Soft Body Ears

Supporting Files
These notes and supporting files can be found at:
http://www.fridgemonsters.com/rigging/softbody_ears/softbody_ears.asp

Annotation
Shortcut keys are indicated by [].
eg
Duplicate = [Ctrl]+[d]
Parent = [p]

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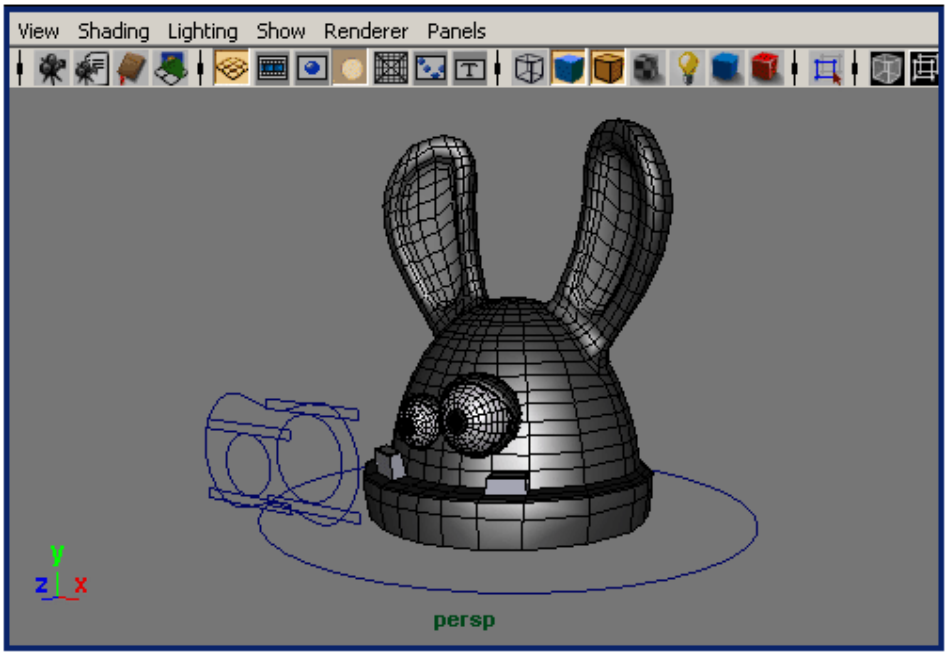
Authored and Tested with MAYA 2010

Introduction
Meet Gus..!! Gus is small FridgeMonster with no arms or legs. To make matters worse, Gus has large rabbit like ears. Consequently, Gus isn't taken very serious by his fellow FridgeMonsters and constantly ridiculed. This has resulted in poor Gus having a low level of self-esteem.

In this tutorial we'll show you how to rig Gus' ears, so that they have a level of elasticity and create an overlapping motion as he moves around.

Download and open the scene file **gusEarsNonRigged.ma**. The scene contains the Gus model, together with a set of controllers (curves) for the following:

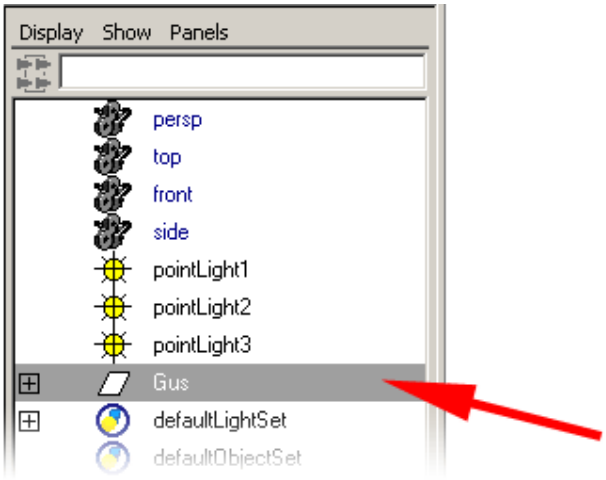
- Main Transformation Controller (gusController)
- General eye direction (mainEyeController)
- Left eye direction (lftEye)
- Right eye direction (rgtEye)
- Left Eyelid Top (lftTopLid)
- Left Eyelid Bottom (lftBottomLid)
- Left Eyelid Top (rgtTopLid)
- Left Eyelid Bottom (rgtBottomLid)



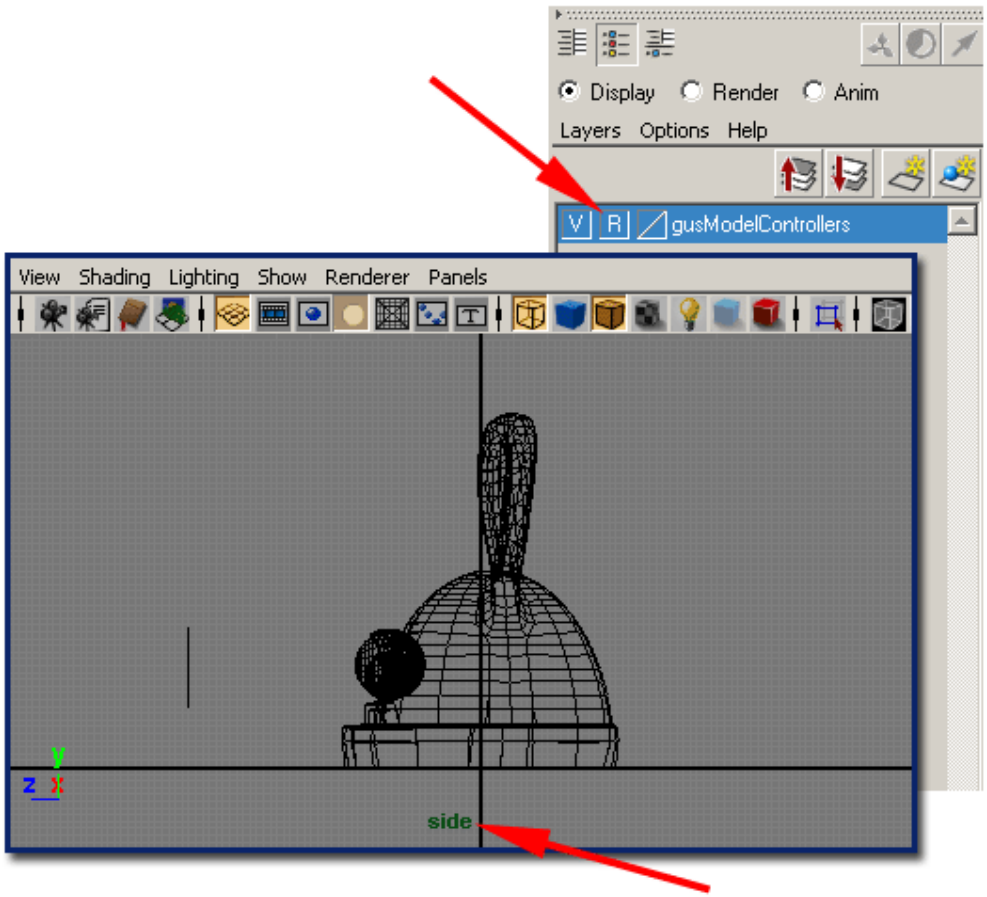
Lesson Plan
Here is list of the steps involved to give you a clear outline of the direction of this tutorial before we start.

1. Create the Joints
2. Bind the Mesh to the Joints
3. Add a simple animation (move backwards and forwards)
4. Create the IK Spline Handle for each ear
5. Duplicate the IK Spline as a target and make the original IK Spline a soft body.
6. Rename the 2 curves (Target & Soft)
7. Adjust the Goal Weights per particle (goalPP)
8. Adjust the Conserve value for the particles
9. Repeat steps 4 – 8 for the right ear

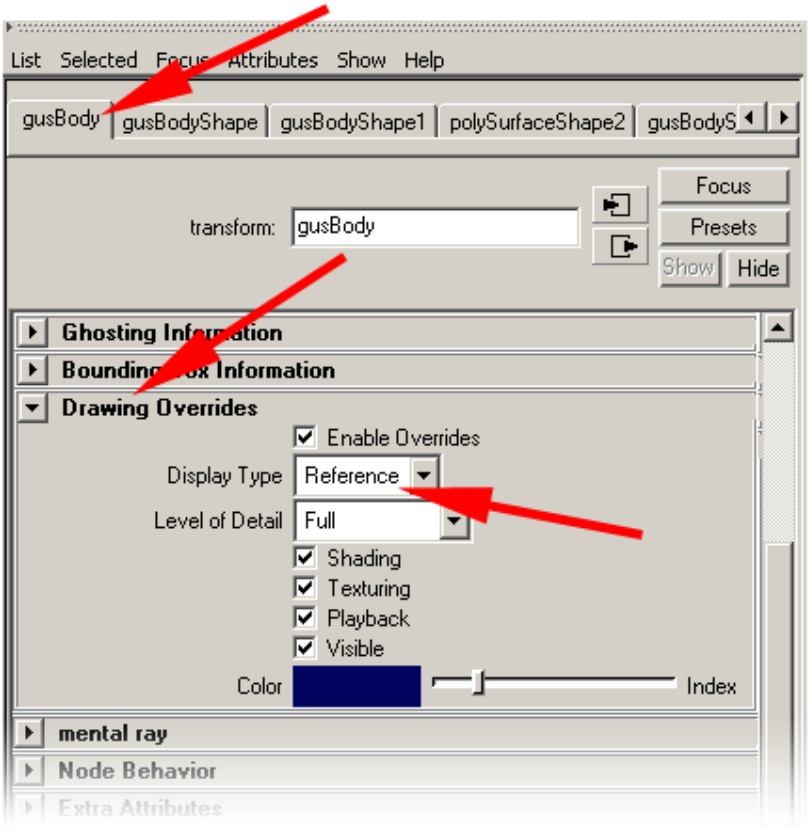
Tutorial
Before you start this tutorial, take note that the scene has been organised with good-keeping practices. All **Controller Curves** and **Meshes** used to define Gus are contained in the **Gus** group.



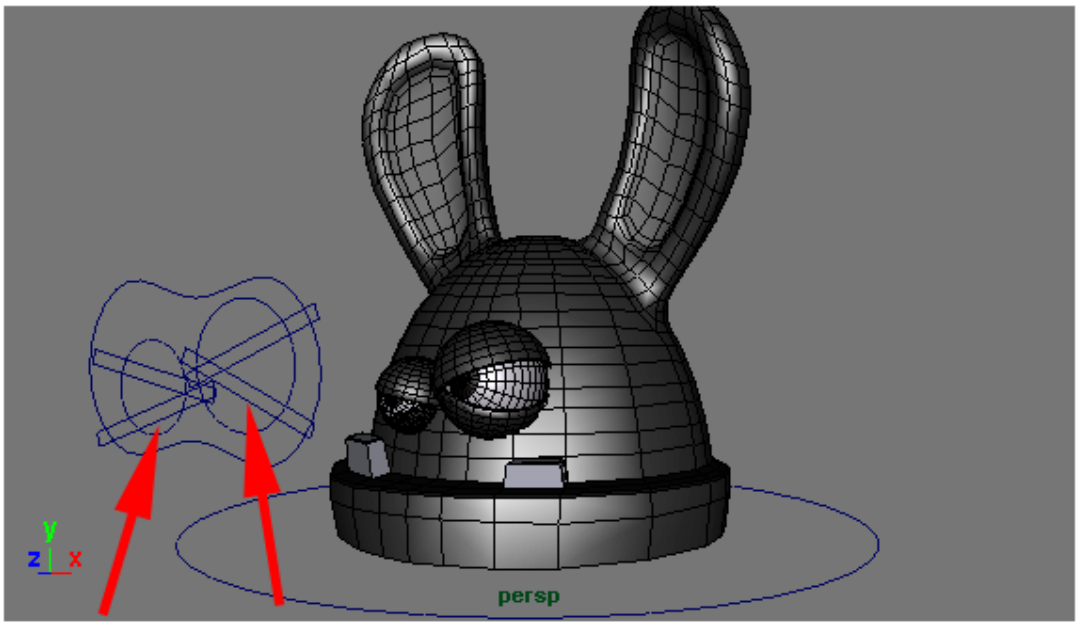
All **Controller Curves** and **Meshes** are also organised into a single **Layer** called **gusModelControllers**. You can freeze all the items on the **gusModelControllers** Layer by Referencing [R] the Layer. This will make life easier for you when selecting objects, joints, curves and particles later in the tutorial.



As there is no real need to select the body mesh, eyeballs and eyelids for Gus, they have also been individually frozen (**Reference**) to avoid accidents. If you need to unfreeze them, simple select the object in the **Outliner**, open the **Attribute Editor** and set the **Drawing Overrides > Display Type** to **Normal**.

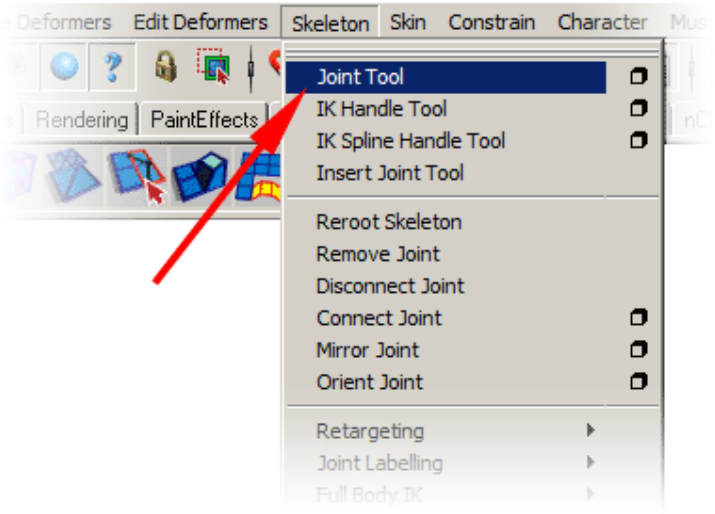


And finally, if you're interested in animate Gus, you may be interested to know that his eye lids are operated by translating and rotating the eyelid controllers.

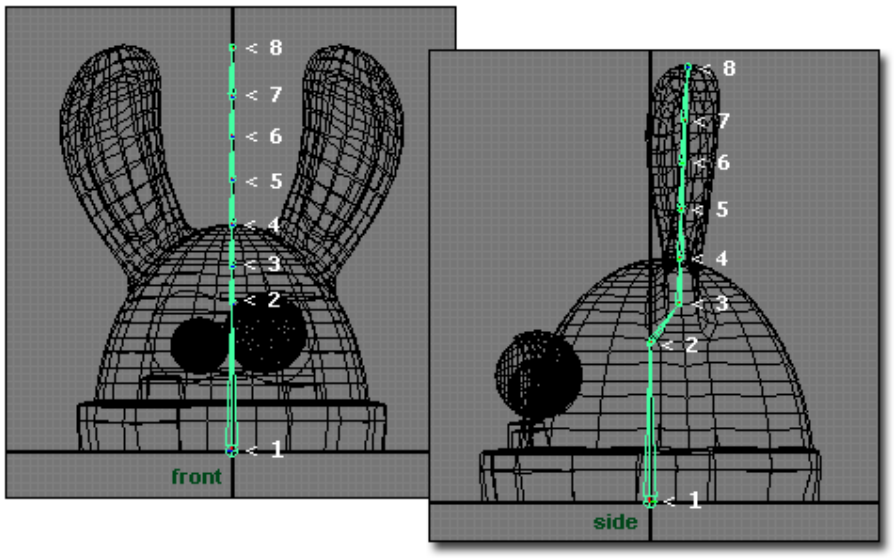


[1] Create the Joints (skeleton)
Maximise a single viewport and set it to **Side** view. Set the Shading setting to Wireframe [4]. Select the **Joint Tool**.

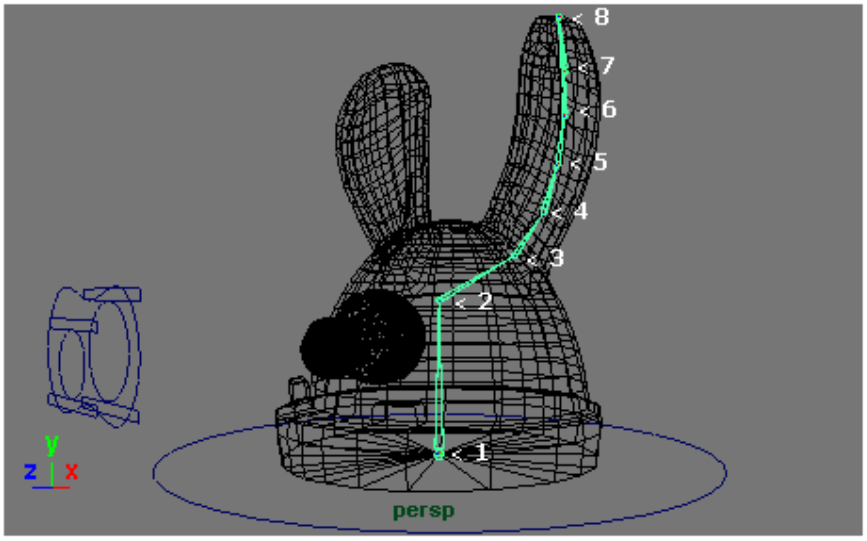
Animation > Skeleton > Joint Tool



Starting at the origin (snap to grid [x]) and create a joint chain, containing 8 joints, as indicated in the diagram below.

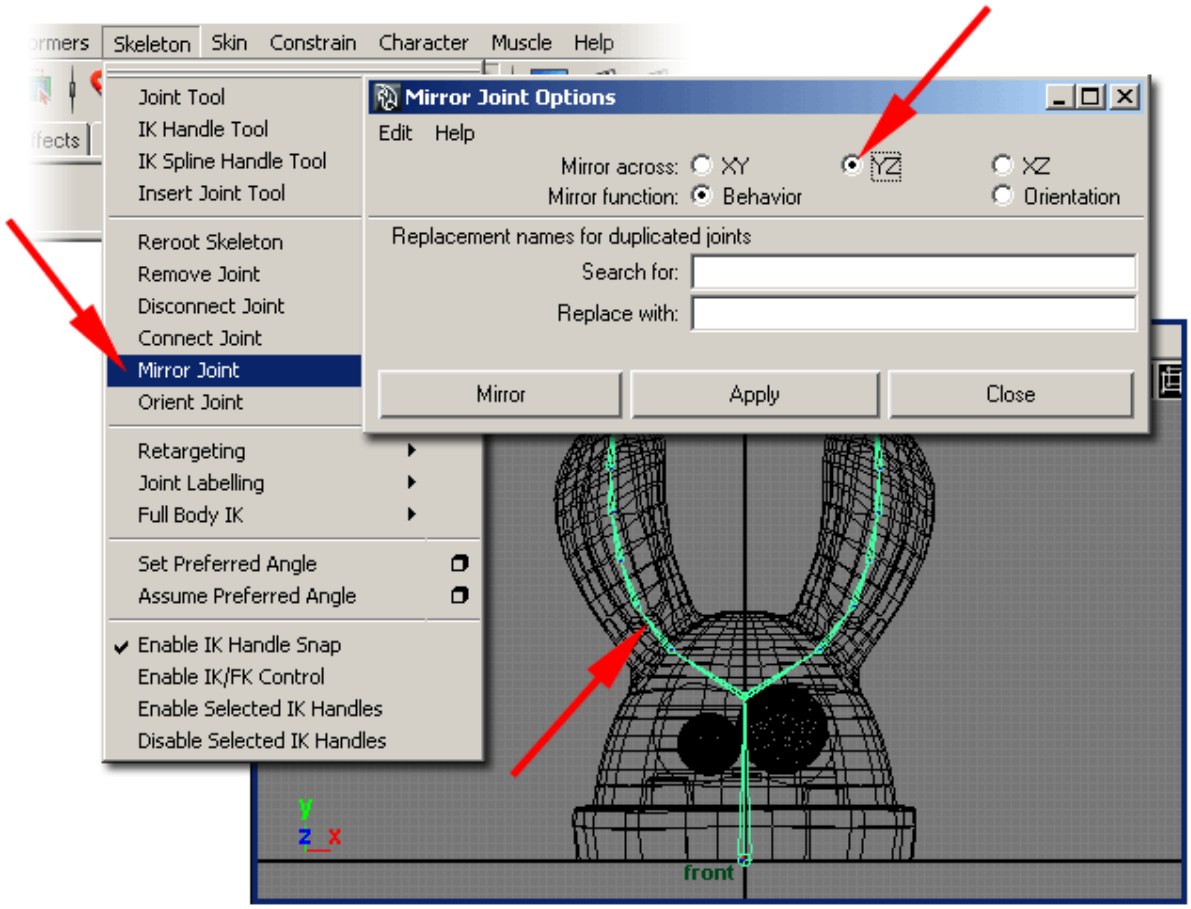


Use the **[INSERT]** key to toggle the local axis ON/OFF and adjust the position of the joints as indicated in the diagrams below.



Mirror the Joints in the left ear to create the Joints for the right ear by selecting **Joint 3** and using the Mirror Joint function. As Gus is modelled facing the Z+ direction, the joints need to be mirrored across the YZ plane.

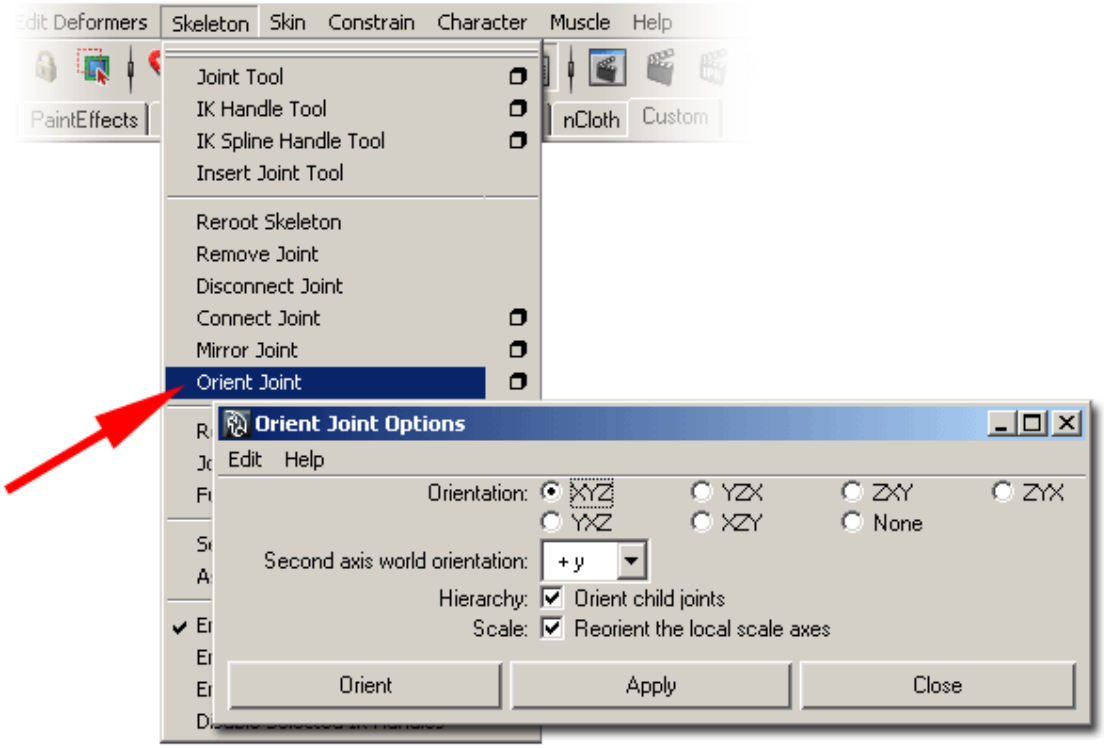
Animation > Skeleton > Mirror Joint



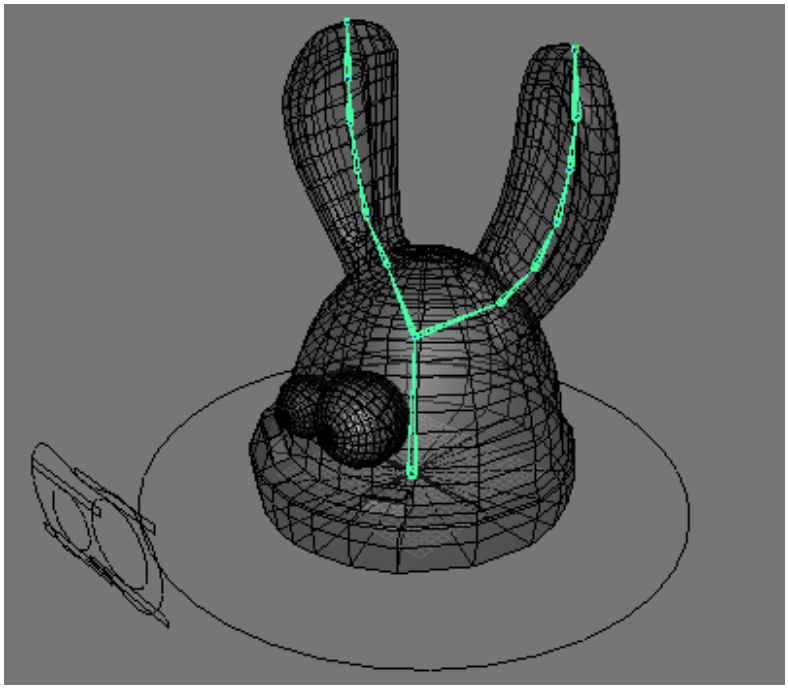
Orienting the Joint – The next step is to ensure that all the Joints have a common axis (X, Y or Z) aligned (Oriented), pointing down the Joints Chain. Also, the joints should have a common 2nd axis aligned, allowing us to rotate a common axis along the joints chain.

This step isn't actually needed in this tutorial as you will never rotate the joints yourself. However, it is a good habit to always remember this step.

Animation > Skeleton > Orient Joints



The Skeleton is now complete, as shown in the diagram below.

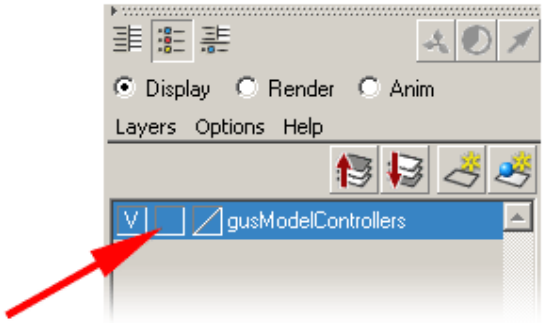


[2] Bind the Mesh to the Joints
The next step is to **Bind** the **Mesh** to the **Joints**. This step is effectively creates the Skin (gusBody) over the Skeleton (joint1) created in step [1].

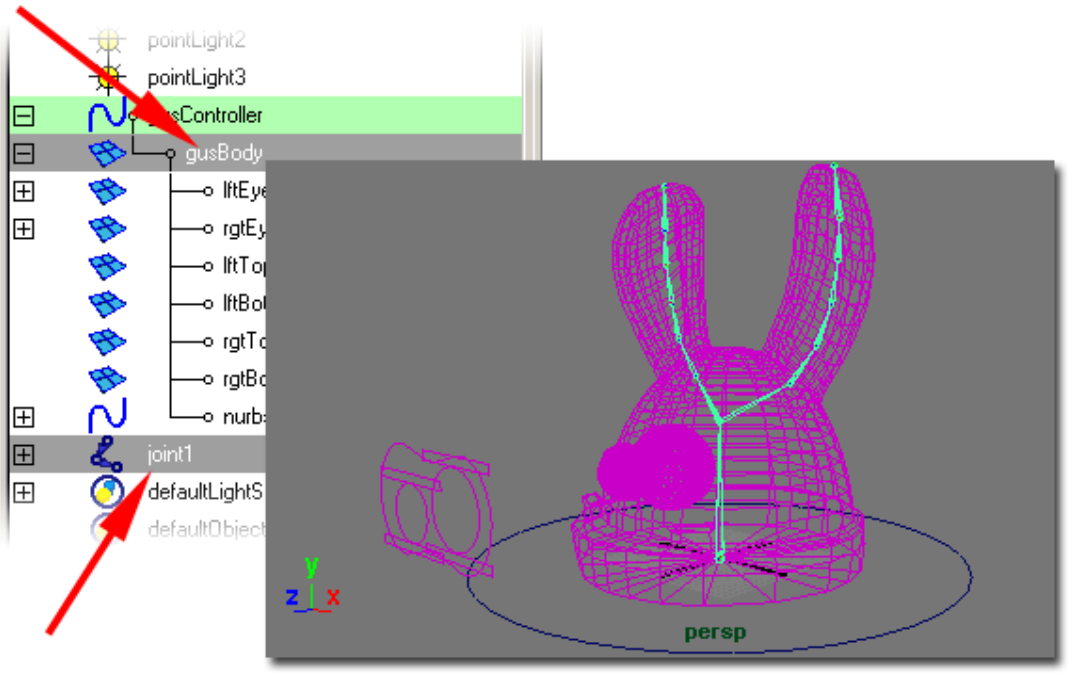
Remember, the **Mesh** (gusBody) is part of the **gusModelControllers** Layer, which is currently **Referenced**. This means you can not select the Mesh (gusBody) in the viewport.

There are 2 options for selecting:

1. Select the **Joint1** and **gusBody** in the **Outliner.** Use [Ctrl] to select more than one object in the Outliner. Not [shift]).
2. Alternatively, you can simply unfreeze the Layer by un-checking the R status box (empty = normal).

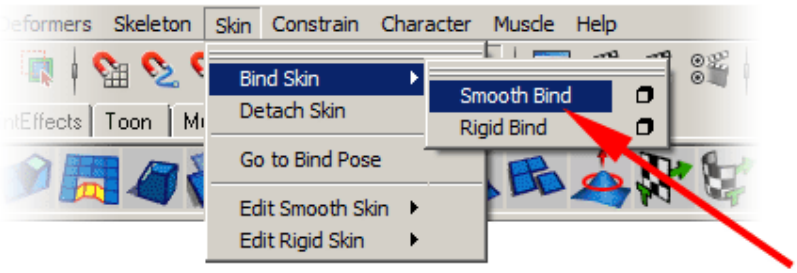


Select the **Root Joint** (joint1) and **[shift]** select the **Mesh** (gusBody).



Then **Bind** them.

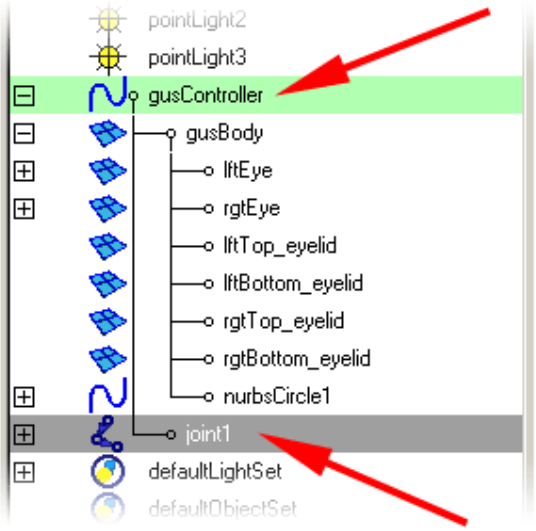
Animation > Skin > Bind Skin > Smooth Bind



To move (translate) Gus around, you need to select the Root Joint (joint1). As it is awkward to select the Root Joint (joint1), you should finally **parent [p]** the Root Joint (**joint1**) to the Controller Curve (**gusController**).

Select the **Skeleton** (joint1) and **[shift]** select **gusController** then parent **[p]**.

To check, simply select and translate gusController in the X axis. The skeleton (joints) and Mesh (gusBody) should also move. Remember to undo.



Summary
You have now successfully created a Joints chain (skeleton) and Skinned it with the Mesh (gusBody) using the **Bind** function. To check, simply select a joint inside one of the ears and rotate in the X axis. The ear should bend. Remember to undo..!! The skeleton (joints) now controls the vertices on the Mesh.

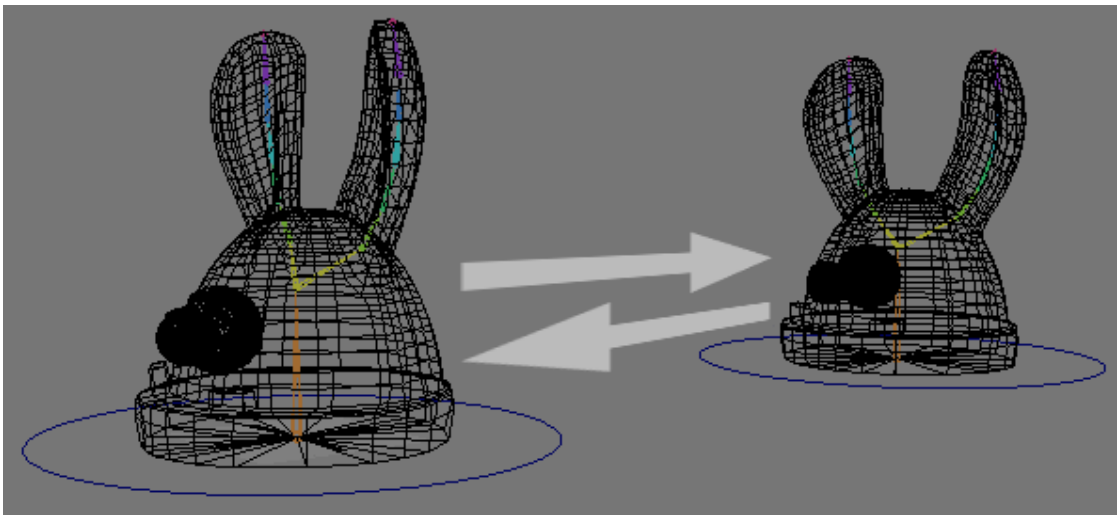
[3] Add a simple Animation (move backwards and forwards)
As the ears will only flop about when Gus moves, the next step is to add a very simple animation of Gus translating (moving) backwards and forwards in the Z axis.

You can decide on the timing yourself. But, it is suggested to set the timeline to 100 frames and the keys as indicated below. You will need some frames after the animation has finished to see his ears flopping about.

Select **gusController** and add **3 Keyframes**.

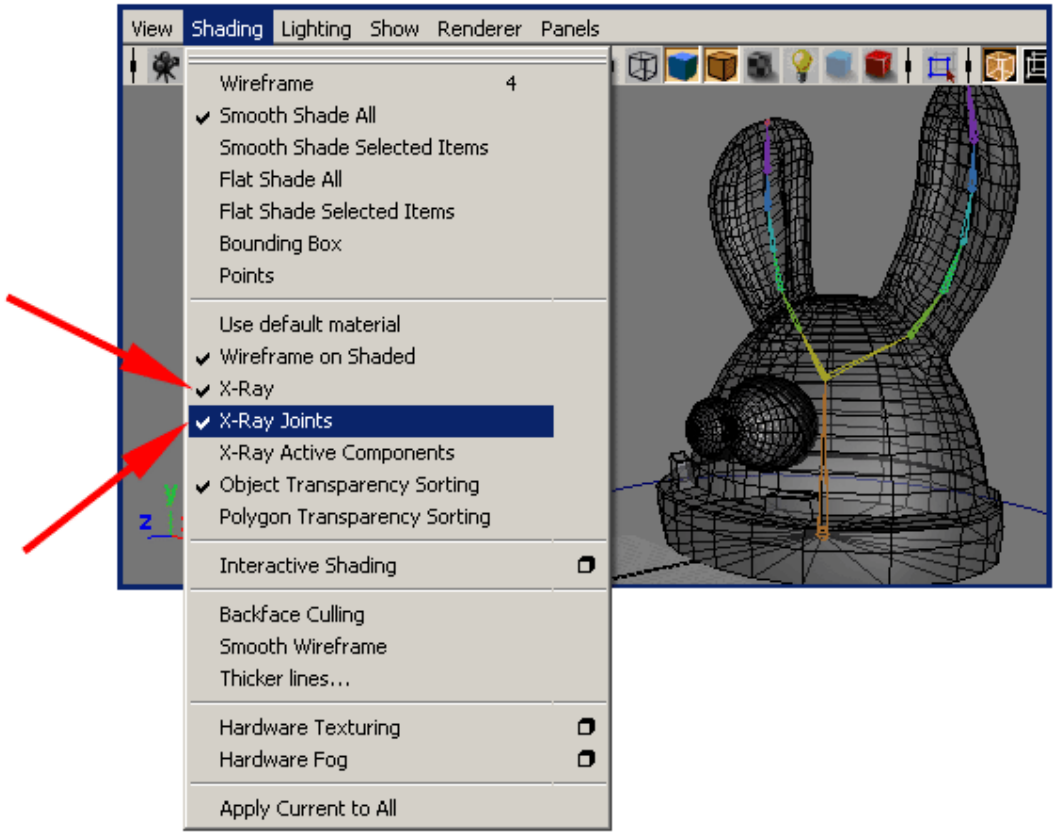
1. (frame 1) : Forward position
2. (frame 25) : Backward position
3. (frame 50) : Forward position (same position as frame 1)

Gus's ears will flop around from frame 51 onwards, eventually settling in their default position.



Note : Before we move on to the next step, it is useful to understand 2 of the viewport **Shading** settings. These settings can make life a lot easier when Rigging.

X-Ray : Displays the Meshes in the scene semi-transparent
X-Ray Joints : Displays the Joints on top of the Meshes, in the foreground.

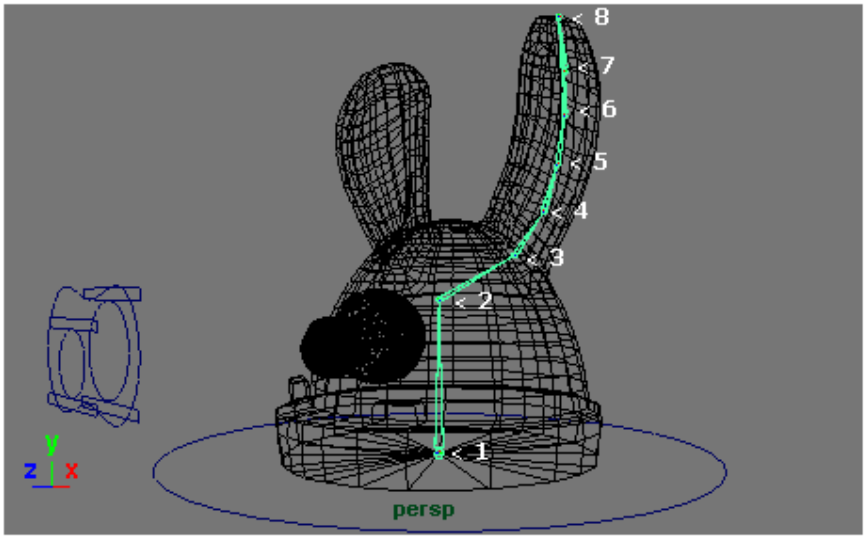


[4] Create an IK Spline Handle for the Left Ear.
The next step is to add an IK Spline Handle to the joints in the ear. The **IK Spline Handle** is a **Curve** that controls the rotation of the joints in the ear.

In the diagram below notice that joints 4 – 8 should be flexible. Joint 3 (the base of the ear) should not move (be flexible) at all.

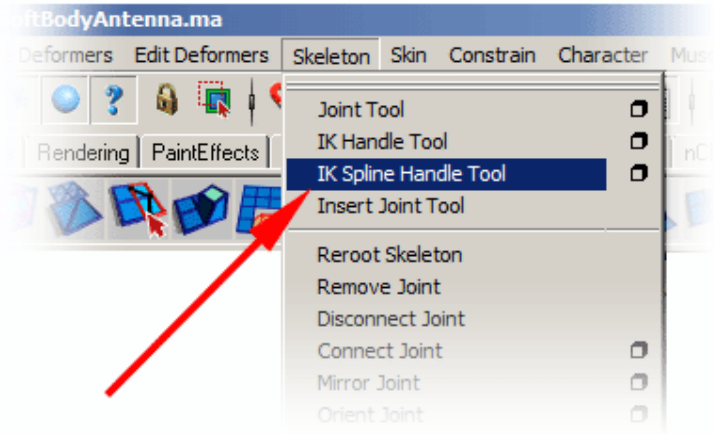
Therefore, the **IK Handle Spline** should only be connected between **joints 4 – 8**.

Note : It is important here to understand that the entire Curve (IK Spline Handle) will be flexible – include the start and end CV's (Control Vertices). This is why the first joint in the ear (joint 3) is not included in the IK Spline Handle.

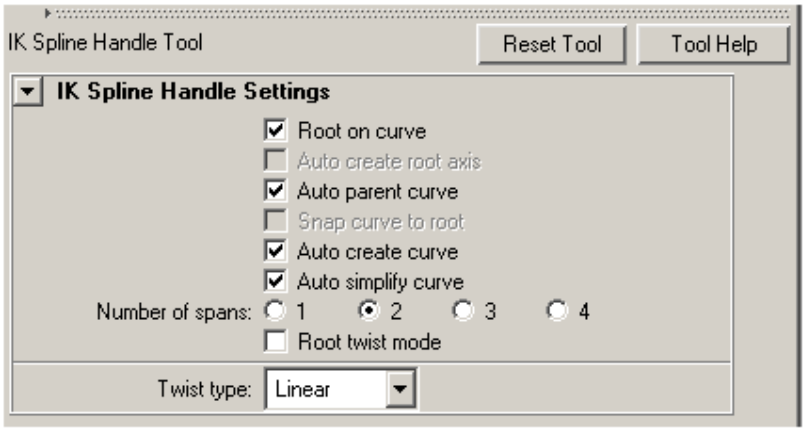


Add an **IK Spline Handle** to the left ear.

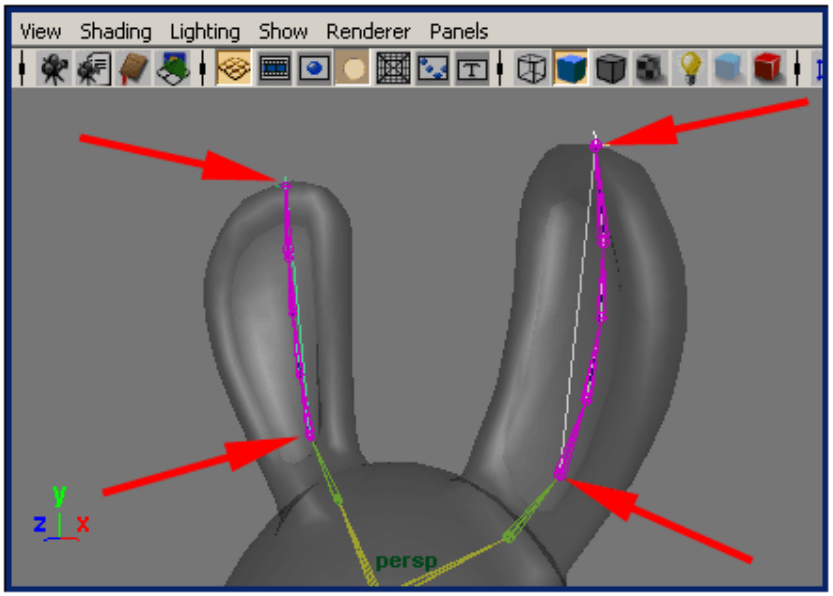
Animation > Skeleton > IK Spline Handle Tool



Check the **Settings** as indicated in the diagram below.

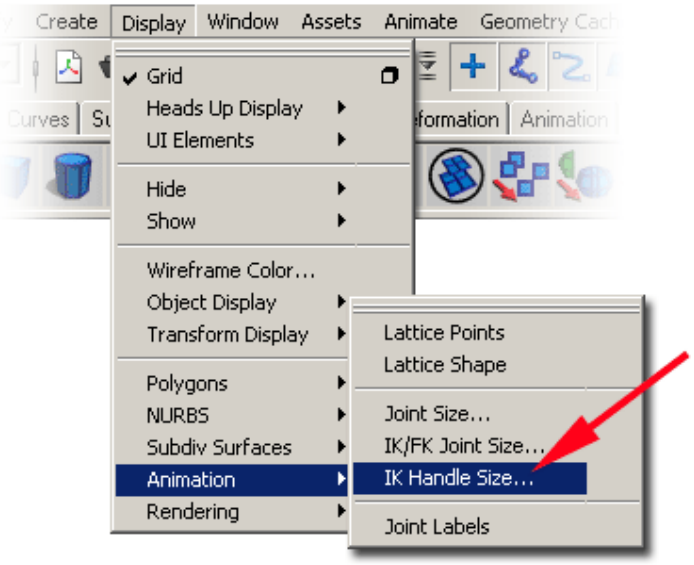


Start by clicking joint4 and then joint8 in the ear. Press **[Enter]** to end.

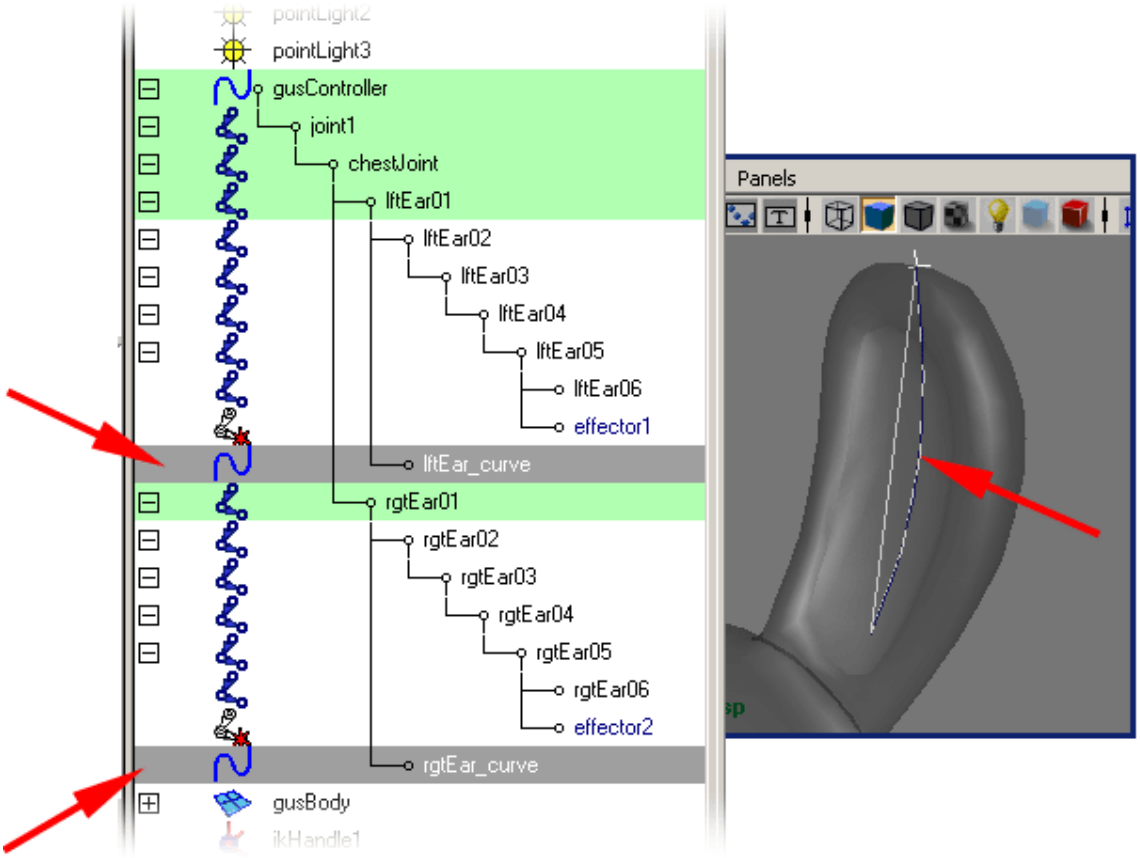


This will create a **Curve** through the ear. The Curve is controlled by moving the **IK Spline Handle** at the top.

You can increase the display **size** of the **IK Spline Handle** as indicated below.



Repeat step 4 for the right ear.
Rename the Curves **lftEar_curve** and **rgtEar_curve**.



Read this section carefully to understand how this Rigging solution works.

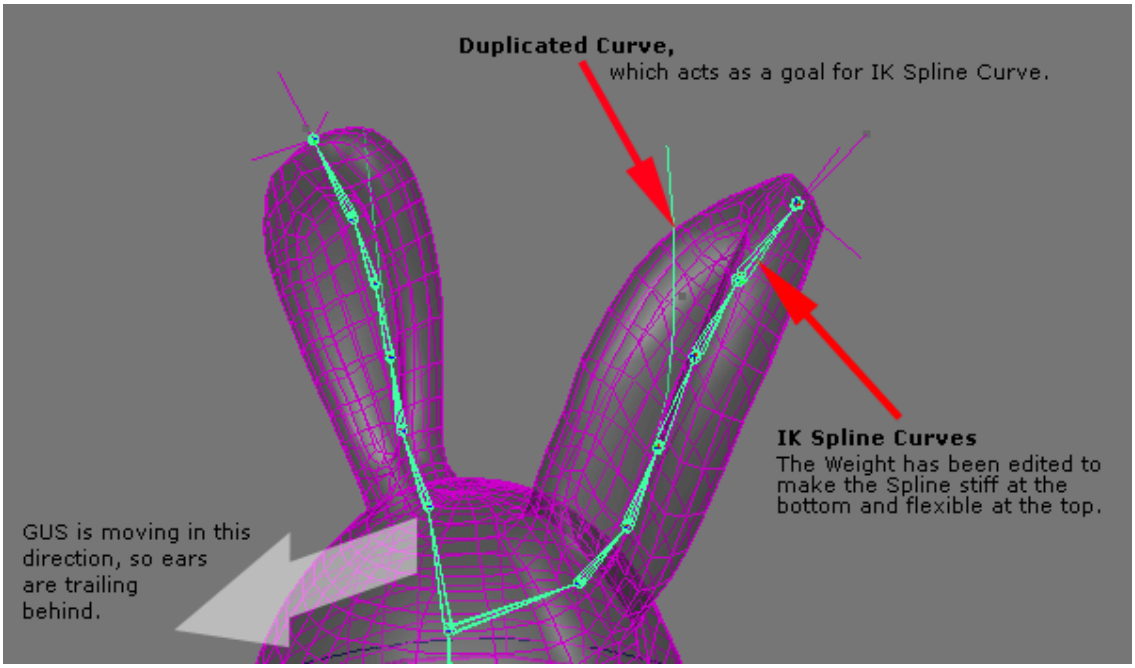
The IK Spline Curves (lftEar_curve & rgtEar_curve) control the rotation of the joints in the ears.

In step [5] you will duplicate the IK Spline Curves (lftEar_curve & rgtEar_curve). The duplicated curves will then serve as a goal object (target) and the original curves (lftEar_curve & rgtEar_curve) will be given Soft Body properties.

This means that the IK Spline Curves (lftEar_curve & rgtEar_curve) will become bendy, but they will be weighted (attracted) to the duplicated curves (target).

Spline Curves are created with CV's (control vertex). When you create Soft Body, MAYA places a particle at each CV. The CV's are connected to the particles and the particles are attracted to the goal Spline Curve (duplicated).

By adjusting the weight of each particle, you will be able to make the ears appear to be stiff (very attracted) near the bottom of the curve and bendy (less attracted) at the top.



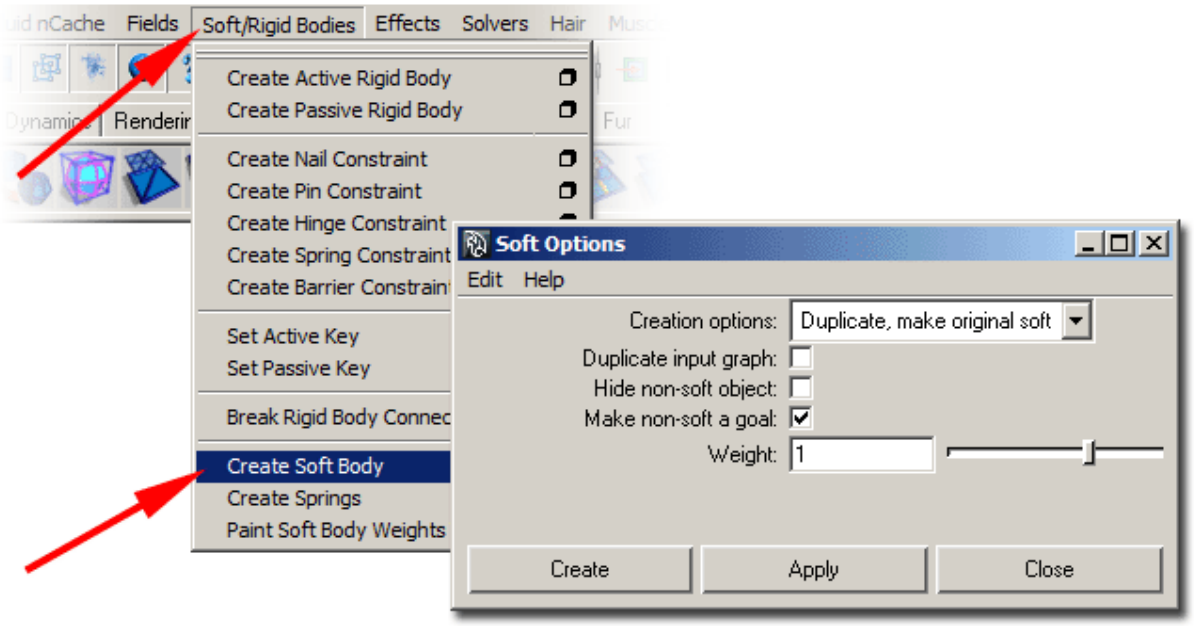
[5] Create the Dynamic Soft Body for the left ear
Select **lftEar_curve** in the Outliner. Create a duplicate and make the original curves soft body

Dynamics > Soft/Rigid Bodies > Create Soft Body

Follow the settings below for the **Soft Options**:

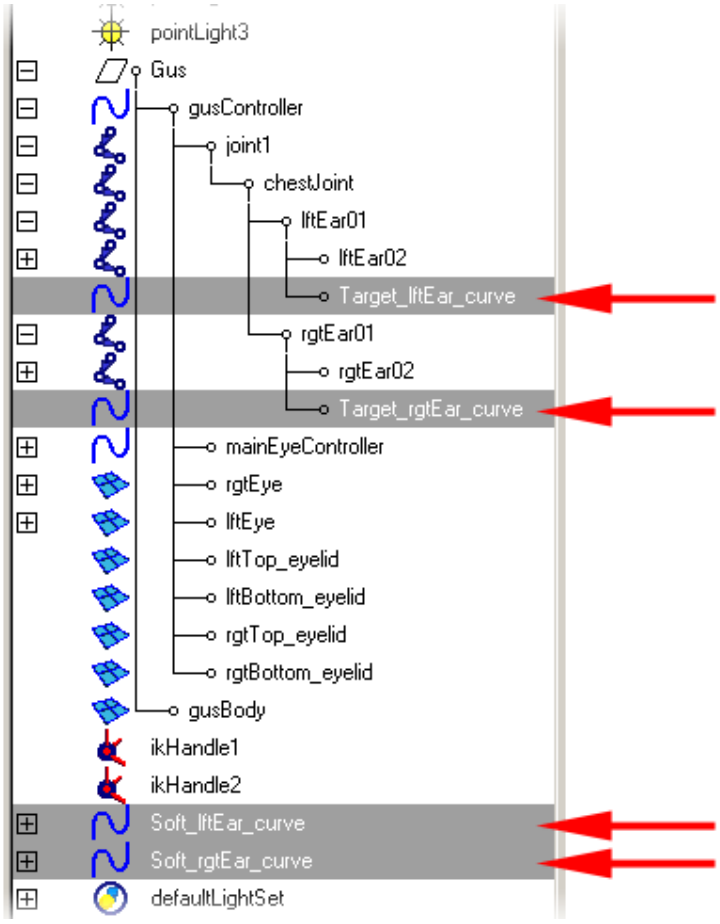
Creation Option >Duplicate, Make Original Soft
Duplicate Input Graph > OFF
Hide Non-Soft Object > OFF
Make Non-Soft a Goal > ON
Weight > 1

Note : See explanation above to understand the Soft Option settings.

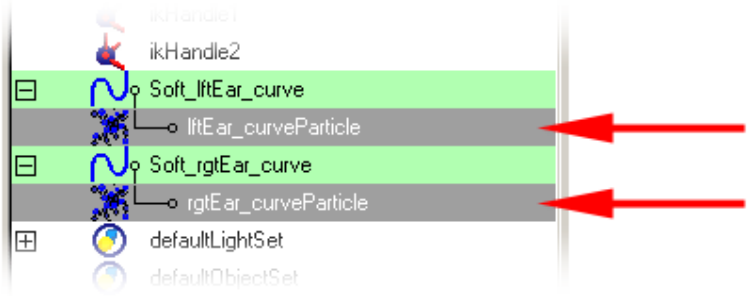


[6] Rename the Curves
In the Outliner, rename the curves as follows:

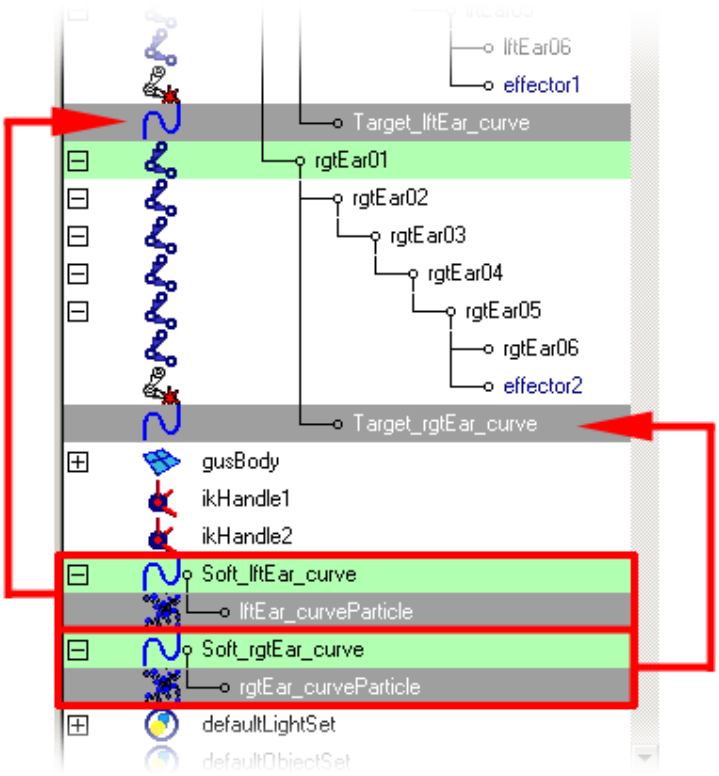
lftEar_curve > **Soft_ lftEar_curve**
rgtEar_curve > **Soft_ rgtEar_curve**
copyOflftEar_curve > **Target_ lftEar_curve**
copyOfrgtEar_curve > **Target_ rgtEar_curve**



As explained earlier, when you create a Soft Body of the IK Spline curves, a particle system is create.

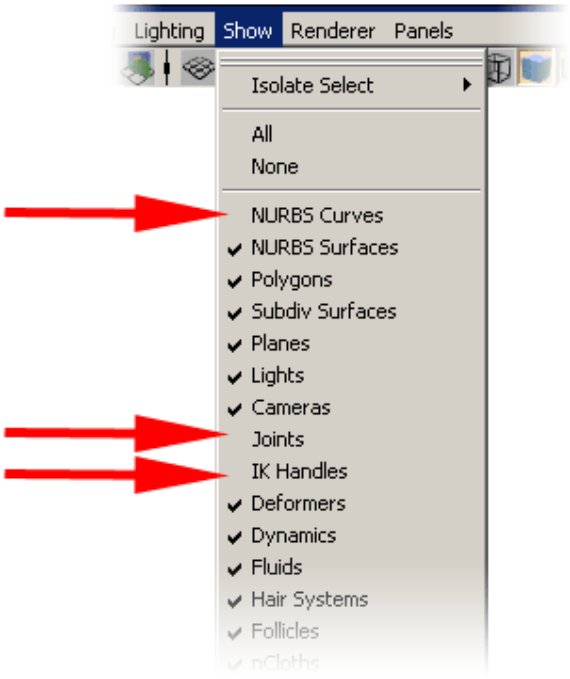


The particles control each of the CVs for the original curve, which is now a Soft Body. Each particle is attracted to the corresponding CV on the duplicated curves (target).



The next step is to edit the Weight value (attraction) of the particles. Particles at the top of the ear should be bendier (less stiff) than the particles are the bottom of the ear (more stiff).

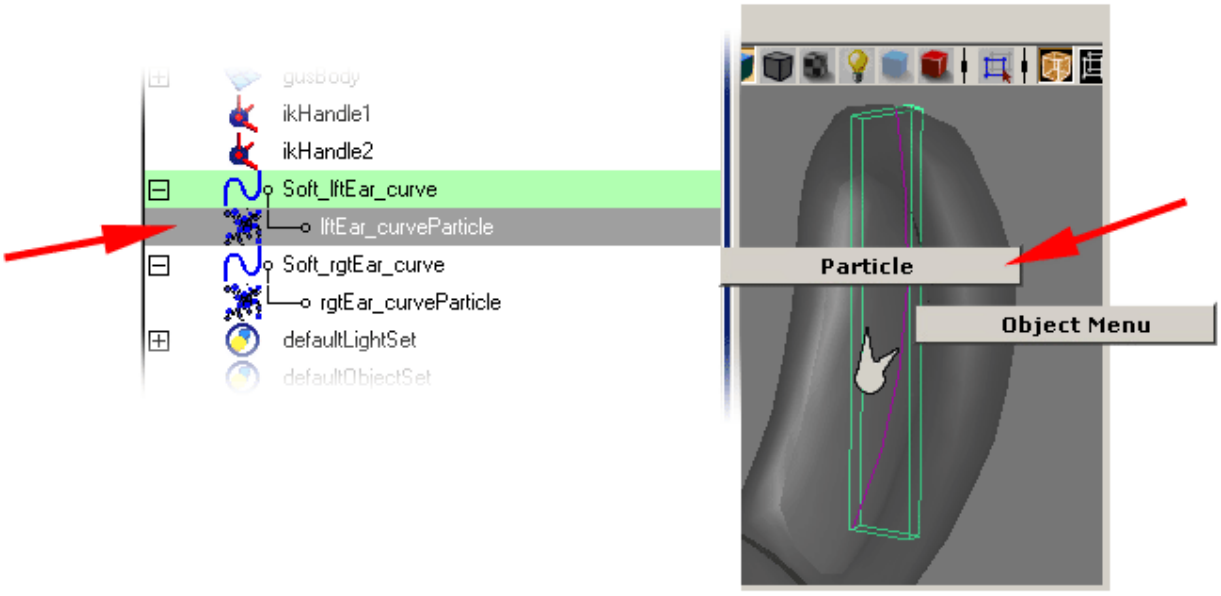
Selecting the particles is slightly tricky. It is useful to hide the Curves, Joints and IK Handles as indicated in the diagram below.



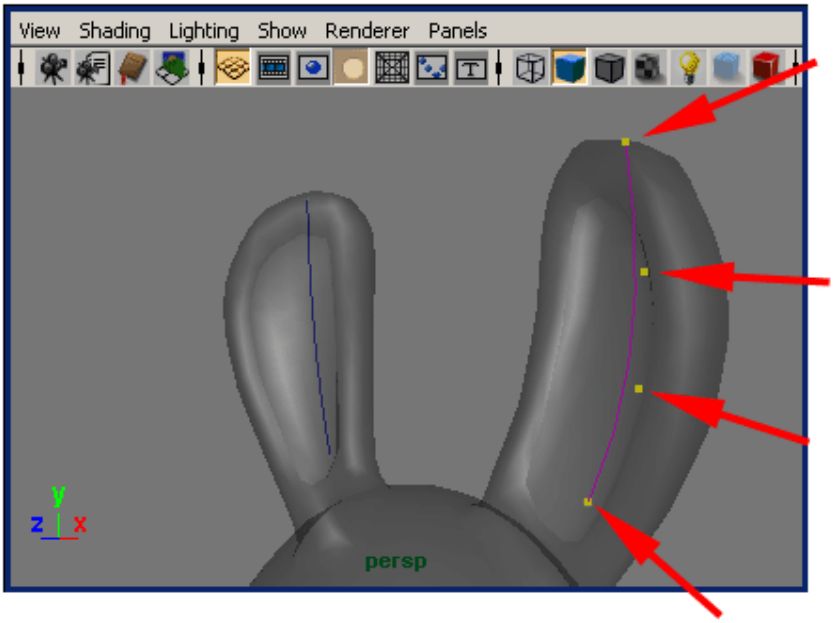
[7] Edit the Goal Weight per particle (goalPP)
As the **Weight** (goal) value of the particles is set to **1** (see step 5), they are literally stuck to the Target curve and therefore the soft Spline Curve will be totally stiff.

You need to edit the **Weight** (goal) value **per particle**. The particles at the bottom of the Curve (ear) will the stiffer (1) than the particles at the end of the curve (<1).

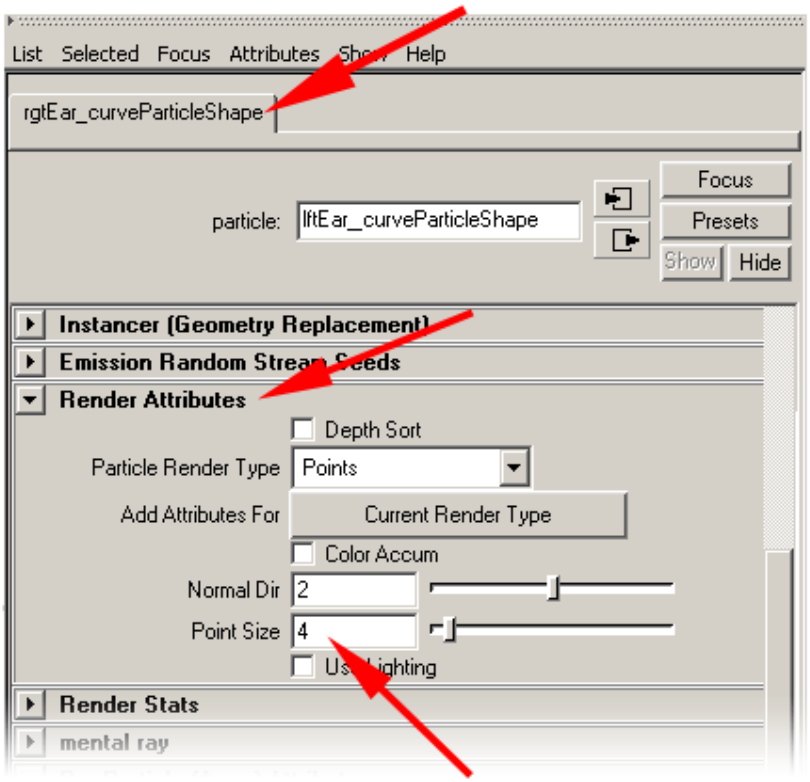
Select the particles by selecting **lftEar_curveParticle** in the outline, then RMB inside the particle bound box (green). Select **Particle** from the Hot menu.



Then select all the individual particles (yellow) by drawing a marquee around them.

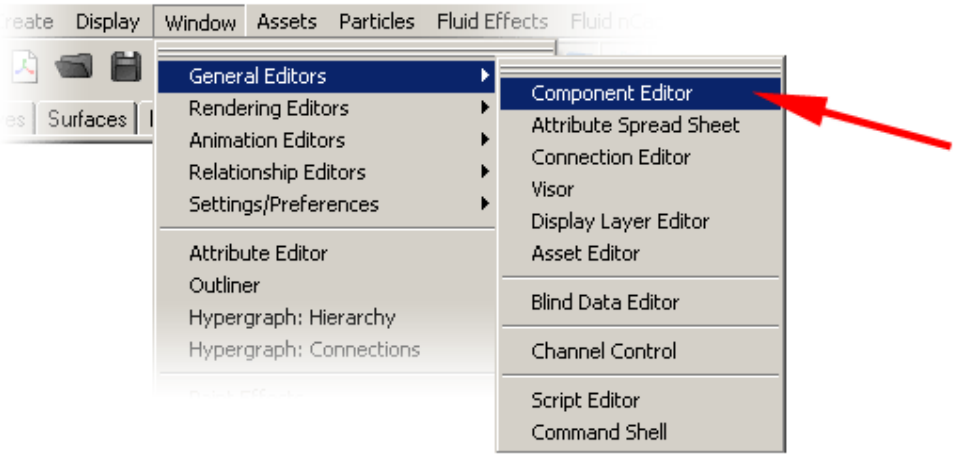


If you have trouble seeing the particles you can edit their **Point Size** in the Attribute Editor [Ctrl]+[a].

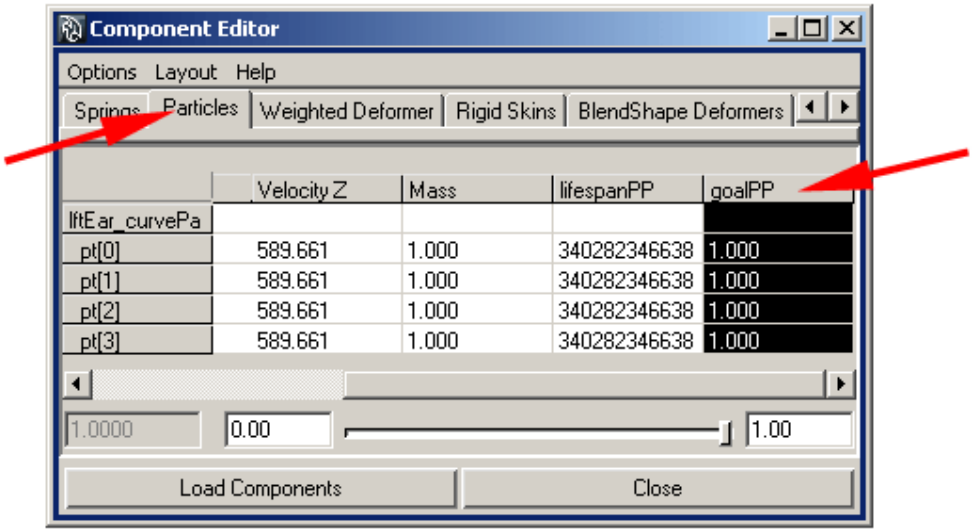


Once you have the particles selected, the Component Editor will allow you to edit the individual value for each particle. Open the **Component Editor**.

Window > General Editors > Component Editor



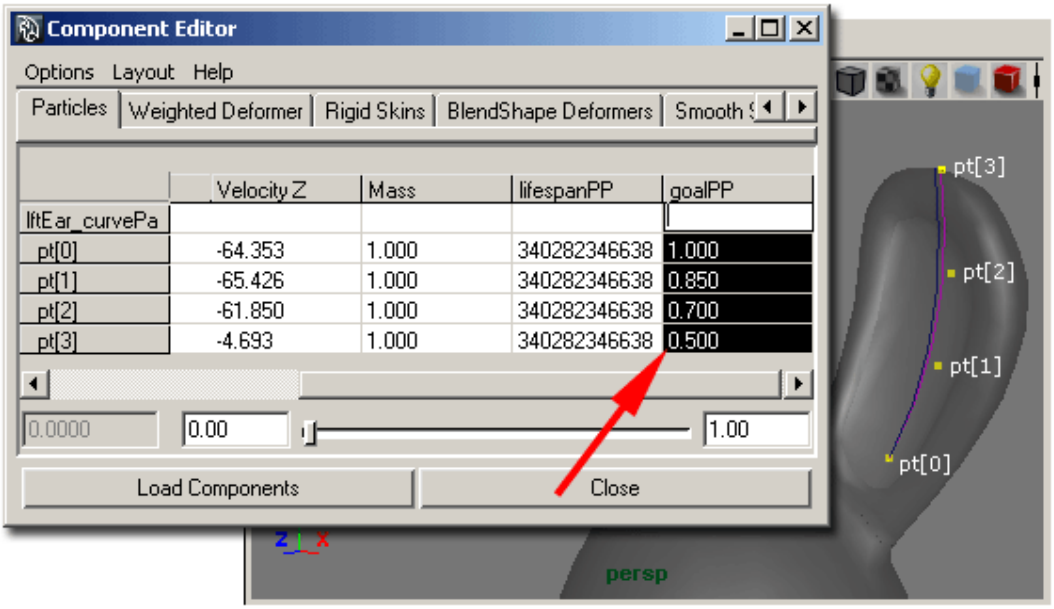
Select the **Particles** tab and scroll to right to view the **goalPP** (Weight) column. You can now see the individual **Weight** value for each particle (goalPP and Weight are the same thing).



Particle pt[0] is the closest to the head (bottom of the curve) and should therefore be the stiffest. To have a high stiffness the goalPP value should remain at 1.

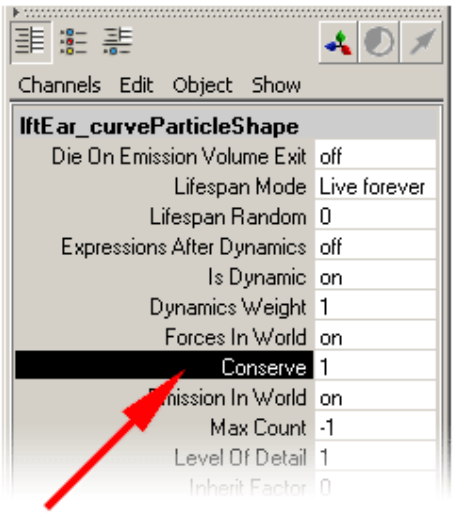
As the particles get further away from the head and closer to the top of ear, they should decease in stiffness.

The values for the particles goalPP should therefore decease from a value of 1 as indicated in below.

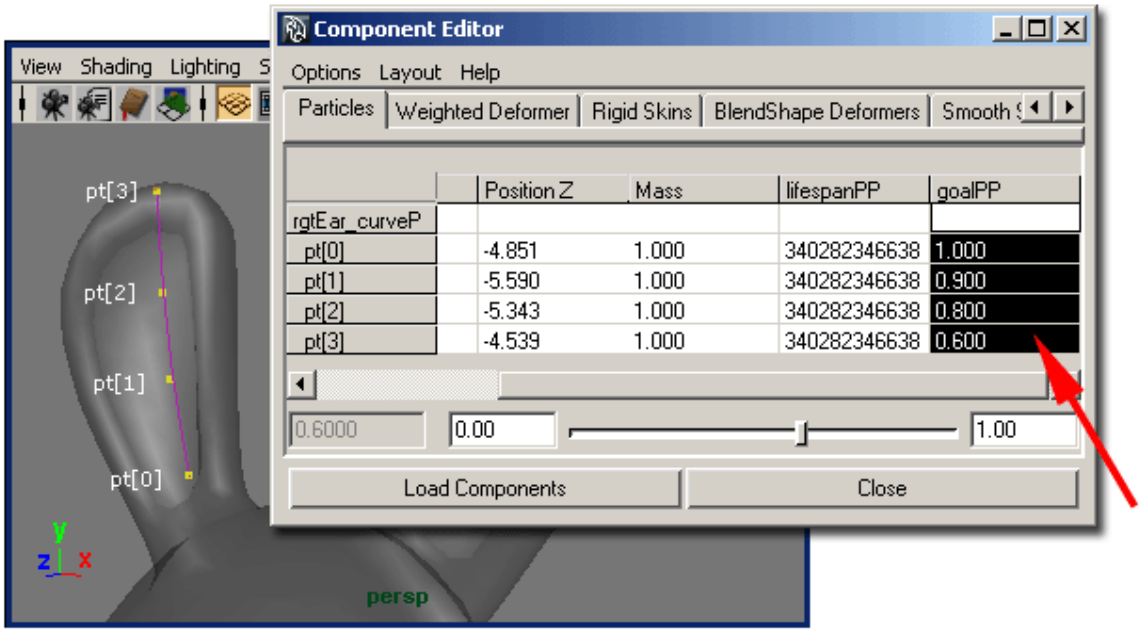


Play your animation and the ears should flop about in a flexible manner. The next step is to tweak the overall flexibility of the ears.

[8] Adjust the Conserve value for the particles
To adjust the overall flexibility of the ears, select **lftEar_curveParticle** in the Outliner. Then open the Channel Editor and lower the **Conserve** value (default = 1). This acts a global multiplier value for the particles.



[9] Repeat steps 5 – 8 for the Right Ear
Repeat Step 5 – 8 above for the Right Ear. It's a good idea to have the goalPP values slightly different from the Left Ear. This will avoid symmetry in the movement of the ears and look more natural.



Play your Animation.