

Cooper tutorials	
	Face modeling This tutorial covers modeling the face using front and side rotoscopes.
	Head and ear modeling This tutorial finishes the head. It covers tips on using the "Magnet tool" and building an ear.
	Mouth and Teeth modeling This tutorial covers modeling a mouth and teeth.
	Hair modeling This is a solution to modeling hair. It covers a method of modeling using a simple skull cap and now includes Version 11 particle hair.
	Eye modeling A tutorial on modeling an eye ball.
	Texturing the face This tutorial covers the creation of textures for the face and applying them using flattening and decals.
	Modeling the torso This covers modeling a clothed (in this case with pajamas) torso.
	Modeling the pelvis and legs This tutorial covers the modeling of the pelvis and legs.
	Modeling a hand How to build a good looking yet simple hand.
	Modeling a foot How to build a good looking yet simple foot.

Modeling the face...

Preface. (A little something about creating your own rotoscopes.)

"Why doesn't my 3d render look like the picture I used as a reference?"
Sound familiar? (if not.... then feel free to move on to step one).

Rotoscopes are very handy things when it comes to modeling. They are the modeling equivalent to tracing in drawing. That said.. if your rotoscopes don't have the right "stuff" then your model probably won't either. What is the right "stuff"? Glad you asked...

Simply put when it comes to rotoscopes, it would be really handy if the world had no perspective. Of course that's not the case, so we are left to figure out the differences when we model. However there are things we can do that can take as much perspective as possible out of our rotoscopes.

You probably wonder why I worry so much about real world perspective.... "what's the big deal" right? Well it has to do with the fact that you model in a window that has no perspective. true its "3d" but the viewing angle is "orthographic". Yes you can toggle this view to perspective, but it is not advisable to try to model with this perspective turned on. things become harder to position correctly. Its a very subtle thing, but it can make a difference when it comes to modeling. Faces get fatter, longer, you name it...

As much as you want to don't get your camera right up in the face of your model... Camera's have wide angle lenses This will introduce artificially inflated perspective. Add to that the perspective that will get added when you take the model based on these unnaturally "fat" rotoscopes into a view with a perspective camera and the results are... "chipmunk cheeks", "Neanderthal foreheads".

So step away from your model as far back as you can get. Better yet get a telephoto lens and keep on backing up.... further.... fuurrrrther. There. OK now how do you model a face that will have all of 3 pixels of detail to model from? If you are asking that you backed up to far.

The point is that in order to make a good rotoscope you'll need a good camera (i.e... lots of megapixels). Shoot it in good "even" lighting, against a dark background if the model is light skinned and a light background if the model is dark skinned. And try as much as you can to eliminate perspective by getting as far back as possible (but still close enough to capture detail).

You will also want to make the rotoscope dark by tinting it with some dark color that contrasts with the shading used in the 3d program. I just tinted mine with a dark gray-green color to match the Animation Master default background. This allows me to see my splines well against the rotoscope.

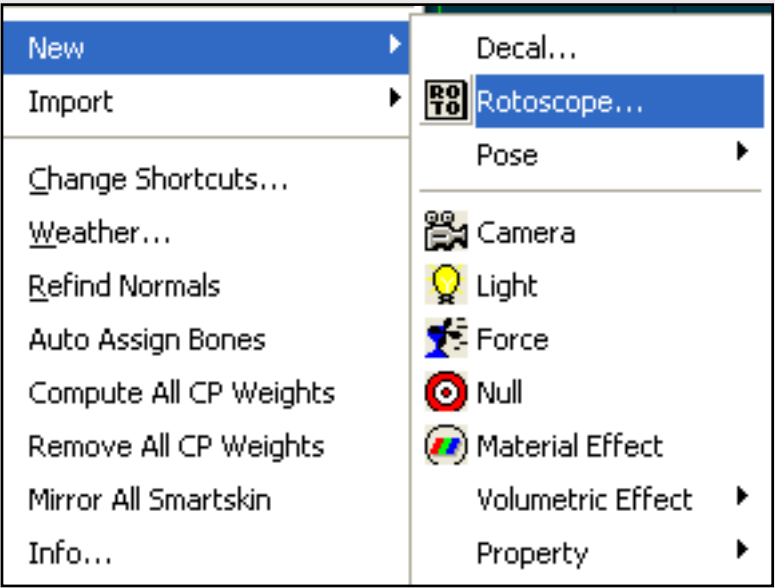
Finally if you don't have a camera to photograph rotoscopes with... draw them. Even if you cant draw, draw something and us it. Its a lot harder to get it right in a 3d environment if you don't have a road map to work from.

Getting the pics in...

Once you finally have a rotoscope to work from, just import it into AM by right-clicking in the modeling window and selecting...

"New / Rotoscope".

Then pick the image you want to use.



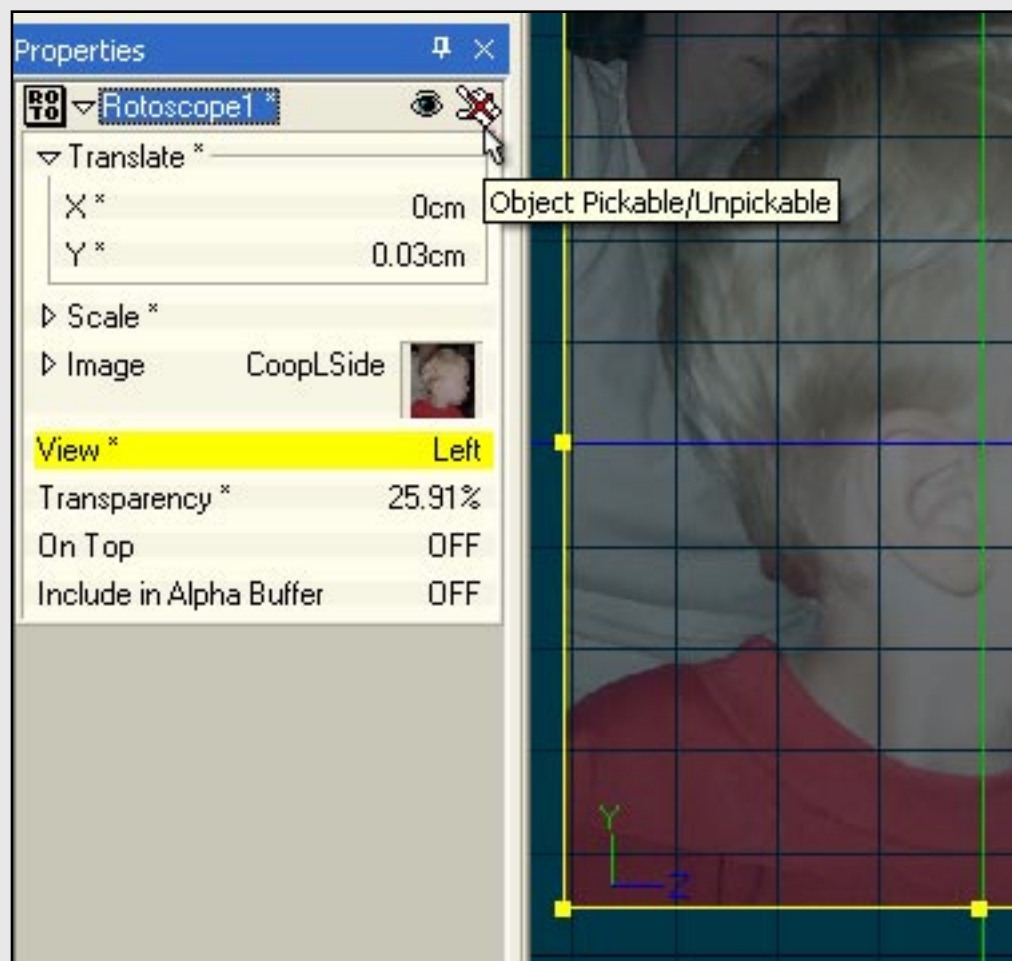
Once you've positioned your rotoscope in the modeling window... turn off its pickable state by clicking on the little hand next to the eye in it's property window. If you brought the rotoscope into the wrong view its OK. you can change the view by selecting the correct view in its property panel.

Notice that I also set some transparency to the rotoscope so that it is easier to see the splines on top.

bring in a front view rotoscope and a right or left view rotoscope and line them up so that they are positioned correctly in there respective views. In other words make sure that the eyes meet and the mouth and nose are at roughly the same location in each view.

if you could see rotosopes correctly aligned in the birds eye view they would look like this.

This isn't showing any view you could actually use... its just to show that Rotoscopes can and should be positioned so as to allow body parts to line up correctly when toggling between views while modeling.

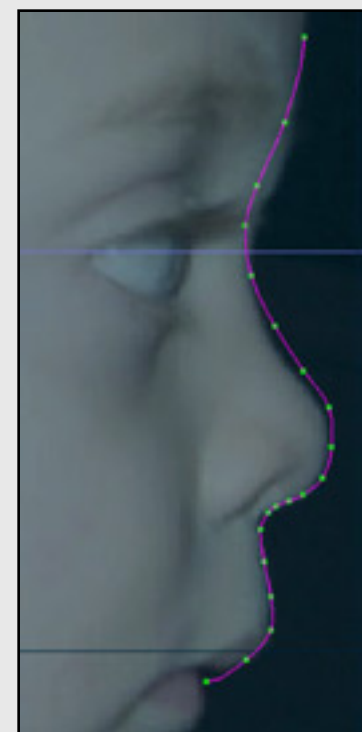


Step 1.

In the left view, draw a spline line (shift A) along the profile of the face. Just draw it from the top of the brow to the upper lip for now. Try not to make the spline too heavy, but give yourself enough points where you need them.

Notice the concentration of points near the nostril? They're there for a reason. They will allow the nostril to curve nicely upward into the nose.

If you don't add enough now you can add them later, so don't worry about the details yet.

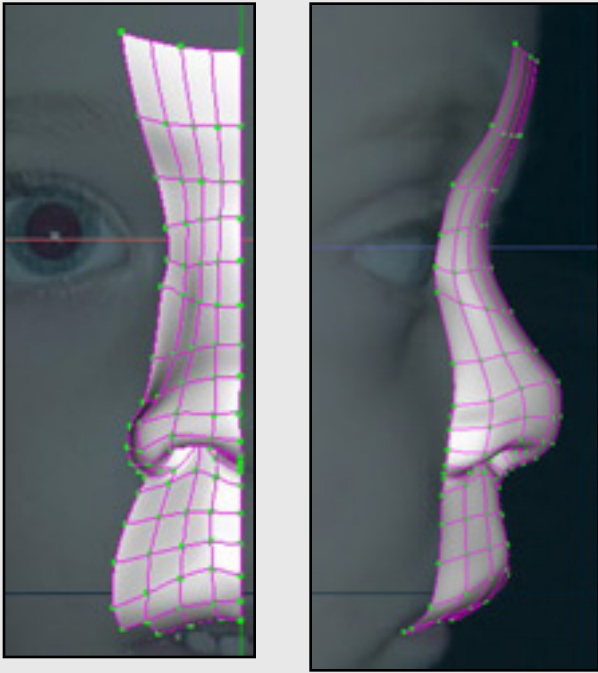


Step 2.

Extrude for splines to the left. Sculpt the splines into the shape of the nose and upper lip.

Then pull the points up to create the nostril.

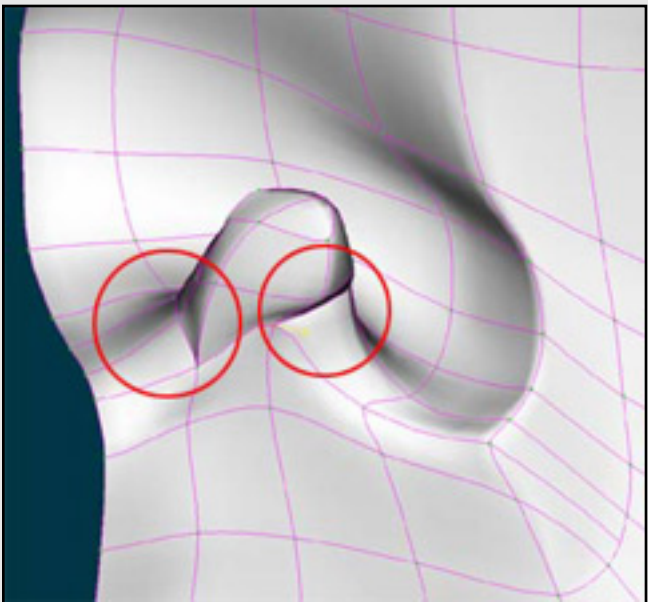
Chances are you'll have to break and reattach points to get the kind of contiguous splines you'll need.



Step 2 a

Notice the creases inside the nostrils. No one will notice these unless you're going to fly up the model's nose. So use all the "hooks" and "crannies" you can to hide odd spline intersections.

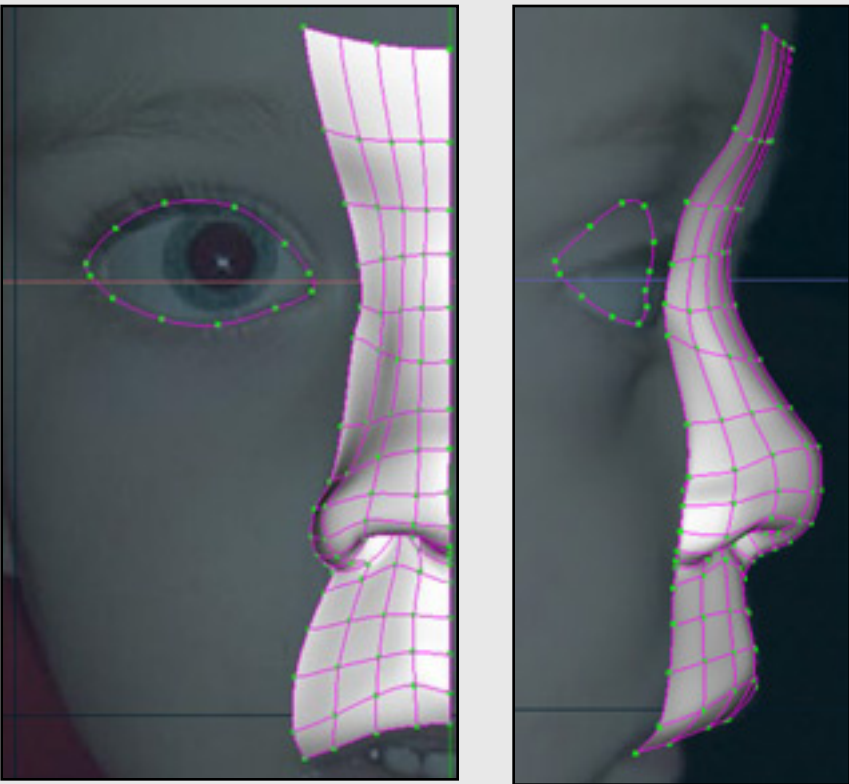
Once you become used to this, you'll find yourself naturally modeling this way.



Step 3.

In the front view, draw the ring that will become the eye opening. Again give yourself enough points to create a nice curve.

In the side view, pull the points of the eye opening to create an approximation of the curve of the eye lid.



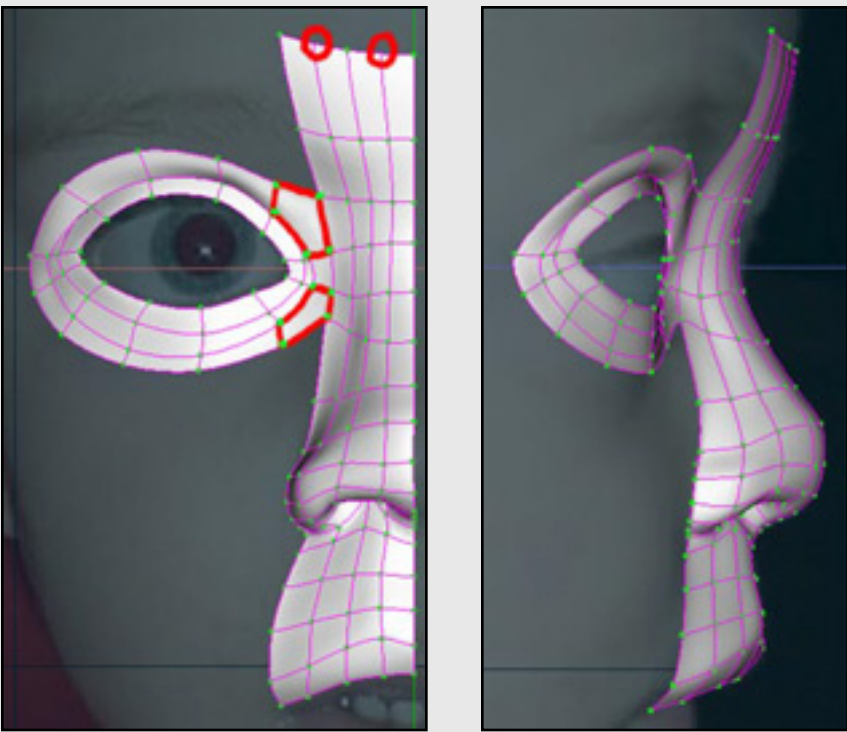
Step 4.

In the front view, extrude the eye opening to create the eyelid. Just do 3 extrusions for now.

Break the points near the nose and attach them to the points that create the bridge of the nose.

Notice the 5 point patches near the nose. The circles on the brow show that 2 of the splines end in hooks in order to keep the mesh manageable.

In the side view, pull the points of the eye lid to create an approximation of the curve of the eye.

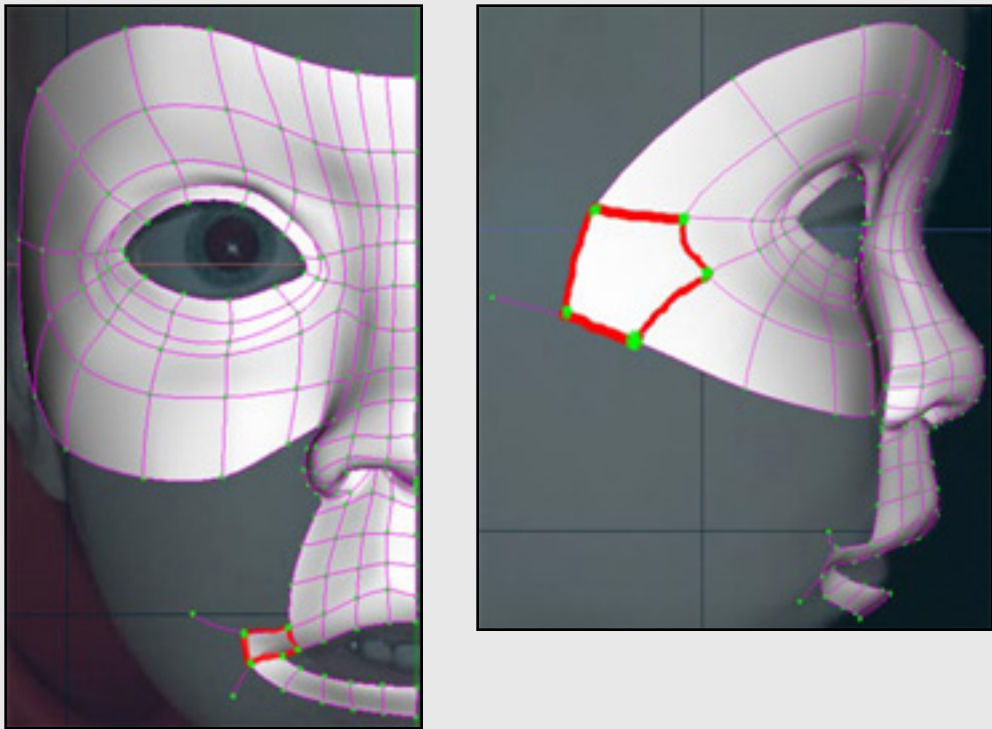


Step 5.

Continue to model the brow and cheeks by drawing spline rings and attaching them to the mesh. Then sculpt the shape from the sides.

Finish the ring that will make the mouth opening.
Extrude it once to create the lower lip.

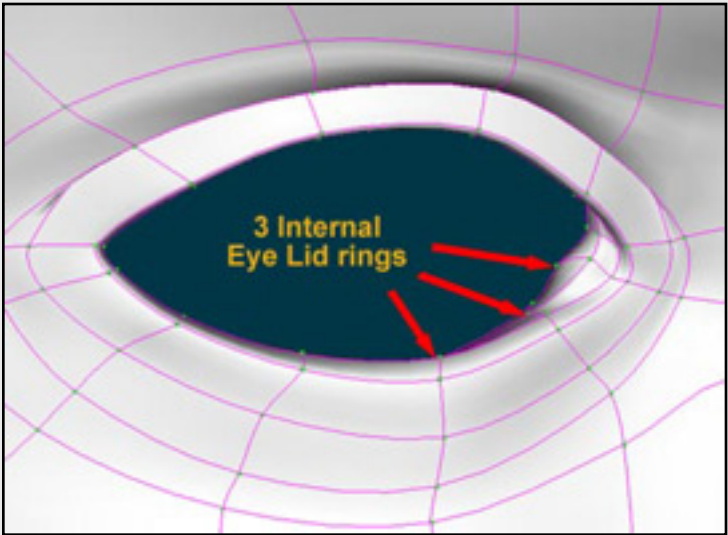
Notice the 5 point patches at the mouth crease and on the side of the cheek. Its generally a good idea to leave 5 point patches in the smooth areas and use something else near creases, but sometimes, depending on the splines and shape around the 5 point patch, it can be desirable to put a 5 point patch near a crease. They give a better crease than some other options.



Step 6.

Extrude the ring that makes the hole of the eye inward to create a nice round eyelid. 3 extrusions should do it. Sculpt the little round tear duct in the inner corner of the eye as well.

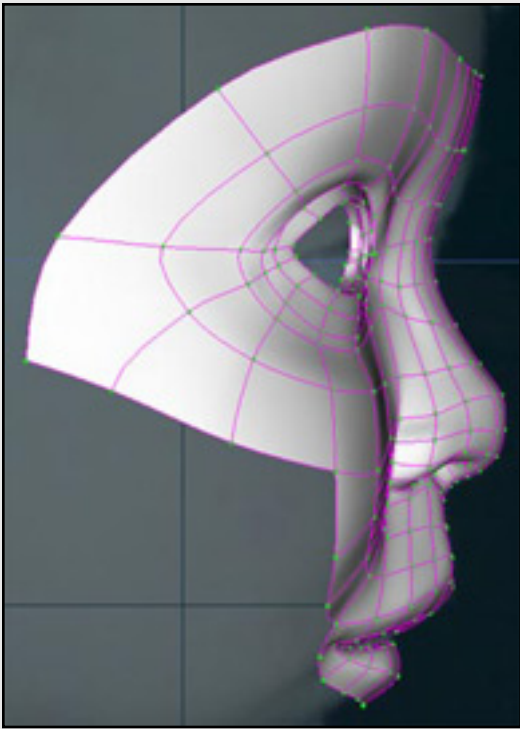
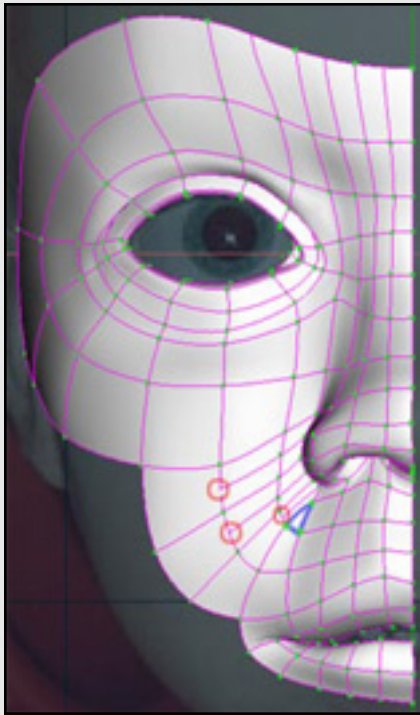
Make sure you pull these rings back into the head enough so that the eyeballs don't have a space between themselves and the lids.



Step 7.

Continue to model the cheeks in the same fashion and flesh out the lips more.

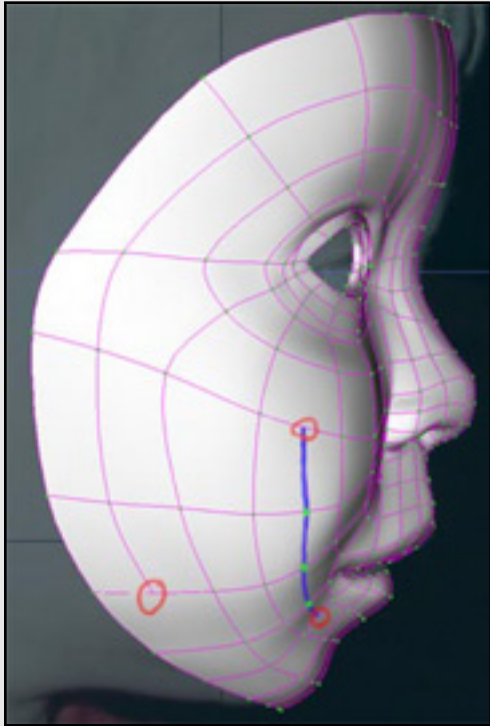
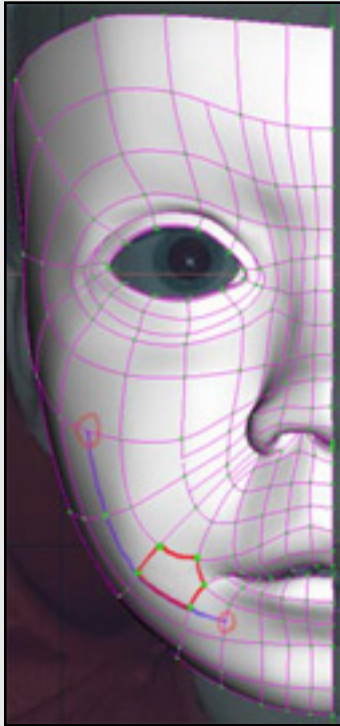
Notice the hooks in the cheek to simplify the mesh. And sin of sins the 3 point patch near the nose. Sometimes they don't crease. You just have to play with it, but try to avoid them when possible, or hide them in nooks if you can.



Step 8.

Another 5 point patch and some hooks and your half way there.

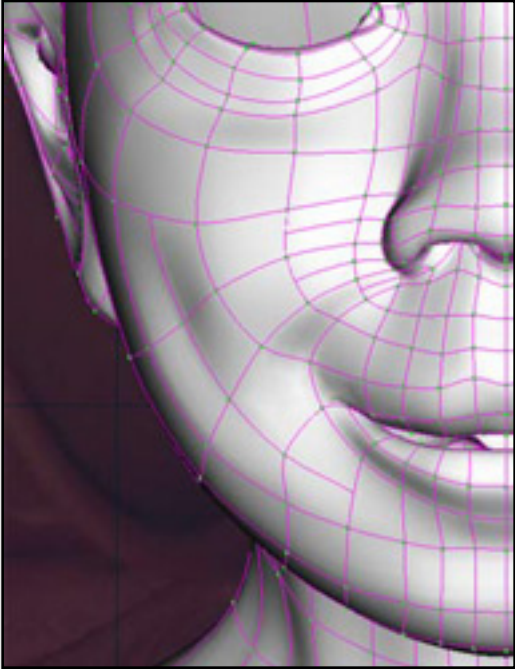
Notice the spline in the cheek. I added this to allow for dimples when he smiles. They might require more mesh, but that can be added later. If your model doesn't have dimples, then leave the spline out.



The five point patches around the mouth should not cause any problems, but if they do you can use hooks to bring the bottom lip line up to the mouth crease. This will give you less control over the crease, but it wont render with any artifacts either.

I've shown the face with a smile to show that the five pointers are fine in this instance. The one in the crease looks rough, but it renders fine.

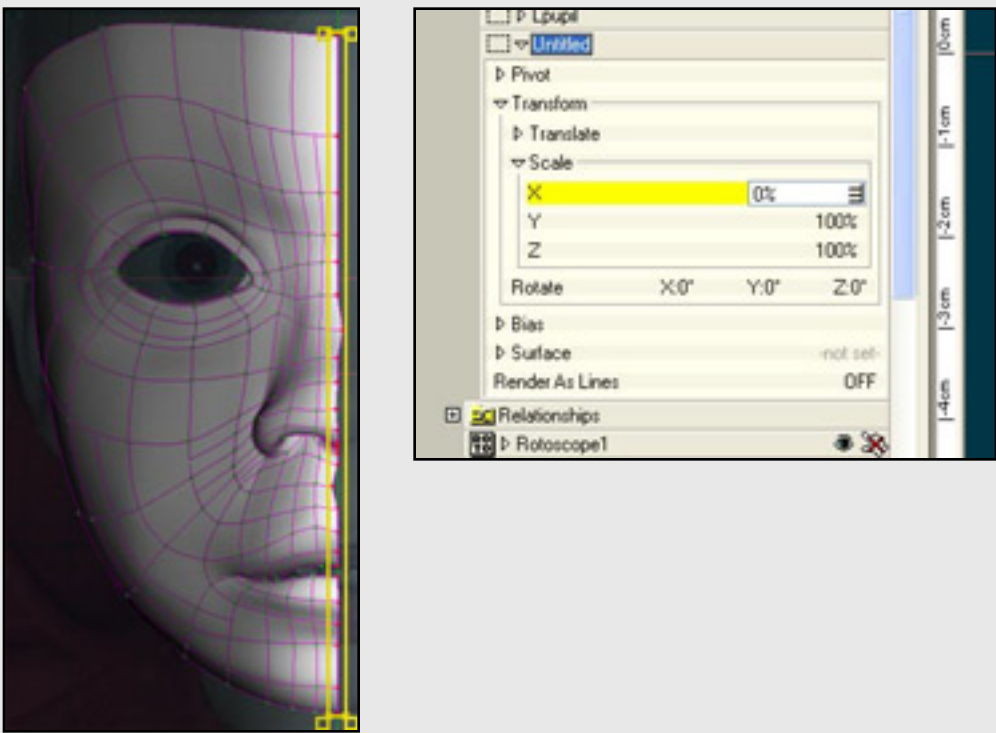
Notice the extra spline creating the dimple.



Step 9.

Now the not so tricky part. In order to use the copy/flip/attach tool that Hash so generously gave us, we have to make sure that the middle spline Line is completely flat on the x axis.

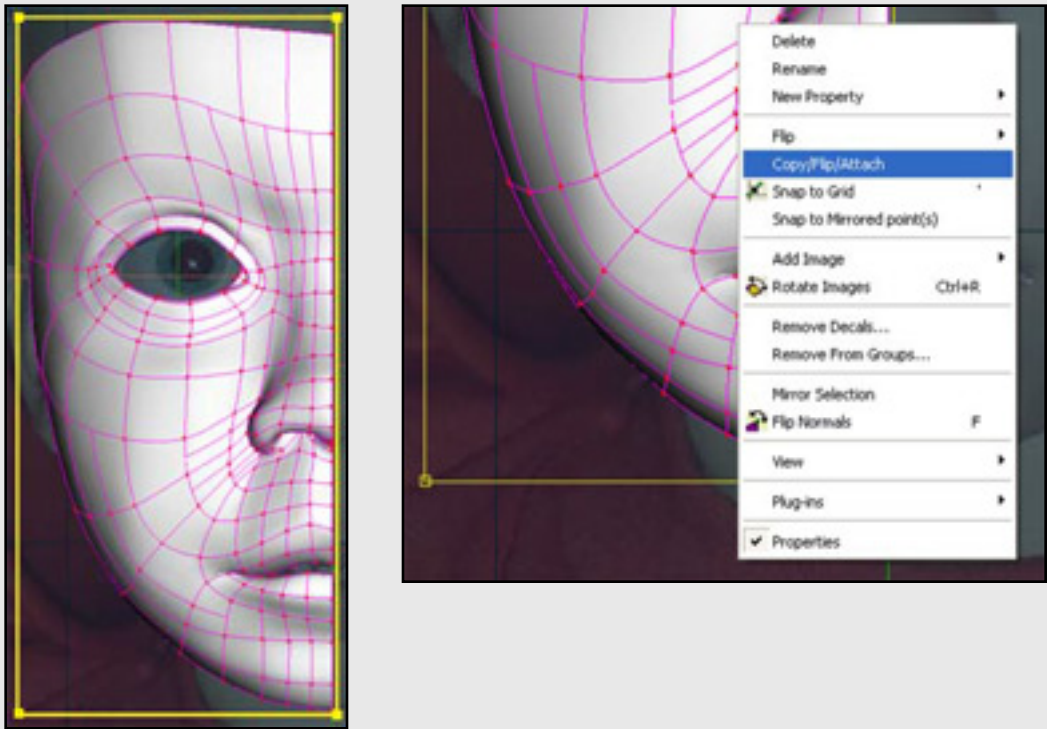
Select the middle spline and open up the transform/scale option under its temporary group. Enter 0% into the x axis and click in the modeling window. That should have given you a completely strait spline if it didn't then try again.



Step 10.

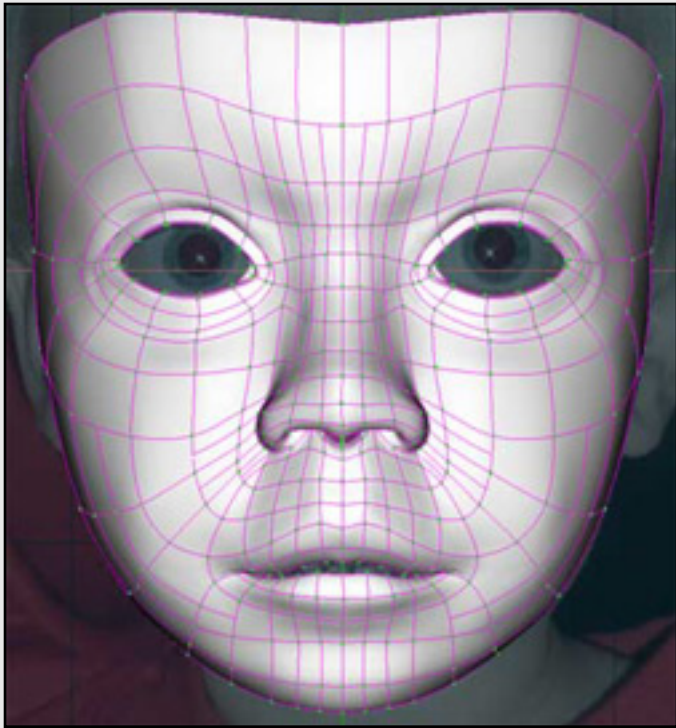
Now select the whole half of the face and right mouse click (Cmnd Mouse click on the Mac) to bring up the context menu.

Select Copy/Flip/Attach and



....

You're done for now.



[Back to tutorial index](#)

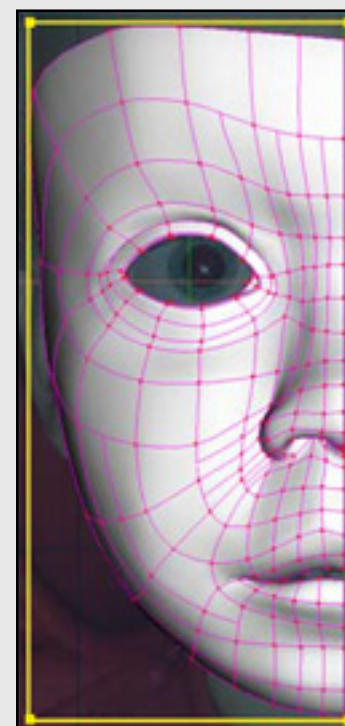
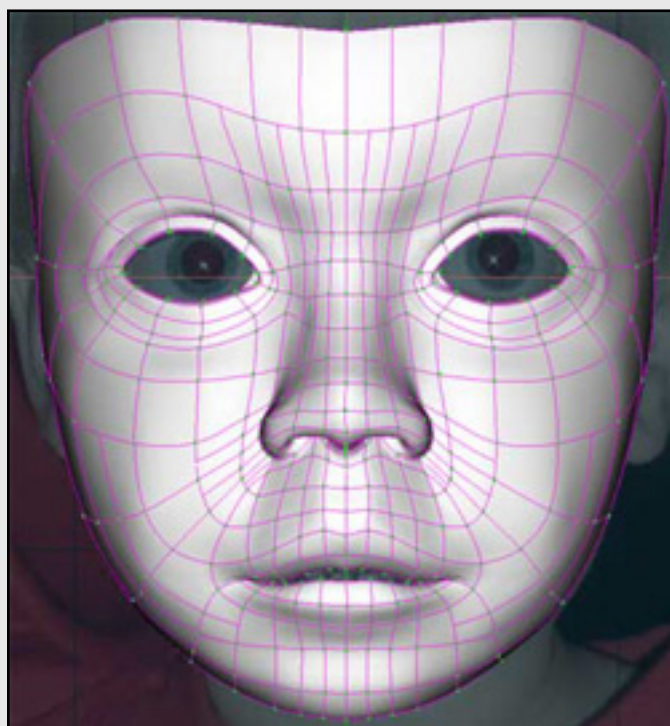
[Next tutorial](#)

Modeling the Head and Ears...

Step 11.

First, delete half the face, leaving the Center Spline. I know you're probably thinking, "What's this guy up to, I'm done with the face and he wants me to get rid of half of it?". Yes.

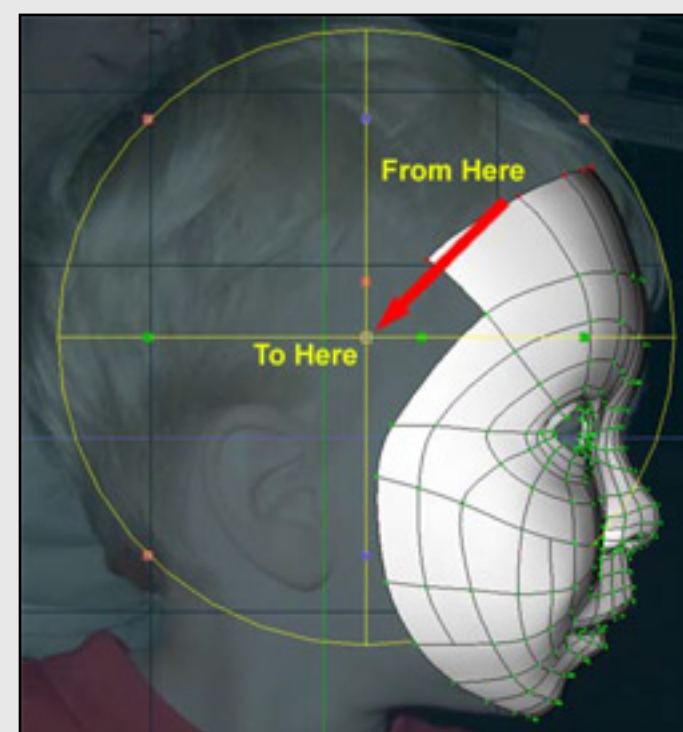
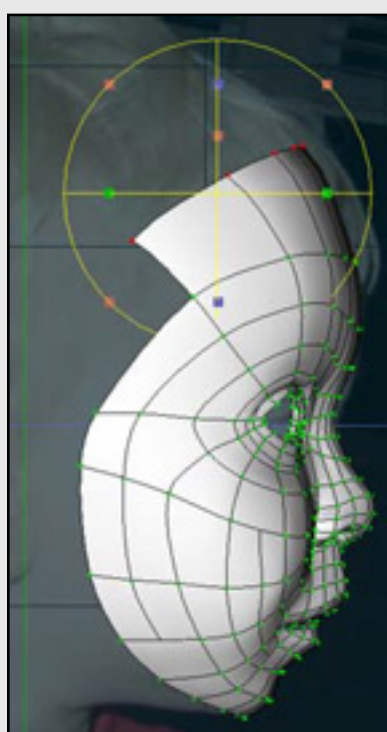
I usually check the symmetry of a model by doing the Copy/flip/attach before I'm done with the modeling. Sometimes things become noticeable that aren't when you only see the half. So before you delete the half of the face, check your work out and tweak the points in Mirror mode, then delete one half of the face.



Step 12.

From the side view select the line of splines along the brow line. Extrude the spline line (E). With the new splines still selected, Select the rotate manipulator (R) and grab its center point. Drag the center down and toward the ear to shift the pivot point for the rotation. Now you can rotate the splines upward and back and they should follow the line of the head.

Notice how the Rotate Manipulator's Circle follows the line of the skull. That's the trick to Extruding and Rotating the shape of the skull.

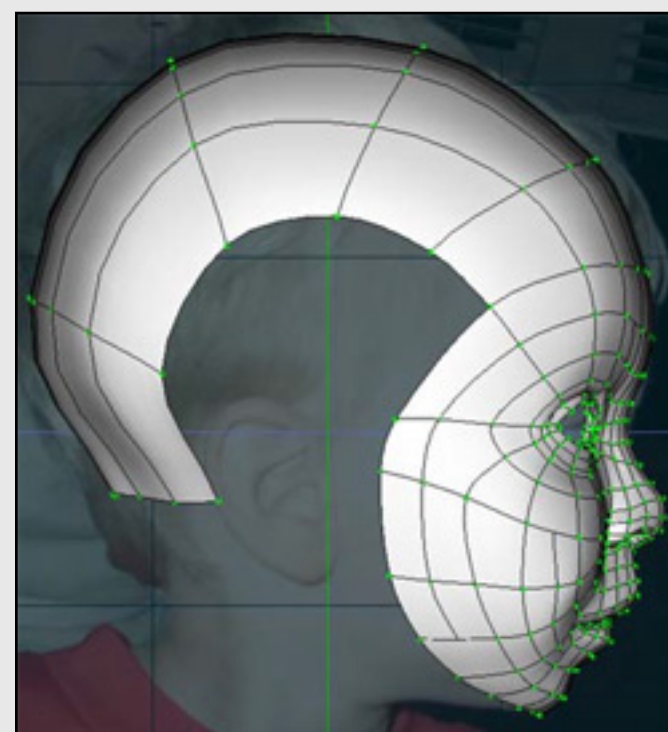


Step 13.

Repeat step 12 with each new spline line until you have the shape of the skull back to the neck.

Then adjust the splines of the skull to match whichever style cranium you're going for. In children the back of the skull is larger than the forehead, and flares out slightly behind the ears, before it curves back into the neck.

Don't forget the little divot at the back of the cranium where the muscles of the neck bulge on both sides of the vertebrae.

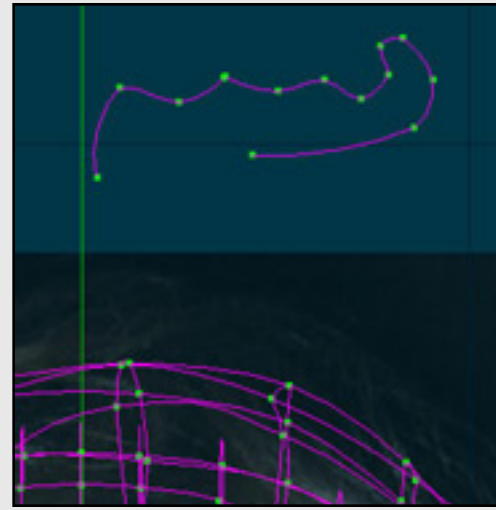


Step 14.

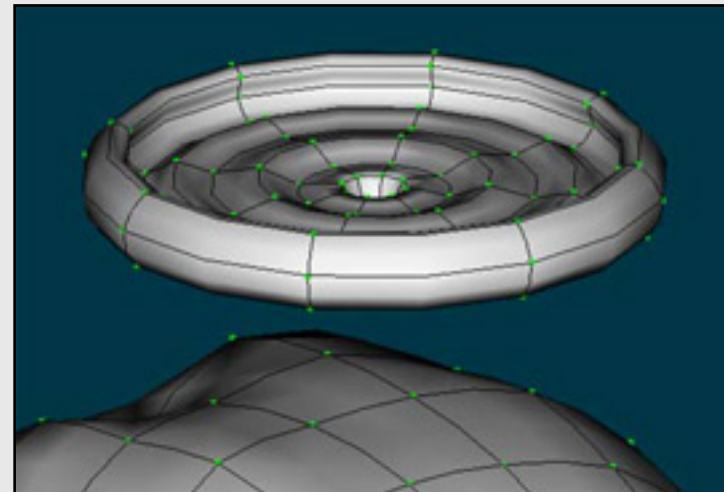
Now the ear. In the front view, create the spline line that looks like Bullwinkle's horn.

Notice that the inner point isn't centered on the y axis. This will be the ear hole.

Make sure that the splines are at zero on the z axis though. Do this by going to the side view and moving them to the center line if necessary. If this isn't done the splines won't lathe properly.

**Step 15.**

Lathe the spline line. Doesn't look much like an ear yet does it?

**Step 15.**

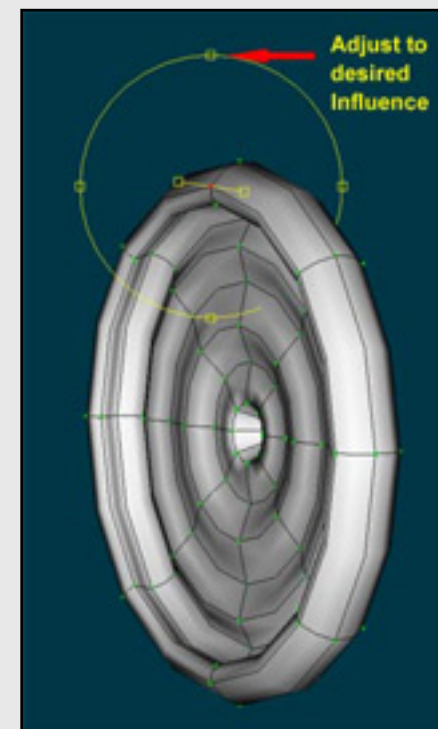
Rotate the ear into its vertical position and start tweaking with the magnet tool.

If you're not familiar with the magnet tool then you're modeling the hard way. This tool is used to smoothly sculpt points by adjusting a sphere of influence around a selected point.

When you use it you can move hundreds of points or just one and they'll all move in an orderly fashion. Translation: Lots and lots of time saved.

All you have to do to use the tool is adjust one of the four points on the sphere you get when you select a point. The bigger the sphere the more points you'll pull. The smaller... well you get the picture.

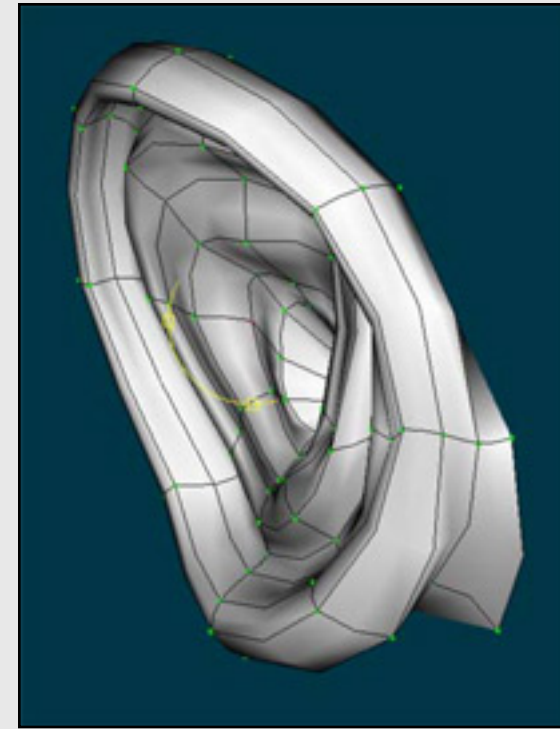
You don't have to select just one point either. You can still select multiples, but it can get confusing quickly if you do.



This is a shot of the ear after just a few tweaks with the magnet tool.

You may have to delete some of the points on the back outer rim of the ear in order to allow for attaching the ear to the skull. Most likely these will be the ones in the front of the ear, but it will depend on the shape you lathed from the beginning.

In this case I had to delete two patches on the front of the ear and pull the rest forward to flatten the front slightly.

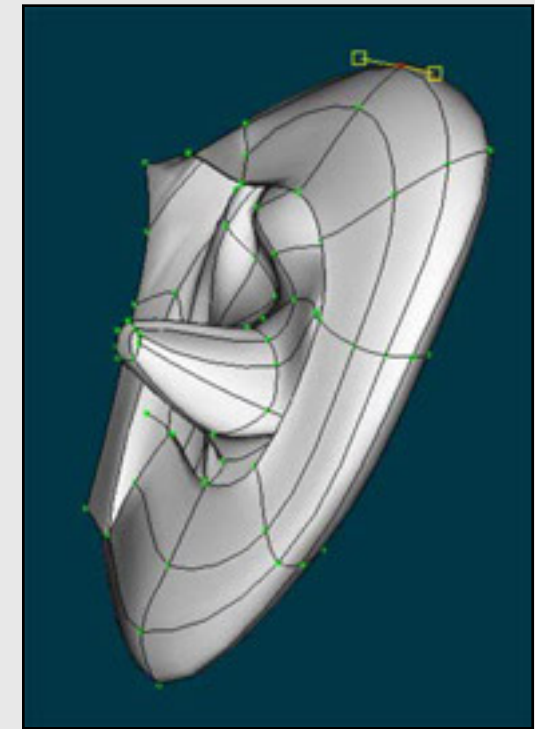
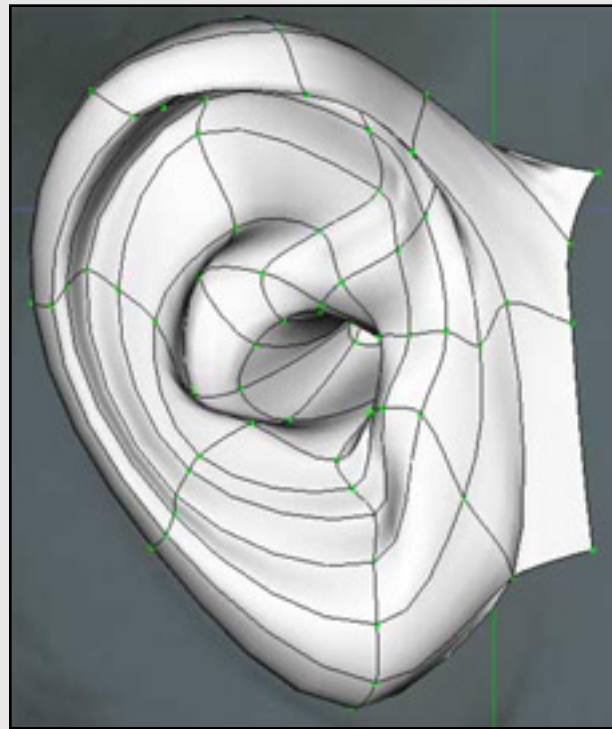


Step 16.

Don't forget to work from your rotoscope. Hide the head and position the ear for your final tweaks.

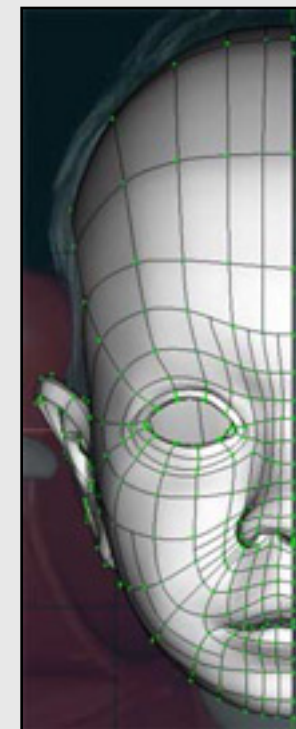
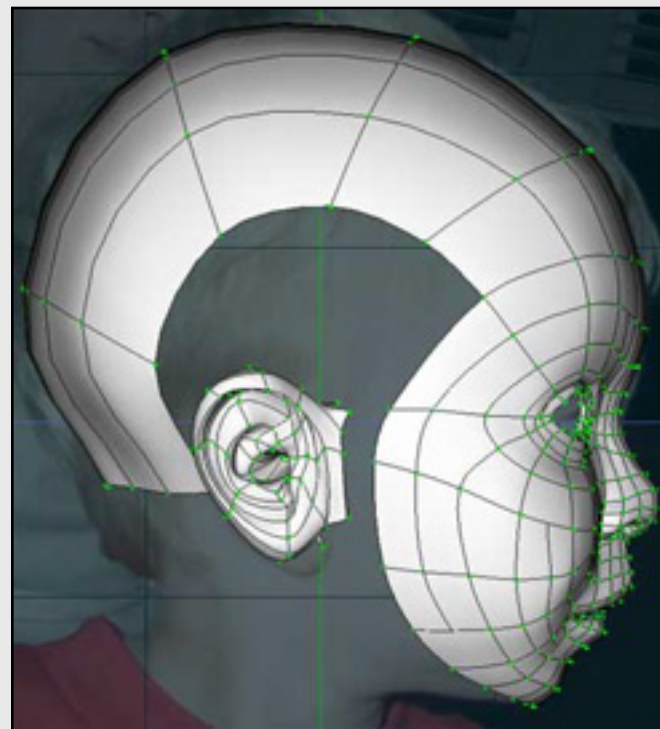
Notice the front of the ear, and how I deleted some of the patches to bring it into the head.

The far Right image is a shot from the back of the ear.



Step 17.

Unhide the skull and position the ear to attach it to the Cranium.



Step 18.

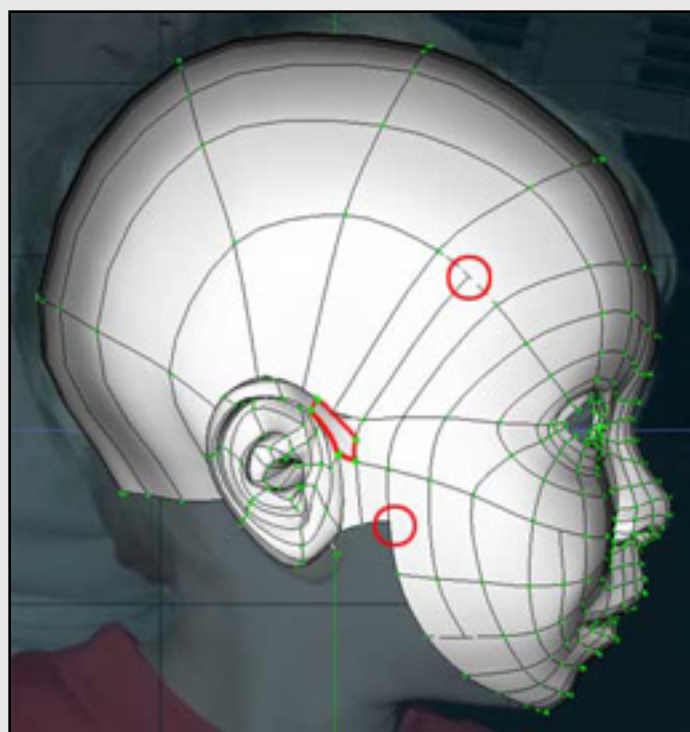
Now one of the hardest things to do. Reattach a severed ear... Seriously though. This is where you start to see why doctors go to school for another four years.

I'm not saying that attaching the ear is hard. Attaching the ear smoothly, that's hard! But with a little practice on cadavers and some late nights studying...

OK I'll drop the analogy.

There are no rules here just try and try again. Hooks, 3 pointers, 5 pointers, dangling splines. Do what you have to.

Notice the use of hooks and a 5 point patch for my ear.

**Step 19.**

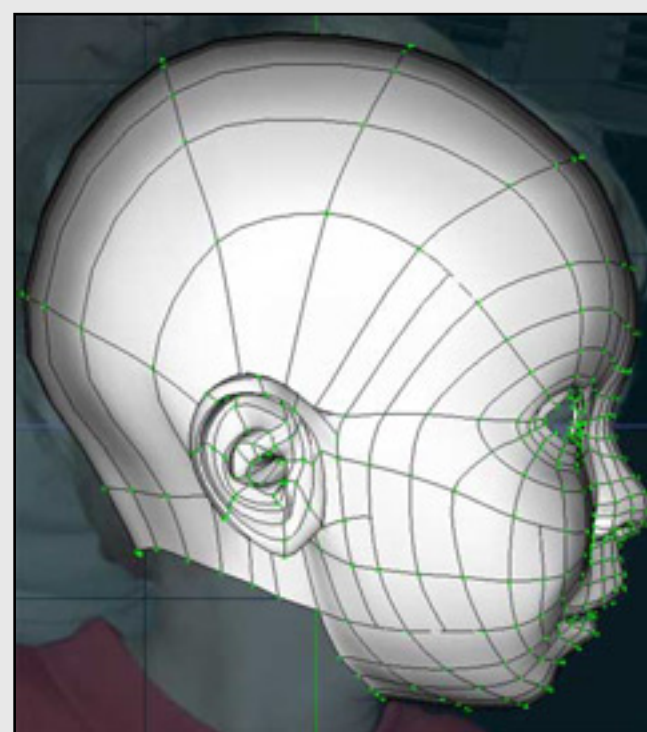
Now extrude the jaw back and the neck down. Then connect the splines where they should meet.

Notice how I did it just under the ear. And I used one more hook right on the jaw line.

If you are observant and I'm sure you are you'll see that the spline that last hook is a part of is hooked on both ends. The other end is at the temple.

Why have the spline at all? Well in my case it was necessary to get the ear to attach correctly. Without it "Weighing" the splines coming off of the ear down I couldn't get the attachment to be smooth.

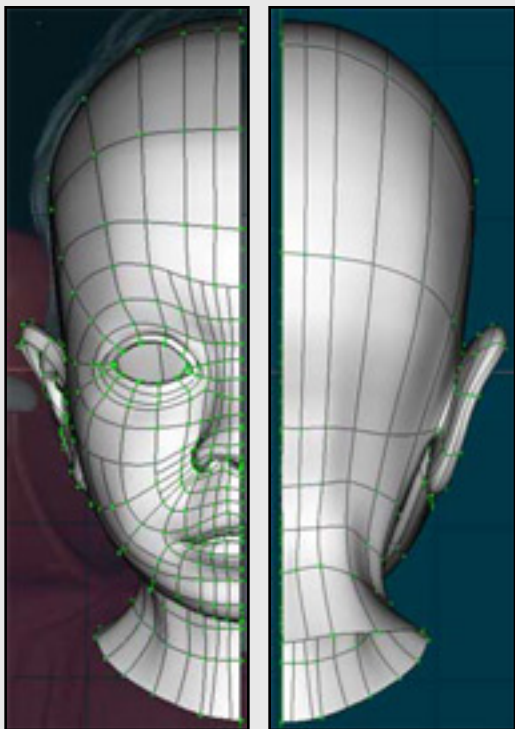
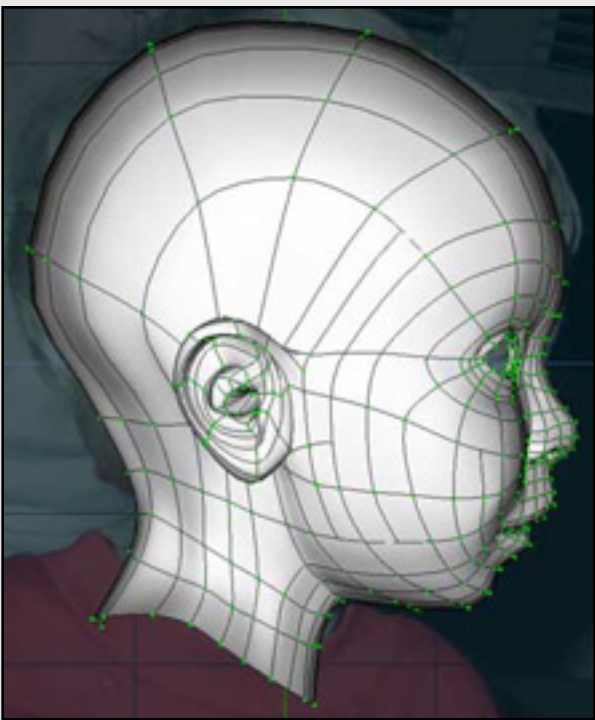
I didn't want to have to rebuild the ear so I compromised. Good thing I didn't become a real doctor, this patient would have a huge scar on

**Step 20.**

Next, select the spline ring that will make the neck. Extrude the rest of the neck down to the clavicles with about 3 extrusions.

Notice the flair from the front view that makes up where the deltoids attach to the neck vertebrae.

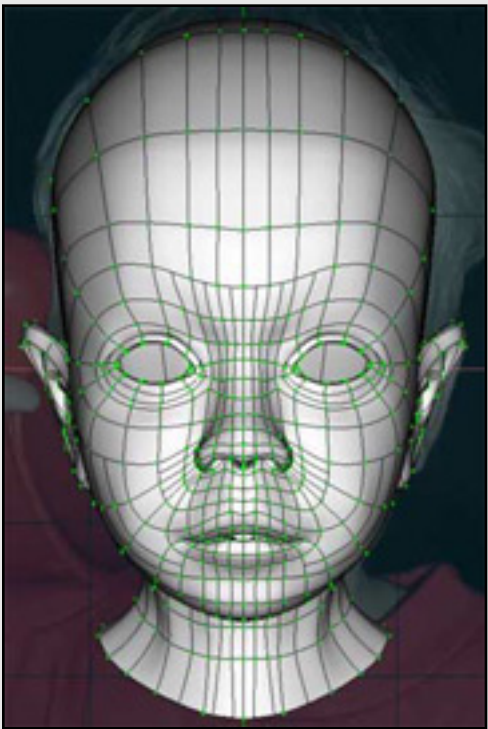
The far right image finally shows a shot of the back of the head.



Step 21.

Finally, select the half of the head. Right mouse click (cmd click on Mac) and Choose Copy/Flip/Attach from the pulldown.

The Head is done. Next we'll work on the eyes, mouth and hair.

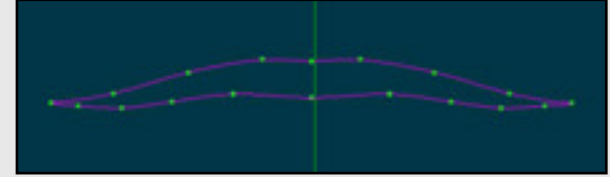
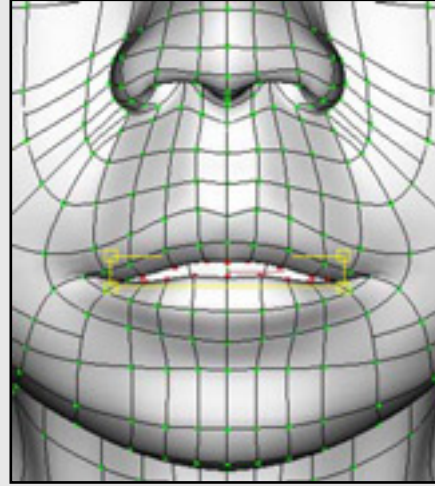


Modeling the mouth...

Step 22.

Select the ring of splines that makeup the inner lips.

Hide the rest of the geometry.



Step 23.

Extrude the ring and pull the next spline ring back.

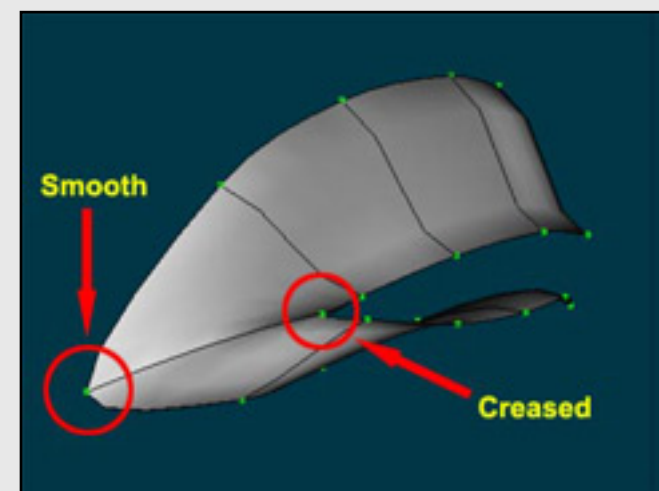
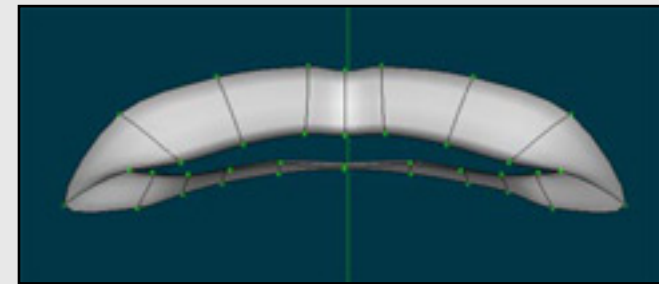
There may be a crease in the lip depending on how you created the edges of the mouth. This is perfectly fine but its probably a good idea to fix the crease on the next spline ring.

Break the spline by clicking on one of the splines that are creased and hitting shift k or k. Sometimes k won't break the spline, depending on the situation.

Once the spline is broken simply reattach it and the continuity of the spline should be restored.

The image to the right illustrates the creasing and what the fixed spline looks like.

This is a trivial issue unless your character's mouth will open wide in animation. If it does and the crease is there it might look odd.



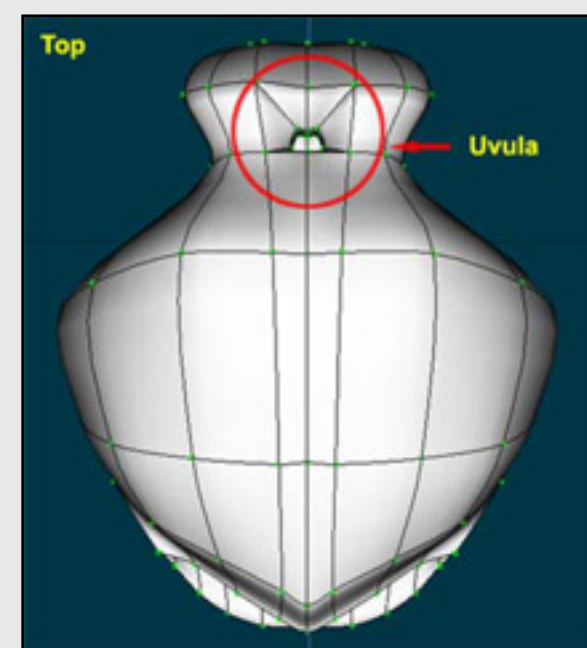
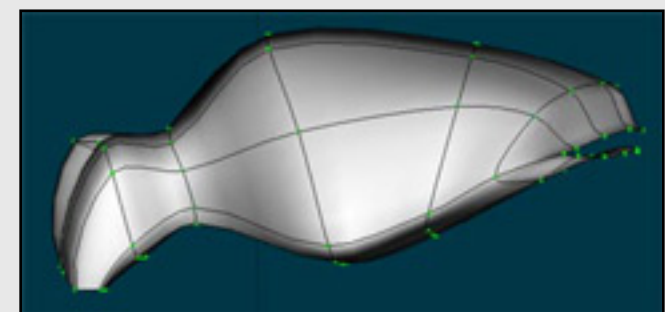
Step 24.

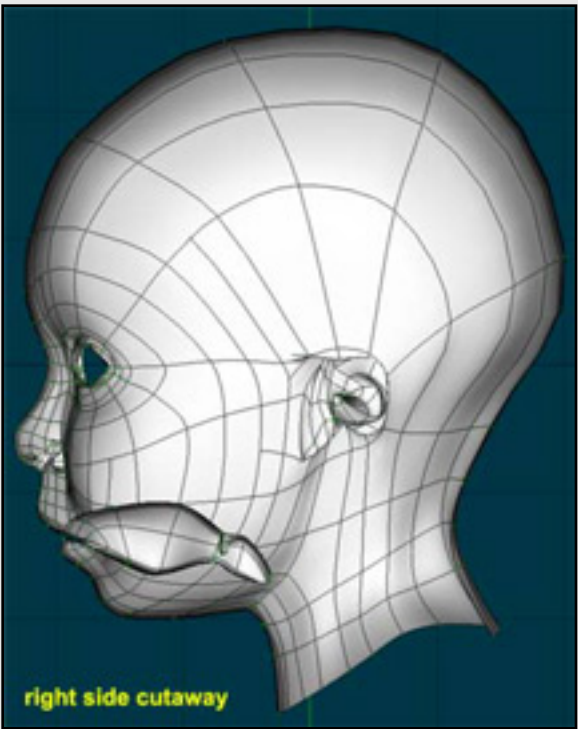
Continue extruding the spline rings back to create a shape similar to the one on the right and bottom left. This can be easily achieved by extruding and scaling the entire ring to create the shape.

Notice the Uvula (punching bag) that was inserted into the shape by lathing a cross-section and breaking and attaching splines to close the holes.

There are creases in the corners of the Uvula, but they probably wont be noticeable so far back in the mouth.

The image on the bottom shows a cutaway of the head and the position of the mouth.





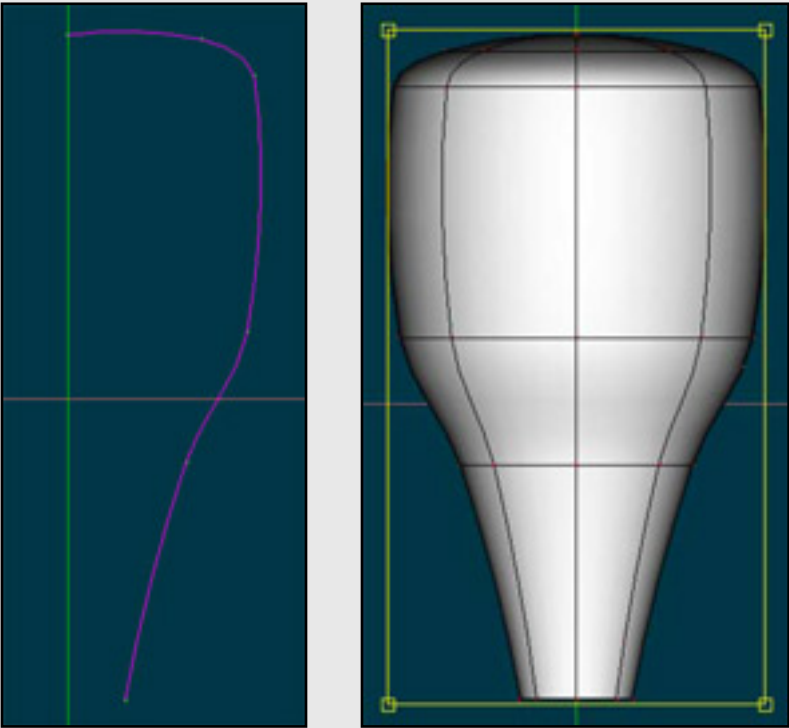
The Teeth and gums

Step 25.

Create an outline similar to a light bulb. The less points the better

Lathe the outline.

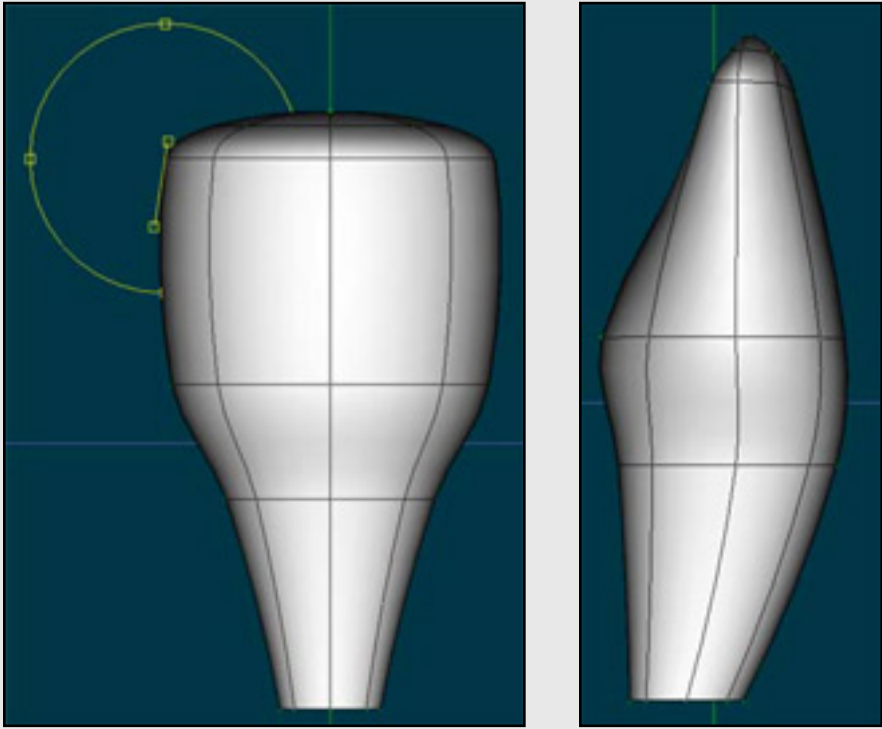
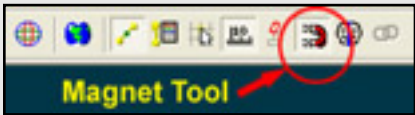
Notice the open end at the bottom. I didn't close the whole because this will be hidden by the gums.



Step 26.

Using our old friend the Magnet tool, sculpt the tooth to look like the images on the right.

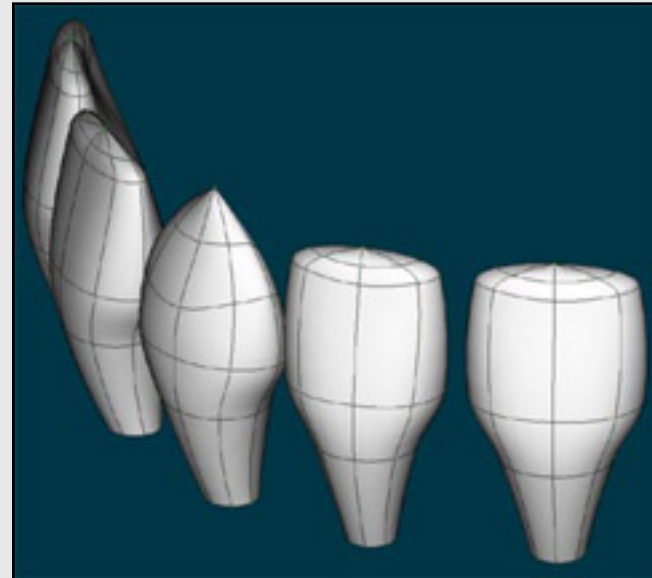
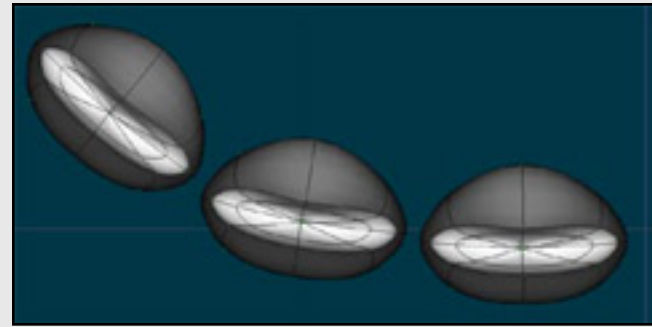
The far image shows the tooth from the left side.



Step 27.

Copy and paste the tooth to create a row of teeth.

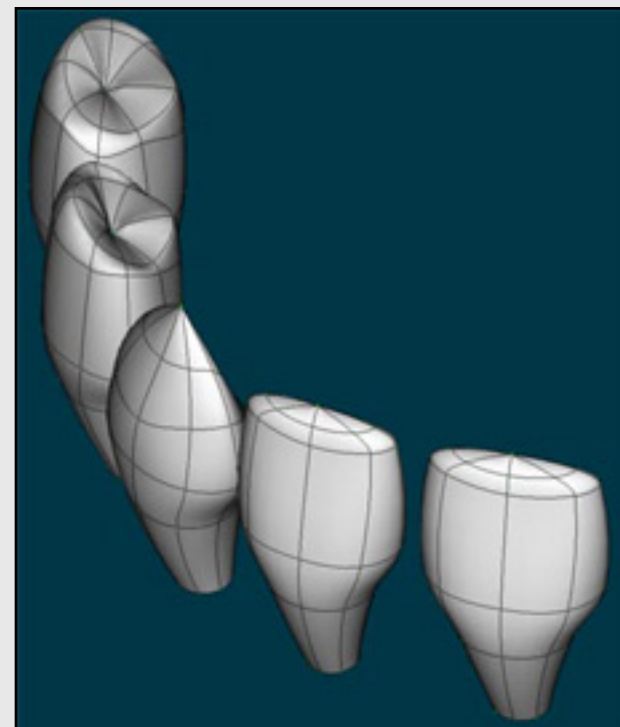
Sculpt the third copy to make it point and have a little more sharpness than the others. Nudge it up a little as well.

**Step 28.**

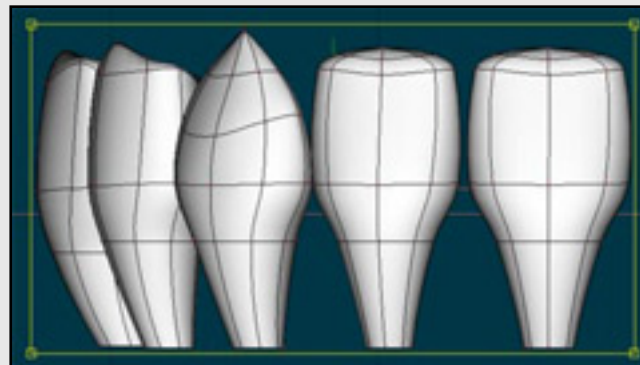
Continue sculpting the next two teeth to make them into molars. This is done by grabbing the center points at the pole and pulling them down into the tooth.

Then pull the front and back points on the edge up to create cusps.

Scale these two teeth on the x axis as well to make them fatter.

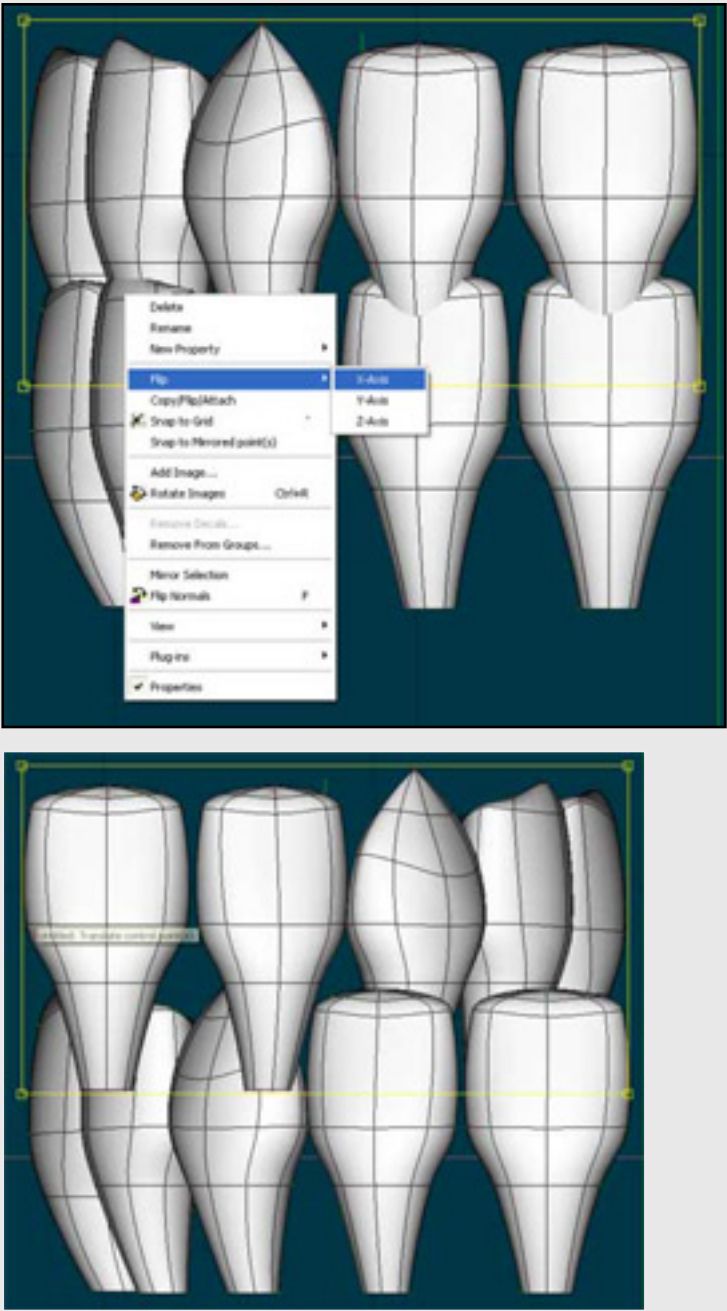
**Step 29.**

Select the row of teeth in the front view.



Right Click (cmd click on the Mac) and flip the copy on the x- axis.

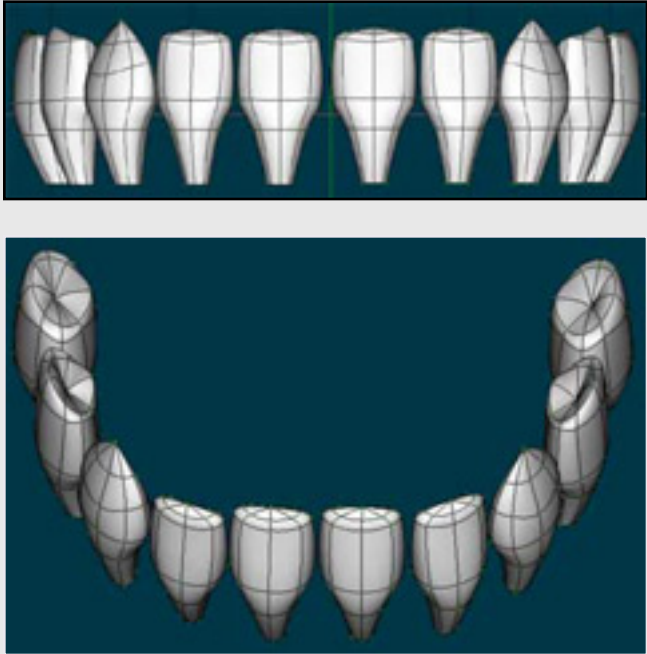
The result should be the other side of the bottom row of teeth.



Step 30.

Move the teeth into place.

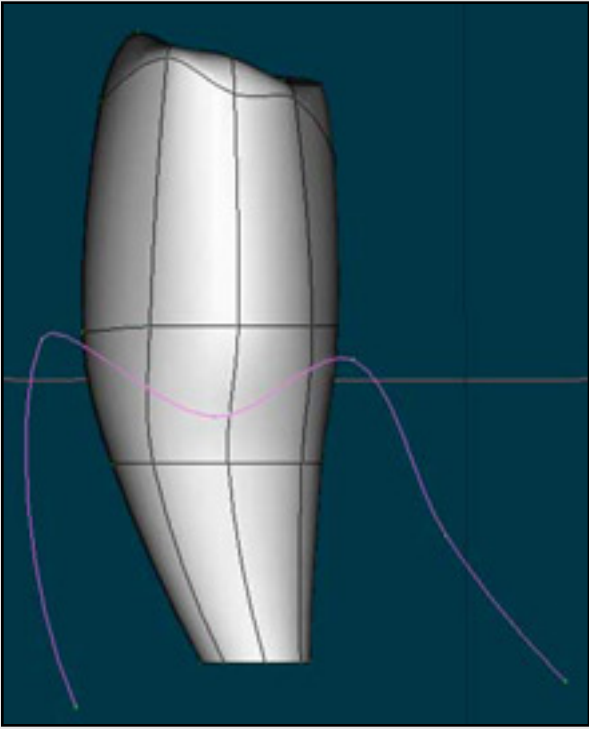
The bottom right picture shows the finished row of teeth, with some slight tweaking to keep them from being too perfect.



Step 31.

Hide all the teeth but the back right molar.

Draw a spline to create the line of the gums of the molar. Make sure you draw this at the height of the gum not the low point.

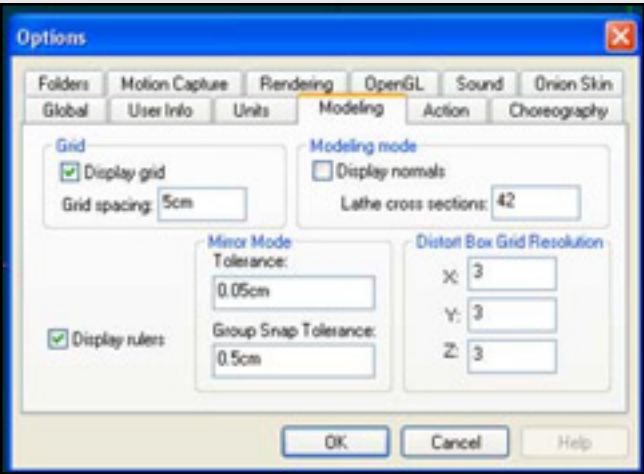


Step 32.

In the modeling tools options set the "Lathe cross sections" option to $((\text{number of Teeth} \times 2) \times 2) + 2$.

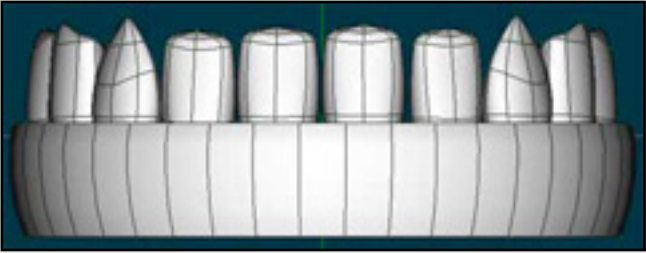
In my case I have 10 teeth so that works out as follows... $((10 \times 2) \times 2) + 2 = 42$

This gives you enough splines on the ring to create a simple mesh but fairly realistic gums.



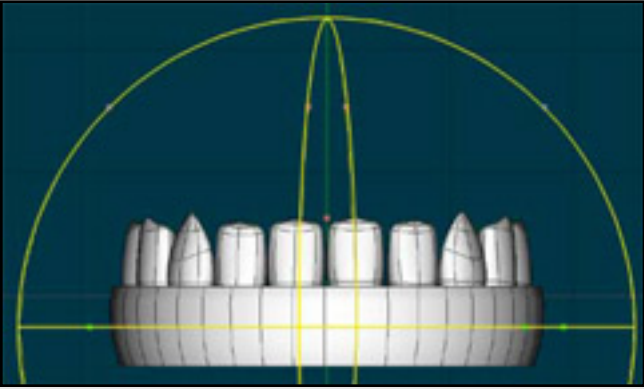
Step 33.

Lathe the gum cross section.



Step 34.

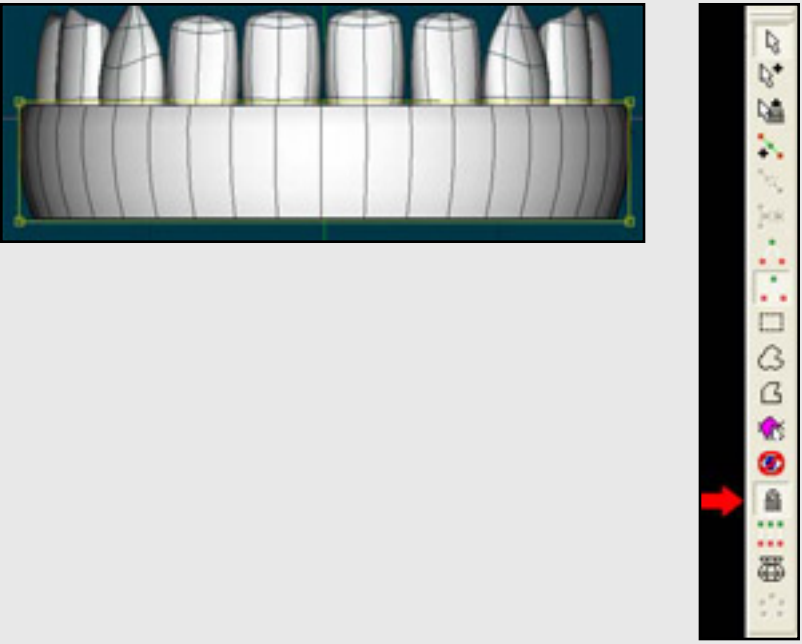
Select the gums and rotate them so that the splines line up between the teeth.



Step 35.

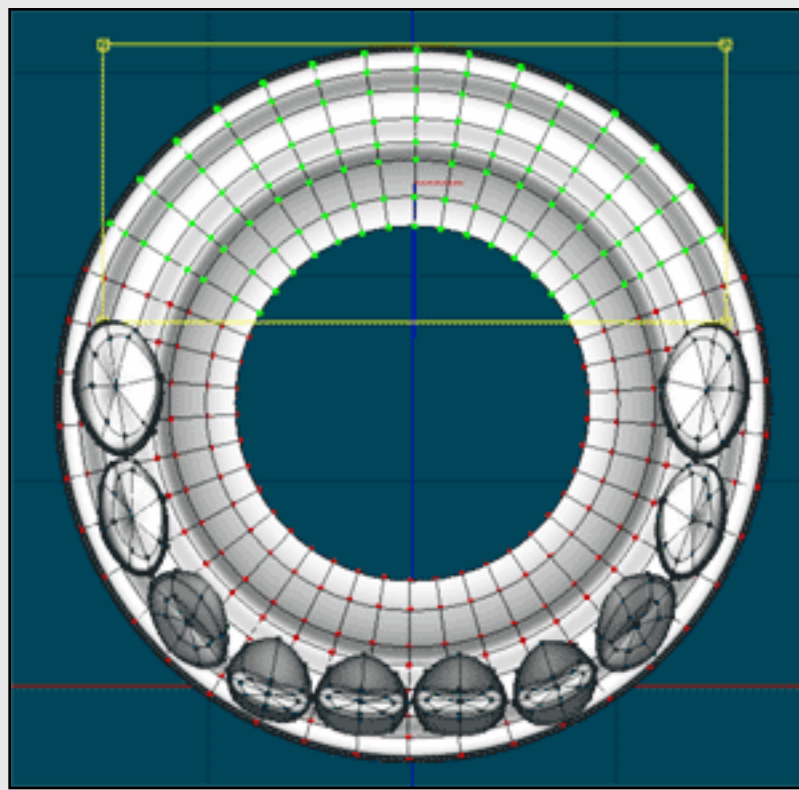
Select the gums and Lock them so that you may edit them without accidentally selecting points on the teeth.

You could hide the teeth, but you'll need to be able to see them in order to model the gums to fit them.

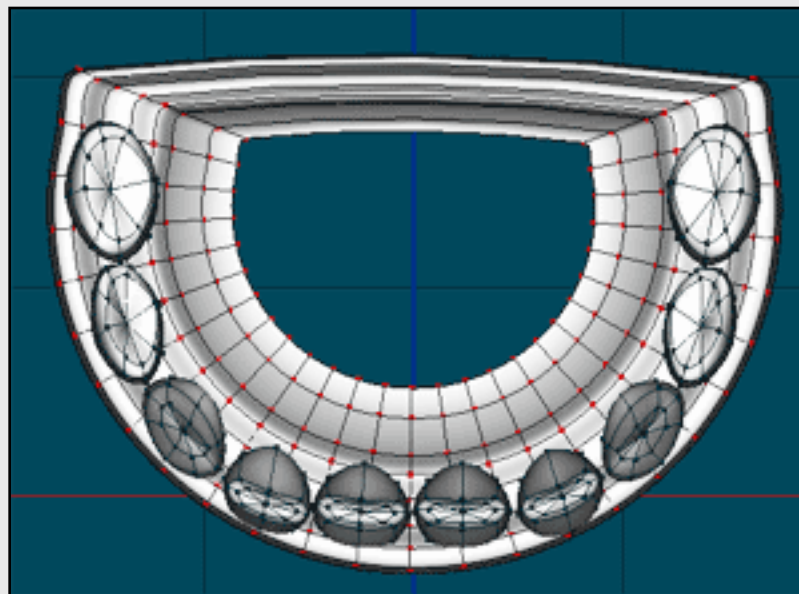


Step 36.

From the Top View. Select a little less than half the gums (make sure its the back half). This is easy to do with the lasso line mode.

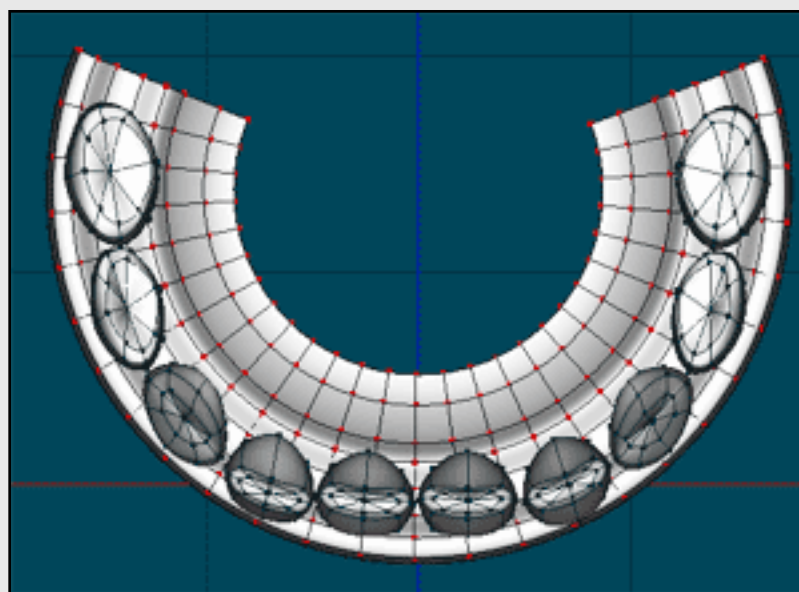


Then delete the selection. This will leave a bridge of splines across the back. Break these splines by selecting them and hitting the "k" key or "shift K" if you just want to break the connections... In our case we are getting rid of them, so break them with the "k" key (the shortcut to the break spline tool).

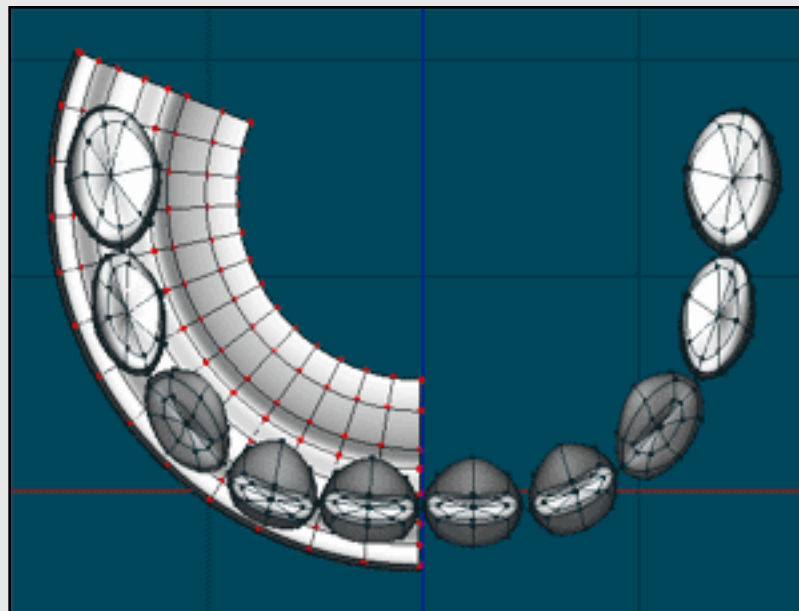


Now you are left with something like this...

However, we only really need to model half of the gums, since we can just copy/flip/attach that half to finish the other side. So select the Right half of the gums and delete them.



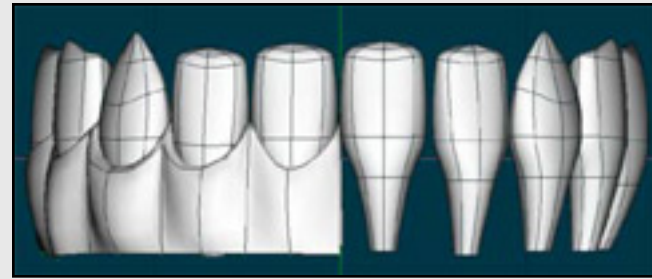
You should end up with something like this.



Step 37.

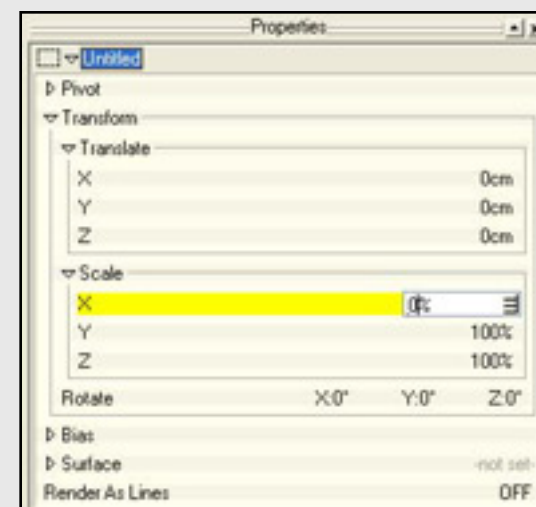
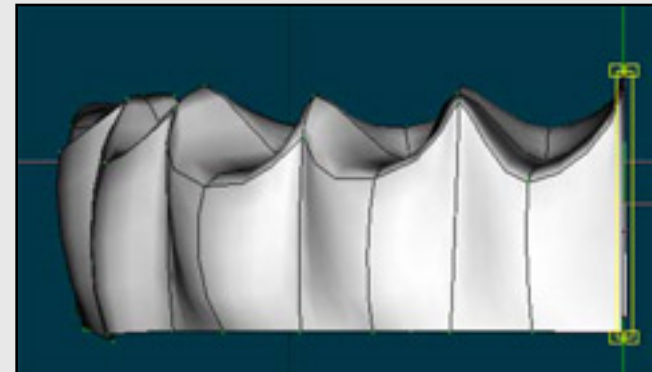
Sculpt the gums by pulling points, to look something like the image on the right.

Basically pull the points between the teeth up. Pull the points in front of the teeth down and create small ridges where the gums sink between the teeth.

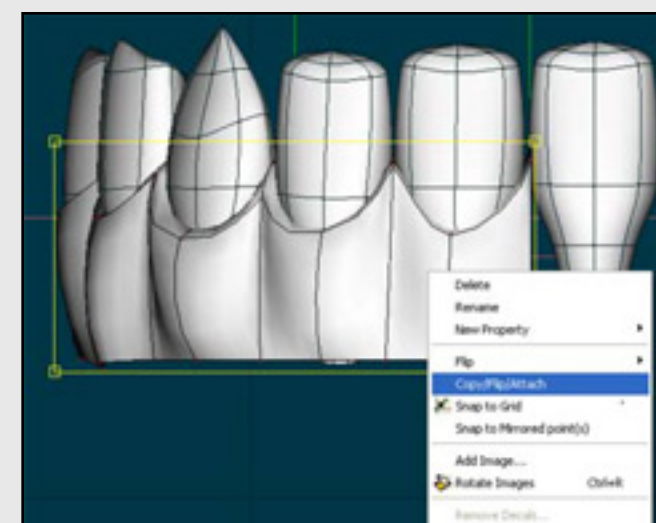
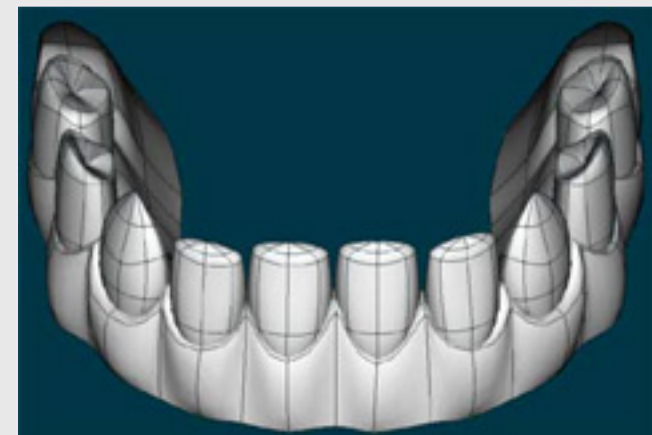
**Step 38.**

This is a good shot of the gums by themselves.

Grab the center spline and scale it on the x-axis to equal 0 percent.

**Step 39.**

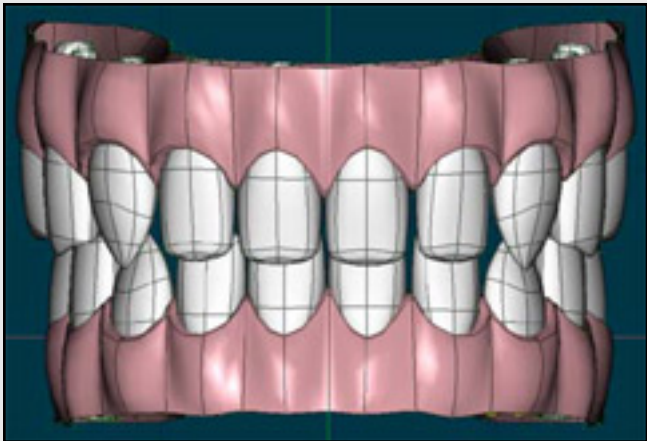
Select the gums and right mouse click (cmd click on the Mac). Select copy/flip/attach to finish the gums.



Step 40.

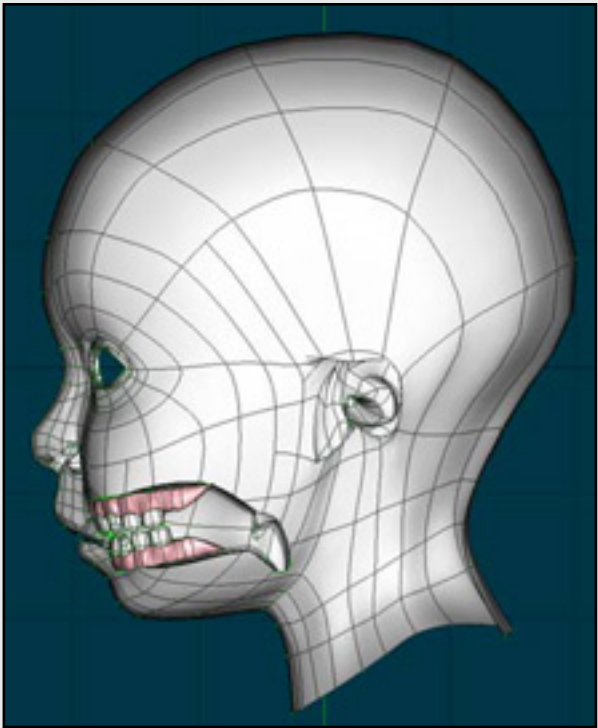
Select the gums and teeth and copy and paste them. Then right mouse click (cmd click on the Mac) to flip them on the y-axis.

Scale the upper teeth and position them as you like.



Step 41.

All that's left is to put the "Dentures" in.



[Back to tutorial index](#)

[Previous tutorial](#)

[Next tutorial](#)

Modeling Hair...

Step 42.

Take photos of your subject's head from several angles, side, top, front, back.

Using a software package such as photoshop, create alpha channels to separate the hair from the skin.

Once these alpha channels are created you can create a Hair texture with an alpha channel similar to the one on the far right. Your images may look very different depending the hair your working with.

For example Cooper's hair is blond so I used the green channel since it gave me nice light tones in the hair and a dark area outside the hair.

Once I have my channel I begin Dodging and burning the edges with the options set to Shadows and highlights respectively. This helps brighten the hair to a white and creates a black mask on every thing else.

My last step is to do a levels to make sure the blacks are black and the whites are white.

Save the final image as a Targa with an alpha channel.

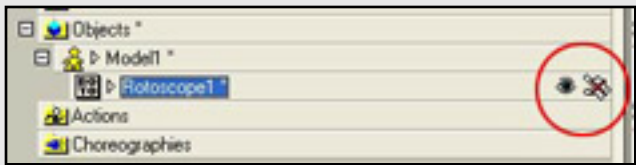
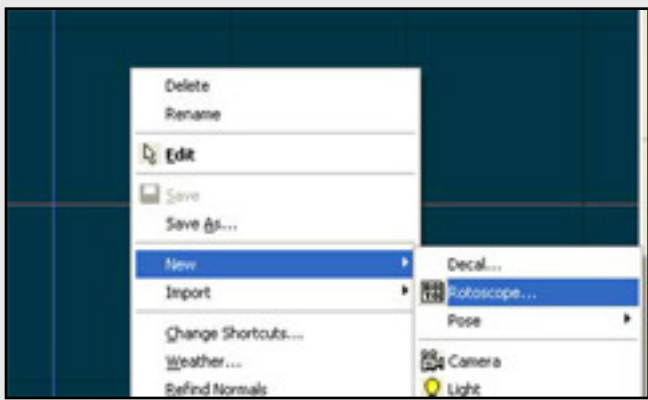


Step 43.

In AM create a new rotoscope in the TOP view by right mouse clicking (cmd click on the Mac) and selecting New/Rotoscope.

Load your Hair Targa.

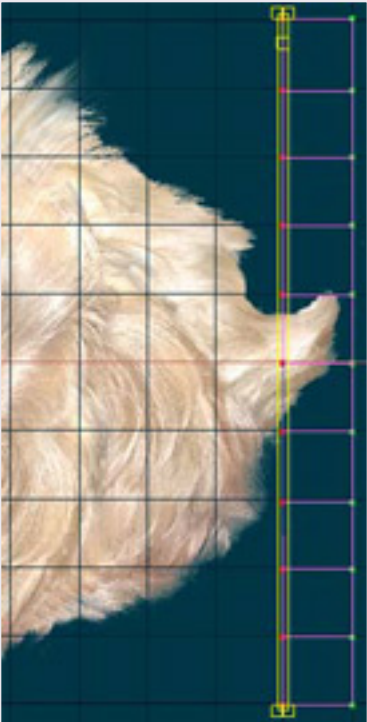
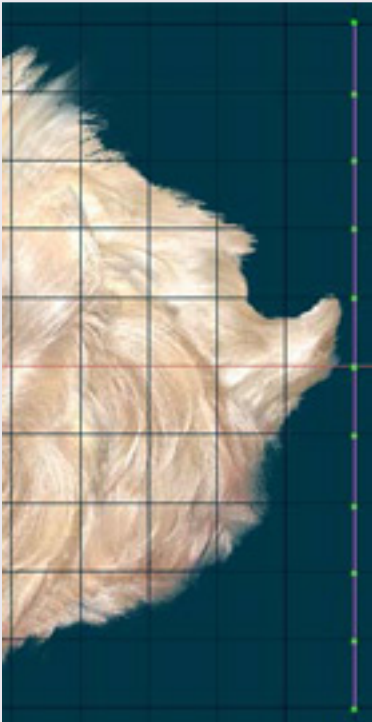
Make the Rotoscope uneditable by clicking on the hand next to its name in the project workspace.



Step 44.

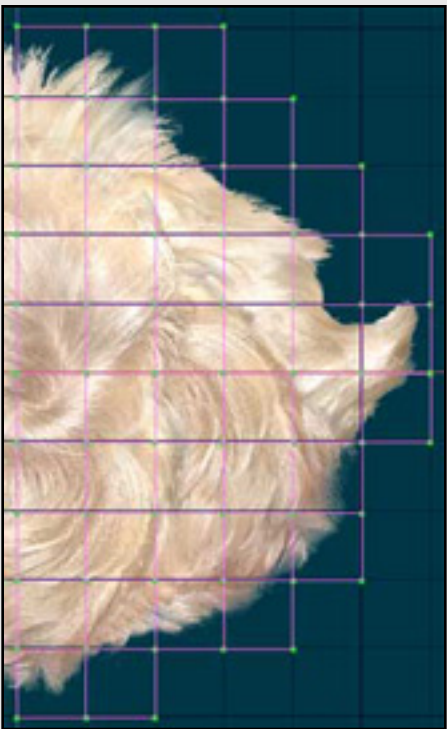
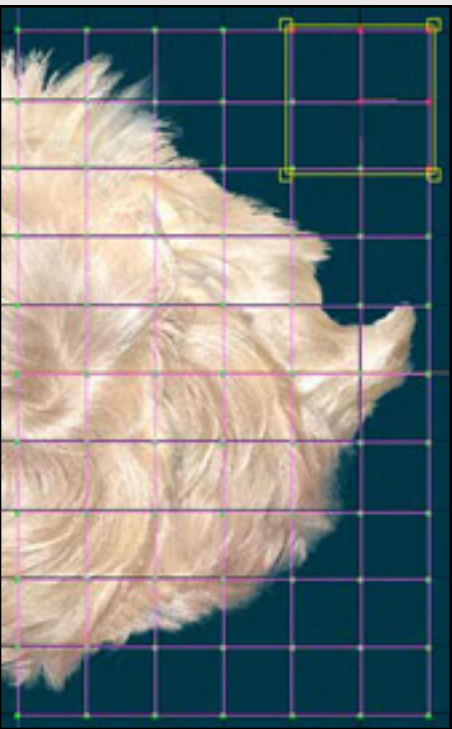
Draw a spline in the top view with enough points to create a hair piece that's will mold around the skull well but won't be too cumbersome to edit.

Begin extruding the spline to create a grid that covers your rotoscope. Only do half the hair.

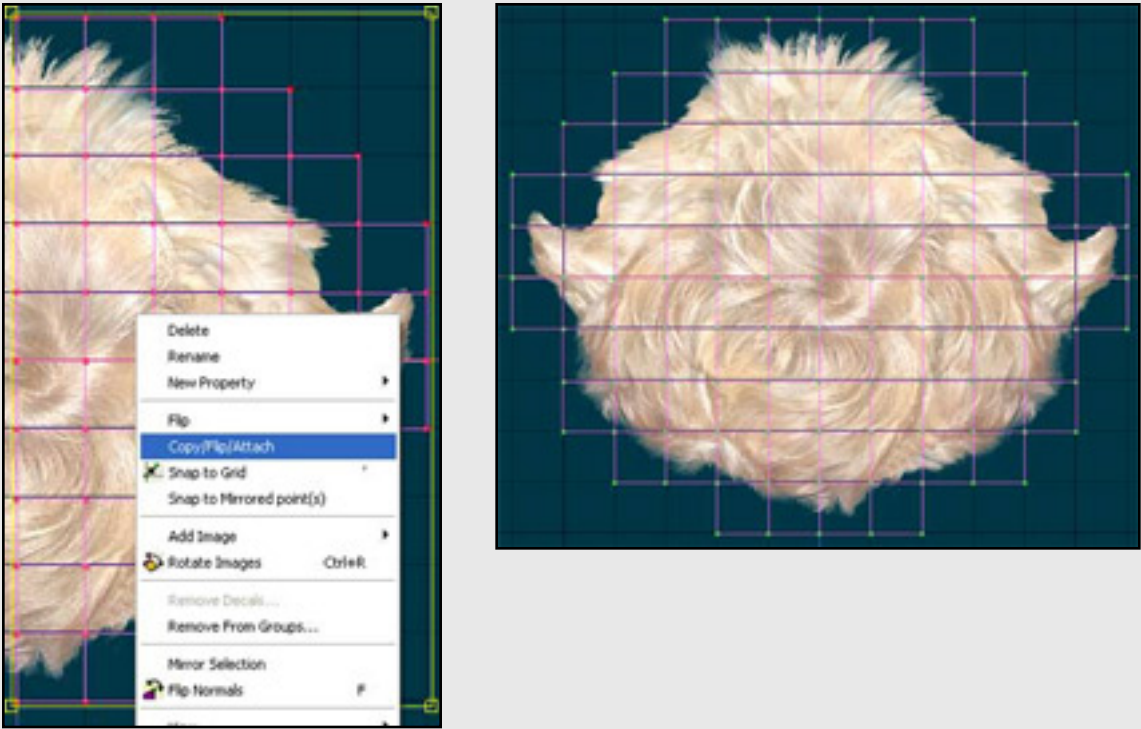


Step 45.

Select the Corner points that don't cover hair and delete them. They aren't necessary if they don't have a texture.



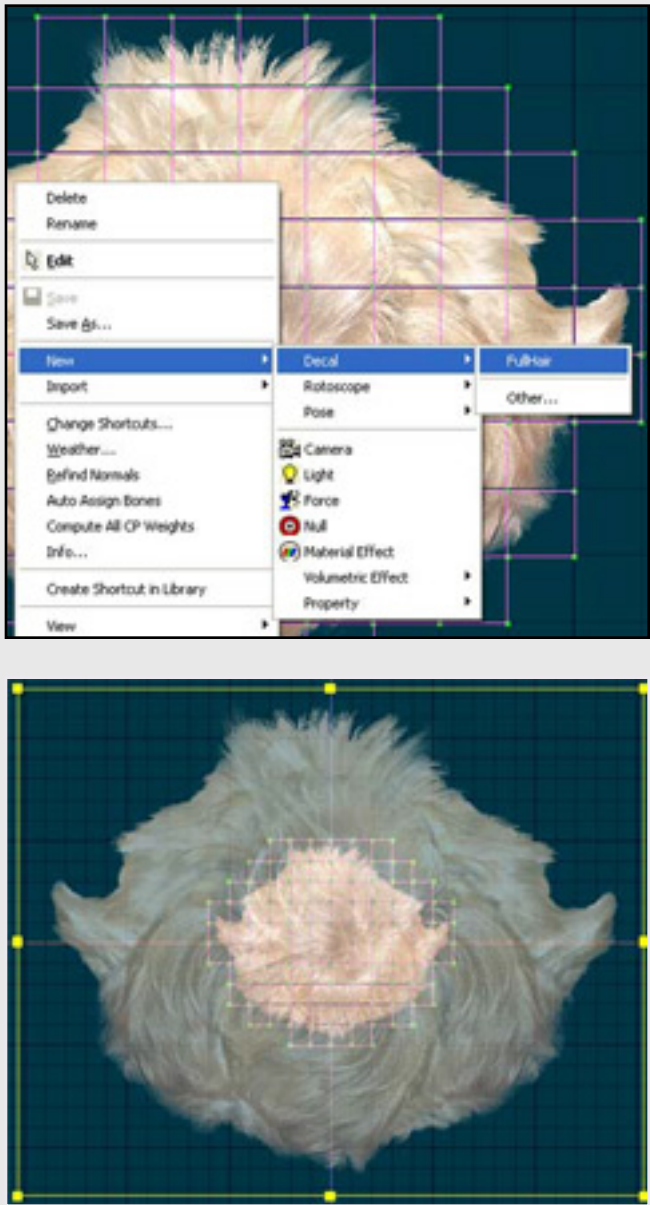
Step 46.
Select the Grid and copy/flip/attach to create the hair grid.



Step 47.
Right mouse click (cmd click on the Mac) and select new/decal/Fullhair.

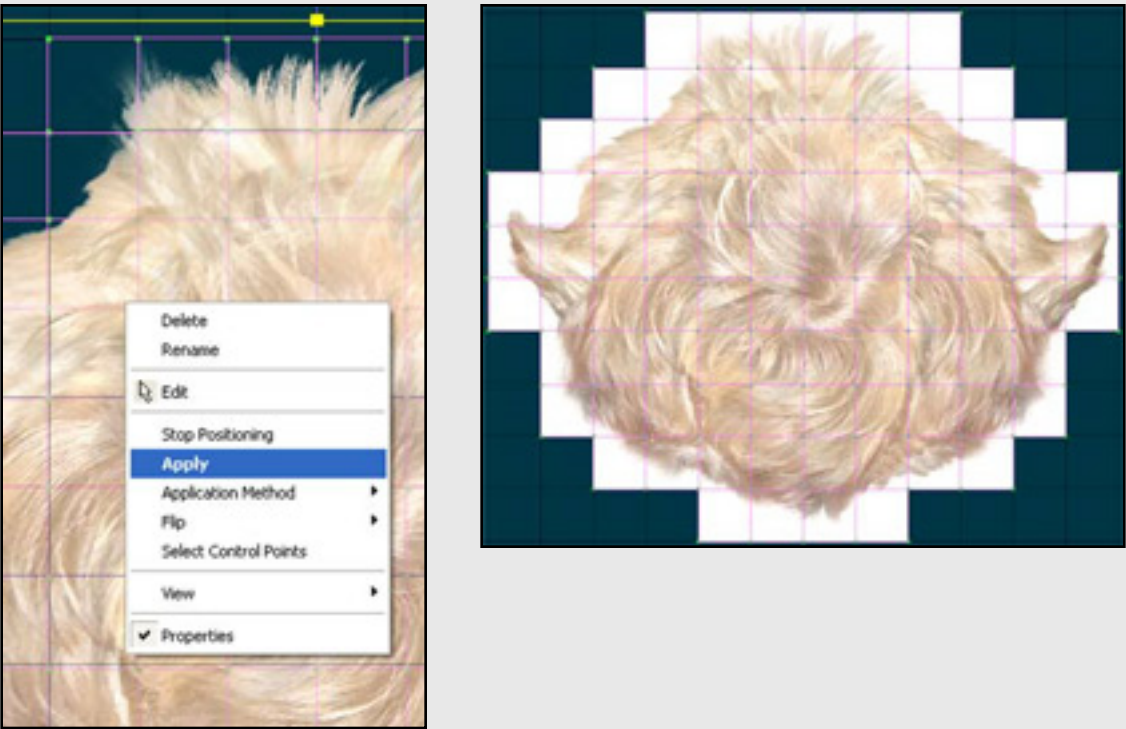
FullHair was the name of my Targa, you'll select your image.

The Decal will appear for positioning. It may need to be scaled to fit the grid you created.



Step 47a.
Scale the decal down to match the size and shape of the rotoscope. Then right mouse click (cmd click on the Mac) and select "Apply" from the pulldown.

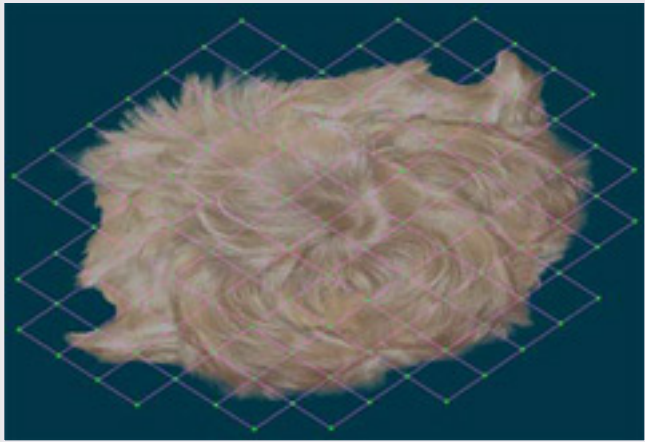
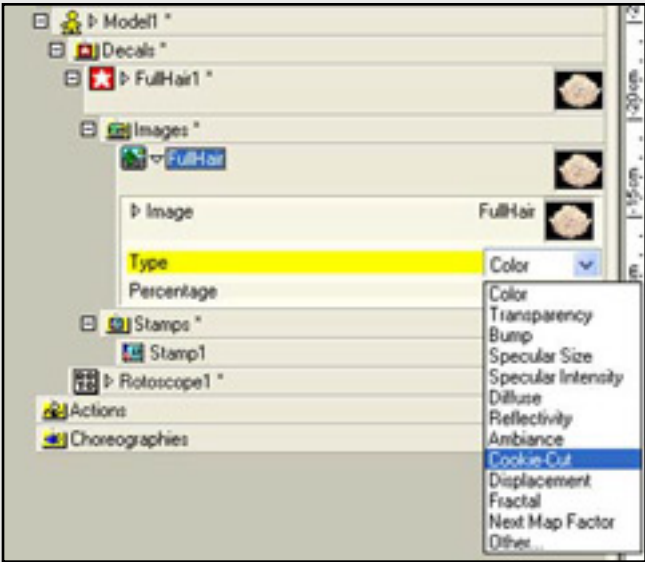
The far right image shows the shaded view of the hair on the grid. But there is a problem. The hair has now transparency do to the fact that it defaulted to a color map.



Step 47b.

In the project workspace open the images folder under the Decal you just created. Change the image type to "Cookie-Cut" in the Type pulldown.

Viola, very flat transparent hair.



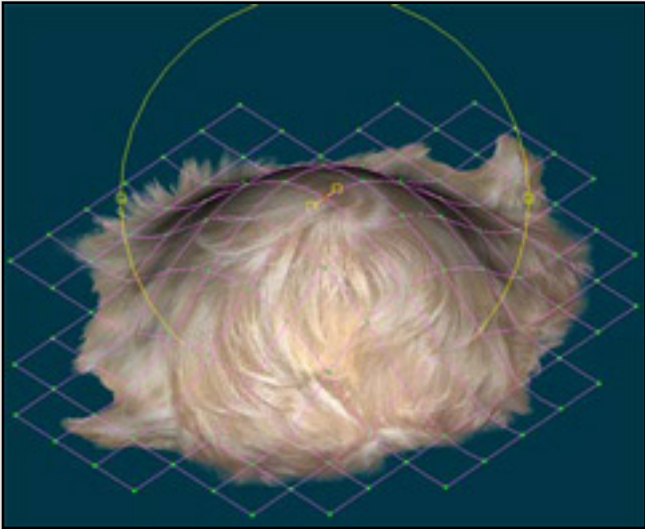
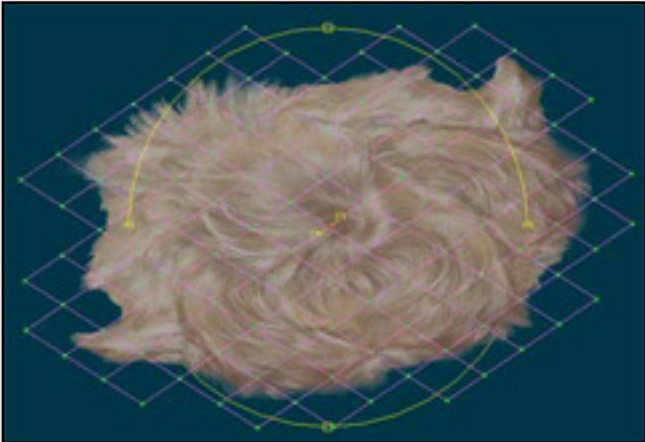
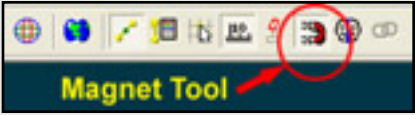
Step 48.

Now our old friend the Magnet tool.

Here is where you need some patience and practice.

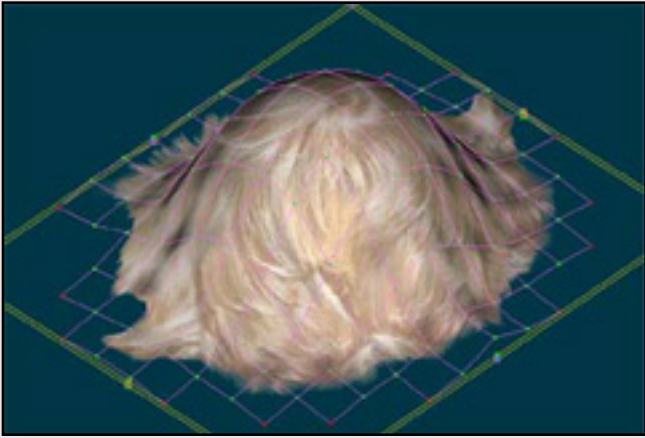
Set your magnet to roughly the size of the grid. Using the 2 key in birds eye view select the center point and pull it up. The 2 key constrains the movement on the y plane.

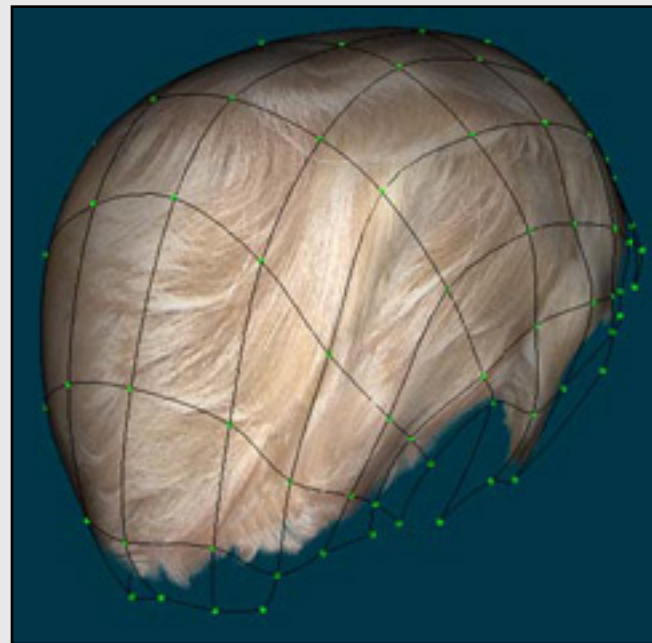
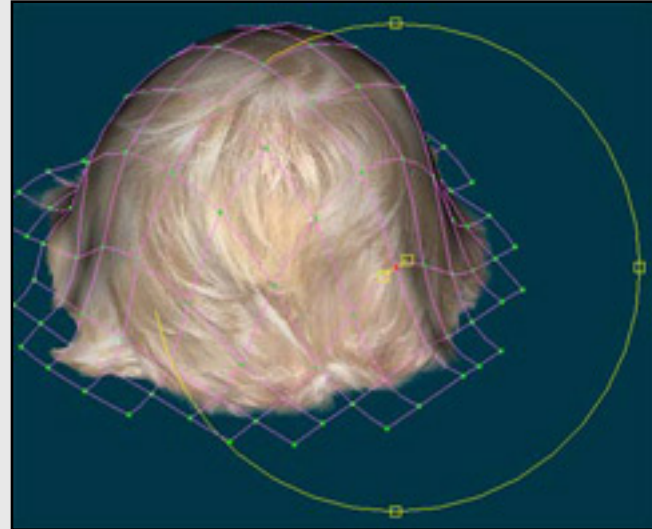
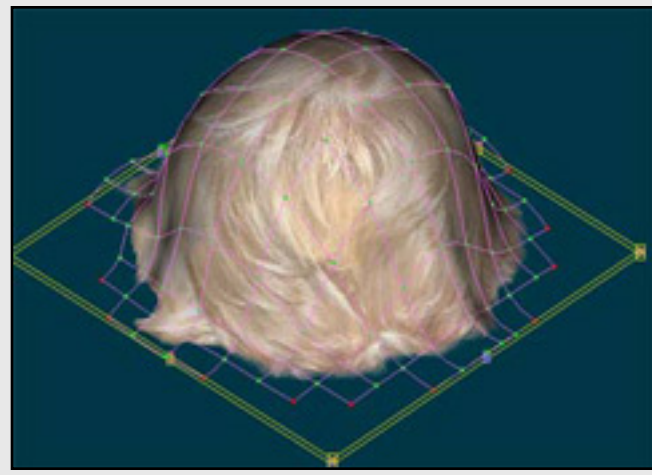
This will pull up a bump in the hair. Its already starting to look better.



Step 49.

You can also select multiple points and manipulate even faster. Keep doing this until you have a rough hair piece in the shape of a skull. It doesn't have to be perfect, we'll save those tweaks for when its positioned on the head.





Step 50.

Position the hair over the skull and continue to tweak. Lock the hair so you don't move points on the skull.

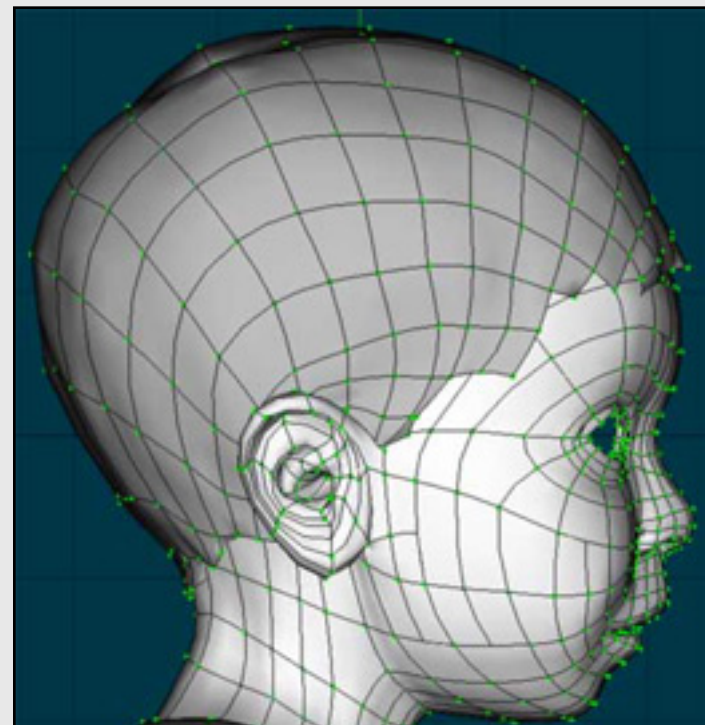
Notice how some of the mesh "collides" Its OK because the hair doesn't appear on that part of the grid.

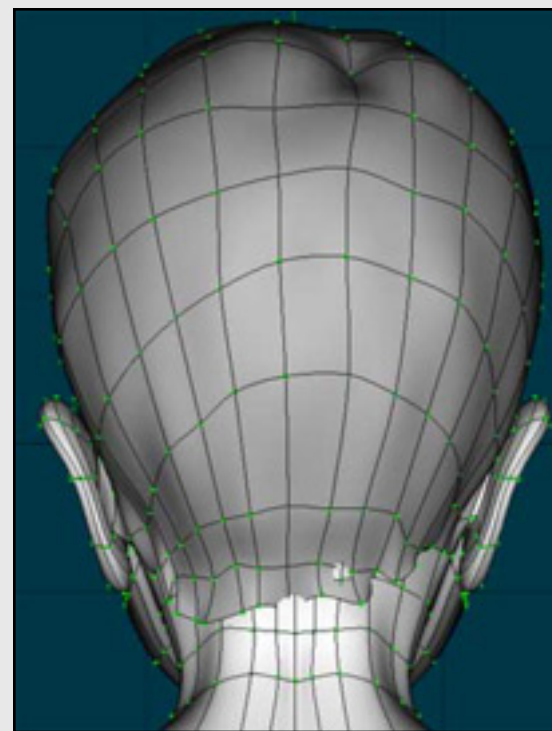
If you don't see this kind of collision with the detail turned up and no textures showing then you probably have the hair sitting too far off the head at the edges.

The idea is to have it "bubble up and out from the skull, but be snug at the edges to mimic the shape of real hair.

In the old version of my tutorial I added a displacement map that added depth to the hair.. however this didn't work very well and wasn't worth the trouble for any extra detail that resulted so if you aren't adding particle hair I would simply suggest adding a bump map for the extra texture.

For AM version 11 hair (which we'll cover later... you'll want to make the wig as snug to the skull as possible. You'll probably want to delete a few more patches on the fringe as these might cause too much hair on the edge of the head.





Version 11 Particle Hair...

Step 51.

Select the skullcap and give the group a name.

Create a new material using the particle hair plugin setting.

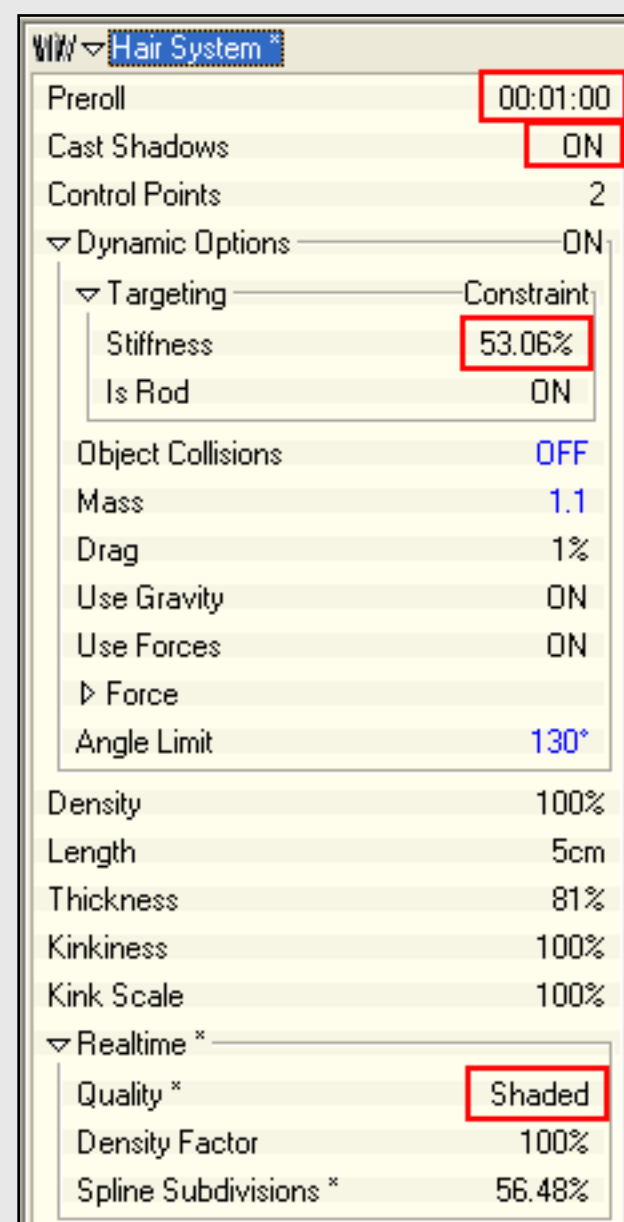
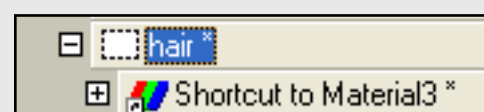
Set the Preroll to something like 1 second to allow the hair to settle if the dynamic options are turned on.

If they aren't on turn on Dynamic options and for now leave them set at constraint... the program will run faster that way... The other settings though more realistic will bog down the redraw making it hard to style the hair. Set the stiffness to whatever you want.. I chose 53 percent.

Leave object collisions off for now as well.

Set the Angle limit to 130 or 140 degrees. This will keep you from combing the hair to a point that makes it lay parallel to the scalp.

Set the Realtime quality settings to shaded.



Step 52.

Set your starting settings for your hair emitter. Ignore the fact that I'm using an image on mine for now... we'll cover that later.

I set the density of my hair to 6... If you are going for hairs that are actually thin and wispy... you'll need to set this much higher, which will slow down the redraw, and in my opinion give you less than stellar results... so for now try leaving this setting low.

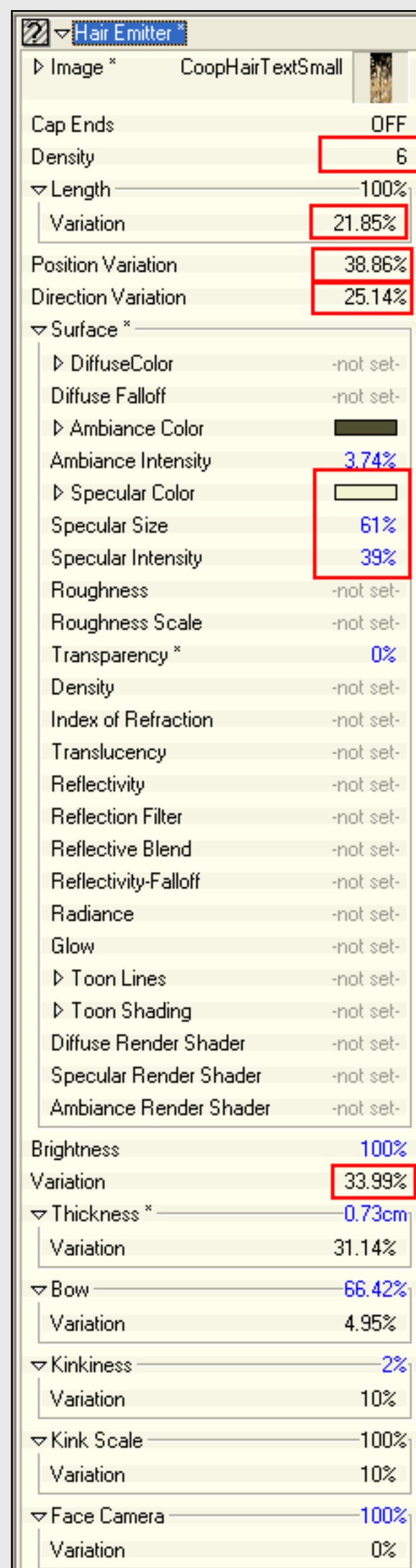
Set your length variation to something like 25 percent. This keeps your hair from being all evenly cut. Of course if you want every hair to be the same length set this number to 0. I set it to a higher number because Coopers hair is messy and tends to clump together in "tufts" and this will help simulate that.

Give your hair some specularity... Unless your character is very sick there hair

should have some shine to it. Don't go overboard here though.

Set the brightness variation to something appropriate for your chosen hair color. Cooper's hair is blond and the colors vary greatly so I use a fairly high setting on brightness variation.

I also added just a little kinkiness to his hair..to make it seem just a little wavy.



Step 53.

And here is the result. Yuck! but there are some things to notice.

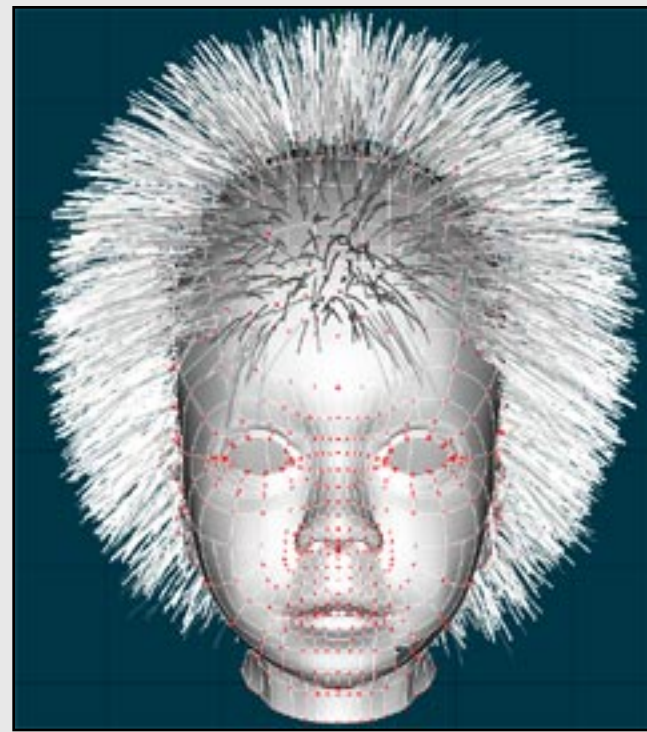
For instance... The hair already looks to be growing in all the right places... No density maps or other tricks needed. This is a big advantage to using skullcaps. The other advantages are that you can add geometry to the Cap at any time and it won't affect your head geometry. You might want to add more patches to add more hair in certain areas like where the hair parts. You could do this with a density map but that can take even more tweaking to get it to look good.

The final advantage of using the "wig" method is just that.. it becomes a wig that you can use on other models. This means you'll end up

combing less virtual hair down the road.

Try both ways and see which way you prefer. To me its easier to model than to texture, which isn't always the case but When your talking about heads with textures for the face why go through all the tedious work of painting a density map and getting it mapped around the whole head when you can just model where the hair should go?

You may find your preference is to texture and that's fine as well.



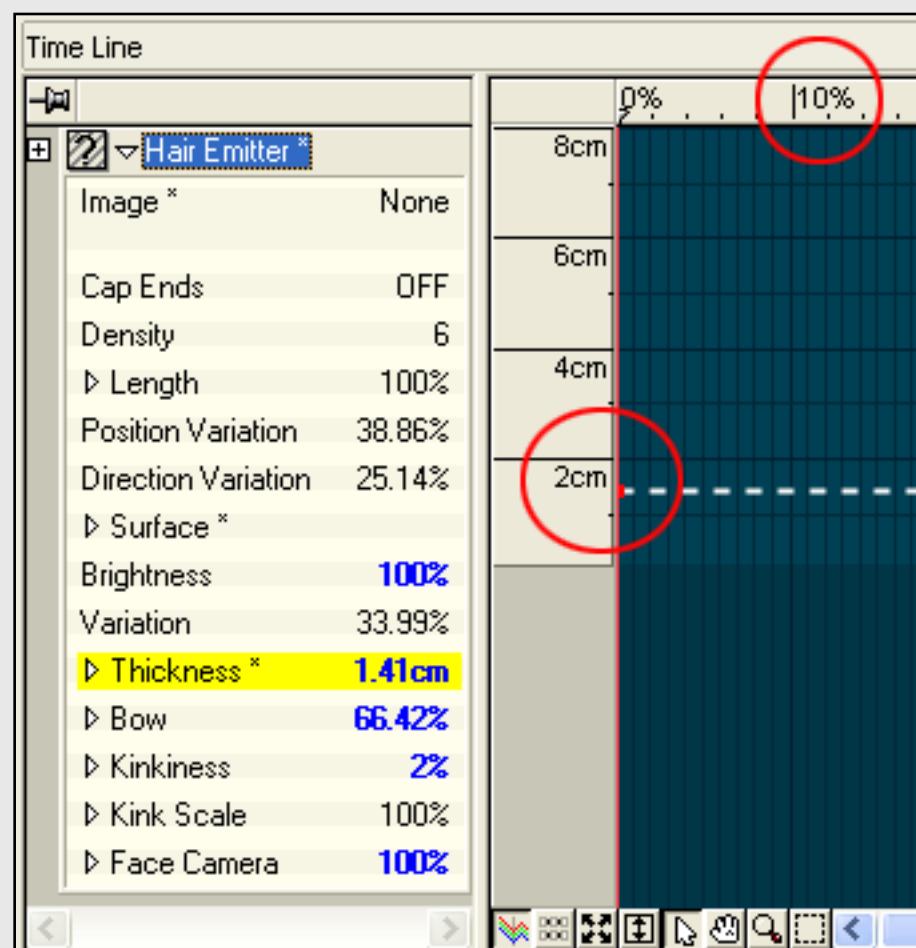
Step 54.

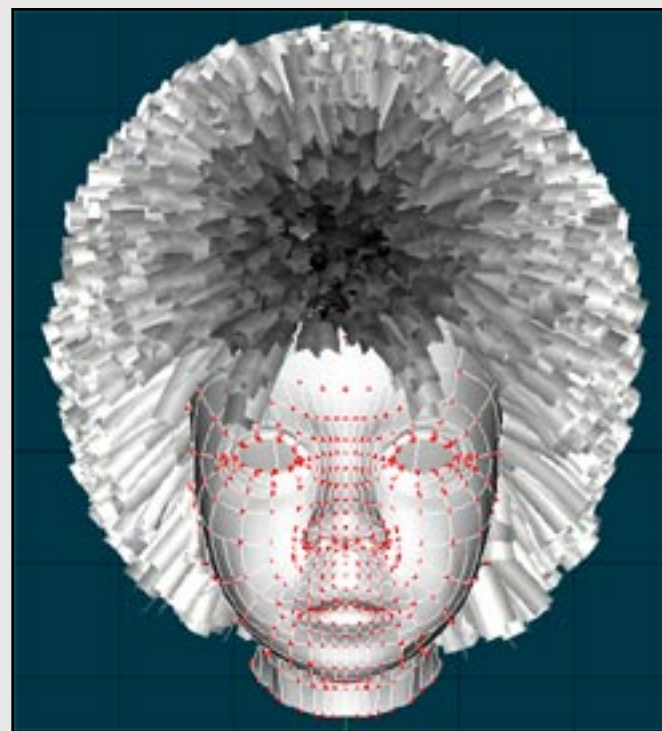
Select the the hair emitter and open the timeline tab if it isn't already open.

Select the thickness setting and click on the graph button at the bottom of the time line. This should change the view from a time based view to a percent based view, counting from 0 to 100 percent.

Set a key at 0 percent add some thickness to the hair. It should look more like shag carpet than fur.

Again you'll have to trust me on this one... Its going to look fine...Remember we are simulating the "clumpiness" that hair usually has... In Cooper's case its very clumpy.





Step 55.

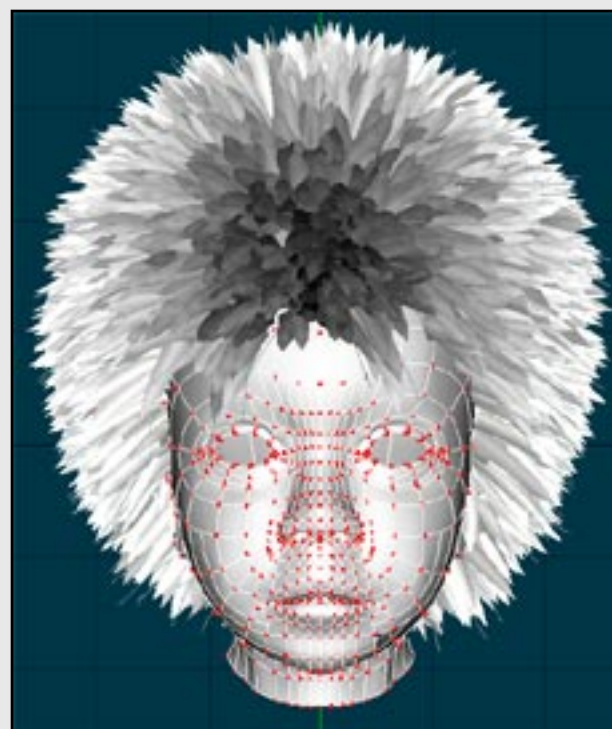
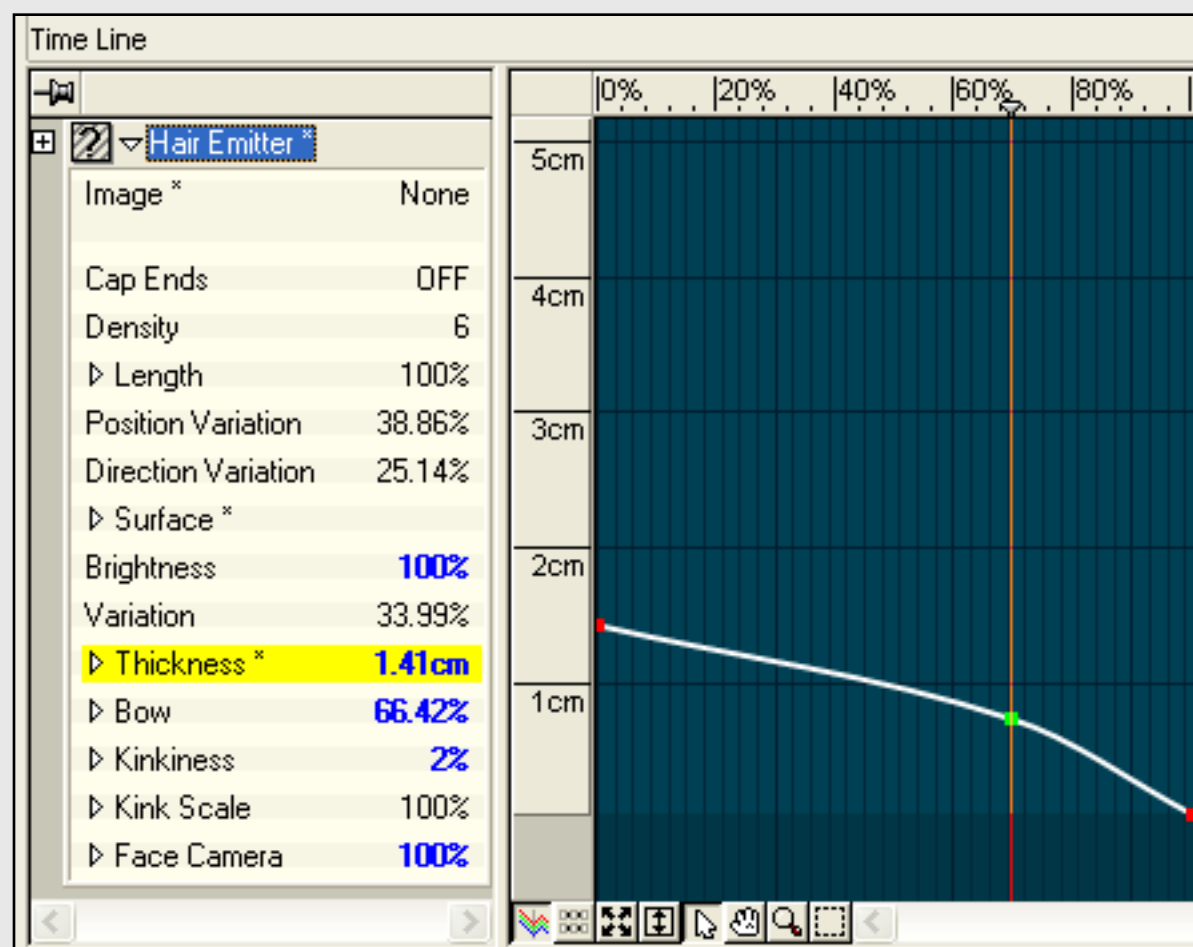
Now set another key at 70 percent that starts to taper the hairs.

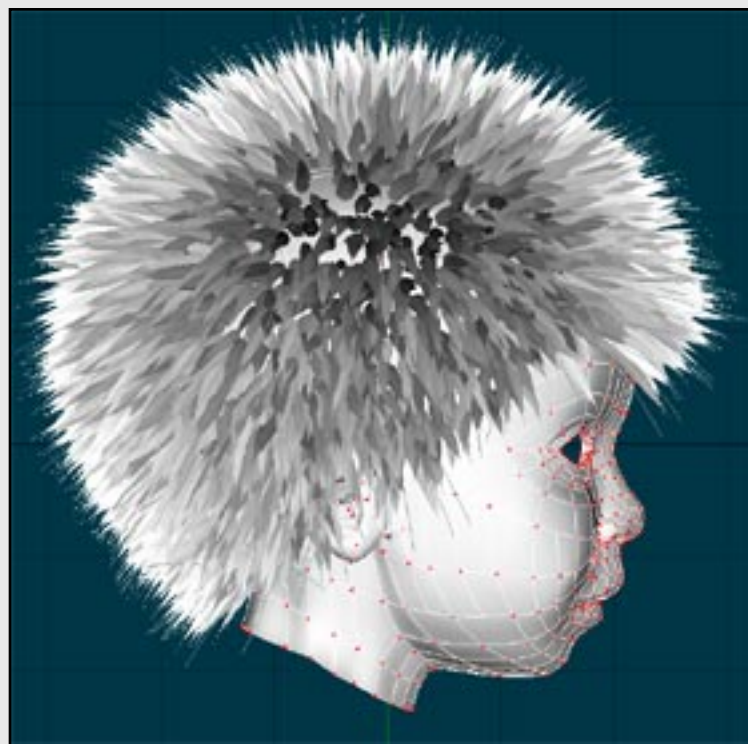
Then set one more key at 100 percent that tapers them completely.

This is also the technique you would use to create feathers or scales.

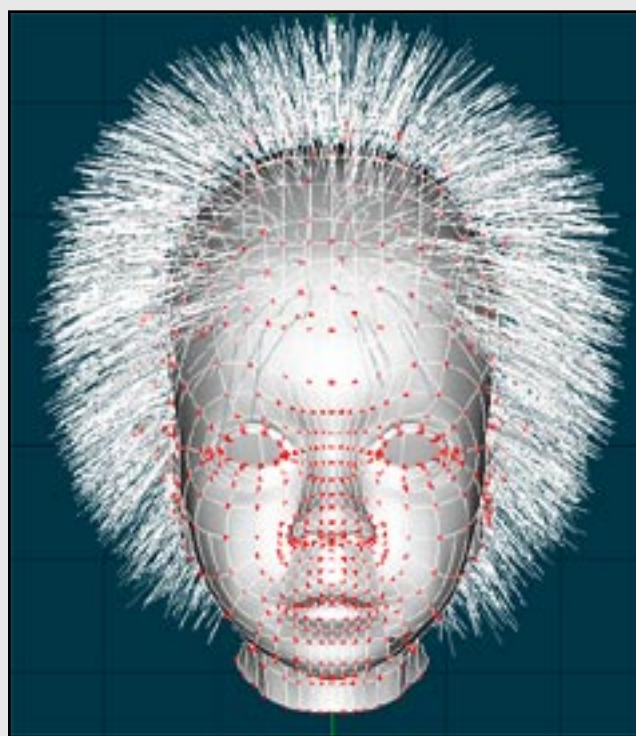
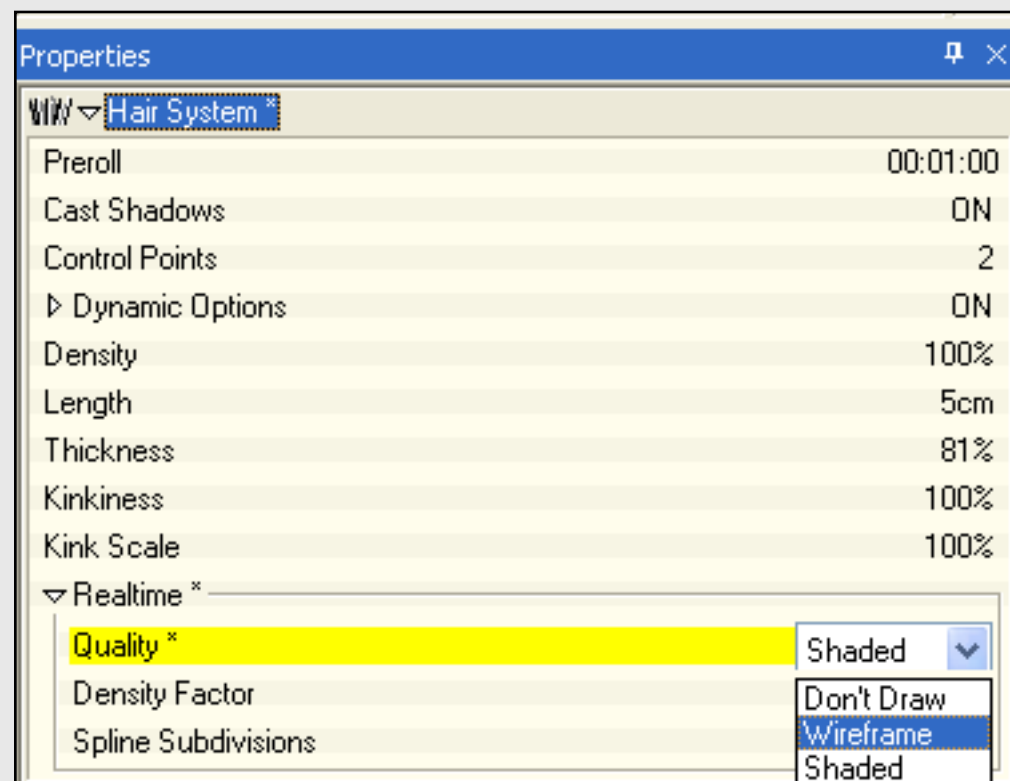
Now the "Shag Carpet" looks a little more fur-like. But still not very realistic.

Also notice the places where you can see through to the scalp. That means that it probably just the right amount of hair. because once you comb the hair down those spots will be covered up and remember since we textured the skullcap earlier with a hair texture.. it will show through if the scalp isn't covered completely. Its better to have to little at this point and add hair density later.



**Step 56.**

Set the Realtime Quality to wireframe for now. This will allow for better feedback while you style the hair.

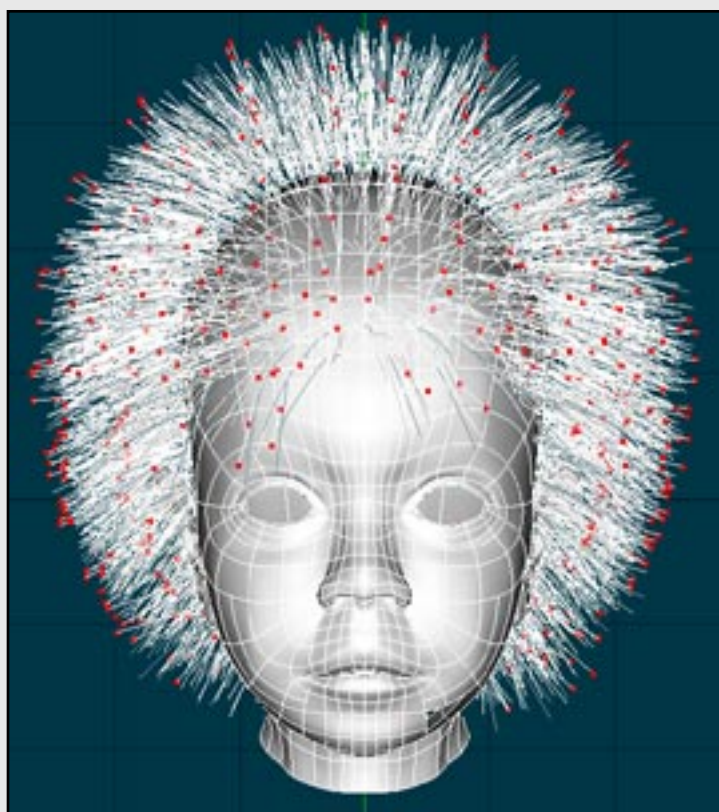
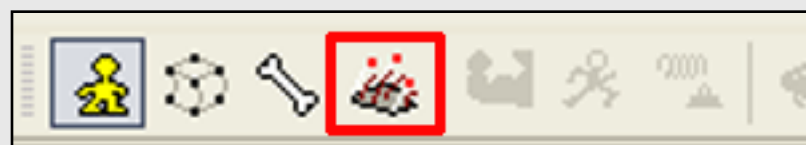


Step 56.

Now go into grooming mode by selecting the grooming mode button located between the bones mode button and the muscle mode button at the top of the modeling window.

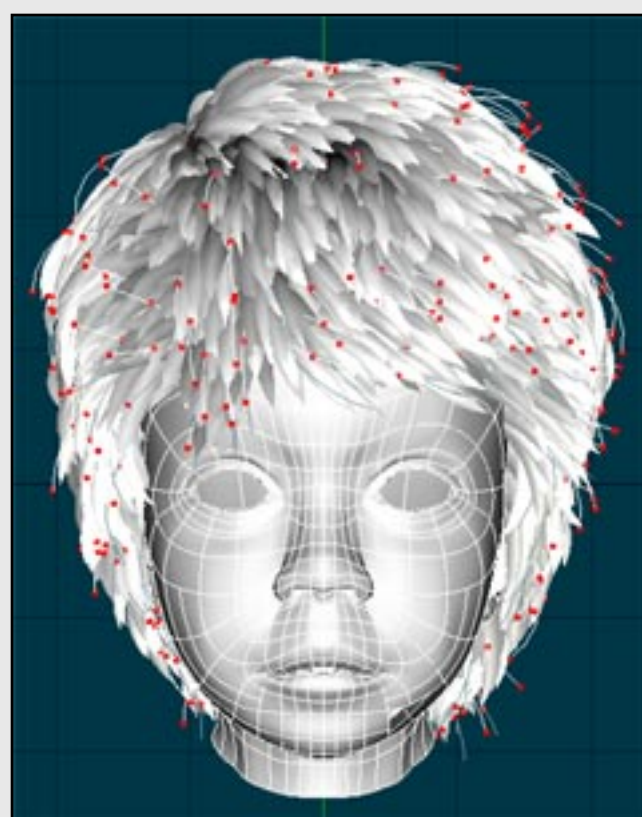
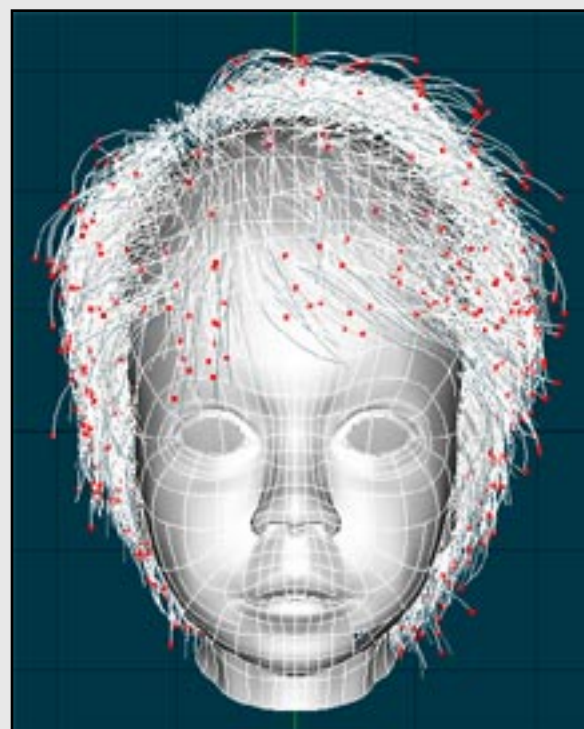
This will bring up a bunch of hair control splines and change the tool bar to the grooming tools.

Select the brush tool and begin combing the hair the way you want it.



The first image is after about a minute of combing.

Make sure you check your work as you go by looking at the hairs with the realtime shading turned on every now and then. It may even be possible for you to groom with it on if your machine has enough horse power.

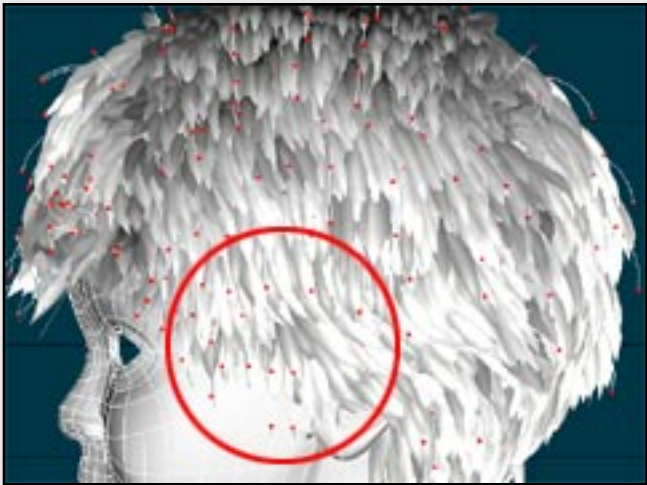


Step 57.

Not bad if I want my son to look like Mick Jagger, but his hair actually is much shorter on the sides and back.

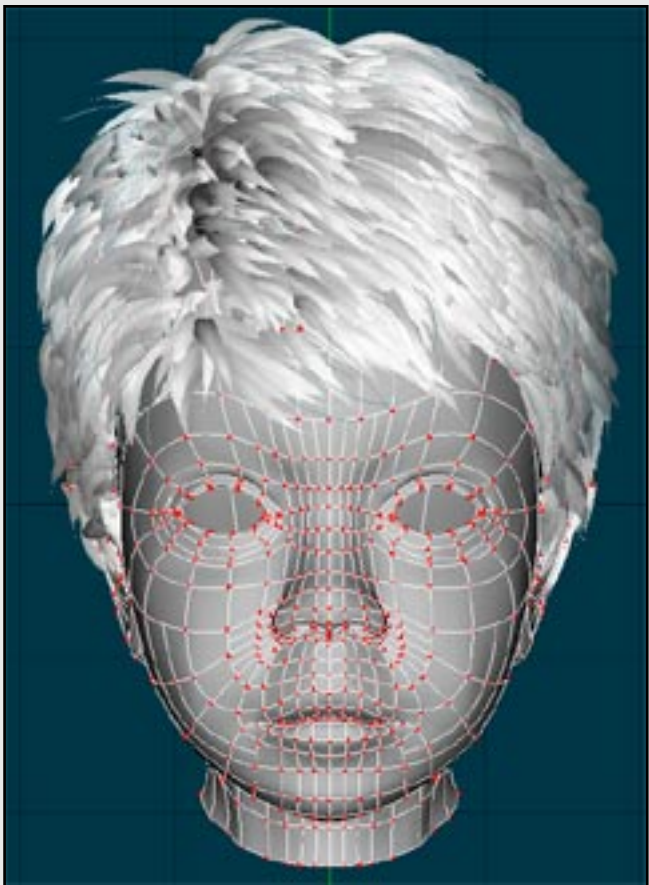
So now I go into lengthen mode by selecting the tool under the brush.

Then I place the cursor over any splines that I want to shorten and drag it against the hair to shorten the strands of hair.



....

A few more minutes and the grooming is over.



Step 58.

Now I add the final touch.

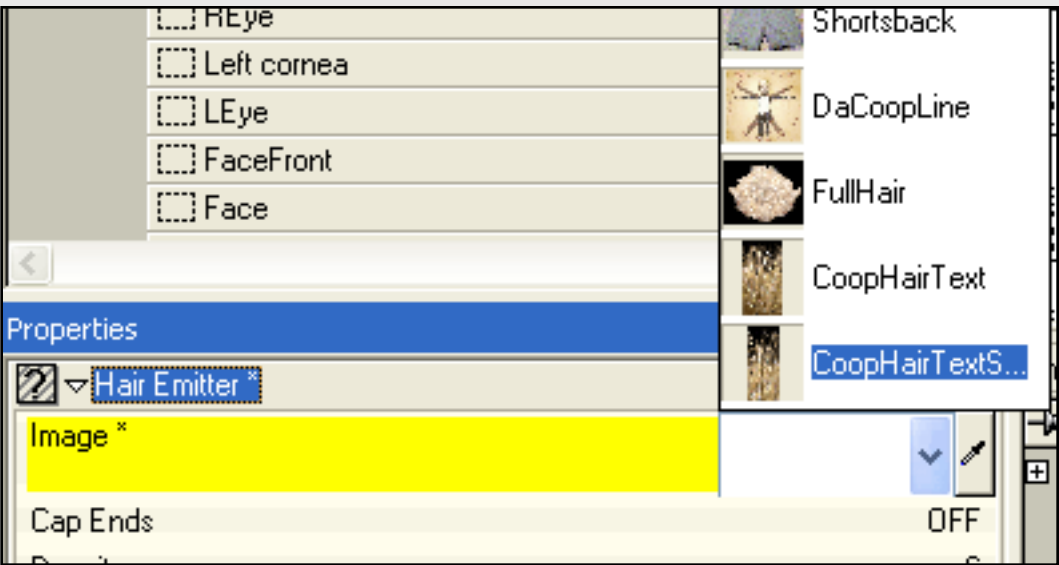
I created a hair texture from one of the source images I had of coopers hair. I copied the image and created an alpha channel using the same technique I mentioned in Step 42.



Step 59.

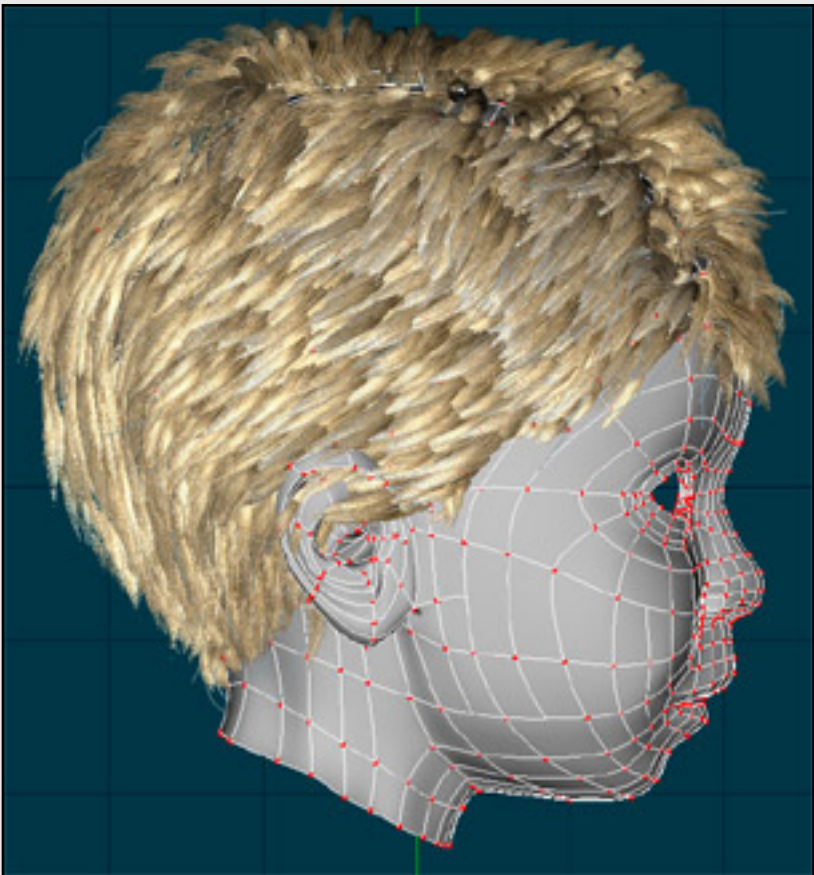
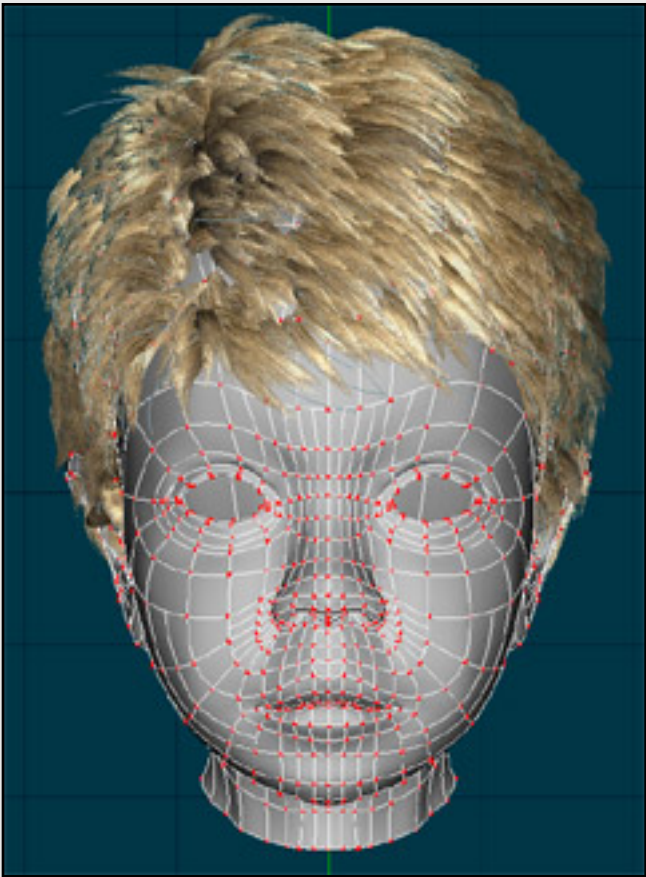
Import the images into the images into AM.

In the properties panel for the hair emitter I set the image setting to my hair texture.



...And that's all.

You might try adding some transparency to the hair as well if its too solid looking.



[Back to tutorial index](#)

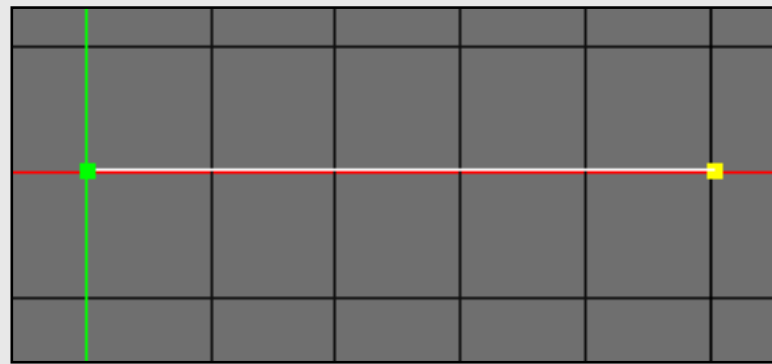
[Previous tutorial](#)

[Next tutorial](#)

Modeling the eye...

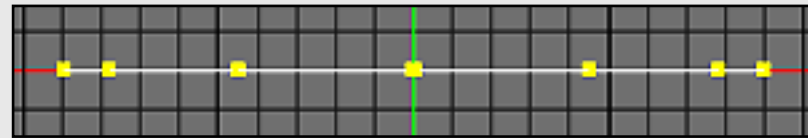
Step 60.

In the front view create a spline



Step 61.

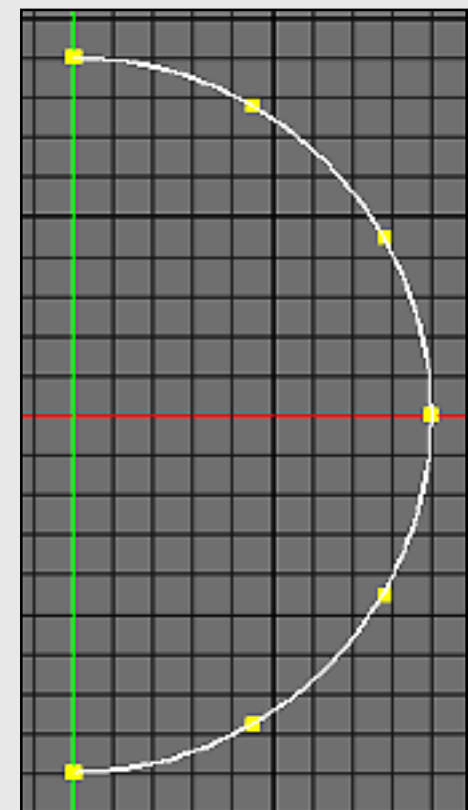
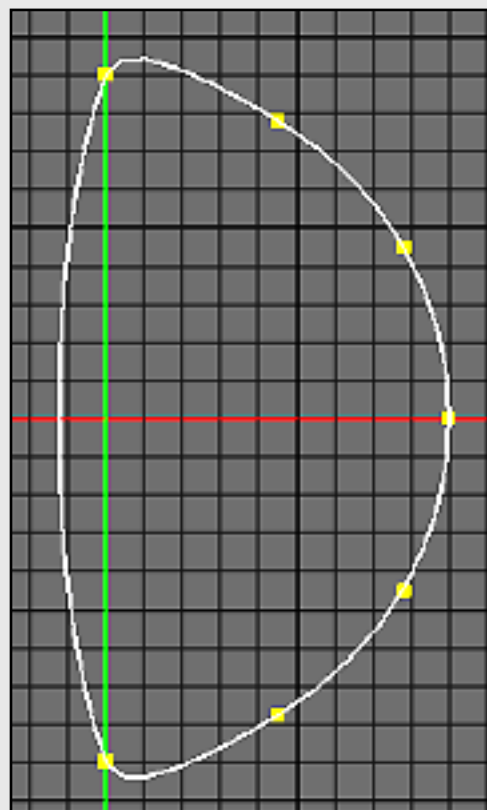
Lathe the spline into a disc with 12 sections.



Step 62.

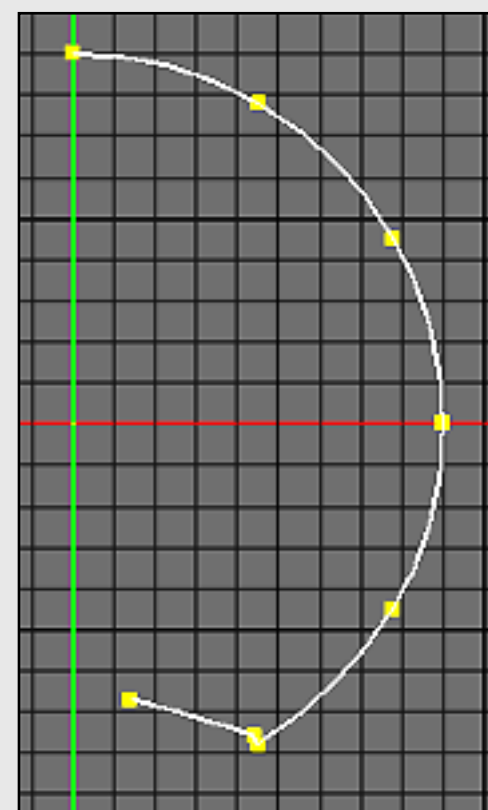
In the Top view, select the disc and rotate it so that the center spline lines up on the z-axis.

Then delete the left group of point on the spline and break the remaining connection with the break spline tool.



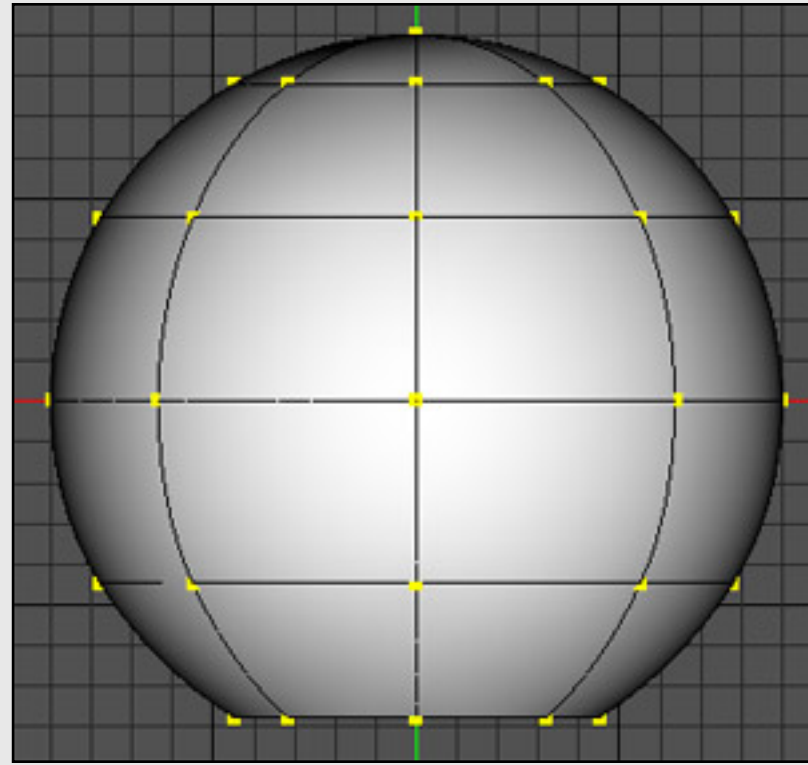
Step 63.

Modify the bottom of the spline like so. I added a point to pull the iris in a little and to allow me to peak the points that will make up the iris.

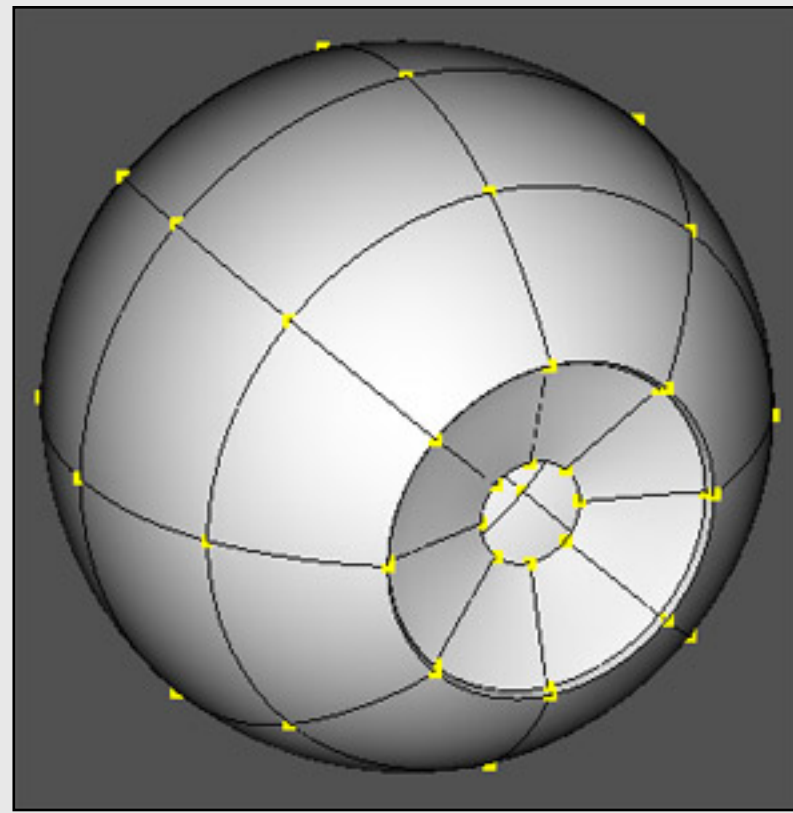


Step 64.

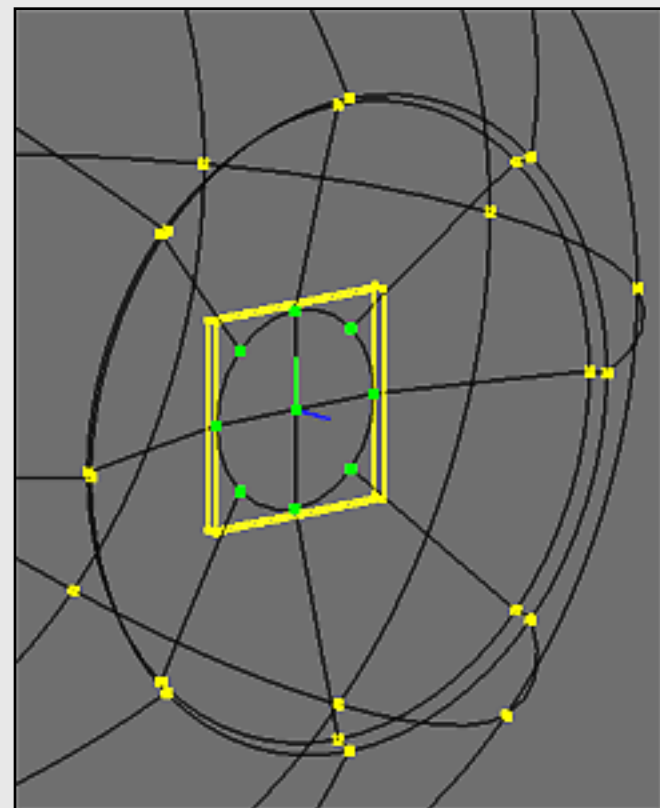
Lathe the resulting spline with 8 sections.



You should end up with something that looks like this.

**Step 65.**

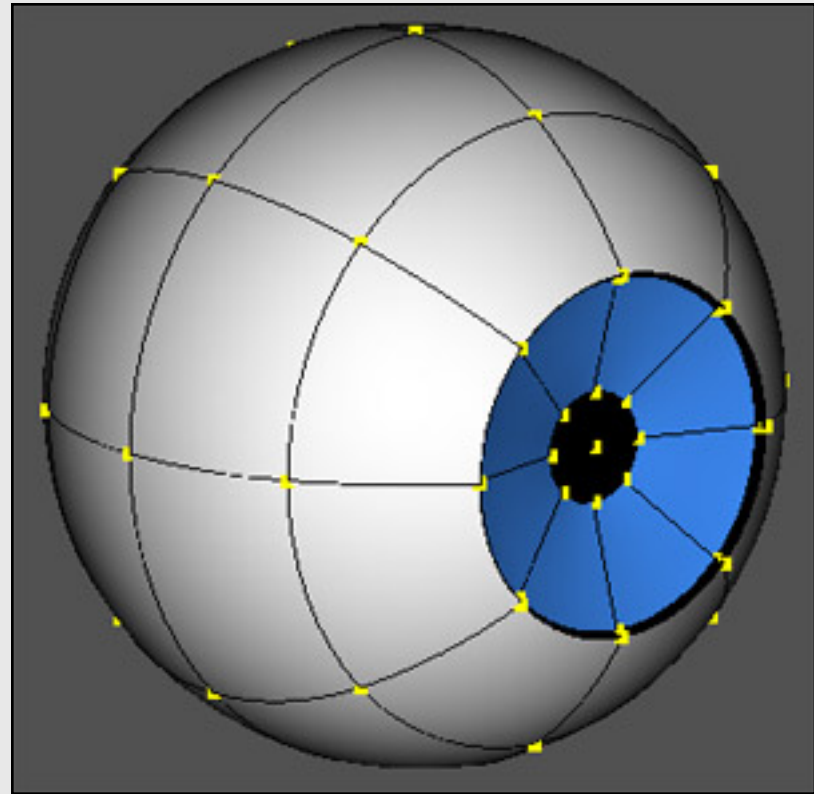
Close the points that will become the pupil and group them in order to set their diffuse color to black.



Step 66.

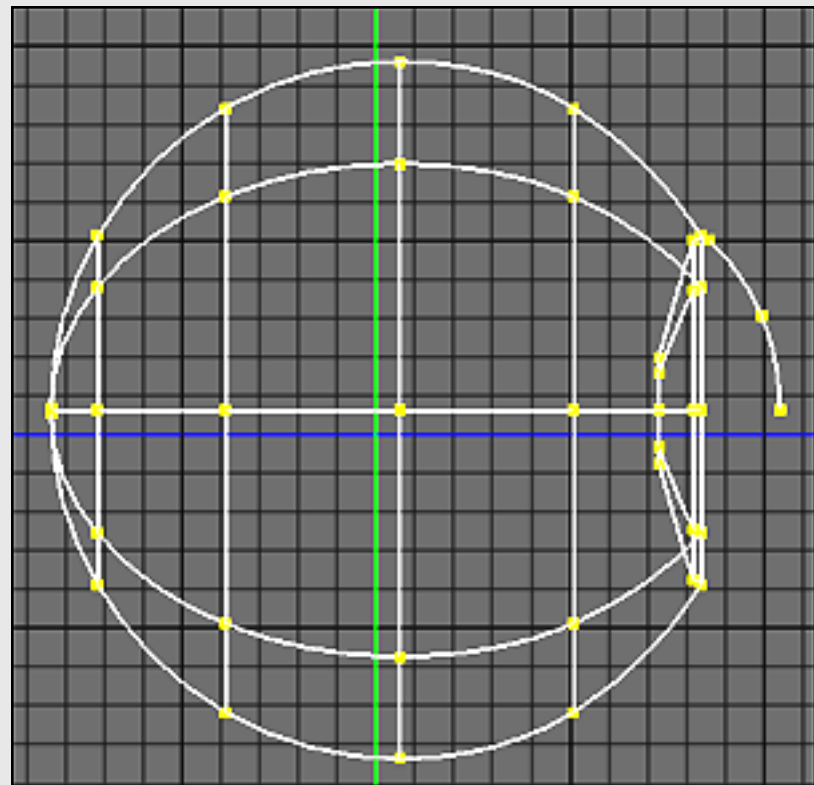
Group the iris points and give them a material or decal or just set their diffuse color to the eye color you want.

I also set the little lip of splines to black in order to fake the shadow that happens around the iris.

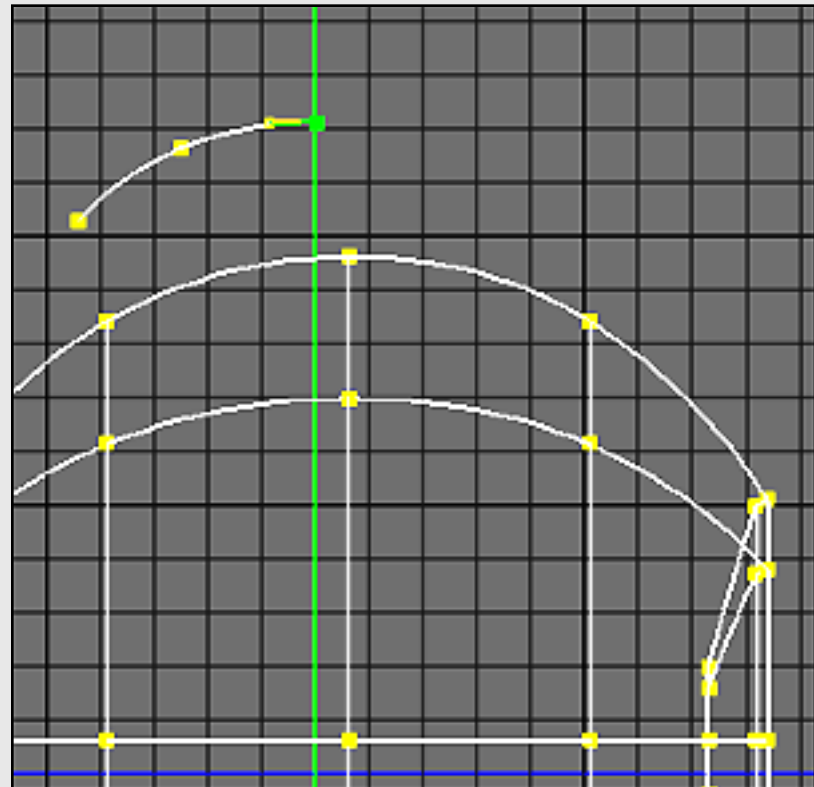
**Step 67.**

Now, in the left or right view, create a spline with about 3 points that looks like this....

This will become the cornea.

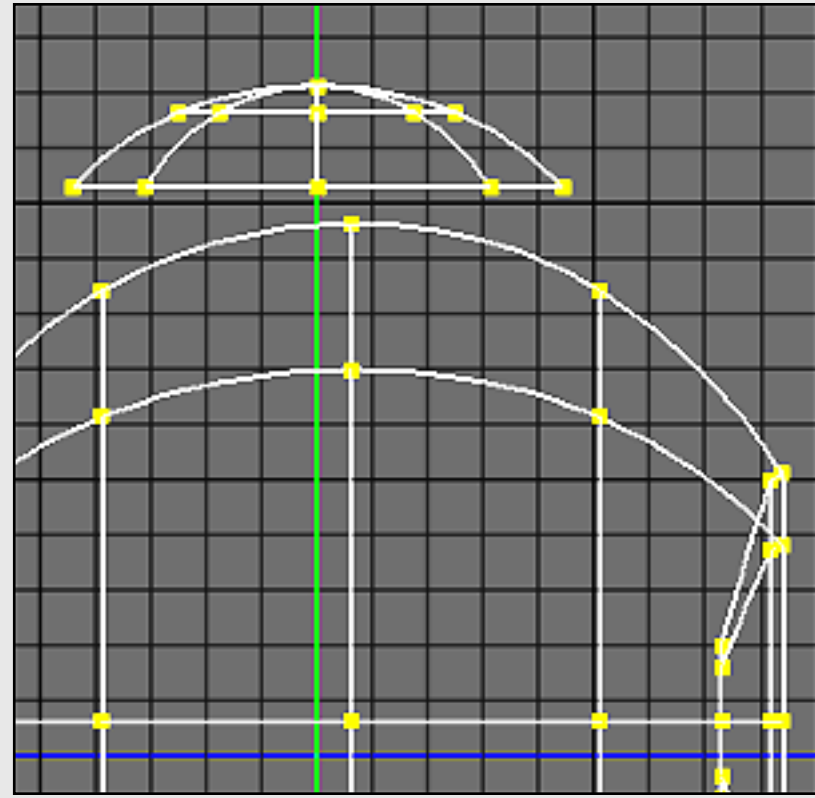
**Step 68.**

Move the Cornea spline up to the top. Center it and rotate it so that you can lathe it.

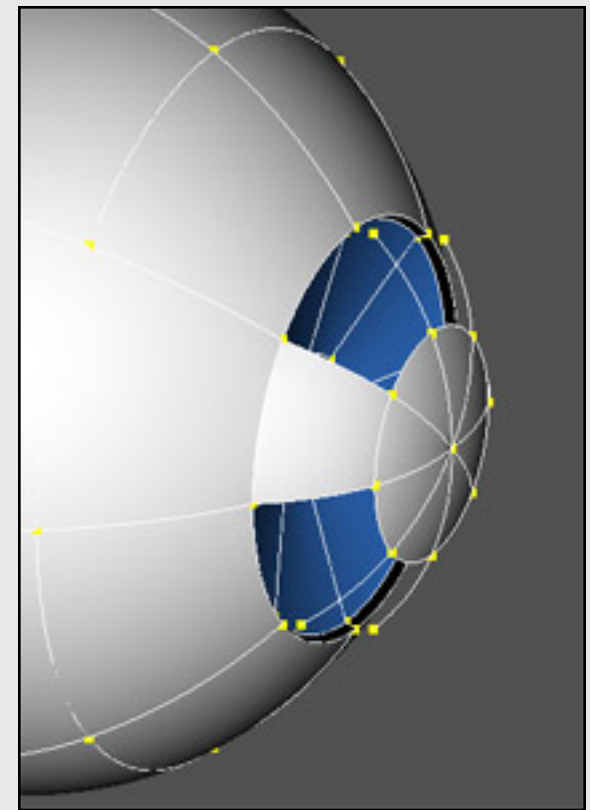
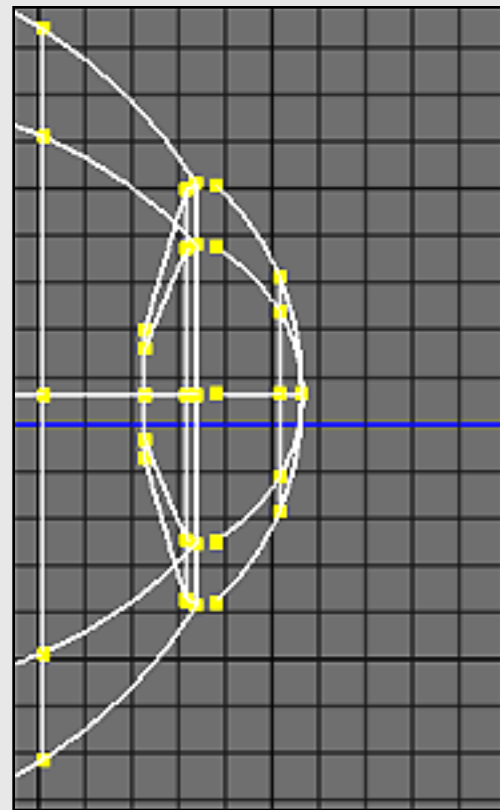


Step 69.

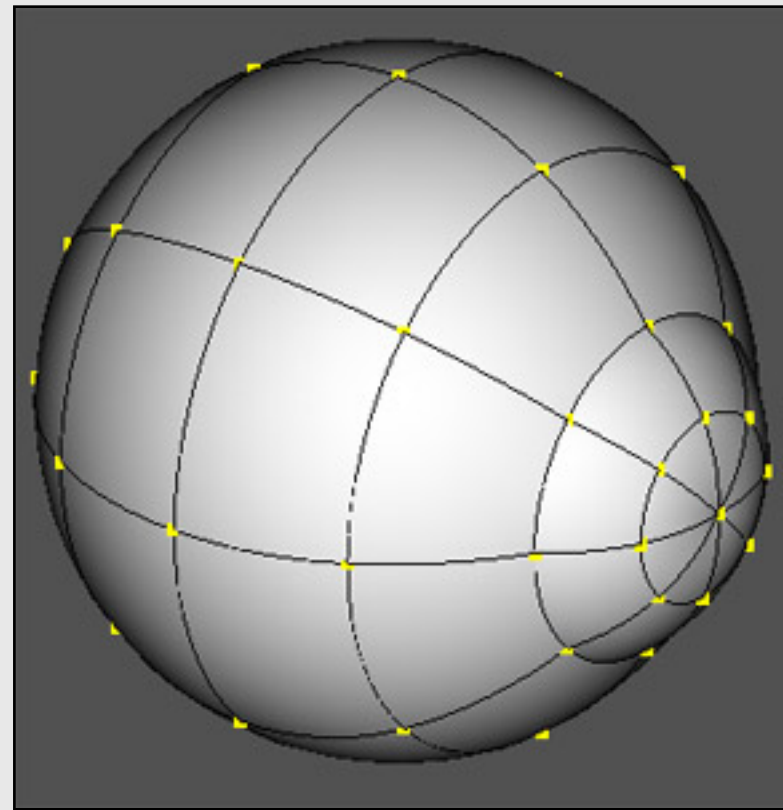
Lathe the cornea spline... it should look like a contact for the eye.

**Step 70.**

Move the cornea back into place and break its outer spline ring in order to start connecting the points to the eye.

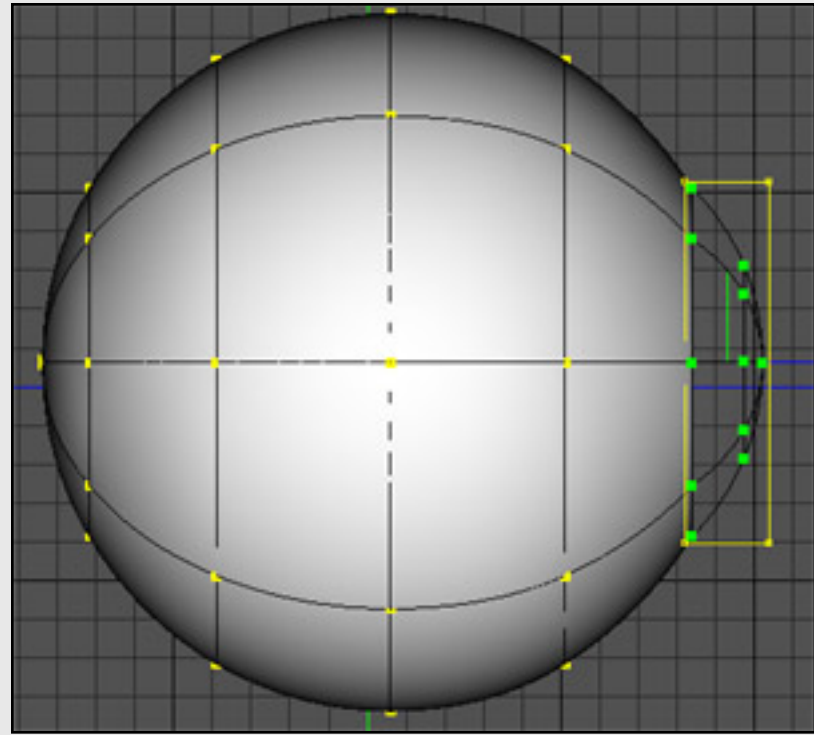


You should end up with something that looks like this.



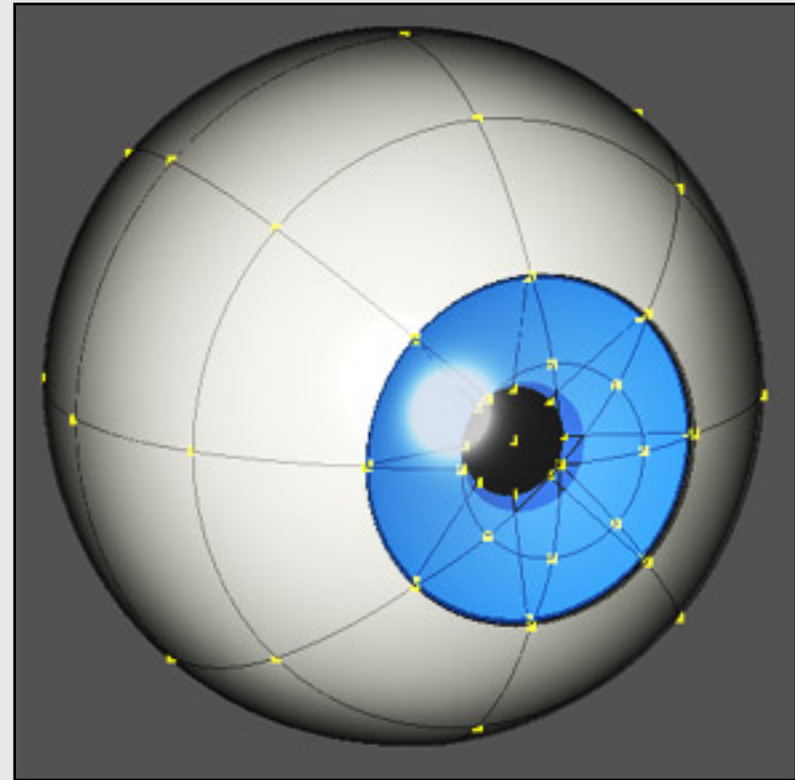
Step 71.

select the cornea patches. Group them and set there transparency, specularity and refraction surface settings to what you desire. I chose a transparency of 95 percent.

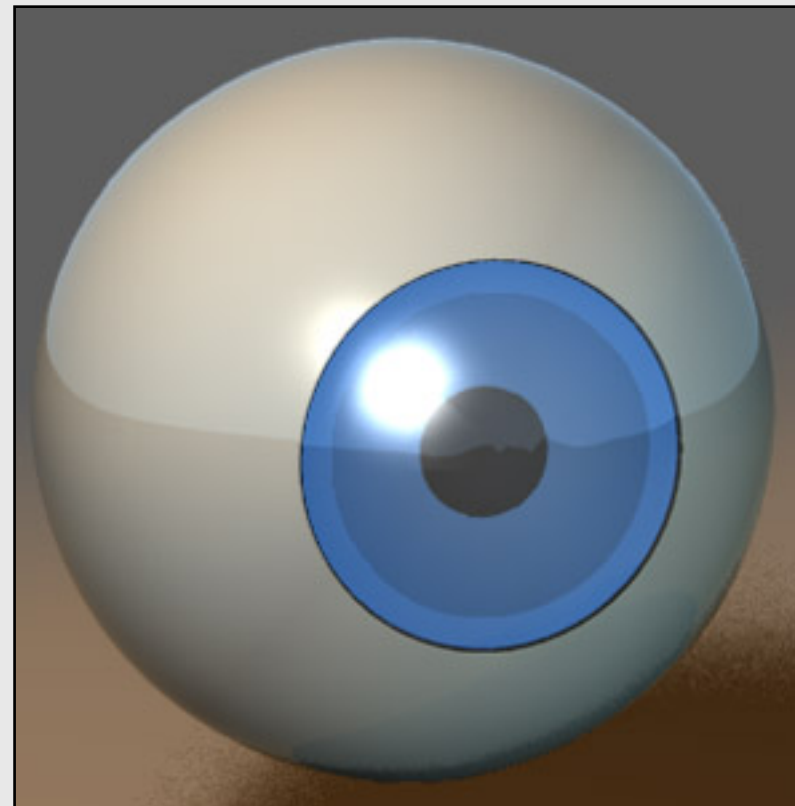


Here is what it looks like in the end... This is a composited render over a wire frame to show the effect of my refraction settings (visible as a slight dark blue around the pupil. The black is the non refracted cornea and the dark blue is the cornea with refraction. This will greatly add to the realism of the eye in close up shots.

The one piece design of this eye is advisable when it comes to trying to get refraction in the cornea. Sometimes, depending on the size of the model, two piece eyes, where there is an outer piece that refracts, render with artifacts.




Here is another render with reflections and refractions.


[Back to tutorial index](#)[Previous tutorial](#)[Next tutorial](#)


Texturing the face using flatten.

Step 72.


In the front view select a point on the skin of the face. Hit the "/" key to select the continuous model and then hide the rest of the mesh using the Hide button .

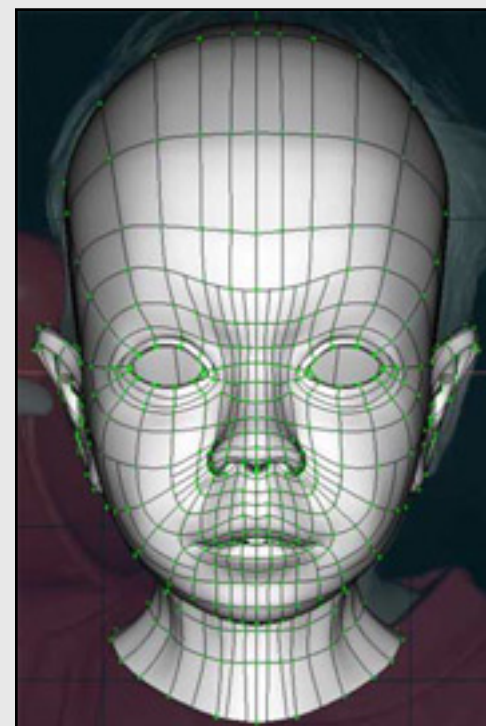
Since we're just texturing the skin, you'll need to deselect the inner mouth points. This can best be done with the following steps.

In wireframe mode and from a side view, draw a selection lasso around the inner mouth. Click on the Hide button , and you should have the lips, inner mouth and some of the cheeks left.

Using the patch select tool , and holding down the shift key, select the patches of the cheeks and lips to the point where they meet the inner mouth.

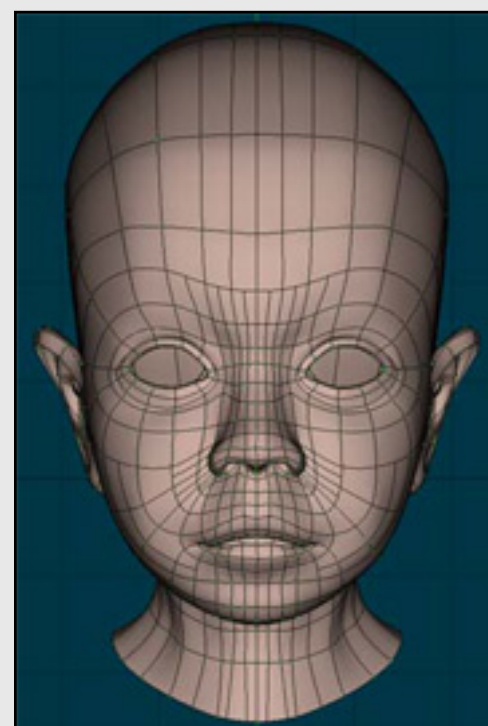
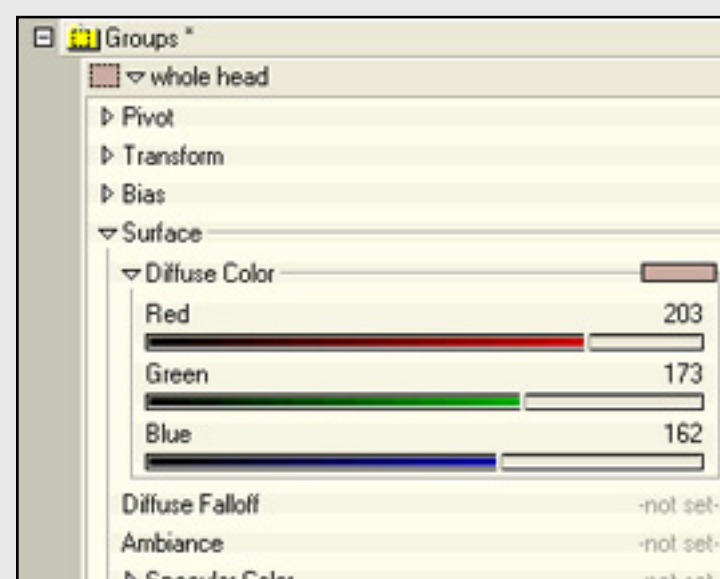
Under the "edit" menu select "compliment all". This will select just the inner mouth. Name this group.... "inner mouth".

Now unhide the meshes and repeat the first paragraph of this step. Then select the "inner mouth" group and under the "edit" menu select "Compliment all". Name this group "head" or something descriptive. Click on the hide button  one more time and you should be left with just the head.



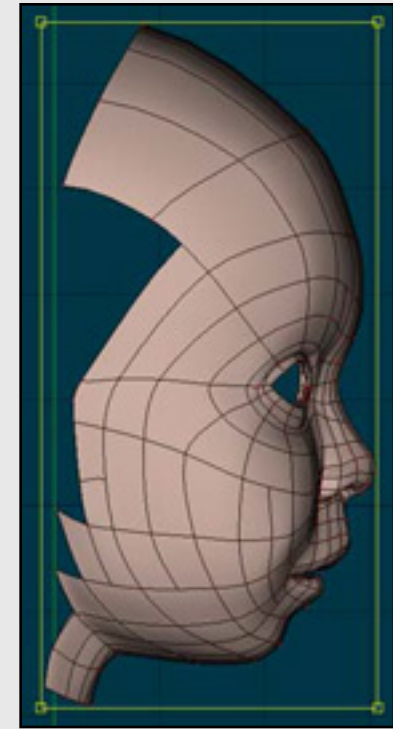
Step 73.

Under the "head" group's surface properties, set the diffuse color option to something like the skin tone you want for your model. No need to be to exact yet.

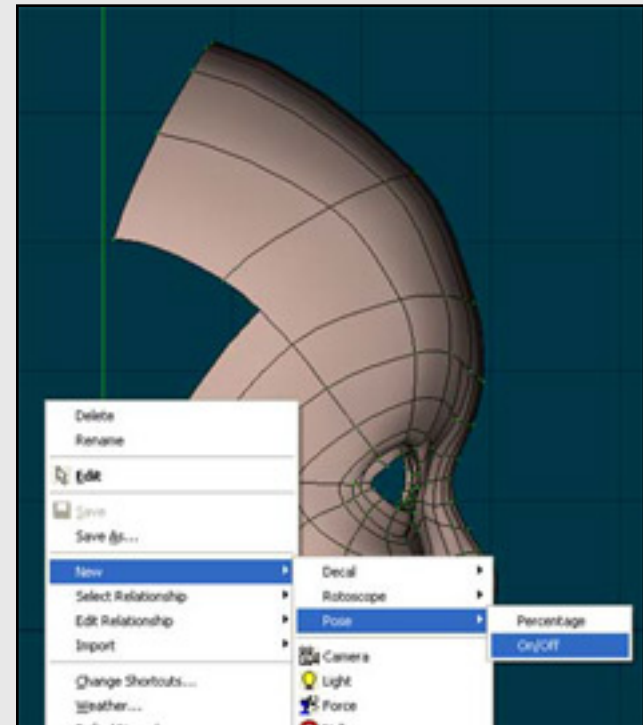


Step 74.

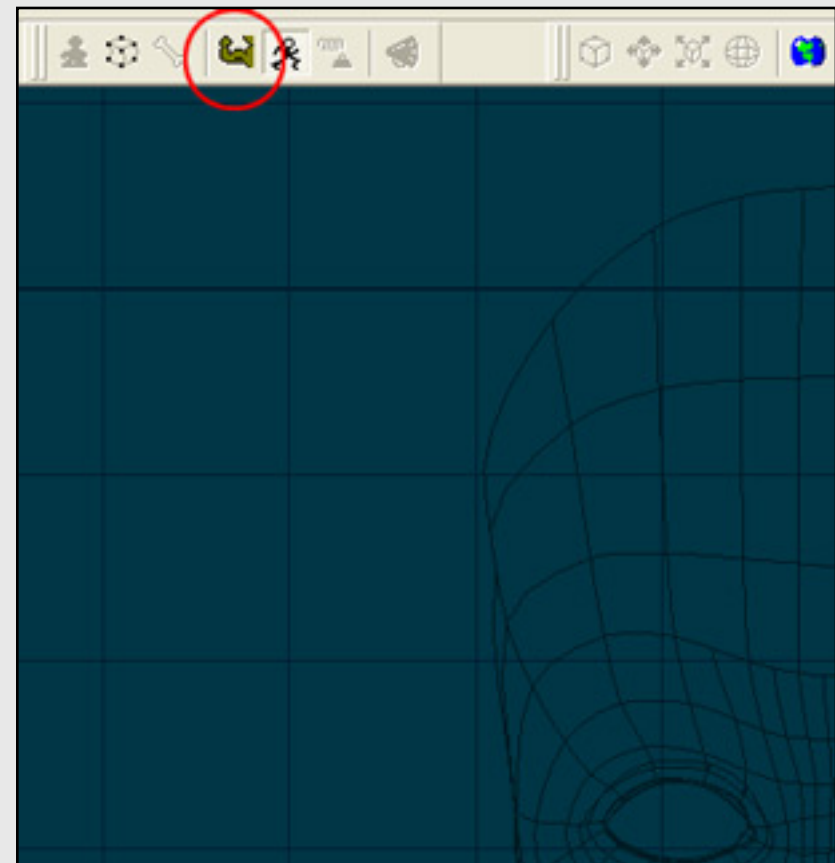
In the side view select just the front face of your model. Double click on the hide button. You should have something similar to the image to the right on your screen.

**Step 75.**

Right mouse click (cmd mouse click on the Mac) and select "New"/"Pose"/"On/Off" to create a new pose.

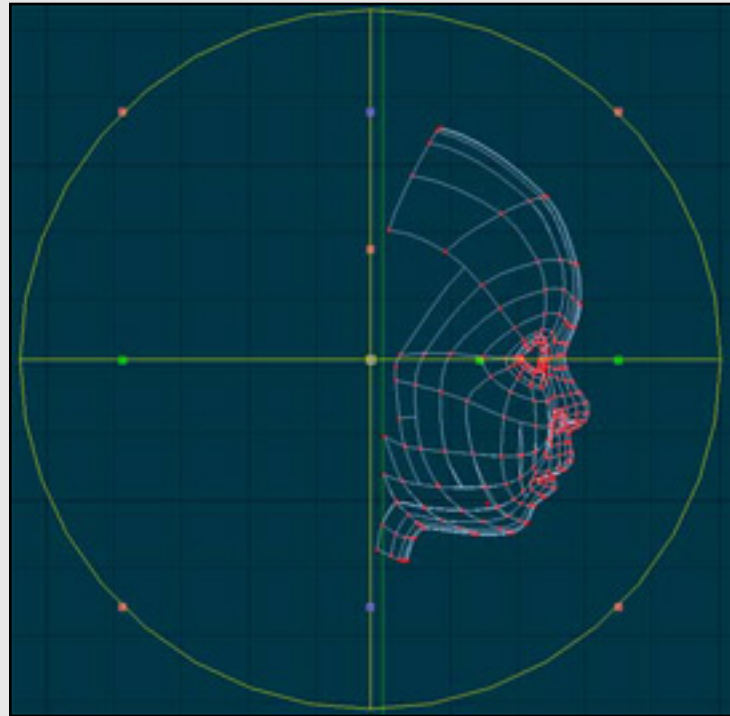
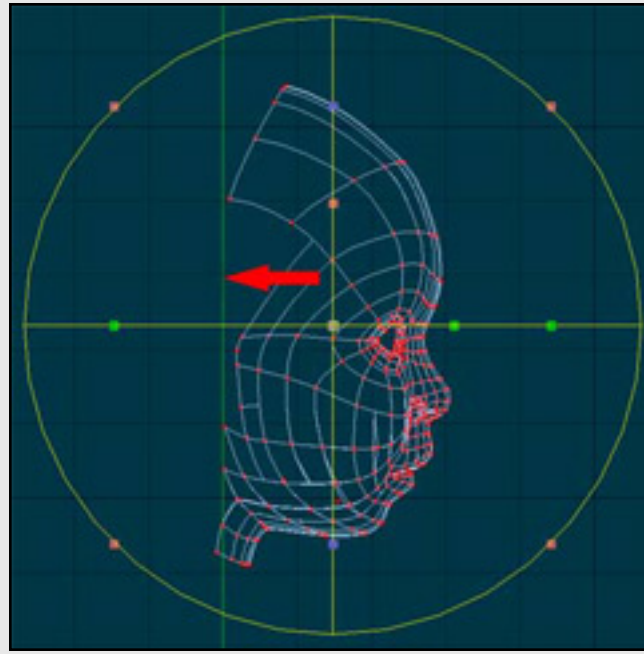
**Step 76.**

Animation Master defaults to skeletal mode when you first open poses or actions. In Order to flatten the mesh for texturing we need to be in "muscle" mode. Click on the "muscle mode" button.



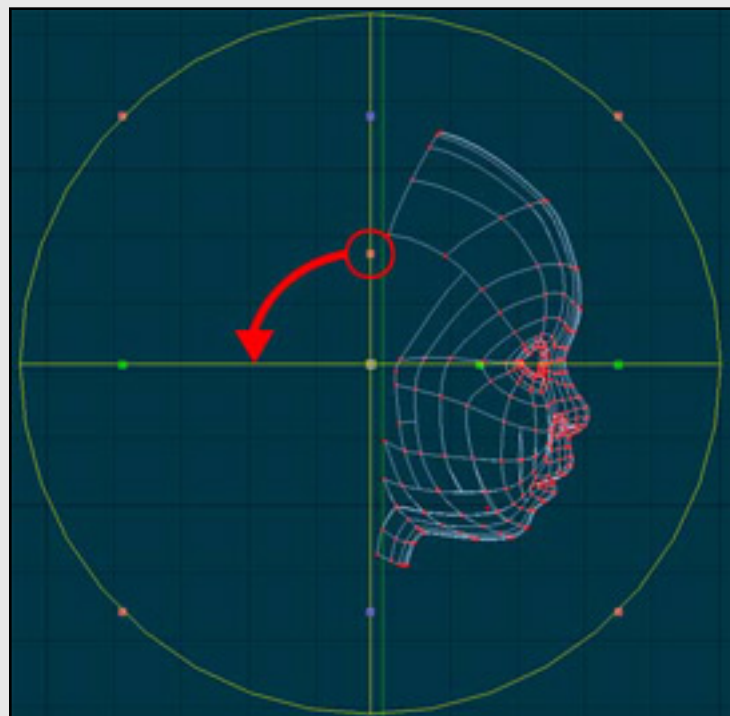
Step 77.

In the side view select the entire mesh and click on the rotate manipulator button. Grab the "center point" and drag the rotational axis back until it's just behind the mesh.

**Step 78.**

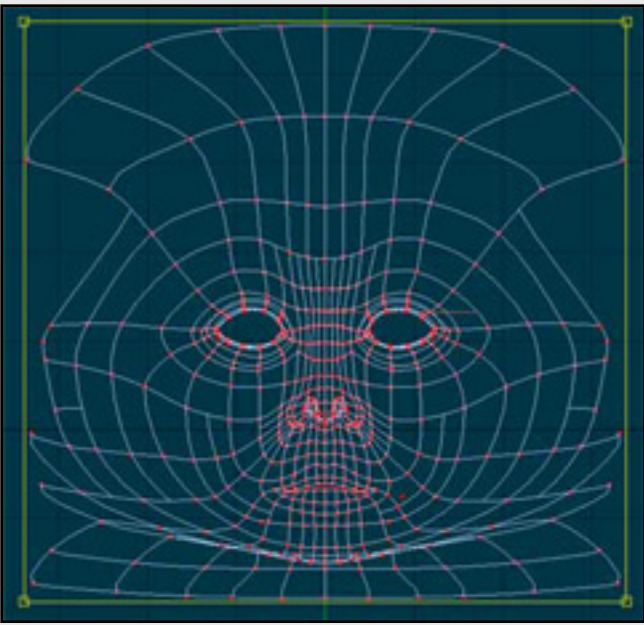
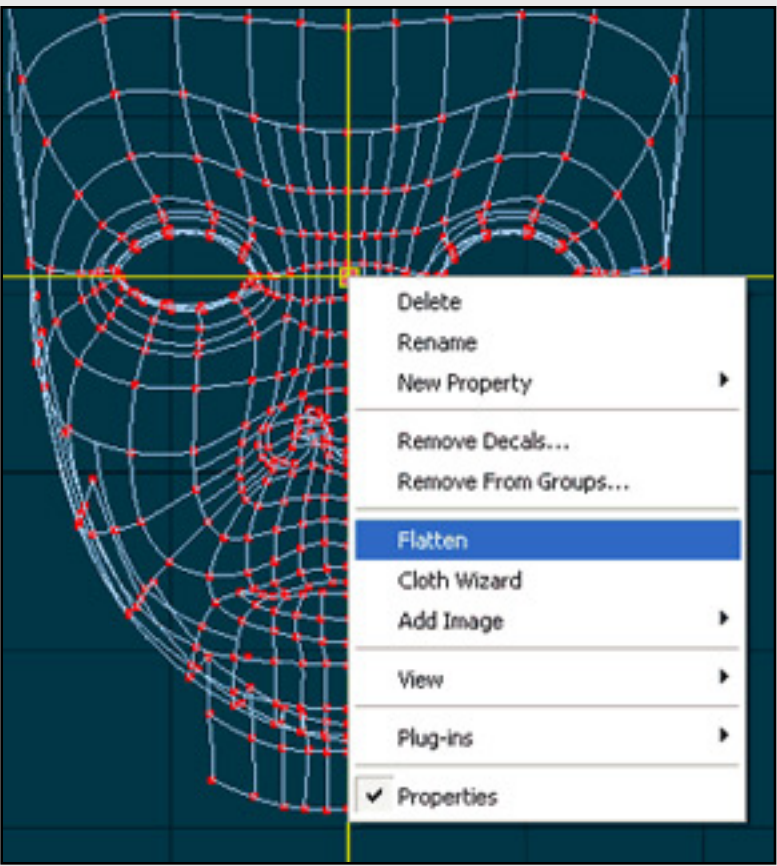
From the side view grab the y-axis point (the little red dot 1/3 of the way out from the center) and rotate it down until its on the x- axis.

If you don't do this the face won't flatten correctly.

**Step 79.**

With the Rotate Manipulator still selected Right mouse click (Cmnd click on the Mac) and select "Flatten". This wont work if you deselect the manipulator so make sure you click within the manipulator.

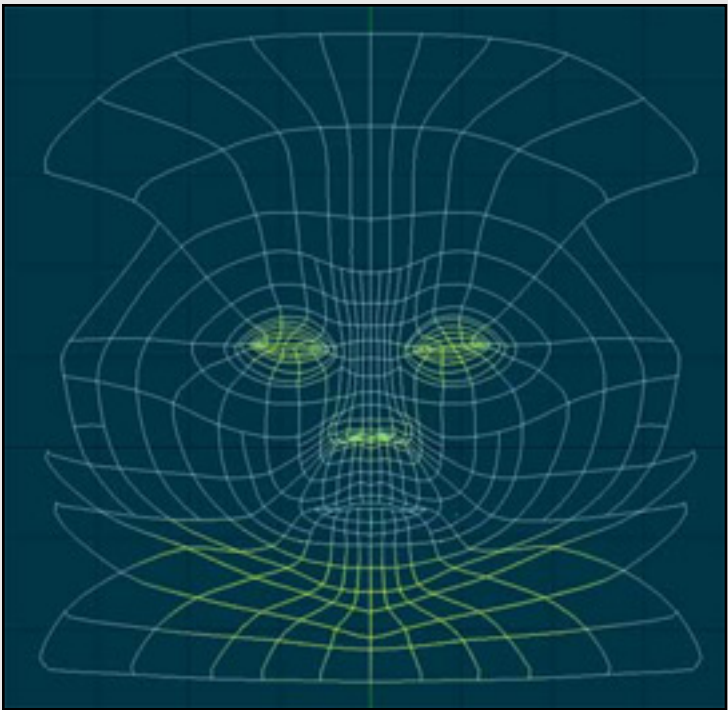
You should get results similar to the far right image. If it doesn't look right you either didn't pull the pivot point back far enough, you deselected the manipulator and reselected it which resets the pivot, or you didn't rotate the y- axis point down to the x-axis.



Step 80.

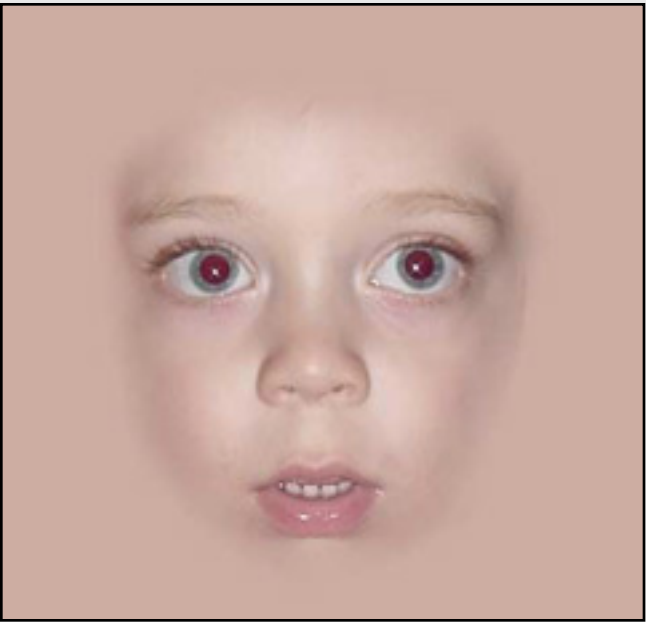
When you decal, AM only textures faces that aren't blocked from view. So we'll need to tweak the mesh a little in order to get it into a form that will texture properly.

The jaw, nostrils and eye lids will definitely have to be fixed on this model. The image to the right shows the tweaks.



Step 81.

How you paint your texture is up to you. I usually start with my front roscope image and outline it with a neutral color, in this case flesh tone. Take note of this color's RGB values because you'll use them later.

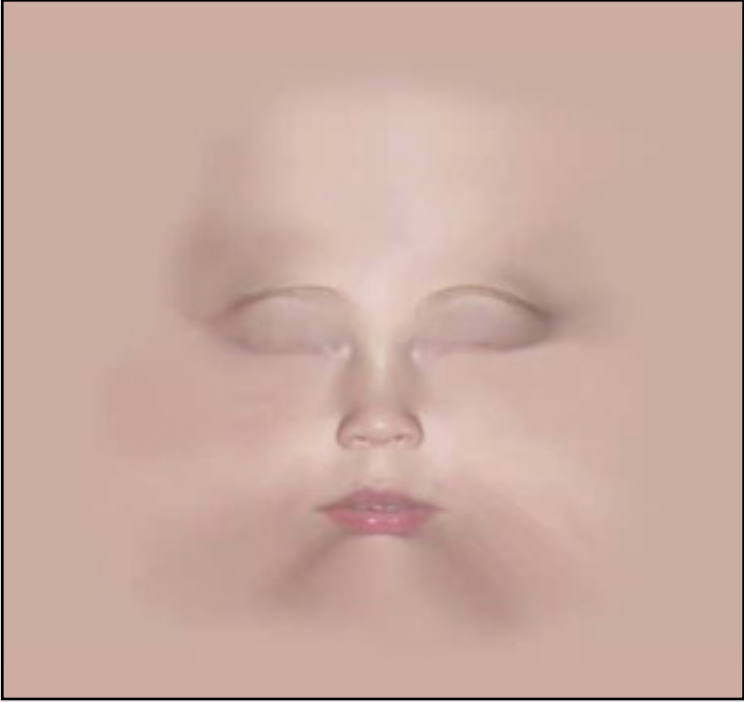


Step 82.

I screen grab the flattened wireframe and use it as a guide for my texture. Then I paint, push and pull the photo to fit the wireframe.



Here's the finished texture.

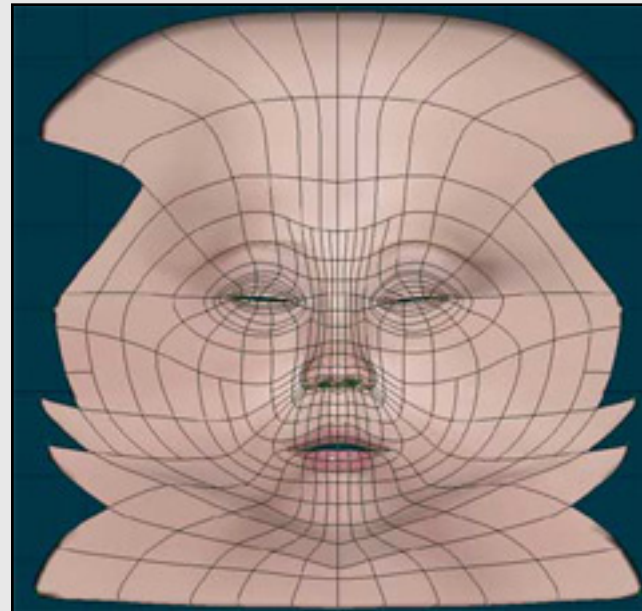
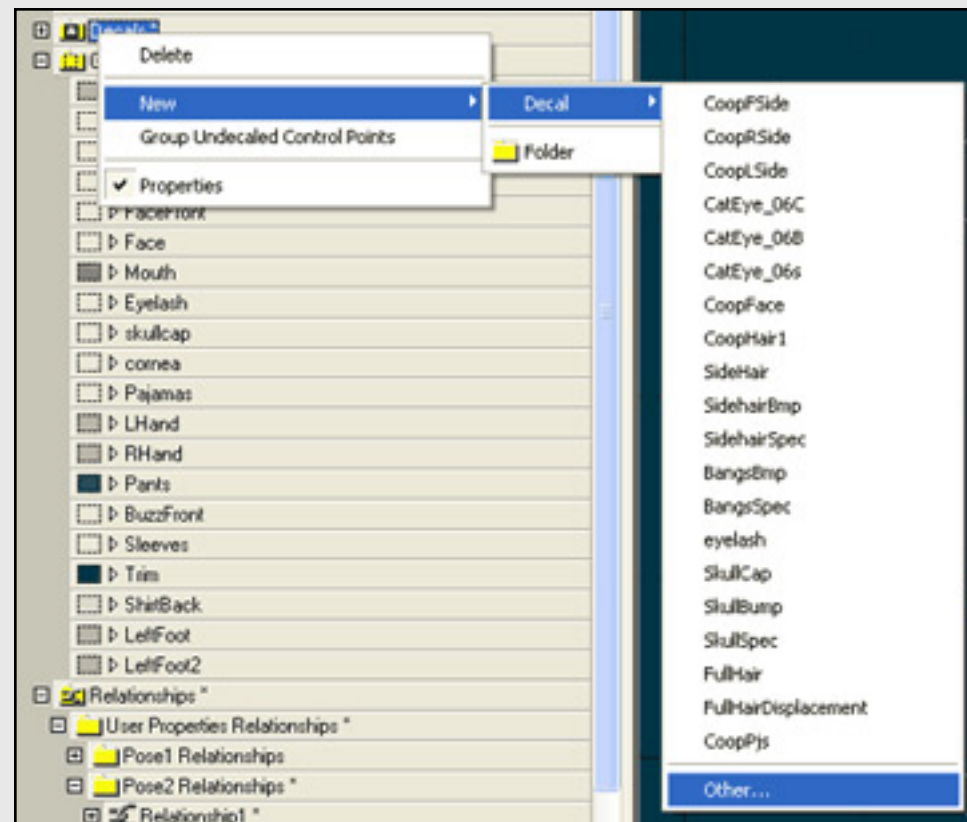


Step 83.

In AM while still in the Flattened pose, right mouse click (cmnd mouse click on the Mac) on the Decals folder in the project workspace. Select "New"/"Decal"/"Other" and load your texture with the wireframe overlay. Having the wireframe overlay allows you to place the texture perfectly.

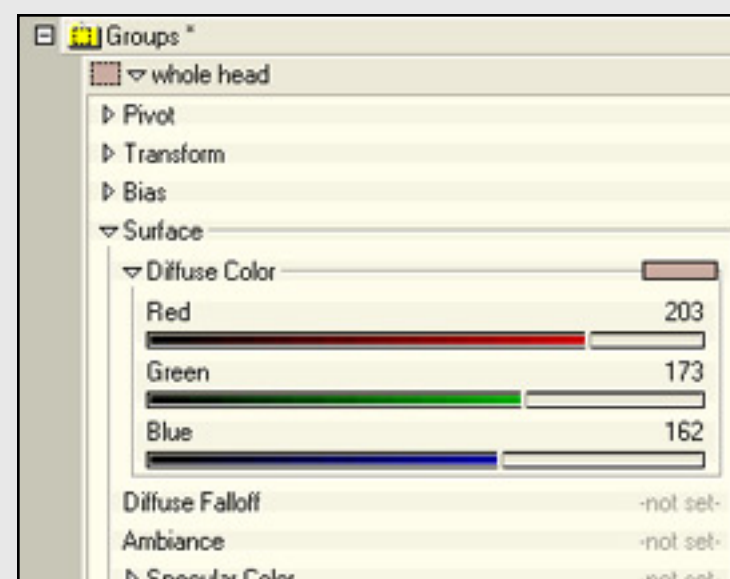
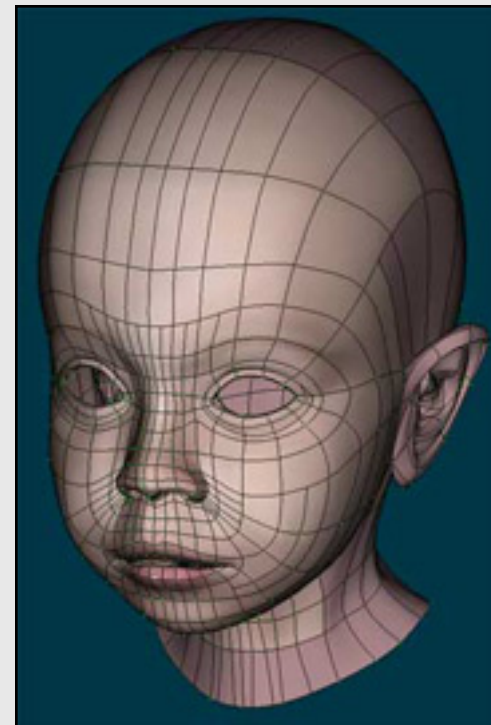
Position and scale the Decal to fit your mesh, then right mouse click (cmnd mouse click on the Mac) and select "Apply" to apply the decal.

Now in the Images folder in the project workspace you can change the file path of this texture to the texture without the wireframe overlay and you're almost done.

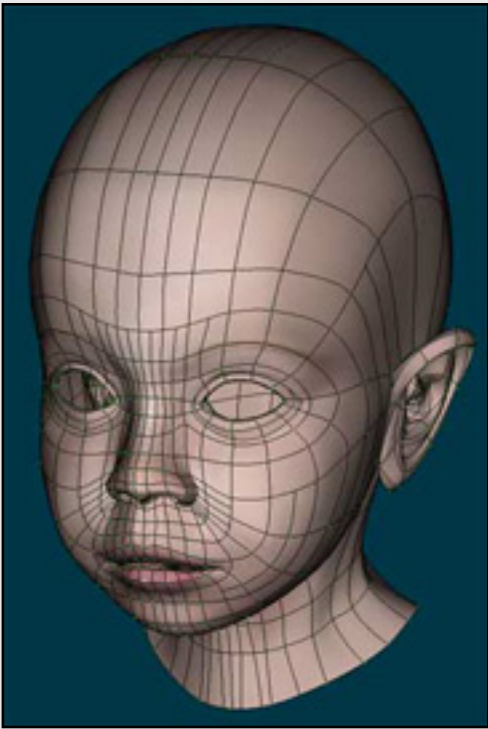


Step 84.

Notice the Hard line on the border of the face. This is easily fixed. Remember in step 80 where I said to remember the RGB colors of your general flesh tone. Well now we set the "Head" groups Diffuse color to those values and...



... Bingo! No more lines. You gotta love groups.



That's all for the head. Next the Body.



Back to tutorial index	Previous tutorial	Next tutorial
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Modeling the Arms and Torso...

Step 85.

Select all of the points on the model except for the last spline ring at the base of the neck.

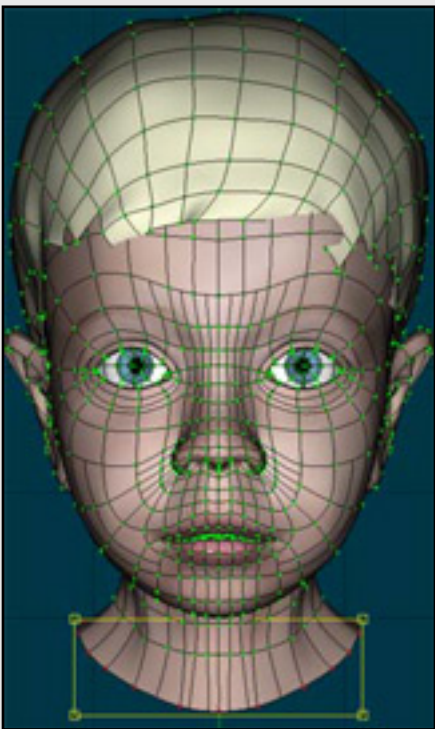
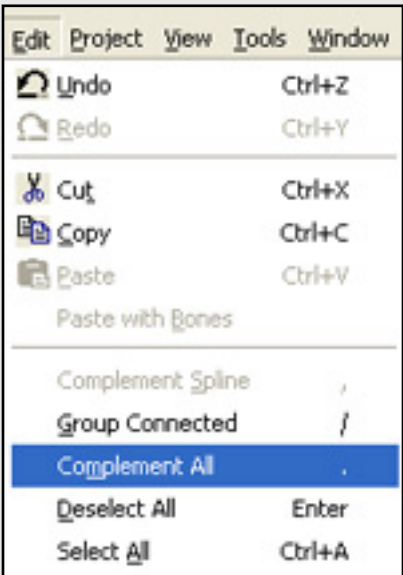
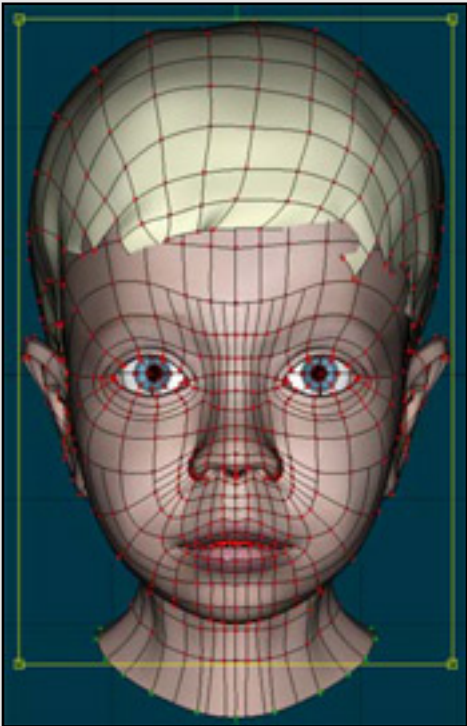
In the "edit" menu select "Compliment All" or simply hit the "." key. This will select all of the points on the model that aren't currently selected, in this case the last spline on the neck.

You might ask, "why not simply select the last spline on the neck in the first place?" To illustrate a point.


Sometimes when you select a large number of points on multiple objects, i.e. a head, eyes, and hair, AM misses some of the points in the selection. This happens more with the Lasso tool than the drag selection tool, but if your not careful you can mess up your model in subtle ways without even knowing it until you've saved it.

This problem with selection happens when using the "Compliment All " command under the "edit " window as well. So be aware of it and double check your selections.

So check the spline ring on the neck . If all of the control points are selected then we're ready for the next step if not... Select them.

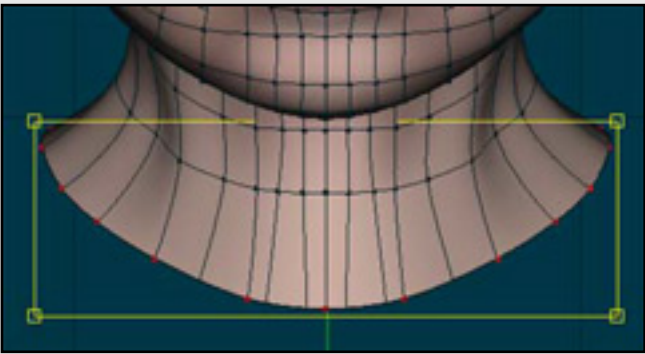


Step 86.

Now you can hit the lock button . This will lock all of the points on the head except the last spline ring on the neck.

Drag a selection around the splines to see that only the last spline is selectable now.

We could just hide the head, but you'll need it as a reference for the torso's proportions, unless you're

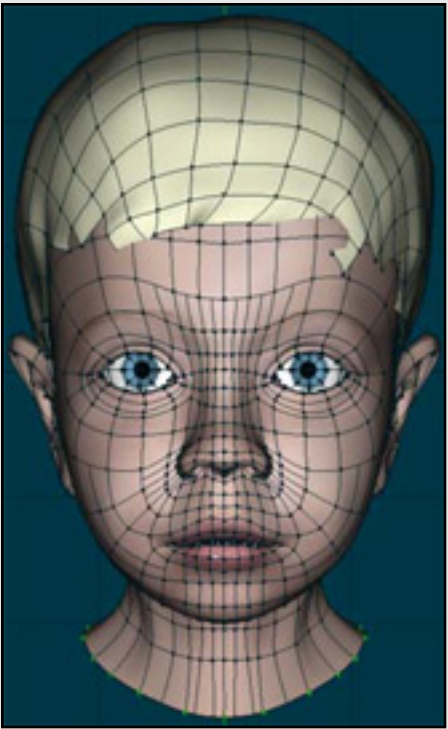


working from a rotoscope (which I do recommend).

In my case getting a 2 year old to assume the T pose and hold still long enough for me to take shots front on and from the side would have taken longer than the time it took to model him in the first place.

So I "free" modeled him, after the head.

Leave the spline ring selected and move on to the next step.



Step 87.

Extrude the spline ring up to start the collar. Scale the ring inward a little to create the effect of cloth laying on the neck.

Continue to extrude the collar out. Create a second ring by extruding down and scaling back out.

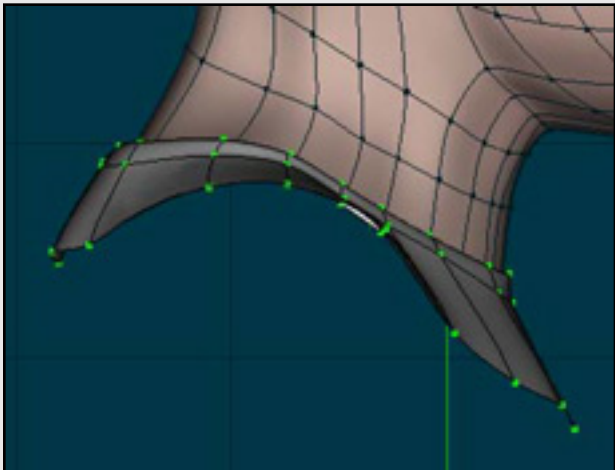
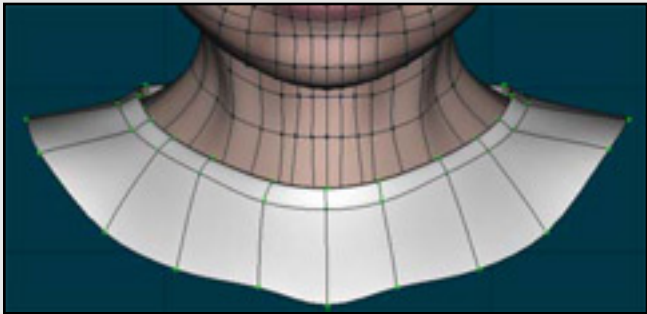
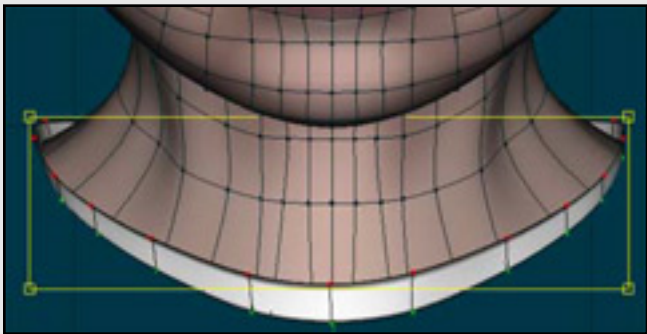
Extrude downward one more time and scale the spline on the x-axis only.

Tweak the points to create the curve of the top of the chest and back.

I wont be covering the modeling of collar bones here, but they are fairly simple to add into the model.

Notice the image on the bottom. The curve of the outer spline ring, particularly at the center of the chest, is very similar to the cleft created by collar bones. If your model has collar bones then simply move this spline up a little and follow this entire step all over again creating a collar bone ridge that will unnaturally go around the neck.

Break the Collar bone ridge splines 4 points out from the center spline and smooth the ridge over the shoulders and back. Now when you create the arms you'll be able to attach the Collar bone to the shoulder and continue on from there.



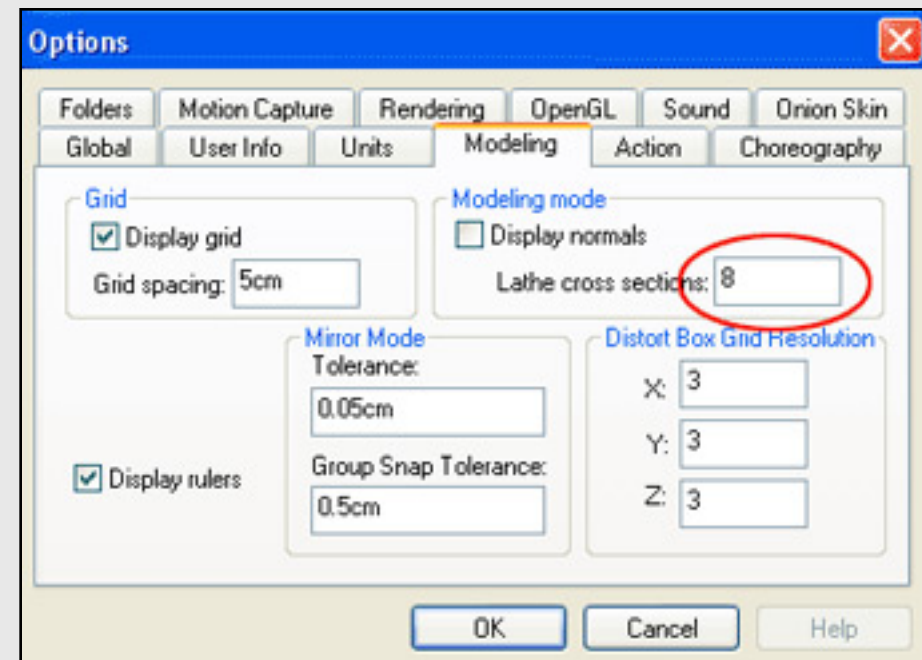
Step 88.

In the front view, either above or below your model draw a spline that looks similar to the one in the image on the right. Make sure it is out from the y-plane. In order to create a tube when we lathe it.

In a side view check to see if the spline is directly on the x-plane. If it isn't move it there.

On the Top menu bar under "Tools"/"options" select the tab labeled "Modeling". Make sure that the Lathe

cross sections are set to 8.



Step 89.

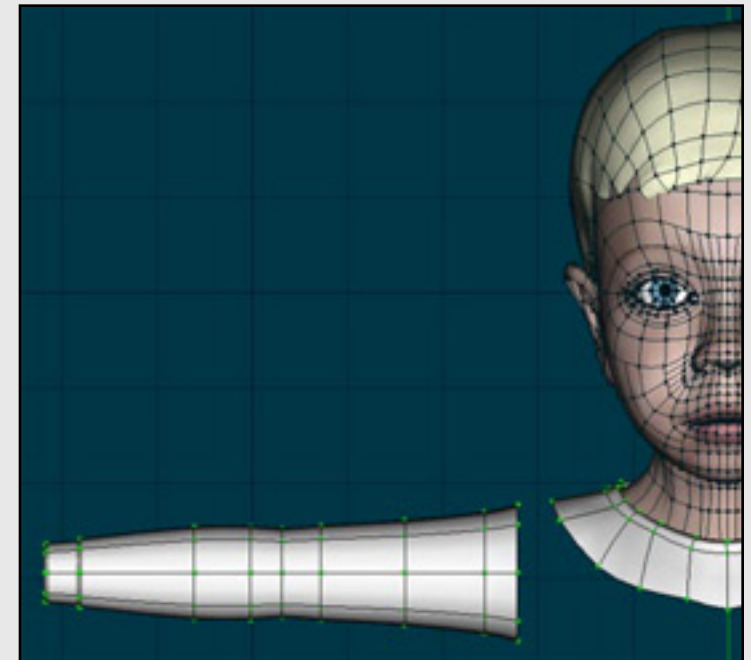
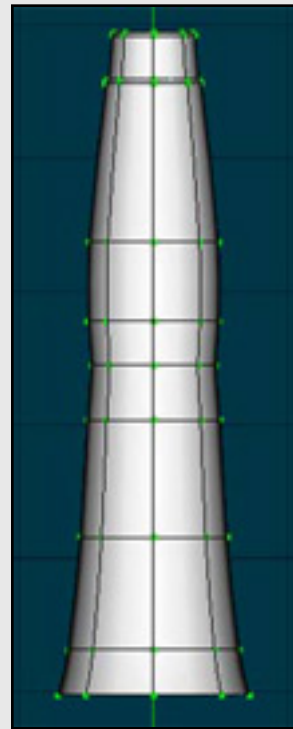
Lathe the spline and Rotate it into position around the shoulder. If you need to Scale the arm as well to fit it to the proportions of the head.

Notice the 3 spline rings that make up the elbow. All Joints on a model should have at least 3 spline rings in order to flex easily. Less than 3 rings and you don't have enough control points to create a bend that will leave the limbs straight.

Looking at the other extreme. Try not to have too many spline rings in your joints as they become very difficult to animate when more geometry is added.

Even photorealistic joints can be created with 3 or 4 spline rings if you're good at sculpting the mesh.

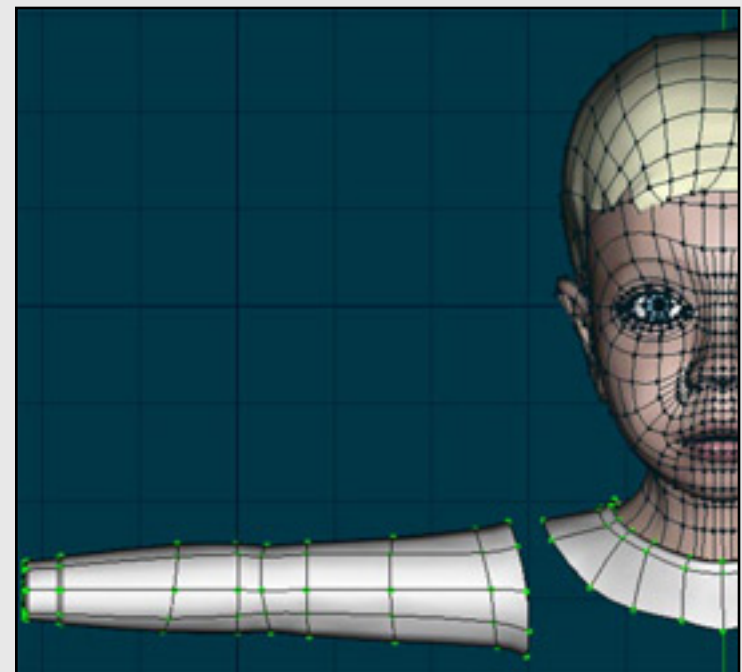
Practice, trial and error are all it takes.

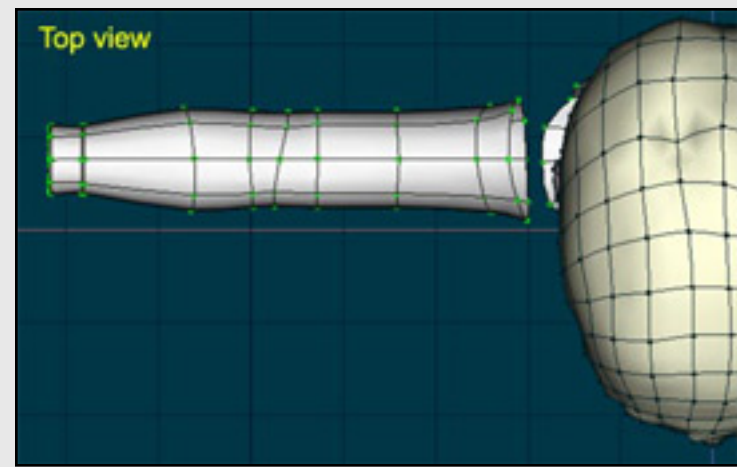


Step 90.

Tweak the points on the arm to create the bulge of the biceps and the forearm.

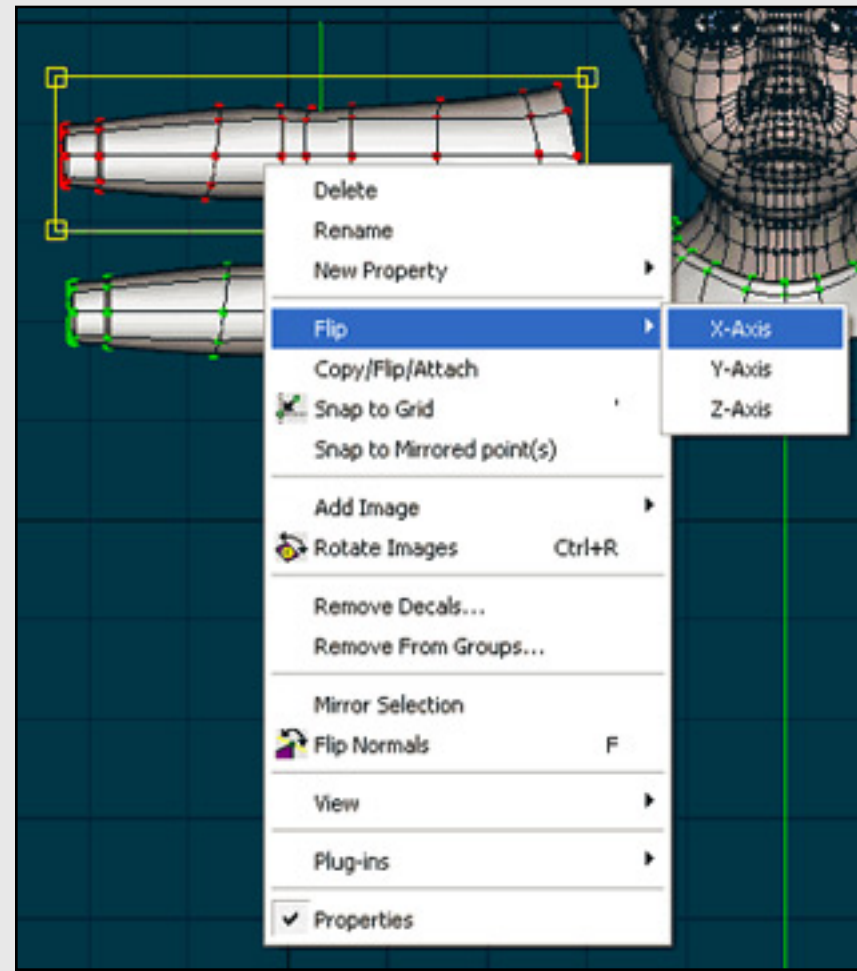
In the top view, notice how I slightly rotate the center spline of the elbow joint. This is a simple trick to make the elbow animate correctly when it is bent. When the spline rotates on its center, the elbows back will point and the inner part of the joint won't collide with the biceps as much. More on this later.



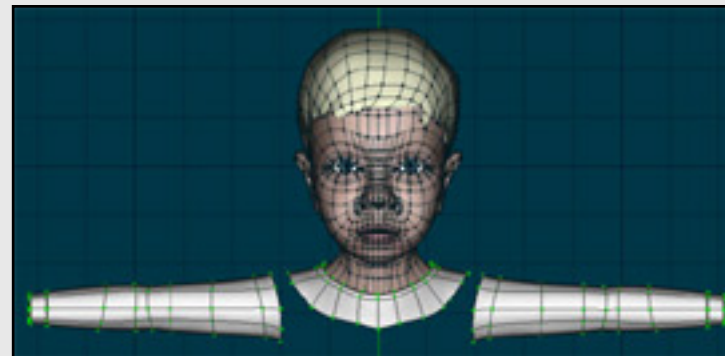
**Step 91.**

Select the arm and copy and paste it.

Then right mouse click (cmd click on the Mac) and select "Flip"/"X-Axis". This will flip the arm on the x-axis to create the left arm.

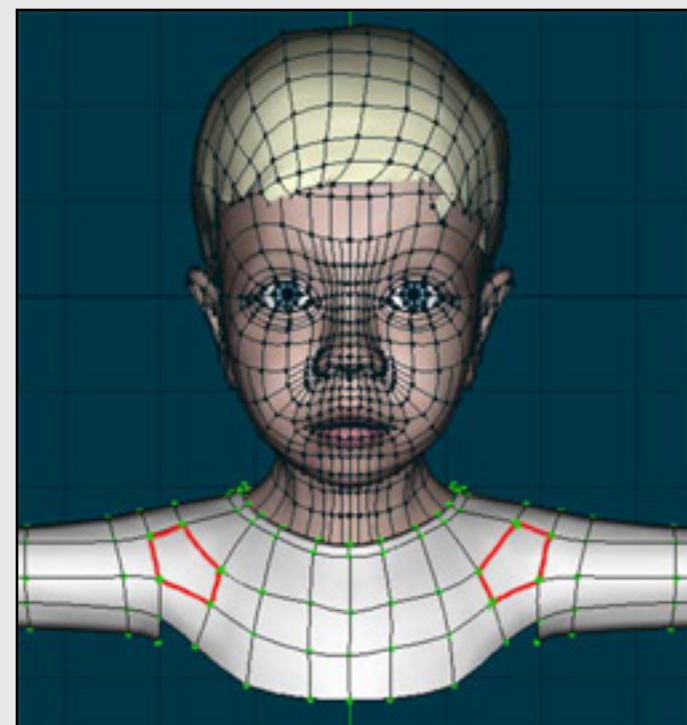
**Step 92.**

Position the left arm.

**Step 93.**

Connect the arms to the shoulders by drawing and connecting splines using the add and add Lock tools.

Notice the 5 point patches at the shoulder. These will animate smoothly.

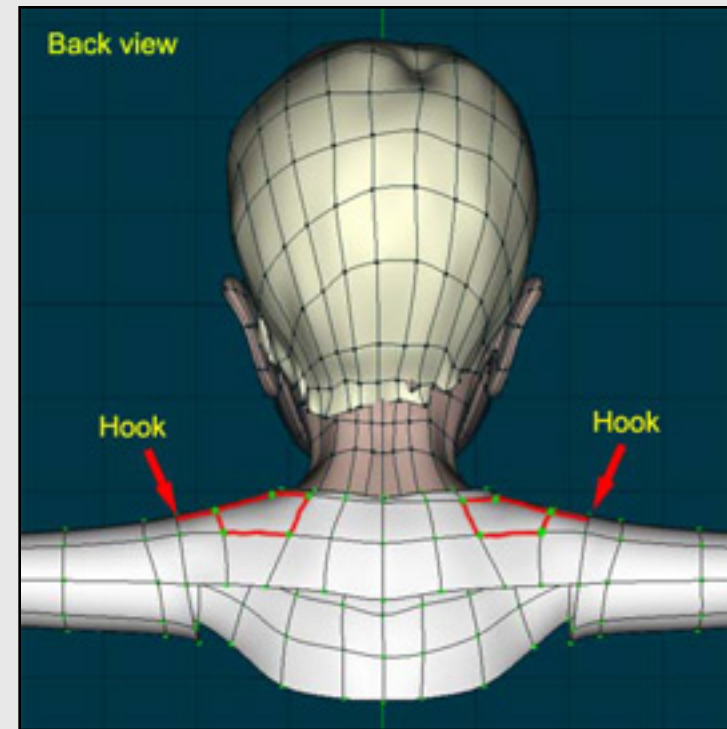


In the back view connect the shoulder and arms in a way similar to the image on the right.

Notice the 5 point patches are used again, but with the addition of a "hook" on each shoulder. This was necessary to give one more control point for shoulder bending, but without adding extra geometry to the arm.

These 5 point patches couldn't be in a better place. The angle of the mesh around them and their position on the body makes them particularly ideal for this location and allows the mesh to be greatly simplified.

Notice how the splines in the neck end in hooks, to further simplify the mesh.

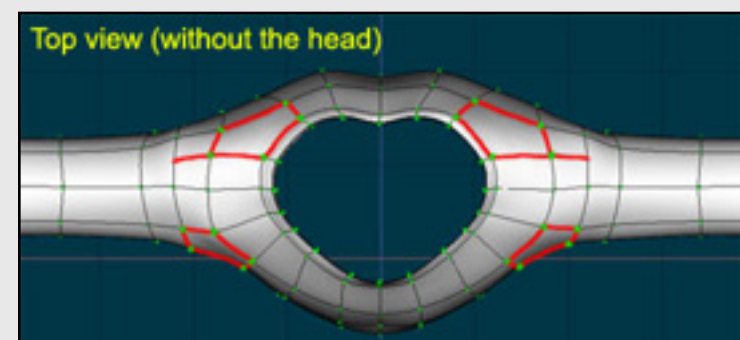
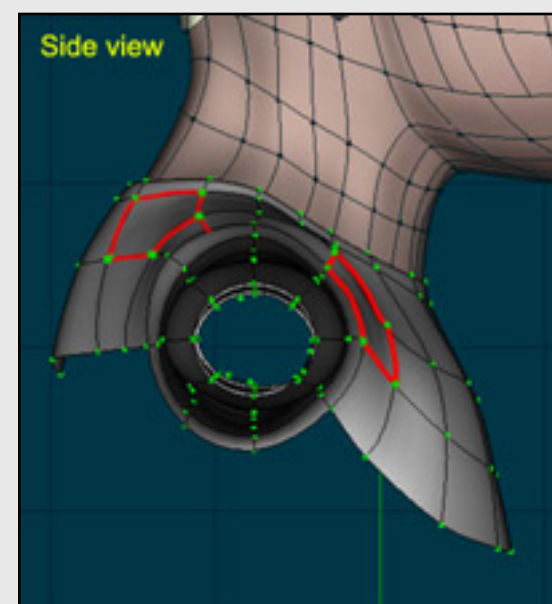


Two more views to show the shape of the mesh and the use of 5 point patches and hooks.

Look at the top view and imagine the arms flexing forward and back and you should be able to see why the 5 point patches work so well in this instance. They bend exactly where the mesh needs to bend.

4 point patches in this case would require more mesh and still bend in a way that required more work to get a good result.

This is of course my opinion, for what its worth, so how you handle these areas is up to you.



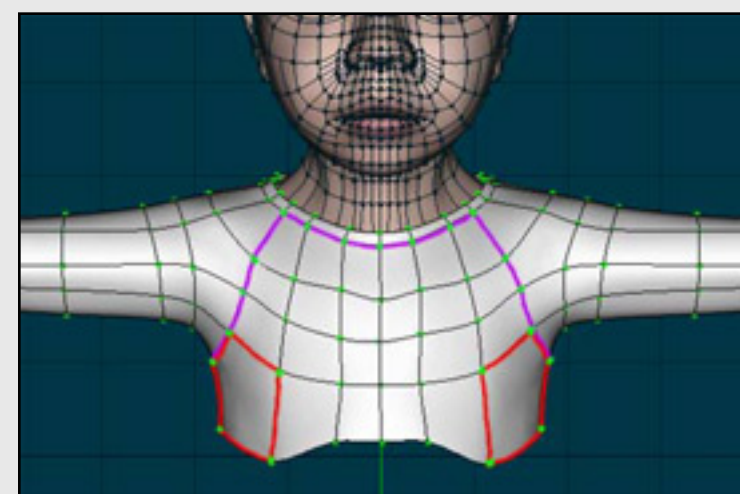
Step 94.

Now comes the point for some tough decisions. Why will they be tough? Well because they will depend more upon the shape and complexity of your mesh than most of the decisions you've had to make so far.

Continue to create the mesh of the torso by adding splines to create the shape of the rib cage.

Notice at the armpits that the spline goes under the arm instead of down the line of the body. This was one of those variable decisions. I chose to do my mesh this way for two reasons.

1. it created a nice anchor point for the underarm to bend with.
2. It allowed me to create a spline line which could be used to create the shading group for the top of the model. This is shown at the end of this tutorial



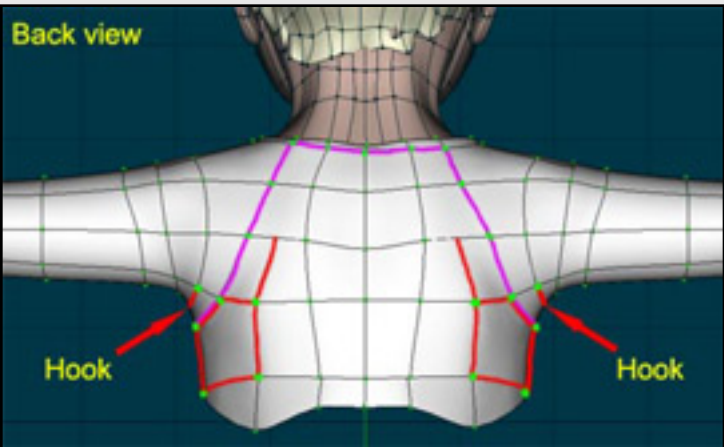
Notice the multiple 5 point patches under the arms. Notice the splines that end in "hooks" as well.

In truth I modeled the shoulder differently the first time. I went back later and changed it to close off the splines under the arm. I was afraid that it would make animation more difficult, but it actually helped make it easier. Perhaps the 5 point patches in this particular configuration give the shoulder a better range of motion (from a creasing point of view) than 4 point patches and "hooks" would.

The image on the Bottom shows an actual render to show that the 5 pointers don't create artifacts. Or if they do they're so slight that texturing will hide them.



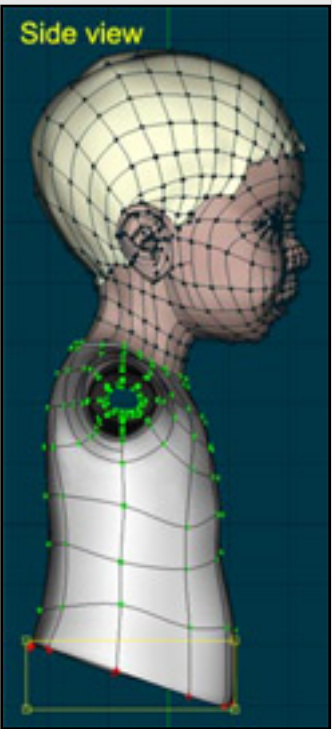
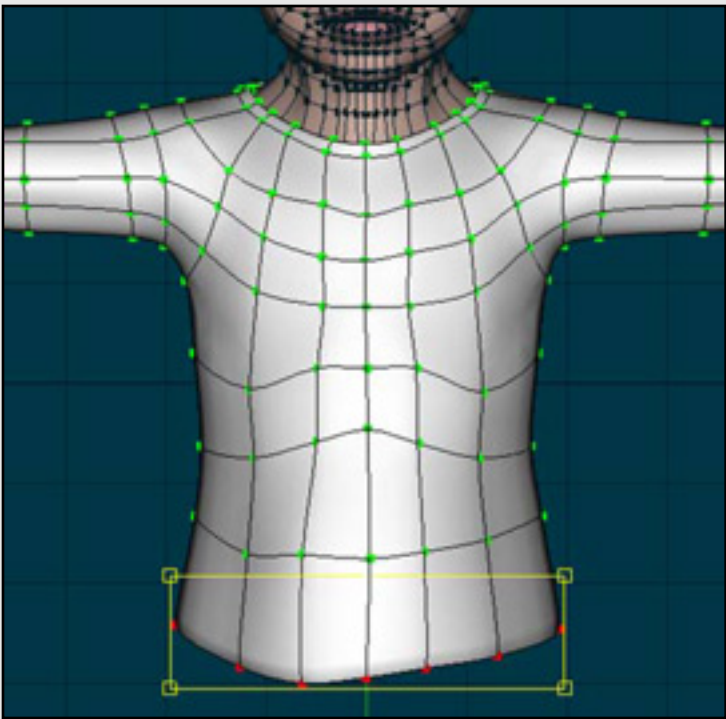
Another shot from the back showing the spline line created for grouping later and the use of "hooks" and 5 point patches.



Step 95.

Finally you can extrude the spline rings down the torso to create the abdomen and lower back.

I wanted to give the effect of a shirt so I got away from complete symmetry in order to simulate the effect of a tight shirt gathering at the hips.



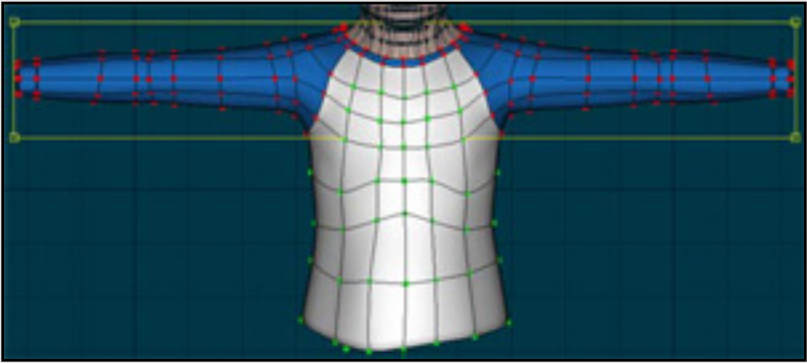
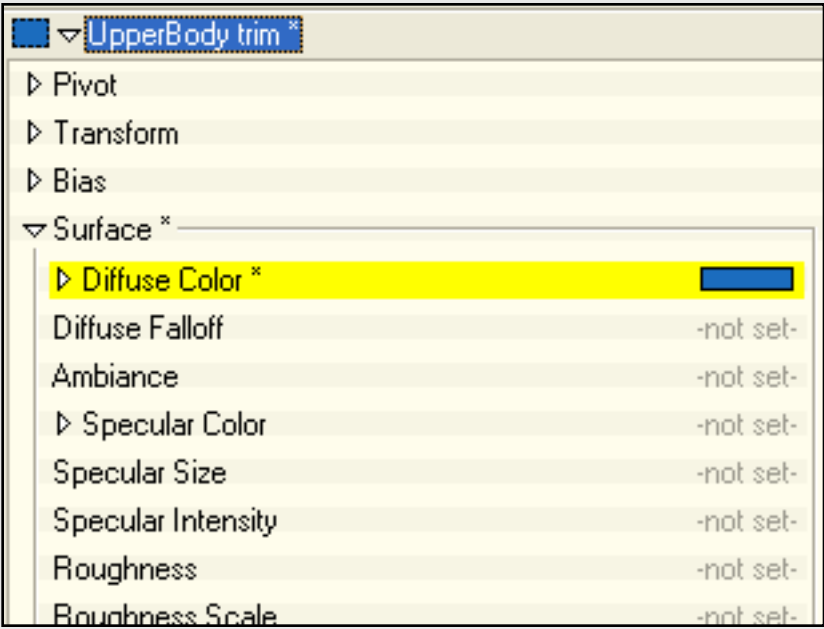
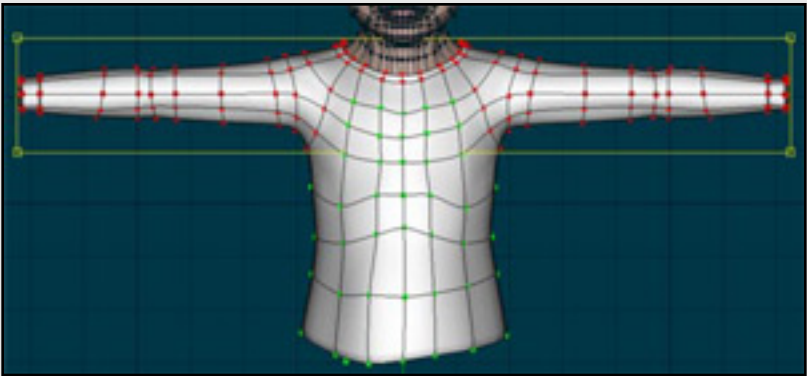
Step 96.

Now onto the grouping. I selected the "Trim" areas of the model, aided by the fact that my patches where created to simulate the shape of the trim.

I grouped the points and gave them a blue diffuse color.

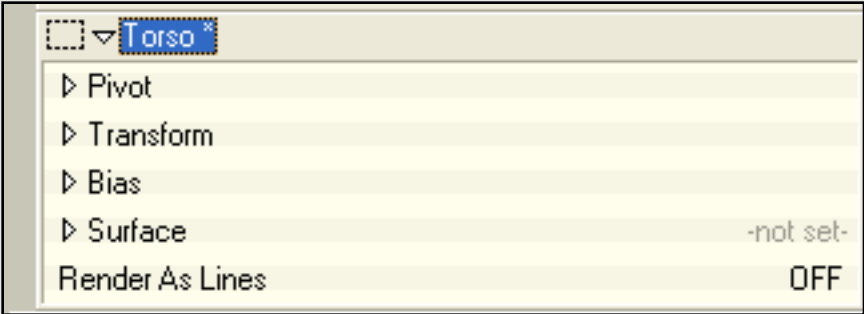
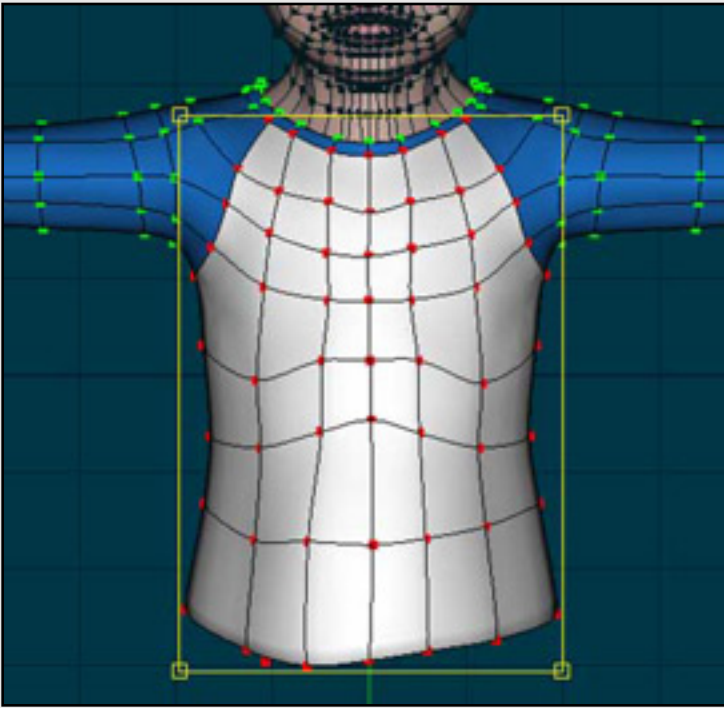
This step probably doesn't apply to your model, because you probably aren't modeling pajamas on your character, but it does illustrate a valuable technique for texturing which will be made very clear when we go over the texturing of the body.

For now its sufficient to show that the creation of groups as you model is very important. It allows you to select things quickly and easily for editing, duplication, hiding, locking, you name it. If you don't use groups much then your working way to hard.



Step 97.

I then selected the complimentary patches and created a group named "torso" , to aid in texturing later.



Next up the hips and legs.

[Back to tutorial index](#)

[Previous tutorial](#)

[Next tutorial](#)

Modeling the hips and legs...

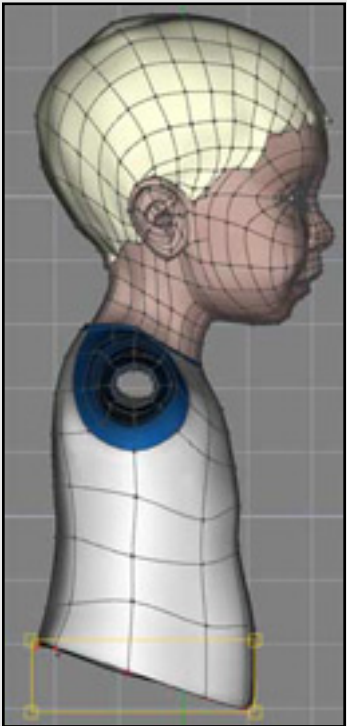
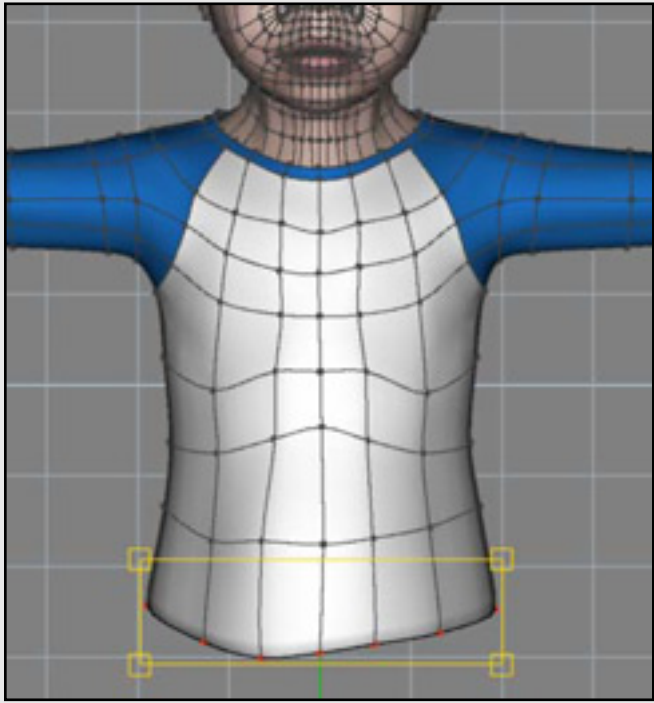
Step 98.

Select the bottom row of points by drag selecting the whole spline or by clicking on one point and hitting the "," key.

a note about the numbering of these tutorials. You're probably thinking "step 98"? Come on this thing is more complicated than building a 747 from tooth picks.

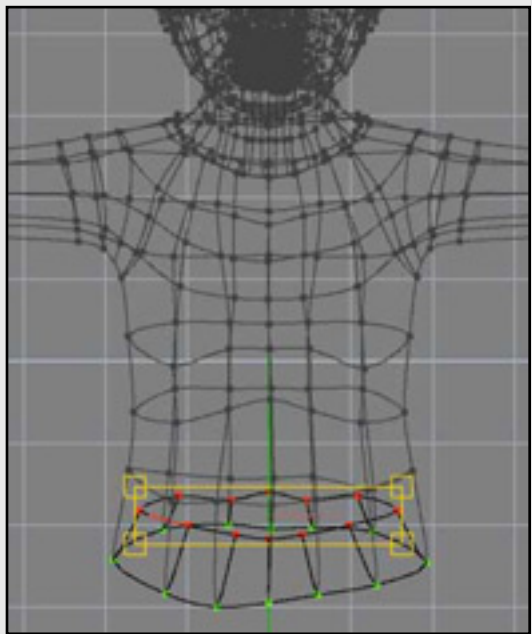
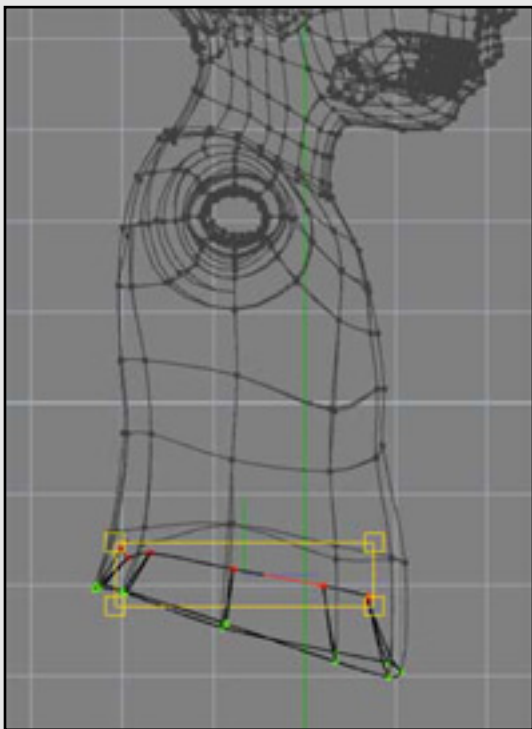
Well I'm simply trying to show a progression from start to finish. Each individual section should be considered its own tutorial, but for those of you who might come into the tutorial midway without seeing the beginning parts, I'm letting you know that there are several other sections besides this one.

Eventually I'll have a nav bar at the top of each section, but till then....



... Step 99.

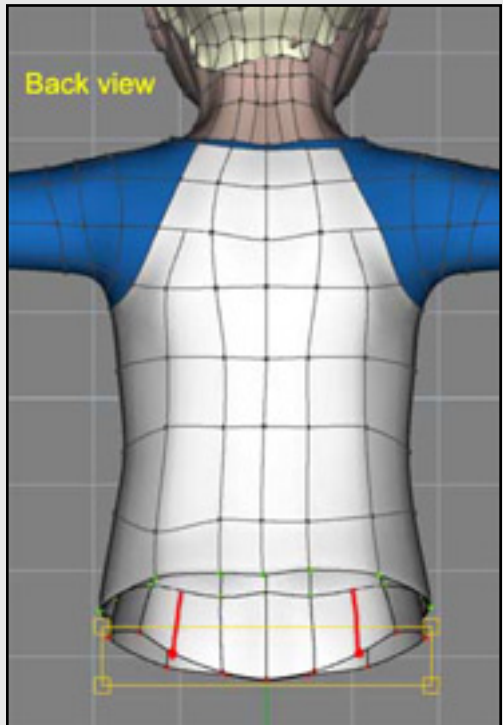
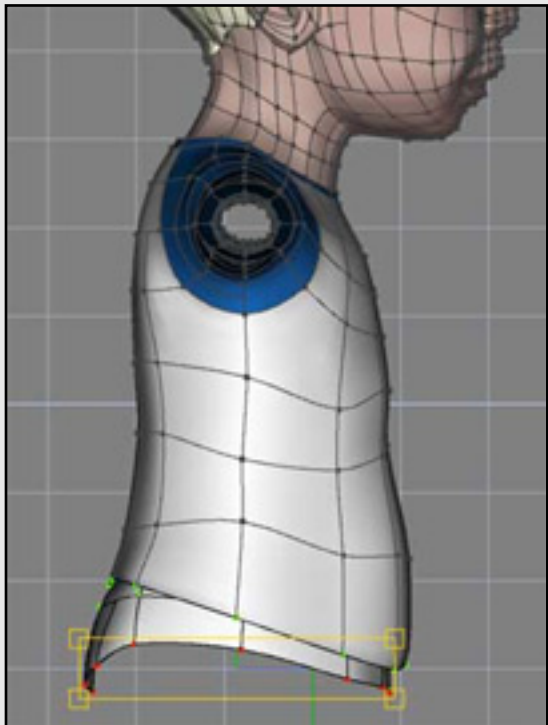
Extrude the spline up into the body cavity, and scale it slightly so that it doesn't collide with the torso's mesh.



Step 100.

Extrude the spline ring down twice. Sculpt the points to begin the form of the butt and hips.

Notice the Hooks I've added on the butt. This will allow for a better curve and more patches to animate. Since the butt stretches a great deal when the leg is lifted, its better to have more patches. If you don't have enough patches you'll end up with some very odd looking buttocks during animation.



Step 101.

Keep extruding the splines down. Keep sculpting the hips and butt cheeks.

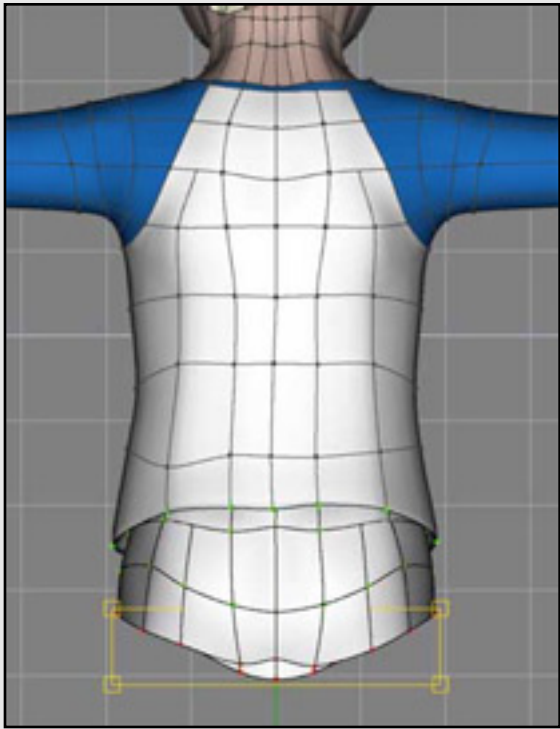
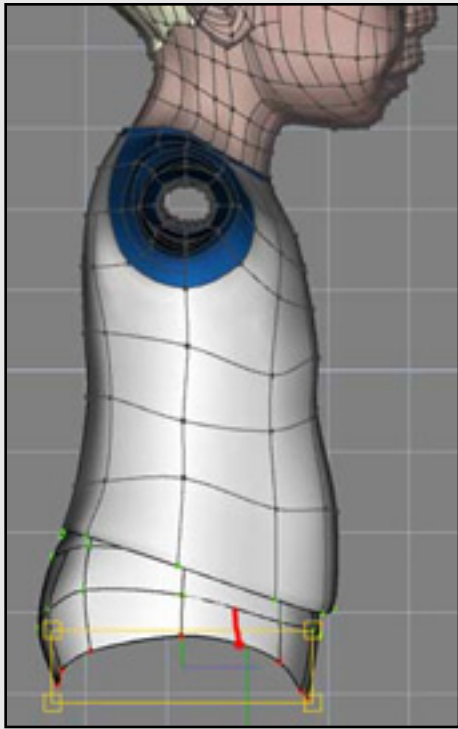
Notice the Hook I've added on the hip. Again this is an area that creases allot, so it will need more geometry in order to describe that crease when we animate.

Don't get caught in the trap of trying to model a low patch count model and leaving out the detail in the joints. If you do your joints wont animate very well.

At the same time don't "over model" your joints. To much detail will make animation a pain.

As a rule I try to give myself one or maybe two more spline rings than I think I'll need to animate. That way I'm covered for most joint bends and I dont have to retrofit the model with splines to fix a joint later.

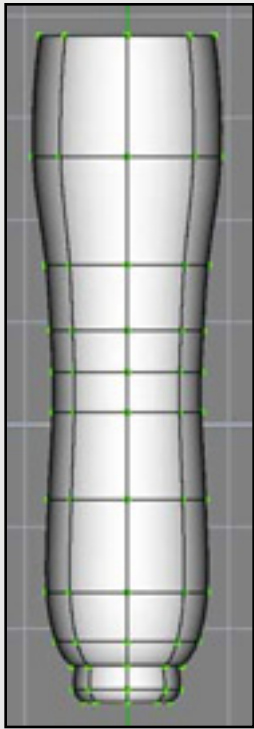
Practice will teach you more than I ever could, so try modeling several types of joints and seeing what it takes to create good bends.



Step 102.

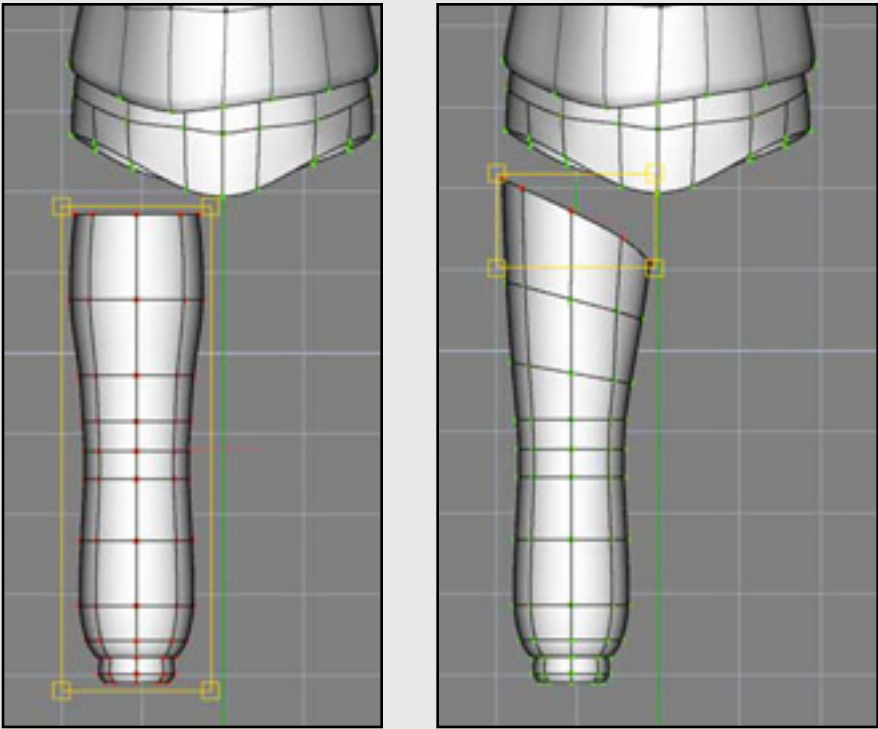
Draw a spline for the contour of the leg. Lathe it with a setting for 8 sections. You can lathe it with more detail if the figure has more muscle definition or detail. Otherwise a setting of 8 sections on a lathe will allways give you a decent amount of patches to work with, and more importantly, a spline on each side.

Having a spline in each corner of a round shape helps to keep that shape round when you start tweaking it. Without those splines to "anchor" the cylinder, you could easily tweak it to the point of losing your curve and make it difficult to recover the shape. Trust me on this one. I've been there.

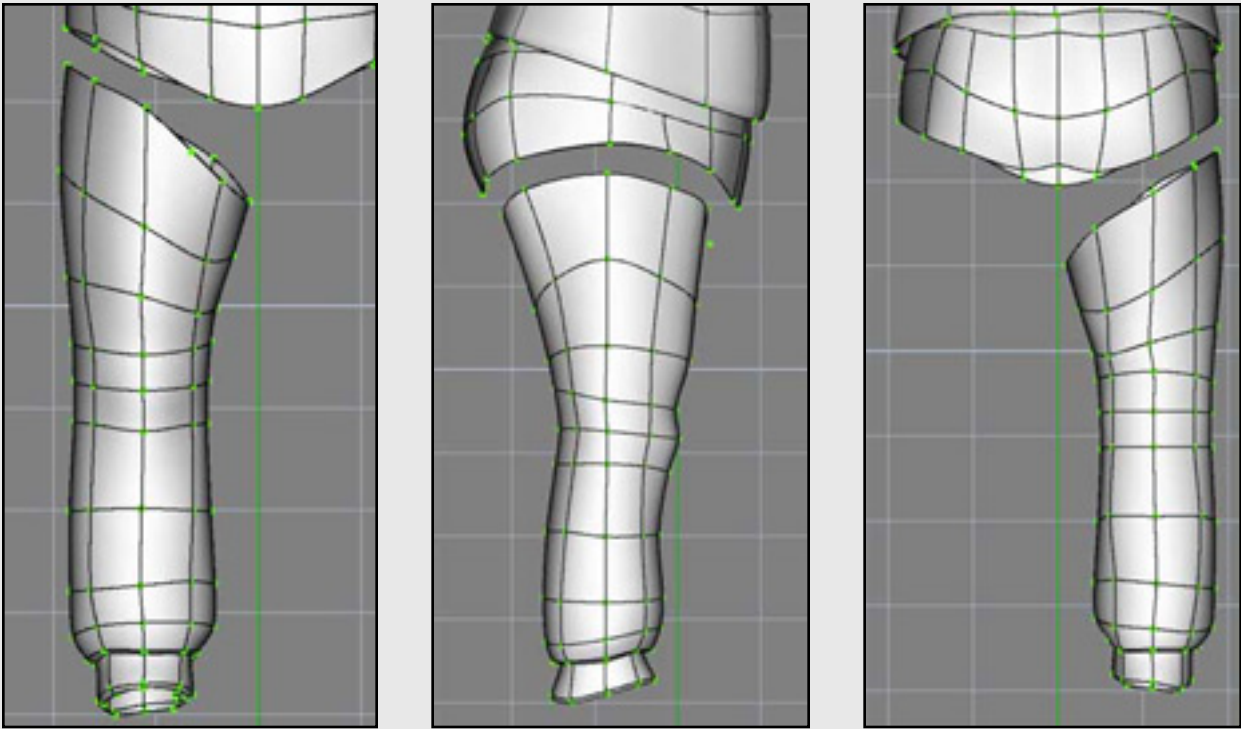


Step 103.

Position the leg and begin tweaking the splines to form the thighs and lower leg.

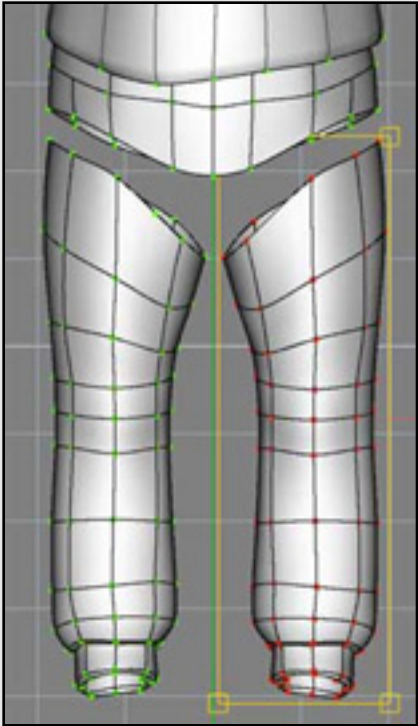
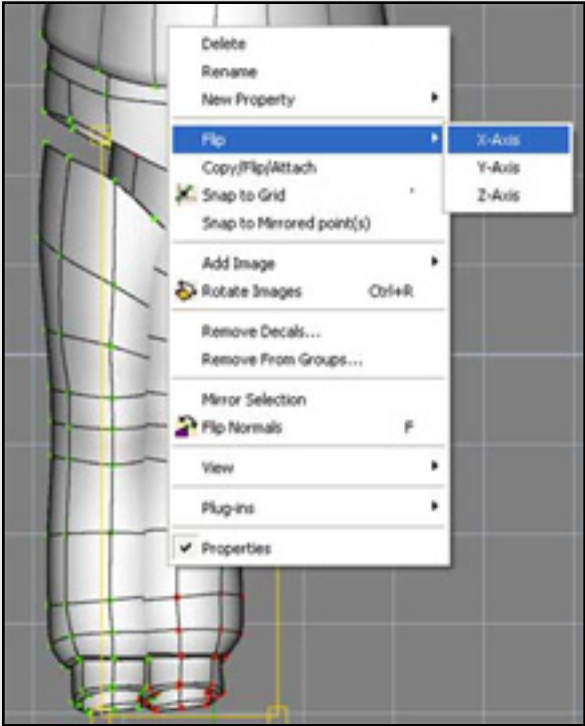


Some images of the finished leg. Very simple, but it describes a fairly complex shape, which can be further enhanced to look like cloth with a displacement map or bump.



Step 104.

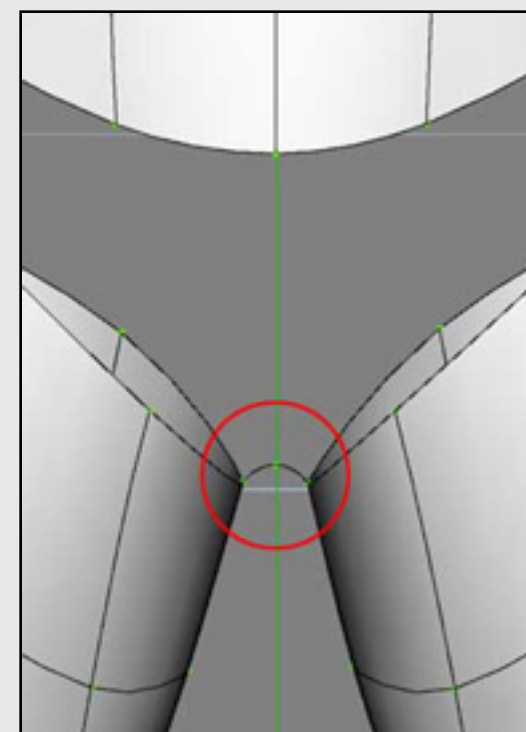
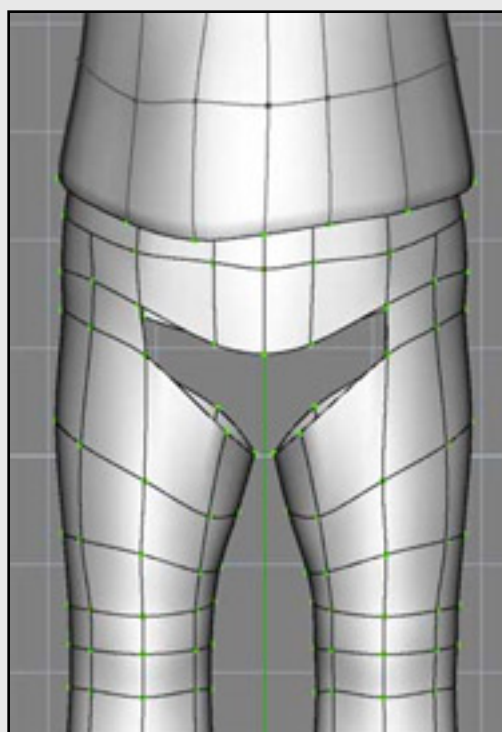
Copy and Flip the leg on the x-axis. Position the copy.



Step 105.

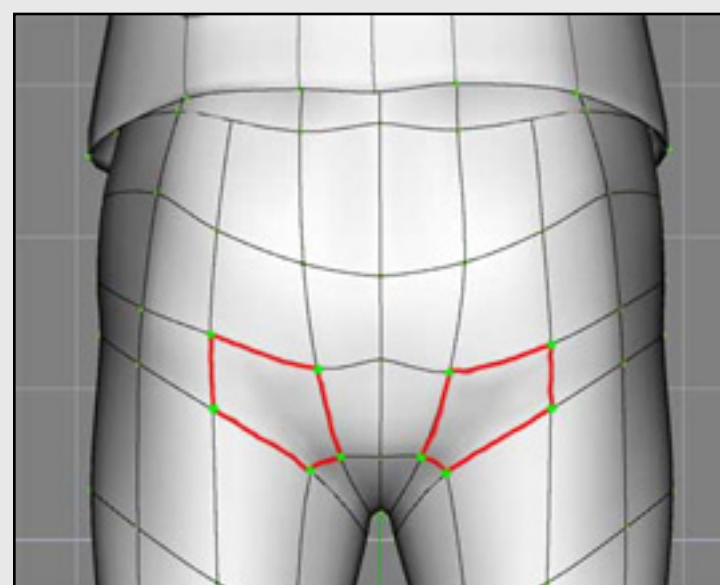
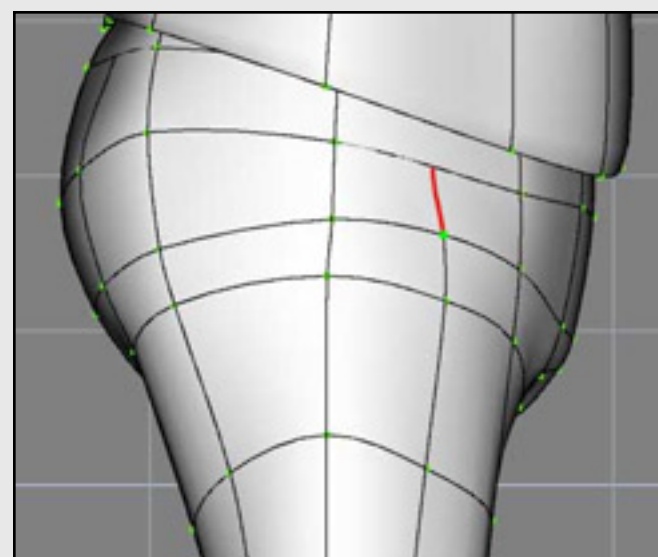
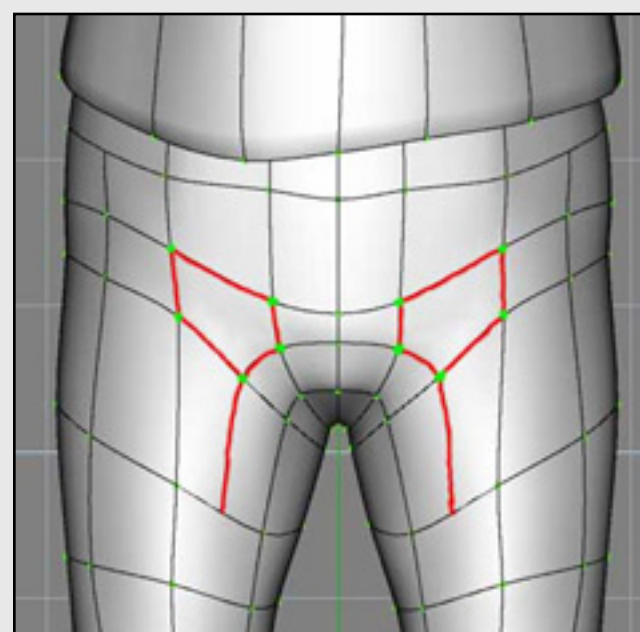
Begin attaching the obvious spline matches. Don't you love to play connect the dots?

Once the obvious stuff is done, create a spline to connect the inner thighs together. Make sure this "crotch" spline has a point on the center axis.

**Step 107.**

Now the fun part. Figuring out how to fill the holes. All I can say is look at the pictures and see if you can get something similar.

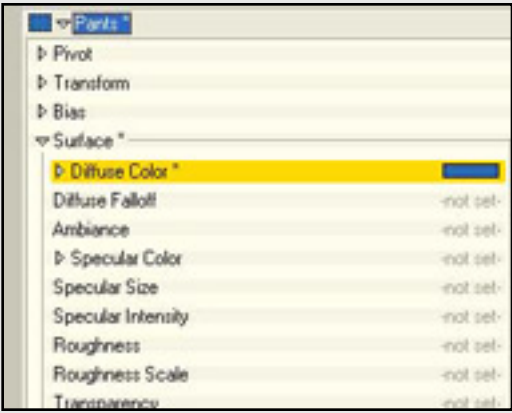
Notice the five point patches and the hooks. I'm starting to notice a pattern here. Maybe its just the way I model, but I always have 5 point patches and hooks at complicated joints.



Step 108.

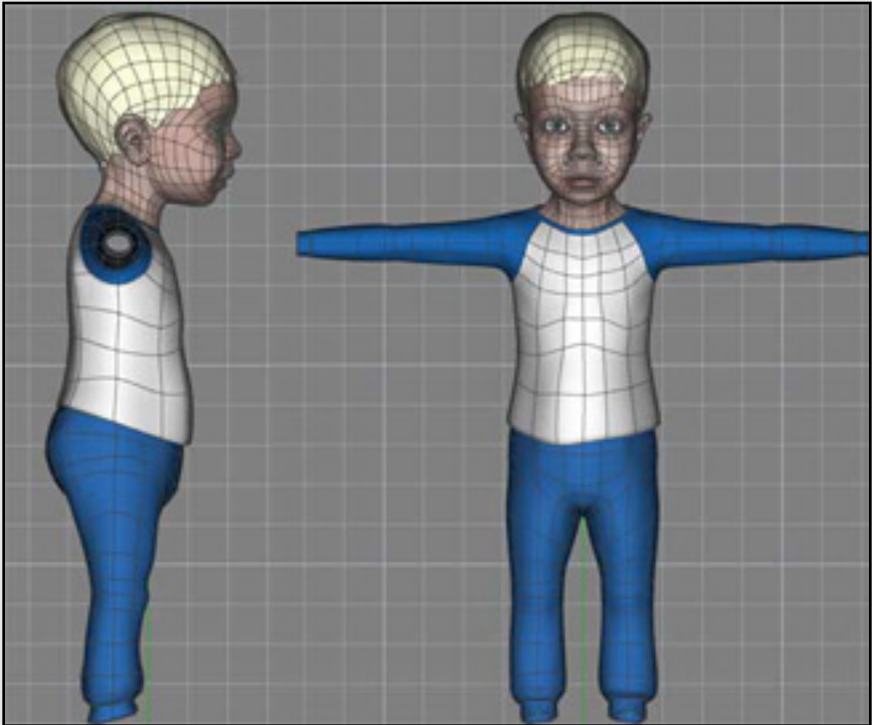
All that's left is to select the patches that make up the pants and group them. Name them something descriptive....like....pants. and give them a color if you wish.

I generally color my groups as I go to give me a visual way of seeing them without having to count them in the project workspace.



And he's done.... Well almost done. Still have to put his hands and feet on him.

Which we will do in the next sections.



[Back to tutorial index](#)

[Previous tutorial](#)

[Next tutorial](#)

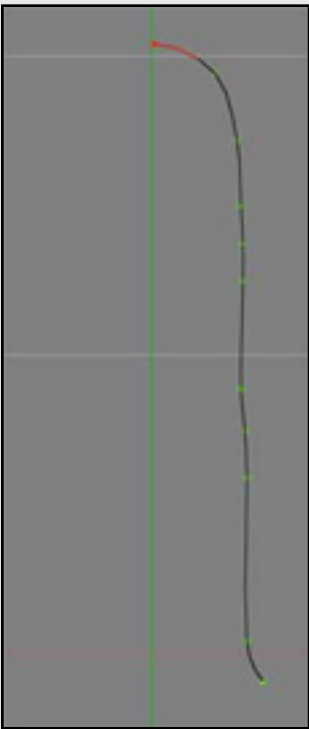
Modeling the hands...

[Click here to download the hand and foot models](#)

Step 109.

Draw a spline that resembles half the silhouette of you index finger.

Notice that there are 3 points per joint, with the exception of the knuckles which only have 2 points.

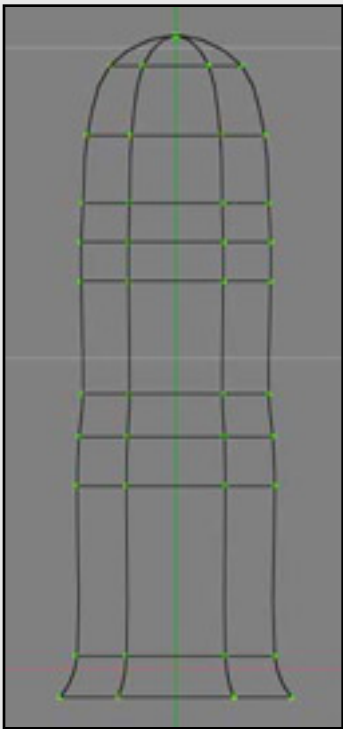
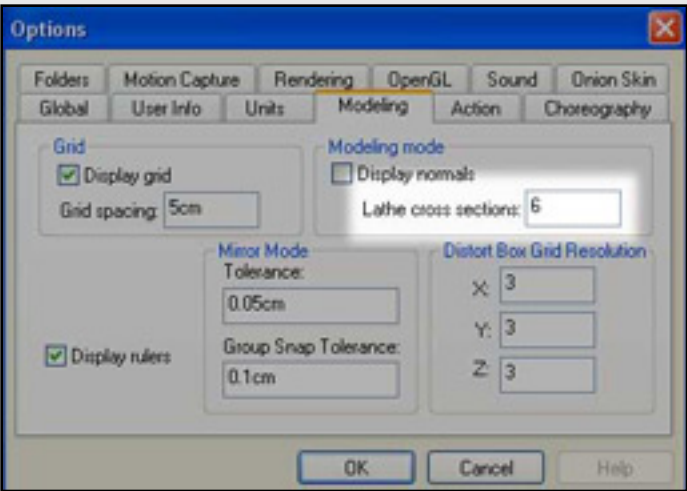


Step 110.

In the modeling options panel set the lathe cross sections to 6. We could set it to 8 but the 2 extra splines aren't really necessary for something as small as the fingers.

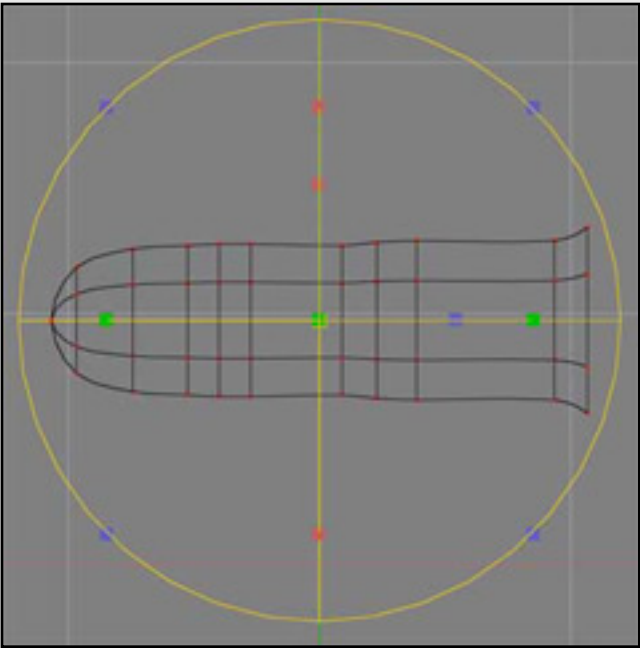
If you are going to get close up on the hands, you may want to set the cross sections to 8 or even 10, as this will give you more to work with when you are modeling the nail beds and knuckles.

Lathe the cross section of the finger.



Step 111.

Rotate the finger on the Z-axis.



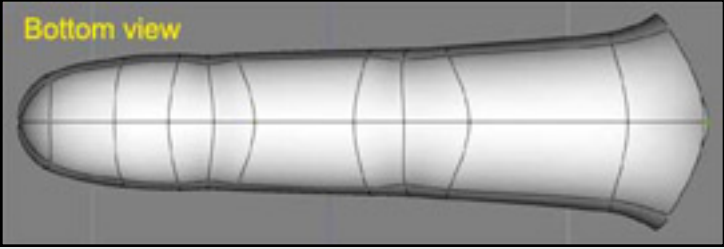
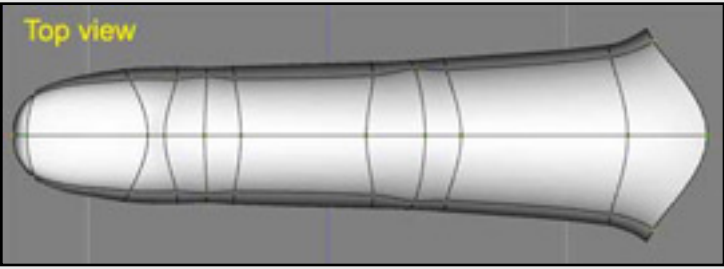
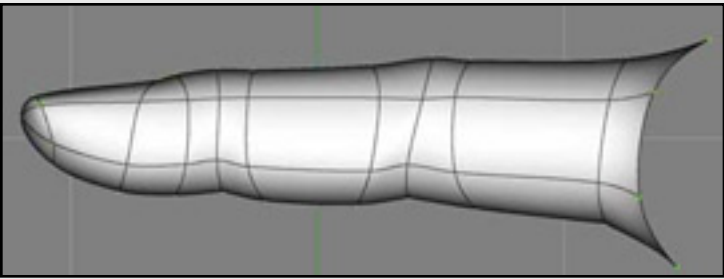
Step 112.

Tweak the points to resemble a finger. Make sure you have 3 spline rings for the knuckles, and notice that the center spline of each knuckle is angled toward the hand. This rotation of the knuckle splines allows for an easy bend when you flex the finger.

I also tend to peak the points in the bends at the joints. This gives a nice crease when you animate. This is seen in the front and bottom views.

I didn't model the nails on this hand. I hinted at them but intentionally left them out. I will texture them using color and probably displacement or bump maps. This will give me greater control over the look of the hand without having to make it spline heavy.

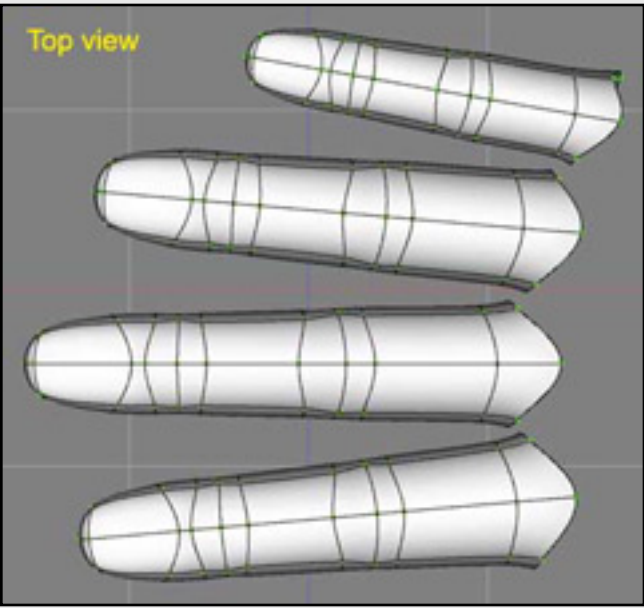
Allways remember that making a model more generic and using textures to make it specific will allow you to use that model over and over again. Why model a hand 100 times over your lifetime when you can do it once or twice and texture or tweak those versions to the desired look?



Step 113.

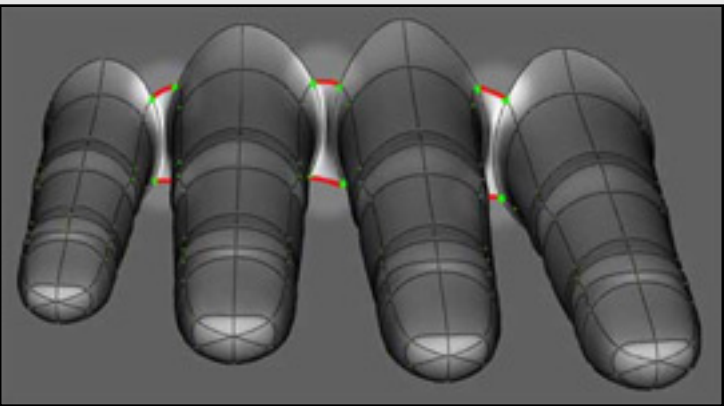
Copy and paste the finger 3 times. Scale and tweak the other fingers to match the middle, ring and pinky fingers.

Don't forget to fan the fingers out so that you can texture and rig the hand. If you leave them pulled together you'll constantly be zooming in to grab points and bones.



Step 114.

Join the splines between the fingers.



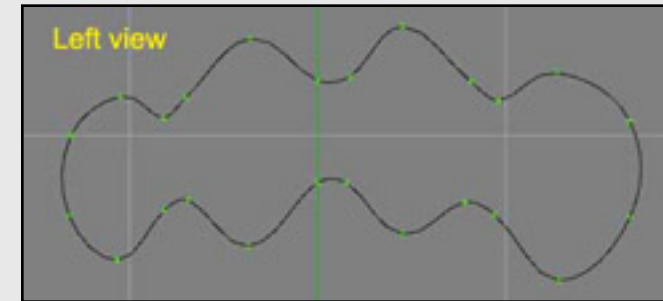
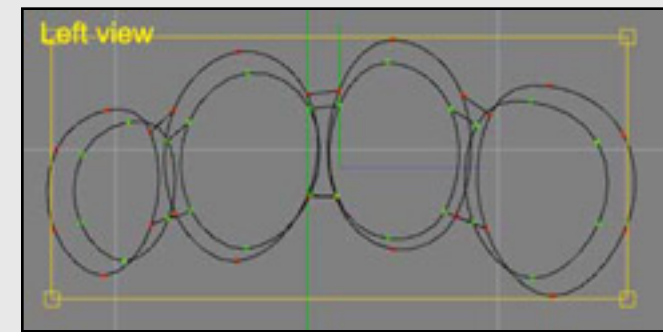
Step 115.

Hide all but the last splines on the fingers.

Copy and paste these splines and scale them slightly. Pull them back from the fingers on the x-axis.

Hide the smaller splines and the fingers.

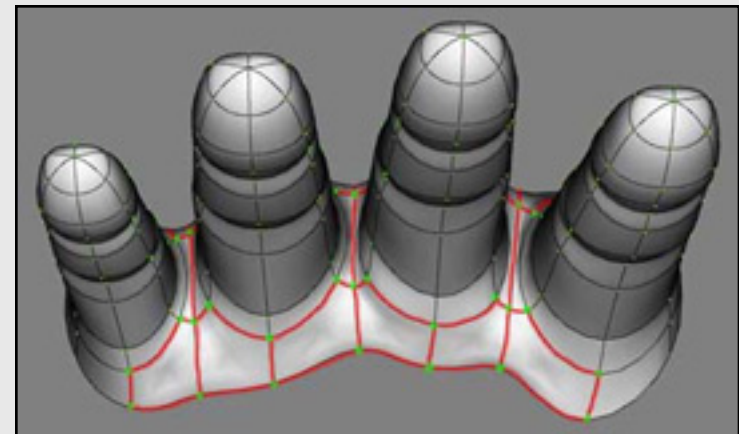
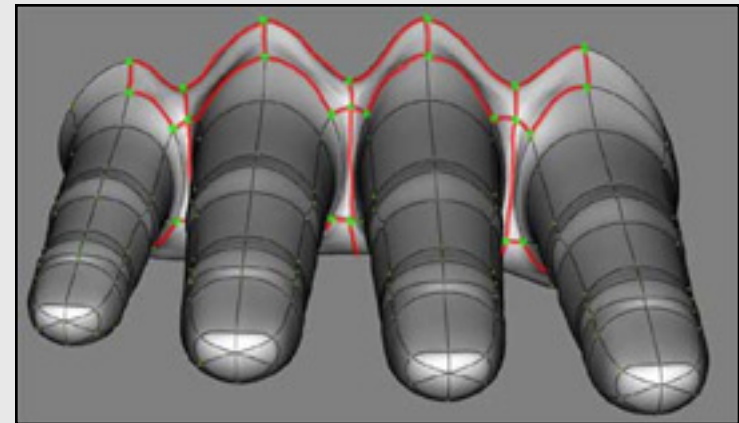
Disconnect and reconnect the points between the knuckles to create one continuous spline ring.

**Step 116.**

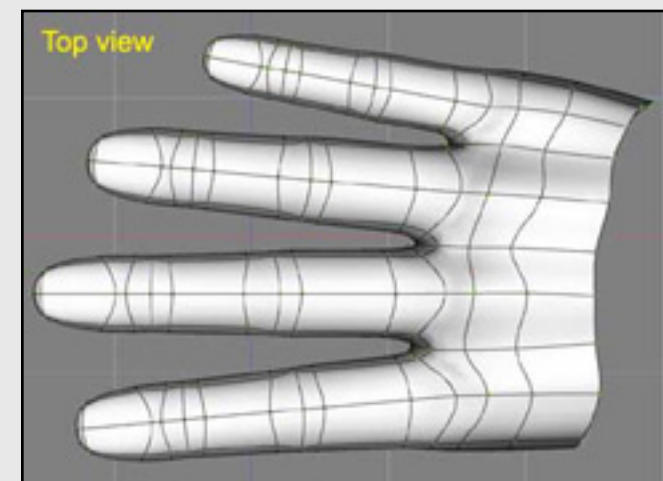
Unhide the fingers and start connecting the two spline rings that make up the knuckles.

I created an additional spline that ran between the fingers.

Notice the five point patches that join the knuckles and palm at the fingers.

**Step 117.**

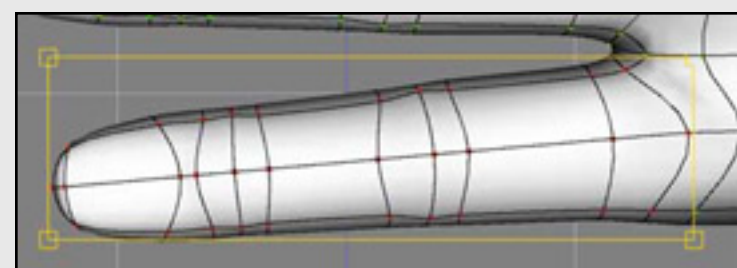
Now that the fingers are joined, begin extruding the hand back toward the wrist. You should only need 2 or 3 spline rings before you get to the thumb.

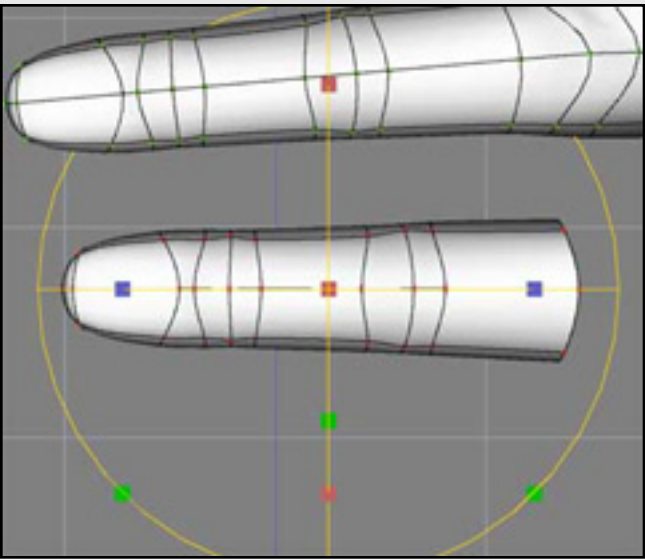
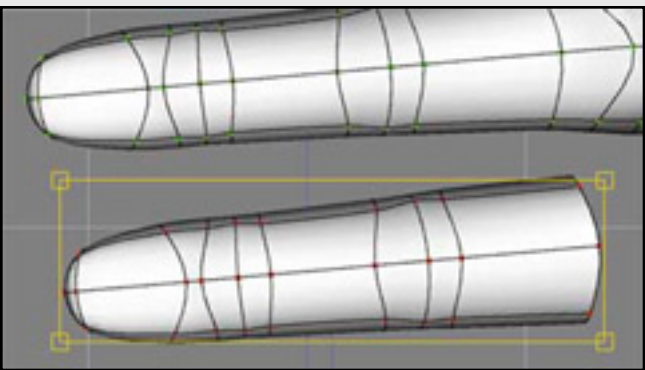
**Step 118.**

In order to create the thumb, copy the splines that make up the index finger.

Paste the finger and rotate it so that it is horizontal.

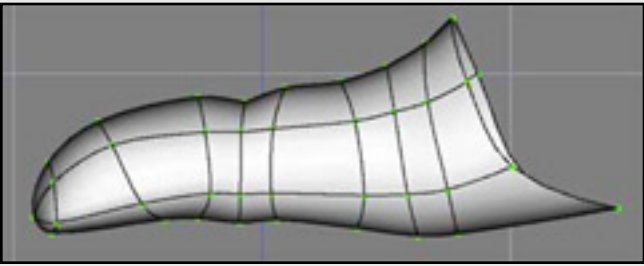
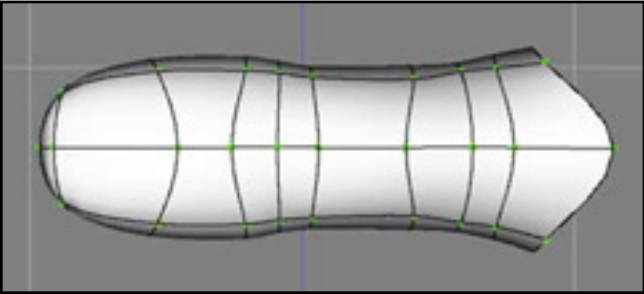
Notice that I deleted the last spline on the copied finger. This is because, the thumb only has two knuckles as opposed to three for the fingers.





Step 119.

Tweak the points to look like a thumb. Don't worry about getting it perfect right now. It will be easier to tweak once you see it in position on the hand.

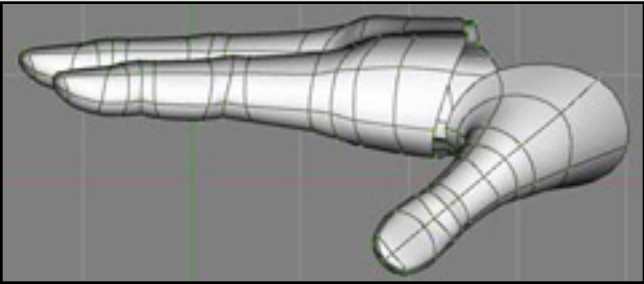
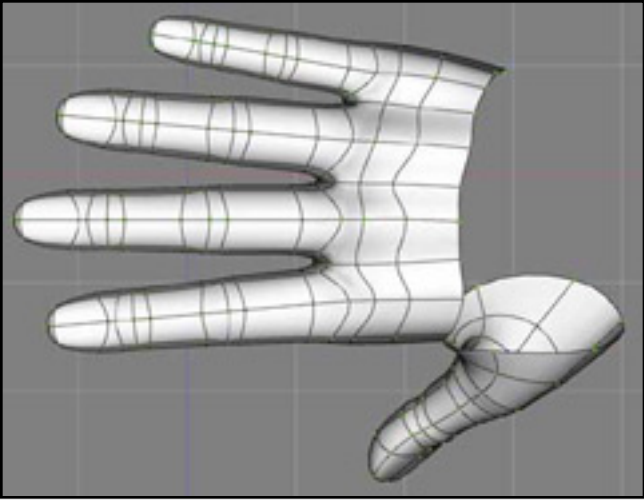


Step 120.

Position the thumb. Make sure you rotate it so that it can oppose the fingers, after all, that's what opposable thumbs are for.

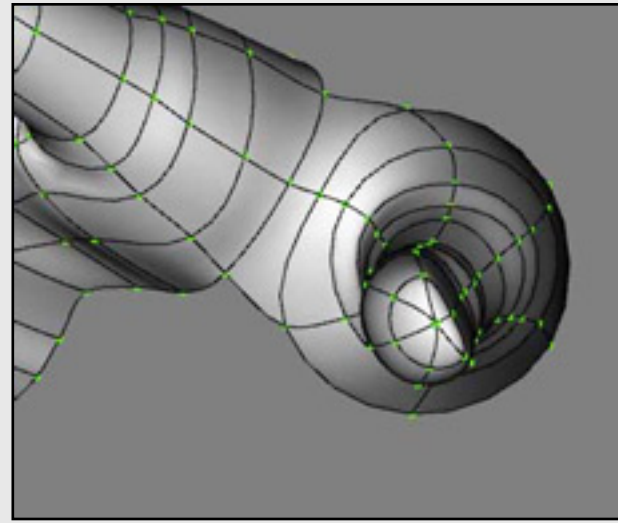
The thumb swings in a half arch when it moves, which means when it is flared out, like the images to the right its nail will point up at about a 45 degree angle. When it is brought in this changes to a 45 degree down angle.

So remember to rotate the thumb slightly, it adds a great deal to the realism of the hand.



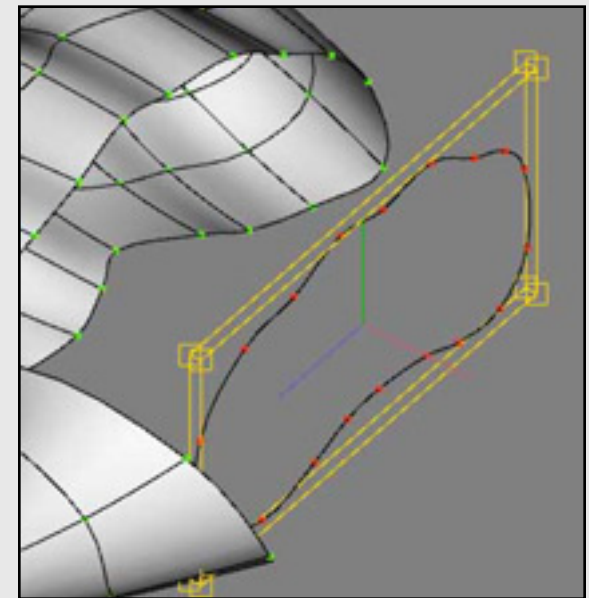
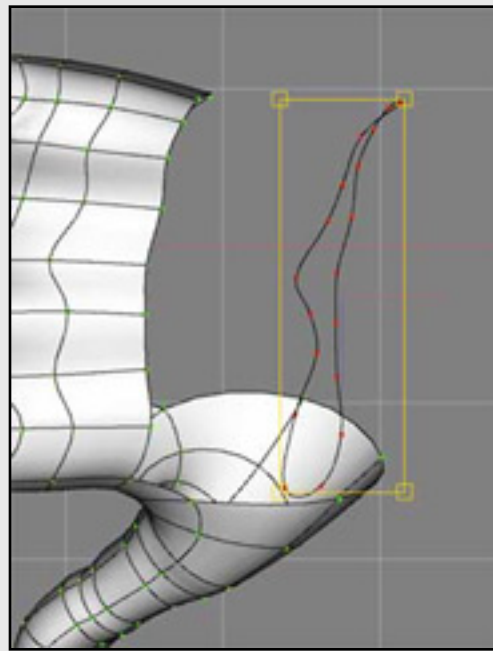
Step 121.

Join the points between the thumb and the hand.

**Step 122.**

Copy the last spline ring on the hand and paste it toward the back of the thumb.

Scale this ring so that it is flat on the x-axis.

**Step 123.**

Break the spline this floating ring at the thumb. This will allow us to connect it to the thumb splines.

Delete every other point on this spline except for the ones that make up the side of the hand.

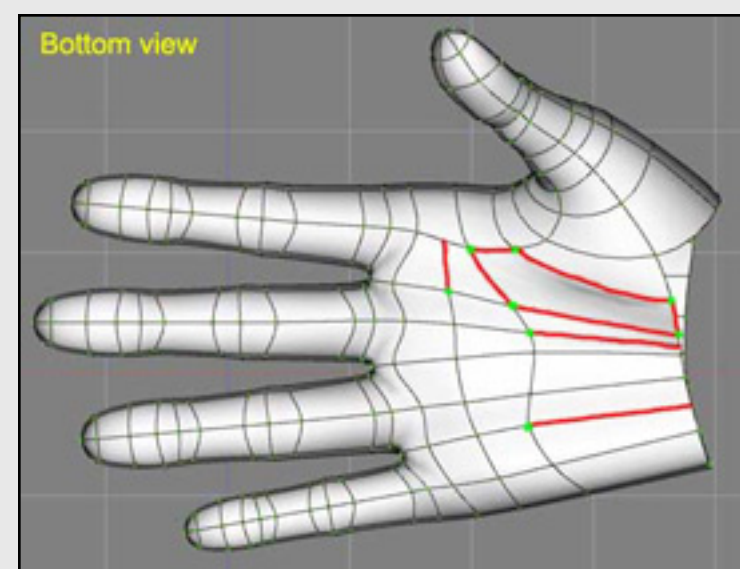
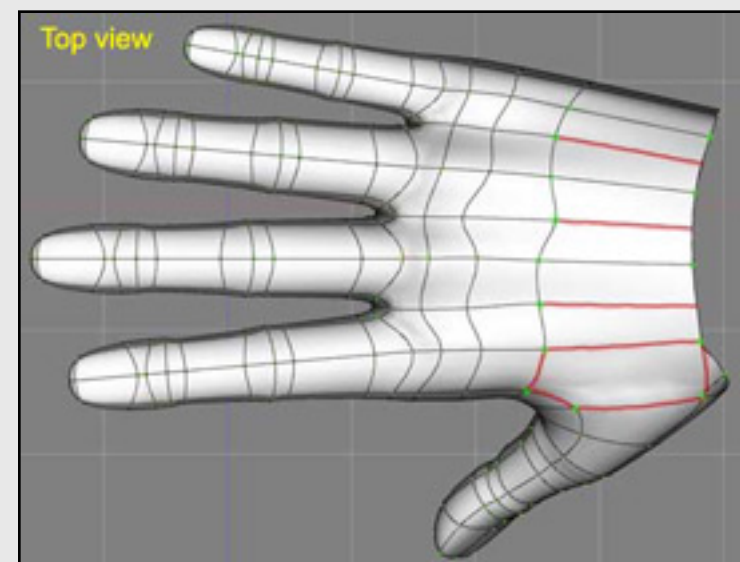
Begin joining the hand and thumb splines together.

Notice the use of hooks to join the odd splines to the places where we deleted every other point. This will reduce the geometry that inserts into the arm and make animating easier.

Notice the five point patches around the thumb and how I broke the spline below the index finger's knuckle to run it down the hand. I did this simply to mimic the way the hand curves and creases.

Again, unless you are really going to focus on the hands, don't worry too much about the hidden areas like the palms, armpits, and crotches is that they hide themselves when they animate.

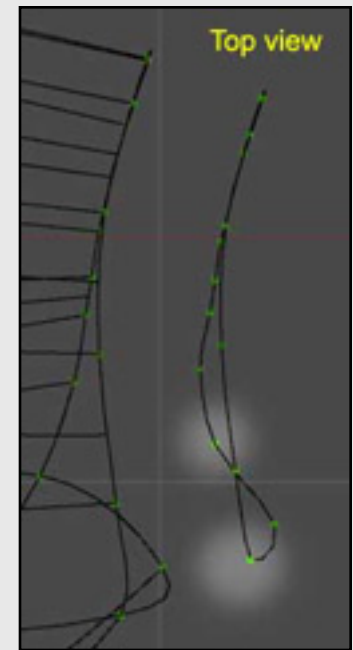
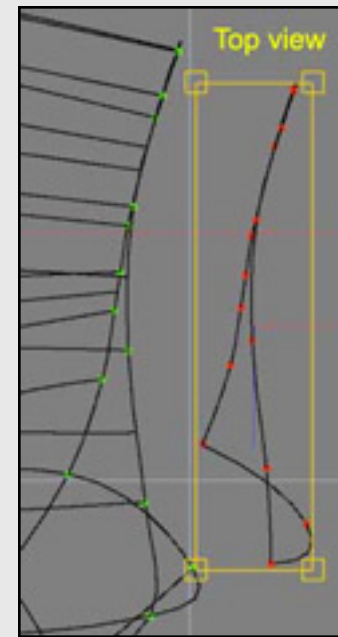
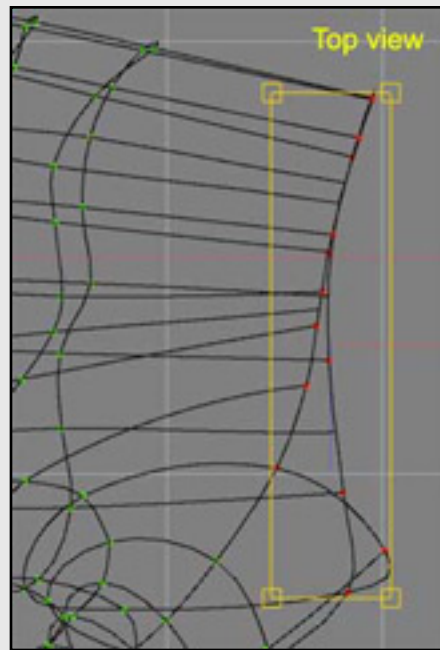
What difference does it make what kind of creasing you have going on in the palm when you make a fist? Who will see it?



Step 124.

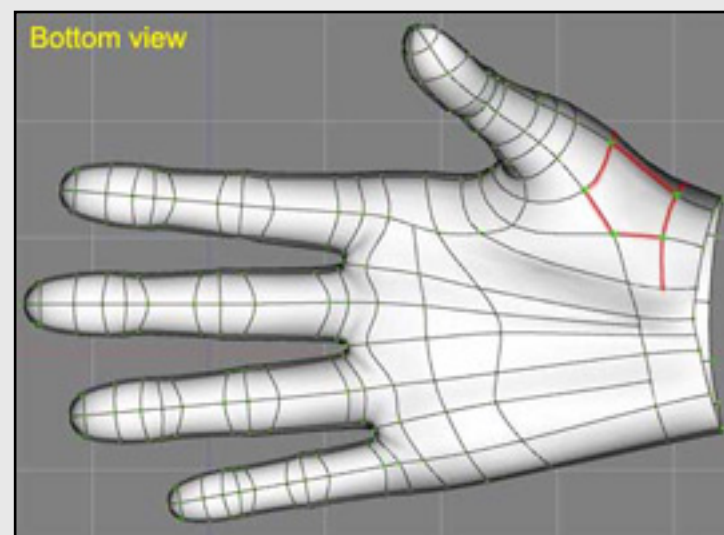
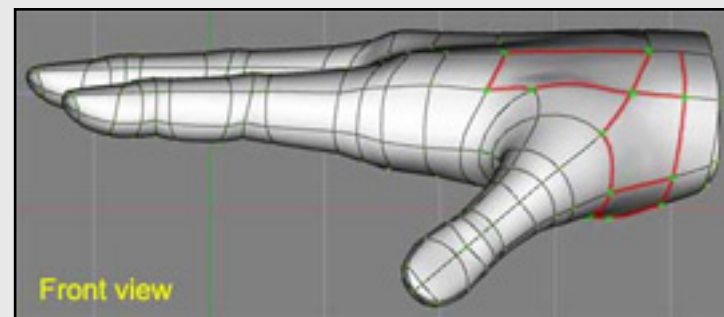
Copy and paste the last spline on the hand.

Fix the two kinks by breaking the spline and reattaching the points to create one contiguous spline.

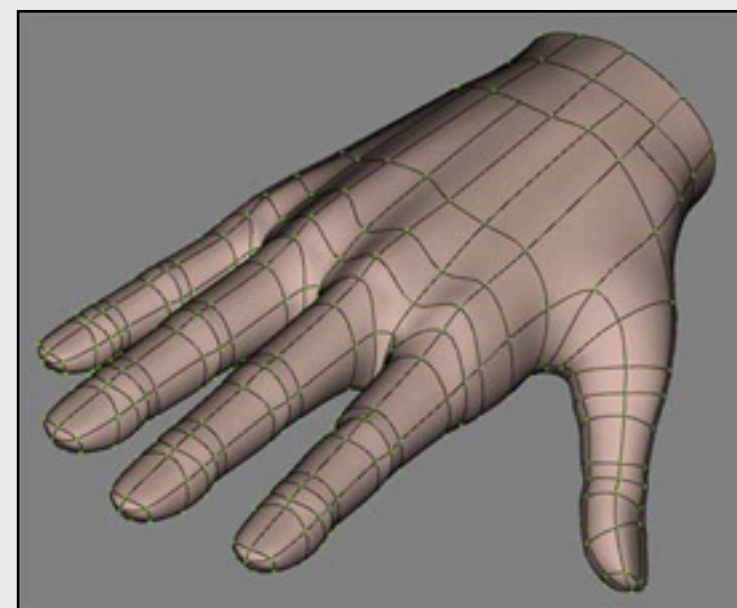
**Step 125.**

Attach this spline to the hand.

Notice the five point patches and hooks.

**Step 126.**

Group the whole thing and give it a skin tone to match the face for now.



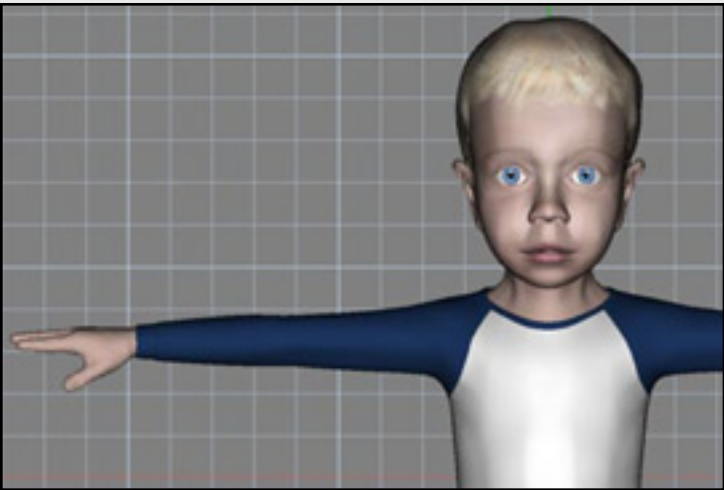
Step 127.

You can simply insert the wrist into the sleeve, making sure that the innermost spline ring is scaled down a little. This will prevent collisions when the wrist bends.

If you aren't using sleeves, just attach the points of the wrist to the arm using hooks where there is a mismatch in the point count.

That's it....

Next up... the feet.



[Back to tutorial index](#)

[Previous tutorial](#)

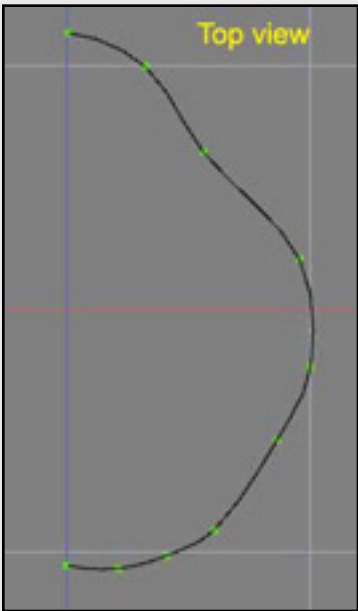
[Next tutorial](#)

Modeling the Feet...

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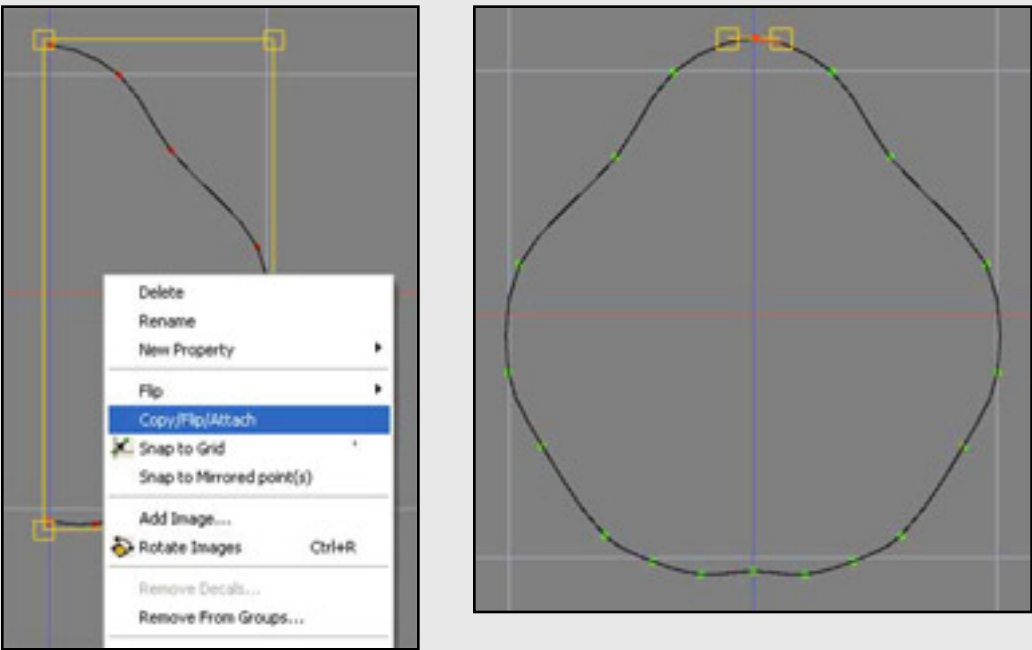
Step 128.

In the top view create a spline that resembles half of an ankle outline. Something close to a pear will do.



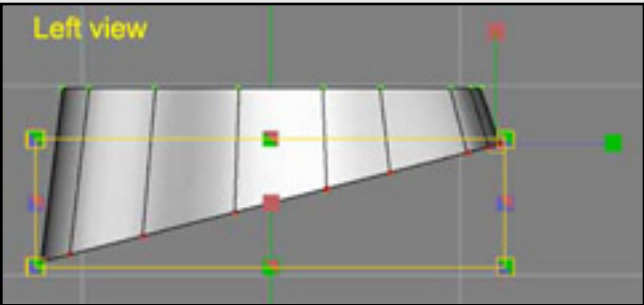
Step 129.

Select the entire spline and copy/flip/attach. This will give you the ankle cross section.



Step 130.

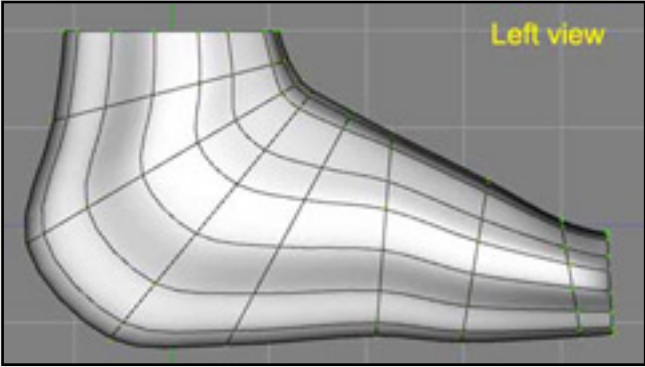
In the left view begin extruding the spline ring to form a foot shape. Scale and rotate as you extrude.



Step 131.

Continue extruding until you get to the toes.

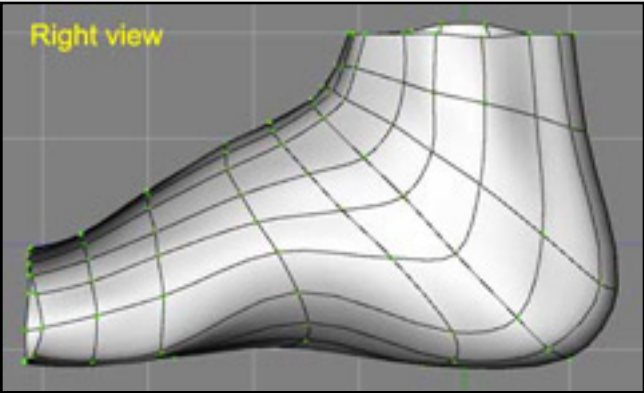
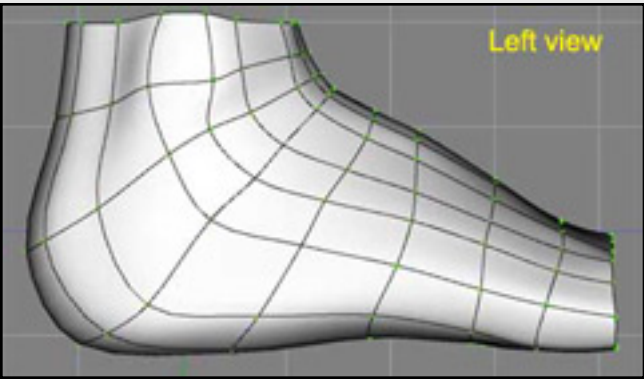
Not very pretty is it? But its pretty close, just needs some tweaking.



Step 132.

Tweak the points on the foot to resemble the shape you want. Feet come in all kinds of shapes, and the wrong shape foot on a body can absolutely kill the sense of realism for the entire model.

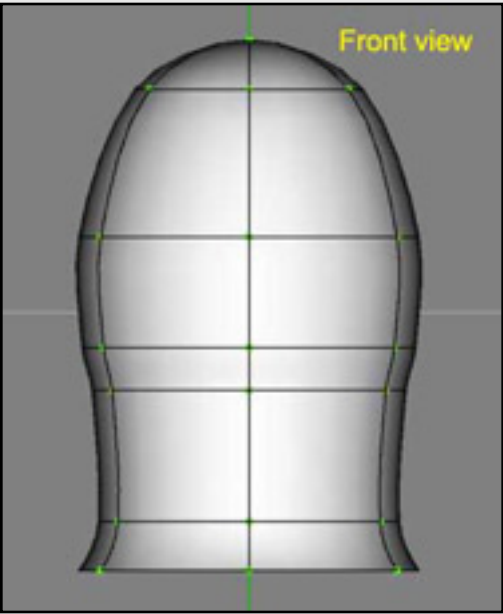
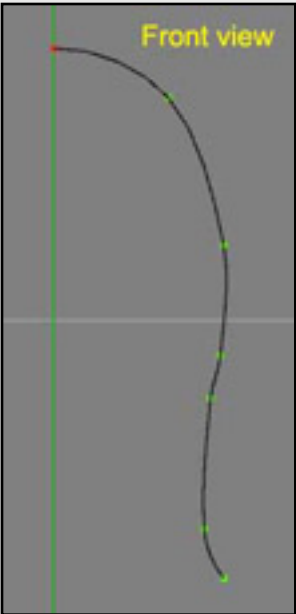
Take your time, take off your shoes and look at your own feet. Better yet take pictures of feet and use them as rotoscopes, it'll make your life so much easier.



Step 133.

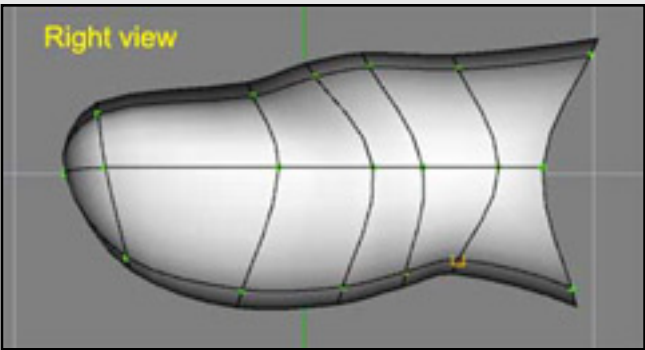
Create a spline that resembles half of big toe. Lathe it.

The toe to the right isn't too bad for a top view, but it's way too fat for a side view.



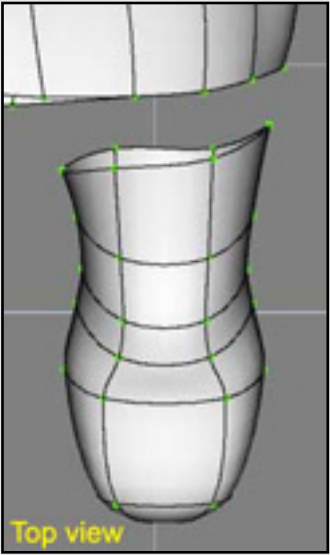
Step 134.

Rotate the toe to the side and begin tweaking it to look like a big toe.



Step 135.

Place the toe approximately where you expect it to go on the foot.



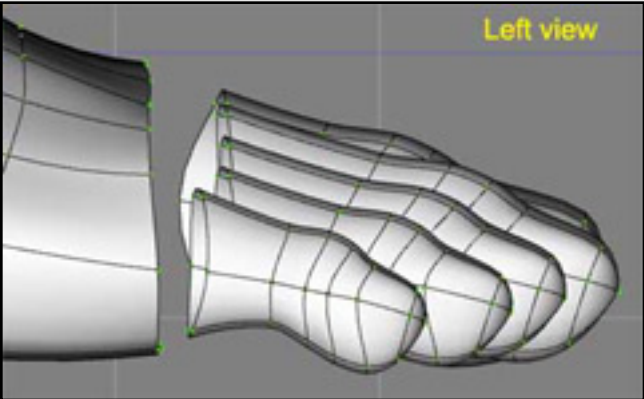
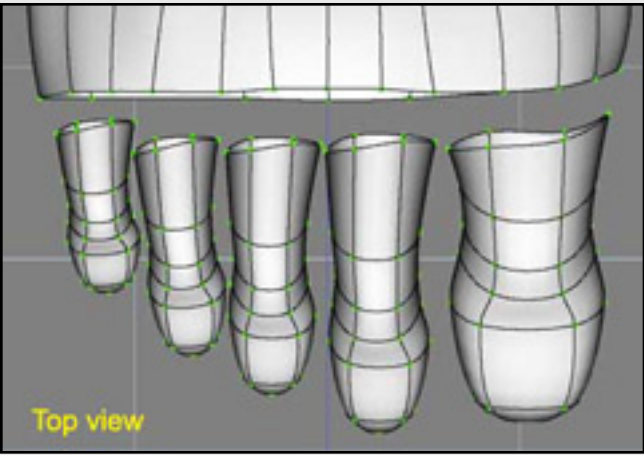
Step 136.

Duplicate and tweak the big toe to create the remaining toes. They don't have to be perfect.... You'll probably tweak them allot more once you have them connected to the foot.

Make sure they all sit flush on the ground though.

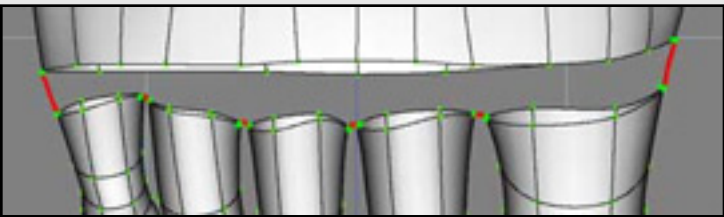
Curl the toes downward as you move out toward the pinkie toe. This will add some realism.

Humans have crammed our feet into poorly fitted shoes for so long that our toes tend to get squeezed inward as we get older, so tilt your smaller toes toward the big toe. A little for a toddler and a lot for an older person.



Step 137.

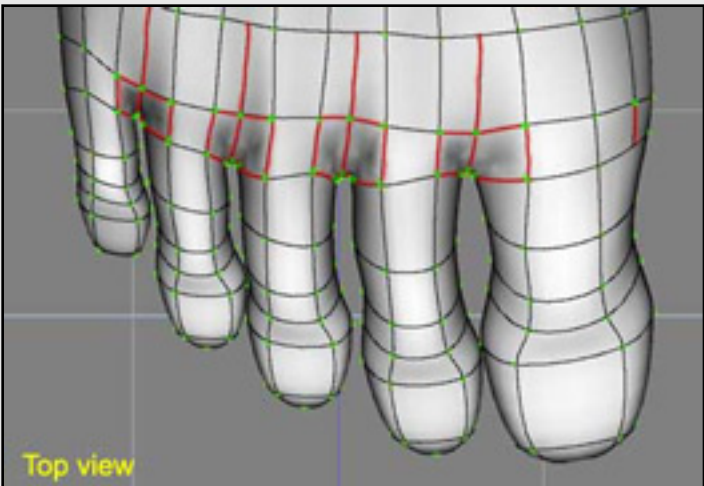
Join the toes to the foot and each other by attaching all the inner and outer splines to each other.



Step 138.

Now play connect the dots again attaching splines from toe to foot.

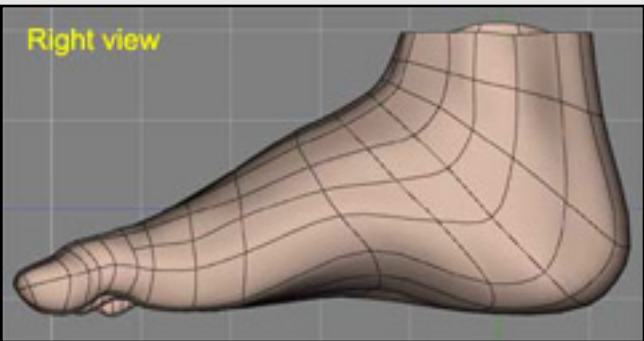
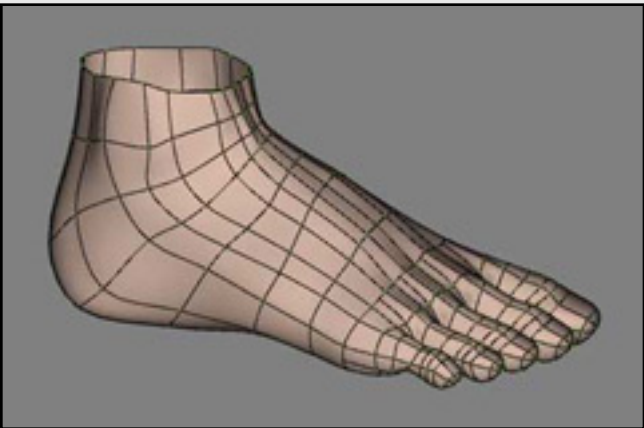
Notice that I created one more spline to go between the toes. And of course lots more 5 point patches in-between the joints.

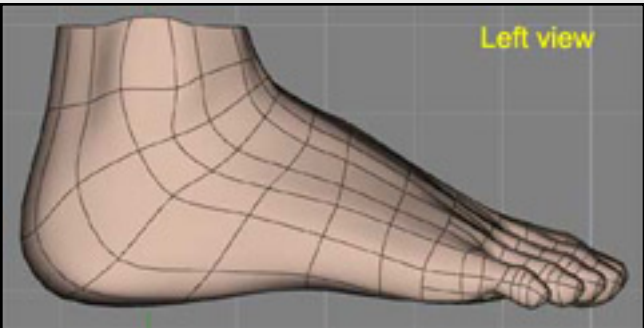


Step 139.

Tweak the foot to shape it into its final form.

Select the whole foot and group it. Call it left or right foot. Give it a skin tone for its color.





Step 140.

You can attach the foot to the leg or just insert it into the pants leg. Either one is fine.

Congratulations! You're done modeling. Now you can texture, rig and animate him.



[Back to tutorial index](#)

[Previous tutorial](#)