Scientific Visualization and Presentation in 3D

Second Lecture

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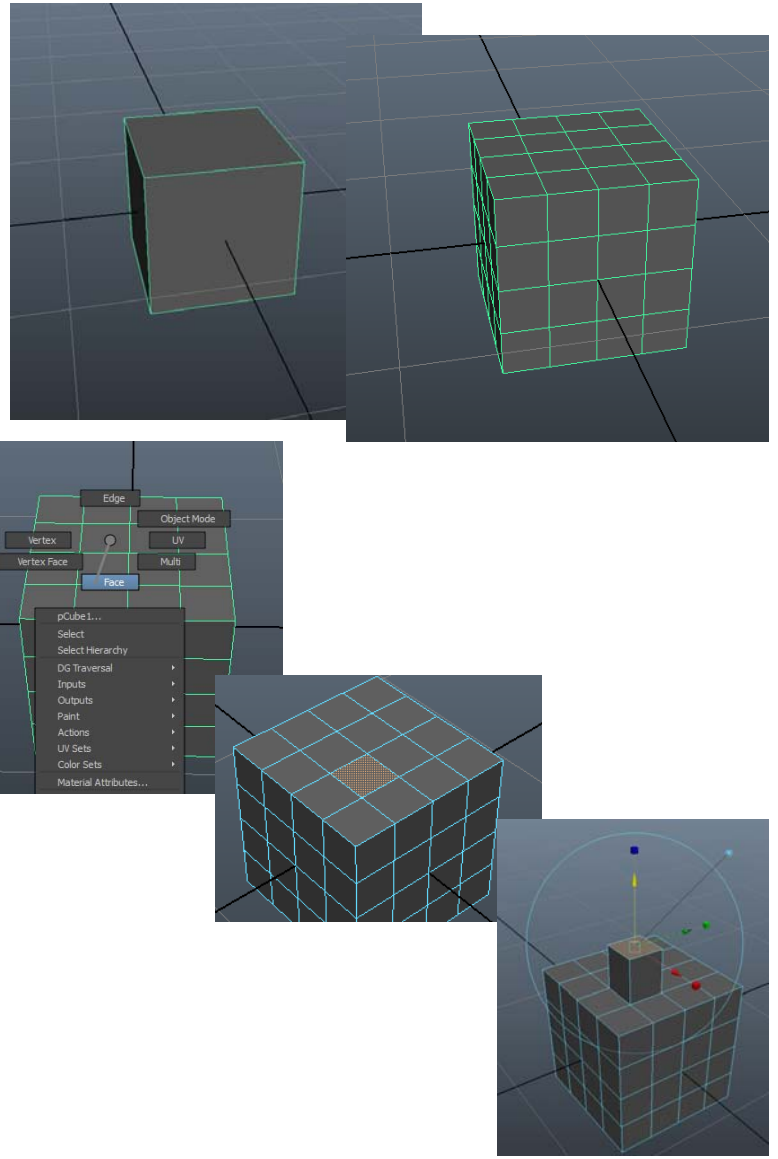
Homework – Pipette

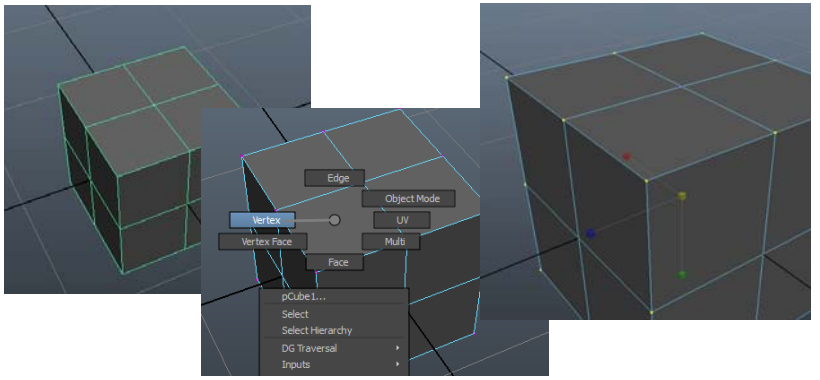
Polygon modelling I – Extrude

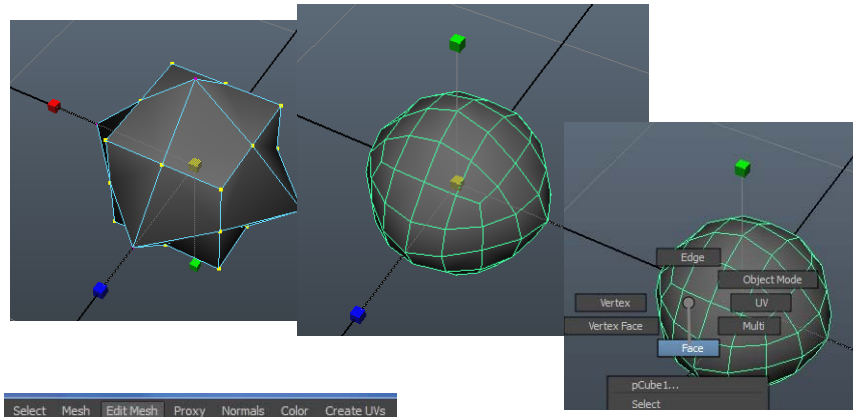
1. Create a polygon cube (**`Create -> Polygon Primitives -> Cube`**). Select it.
2. In the **`Channel Box`**, click on **`polyCube1`** under **`INPUTS`**, a few attributes should expand.
3. Select **`Subdivisions Width, Height`** and **`Depth`** with LMB, move the mouse over to the viewport, MMB drag to the left and right to dynamically change the number of subdivisions.
4. MMB drag with the attributes selected like in 3. to make the box have about 3-4 subdivisions per edge.
5. With the cursor over the cube, RMB-click-and-drag to **`Face`**
6. With the **`Polygons`** menu-set selected, do **`Edit Mesh -> Extrude`**.
7. Drag the extruded surface out of the cube using the arrows.
8. Click one of the scale-cubes, outside of the arrows. Notice how the pivot changes from a cube to a scaling cube.
9. Try moving the face around and rotating and scaling it.
10. Press **`G`** to repeat the last function (extrude in this case)
11. Rotate, scale an translate the new extrusion out.

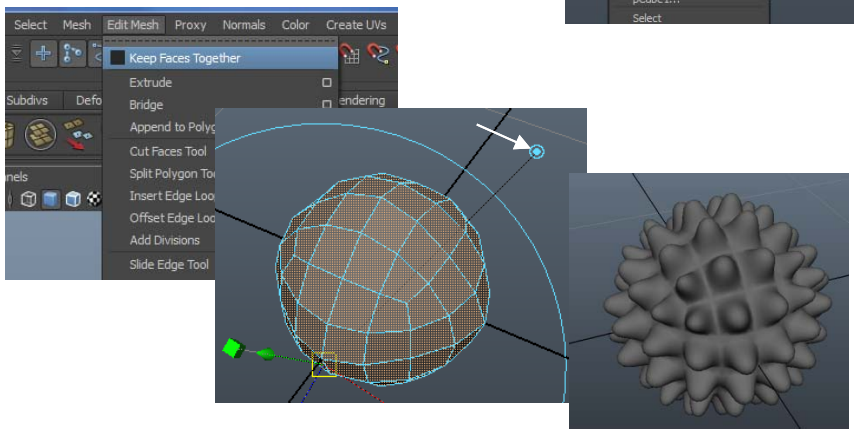


Polygon modelling II – Vertices, Smooth

1. Create a polygon cube with 2 subdivisions along each dimension.
2. RMB click-and-drag on the cube to **`Vertex`**.
3. Drag-over the whole cube to select all vertices.
4. Shift-select to remove the vertices located in the center of the 6 cubic face.
5. Press R to scale, scale down the vertices symmetrically (using the center scale cube).
6. Do **`Mesh -> Smooth`**.
7. RMB click-and-drag on the cube to **`Face`**.
8. Click-and-drag to select all faces of the polygon.
9. Uncheck **`Edit Mesh -> Keep Faces Together`**.
10. Do **`Edit Mesh -> Extrude`**.
11. In the extrude tool that appears, click the  handle (see arrow in fig.) to work with all faces globally.
12. Scale out all faces (using the center cube).
13. Click the  again and scale down all faces.
14. Return to object mode (RMB drag the cube).
15. Do **`Mesh -> Smooth`**. Press **`G`** to do it again.

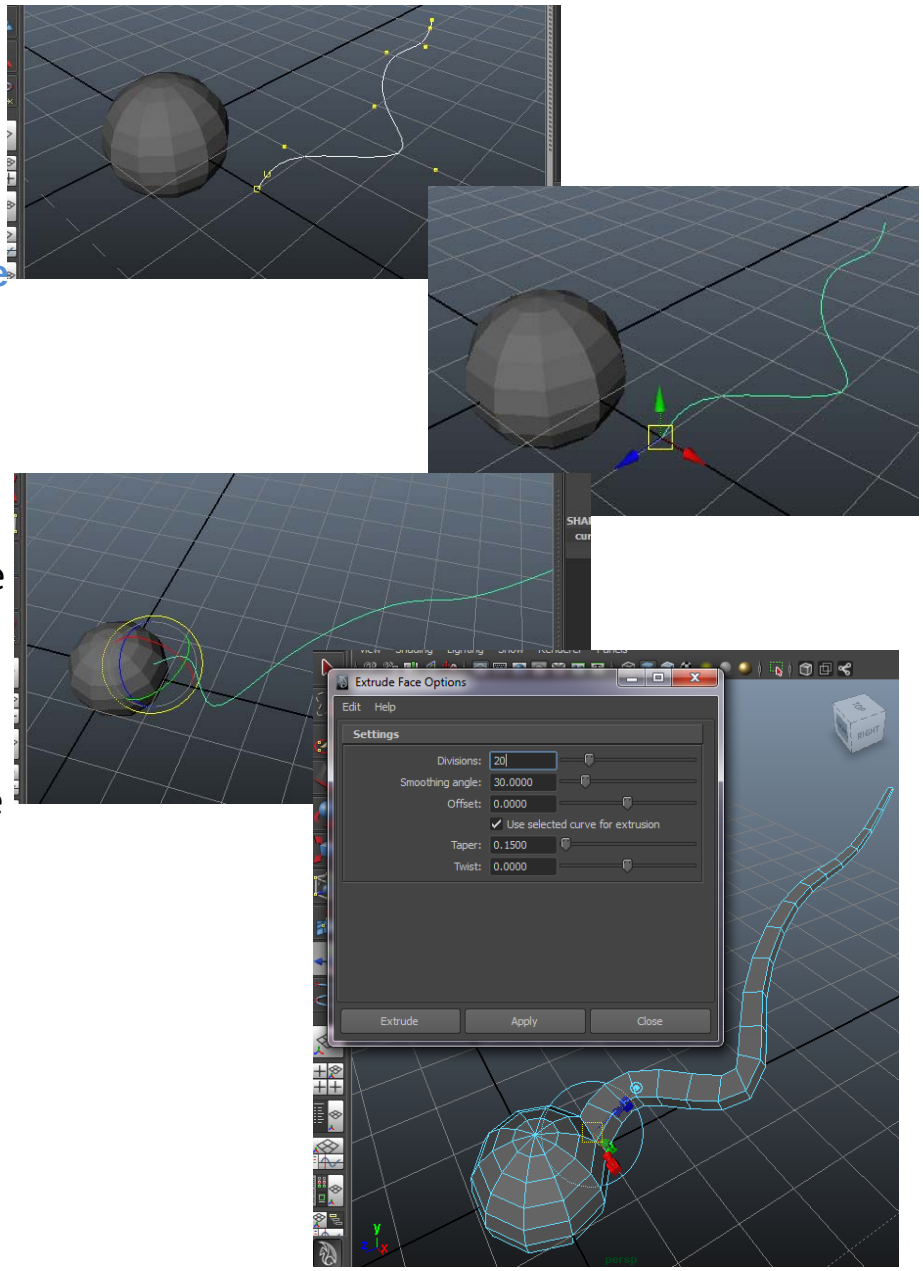






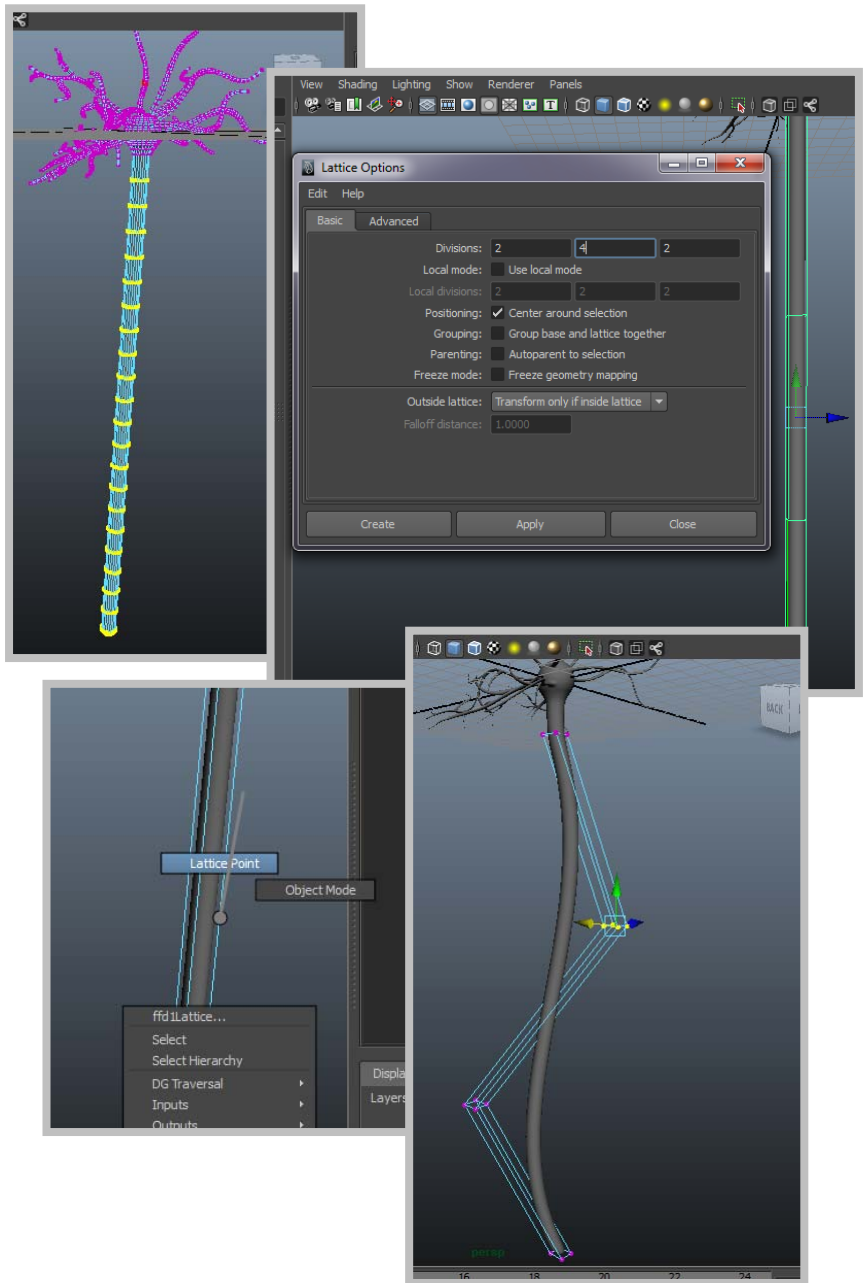
Polygon modelling III – Curve extrude

1. Create a polygon sphere. Select it.
2. In the **Channel Box**, click on **polySphere1** under **INPUTS**, a few attributes should expand.
3. Change **Subdivisions Axis** and **Subdivisions Height** to 10.
4. Activate the CV curve tool: **Create -> CV Curve Tool**
5. Draw a few CVs on the plane like in fig. 1. Press enter to finalize the curve
6. Select the curve, press **W** to activate the move tool. Press **D** and keep it pressed. While keeping **D** pressed, move the pivot to the end of the curve like in fig. 2. (constrain the movement in the plane by moving the pivot only by dragging in the **x** and **z** directions.)
7. Move and rotate the curve so that it looks like it is shooting out of one of the faces of the sphere.
8. RMB click on the sphere in the viewport. Keep the RMB pressed and drag to **Face**.
9. Click on the face of the sphere closes to the curve to select it.
10. Shift select the curve.
11. Go to **Edit mesh -> Extrude** and select the options box ☐ to the right of the menu item.
12. Change the **Divisions** to **20** and the **Taper** to **0.15** and press **Extrude** to extrude a tentacle reaching out of the sphere along the curve.



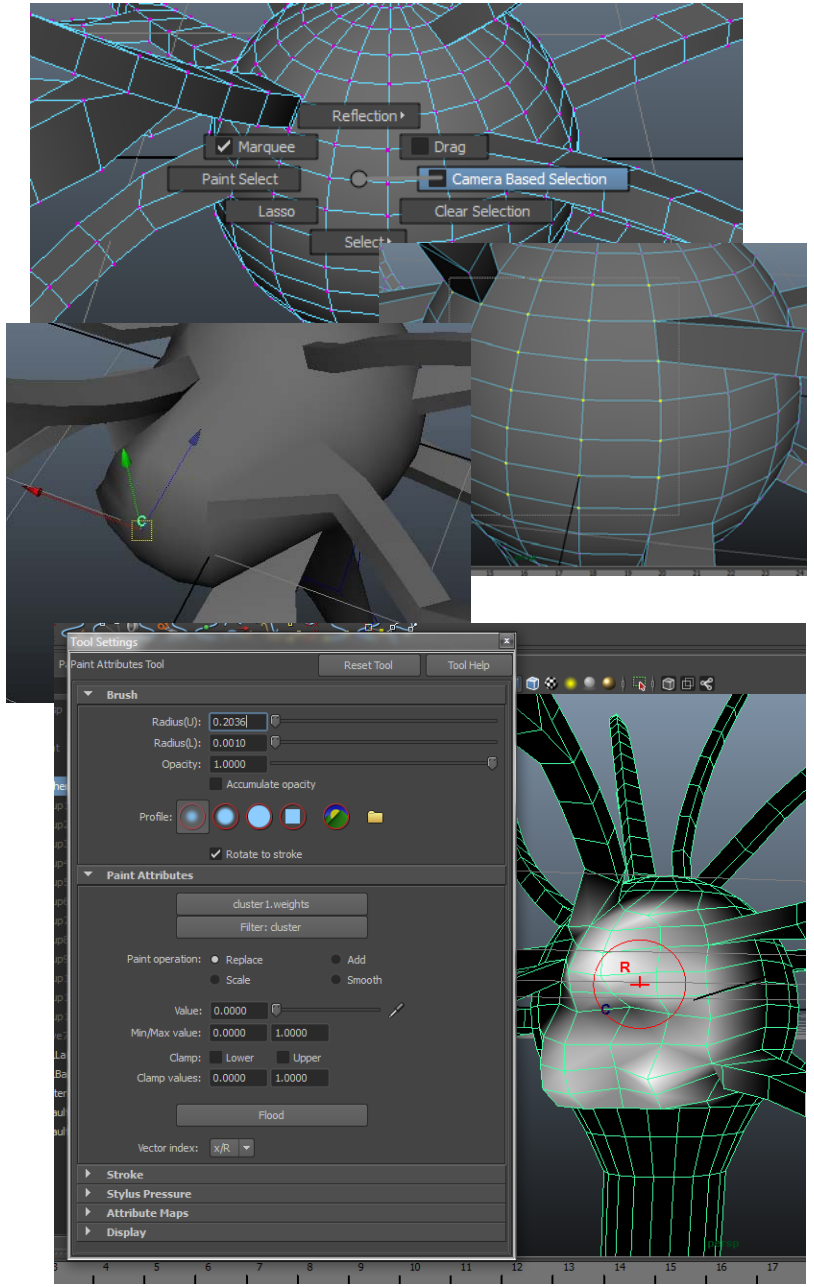
Deformers I: Lattice deformers

1. Open the file **neuronModelling.mb**.
2. With the mouse pointer over the neuron geometry, RMB click and drag to **Vertex**.
3. Click and drag to select all the vertices of the axon.
4. Select the **Animations** menu-set, go to **Create Deformers -> Lattice** and click the options box.
5. Under **Divisions**, input 2, 4 and 2 divisions in the **x**, **y** and **z** boxes as shown, make sure **Local mode** is unchecked and press **Create** to create a lattice around the axon geometry.
6. With the mouse over the lattice, RMB click and drag to **Lattice point**.
7. Select a few of the lattice points and drag them to the sides to smoothly modify the axon geometry.
8. Scale down the size of the lattice in the middle to thin down the axon.
9. Save the file as **neuronModelling.001.mb**



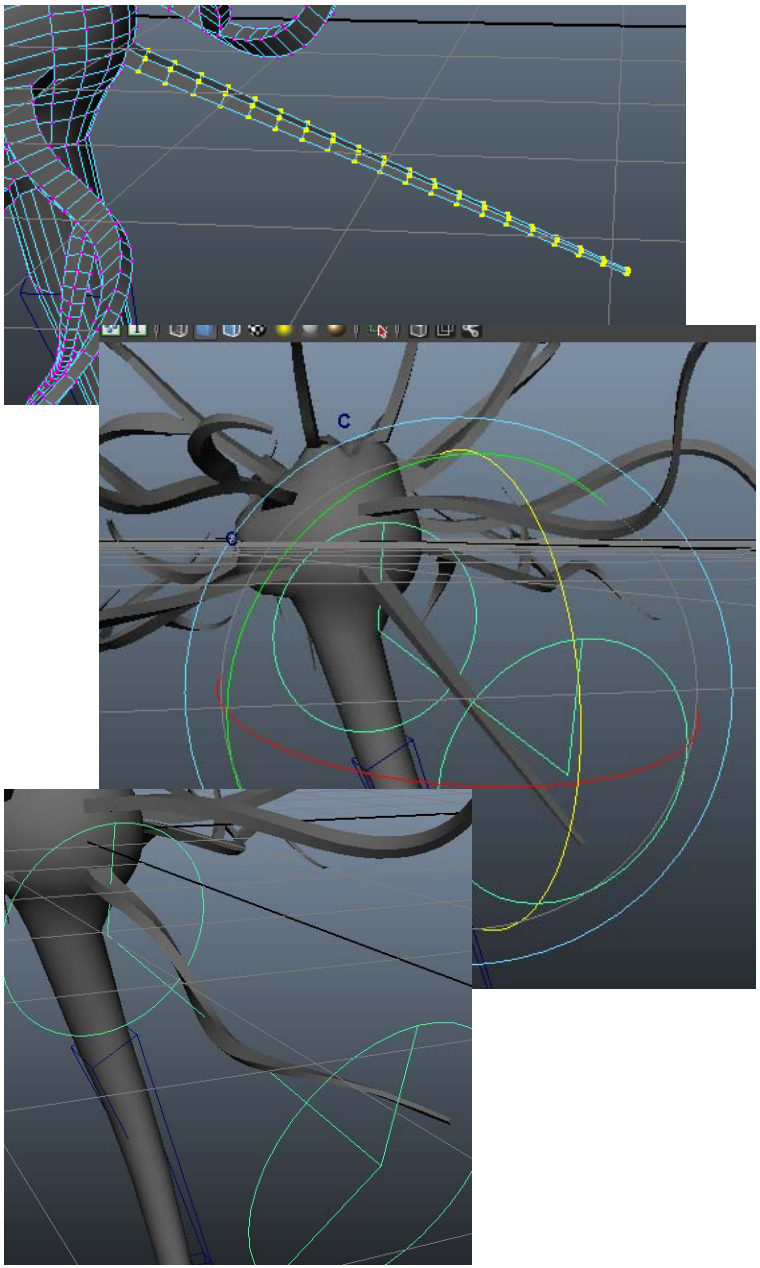
Deformers II: Clusters

1. Continue with the **neuronModelling** file.
2. RMB click the neuron and drag to **Vertex**
3. Press **Q** and keep it pressed while RMB draging to **Camera Based Selection**
4. Drag select a bunch of vertices on the cell body.
5. Do **Create Deformers -> Cluster**
6. Select the cluster and drag it out from the cell body.
7. Do **Edit Deformers -> Paint Cluster Weights Tool** and press the options box.
8. Use a brush **Radius** of about 0.2
9. Use the leftmost **Profile**.
10. Start with **Paint Operation** = **Replace** and a Value of 0.0. When you paint the weight of the vertices will be reduced to 0.0 (i.e. they will no longer be affected by the cluster.)
11. Switch to **Paint Operation** = **Smooth** and paint again over all vertices to even out the surface after the replace painting.
12. Repeate the create cluster and paint weights operations on other parts to create a more organic looking cell body. Save the file as **neuronModelling.002.mb**



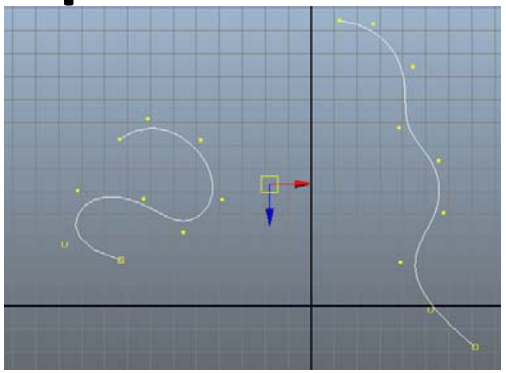
Deformers III: Bend and Twist

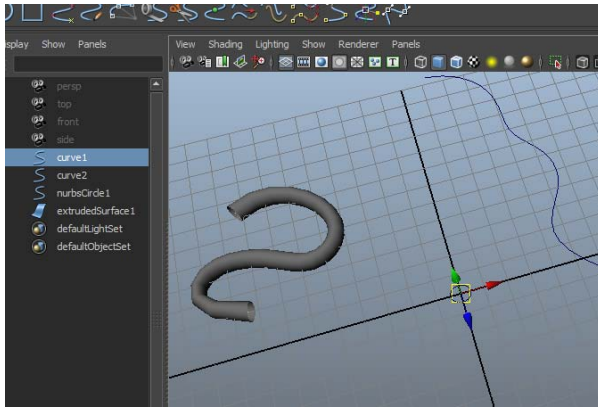
1. Continue with the **neuronModelling** file.
2. RMB click the neuron and drag to **Vertex**
3. If you had camera based selection on, press **Q** and keep it pressed while RMB draging to **Camera Based Selection** again.
4. Select the vertices of the straight dendrite.
5. Do **Create Deformers -> Nonlinear -> Twist**
6. Select the newly created twist handle and rotate it so that it *almost* lines up witht the dendrite.
7. With the twist handle still selected, in the channel box, press **twist1** under **INPUTS**
8. Change the **End Angle** (or **Start Angle** depending on how you rotated the twist handle) to something like 200.
9. Select the vertices again like in 2-4. Try **Create Deformers -> Nonlinear -> Bend**
10. Align the bend handle along the dendrite like we did with the twist handle.
11. Edit the bend deformer by changing **Curvature**, **Low Bound** and **High Bound** under **bend1** under **INPUTS** in the channel box (when the bend handle is selected)
12. Save as **neuronModelling.003.mb**

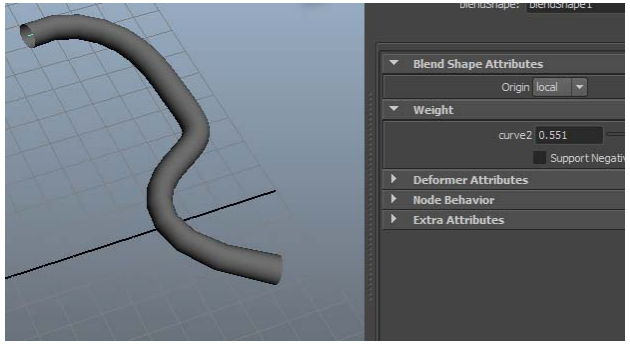


Deformers IV: Blend Shape

1. Create a new scene by pressing 
2. Go to top-view by pressing space bar, keeping it pressed down and LMB drag in the viewport to **`Top View`**
3. Do **`Create -> CV Curve Tool`** and draw a curly curve with about 6-8 CVs
4. Select the curve and duplicate it by **`Ctrl+D`**
5. Press **`W`** and drag the duplicate to the side
6. RMB click on the duplicate and drag to **`Control Vertex`**.
7. Select individual or groups of vertices and move them around *while keeping* **`L`** *pressed* (this will lock the length of the curve, ensuring both curves have the same lenght in the end). Make the duplicate look more straight.
8. RMB click on the curve and drag to **`Object Mode`**
9. Select the straighter curve and then shift-select the original curly curve.
10. Do (**`Animations`** menu-set) **`Create Deformers -> Blend Shapes`**.
11. Create a small NURBS circle, select it first and then the curly curve, do: **`Surfaces`** menu-set: **`Surfaces -> Extrude`** to create a tube around the first curve.
12. In the Outliner (or in the viewport) select the first **`curve1`**
13. In the **`Attribute Editor`** (tab on right edge of screen) select the **`blendShape1`** tab. Under **`Weight`** scrub the **`curve2`** slider and watch the string fold and unfold.

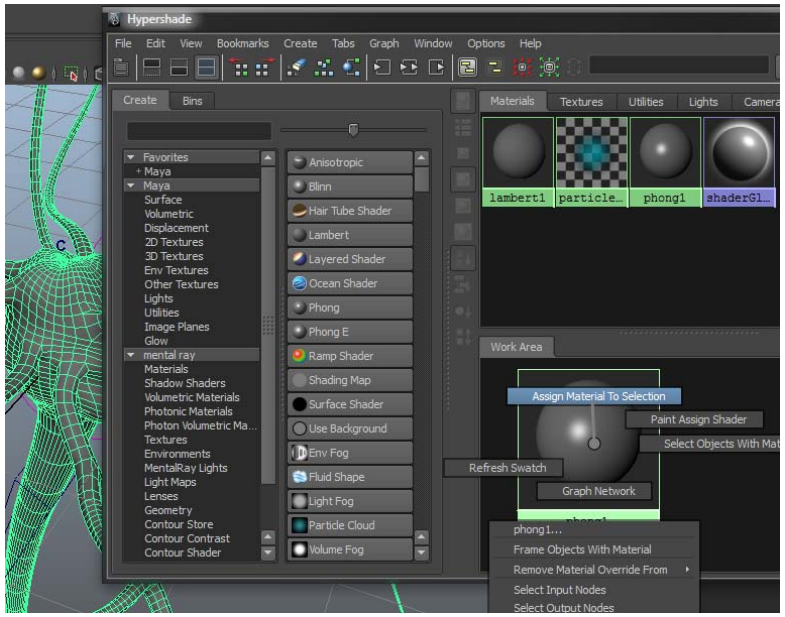


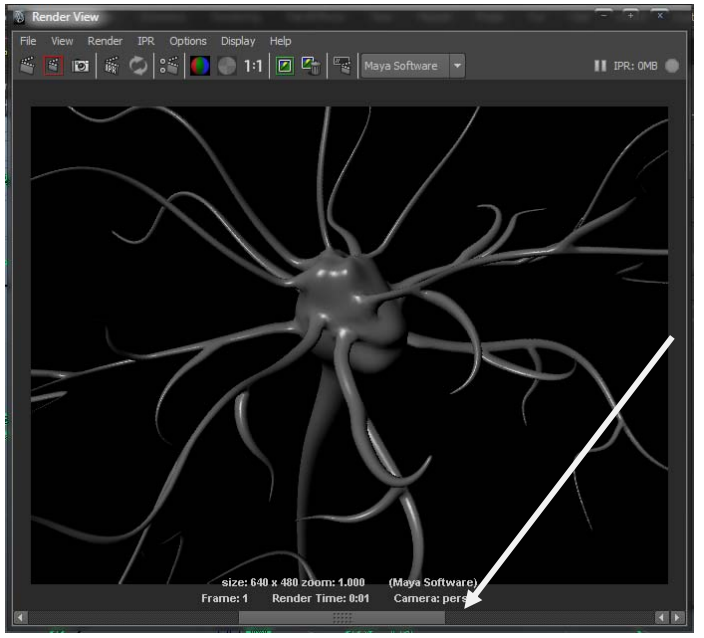




Shaders

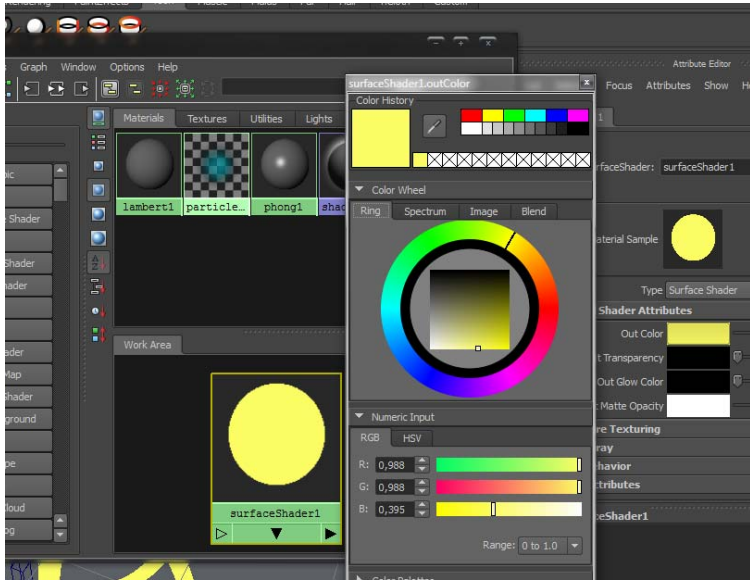
1. Open the **neuronModelling.003.mb** file that we worked with before.
2. In the **Polygons** menu-set, do **Mesh -> Smooth**
3. Do a render by pressing 
4. In the rendering window, save the image by pressing **Keep Image** 
5. Open the hypershade by doing **Windows -> Rendering Editors -> Hypershade**
6. Create a phong shader by pressing **Phong**
7. With the neuron selected, RMB click the phong material and drag to **Assign Material To Selection**
8. Do a new render, do **Keep Image** like in 4.
9. With the slider at the bottom of the render view, scrub it to compare the different renders.
10. Repeat 6-9 with other shaders to check them out.

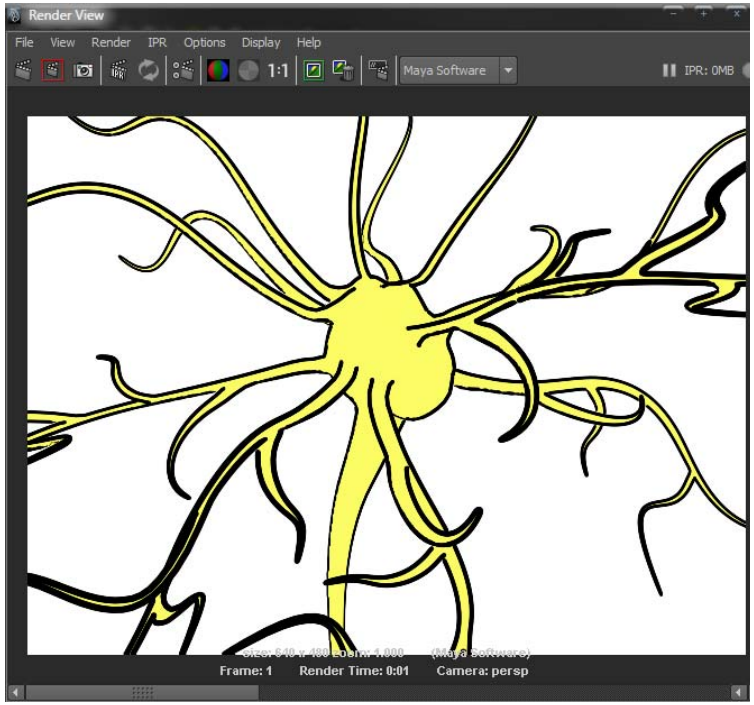




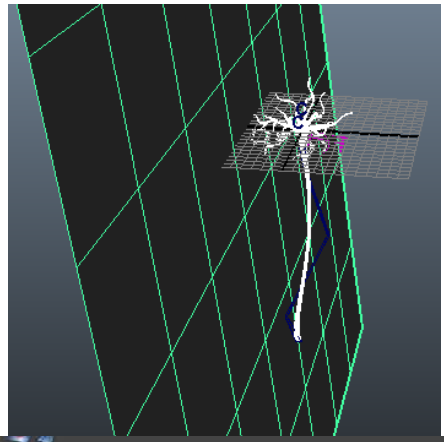
The Toon Shader

1. Continue with the **neuronModelling.003.mb** file.
2. Assign a **Surface Shader** to the neruon. (See previous exercise)
3. Double click the shader in the Hypershade to bring up the materials attributes in the Attribute editor.
4. In the attribute editor, double click the field of black in **Out Color** to bring up a color selection dialogue.
5. Select a nice light color like light blue or yellow.
6. In the outliner, select the **persp** camera, in the attribute editor, scroll down to **Environment**. Change the **Background Color** to white
7. In the **Rendering** menu-set do: **Toon -> Assign Outline -> Add New Toon Outline**
8. In the outliner, select the toon outline **pfxToon1**
9. In the channel box scroll down to **Line Width** and change it to 0.06
10. Do a render. Save as **neuronModelling.004.mb**

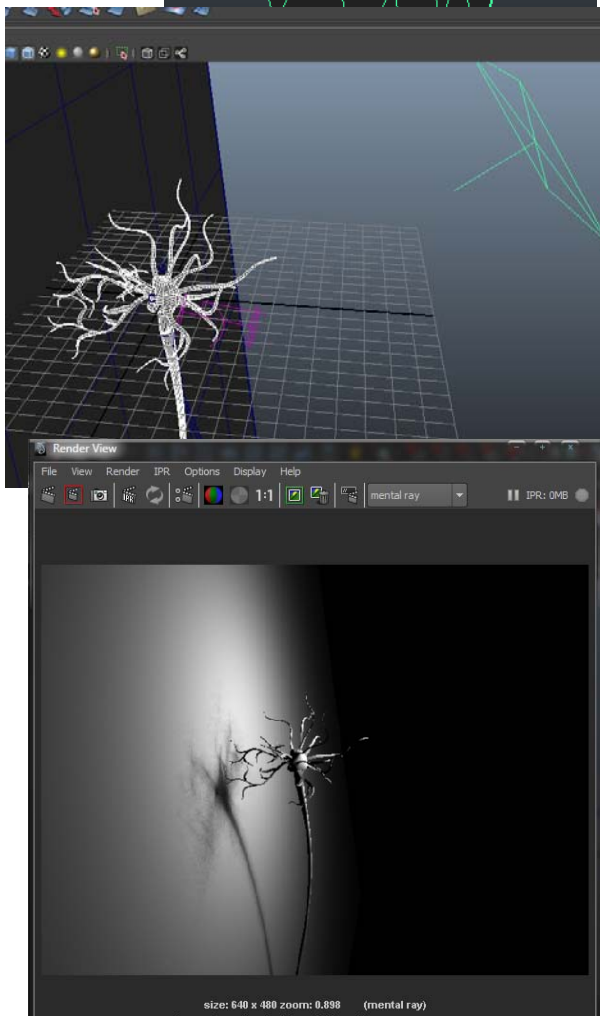




Lighting and shadows



1. Go back to the **neuronModelling.003.mb** file.
2. Create a NURBS plane as a backdrop and scale it up and place it behind the neuron.
3. Do **Create -> Lights -> Area Light**
4. With the light selected, in the viewport do: **Panels -> Look Through Selected Camera**
5. Tumble, dolly and pan out so that the light sees the neuron in front of the backdrop.
6. Press and hold space, LMB drag to **Perspective View**. The light should now have moved out.
7. Scale up the lights **Scale X,Y** and **Z** to 4
8. Take a render. Press keep image. Notice the lack of shadows.
9. With the light selected, go to the channel box and change the **Intensity** to 2
10. With the light selected, go to the attribute editor, scroll down and press to expand **Shadows**
11. Scroll down to **Raytrace Shadow Attributes** and check **Use Raytrace Shadows**, increase **Shadow Rays** to 64
12. Open render settings 
13. In the dropdown box **Render Using**, select **mental ray**.
14. Save as **neuronModelling.005.mb** Take another render.



Ambient Occlusion

1. Continue with the **neuronModelling.005.mb** file.
2. Below the channel box to the lower right, you'll find the layers pane. Click the **Render** tab.
3. Select the neuron and the backdrop plane.
4. In the Render tab, do **Layers -> Create Layer from Selected**
5. With one of the objects in the layer selected (e.g. the neuron), go to the attribute editor and bring up the **layer1** tab.
6. Press the **Presets** button and select **Occlusion**
7. Save as **neuronModelling.006.mb**
8. Take a render, if you have a slow computer, be prepared to wait a while.