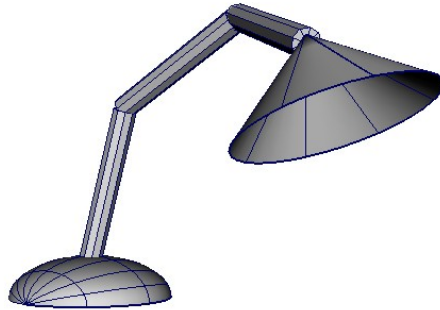


More on Hierarchies

Maya 2012



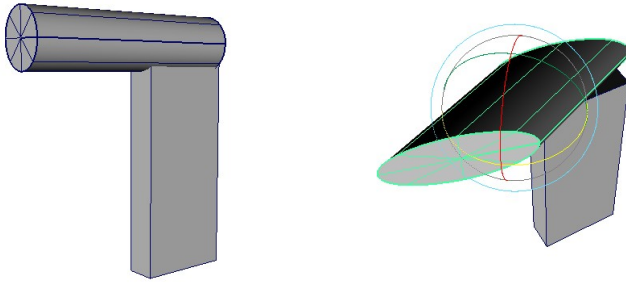
Concepts

- Hierarchical modeling is extremely important in 3D computer graphics
 - Except for the very simplest models,
 - all models must be organized hierarchically
 - The range of movement for the model is determined by its hierarchy

WARNING: Awkward Maya Approach

- Transformations are calculated unusually in Maya,
 - unlike the approach used by most other 3D programs
- In Maya,
- If a parent node has a **non-uniform scale** transformation on it,
 - -- that is, a scale where not all three of the numbers are identical,
 - for example, 2, 3, 2
 - any rotations on lower-level children nodes
 - will skew/distort the children

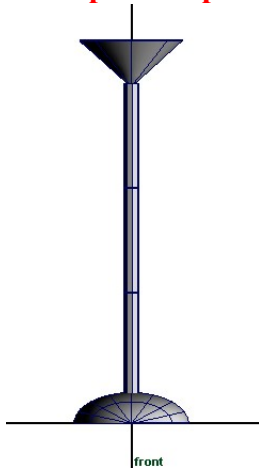
A Simple Test Model



- Create a cube
 - Scale it to make it tall
- Create a cylinder
 - Translate , rotate and scale it to the top of the cube
- In the Outliner or Hypergraph,
 - Middle mouse drag the cylinder icon on top of the cube icon
 - The cylinder is now a child of the cube
- Select the cylinder
- Rotate it by dragging the rotation manipulator icon
 - The cylinder deforms
 - (yah!)
 - because its parent (the cube) is scaled non-uniformly
- Solution:
 - There are several ways to get around this problem
 - The easiest is usually to do the following:
 - Select the parent node that has the non-uniform scale
 - – in our case, the cube
 - >Modify >Freeze Transformations
 - This recalculates the geometry of the cube
 - so that the object looks the same,
 - but now it has an Identity Transformation matrix
 - that is, its transformation matrix is now:
 - move = 0 0 0
 - rotate = 0 0 0
 - scale = 1 1 1

- Confirm this by looking at the transformation numbers in the Channel Box
- Select the cylinder again
- Rotate it
 - Since the parent cube's scale is now 1 1 1
 - its child – the cylinder – will not be skewed
 - *(Would that our human families were as easily corrected!)*
- Delete your test model

A Simple Lamp Model



- We will make a “Luxo” style lamp
 - like the image at the very top of this tutorial
- **TIP:**
 - It is easiest to create the lamp model
 - initially with no bends
 - -- that is, straight up in the air
 - This allows you to be more precise in your modeling
 - After you have created a hierarchy,
 - you will be able to easily bend and rotate the parts
- >Create >NURBS Primitives >Sphere
- In the Channel Box window,
 - In the Inputs sub-window,

- click on makeNurbSphere1
 - to open the parameters
 - Change End Sweep Angle = 180
 - to make it a hemi-sphere
- Rotate the hemisphere so it is flat on the ground
- Scale it so that it is somewhat flat
- >Create >Polygon Primitives >Cylinder
 - Scale it so it is long and tall
 - Translate it to just above the hemisphere
- With the cylinder selected
 - >Edit >Duplicate
 - Translate the second cylinder up above the first
- Repeat to make a third cylinder directly above the second
- >Create >Polygon Primitives >Cone
 - Translate it to on top of the top cylinder
 - Scale it to make it larger and flattened

Define the Pivot Points

- Each cylinder has to rotate about its bottom, so...
- For each of the cylinders
 - Hit the **e** key for rotation mode
 - Hit the *Insert* key for pivot-point mode
 - Drag to translate the pivot point to the bottom of the cylinder
- Repeat the same procedure
 - to move the cone's pivot point to its tip
- Hit the *Insert* key to leave pivot-point mode
- Back in rotation mode,
 - drag the rotation manipulator icon to test rotate each piece

A Hierarchy for the Lamp

- >Window >Hypergraph: Hierarchy
 - Middle mouse drag the bottom cylinder's icon on top of the sphere's icon
 - to make that cylinder a child of the hemisphere

- Middle mouse drag the middle cylinder's icon on top of the bottom cylinder's icon
- Middle mouse drag the top cylinder's icon on top of the middle cylinder's icon
- Middle mouse drag the cone's icon on top of the top cylinder's icon
- Each piece is now a child of the piece that is below it in the modeling window
- Test the rotations of each child
 - When you rotate each child node,
 - all the nodes under it in the hierarchy – that is, all its children – also rotate
 - Problem:
 - All the pieces are skewing when you rotate them
 - This is because the parent node, the hemisphere, is non-uniformly scaled
 - Select the sphere node
 - >Modify >Freeze Transformations
 - This node
 - and all its children nodes
 - have their transformations changed to the identity transformation
 - Test the rotations again
 - Now the children nodes do not distort when you rotate their parent

Removing an Object from a Hierarchy

- Again, several techniques:
- Menus:
 - Use either:
 - Select child
 - >Edit >Unparent
 - Select parent
 - >Edit >Ungroup
- Visual:
 - In either the Outliner or the Hypergraph windows,
 - middle mouse drag the child node out of its parent node

- Undo your test
 - so the lamp has the correct hierarchy again

Remove the Cone's bottom

- Select the cone
- Middle-mouse over the cone,
 - Drag to Face
- Tumble your Persp view
 - So you can see the bottom face of the cone
- Click that face to select it
- Hit the Delete key

Some Lighting

- >Create >Lights >Spot Light
- Translate it to within the cone
- Rotate it so it is pointing in the same direction as the cone

- Make the spotlight a child of the cone
 - Wherever you aim the cone,
 - the spotlight will now go with it

Save your Scene File

- ...for later re-use in the *Hierarchical Animation* tutorial in this set