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www.chrisgrim.com.

Summary

2.1   Once again, we are reminded to KEEP IT SIMPLE. The simpler the character design, the easier it will be to model character.

2.2   Don't be afraid to explore tools and experiment. Sometimes it is best to scrap your first attempt and start over.

2.3   While working, it is suggested to use X-ray mode and wireframe on shaded so that you can see what you're doing while modeling.

2.4   Object mode and component mode are generally the two levels that are used during the character creation process. Object mode allows you to affect the entire object, while component mode allows you to manipulate finer details, or pieces of the object.

2.5   The type of geometry, NURBS, polygons, or subdivision surfaces, used for your character model truly does not matter. However, subdivision surfaces can still be unreliable when performing during animation.

2.6   The EP Curve Tool creates curves by clicking a series of points, which then creates a line between the points.

2.7   The Revolve Tool creates a surface around the chosen axis of the selected curve, such as a profile curve created with the EP Curve Tool.

2.8   A NURBS cylinder is a primitive object that can be used to create other shapes.

2.9   A lattice deformer surrounds the object with a type of scaffolding, which can then be manipulated to change the shape of an object.

2.10   A deformer is used to speed up the process of modeling because it affects multiple points of geometry at the same time.

2.11   A NURBS sphere is another primitive object that can be used as a base to create other shapes.

2.12   Construction history is a list of processes used on an object during modeling. It is sometimes needed, but often it must be deleted. So that tools work predictably, construction history should be deleted often.

2.13   The Sculpt Geometry Tool provides an artistic approach to modeling and can be used on all types of geometry.

2.14   Sometimes the only way to get the desired shape when modeling is to move individual CVs.

2.15   To make polygons easy to select, change your selection preferences to whole face.

2.16   When modeling with polygons, make sure that the faces are square shaped. This provides deformation during the animation process.

2.17   A polygonal cube is a primitive object that is generally the starting point for a method called box modeling.

2.18   The Split Polygon Tool can be used to divide up the polygonal faces during the modeling process.

2.19   When modeling in polygons is important to keep faces as quadrilaterals, or four sided.

2.20   During the box modeling process, extrude polygons is used often as a tool to create more faces.

2.21   It is important to have the option for Keep Faces Together checked while extruding except in cases when the faces need to be separate such as in the fingers.

2.22   NURBS surfaces can be converted to polygonal surfaces in order to create one seamless piece of geometry. Make sure to convert using control points as the setting for the tessellation method.

2.23   When working with polygonal geometry, it can be more efficient to only model half of the character and mirror the geometry for the other side.

2.24   Separate pieces of polygonal geometry must be combined before the vertex points can be merged.

2.25   Vertex points can be aligned easily by holding down the **(v)** hot key on the keyboard while moving them.

2.26   The append polygon tool is perfect for filling gaps or holes in polygonal geometry.

2.27   The Insert Edge Loop Tool will divide polygonal faces completely around the entire piece of geometry.

2.28   Two overlapping vertices can be combined into one by using the merge command. Remember, if merging vertices on two separate pieces of geometry, they must first be combined.

2.29   When mirroring geometry, it is important to make sure that none of the interior vertices have crossed the origin line.

2.30   All polygonal normals should face outwards. Normals can be flipped during the modeling process. You can display them and then use some of the normal tools to flip them back out, if necessary.

2.31   Whilst smoothing the polygonal geometry may be desired, it should not be done at this point of the workflow. Simply press (3) on the keyboard for a smooth preview.

2.32   As you work, make sure to delete history and labeled geometry.

2.33   When completing your geometry, create a layer in the Layer Editor and add the character geometry to that layer.

2.34   Freeze transformations on finished geometry.

Assignments: Modeling a Character

When modeling a character in 3D space, it is important to make sure that your character faces front in the front view, side in the side view, and down in the top view in

order for all of the tools to work appropriately. The programmers created the character tools in Maya to work with your character facing in the positive Z direction.

Assignment 2.1: Model a Head, Neck and Torso

1. Open Maya and set your project.

    a. Go to [**Start > Programs**] and select Maya.

    b. Once Maya is open go to [**File > Project > Set...**] and browse to your project folder then click "OK".

2. Open your last saved file: go to [**File > Open**] and select *01_referenceImages.ma*.

3. Set all four view panels to X-ray mode and wireframe on shaded.

    a. Turn on hardware texturing (**press 6**) on the keyboard so that you can see your reference images.

    b. In the top view panel, go to [**Shading > X-Ray**], and then [**Shading > Wireframe**] on shaded.

    c. In the perspective view panel, go to [**Shading > X-Ray**], and then [**Shading > Wireframe**] on shaded.

    d. In the front view panel, go to [**Shading > X-Ray**], and then [**Shading > Wireframe**] on shaded.

    e. In the side view panel, go to [**Shading > X-Ray**], and then [**Shading > Wireframe**] on shaded.

4. Draw a profile curve of your character's head, neck and torso. If your character has clothing, it should be part of this profile curve. Clothing does not need to be separate, unless your character is going to change clothing in the animation.

    a. Go to [**Create > EP Curve Tool**] and open the option box, click **Reset Tool** and close the option box.

    b. In the front window, trace your drawing by clicking points along the outline on the right side of your character (your left side), starting at the center of the head and ending in the crotch. Hit enter when finished. Ignore the arms for now.

    c. You can adjust the positions of the points on the curve by RMB on top of the curve and choose **Control Vertex**. Use your move tool by pressing **(w)** to select points and move them around to refine the shape of your curve. You can also delete extra points by selecting them and hitting the delete key.
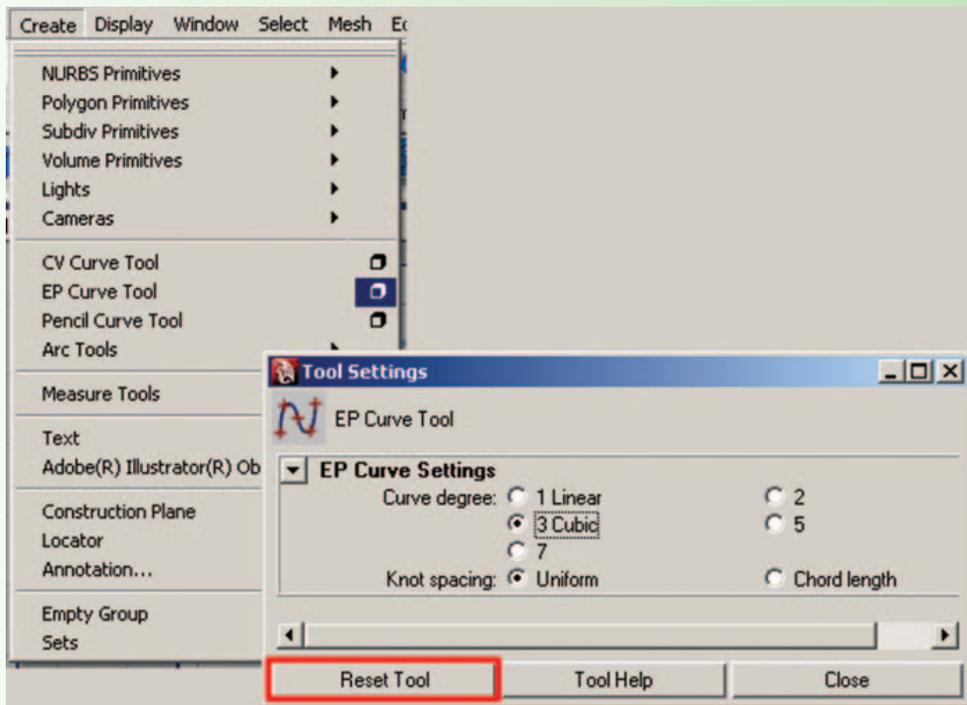
**Create > EP Curve Tool.**
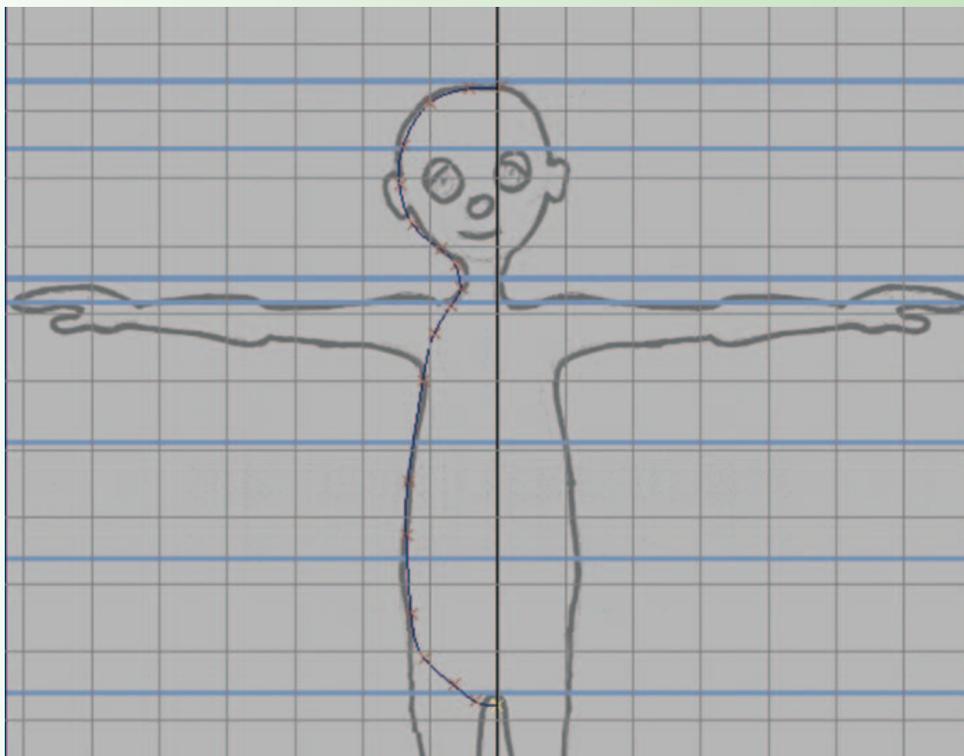
Tracing your drawing with the EP Curve Tool. An X marks each click of the mouse and becomes a point on the curve.
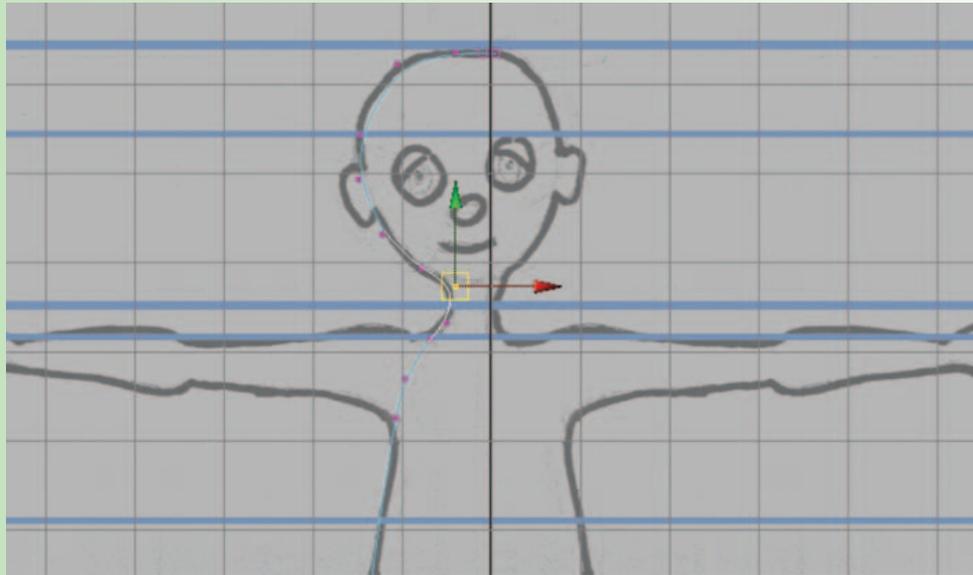
Refining the curve by adjusting the positions of the points on the curve with the move tool.

5.   Create the surface for your character's head, neck and torso.

a.   Select *curve1*, the curve you created, and go to **[Surfaces > Revolve]**. This process creates *revolvedSurface1*, a NURBS surface in the shape of the profile curve.
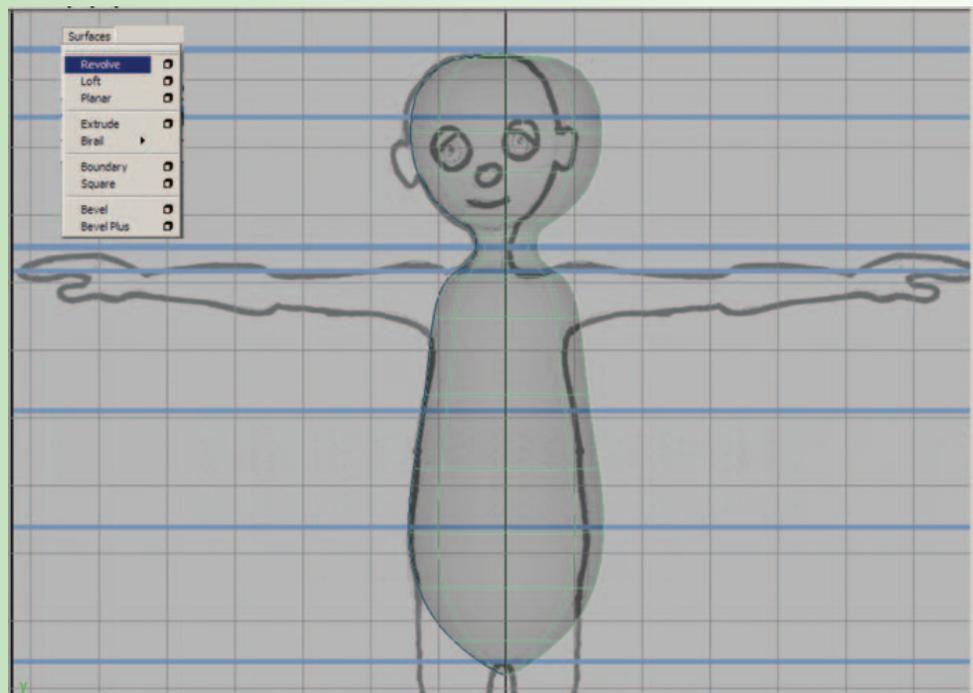
Creating the surface for you character's head and torso using the revolve command.

b. Open the outliner [**Window > Outliner**] and select *curve1*, the curve you created. In the perspective view panel, **RMB** to the left of the curve (in a blank area of the window NOT touching the curve or the surface) and choose **Control Vertex** (this will show the CV points only on the curve). Use your move tool by pressing (**w**) on the keyboard to select points and move them around to refine the shape of your surface. Because Maya has construction history, each operation you perform is connected to the preceding operation, and moving the points on the curve will automatically affect the surface and change its shape.
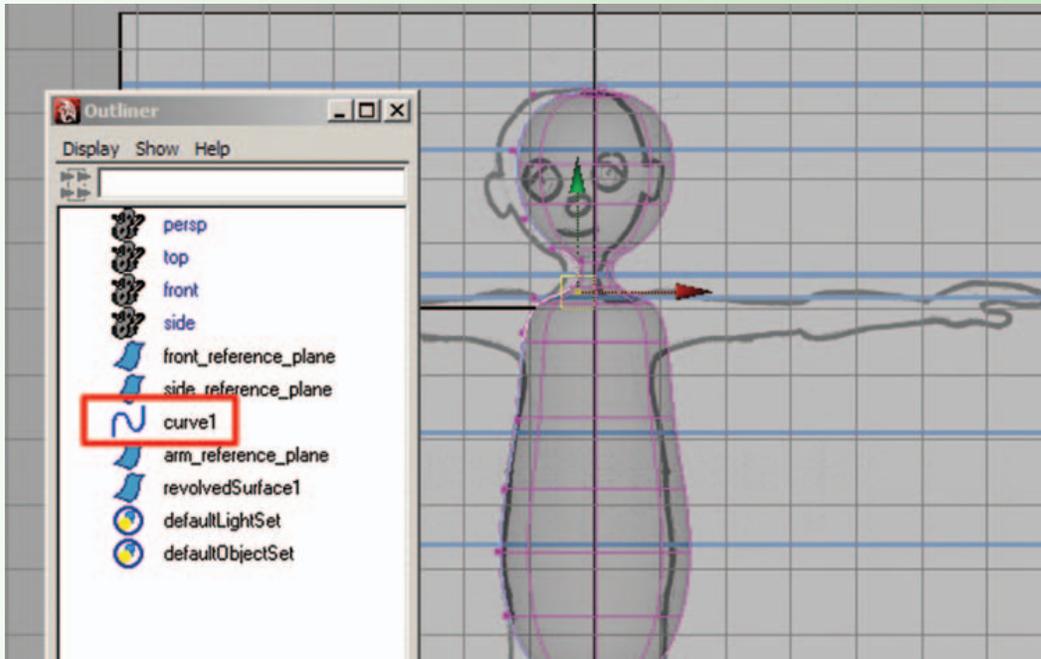
Refining the surface by adjusting the positions of the points on the curve with the move tool.

c. Select *revolvedSurface1*, go to [**Create Deformers > Create Lattice**] and with the lattice selected, in the **Shapes** section of the channel box, increase the T divisions from 5 to about 10–14.

d. In the side view panel, **RMB** on top of the lattice and choose **Lattice Point**. Use your move tool by pressing (**w**) on the keyboard to click drag (or marquee drag) over points on the lattice (this ensures that you are selecting the points on both sides of the lattice) and move them around to refine the shape of your surface. In the perspective view panel, continue to move and scale (if adjusting 2 or 4 points on the same row) the points on the lattice to refine the shape of your surface. Your reference drawings are just a reference. Feel free to make artistic changes while modeling in order to achieve the look you want.

e. Select *revolvedSurface1* then go to [**Edit > Delete by Type > History**]. This will remove the lattice, but any changes that have been made are now permanent. This also removes the connection to *curve1*.
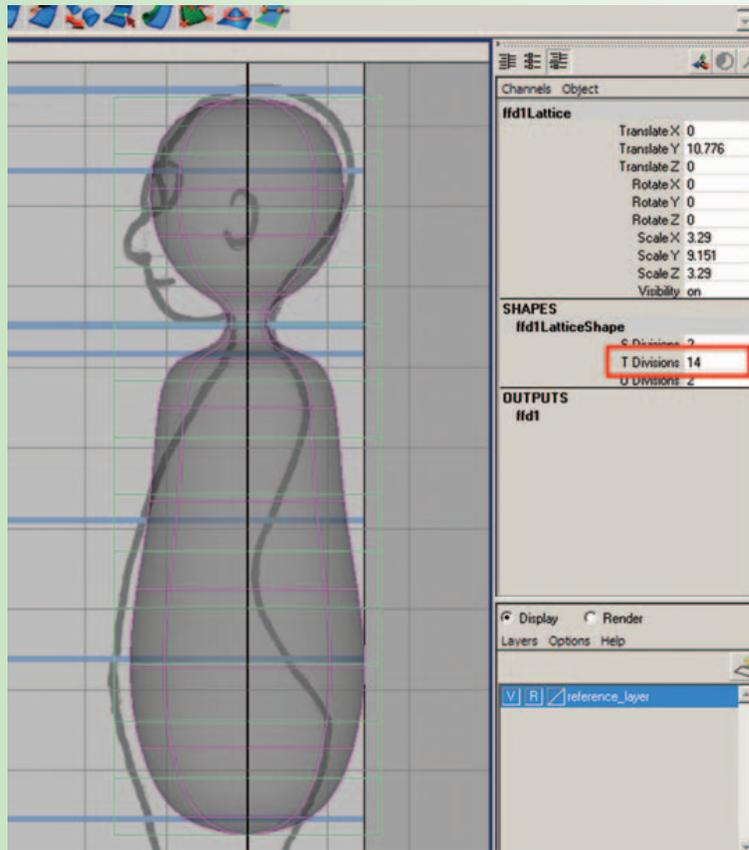
Adding a lattice deformer to your head and torso shape. Using a lattice allows even distribution and the changes to affect the entire piece of geometry.
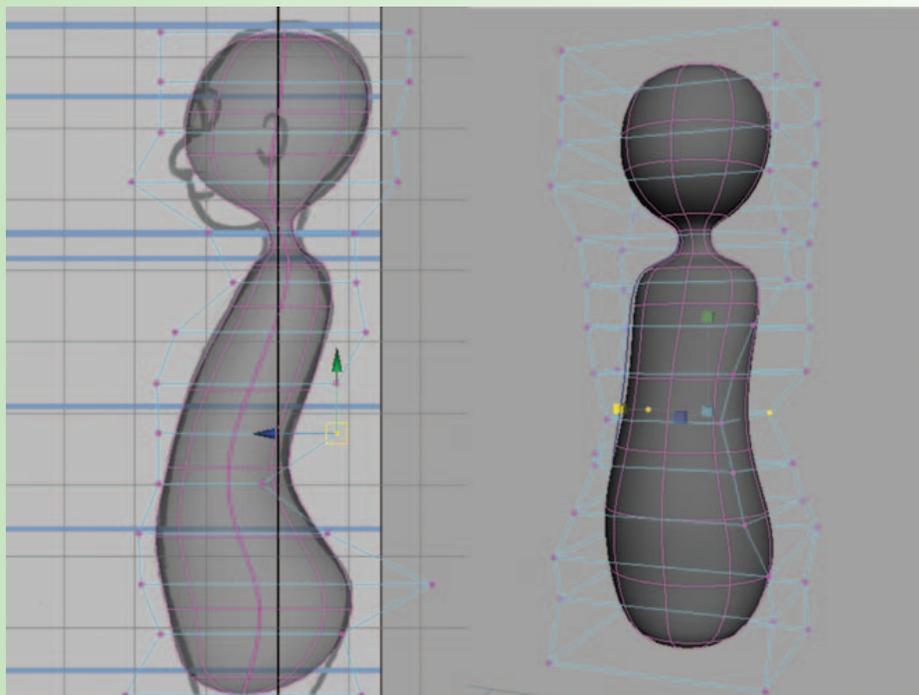

Refining the surface by adjusting the positions of the lattice points with the move and scale tools.
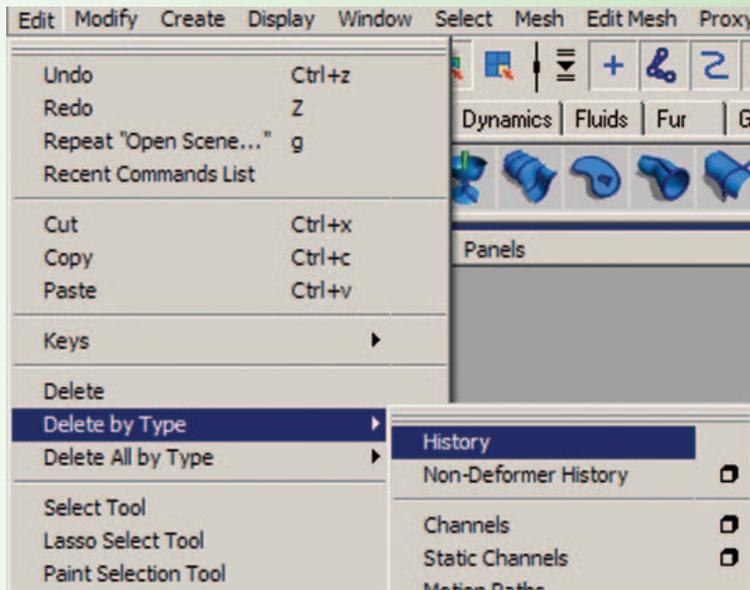
Edit > Delete by type > History.

f. In the outliner, select *curve1* and hit **delete**.

g. Select *revolvedSurface1* and rename to *body_geo* by clicking on the name and typing in the channel box.
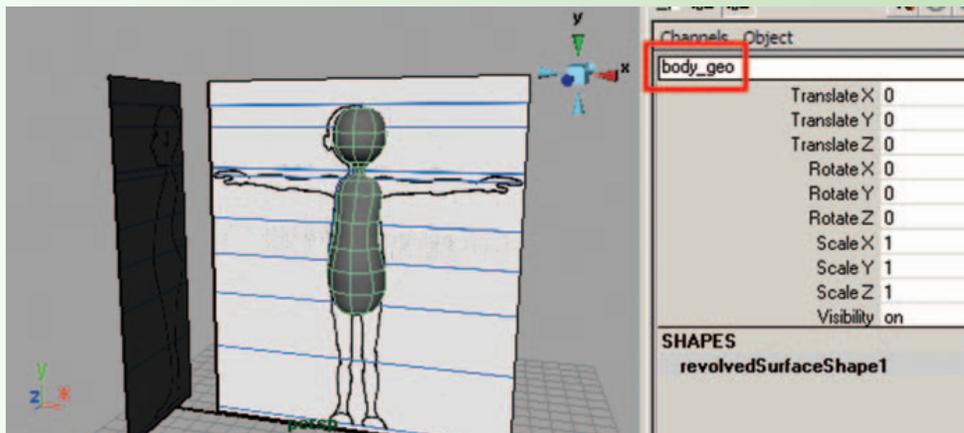
Renaming the torso and head shape in the channel box.

h. In the Layer Editor of the channel box, create a new layer. Double click on the new layer (layer1) and rename this layer *geometry_layer*, then click **save**. Select *body_geo*, **RMB** click and hold on top of the *geometry_layer* and choose Add Selected Objects. To make the objects non-selectable, click in the empty box between the V (visibility) and the layer name. An R (reference) should appear. This keeps any objects assigned to a layer visible but not selectable.
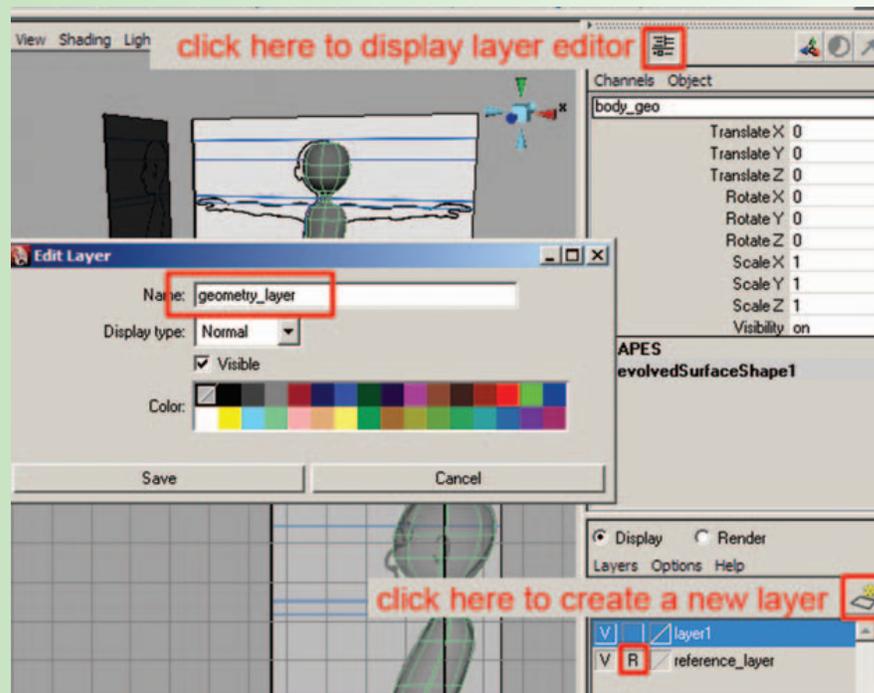
Click on the "create a new layer" button in the Layer Editor and rename it geometry_layer.

6.   Save your scene file.

    a.   Go to **[File > Save as]**. This should open the scenes folder of your project (assuming you set the project as in step 1).

   b.   Name your scene *02_asgn01_body_geo.ma*.
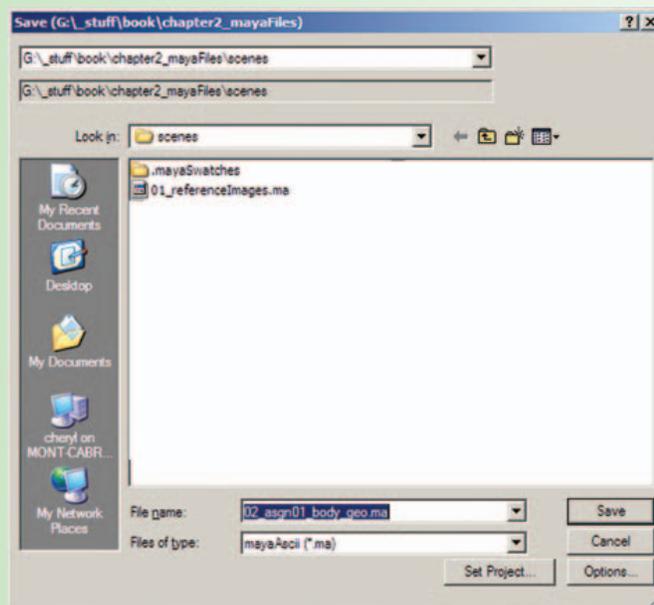
Saving and naming your scene *02_asgn01_body_geo.ma*.

Assignment 2.2: Model a Leg

1. Open Maya and set your project.

    a. Go to [**Start > Programs**] and select Maya.

    b. Once Maya is open go to [**File > Project > Set…**] browse to your project folder and click **OK**.

2. Open your last saved file. Go to [File > Open] and select *02_body_geo.ma*.

3. Continue working in X-ray mode and wireframe on shaded.

4. Go to [**Create > NURBS Primitives > Interactive Creation**] to uncheck this option and turn it off. (Interactive creation allows you to click and drag on the grid to create the size and shape of a primitive.)
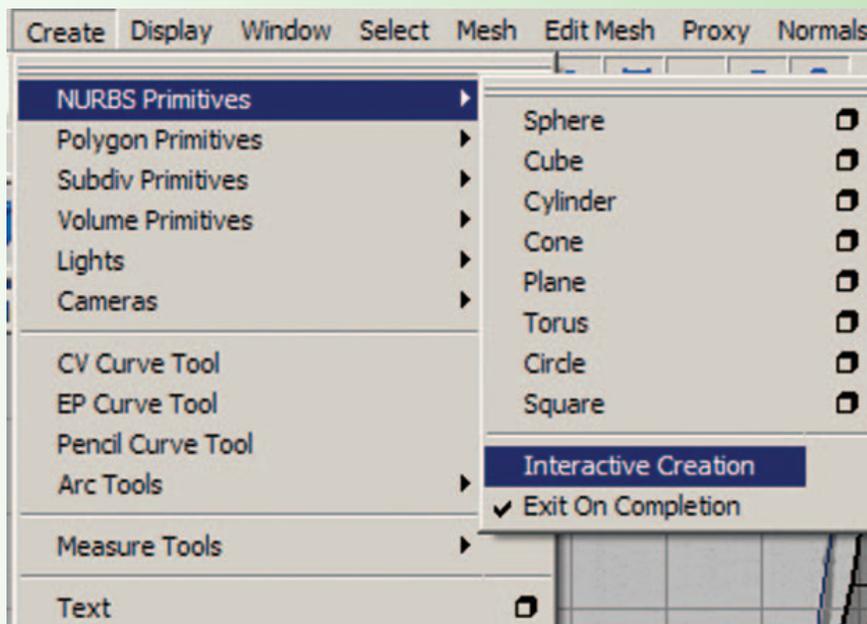
Turning off interactive creation.

5. Create a NURBS cylinder [**Create > NURBS Primitives > Cylinder**].

    a. Move and scale the cylinder over the character's right leg.

    b. In the **INPUTS** section of the channel box, click on *makeNurbCylinder1* and change **Spans** to 12.

6. With the *NurbCylinder1* still selected, create a Lattice Deformer [**Create Deformers > Lattice**].

    a. With the lattice selected, in the **Shapes** section of the channel box, increase the T Divisions from 5 to about 12.
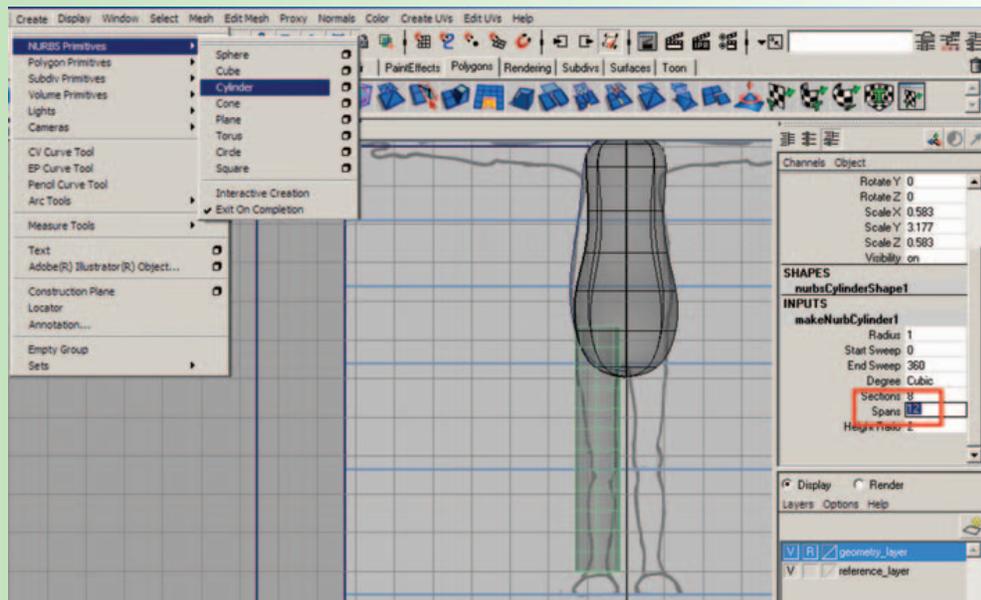
Creating a NURBS cylinder, positioning it for the leg, and dividing it for adequate deformation later.
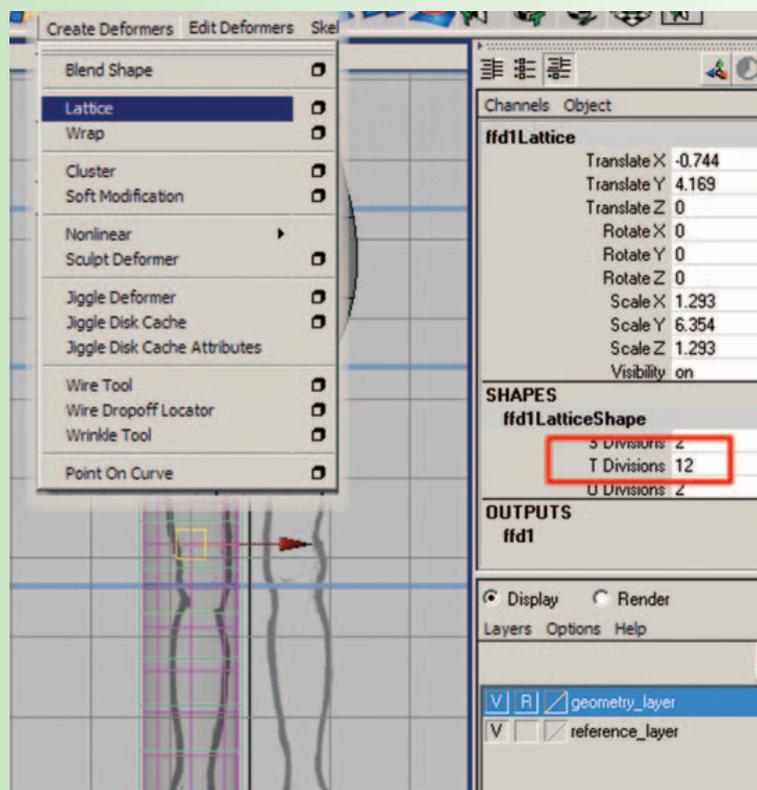
Adjusting the lattice for additional divisions. Using a lattice allows even distribution and the changes to affect the entire piece of geometry.

b. In the front view panel, **RMB** on top of the lattice and choose **Lattice Point**.
(You may need to **RMB** in the perspective window if your lattice is close to the
geometry, in order to see the correct marking menu.) Starting at the hip area, in
the front view panel, use your move tool by pressing (**w**) on the keyboard to
click drag (or marquee drag) over points on the lattice (this ensures that you are
selecting the points on both sides of the lattice) and move them around to refine
the shape of your surface. Then starting at the hip area, in the side
view panel, continue to move the points on the lattice to refine the shape of
your surface. Make sure to check the shape in the perspective window.
Your reference drawings are just a reference. Feel free to make
artistic changes while modeling in order to achieve the look you want.
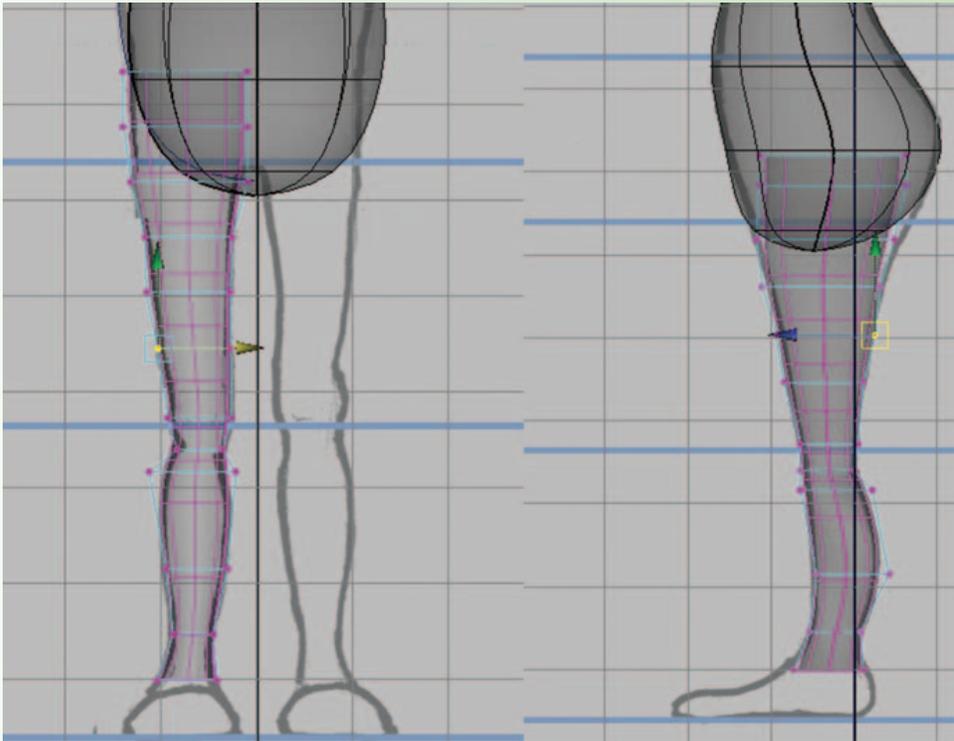
**Refining the shape of the leg by adjusting the positions of the lattice points with the
move and scale tools.**

c. Select *NurbCylinder1* then go to [**Edit > Delete by Type > History**]. This will
remove the lattice but any changes that have been made are now permanent.
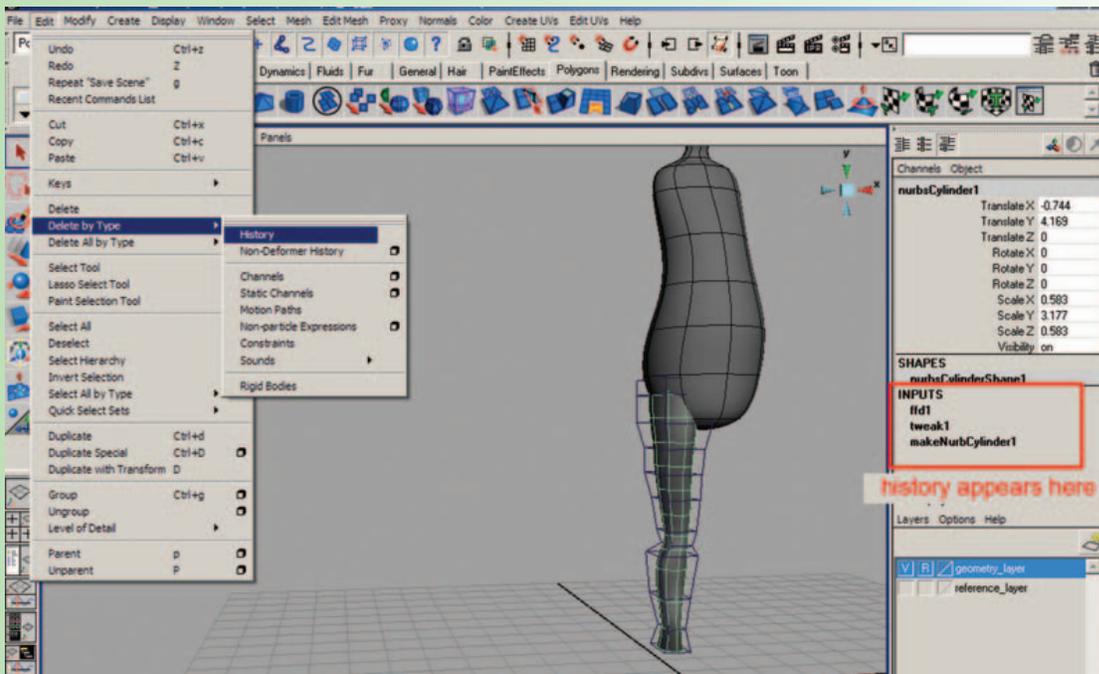
Deleting history to remove the lattice and bake the changes to the shape of the cylinder.

    d.   Rename *NurbCylinder1* to *rightLeg_geo* by clicking on the name and typing in the channel box.
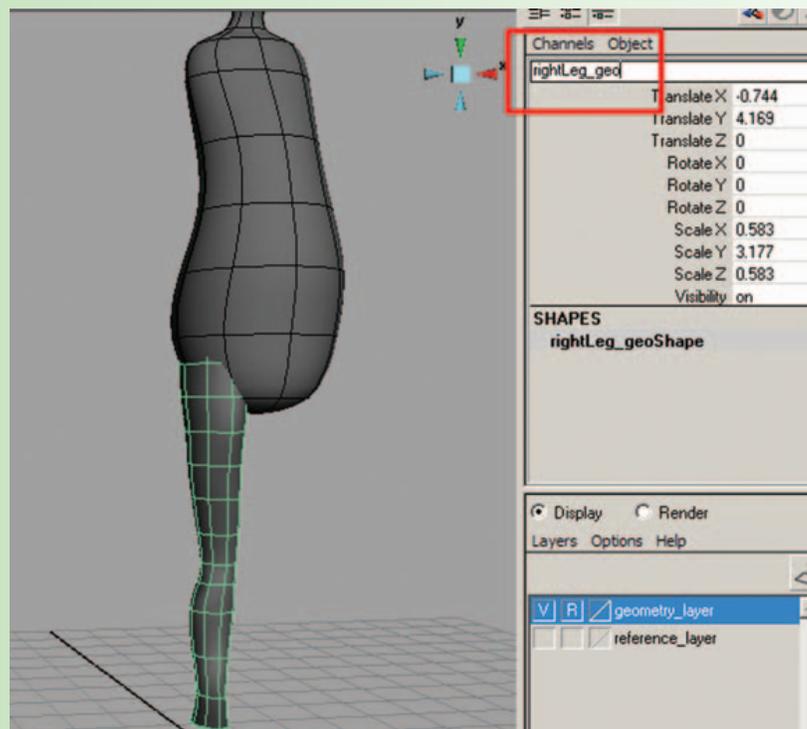
Keep your scene organized by labeling your geometry appropriately.

e.   Duplicate *rightLeg_geo* **[Edit > Duplicate] or press (ctrl + d)** on the keyboard.
In the channel box, rename *rightLeg_geo1* to *leftLeg_geo*, change the **TranslateX**
value to positive (which positions the leg onto the other side of the origin) and
change the **ScaleX** value to negative (which makes the leg invert).
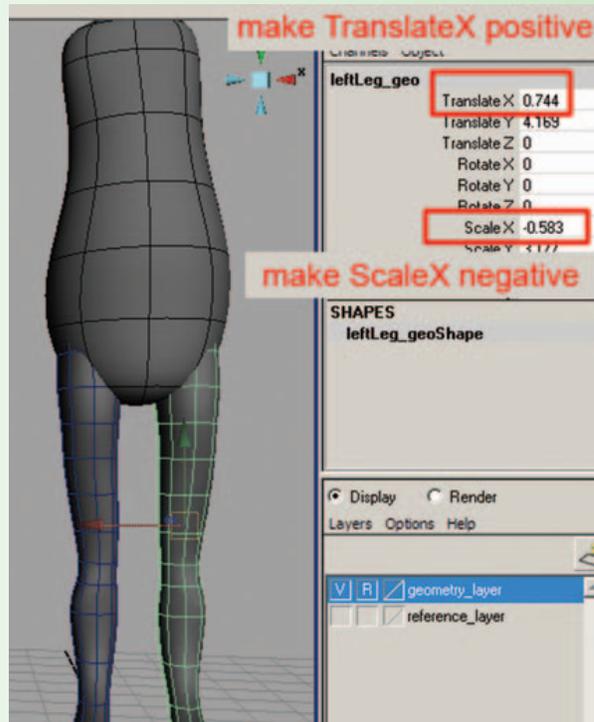
**Duplicating the geometry and changing the ScaleX value to the negative inverts the
shape. Changing the TranslateX value to positive positions the leg evenly on the
opposite side of the origin.**

f.   Select *rightLeg_geo* and *leftLeg_geo* **[Modify > Freeze Transformations]**. Freeze
transformations on finished geometry will return the translation and rotation
values to 0 and the scale values to 1.
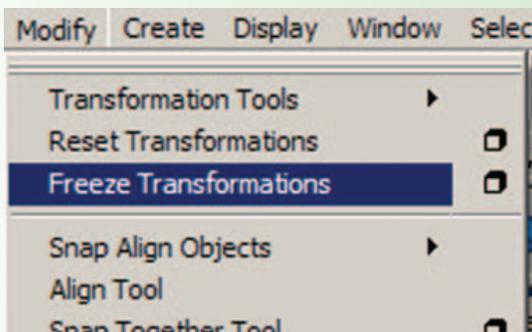
**Freezing transformations makes
the geometry transformation
values return to 0 for translations
and rotations and 1 for scale.**

g. In the Layer Editor of the channel box, **RMB** click and hold on top of the *geometry_layer* and choose "**Add Selected Objects**".

7. Save your scene file.

a. Go to [**File > Save as**]. This should open the scenes folder of your project (assuming you set the project as in step 1).

b. Name your scene *02_asgn02_leg_geo.ma*.
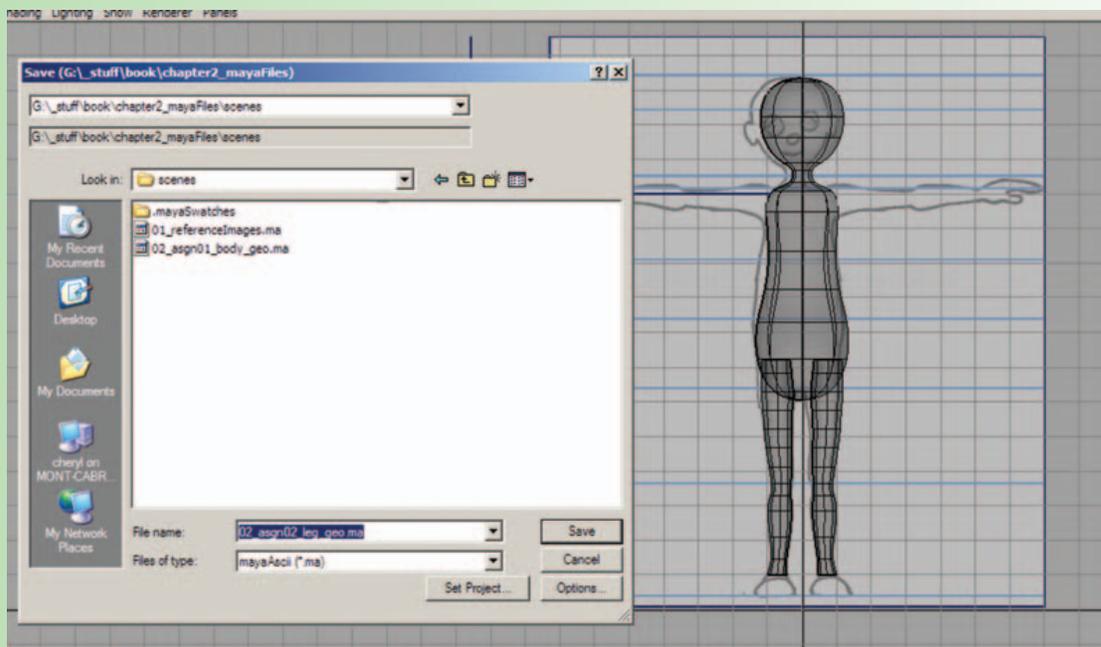
**Saving and naming your scene *02_asgn02_leg_geo.ma*.**

Assignment 2.3: Model an Arm

1. Open Maya and set your project.

a. Go to [**Start > Programs**] and select Maya.

b. Once Maya is open go to [**File > Project > Set…**] browse to your project folder and click **OK**.

2. Open your last saved file. Go to [**File > Open**] and select *02_asgn02_leg_geo.ma*.

3. Continue working in X-ray mode and wireframe on shaded.

4. Continue working with Interactive Creation unchecked [**Create > NURBS Primitives > Interactive Creation**]

5. Create a NURBS cylinder. [**Create > NURBS Primitives > Cylinder**].

a. In the channel box, change **RotateZ** to 90.

b. Move and scale the cylinder over the character's right arm.

c. In the **INPUTS** section of the channel box, click on *makeNurbCylinder1* and change **Spans** to 10.
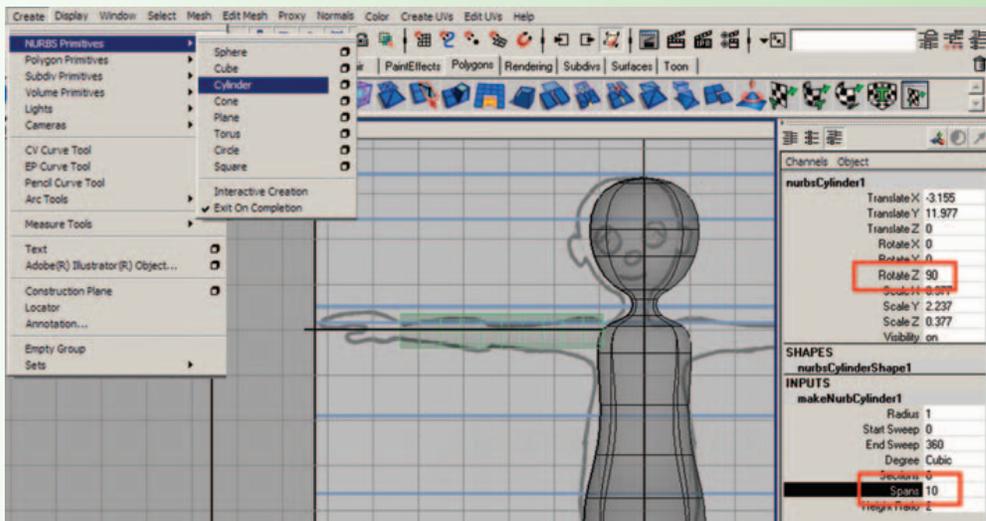
Creating a NURBS cylinder, positioning it for the arm, and dividing it for adequate deformation later.

6. With the *NurbCylinder1* still selected, create a Lattice Deformer **[Create Deformers > Lattice]**.

    a. With the lattice selected, in the **Shapes** section of the channel box, increase the **T divisions** from 5 to about 8.
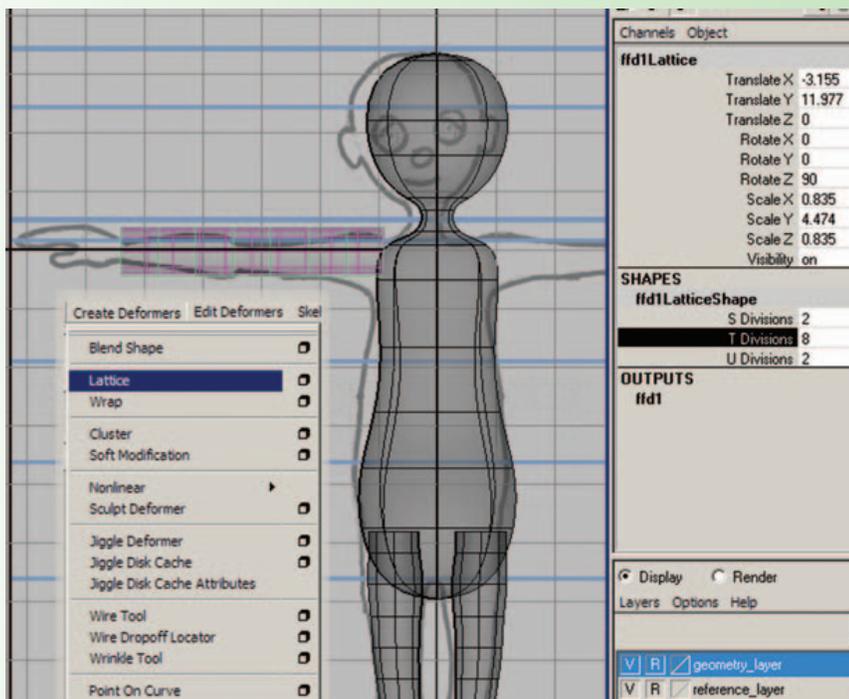

Adjusting the lattice for additional divisions. Using a lattice allows even distribution and the changes to affect the entire piece of geometry.

b.   Starting at the shoulder area, in the front view panel, **RMB** on top of the lattice and choose **Lattice Point**. (You may need to **RMB** in the perspective window if your lattice is close to the geometry, in order to see the correct marking menu.) In the front view panel, use your move tool by pressing (**w**) on the keyboard to click drag (or marquee drag) over points on the lattice (this ensures that you are selecting the points on both sides of the lattice) and move them around to refine the shape of your surface. Then starting at the shoulder area, in the top view panel, continue to move the points on the lattice to refine the shape of your surface. Make sure to check the shape in the perspective window. Your reference drawings are just a reference. Feel free to make artistic changes while modeling in order to achieve the look you want.
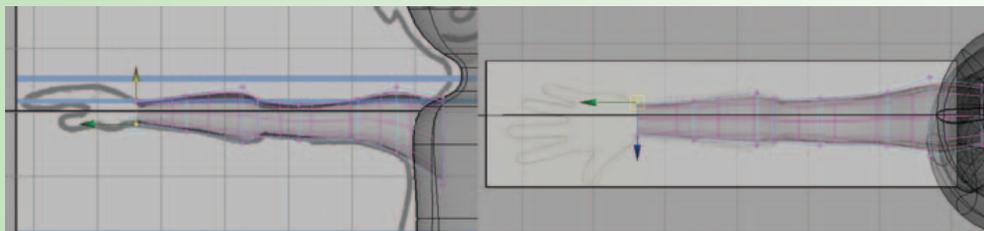
**Refining the shape of the arm by adjusting the positions of the lattice points with the move and scale tools.**

c.   *Optional*: For better deformation in the forearm later, you can rotate the last three rows of lattice points incrementally to total 45 degrees forward (starting with the row closes to the elbow, rotate slightly, then the next row, and the row at the wrist should have the points even again.) To see what I am talking about, hold your arm out parallel to the floor and palm forward, then rotate your arm so that the palm is facing the floor, Notice how your skin moves with your forearm during this rotation.
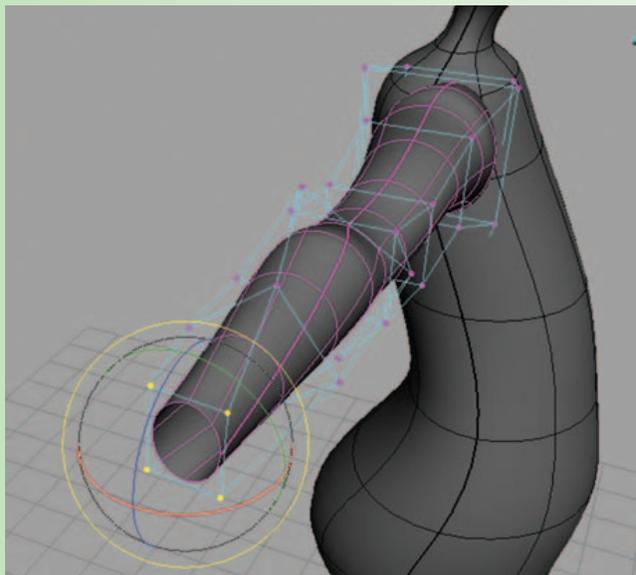
Rotating the forearm for better deformation when the hand twists.

d. Select *NurbCylinder1* then go to [**Edit > Delete by Type > History**]. This will remove the lattice but any changes that have been made are now permanent.

e. Rename *NurbCylinder1* to *rightArm_geo* by clicking on the name and typing in the channel box.
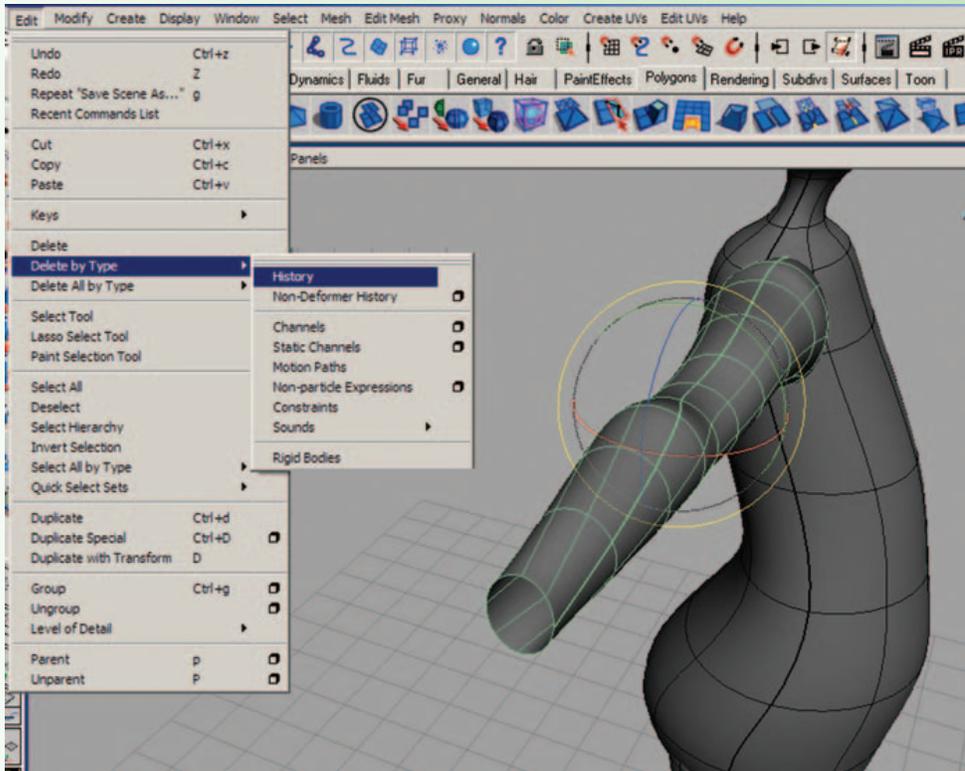
Deleting history to remove the lattice and bake the changes to the shape of the cylinder, then renaming the geometry appropriately.

f. **Duplicate** *rightArm_geo* [**Edit > Duplicate**] or press (**ctrl+d**) on the keyboard. In the channel box, rename *rightArm_geo1* to *leftArm_geo*, change the **TranslateX** value to **positive** (which positions the arm onto the other side of the origin) and change the **ScaleY** value to **negative** (which makes the arm invert).

g. Select *rightArm_geo* and *leftArm_geo* [**Modify > Freeze Transformations**]. Freeze transformations on finished geometry will return the translation and rotation values to 0 and the scale values to 1.

h. In the Layer Editor of the channel box, **RMB** click and hold on top of the *geometry_layer* and choose Add Selected Objects.
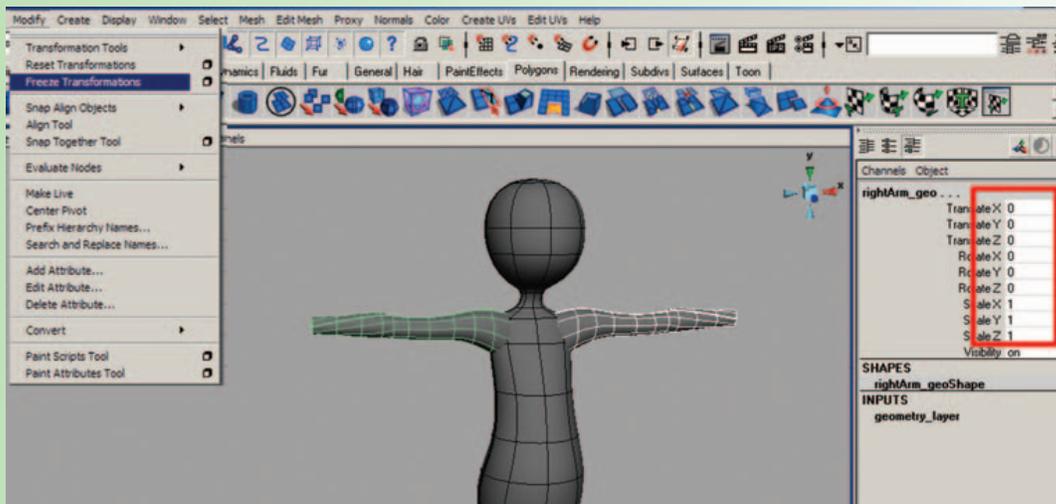
Freezing transformations on the arm geometry.

7.   Save your scene file.

   a.   Go to [**File > Save as**]. This should open the scenes folder of your project (assuming you set the project as in step 1).

   b.   Name your scene *02_asgn03_arm_geo.ma*.
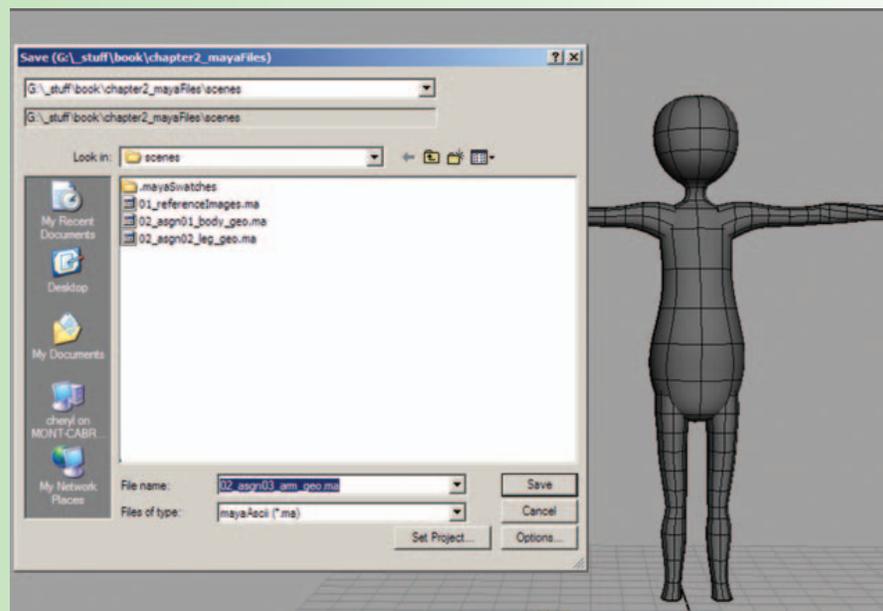

Saving and naming your scene *02_asgn03_arm_geo.ma*.

*Assignment 2.4: Model a Hand*

1.   Open Maya and set your project.

   a.   Go to [**Start > Programs**] and select Maya.

   b.   Once Maya is open go to [**File > Project > Set…**] browse to your project folder and click **OK**.

2. Open your last saved file. Go to [**File > Open**] and select *02_asgn03_arm_geo.ma*.

3. Continue working in X-ray mode and wireframe on shaded.

4. Continue working with Interactive Creation unchecked [**Create > NURBS Primitives > Interactive Creation**].

5. Create a NURBS sphere [**Create > NURBS Primitives > Sphere**].

    a. In the channel box, change "**RotateZ**" to 90.

    b. Move and scale the sphere over the character's right palm.

    c. In the **INPUTS** section of the channel box, click on *makeNurbSphere1* and change **Spans** to 8.
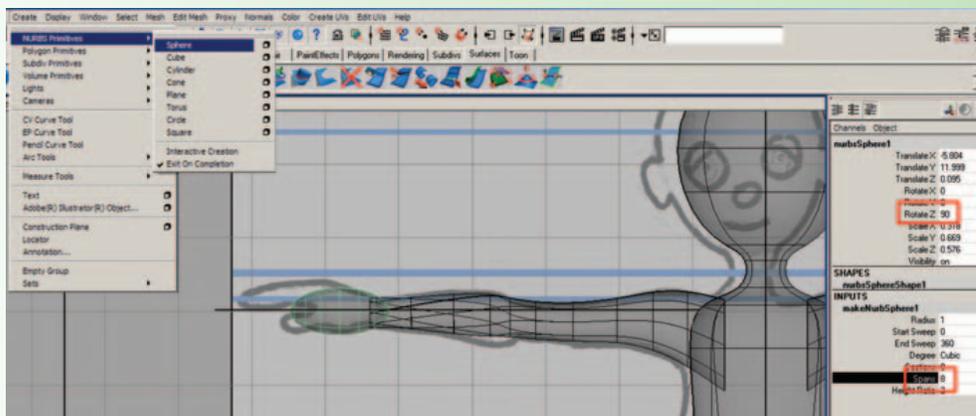

Creating a NURBS cylinder, positioning it for the palm, and dividing it for adequate deformation.

6. With the *NurbSphere1* still selected, create a Lattice Deformer [**Create Deformers > Lattice**].

    a. Starting at the wrist area, in the front view panel, **RMB** on top of the lattice and choose **Lattice Point**. (You may need to **RMB** in the perspective window if your lattice is close to the geometry, in order to see the correct marking menu.) In the front view panel, use your move tool by pressing (**w**) on the keyboard to click drag (or marquee drag) over points on the lattice (this ensures that you are selecting the points on both sides of the lattice) and move them around to refine the shape of your surface. Then starting at the wrist area, in the top view panel, continue to move the points on the lattice to refine the shape of your surface. Make sure to check the shape in the perspective window. Your reference drawings are just a reference. Feel free to make artistic changes while modeling in order to achieve the look you want.

    b. Select *NurbSphere1* then go to [**Edit > Delete by Type > History**]. This will remove the lattice, but any changes that have been made are now permanent.

   c. Rename *NurbSphere1* to *rightPalm_geo* by clicking on the name and typing in the channel box.
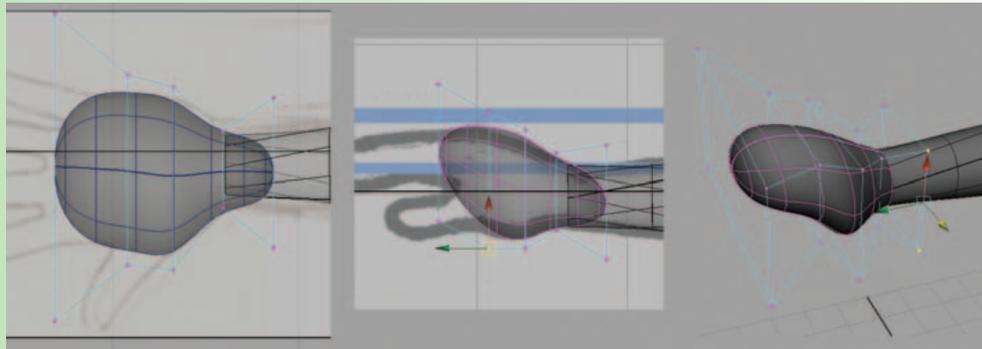
Adjusting the lattice for additional divisions and reshaping the lattice to make the sphere into a palm.

7. Create another NURBS sphere. [**Create > NURBS Primitives > Sphere**].

    a. In the channel box, change "**RotateZ**" to 90.

    b. Move and scale the sphere over the character's right index finger.

    c. In the **INPUTS** section of the channel box, click on *makeNurbSphere1* and change **Spans** to 8.

8. With the *NurbSphere1* still selected, create a Lattice Deformer [**Create Deformers > Lattice**].

    a. Starting at the palm area, in the front view panel, **RMB** on top of the lattice and choose **Lattice Point**. (You may need to **RMB** in the perspective window if your lattice is close to the geometry, in order to see the correct marking menu.) In the front view panel, use your move tool by pressing (**w**) on the keyboard to click drag (or marquee drag) over points on the lattice (this ensures that you are selecting the points on both sides of the lattice) and move them around to refine the shape of your surface. Then starting at the palm area, in the top view panel, continue to move the points on the lattice to refine the shape of your surface. Make sure to check the shape in the perspective window. Your reference drawings are just a reference. Feel free to make artistic changes while modeling in order to achieve the look you want.
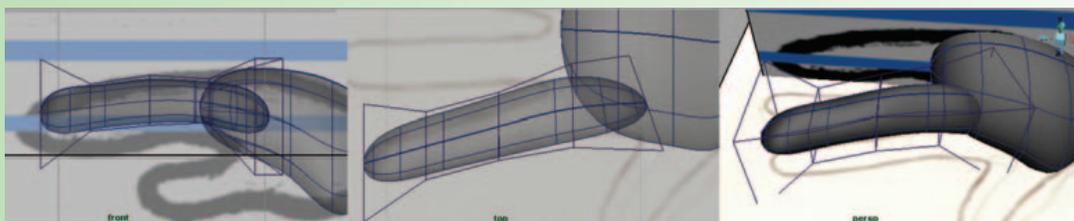
Making the index finger.

b.   Select *NurbSphere1* then go to **[Edit > Delete by Type > History]**. This will remove the lattice but any changes that have been made are now permanent.

c.   Rename *NurbSphere1* to *rightIndex_geo* by clicking on the name and typing in the channel box.

9.   Repeat steps 7–8 for each finger and the thumb, renaming them *rightMiddle_geo, rightRing_geo, rightPinky_geo, and rightThumb_geo.*
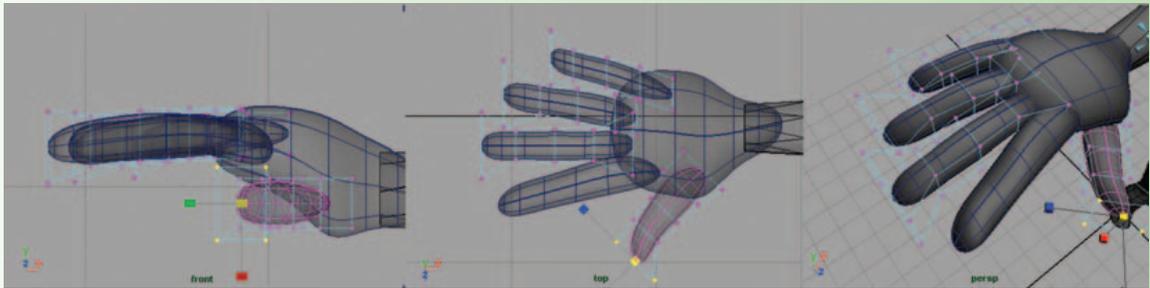

Making the fingers and thumb.

10. Duplicate the hand for the left side.

a.   Select *rightPalm_geo* and duplicate **[Edit > Duplicate]** or press **(ctrl+d)** on the keyboard. In the channel box, rename *rightPalm_geo1* to *leftPalm_geo*, change the **TranslateX** value to **positive** (which positions the arm onto the other side of the origin) and change the **ScaleY** value to negative (which makes the palm invert).

11. Repeat this process for each finger.

12. Select *rightPalm_geo, rightIndex_geo, rightMiddle_geo, rightRing_geo, rightPinky_geo, rightThumb_geo, leftPalm_geo, leftIndex_geo, leftMiddle_geo, leftRing_geo, leftPinky_geo, and leftThumb_geo* **[Modify > Freeze Transformations]**. **Freeze Transformations** on finished geometry will return the translation and rotation values to 0 and the scale values to 1.

13. In the Layer Editor of the channel box, **RMB** click and hold on top of the *geometry_layer* and choose **Add Selected Objects**.

14. Save your scene file.

a.   Go to **[File > Save as]**.

b.   Name your scene 02_assgn04_hand_geo.ma.

Assignment 2.5: Model a Foot

1.   Open Maya and set your project.

a.   Go to **[Start > Programs]** and select Maya.

b.   Once Maya is open go to **[File > Project > Set…]** browse to your project folder and click **OK**.

2. Open your last saved file. Go to [**File > Open**] and select *02_asgn04_hand_geo.ma*.

3. Continue working in X-ray mode and wireframe on shaded.

4. Continue working with Interactive Creation unchecked [**Create > NURBS Primitives > Interactive Creation**].

5. Create a NURBS sphere [**Create > NURBS Primitives > Sphere**].

   a. Move and scale the sphere over the character's right foot.

   b. In the **INPUTS** section of the channel box, click on *makeNurbSphere1* and change **Spans** to 6.
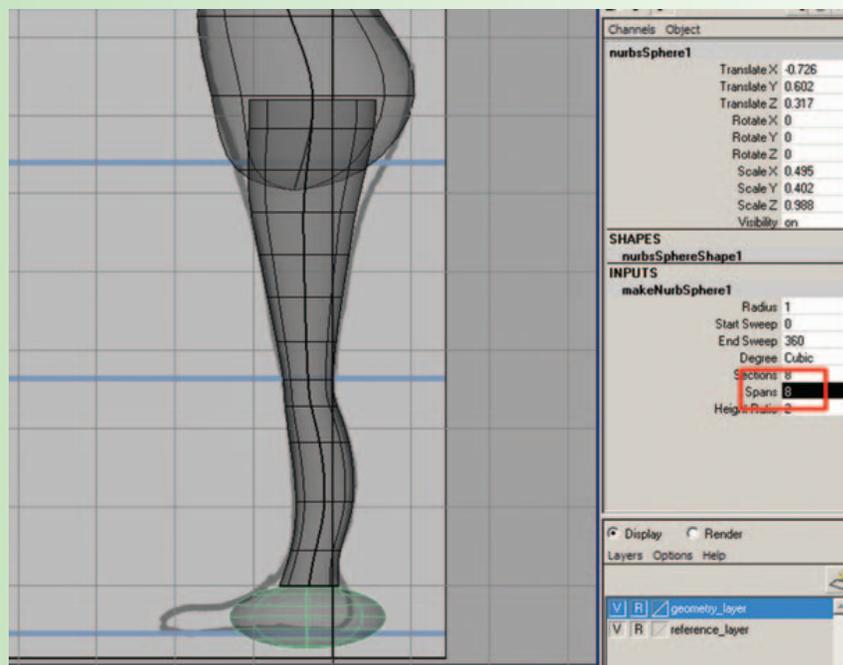
Creating a NURBS sphere, positioning it for the foot, and dividing it for adequate deformation.

6. With the *NurbSphere1* still selected, create a Lattice Deformer. [**Create > Deformers > Lattice**].

   a. In the **Shapes** section of the channel box, change the **T** divisions to 2 and the **U** divisions to 5.

Starting at the ankle area, in the side view panel, **RMB** on top of the lattice and choose **Lattice Point**. (You may need to **RMB** in the perspective window if your lattice is close to the geometry, in order to see the correct marking menu.) In the front view panel, use your move tool by pressing (**w**) on the keyboard to click drag (or marquee drag) over points on the lattice (this ensures that you are selecting the points on both sides of the

lattice) and move them around to refine the shape of your surface. Check the shape in the perspective window. Reshape the front of the foot. Your reference drawings are just a reference. Feel free to make artistic changes while modeling in order to achieve the look you want.

b. Select *NurbSphere1* then go to [**Edit > Delete by Type > History**]. This will remove the lattice, but any changes that have been made are now permanent.

c. Rename *NurbSphere1* to *rightFoot_geo* by clicking on the name and typing in the channel box.
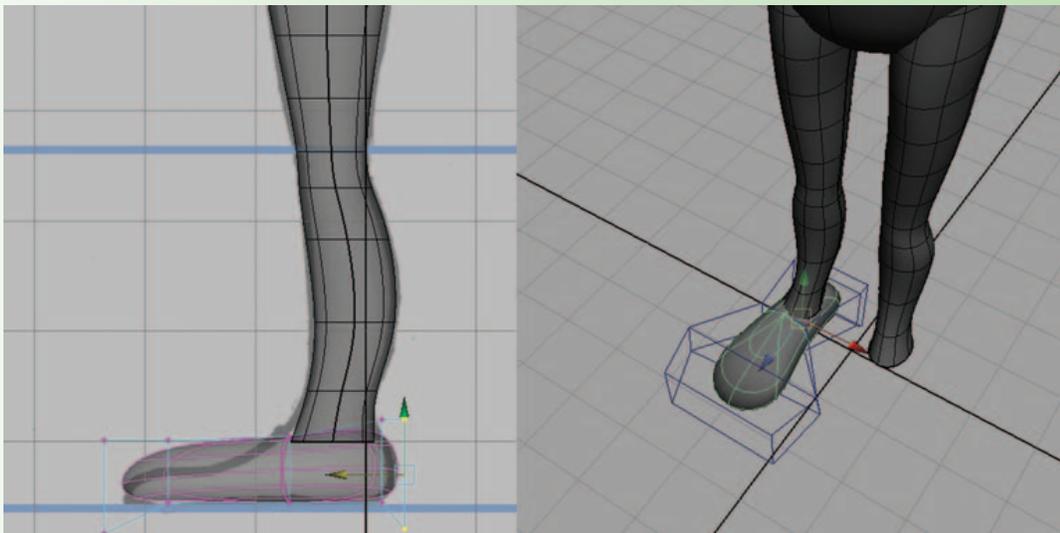
Adjusting the lattice for additional divisions and reshaping the lattice to make the sphere into a foot.

d. Select *rightFoot_geo* and duplicate [**Edit > Duplicate**] or press (**ctrl+d**) on the keyboard. In the channel box, rename *rightFoot_geo1* to *leftFoot_geo*, change the **TranslateX** value to positive (which positions the foot onto the other side of the origin) and change the **ScaleX** value to negative (which makes the foot invert).

e. Select *rightFoot_geo* and *leftFoot_geo* [**Modify > Freeze Transformations**]. Freeze transformations on finished geometry will return the translation and rotation values to 0 and the scale values to 1.

f. In the Layer Editor of the channel box, **RMB** click and hold on top of the *geometry_layer* and choose Add Selected Objects.

g. Save your scene file: Go to [**File > Save as**].

h. Name your scene *02_asgn05_foot_geo.ma*.
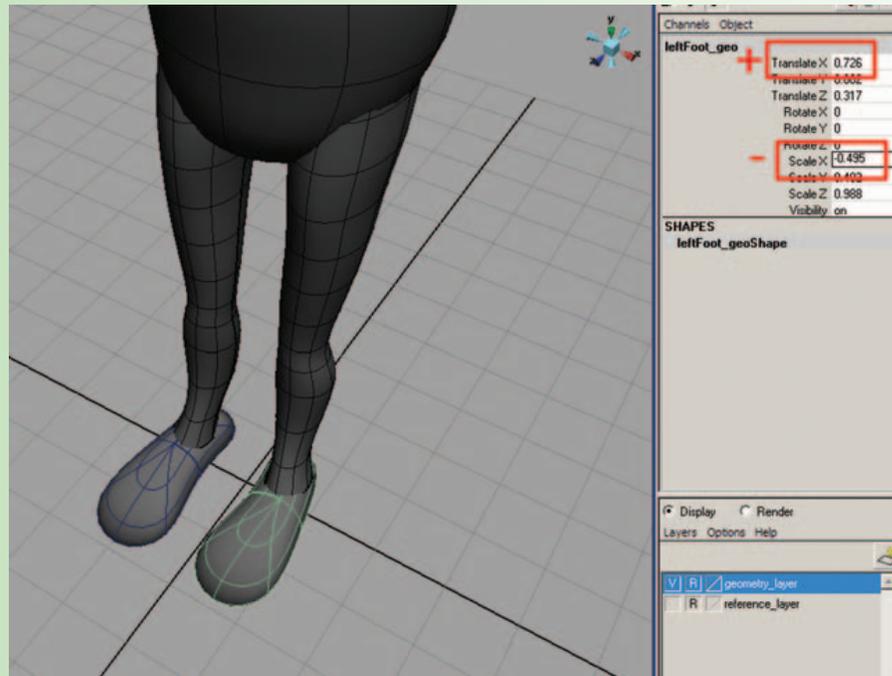
Duplicating the right foot to create the left foot.

Assignment 2.6: Model Eyes

1. Open Maya and set your project.
   a. Go to [**Start > Programs**] and select Maya.
   b. Once Maya is open go to [**File > Project > Set…**] browse to your project folder and click **OK**.

2. Open your last saved file. Go to [**File > Open**] and select *02_asgn05_foot_geo.ma*.

3. Continue working in X-ray mode and wireframe on shaded.

4. Continue working with Interactive Creation [**Create > NURBS Primitives > Interactive Creation**].

5. Turn your *geometry_layer* to invisible by clicking and hiding the **V** next to the layer.
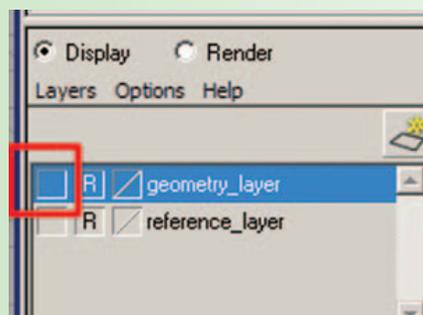
Turn the geometry layer invisible by hiding the V in the Layer Editor.

6. Go to [**Create > NURBS Primitives > Sphere – option box**]. Change the **Axis** to Z and the **Spans** to 6. Click **Create**.

7. Rename *NurbSphere1* to *eyeball_geo* by clicking on the name and typing in the channel box.
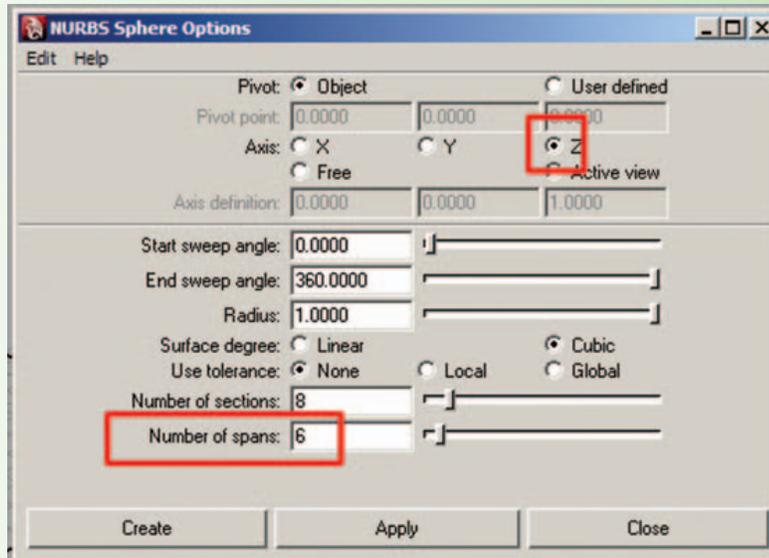
The NURBS sphere option box.

8. Hold your cursor over the sphere and **RMB**, click and hold, select [**Assign New Material > Phong**] (Phong is a reflective material when rendered. You may want to try a different material to achieve your desired look.) The attribute editor will open. Rename the material eye_phong.

    a. In Attribute Material window, click on the **checkered square** next to the Color. Create Render Node will appear. Select **2D Textures – Ramp**. Press **(6)** to see how the material looks on the Sphere.

    b. Change the **Ramp Attribute Type** to a **U Ramp**.

    c. Click on the blue circle of color, then click on the blue box in the **Selected Color** section, this opens the color picker where you can change the color to a very dark blue, almost black. You really should never use black, as black is very flat and creates a **visual death** on the screen.

    d. Click on the red circle of color, then click on the red box in the **Selected Color** section, this opens the color picker where you can change the color to a very pale orange, almost white. For the same reasons as black, you really should never use white either.

    e. Click on the green circle of color, then click on the green box in the **Selected Color** section, this opens the color picker where you can change the color to the color chosen for your character's eye color. You will also need to click inside of the ramp rectangle to create a fourth circle of color, which allows you to make your eyes two toned for more interest.

    f. Click and drag the circles up and down to adjust their position. The closer the circles are to each other, the sharper the edge of color.
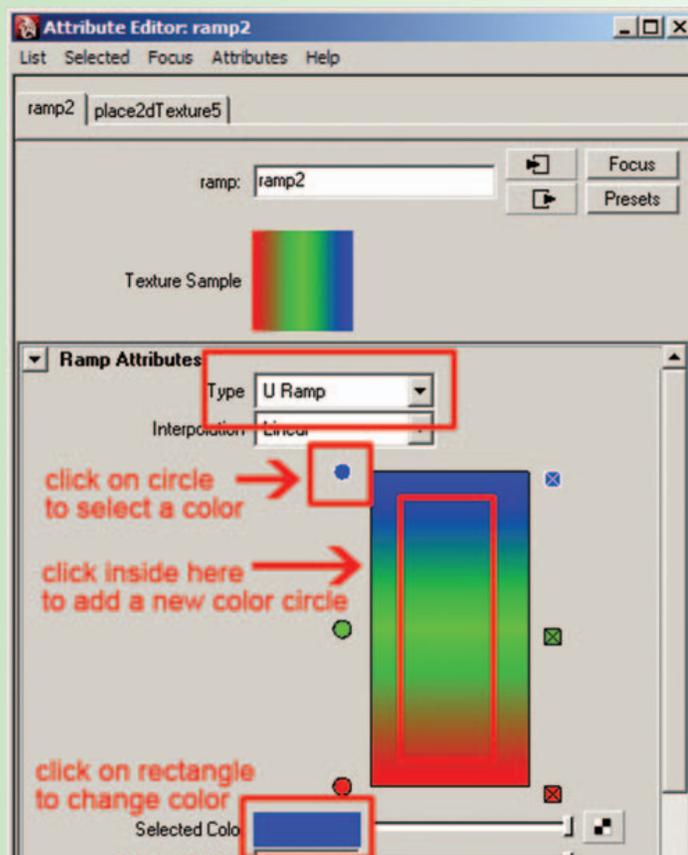
Adjusting the ramp attributes.
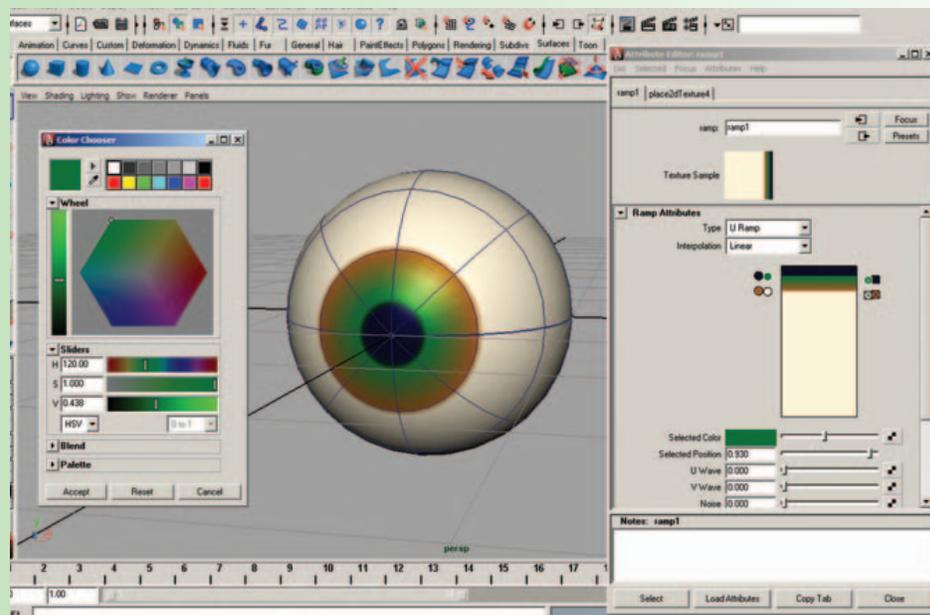
Adjusting the ramp colors to make an eye shader.

! Don't be afraid to add more detail or your own ideas. For example, all eyes have a thin dark ring around the outside of the iris called a limbus line. You could add this detail because it also adds quite of bit of visual interest.

9. Go to [**Create > NURBS primitives > Sphere – option box**] Change the **Axis** to **X**, the **Start sweep angle** to **55**, and the **End sweep angle to 355**. Click **Create**.

10. In the channel box, in the **INPUTS** section, click on the *makeNurbSphere* which reveals additional attributes including *Start Sweep* and *End Sweep*, which will allow your character to blink. You can test this out by clicking on the **WORD Start Sweep**, then click and drag the **MMB** (middle mouse button) in a view panel to see the eye blink. Make sure to undo this motion by pressing (z) on the keyboard.

  a. Rename *NurbSphere1* to *eyelid_geo* by clicking on the name and typing in the channel box.

  b. In the channel box, change **RotateX to 206** (your value may be different), and **ScaleX, ScaleY, ScaleZ to 1.02**.
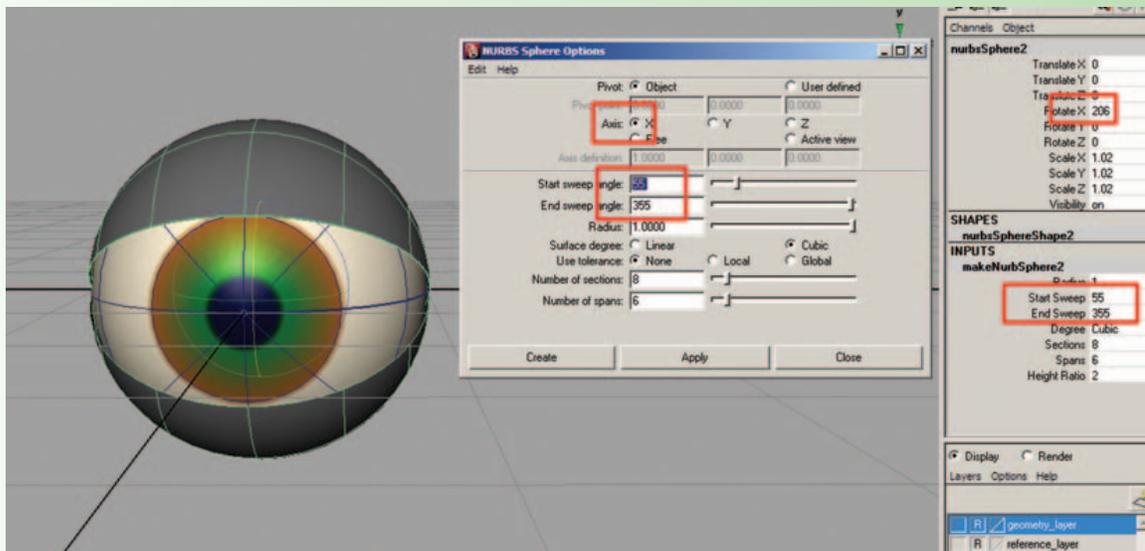
Creating another NURBS sphere for the eyelid.

  c. Add dimension to the eyelid. Add a couple additional horizontal isoparms to the eyelid. To insert a single isoparm, **RMB** and hold over a surface (which brings up the marking menu), choose **Isoparms** (which brings you into component

level), click and drag on an isoparm on the surface near to where you want to add one, drag it into position, then **[Edit NURBS > Insert Isoparms]**.

d. **RMB** on top of the eyelid and choose **HULLS**.

e. Select a hull near the edge of the upper eyelid, then shift select a hull near the edge of the lower eyelid.
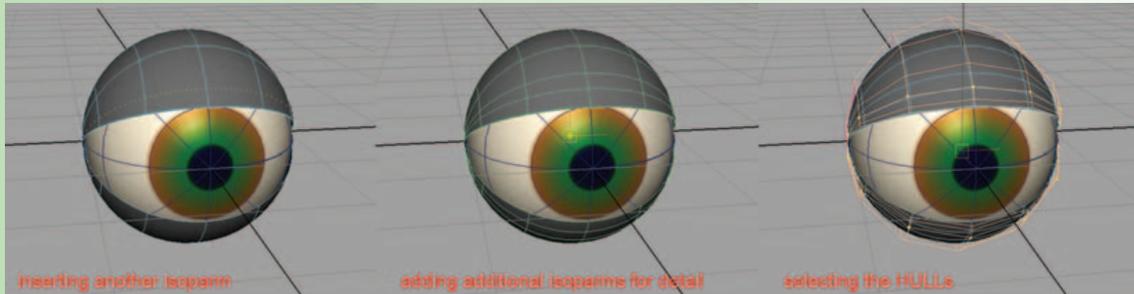
Inserting isoparms and selecting the HULLS.

f. **RMB** on top of the eyelid and choose **Control Vertex**.

g. Hold down the **ctrl key** and drag select each pole to deselect it.

h. Use the scale tool to scale out a lip around the edge of the eyelid.
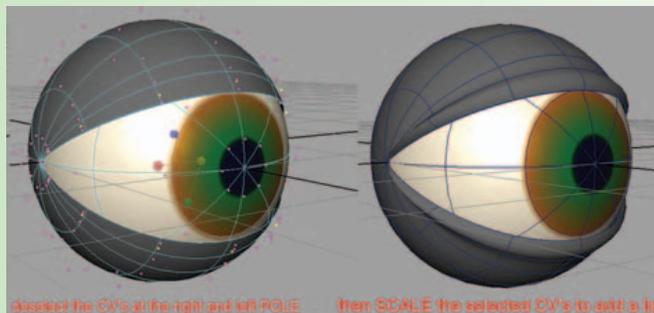
Reshaping the eyelid to add dimension.

i. If you want to reshape your eye to something other than spherical, you can now add a lattice. Select both *eyeball_geo and eyelid_geo*, then **[Create Deformers > Lattice]**.

   i. Open the outliner and select both *fftd1 Lattice* and *fftd1 Base*. You will need to scale these up so that reshaping them doesn't cause intersection problems between the eyelid and eyeball when the eyelid closes.
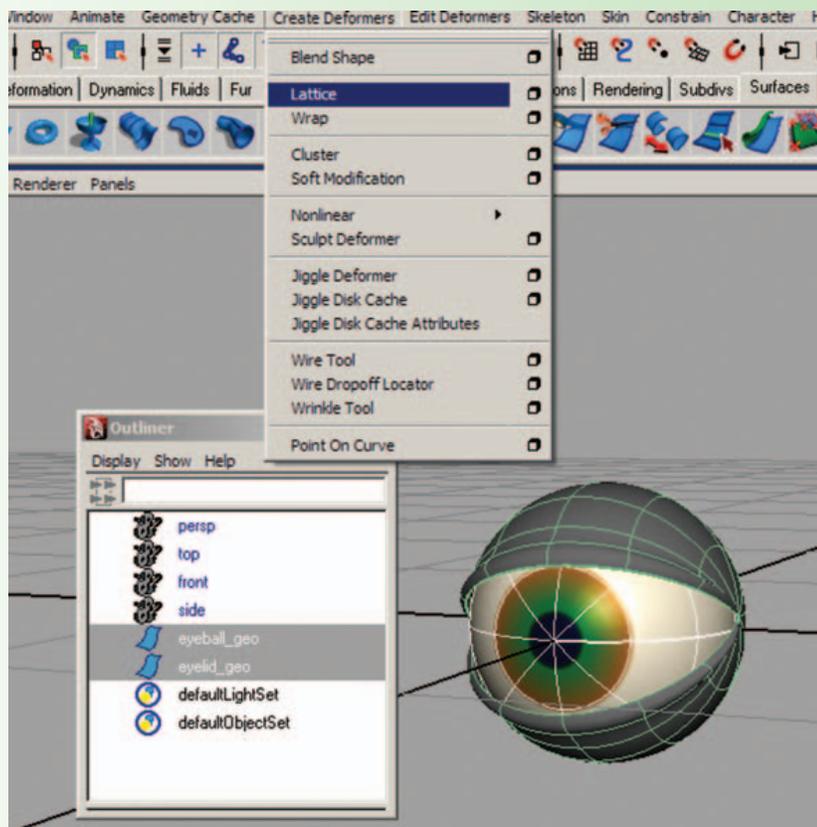
**Adding a lattice deformer to the eye and eyelid.**
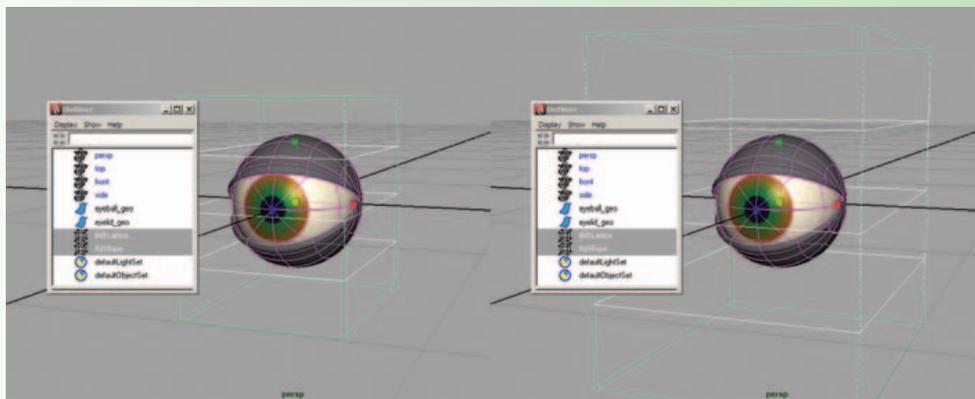
Scaling both the lattice and the base larger.

ii.   You can reshape the lattice by **RMB** on the lattice and moving the lattice
      points with the move tool by pressing (**w**) on the keyboard. If the eyeball
      starts to intersect the eyelid, you can scale the eyelid up slightly.
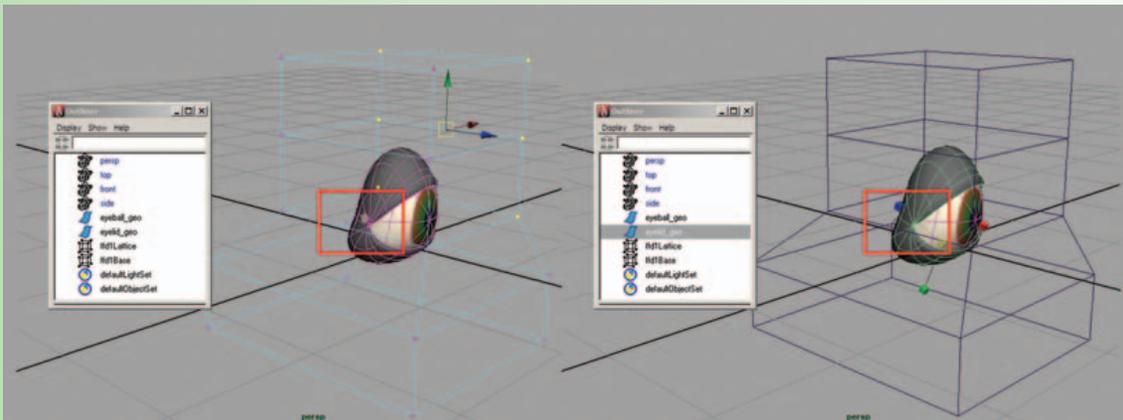
Exposing part of the eyeball while reshaping the lattice (left) can be alleviated by scaling the eyelid slightly larger (right).

    j.   Open the outliner, [**Windows > Outliner**] Select the *eyeball_geo, eyelid_geo, fftd1Lattice*, and *fftd1Base* and (if you have a Lattice and Base) **ctrl + g** to group them together. Rename *group1* to *right_eye_geo* by clicking on the name and typing in the channel box.
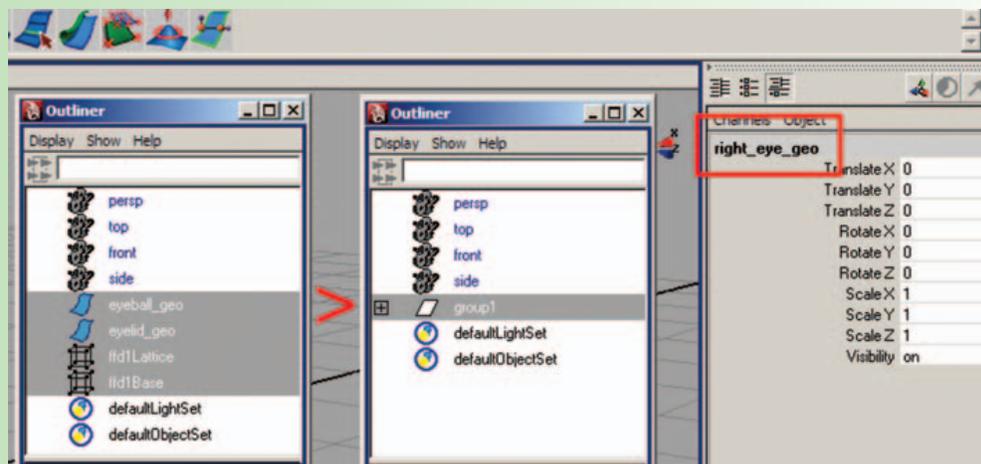
Grouping the eye parts and renaming the group to right_eye_geo.

    k.   Turn your *geometry_layer* to visible by clicking on the first empty box and **V** will appear next to the layer.

    l.   Select the *right_eye_geo* group in the outliner and move the eye into place. You can also scale this group if necessary. Adjust the lattice if needed as well, once the **EYE GROUP** is in position. Make sure that you do not move the individual pieces of the eye, as this will cause problems when the eye needs to rotate later.
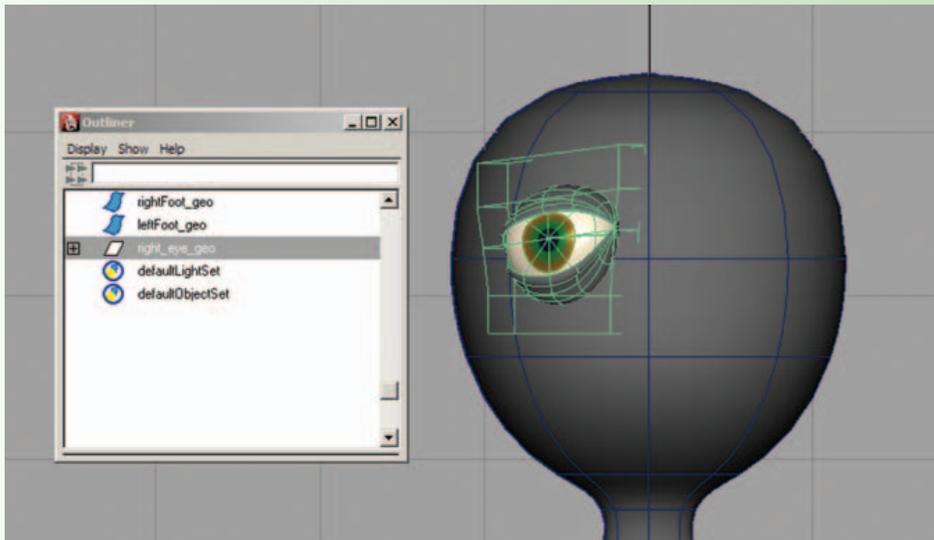
Repositioning the right_eye_group.

m. Duplicate the eye [**Edit > Duplicate Special – option box**]. Check **Duplicate input graph**. Rename *right_eye_geo1 to left_eye_geo*. This keeps the input (makeNurbSphere) which is necessary for blinking.
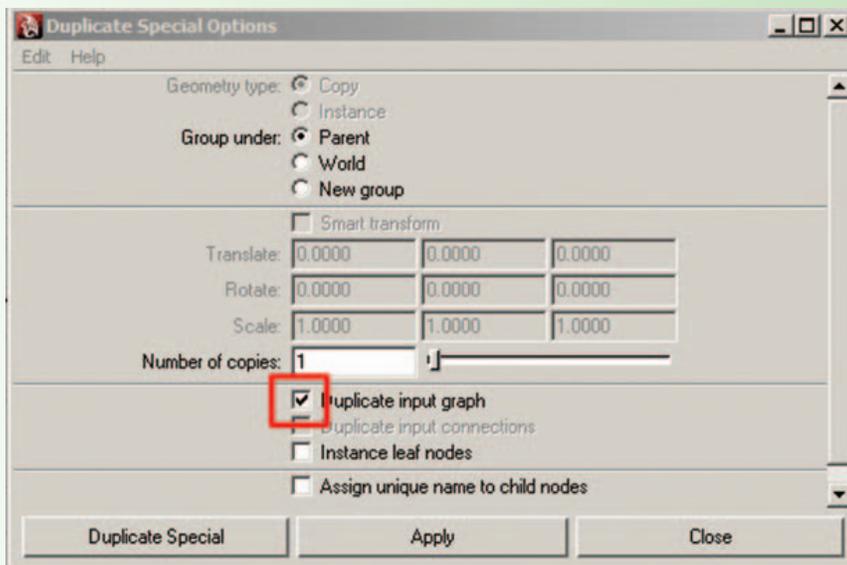
The Duplicate Special option box with the Duplicate input graph option checked.

n. Change the **TranslateX** value of *left_eye_geo* to positive (which positions the eye onto the other side of the origin) and change the **ScaleX** value to negative (which makes the eye invert).

o. Select both lattice and hide them by pressing (**ctrl + h**).

p.   DO NOT FREEZE TRANFORMATIONS OR DELETE HISTORY on your eyes. Doing so will remove the shape changes and the lattice, as well as the INPUTS for *makeNurbSphere* which is needed to create eye blinks.

q.   Select *right_eye_geo* and *left_eye_geo*. In the Layer Editor of the channel box, **RMB** click and hold on top of the *geometry_layer* and choose **Add Selected Objects**.

11. Save your scene file.

a.   Go to [**File > Save as**].

b.   Name your scene *02_asgn06_eye_geo.ma*.

Assignment 2.7: Adding Detail to the Face

You can continue to add additional spheres that are shaped by lattices to create the nose, mouth, and eyebrows. The technique that follows shows how to create those features and keep them as part of the head, instead of separate geometry.

1.   Open Maya and set your project.

a.   Go to [**Start > Programs**] and select Maya.

b.   Once Maya is open go to [**File > Project > Set…**] browse to your project folder and click **OK**.

2.   Open your last saved file. Go to [**File > Open**] and select *02_asgn06_eye_geo.ma*.

3.   Continue working in X-ray mode and wireframe on shaded.

4.   Continue working with Interactive Creation [**Create > NURBS Primitives > Interactive Creation**].

5.   To add detail to the head:

a.   Add a couple additional vertical isoparms where the eyes would be. To insert a single isoparm, **RMB** and hold over a surface (which brings up the marking menu), choose Isoparms (which brings you into component level), click and drag on an isoparm on the surface near to where you want to add one, drag it into position, then [**Edit NURBS > Insert Isoparms**].
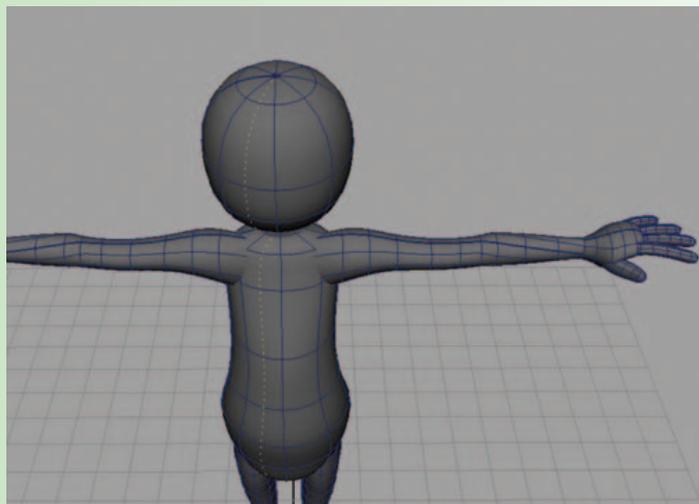

Adding an isoparm.

b.   Add additional horizontal isoparms as needed. You can add multiple isoparms at the same time by **RMB** and hold over a surface, choose Isoparms, and shift selecting two isoparms. Open the [**Edit NURBS > Insert Isoparms – option box**]. Choose **Between Selections** and then type in the # of isoparms to insert.
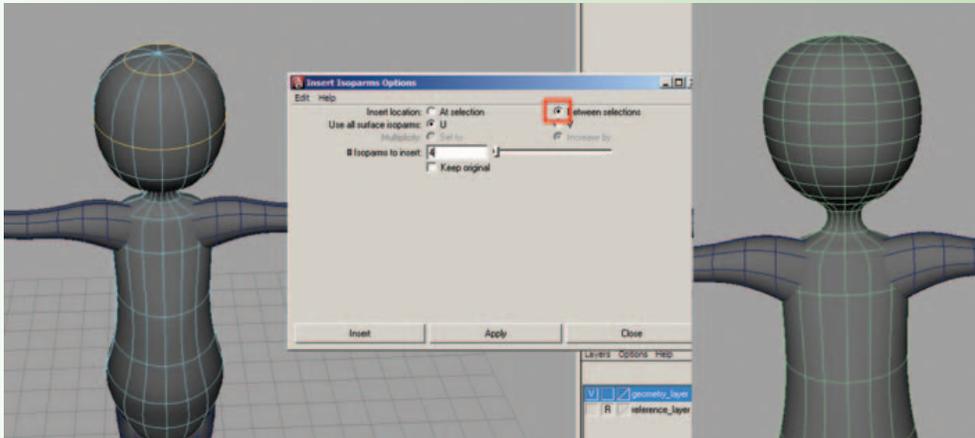

Adding additional isoparms using the option for between selections.

c.   Use the Sculpt Geometry Tool [**Edit NURBS > Sculpt Geometry Tool – option box**] to pull out a nose for your character.
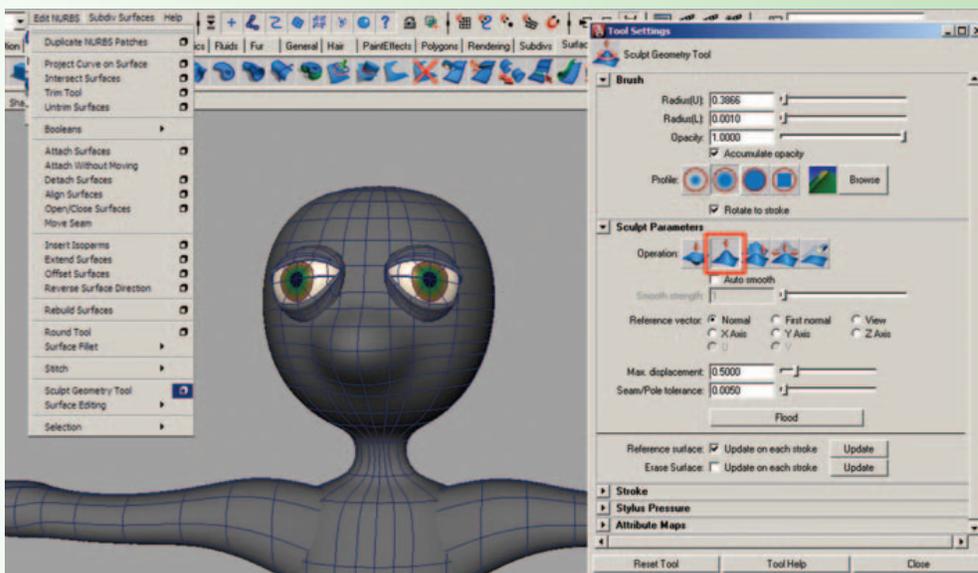
Creating a nose shape.

d. With the view panel active, hold the mouse over the surface, hold down the "**b**" key and **MMB** click and drag to interactively adjust the size of the brush.

e. You can use the reflection option under the **Stroke** tab for creating the same changes on both sides of the face at once. This can be helpful for pulling out eyebrows. Also make sure you reduce the **maximum displacement** from 1 to 2 so that the eyebrows are not pulled out as far.
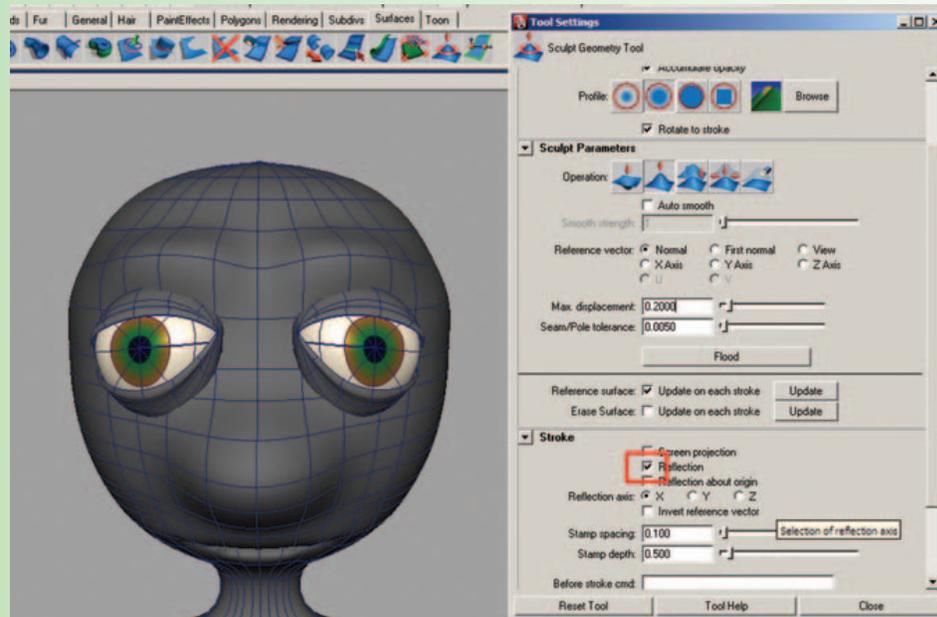

Use the reflection option to create eyebrows.

f. Continue to add **ISOPARMS** as necessary to create the detail necessary. The more detail you want, the more isoparms are needed.

g. **RMB** over the geometry and choose **Control Vertex** in order to select **CVs** in the mouth area and pull them into make a mouth.

6. Save your scene file.

a. Go to [**File > Save as**]. This should open the scenes folder of your project (assuming you set the project as in step 1).

b. Name your scene *02_asgn07_faceDetail_geo.ma*.

### *Optional Assignment 2.8: Model Ears, Hair, and Accessories*

This is an optional assignment, as not all characters have hair or ears. However, the ears a can change the appearance of your character and add an element that allows for character, personality, and a way of conveying expression.

This is not a step by step tutorial. Rather, you can use techniques learned so far to create ears and hair. A simple way of creating an ear is to begin with a sphere on the Z axis with 8 spans, position it near the head and scale it on the X axis to create the proper thickness. Add a lattice deformer, and reshape the lattice points to create an ear. Delete history and duplicate for the other side, changing the TranslateX value to positive, the ScaleX to negative, and rotate to position as needed.
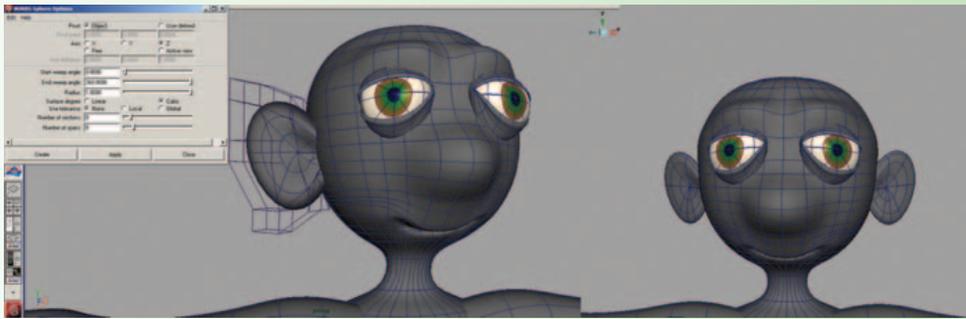
Creating an ear using a NURBS sphere.

A similar approach using a NURBS sphere and a lattice can be used to create the hair.
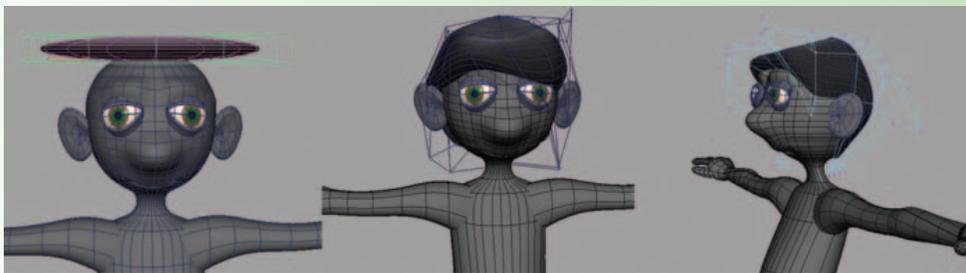
Creating hair using a NURBS sphere.

Try experimenting with a NURBS cone and nonlinear deformers, such as bend and twist. Make sure to add adequate spans to the cone BEFORE adding the deformer, so that the geometry will bend properly.
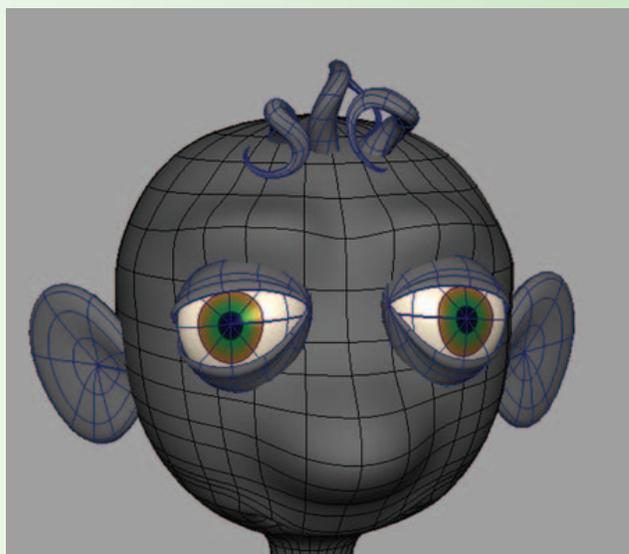
Curly hair using a NURBS cone.

Accessories, such as hats, ties, and other props can be modeled in similar ways. Hats, for example, can be created using a profile curve and revolving a surface, much like we did for the head and neck.

Optional Assignment 2.9: Combining Everything into a Single Polygonal Shape with Additional Approaches to Modeling Hands and Feet

1. Open Maya and set your project.

    a. Go to [**START > PROGRAMS**] and select Maya.

    b. Once Maya is open go to [**File > Project > Set …**] browse to your project folder and click **OK**.

2. Open your last saved file. Go to [**File > Open**] and select *02_asgn07_faceDetail_geo.ma*.

3. Continue working in X-ray mode and wireframe on shaded.

4. Select all the body geometry. Use the outliner [**Window > Outliner**] or the hypergraph [**Window > Hypergraph: Hierarchy**] to verify that all body geometry is selected. Do not select the eyes and eyelids.

[**Modify > Convert > NURBS to POLYS**] except for the eyes and eyelids.

5. Delete history on all converted polygons. [**Edit > Delete by Type > History**].

6. Delete NURBS geometry except for the eyes and eyelids.
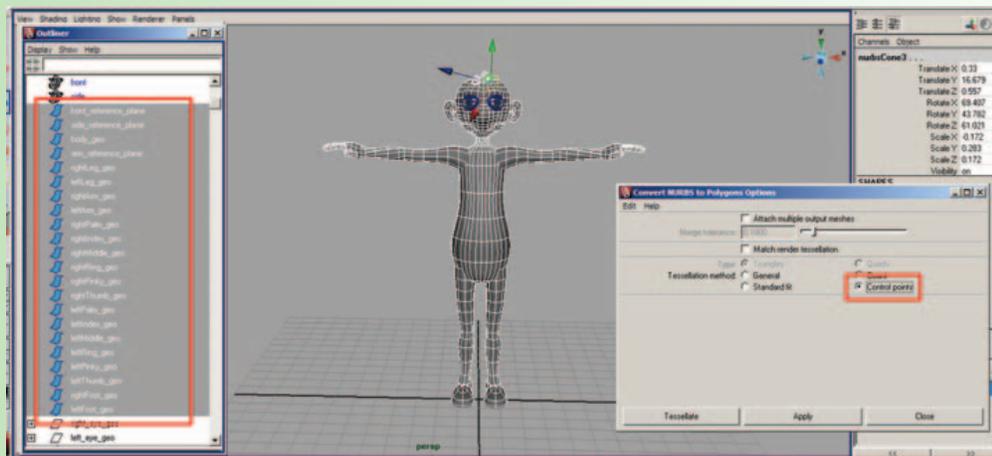
Converting NURBS to polygons.

7. Delete half of your model [**RMB** over geometry **> FACES, select the faces and hit delete**] all except the eyes and hair, if any.

8. With the geometry still selected, combine separate polygonal pieces into one [**Mesh > Combine**].
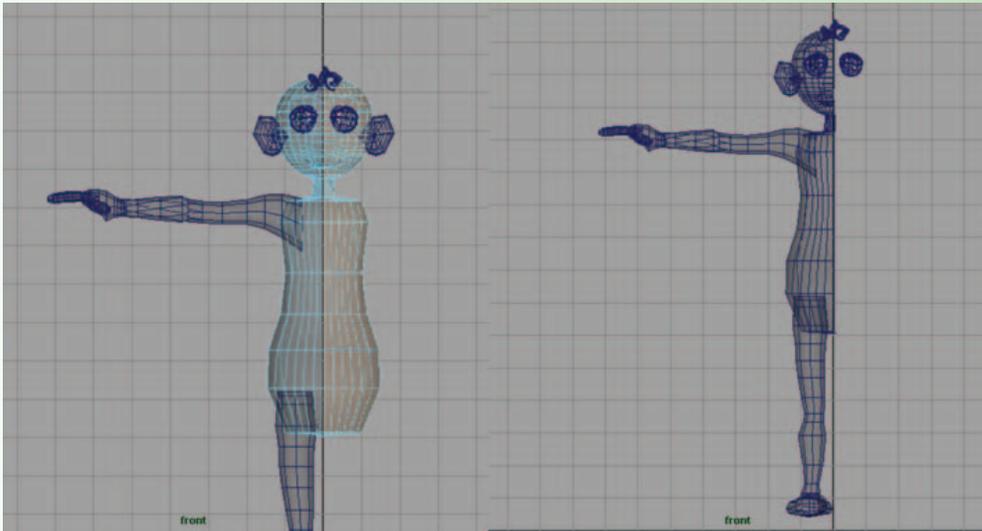
Selecting half of the faces of your polygonal face and torso.

Note: You may want to review the box modeling section that follows for the hands and feet. It is easier to delete the NURBS geometry at this time rather than deleting the polygonal faces after combining.
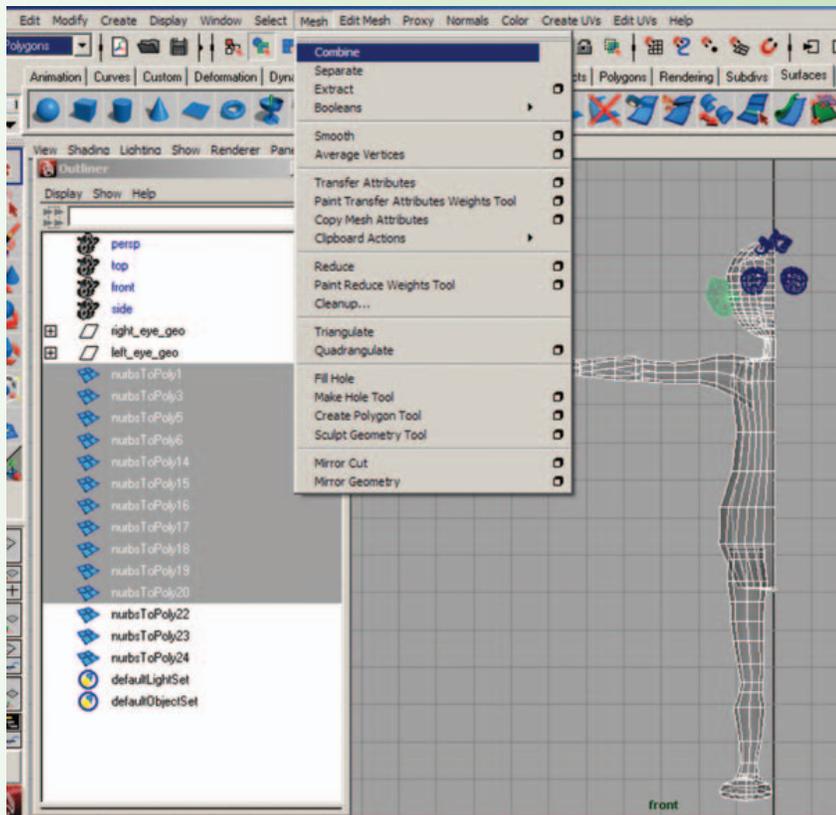

Combining all polygonal surfaces into one.

9. Delete history on *polySurface1* and rename *polySurface1* to *body_geo*.

10. Determine if there are equal numbers of edges on the two areas that need to be attached, and add additional geometry where needed. **[Edit Mesh > Insert Edge Loop Tool]**. Click on an edge and drag the new edge into place.

Click-drag on edges.
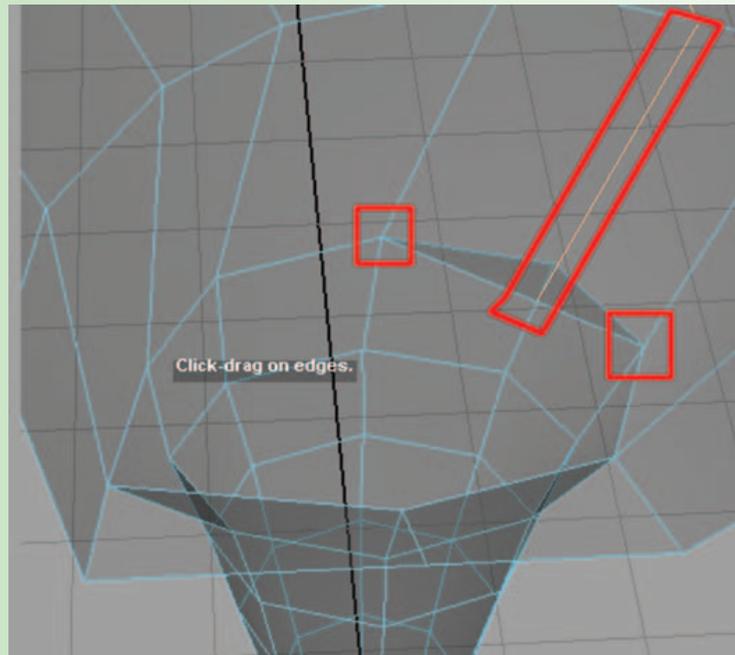
Add a new edge in order to align the torso with the leg.

11. Delete any overlapping geometry **RMB** over the geometry, choose **FACES**, select the faces that you want to remove and hit the **DELETE** key.

12. Using the move tool by pressing **(w)** on the keyboard hold down the 'v' key and move snap vertex points to line up with the other point nearby.

Delete any overlapping faces   move (v snap) the vertices into place   so that both pieces of geometry line up
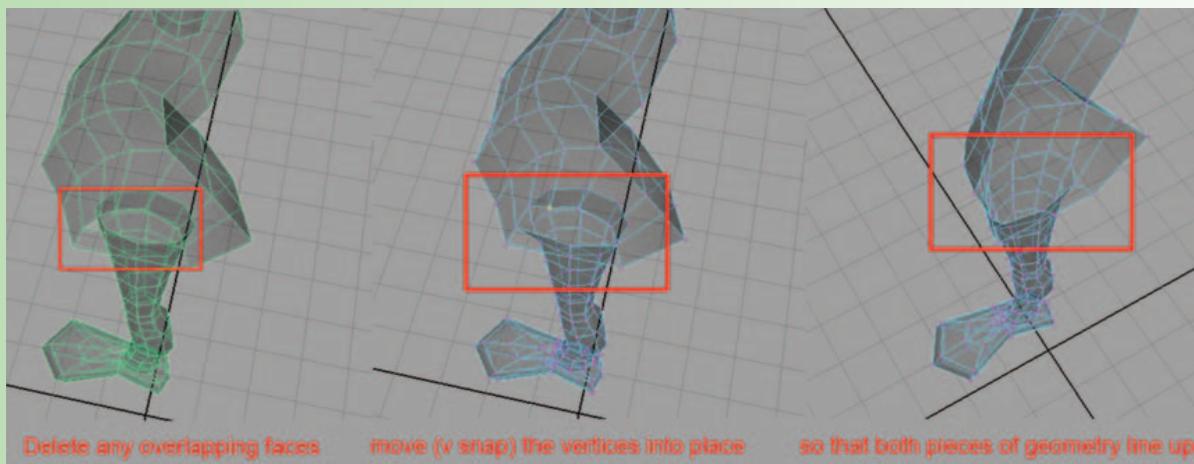
Aligning the torso vertices with the leg vertices.

13. Select the row of overlapping vertices and merge vertices. [**Edit Mesh > Merge**].
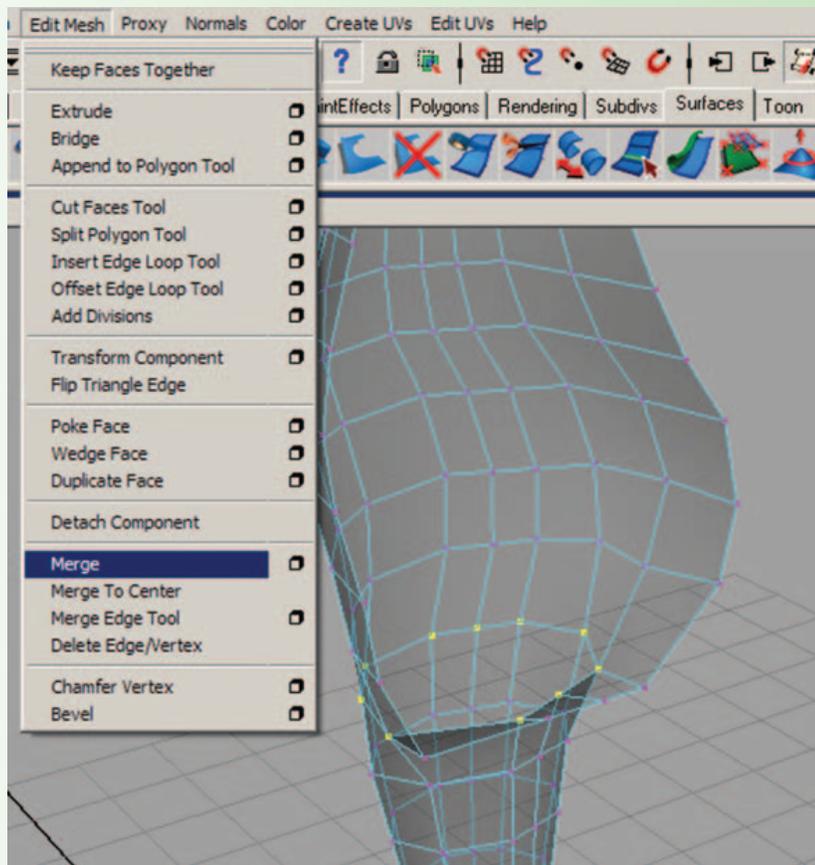
Merging the overlapping vertices.

14. Save your scene file: Go to [**File > Save as**].

15. Name your scene *02_asgn09_01_convert_to_polys_geo.ma*.

    You can repeat the process of deleting overlapping geometry, adding additional edges, v snapping vertex points, and merging vertices for each separate body part. However, in the case of the foot and the hand, it is easier to delete the existing parts and remodel them using the box modeling technique as shown in the following tutorials. Remember, deleting the foot and hand should be done BEFORE combining polygonal surfaces, as it is more difficult to select the overlapping geometry then it is to delete an entire, uncombined object.

Tutorial 2.9.a: Box Modeling a Foot

1. If you have not deleted the foot as suggested earlier, remove the existing foot geometry if it was converted and combined. **RMB** over the foot geometry, choose **FACES**, select the faces that you want to remove and hit the **DELETE** key.

2. Create a polygonal cube [**Create > Polygon Primitives > Cube – option box**] and divide the width and depth to 2. Reposition it to where the foot should be, scaling as needed.
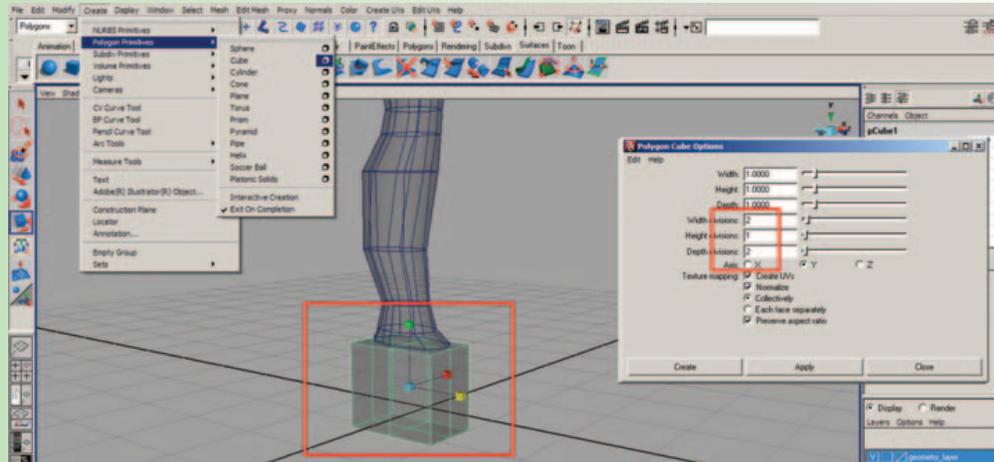

Creating a polygonal cube to become the foot.

3. RMB over the cube, choose **FACES**, and select the top faces and hit the **DELETE** key.

4. Select the cube, shift select the *body_geo*, and combine them into one piece [**Mesh > Combine**].

5. RMB over the cube, and choose **VERTEX**. Using the move tool by pressing (**w**) on the keyboard hold down the '**v**' key and select a vertex to move snap vertex points to line up with the other point nearby.
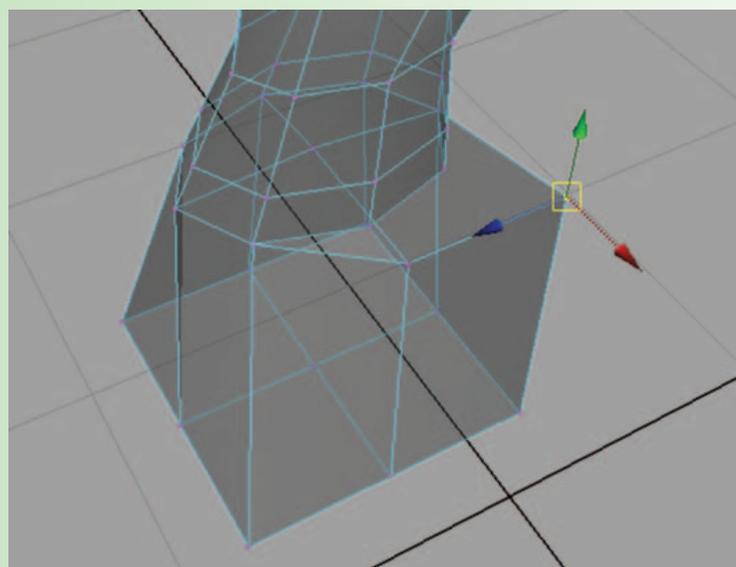
Snapping the vertices of the cube to those of the leg.

6. Delete history on *polySurface1* and rename *polySurface1* to *body_geo*.

7. Select the row of overlapping vertices and merge vertices **[Edit Mesh > Merge]**.
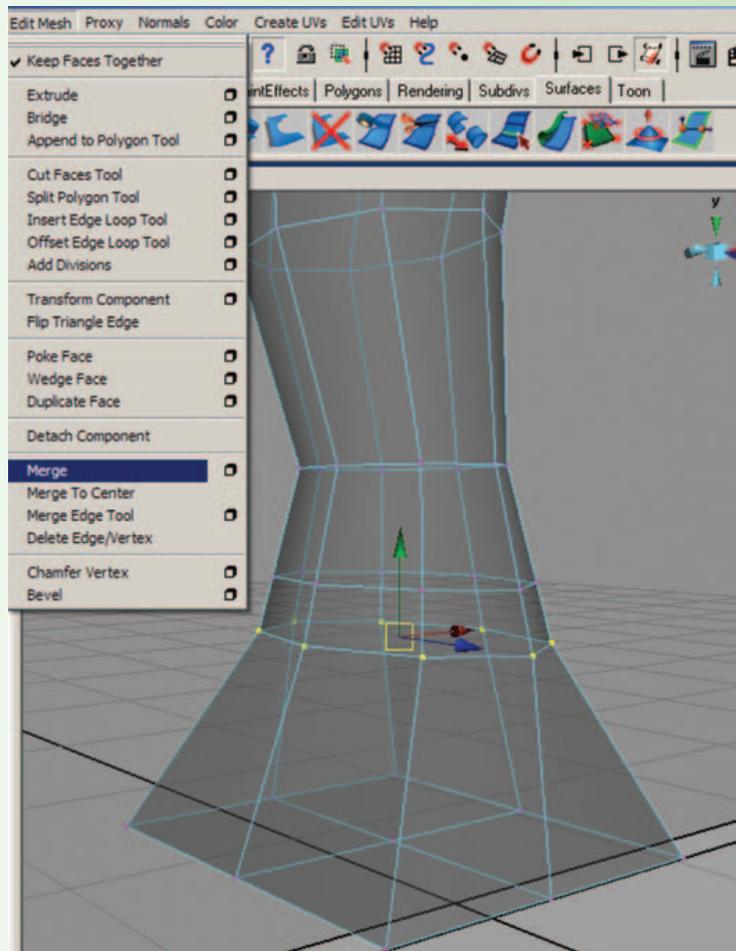
Merging the overlapping vertices of the foot and leg.

8. In the SIDE view panel, RMB over the foot geometry, choose VERTEX, select and move the bottom row of vertices to line up with your reference drawing.
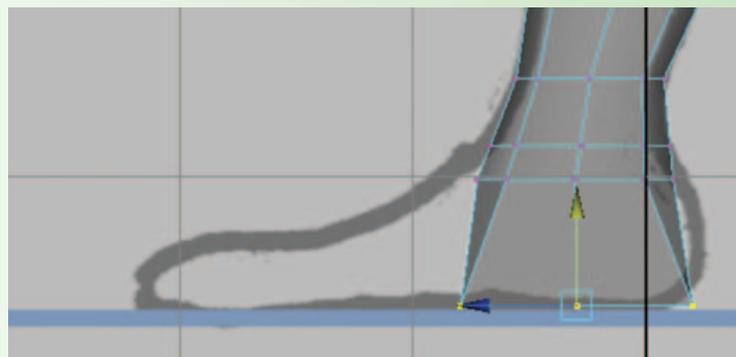

Adjusting the bottom row of vertices.

9. RMB over the foot geometry, choose **FACES**. In perspective view panel, select the two front faces and go to **[Edit Mesh > Extrude]**. Click on the little blue circle, and drag the arrow forward which will extrude your polygons in world space, perpendicular to the graph. Do not extrude all the way to the tip of the foot, rather, extrude only about a third of the way there.
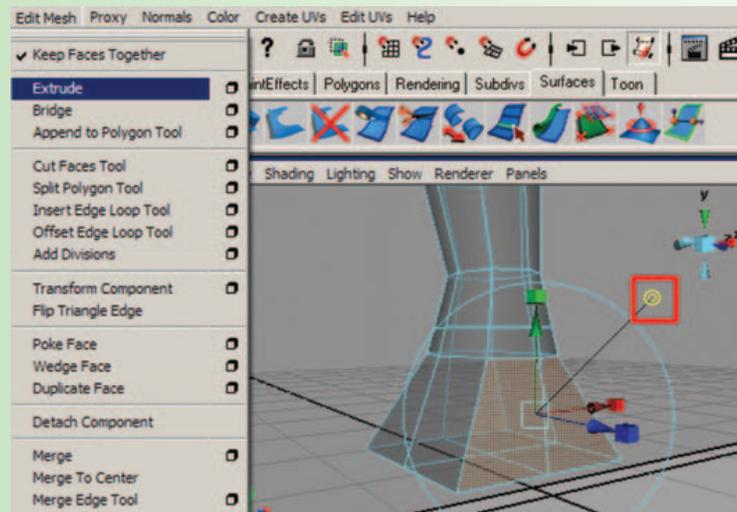
Extruding the foot parallel can occur if first clicking on the blue circle (shown yellow in this image because it is already selected) then clicking on the arrow to drag the extrusion forward.

10. Hit the **(g)** key to extrude again, and click on the blue circle before dragging the arrow forward, about halfway to the tip of the foot.

11. Hit the **(g)** key to extrude again, and click on the blue circle before dragging the arrow forward, to the tip of the foot.

12. **RMB** over the foot geometry, choose **VERTEX**, and use the move tool to reshape the vertices into the shape of the foot. Be sure NOT to cross the origin line.
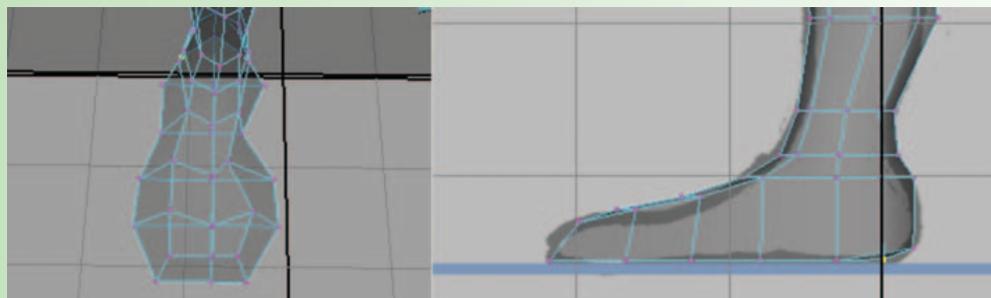

Reshaping the extruded faces into a foot.

Tutorial 2.9.b: Box Modeling a Hand

1. If you have not deleted the hand as suggested earlier, remove the existing hand geometry if it was converted and combined. **RMB** over the hand geometry, choose **FACES**, select the faces that you want to remove and hit the **DELETE** key.

2. Create a polygon cube and divide the width, height and depth to 2 and reposition it to where the hand should be, scaling as appropriate.
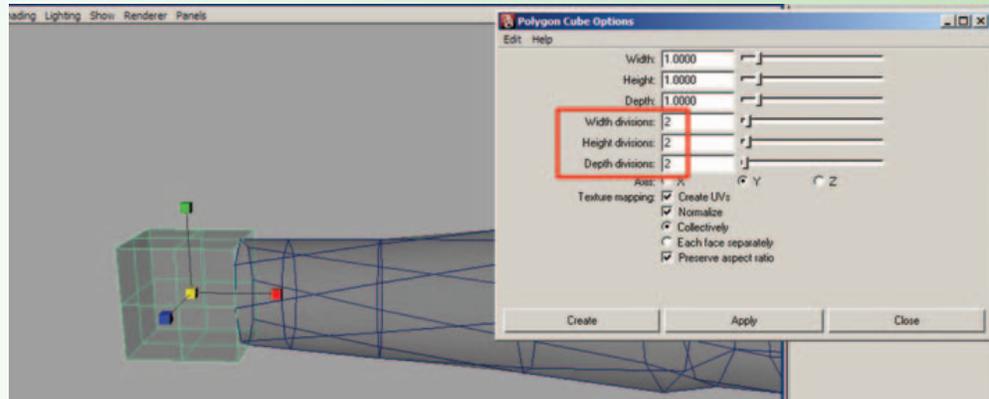

Creating a polygonal cube to become the hand.

3. **RMB** over the cube, choose **FACES**, and select the side faces closest to the wrist and hit the **DELETE** key.

4. In the **FRONT** and **TOP** view panel, **RMB** over the hand geometry, choose **VERTEX**, select and move the vertices to line up with your reference drawing.
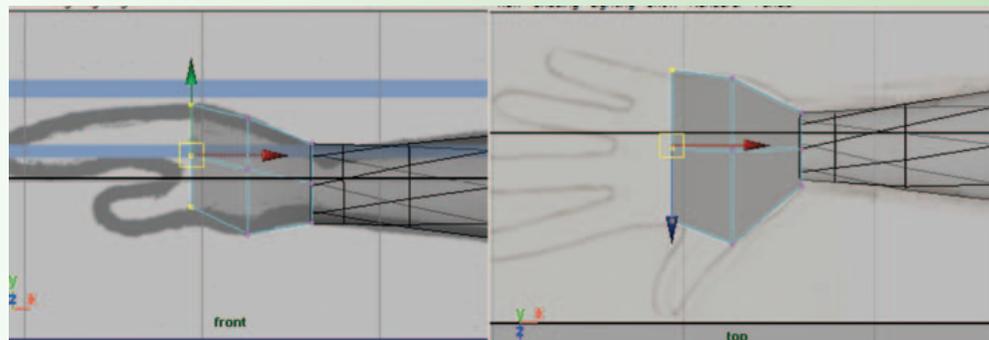

Reshaping the cube into a palm.

5. Determine where the fingers will be and add additional geometry where needed [**Edit Mesh > Insert Edge Loop Tool**]. Click on an edge and drag the new edge into place (It might be a great idea to limit your character's fingers to a thumb and two fingers for the first time you create one, as it takes additional time to create and control four fingers and a thumb).
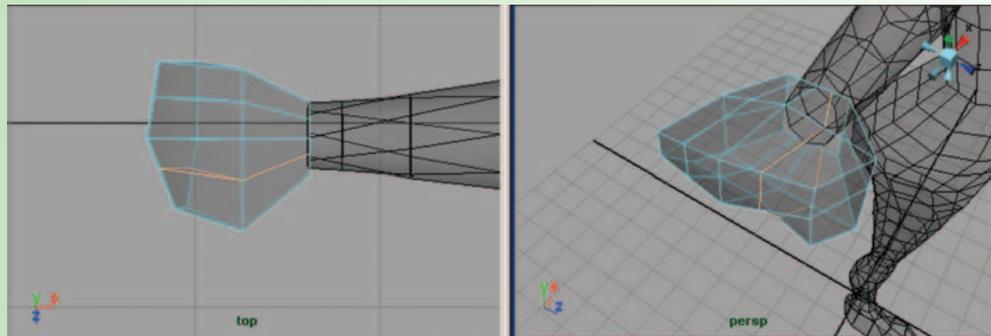
Adding additional edges to divide the geometry for fingers.

6.   Extrude the fingers:

   a.   Before we extrude the fingers, we want to make sure we get separate faces
        during the extrusion. Make sure to uncheck [**Edit Mesh > Keep Faces
        Together**] **RMB** over the hand geometry, choose **FACES**. In perspective view
   panel, select the faces where the fingers will be.
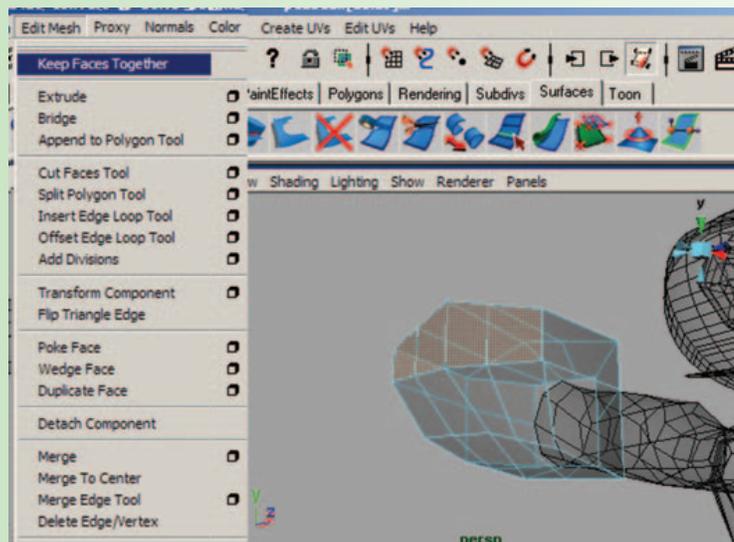
Making sure Keep Faces Together is unchecked.

   b.   [**Edit Mesh > Extrude**] In the **TOP** view panel, drag the arrow forward which
        will extrude your polygons. Do not extrude all the way to the tip of the fingers;
        rather, extrude only about a third of the way there (to the first knuckle). Then
        click on one of the scale boxes.

   c.   Then click on the center scale box, and **MMB** click and drag to scale the fingers
        slightly and separate the end faces. This will make it easier to reposition the
   vertices because they will not be overlapping.
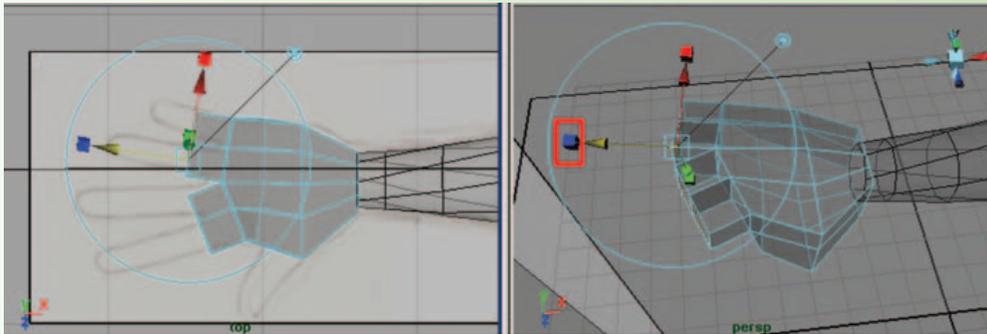
**Extruding the fingers to the first knuckle.**
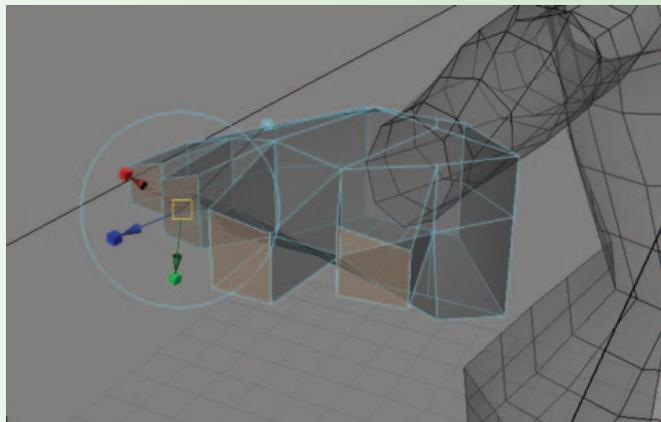
Scaling the extrusion to separate the fingers.

d. Using the move tool by pressing **(w)** on the keyboard, in the **TOP** and **FRONT** view panel, reposition the end row of vertices for each finger.
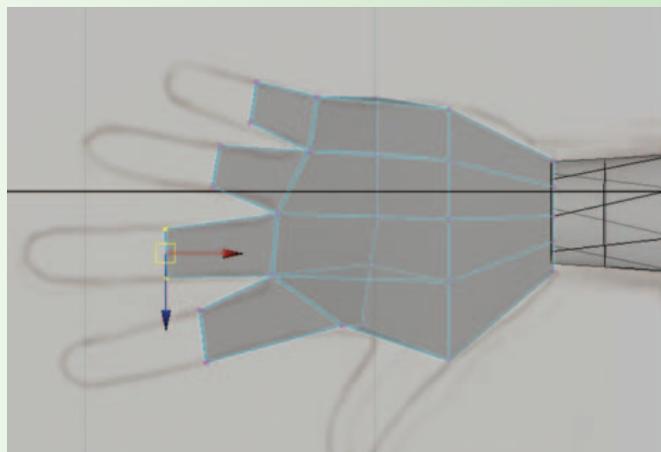

Adjusting the positions of the finger geometry.

e. **RMB** over the hand geometry, choose **FACES**. In perspective view panel, select the end faces of each finger and go to **[Edit Mesh > Extrude]**. In the **TOP** view panel, drag the arrow forward which will extrude your polygons. Do not extrude all the way to the tip of the fingers; rather, extrude only about a half of the way there (to the second knuckle).
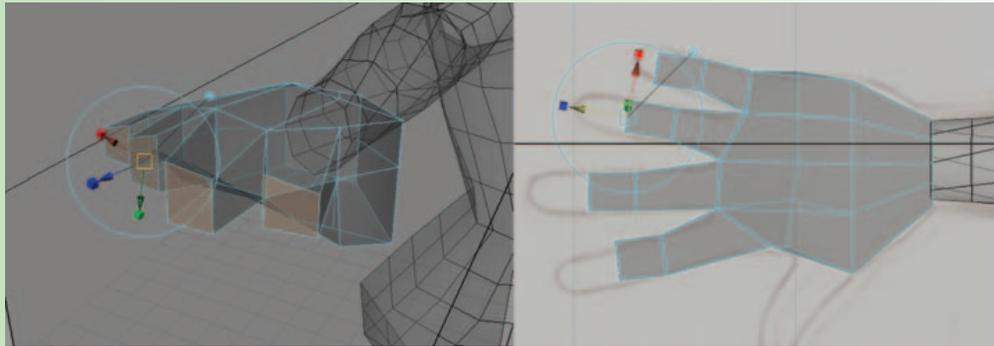

Extruding the fingers to the second knuckle.

f. Using the move tool by pressing **(w)** on the keyboard, in the **TOP** and **FRONT** view panel, reposition the end row of vertices for each finger.

g. **RMB** over the hand geometry, choose **FACES**. In perspective view panel, select the end faces of each finger and go to **[Edit Mesh > Extrude]**.

h. In the **TOP** view panel, drag the arrow forward which will extrude your polygons, all the way to the tip of the fingers.

i. Using the move tool by pressing **(w)** on the keyboard, in the **TOP** and **FRONT** view panel, reposition the end row of vertices for each finger.
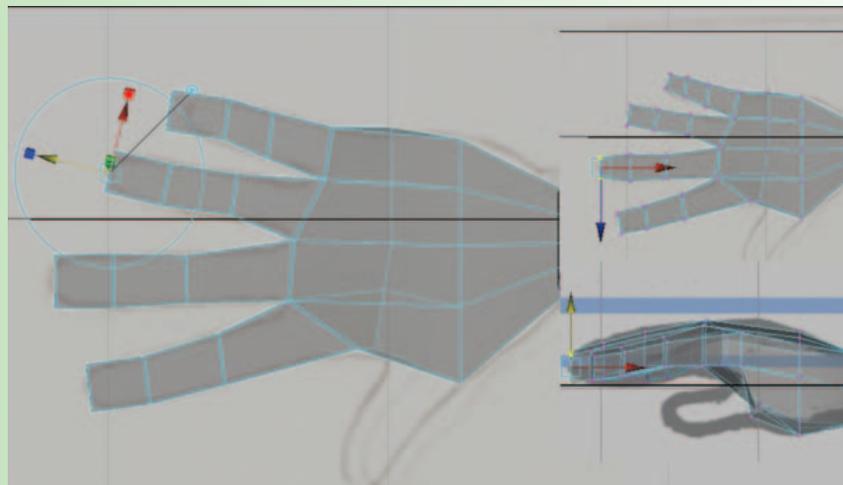

Extruding the fingers to the tip.

7. Extrude the thumb:

a. **RMB** over the hand geometry, choose **FACES**. In perspective view panel, select the face where the thumb will be and go to **[Edit Mesh > Extrude]**.

b.   In the **TOP** view panel, drag the arrow forward which will extrude your polygons. Do not extrude all the way to the tip of the thumb; rather, extrude only about a half of the way there (to the first knuckle).

c.   Using the move tool by pressing **(w)** on the keyboard, in the **TOP** and **PERSPECTIVE** view panel, reposition the end row of vertices for the thumb.
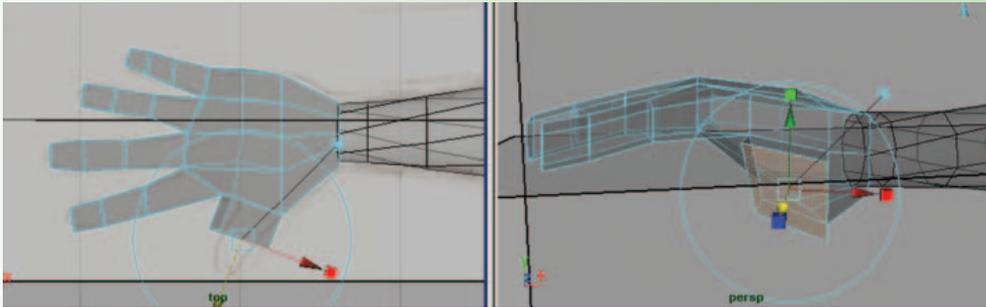
**Extruding the thumb to the first knuckle.**

d.   RMB over the hand geometry, choose **FACES**. In perspective view panel, select the end face of the thumb and go to **[Edit Mesh > Extrude]**.

e.   In the **TOP** view panel, drag the arrow forward which will extrude your polygons all the way to the tip of the thumb.

f.   Using the move tool by pressing **(w)** on the keyboard, in the **TOP** and **PERSPECTIVE** view panel, reposition the end row of vertices for the thumb.
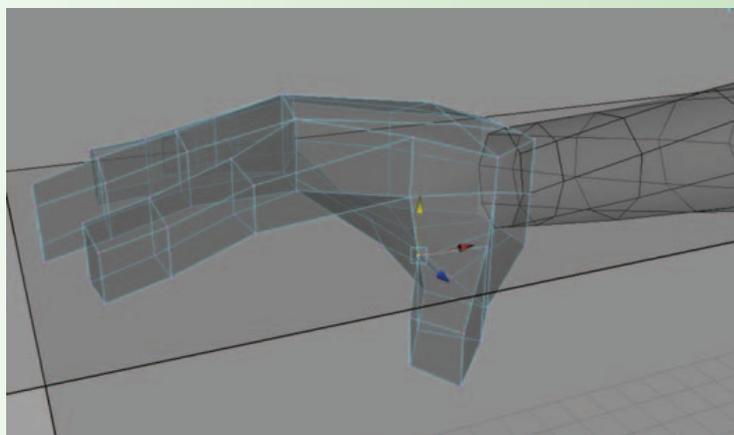
Extruding the thumb.

8.   Combine the hand with the existing *body_geo*:

a.   Determine if there are equal numbers of edges on the two areas that need to be attached, and add additional geometry where needed **[Edit Mesh > Insert Edge Loop Tool]**. Click on an edge and drag the new edge into place.
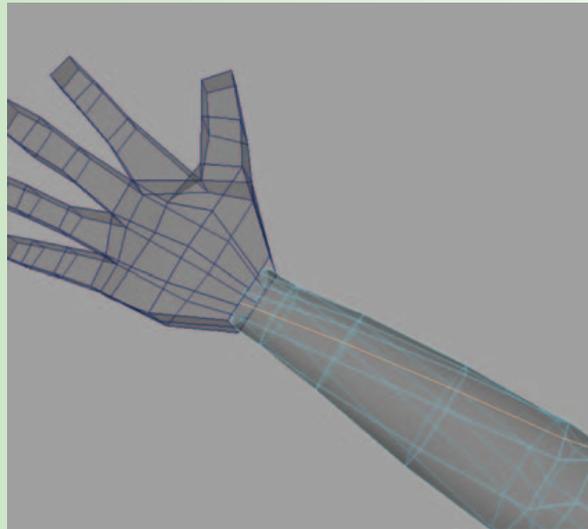
Inserting a new edge in order to align the arm with the hand.

b. In object mode – press **(F8)** on the keyboard, with the selection tool – press **(q)**, select the hand, shift select the *body_geo*, and combine them into one piece **[Mesh > Combine]**.
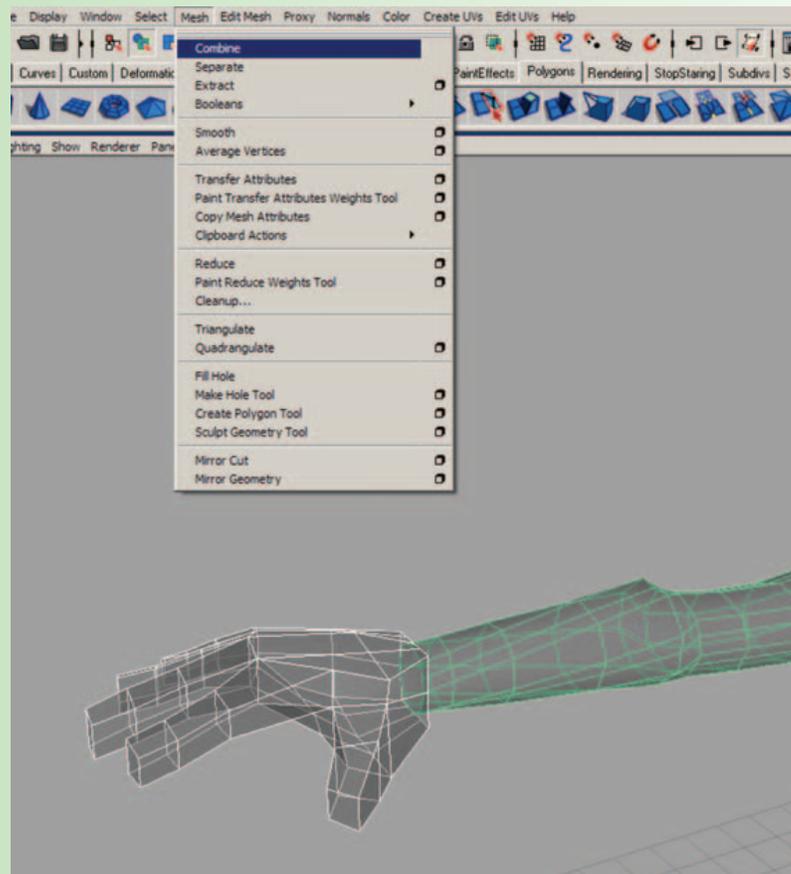

Combining the hand and body geometry.

c. **RMB** over the hand, choose **VERTEX**, then **RMB** over the arm and choose
VERTEX. Using the move tool by pressing **(w)** on the keyboard, hold down the
'**v**' key and select a vertex to move snap vertex points to line up with the other
point nearby.

d. Select the row of overlapping vertices and merge vertices [**Edit Mesh > Merge**].
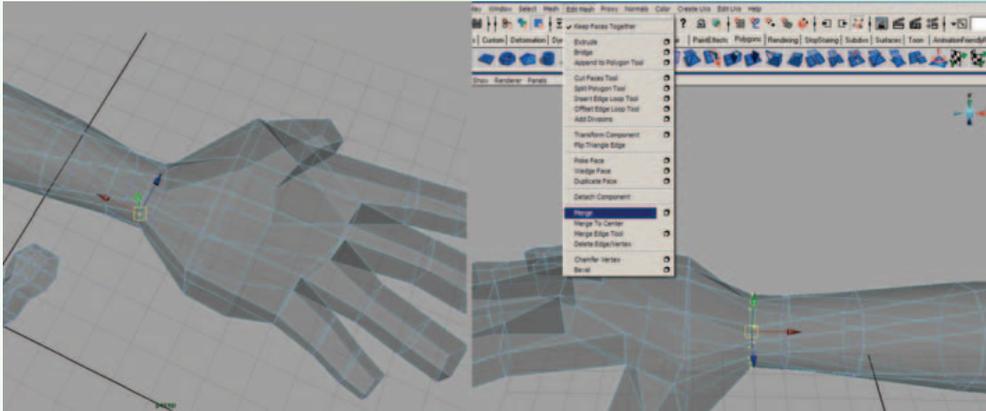
Aligning the hand and arm vertices, then merging them.

e. Delete history on *polySurface1* and rename *polySurface1* to *body_geo*.
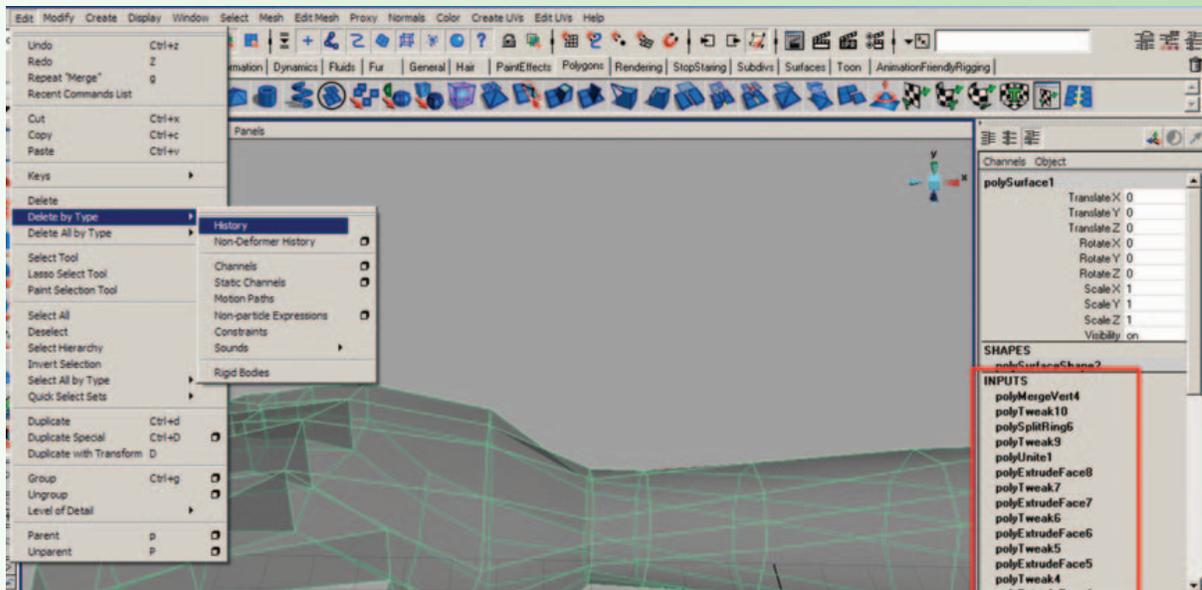

Deleting construction history.

9. Save your scene file: Go to [**File > Save as**]. Name your scene
02_asgn09_02_convert_to_polys_geo.ma.

Ears and hair will also need to be deleted and remodeled using the box modeling
approach, as this method is less tedious than trying to combine the spheres and
cones originally used in the NURBS model with the polygonal topology of the head.

It is perfectly fine to keep the hair separate. It really depends on how much time you want to dedicate to your model. Do not combine any accessories, such as ties or hats. These geometry pieces should remain separate so that they can be removed or controlled independently from the character's body.

Once you have combined everything into one half of your character, you will want to create the other side. Make sure that all of the interior vertices are lined up on the origin. When you mirror, you will notice immediately if there is a problem. You will probably need to delete the faces at the top of the head, near the pole, and then append them using **[Edit Mesh > Append Polygon Tool]**. Click on one edge, then click on another edge and hit the Enter key to finish the process. Remember to keep everything as quadrangles. In order to do this, you may also need to use the **[Edit Mesh > Split Polygon Tool]**.
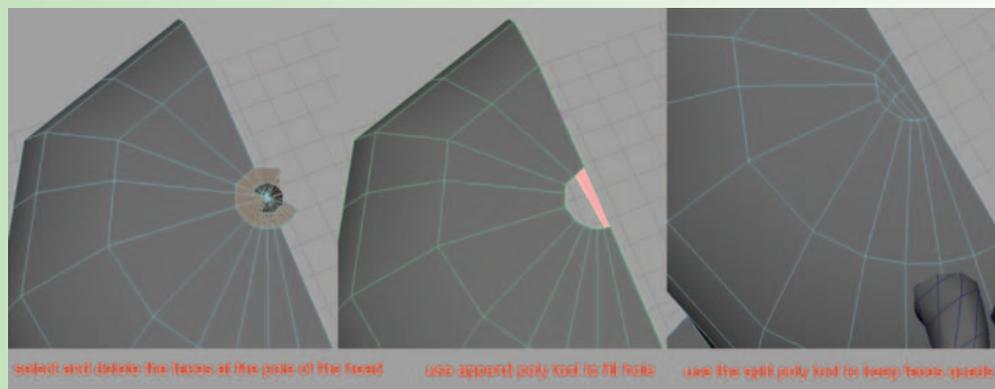

Fixing the pole at the head into fewer quads.

1. Select *body_geo* and go to [Mesh > Mirror Geometry].
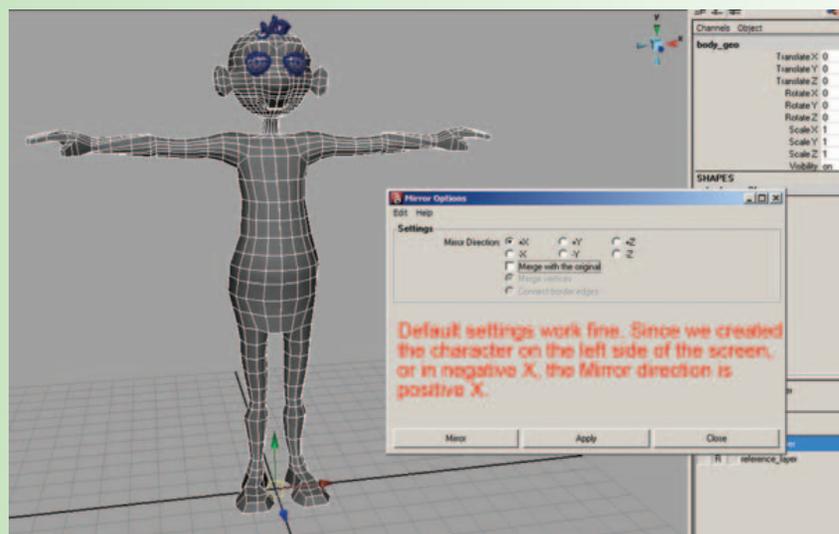
Mirroring the right side to create the left side.

2. Pay close attention to the mouth area. You may need to separate the vertices (using the move tool) before merging so that they do not merge the mouth shut in the center, then reposition them after the mirror is successful.
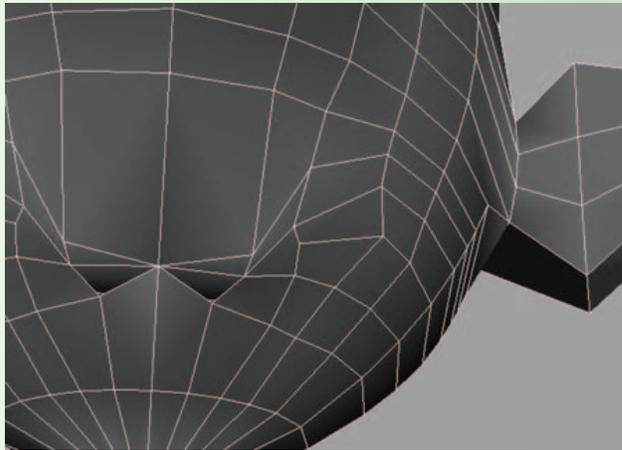
Mirroring usually causes the mouth vertices to pinch.

3. Once the mirroring is complete, check your normals to verify their position [**Display > Polygons > Face Normals**].
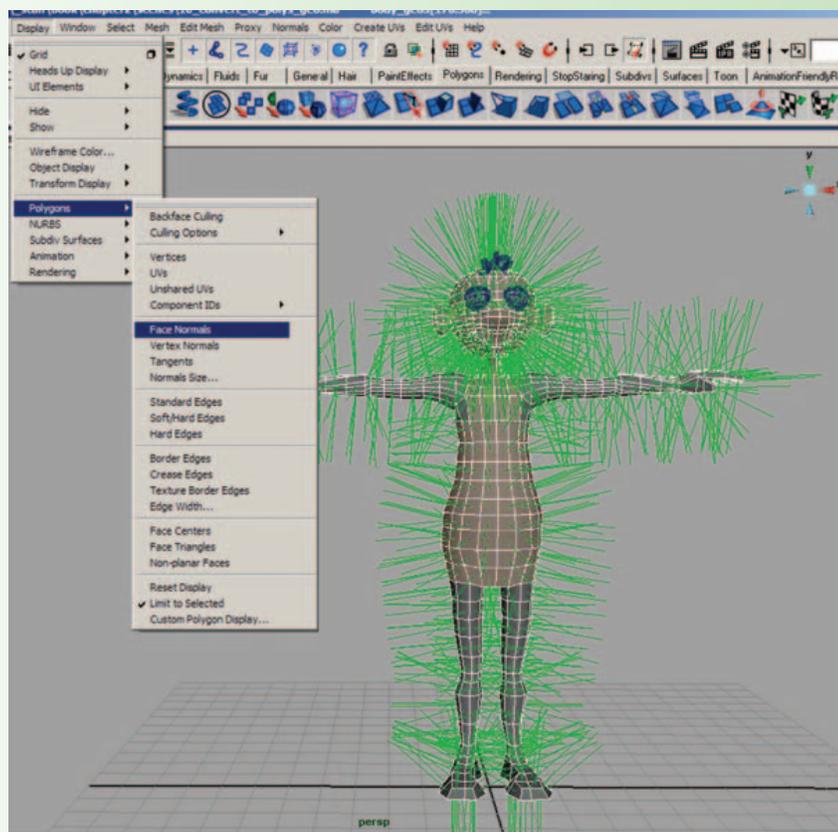

Checking the position of the Face Normals.

4. If any are flipped inward, you will need to change their direction by selecting the geometry and first going to [**Normals > Conform**]. This usually solves the problem, however you may have to reverse them all if they now ALL face inward. If so, then [**Normals > Reverse**] will correct their direction. To hide the normals again, go to : [**Display > Polygons > Face Normals**].

5. Once you have all of the normals facing outward, you can select the entire object in object mode and go to [**Normals > Average Normals**] to make the geometry appear smoother without adding more physical geometry.

6. Delete history on *body_geo* [**Edit > Delete by Type > History**].

7. Save your scene file.

    a. Go to [**File > Save as**].

    b. Name your scene *02_asgn09_03_convert_to_polys_geo.ma*.

As mentioned earlier in the chapter, a NURBS character is quick and easy with the approach covered Assignments 2.1–2.8. However, if you would like to create a seamless character or have better control over texturing, you will need to convert your character into polygonal surfaces.

Remember, the first time you model your character, you may not end up with the desired look. Do not be afraid to scrap the areas that are not working and start again.
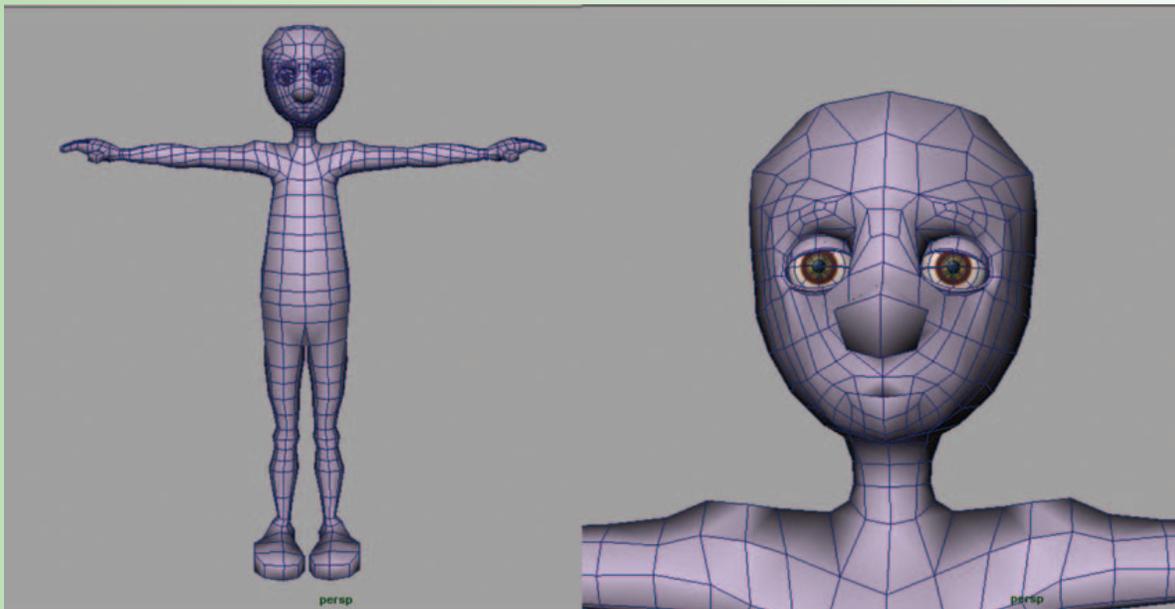
In this character, I remodeled the head all over again in polygons.