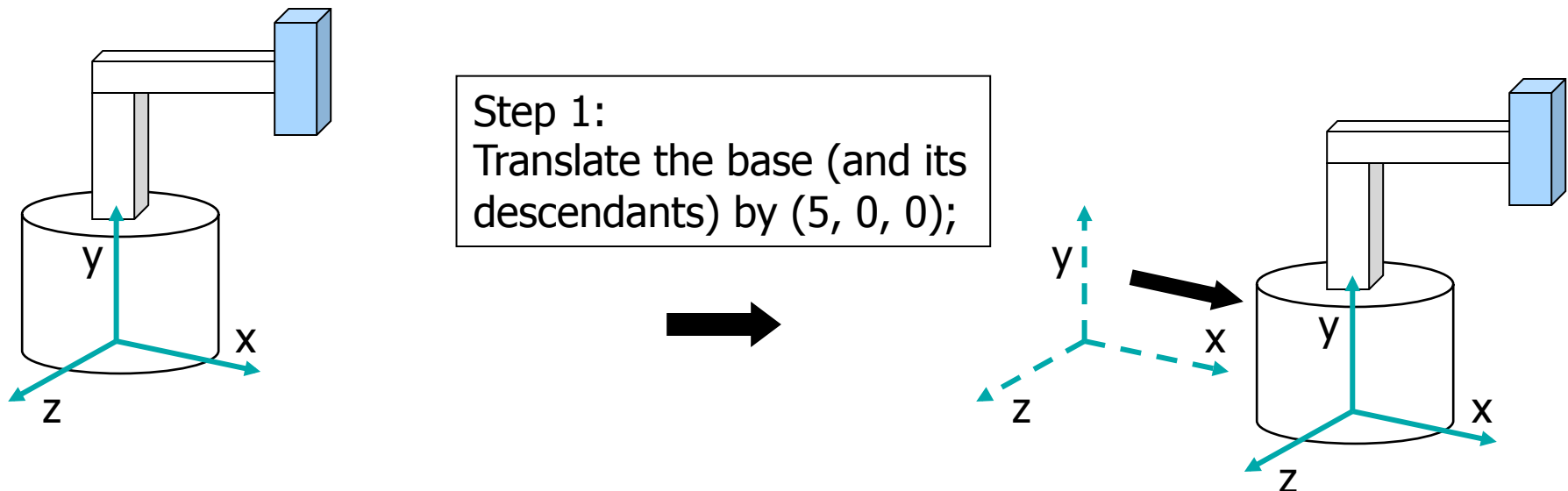
Transformations

- Two ways to specify transformations
 1. Absolute transformation: each part of the object is transformed independently relative to the origin



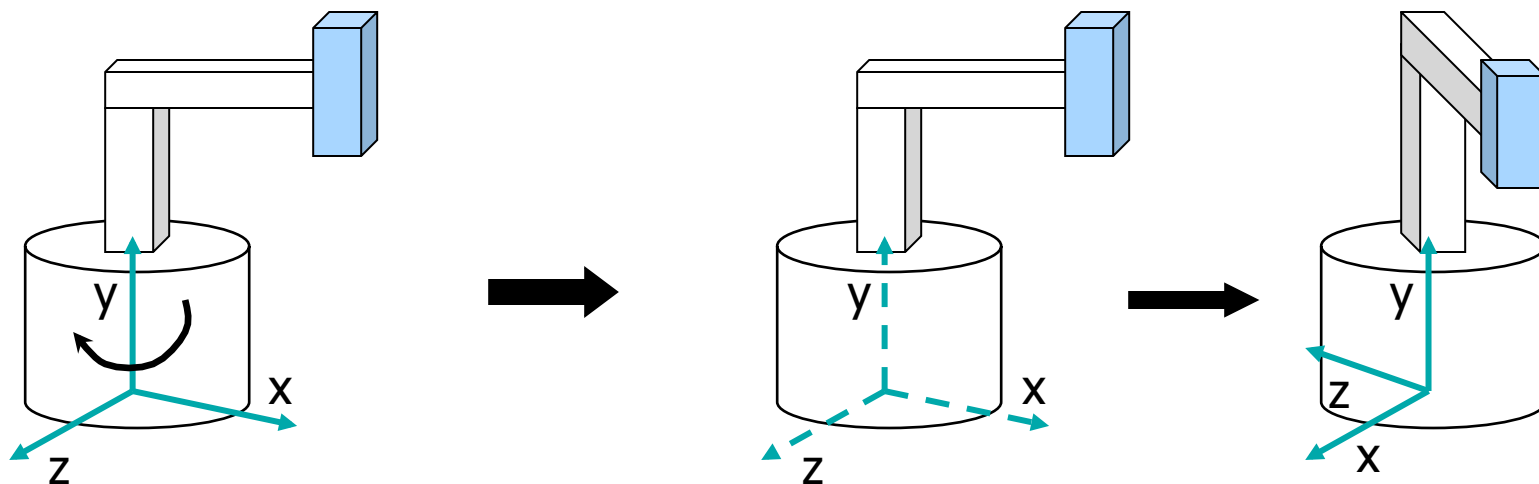
Relative Transformations

- A better (and easier) way
 1. Relative transformation: Specify the transformation for each object relative to its parent



Relative Transformations (cont.)

Step 2:
 Rotate the lower arm and (its descendants) relative to the base's local y axis by -90 degrees



Relative Transformations Using a Scene Graph

