Summary

8.1   Skinning is a deformer that controls geometry points with joints.

8.2   There are two types of skin deformers: rigid bind and smooth bind.

8.3   Rigid bind assigns each point to only one joint in the skeleton.

8.4   Smooth bind assigns each point to one or more joints in the skeleton. Smooth bind allows a single point to be shared across multiple joints. Because of this, smooth bind provides smoother deformations.

8.5   The component editor provides a quick and easy way to edit individual points on the smooth skin.

8.6   The total amount of influence that point can have must equal one. This can be spread out on several joints or found on a single joint.

8.7   The smooth skin weights tool provides a quick easy way to spread the weights of selected points to joints nearby.

8.8   Influence objects can be added to a smooth skin and used to help obtain the results of a particular shape during the deformation process when joints are rotating. They can also be used to mimic muscle contractions and breathing.

8.9   The paint skin weights tool is an interactive approach to adjusting how the joints influence the points in the geometry.

8.10   Correcting the skin weights on the geometry is a tedious and time-consuming process. The mirror skin weights command provides the ability to reflect the corrections from one side of a character to the other. Because of this, the time correcting skin weights can be reduced in half.

8.11   It is important to remember to save often during the scanning process. It is a good idea to save versions of your files and save often.

# Assignments: Skinning a Character

Because of this process can be a long and tedious one, it is a good idea to save your work often. In case there is a problem, you can simply reopen the latest file. Many times the undo command does not work during the skinning process.

Assignment 8.1: Skin the Character

Set up your work environment by doing the following:

1. **Open** Maya and **set** your project.

    - From your computer's desktop, go to **[Start > Programs]** and **select** Maya.

    - 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 *07_asgn01.ma*.

3. Turn off X-ray Mode. In the view panel, go to [**Shading > X-ray**].

4. Import your objects from the reference file if you didn't do this in Chapter 6.

   ● **Open** the reference editor by going to [**File > Reference Editor**]

   ● **Click** on the filename to highlight it, then in the reference editor window, go to [**File > Import Objects From Reference**]. This will PERMANENTLY import the reference file into your scene.

5. If you didn't do this in Chapter 6, make sure that history has been deleted from the geometry, except for the blend shape deformer. To do this, go to [**Edit > Delete by Type > Non-deformer History**]. DO NOT DELETE HISTORY FROM THE EYELIDS if you have created them using the NURBS sphere method as discussed in Chapter 2.

6. If you didn't do this in Chapter 7, take time now to go through the outliner and hypergraph and rename your geometry nodes as appropriate.

7. Make sure that your geometry layer is **set** to *normal* by **clicking** on the R until the box is empty so that you are able to add the geometry to the selection.
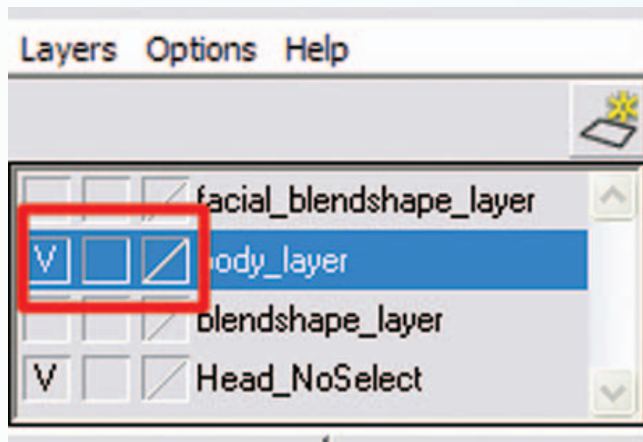

Setting the geometry layer to *NORMAL*.

8. To make selection easier, **open** your outliner by going to [**Windows > Outliner**]

9. **Select** the skinnable joints (open the + next to skinJoints in the outliner and **drag** select all joints).

10. Hold down the **shift key** and **click** on the character geometry piece(s).

11. Go to: [**Skin > Bind Skin > Smooth Bind – option box**] and reset the settings. Then **change** the following:

    ● Bind to: Selected Joints.

    ● Bind method: Closest in hierarchy.

    ● Max influences: "3".

    ● **Click** apply.
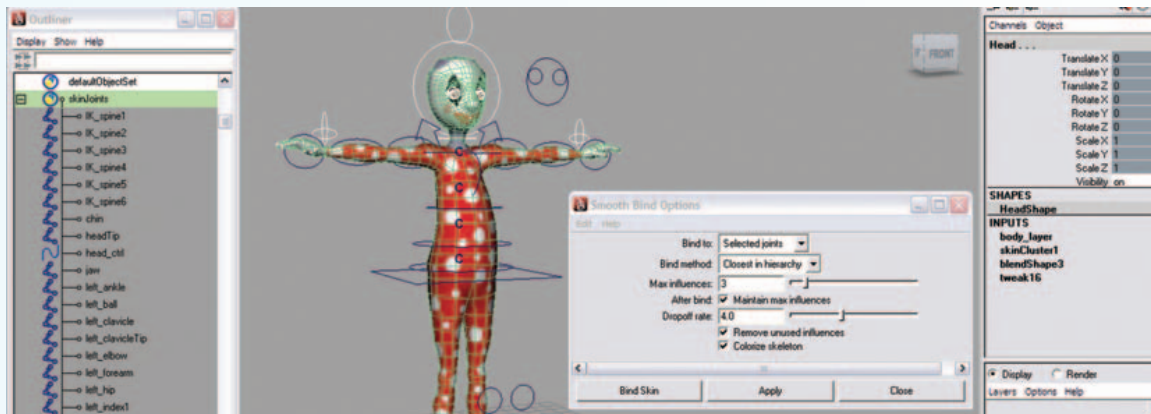
Skinning your character.

12. If the *Master_ctrl* is moved at this point, the body geometry explodes out of the rig because it has two inputs of control: the skin deformer and the *Master_ctrl* (acting as a parent node). This leads to double transformations in the geometry (moving twice as far as everything else).
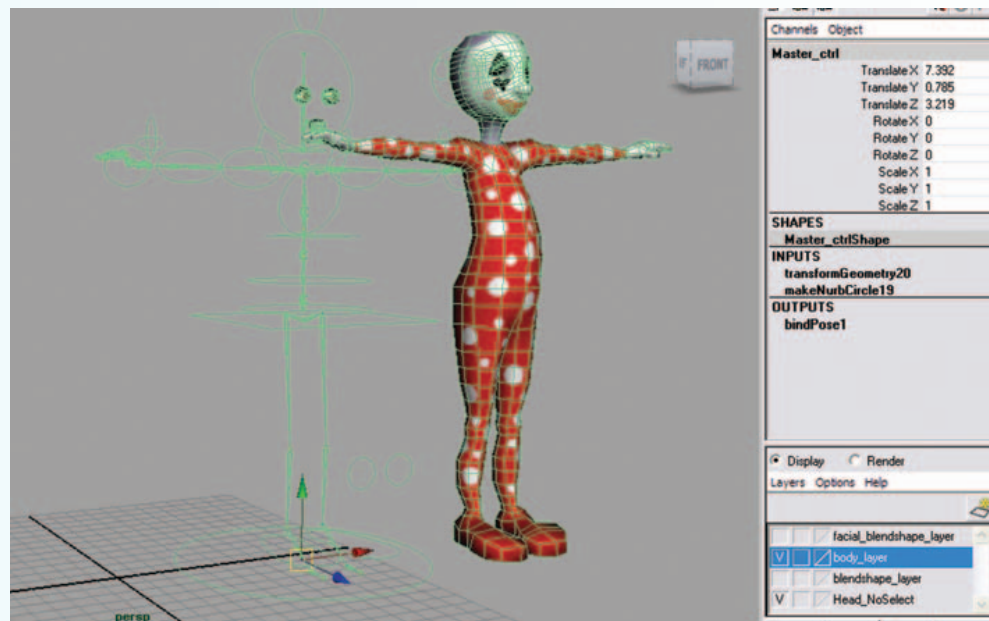

Geometry moving with double transformations.

To solve this problem, do the following:

● In the PERSPECTIVE window, select the geometry that is moving away from the control rig. (If your geometry was already in a group, like mine is, make sure to find the group in the outliner and select that instead.)

● Press **(ctrl + a)** to open the attribute editor.

i. **Select** the first tab.

ii.   Under *Transform Attributes* set the following:

1.   Remove the check next to *inherits transform*. (This makes the *geometry* free from the parent *Master_ctrl* transformations.)
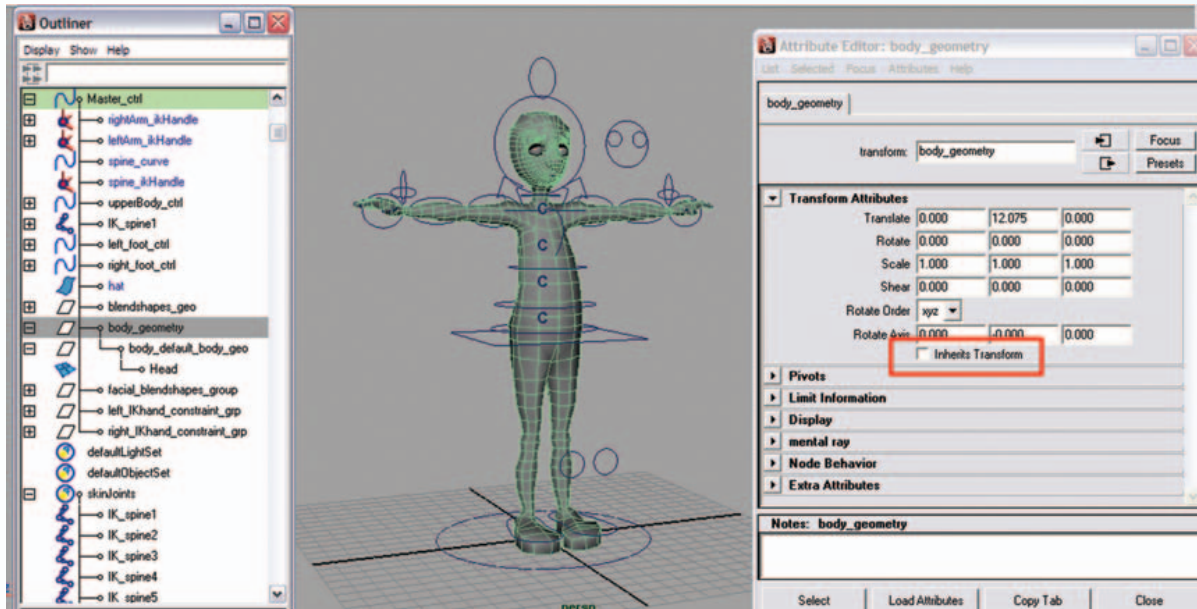
**Turning OFF inherits transform on the geometry or the geometry group.**

13. **Save** your file as *08_asgn01.ma*.

> ! If your character has multiple pieces of geometry, it is possible to skin each piece separately instead of all at one time. This usually provides for cleaner binds and less problems to fix. To skin individual pieces, select only the joints in the area of the piece of geometry plus one additional joint beyond, then select the piece of geometry, and then apply the Smooth Bind procedure. (For the head, I would select the neck, skull, chin, jaw, AND the top IK spine joint.)

Assignment 8.2: Fix the Skin Weights Using the Component Editor

1.   **Continue** working on scene *08_asgn01.ma*.

2.   **Test** the movement of your character by selecting controllers and translating or rotating them around.

3.   Determine if joints are affecting the wrong area of geometry (e.g. the left foot moves the right foot geometry).

> ! The main areas for shared weights are usually in the legs and feet, the head and shoulder, or the fingers. Basically, anywhere when you have parallel areas of geometry and joints.
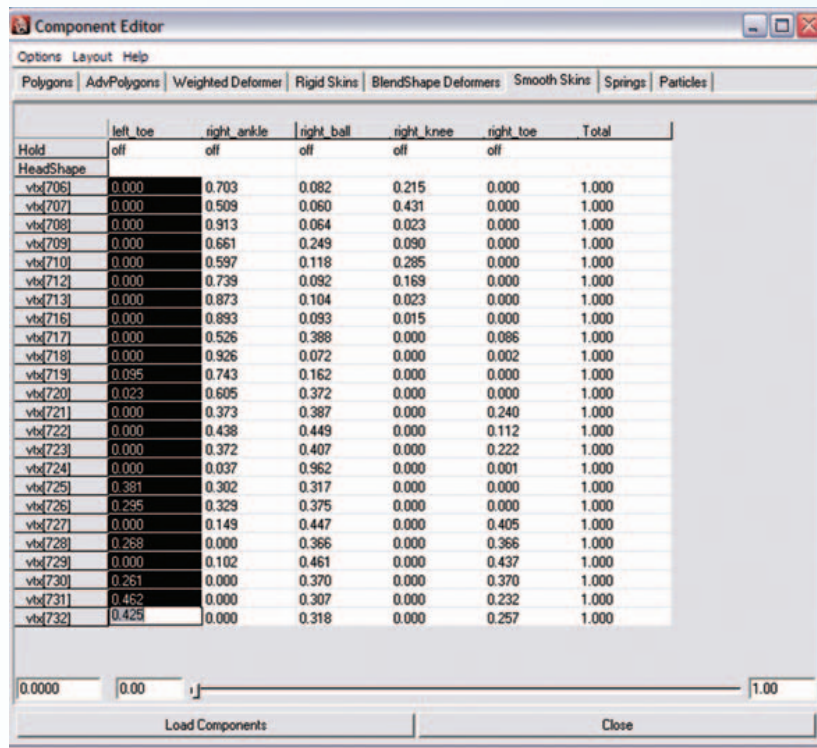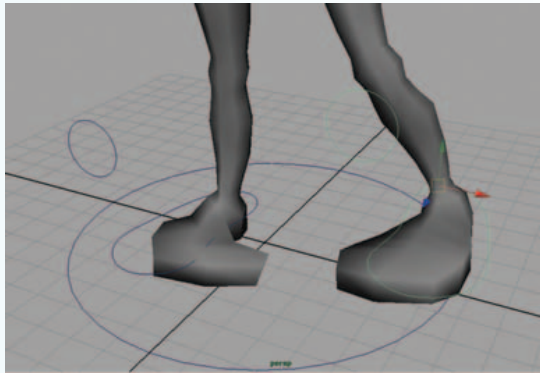
In this example, the toe geometry is being affected by both the left and the right toe joints, so there is a pulling of the geometry when the feet move.

4. In the view panels, **go** to [**Show > None**], then go to [**Show > NURBS curves**], [**Show > NURBS surfaces**], and [**Show > Polygons**] (this way you don't accidentally select joints or IK handles while making corrections).

5. **Select** the vertices or CVs that are being affected incorrectly **RMB** (right mouse button, to display them, and then **drag** your mouse around to **select** them).
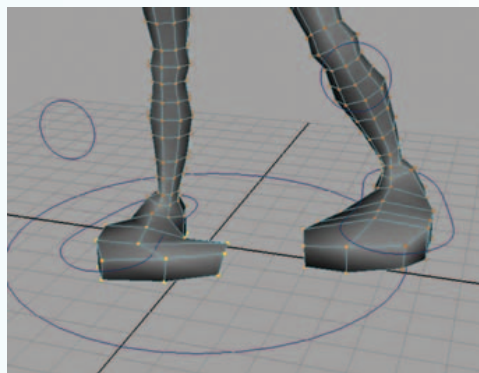
In this example, the right toe geometry vertices are selected. Work only on one area at a time to avoid confusion.

6. Go to [**Window > General Editors > Component Editor**] and **click** on the **Smooth Skin** tab.

7. In the top list, find the joints that are affecting these points and should not be. **Click** on the box in the very top row, **scroll** down to the bottom of the list, **hold** down the **shift key** and **click** on the bottom row, then **type** "0" to remove the influence (e.g. the left toe joint should not be affecting the right foot geometry).

8. **Repeat** this for other affected areas.

9. **Return** the controllers back to their default position by typing "0" in the channel box for the translations.

10. **Save** your file as *08_asgn02.ma*.

Component Editor

Options Layout Help

Polygons | AdvPolygons | Weighted Deformer | Rigid Skins | BlendShape Deformers | Smooth Skins | Springs | Particles

	left_toe	right_ankle	right_ball	right_knee	right_toe	Total
Hold	off	off	off	off	off	
HeadShape						
vtx[706]	0.000	0.703	0.082	0.215	0.000	1.000
vtx[707]	0.000	0.509	0.060	0.431	0.000	1.000
vtx[708]	0.000	0.913	0.064	0.023	0.000	1.000
vtx[709]	0.000	0.661	0.249	0.090	0.000	1.000
vtx[710]	0.000	0.597	0.118	0.285	0.000	1.000
vtx[712]	0.000	0.739	0.092	0.169	0.000	1.000
vtx[713]	0.000	0.873	0.104	0.023	0.000	1.000
vtx[716]	0.000	0.893	0.093	0.015	0.000	1.000
vtx[717]	0.000	0.526	0.388	0.000	0.086	1.000
vtx[718]	0.000	0.926	0.072	0.000	0.002	1.000
vtx[719]	0.095	0.743	0.162	0.000	0.000	1.000
vtx[720]	0.023	0.605	0.372	0.000	0.000	1.000
vtx[721]	0.000	0.373	0.387	0.000	0.240	1.000
vtx[722]	0.000	0.438	0.449	0.000	0.112	1.000
vtx[723]	0.000	0.372	0.407	0.000	0.222	1.000
vtx[724]	0.000	0.037	0.962	0.000	0.001	1.000
vtx[725]	0.381	0.302	0.317	0.000	0.000	1.000
vtx[726]	0.295	0.329	0.375	0.000	0.000	1.000
vtx[727]	0.000	0.149	0.447	0.000	0.405	1.000
vtx[728]	0.268	0.000	0.366	0.000	0.366	1.000
vtx[729]	0.000	0.102	0.461	0.000	0.437	1.000
vtx[730]	0.261	0.000	0.370	0.000	0.370	1.000
vtx[731]	0.462	0.000	0.307	0.000	0.232	1.000
vtx[732]	0.425	0.000	0.318	0.000	0.257	1.000

0.0000   0.00   ⎸ ─────────────────────────────────── 1.00

Load Components   Close

Highlighting the column of influence on the joint that should NOT be affecting the area.

Assignment 8.3: Fix the Skin Weights Using the Smooth Skin Weights Tool
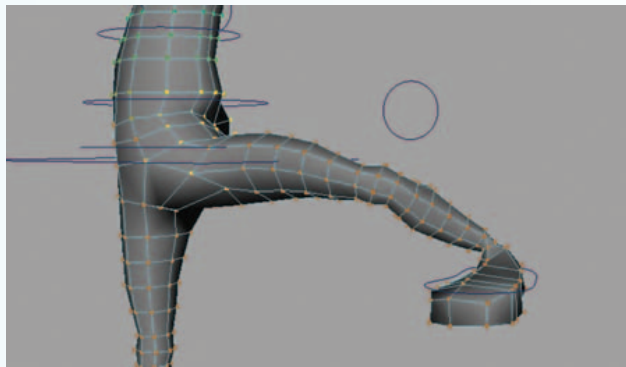[*Skin > Edit Smooth Skin > Smooth Skin Weights*] *(New in Maya 2008)*

1. **Continue** working on scene *08_asgn02.ma*.

2. **Test** the movement of your character by **selecting** controllers and **translating** or **rotating** them around.

3. **Determine** if joints are affecting the geometry too much (e.g. the arm rotation causes the underarm area to indent too far, or the leg translation causes the pelvis area to collapse).
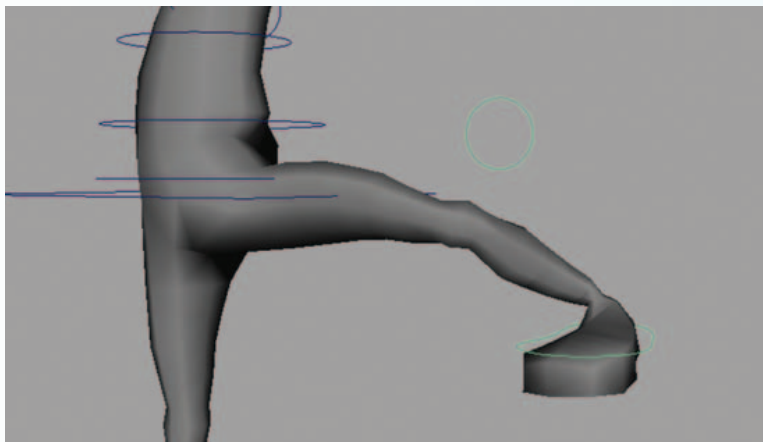
**In this example, the movement of the foot control is collapsing the pelvis region.**

> The main areas for collapsing weights are usually in the pelvic region, the buttock area, and the underarm area.

4. In the view panels, make sure only NURBS curves, NURBS surfaces, and polygons are seen. If not, go to **[Show > None]**, then go to **[Show > NURBS curves]**, **[Show > NURBS surfaces]**, and **[Show > Polygons]** (this way you don't accidentally select joints or IK handles).

5. **Select** the vertices or CVs that are being affected incorrectly (**RMB** to display them, and then **drag** your mouse around to select them).

Selecting the points in the problem area.

6. Go to **[Skin > Edit Smooth Skin > Smooth Skin Weights]**.
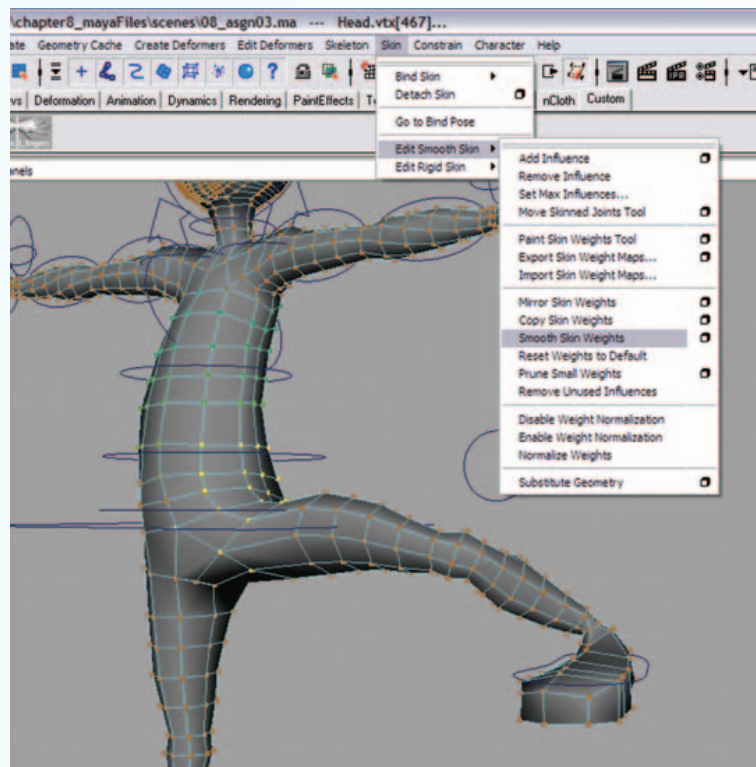

The results look MUCH better!

7. **Repeat** this for other affected areas.

8. **Save** your file as *08_asgn03.ma*.

Assignment 8.4: Adding Influence objects

You can use influence objects (additional joints or geometry) to help the knees, heel, and elbows hold their shape when bending. You can also add an influence object in the character's chest cavity and create a control for breathing. Influence objects can also be used to create simulated muscle flexing, such as in the bicep.

If your character's knees and/or elbows are pinching when they bend (and you have ruled out that it is a geometry issue, like the flexi straw and regular straw comparison in Chapter 5) extra joints can be placed in those areas and added as influence objects to help hold the shape.

1. **Continue** working on scene *08_asgn03.ma*.

2. **Test** the movement of your character by **selecting** controllers and **translating** or rotating **them around**.

3. **Determine** if the geometry is pinching in the elbows and/or knees.

4. In the view panels, **turn** X-ray ON.

5. For the knees: In the side view panel, use the joint tool **[Skeleton > Joint Tool]** and **click** a single joint behind the knee at the top of the calf and in the outliner, **rename** this joint *left_knee_influence*.

6. In the front view panel, use the move tool by pressing **(w)** on your keyboard and position the *left_knee_influence* and **align** it with the left leg.

7. Go to **[Skeleton > Mirror Joint]**.
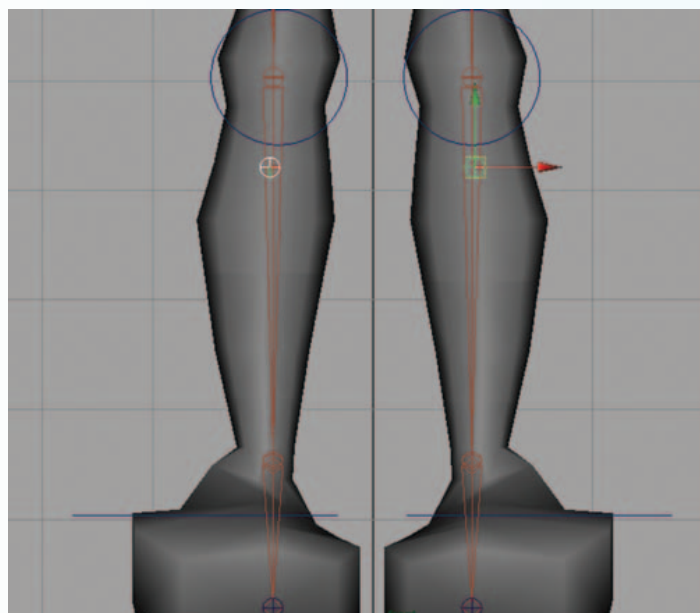
Creating and positioning the knee influence joints.

8. **Select** the *left_knee_influence*, shift select the left_knee, and press (**p**) on your keyboard to parent. **Repeat** for the right side.

9. For the elbows: In the top view panel, use the joint tool [**Skeleton > Joint Tool**] and **click** a single joint in front of the elbow at the bottom of the bicep and in the outliner. **Rename** this joint *left_elbow_influence*.

10. In the front view panel, use the move tool by pressing (**w**) on your keyboard and position the *left_elbow_influence* to align it with the left arm.

11. Go to [**Skeleton > Mirror Joint**]
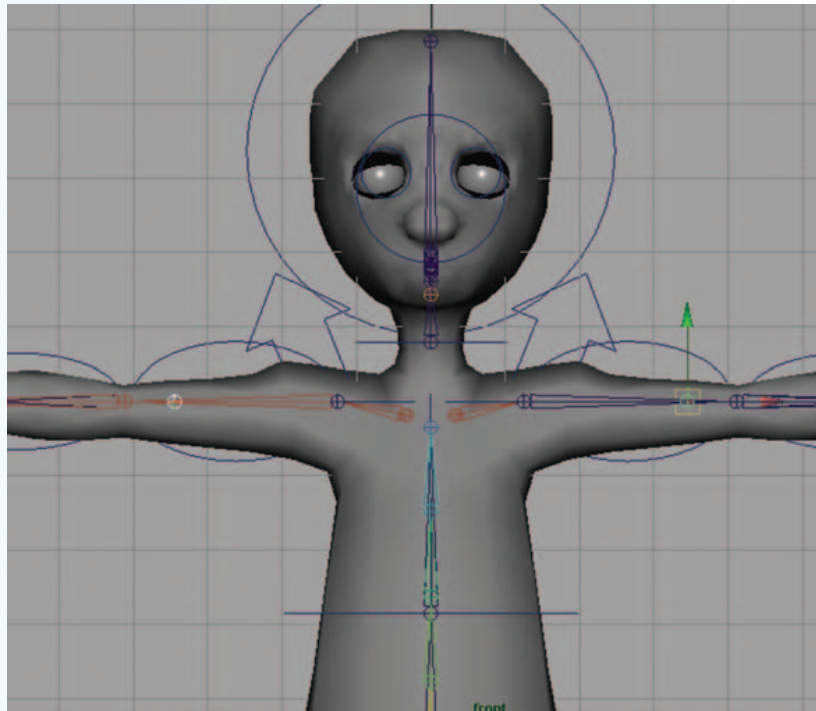
Creating and positioning the elbow influence joints.

12. **Select** the *left_elbow_influence*, **shift select** the left_shoulder, and press (**p**) on your keyboard to parent. Repeat for the right side. You should also add influence joints for the heels and parent them to the ankle joints.

13. To add each new joint influence, **do** the following:

    a. **Select** the geometry (if there are multiple pieces, **select** only the geometry in the area of one influence joint), **select** one influence joint, and then **go to** [**Skin > Edit Smooth Skin > Add Influence – option box**].

    b. **Uncheck** the use geometry option.

    c. **Click** Apply.

    d. **Repeat** for each new joint influence.
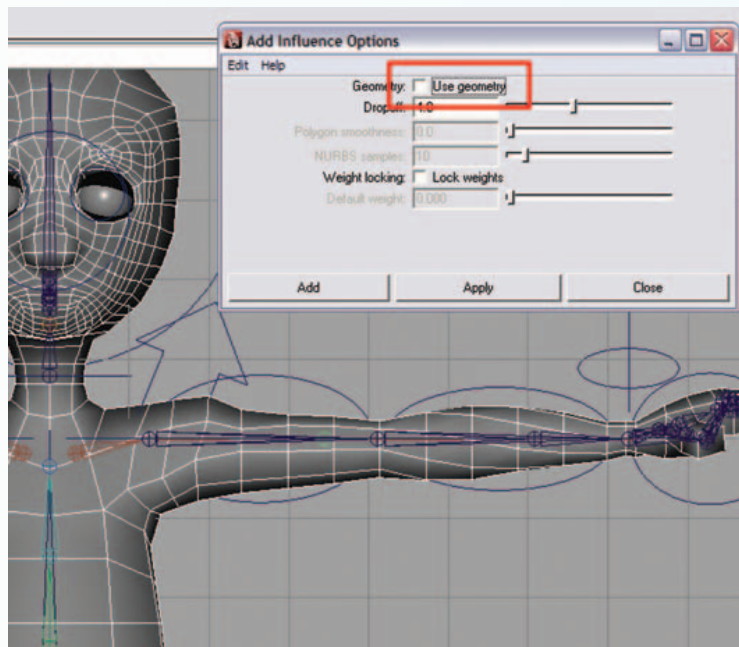
Adding a new joint as an influence. This must be repeated one at a time.
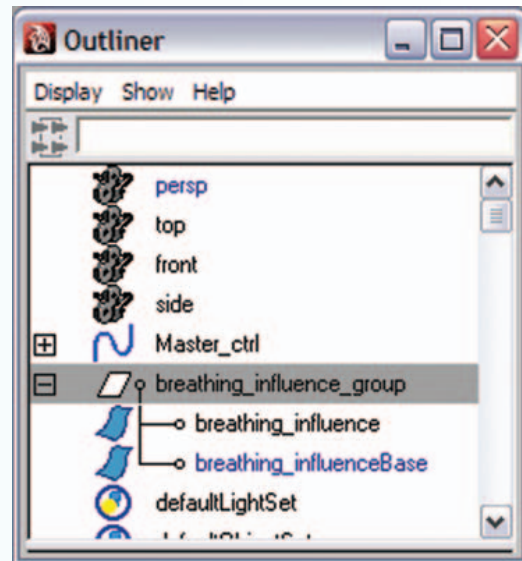
14. For the breathing influence, go to [**Create > NURBS primitives > Sphere**] and rename the sphere *breathing_influence*.

15. Using the move tool by pressing (**w**) on the keyboard, reposition the sphere into the chest cavity of your character. Using the **scale** tool by pressing (**r**) on the keyboard, **resize** the sphere so that it fills the chest cavity of your character, but does not extend outside of the character's geometry. You can also go into component mode (F8) to reshape the sphere.

16. To add the breathing influence, do the following:

 e. **Select** the geometry (if there are multiple pieces, **select** only the torso geometry), **select** the *breathing_influence* sphere, and then go to [**Skin > Edit Smooth Skin > Add Influence – option box**].

 f. **Check** the use geometry option.

 g. **Click** Apply.
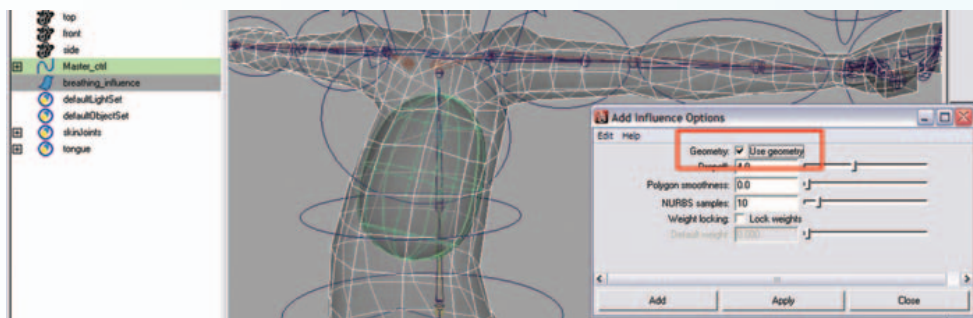
Adding a piece of geometry as an Influence Object.

17. In the outliner, **select** the *breathing_influence* and the *breathing_influence_base* that is created. Press (**ctrl + g**) to group them and rename the group *breathing_influence_group*.

**Grouping the influence object and base.**

18. With the group still **selected, press (shift)** and **click** on the nearest IK spine joint (mine was *IK_spine5*). Then press (**p**) to parent the group to the joint.

19. **Create** a control for the breathing influence by doing the following:

    h. **Select** the *upperBody_ctrl* and go to [**Modify > Add Attribute**] and enter the following:

        i.   Attribute name: type "Breathe".

        ii. Under *Numeric Attribute Properties*

            1.   Minimum: type "–1".

            2.   Maximum: type "1".

        iii. **Click** "OK".
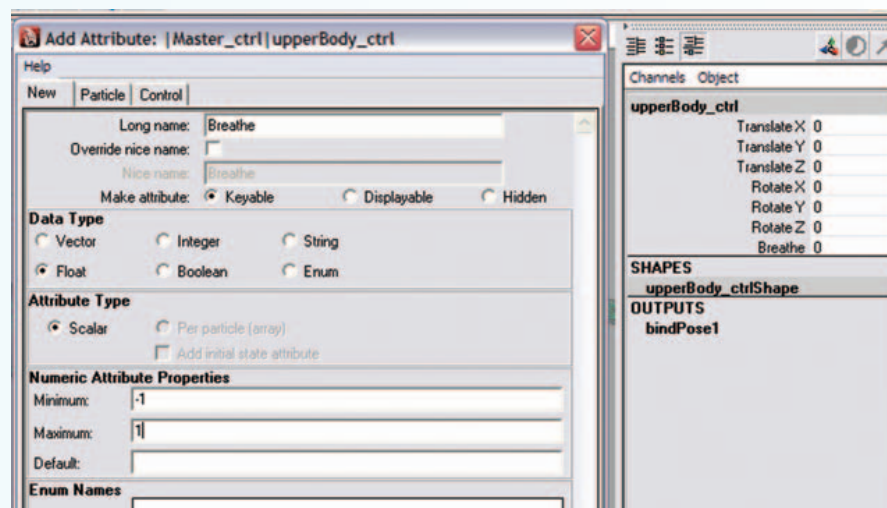
Adding the attribute "Breathe" to the *upperBody_ctrl*.

i. **Select** the *breathing_influence* and go to [**Animate > Set Driven Key > Set …**] (this places *breathing_influence* as the driven in the *Set Driven Key* window).

    i. **Select** the *upperBody_ctrl* and **click** "Load Driver" in the *Set Driven Key* window.

    ii. In the *Driver* section of the *Set Driven Key* window, **choose** "Breathe" in the right column.

    iii. In the *Driven* section of the *Set Driven Key* window, **choose** "ScaleX" in the right column, hold down the **(shift) key** and also **click** on "ScaleY" and "ScaleZ".

    iv. In the *Set Driven Key* window, **click** "Key" to set a default pose at "0".
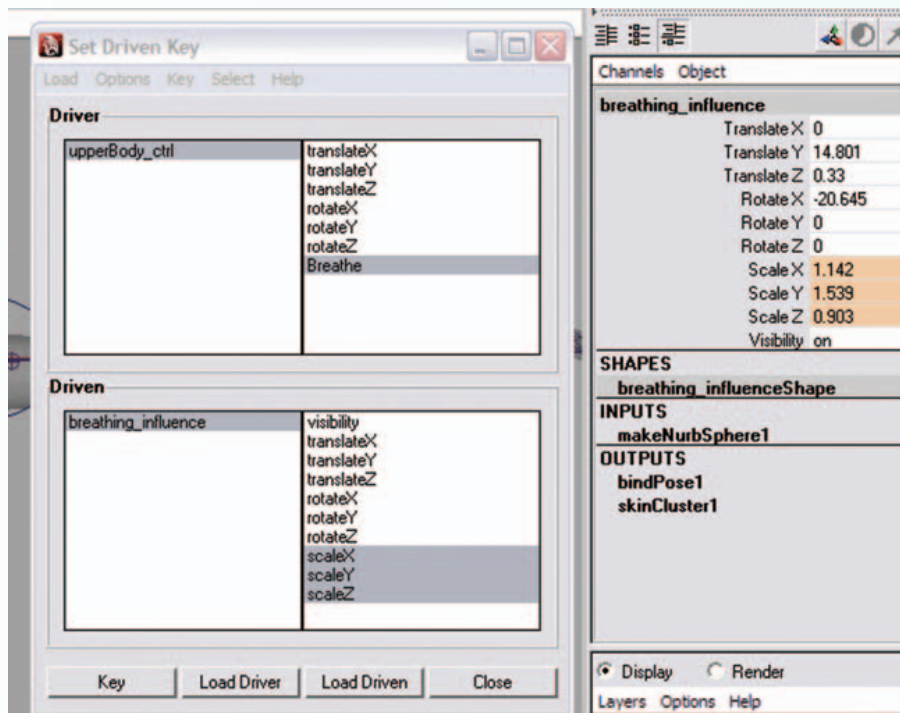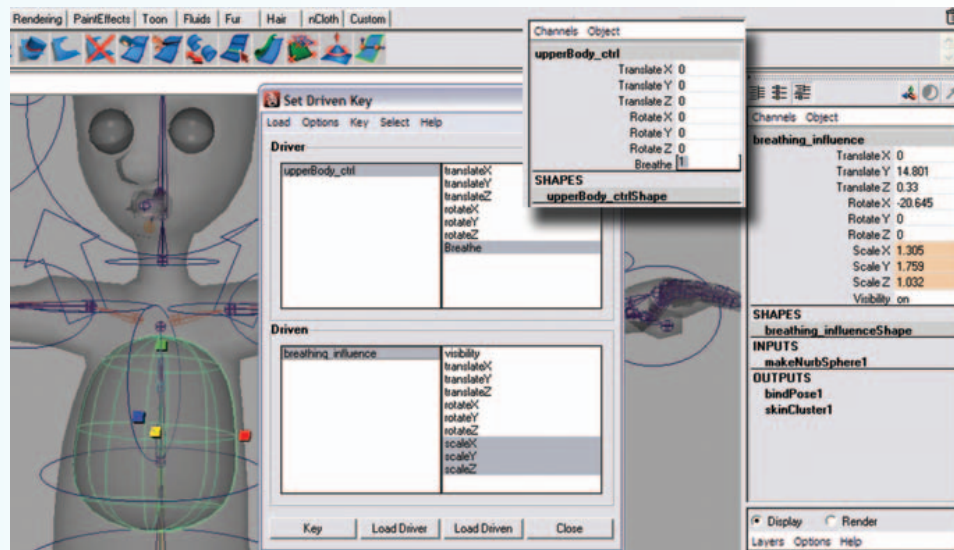

Loading the Set Driven Key window and setting the first key so that when Breathe is set to "0", the breathing influence is in the default (original) position.

    v. In the channel box, **change** *Breathe* to "1".

    vi. In the *Driven* section of the *Set Driven Key* window, **click** on *breathing_influence* to **select** it.

    vii. With the scale tool – **(r)** on the keyboard, **scale** the *breathing_influence* until the chest looks inflated with air, as when inhaling.

> **!** Do not worry if the inhaling does not look correct. You can fix this using [**Skin > Edit Smooth Skin > Smooth Skin Weights**] or the [**Skin > Edit Smooth Skin > Paint Skin Weights Tool – option box**] All influences will appear in the *Influence* section of the paint weights options. The weights will be painted in the next assignment.

    viii. In the *Set Driven Key* window, **click** "Key".

Setting the second key so that when Breathe set to "1", the breathing influence is scaled for inhaling.

ix. In the *Driver* section of the *Set Driven Key* window, **click** on *upperBody_ctrl* to **select** it.

x. In the channel box, **change** *Breathe* to "–1".

xi. In the *Driven* section of the *Set Driven Key* window, **click** on *breathing_influence* to **select** it.

xii. With the scale tool – **(r)** on the keyboard – **scale** the *breathing_influence* until the chest looks slightly deflated as when exhaling.

xiii. In the *Set Driven Key* window, **click** "Key".
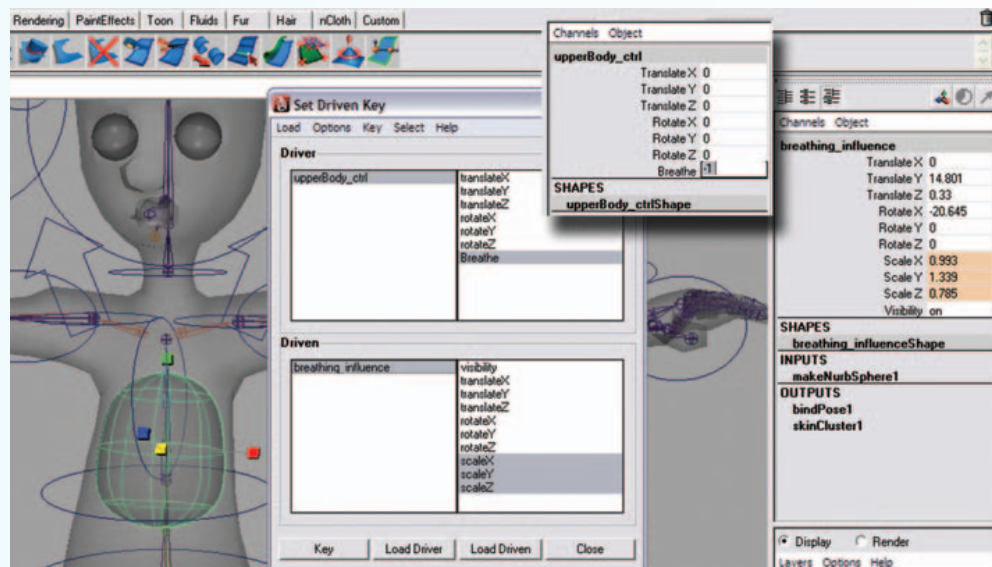
**Setting the second key so that when Breathe set to "-1", the breathing influence is scaled for exhaling.**

j.   Hide the *breathing_influence* by selecting it in the Perspective window or the outliner and pressing (**shift + h**).

k.   Test the *Breathe* attribute by **selecting** the *upperBody_ctrl*. In the channel box, **click** on the word *Breathe*. In the Perspective window, **MMB** (middle mouse button) **click** and **drag** the mouse left to right to test the breathing motion.

20.   Save your file as *08_asgn04.ma*.

Optional assignment 8.7 creates an expression to give automated breathing animation to your character using this *Breathe* attribute.

Assignment 8.5: Fix the Skin Weights Using the Paint Skin Weights Tool (optional) [*Skin* > *Edit Smooth Skin* > *Paint Skin Weights Tool – option box*]

! I say this assignment is optional, because you will probably be able to solve all of your weight issues with the tools that we have already used. If you are working in an earlier version of Maya (before Maya 2008), you won't have access to the Smooth Skin Weights tool, and you will need to paint all of your weights as shown in this assignment.

1.   **Continue** working on scene *08_asgn04.ma*.

2.   **Test** the movement of your character by **selecting** controllers and translating or rotating them around.

3.   Identify the problem areas that could not be corrected using the component editor or the smooth skin weights tool.
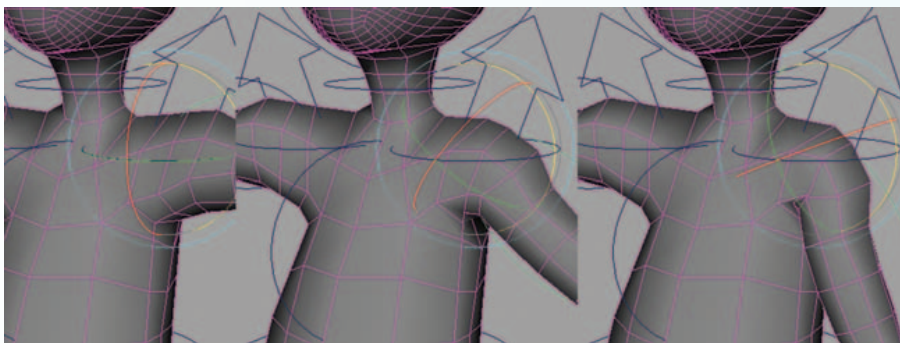

In this example, the movement of the arm shows that the shoulder geometry is not moving with it, causing it to crack slightly.

4.   In the view panels, **turn** X-ray OFF.

5.   In the view panels, go to [**Show > None**], then go to [**Show > NURBS curves**], [**Show > NURBS surfaces**], and [**Show > Polygons**] (this way you don't accidentally **select** joints or IK handles).

> ❗ A great tip is to **select** all of your controllers and set a key frame (Keys can be set by pressing **(s)** on the keyboard) on all of the controllers on frame one. Move the timeline to frame 10 and rotate or move the controllers to place the character into a pose where the problem areas can be seen. Key the controllers again on frame 10, then move to frame 20 and pose the character again where you can see different problems, and key this pose. MAKE SURE TO DELETE THE KEY FRAMES WHEN YOU ARE FINISHED. To do this, **select** all of the controllers and in the channel box, **click** on the top attribute name and shift **click** on the bottom attribute name. Then **RMB** and choose break connections.

6. **Select** the vertices or CVs that are being affected incorrectly (**RMB** to display them, and then **drag** your mouse around to **select** them).
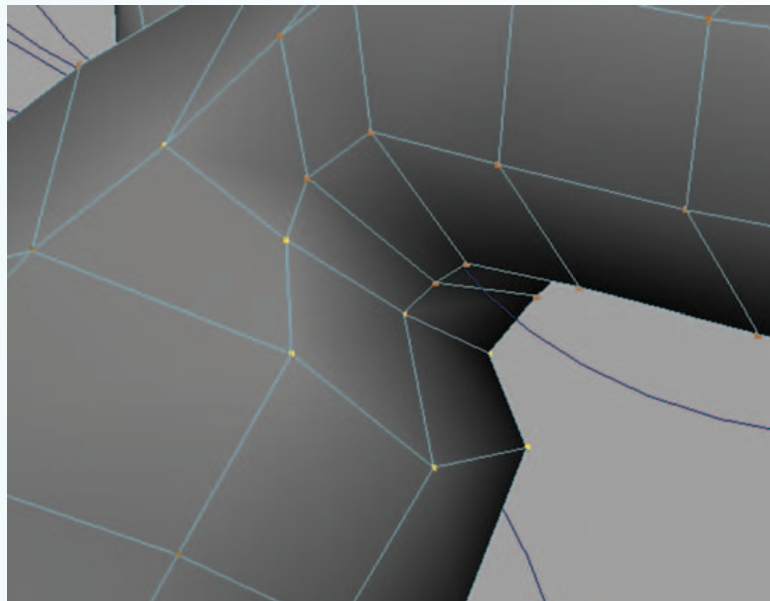
Selecting the points in the problem area.

7. Go to [**Skin > Edit Smooth Skin > Paint Skin Weights Tool – option box**].

8. Under Display section, **UNCHECK** multi color feedback to see the weights in black and white.

9. In the *Influences* section of the *Paint Skin Weights Tool* – option box, **select** the joint or influence that SHOULD be affecting the area more (e.g. in this case, the *left_shoulder* joint).

10. In the Paint Weights section, **use** the ADD paint operation and change the value to about 0.1.

11. You can adjust the size of the brush. Simply hold down the **(b)** key, place your brush over your model, and **LMB** click and drag left to right to change the brush size smaller and larger.

12. **Begin** painting (single clicks on top of the cross areas of your geometry lines) or **click** and **drag** on the geometry.
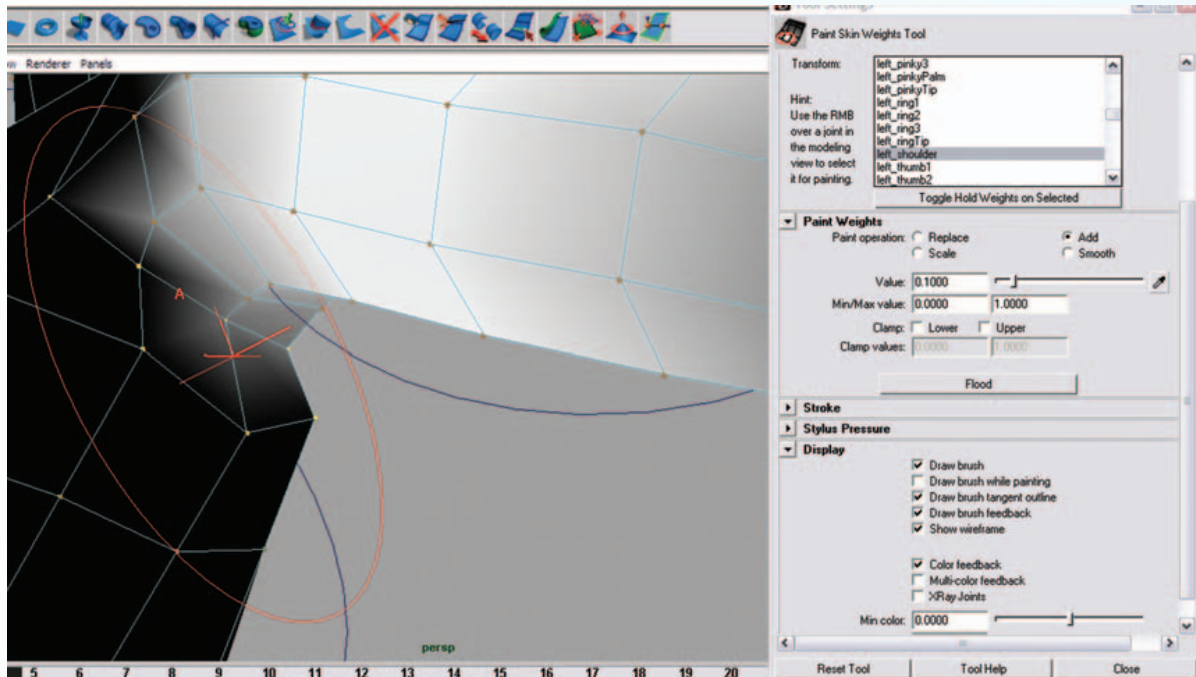

Painting skin weights in a problem area.

13. You may need to **check** the surrounding joints and **add** a little influence there (e.g. the spine joint above and below the one you originally chose to paint, if working on the spine).

14. **Scrub** your timeline (to scrub the timeline, **click** on the indicator in the time line and **drag** your mouse left to right) to see how it looks (if keys were set on the controls). If keys have not been set, test the deformation of your character by **selecting** controllers and **translating** or **rotating** them around.

15. You may need to change the Paint Weights section to SMOOTH and paint the joint that should NOT be affecting that area (in this example, the shoulder joint), then also smooth the other joints in the area.

16. **Repeat** this for other affected areas.

17. REMEMBER, you only need to paint the left side or the right side as we can mirror the weights to the other side in the next assignment.

18. **Save** your file as *08_asgn05.ma*.

! MAKE SURE TO DELETE THE KEY FRAMES on the controllers if you created them. To do this, **select** all of the controllers and in the channel box, **click** on the top attribute name and shift **click** on the bottom attribute name. Then RMB and choose break connections.

Assignment 8.6: Mirror the Skin Weights [Skin > Edit Smooth Skin > Mirror Weights – option box]

1. **Continue** working on scene *08_asgn06.ma*.

2. **Select** the geometry that needs to have the skin weights mirrored. Go to [**Skin > Edit Smooth Skin > Mirror Weights – option box**] and set the following:

   a. **Mirror** across the YZ axis (on the X axis).

   b. **Uncheck** positive to negative only IF you painted on the character's right side and need to mirror to the left (your left to right – character's right to left).
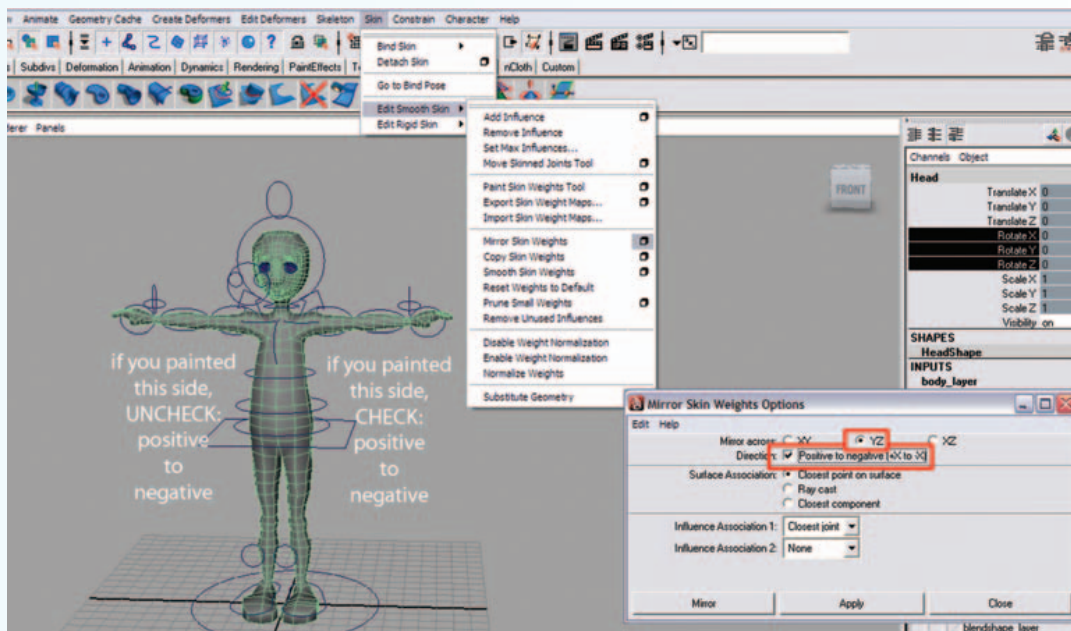

Mirroring the Skin Weights from positive X to negative X.

3. **Save** your file as *08_asgn06.ma*.

> **!** This tool doesn't always work predictably. You may have to go back and paint weights here and there, but it does generally save you a lot of time.

Assignment 8.7: Create a Breathing Expression (Optional)

1. **Continue** working on scene *08_asgn06.ma*.

2. **Create** an expression that will automatically animate the *Breathe* attribute by doing the following:

   a. **Select** the *upperBody_ctrl* and go to [**Modify > Add Attribute**] and **enter** the following:

      i. Attribute name: type 'BreathSpeed'

      ii. **Click** 'OK'
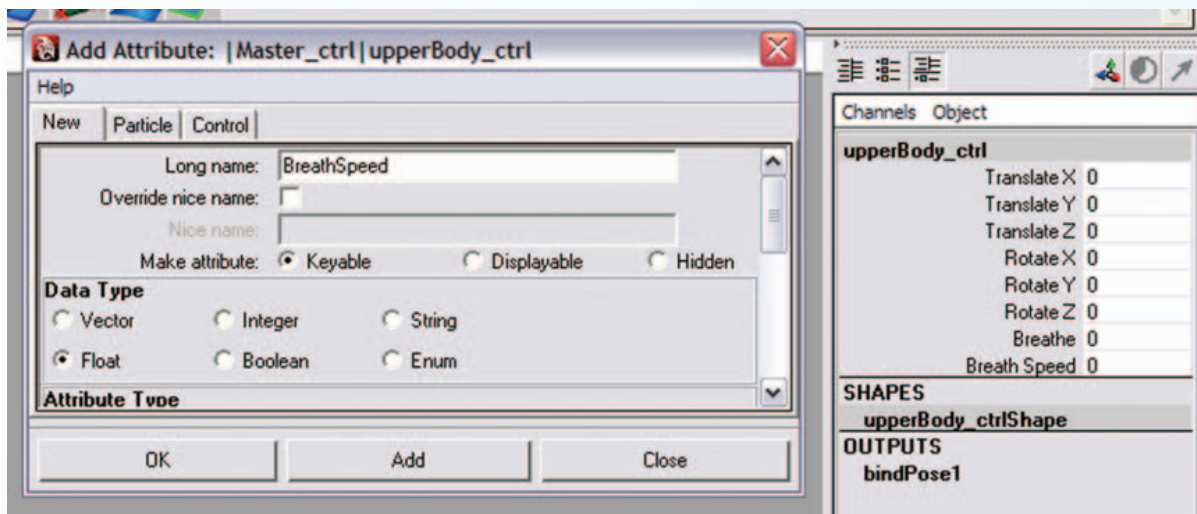
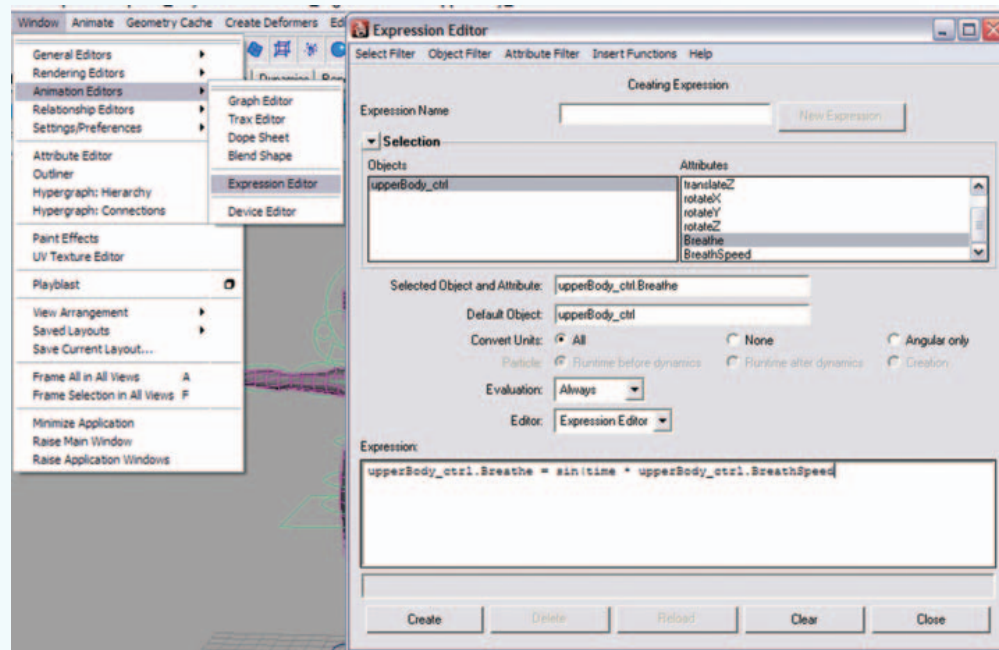**Adding the attribute 'BreathSpeed' to the *upperBody_ctrl*.**

b. **Create** the expression. Go to [**Window > Animation Editors > Expression Editor**] and **type** the following in the *Expression* section:

```
upperBody_ctrl.Breathe = sin(time * upperBody_ctrl.
BreathSpeed).
```

i. **Click** 'create'

> ! This expression makes Breathe equal to the value of BreathSpeed (the number set in the channel box) times the current time line value and multiplies it with a sine wave. The sine wave causes the value of Breathe to fluctuate between −1 and 1 (where −1 and 1 are also the min/max of the Breathe attribute).

3. **Test** the expression:

a. **Select** the *upperBody_ctrl*.

b. In the channel box, **change** *BreathSpeed* to '5'.

c. In the timeline, **press** the play (>) button to see the breathing occur.

Creating the expression for breathing.

> **!** The BreathSpeed Attribute can be set to '0' for no motion, or any other number to vary the speed. The breathing motion will automatically occur when animating.

4. Click on the attribute word *Breathe* in the channel box. Since the channel is purple, hold down the **RMB** (right mouse button) and **choose** *Hide selected*.

5. Save your file as *08_asgn07.ma*.

### Assignment 8.8: Create a Smooth Switch for Polygonal Characters (Optional)

This should be done AFTER skinnings!

1. **Continue** working on scene *08_asgn07.ma* (or *08_asgn06.ma*).

2. **Select** the polygonal geometry and go to **[Mesh > Smooth]**. (If any geometry is parented to other geometry, this will not work. You must first un-parent by **selecting** the children and pressing **(shift + p)** on the keyboard, smooth, then re-parent.)

3. **Select** the *Master_ctrl* and go to **[Modify > Add Attribute]** and enter the following:

   a. Attribute name: **type** 'SmoothSwitch'

   b. Under *Numeric Attribute Properties*

      i. Minimum: type '0'

   ii. Maximum: type '2'
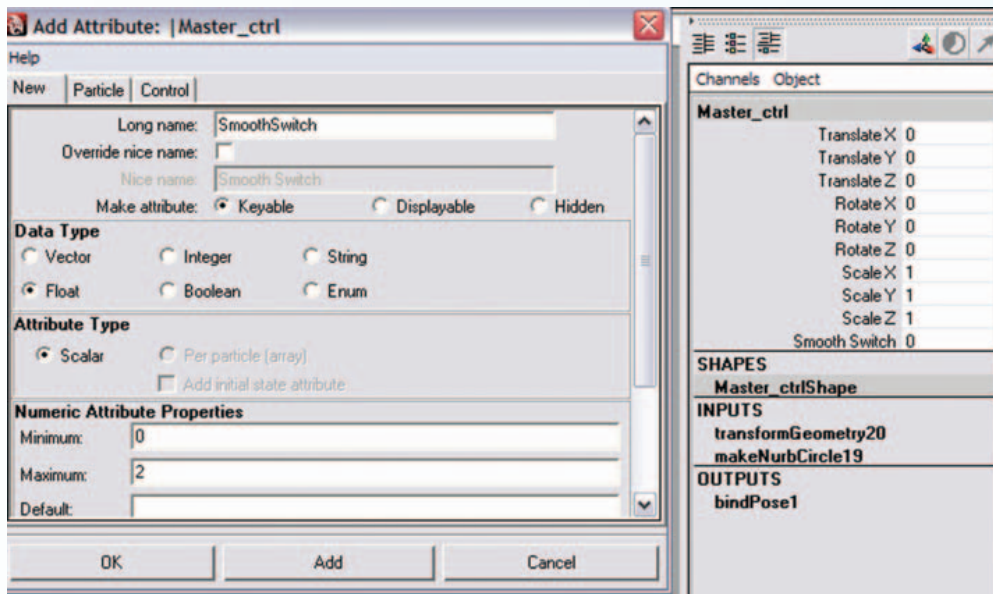
   c. **Click** 'OK'

Adding the attribute 'SmoothSwitch' to the *Master_ctrl*.

a. **Select** each piece of polygonal geometry (or the one combined piece, if you
    took the time to combine it in Chapter 2), in the *Inputs* section of the channel
    box, **click** on *polySmoothFace1*, and then go to [ANIMATE > SET DRIVEN KEY >
    SET …] (This places the geometry as the driven in the *Set Driven Key* window.)

    i. **Select** the *Master_ctrl* and **click** 'Load Driver' in the *Set Driven Key*
        window.

    ii. In the *Driver* section of the *Set Driven Key* window, **choose** *SmoothSwitch* in
        the right column.

    iii. In the *Driven* section of the *Set Driven Key* window, **click** on
        polySmoothFace1 to **select** it.

    iv. In the *Driven* section of the *Set Driven Key* window, **choose** 'divisions' in
        the right column.

    v. In the channel box, **change** *divisions* to '0'

    vi. In the *Set Driven Key* window, **click** 'Key', setting a default key.

    vii. In the *Driver* section of the *Set Driven Key* window, **click** on *SmoothSwitch*
        to **select** it.

    viii. In the channel box, **change** *SmoothSwitch* to '2'.

    ix. In the *Driven* section of the *Set Driven Key* window, **click** on
        polySmoothFace1 to **select** it.

    x. In the channel box, **change** *divisions* to '2'.

    xi. In the *Set Driven Key* window, **click** 'Key'.

    xii. Return the character back to the non-smoothed version. In the *Driver*
        section of the *Set Driven Key* window, **click** on *SmoothSwitch* to **select** it.

    xiii. In the channel box, **change** *SmoothSwitch* to '0'.
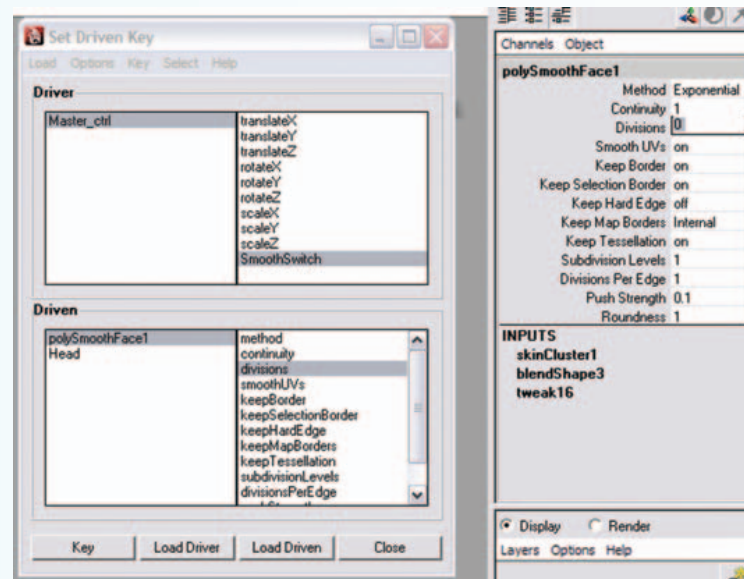
Loading the Set Driven Key window and setting the first key so that when the SmoothSwitch_is set to '0', the Polygonal Mesh will not be smoothed.
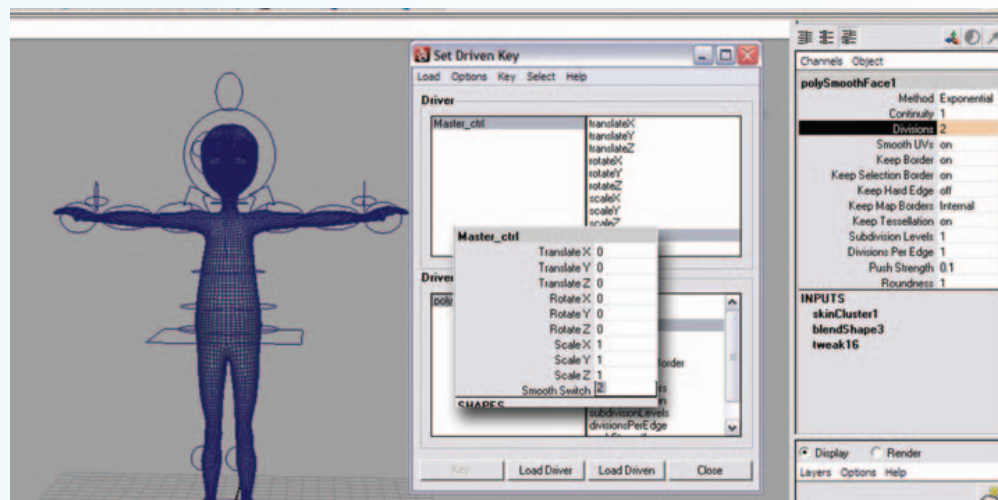
Setting the second key so that when the SmoothSwitch_is set to '2', the Polygonal Mesh will be smoothed.

! This provides an easy way of switching the display of the low res polygonal mesh at SmoothSwitch = 0, and the higher res for rendering at SmoothSwitch = 2.

4. Return your geometry layer back to *reference* by **setting** the layer to **R** so that you are unable to select the geometry by mistake when animating.

5. Save your file as *08_asgn08.ma*.