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How to Model Curly Hair

There are a few important notes to mention before we begin. First, this is just one of many, many ways that this task can be accomplished. I found it to be quite simple and effective in the end, so hopefully you will too. Second, this method will result in quite a bit of interpenetrating geometry. RenderMan 22 isn't bothered by interpenetration as much as it or other renderers used to be, however issues could still arise. A commonly known issue with interpenetrating geometry results in faces or surfaces flickering due to the renderer's inability to properly calculate the area. My team was able to avoid this due to our specified style in which we do not use specular maps. By just using diffuse maps, we create a flat, painterly style and also avoid the light interaction that often causes flickering errors. This is to say that this method to create curly hair may not work if the textures used include specular maps, but it is worth testing. Third, for this method, I used a free plug-in found online. This plug-in is not necessarily required, but it will save hours of time. Lastly, I would like to credit much of my success to the creator of this video: https://www.youtube.com/watch?v=CmgV7PA5Oo8&t=394s Feel free to use it to help you along the way. All good? Here we go!

1. Create your character.

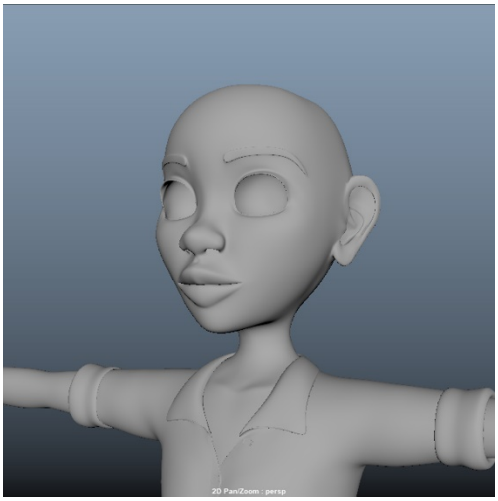

Figure 1.1

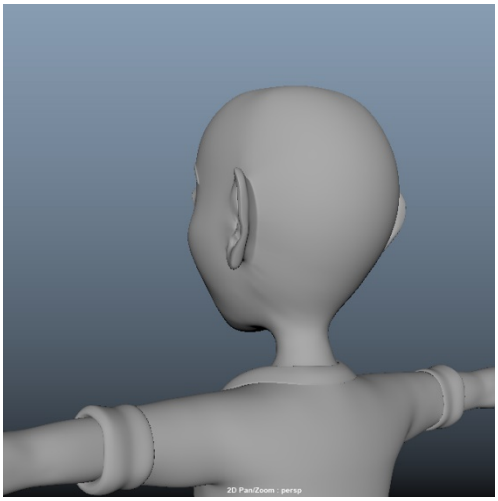

Figure 1.2

I. *Separate the head from the body. This is not only an important modeling point when creating a character, but it will make it easier to sculpt the hair pieces later.*
II. *Only have the head showing, so hide all extra head pieces such as the teeth, tongue, eyes, etc. (Figure 1.3)*
III. *Make sure the head is closed in the back. (Figure 1.2)*

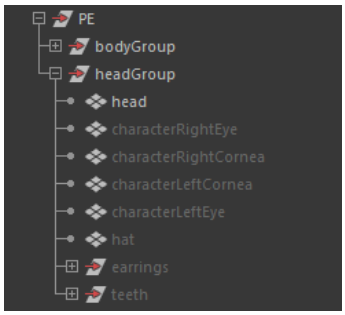

Figure 1.3

2. In edge mode, carefully select the edges around the area where hair is wanted.

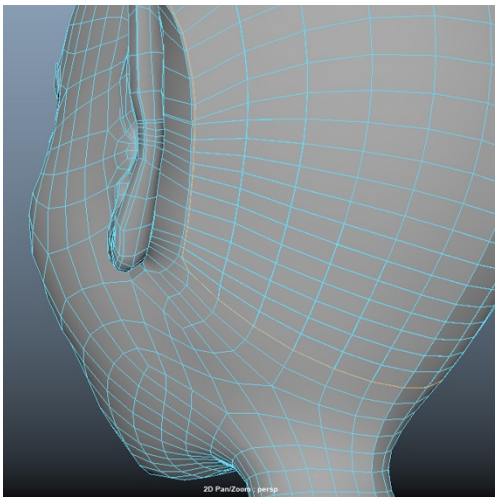

Figure 2.1

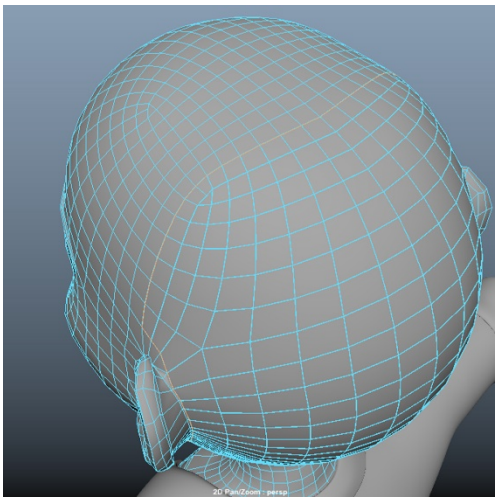

Figure 2.2

I. *Persephone wears a hat, so she doesn't need hair on the very top of her head. (Figure 2.2)*

3. Under the Modeling menu set, go to *Edit Mesh* > *Detach.* (Figure 3.1)

I. *It's best to do this part in non-smoothed mode. Hit 1 on your keyboard to see your original model.*

4. Go to *Mesh* > *Separate*. (Figure 4.1)

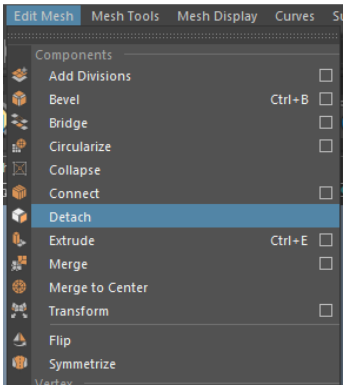

Figure 3.1

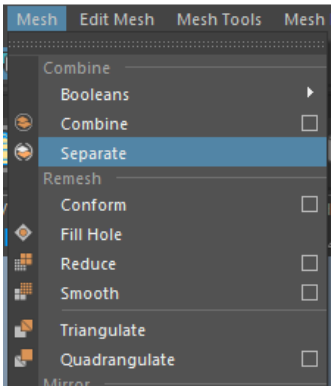

Figure 4.1

5. In your outliner, you will see that another piece of geometry has been created, and the original "head" geometry is now a group. (Figure 5.1) A transform node has also been created which is not needed. To delete this node, you will need to delete the history. Select the "head" group and go to *Edit* > *Delete By Type* > *History.* (Figure 5.2)

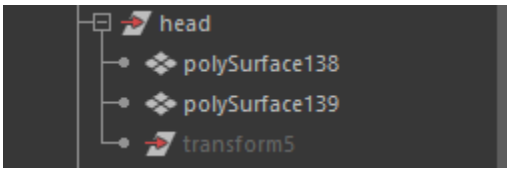

Figure 5.1

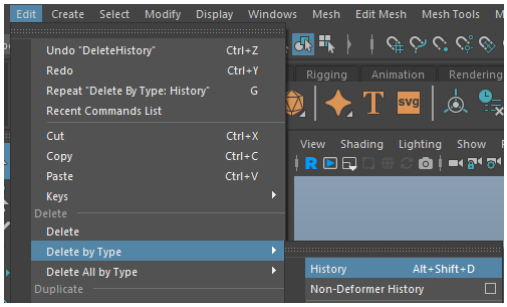

Figure 5.2

6. Select both pieces of geometry in the "head" group to discover which is the base and which is the hair piece. Duplicate whichever is the hair piece by pressing Ctrl + D on a PC or Cmd + D on a Mac, then select the original hair piece geometry and press H on your keyboard to hide it. Name the base piece "base," the hidden original hair piece "hairPiece," and the duplicate "hairPieceDuplicate." (Figure 6.1)

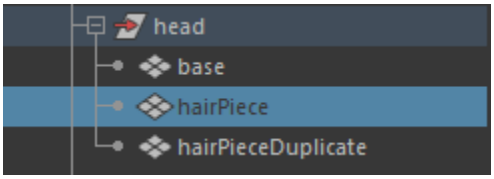

Figure 6.1

7. We now want to make "hairPieceDuplicate" and "base" one object again. Select them both, then go to *Mesh* > *Combine.* (Figure 7.1) The new geometry will combine and be pulled out of the "head" group. Rename it "base" again if you have to, then pull it back into the "head" group. Delete the history on the group again. (Figure 5.2)

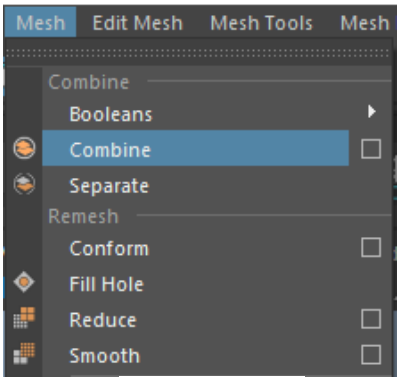

Figure 7.1

8. This part takes a minute or two. Around the parameter of the hair piece, carefully select each pair of vertices and go to

Edit Mesh > Merge. (Figure 8.1) After clicking through this command once, however, you will be able to hit G on your keyboard to repeat the last command.

I. *Each pair of vertices will be right on top of each other and will appear as one vertex point as long as "hairPieceDuplicate" has not moved. Be sure to still select over the area that the vertices are in, however, to ensure both are being selected before merging them.*

II. *Do not use the Symmetry feature for this step. It can cause the vertices to not merge.*

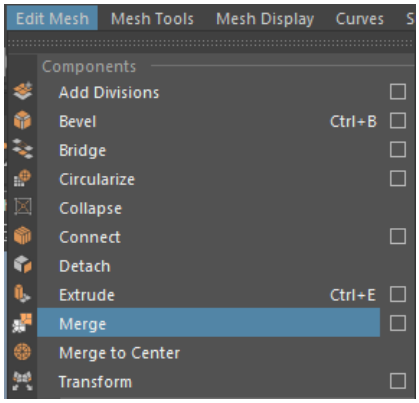

Figure 8.1

9. Unhide "hairPiece." The character should now have a full base piece, and a hairPiece directly on top of it. (Figure 9.1 and 9.2)

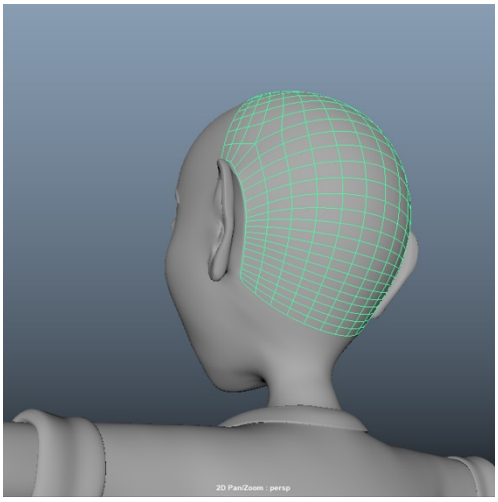

Figure 9.1

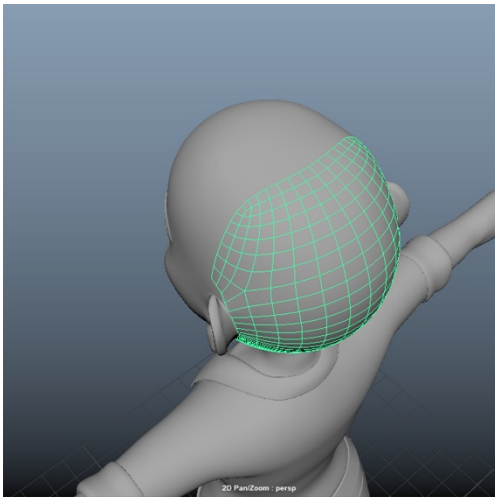

Figure 9.2

10. Switch to the FX menu set. Select "hairPiece" and go to *nHair > Create Hair > Options Box.* In the Options Box, go to *Edit > Reset Settings.*

11. In the dropdown menu under *Output:,* click on *NURBS curves*. Check the box that says *Collide with mesh.* Change the *U count:* and the *V count:* to 40. Change *Points per hair:* to 15. Change *Length:* to 4.5000. Click *Create Hairs.* (Figure 11.1) Another window will pop up asking if it is okay to generate hairs. Click *Create Hair Curves.* The character will look something like Figure 11.2. We love her. She is beautiful.

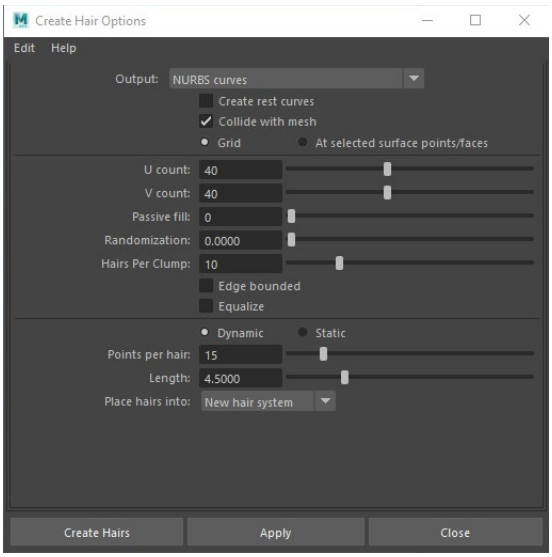

Figure 11.1

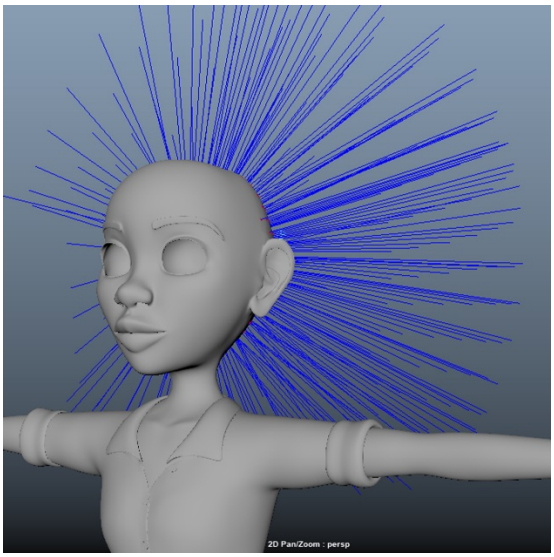

Figure 11.2

I. *It's important to remember that these are just the settings I used for Persephone. These settings will vary based on character.*

12. By pressing the Play button on your timeline, you will see the hairs drop. This is how we will begin to position the hairs. Try it out, then pull the timeline back to frame 1.

13. Select "base," then go to *nCloth* > *Create Passive Collider*. (Figure 13.1)

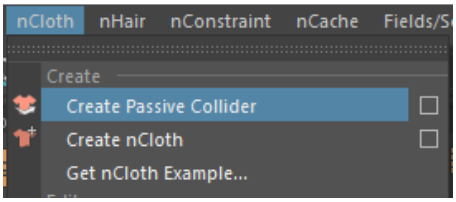

Figure 13.1

14. In the Outliner, click on "hairSystem1." Open the Attribute Editor by clicking the tab on the right side of the screen. Under the *hairSystemShape1* tab, open the *Collisions* drop down menu. Check *Self Collide* at the top of the menu. A little further down open the dropdown menu under *Solver Display* and click *Collision Thickness*. (Figure 14.1) The hair will change to look something like Figure 14.2.

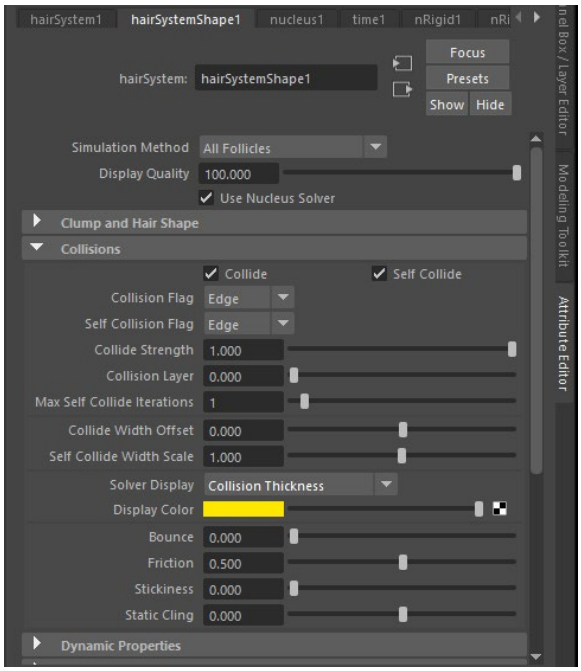

Figure 14.1

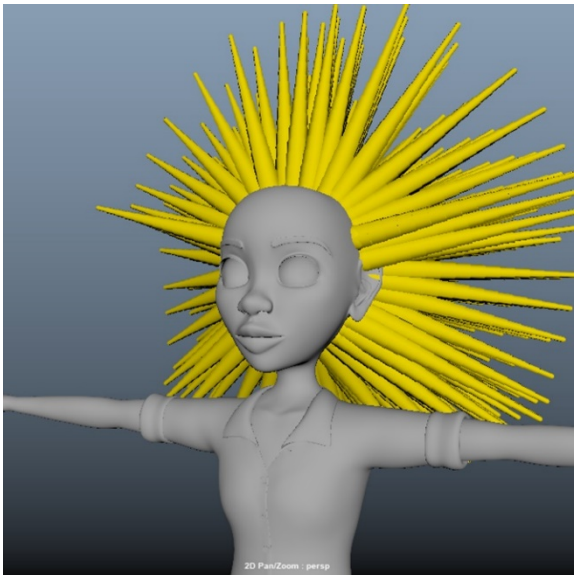

Figure 14.2

15. Open the *Clump and Hair Shape* drop down menu in the Attribute Editor. Change *Clump Width* to 0.350. Under *Clump Width Scale*, slope the line so it looks generally like Figure 15.1. Go to the start of the playback range or click the rewind button to load the new parameters. (Figure 15.2)

I. *As a reminder, these settings will vary based on character.*

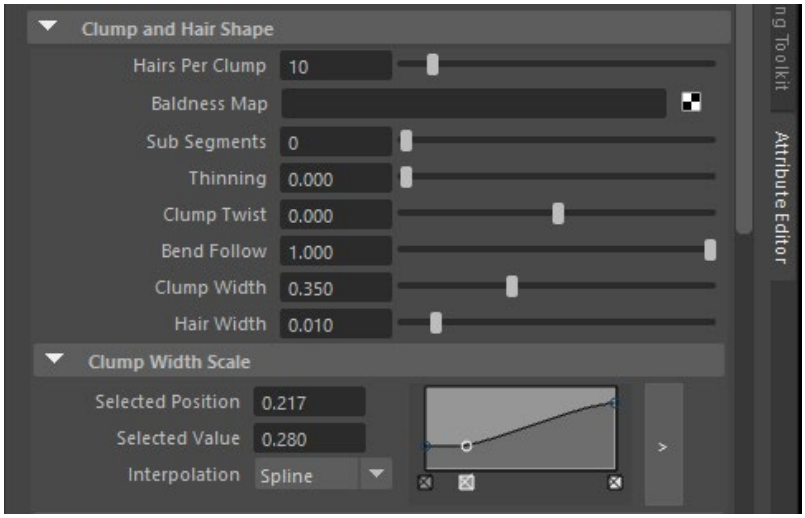

Figure 15.1

16. Click on "nucleus1" in the Outliner. Open the *Gravity and Wind* drop down menu. If your character is facing forward on the grid, you will need to change your *Wind Direction* settings to 0.000 in the X and Y box, and -1.000 in the Z box. (Figure 16.1)

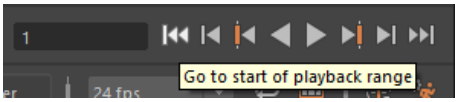

Figure 15.2

I. *If your character is facing another way, test the wind direction by bringing the* Wind Speed *up to 50.000 (Figure 16.1) then press Play. The character's hair should blow behind them, so change any parameters necessary so this happens. You can also just turn your character so that they are facing the correct direction for this tutorial.*

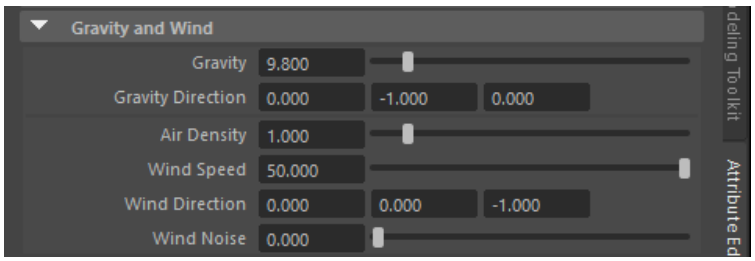

Figure 16.1

17. Now it's time to play with the *Air Density* and *Wind Speed* during the playback. These two parameters effect how the hair follicles fall throughout the 120 frames allotted. This part is completely subjective as all hair will fall differently and the look will be slightly different with every setting and every frame. For Persephone, one way to get the look I wanted was by setting the *Air Density* to 0.876 and the *Wind Speed* to 6.186. After finding settings you want to test, press the play button to see how the follicles fall. Stop the playback on a frame that gives you the shape that you want in the hair. For these settings, I stopped on frame 111.

I. *When you press play, you can't go back to a previous frame. If you see a frame you liked but passed it, you must rewind back to frame 1 and play it again.*

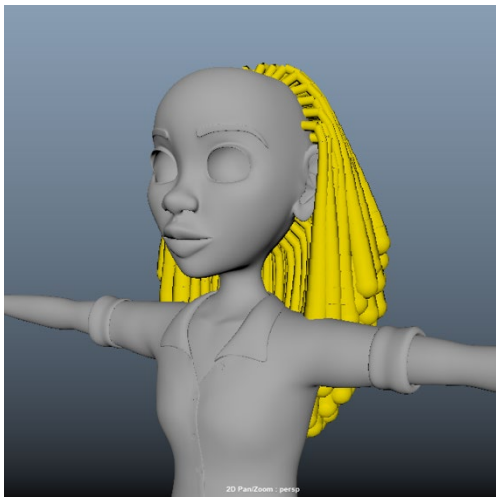

Figure 17.1

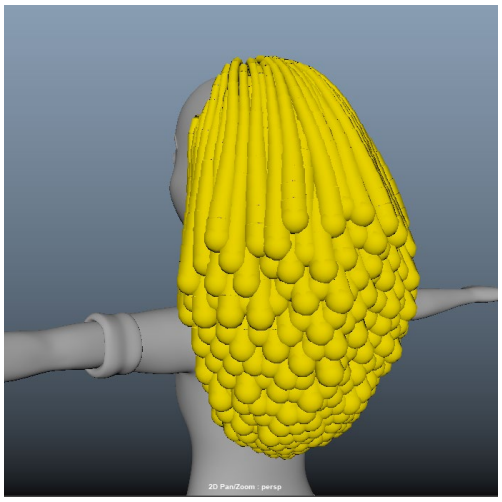

Figure 17.2

18. Click on "hairSystem1OutputCurves" group in the Outliner. Up in the menu bar, click *nHair > Set Rest Position > From Current.* Then again in the menu bar, click *nHair > Set Start Position > From Current.* (Figure 18.1)

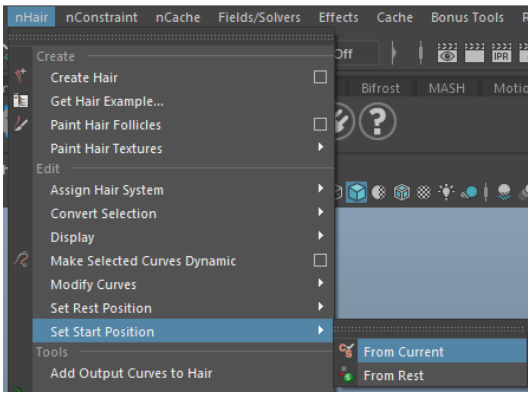

Figure 18.1

19. In the Outliner, delete "hairSystem1," "hairSystem1Follicles," "nucleus1," "nRigid1," and "nRigid2."

20. Open the "hairSystem1OutputCurves" in the Outliner. With the group selected, go to the menu bar and click *Select > Hierarchy.* (Figure 20.1)

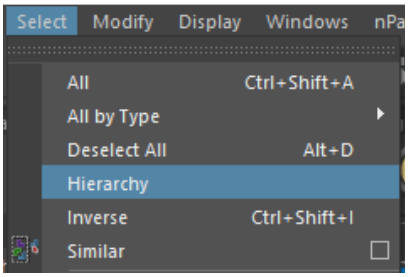

Figure 20.1

21. Switch to component mode. (Figure 21.1)

Figure 21.1

22. Switch your camera view to right view. Select the points below the shoulders and delete them.

I. *Having above-shoulder-length hair is a common method for characters used in the industry. It takes away the constant interpenetration of hair through the shoulders.*

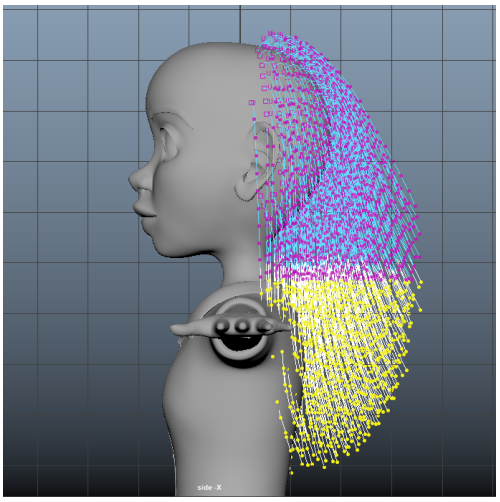

Figure 22.1

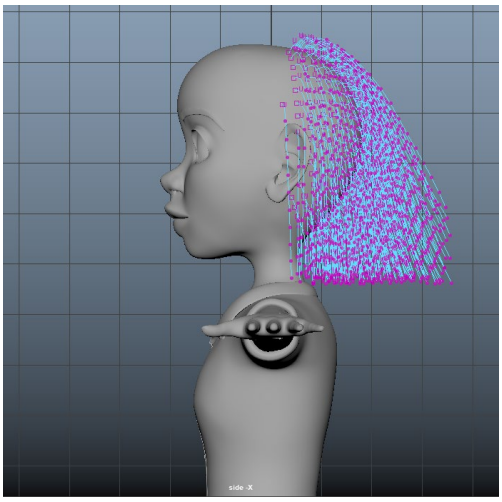

Figure 22.2

23. Shape the hair follicles by selecting points on the curves and moving them. You can do this individually or with Soft Select by pressing B on your keyboard.

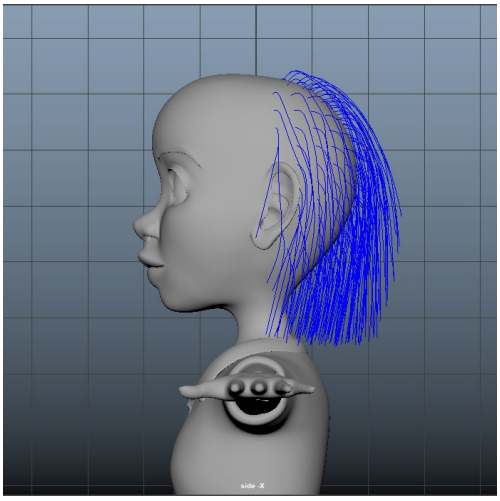

Figure 23.1

24. Now it's time for the plug-in. The downloaded folder is on the server named *Spiral_Along_Curve*, or you can download it yourself by going to:

https://www.highend3d.com/maya/plugin/spiral-along-curve-for-maya

I. *If you can't use the plug-in or choose not to, you can use the* Curl *tool by going into the Modeling menu set, selecting each curve, then going to* Curves > Curl. *There is an option box where you can play with the parameters until you get your desired effect.*

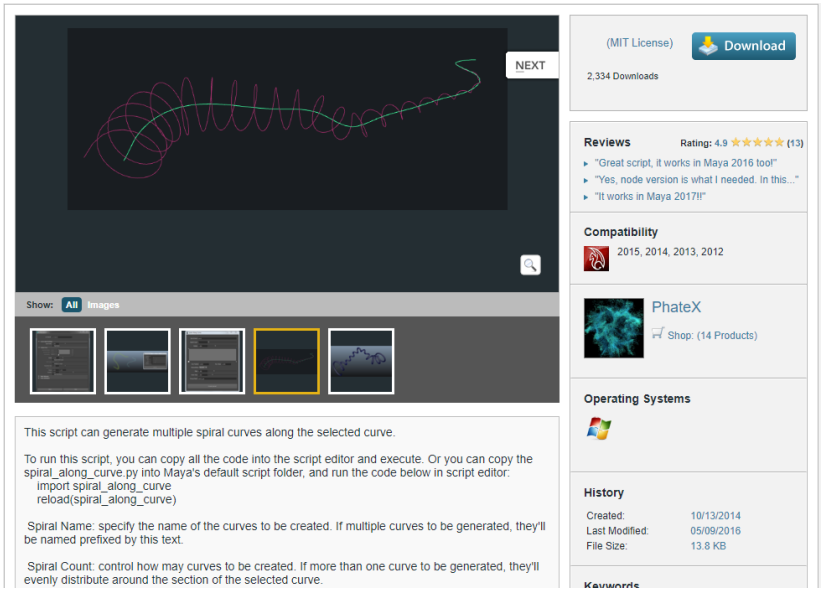

Figure 24.1

25. Right-click on the *spiral_along_curve.py* file and open it in any code editing program. (Figure 25.1)

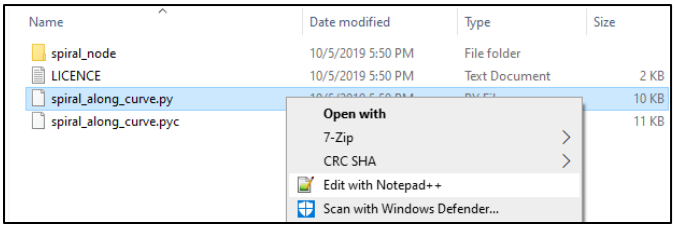

Figure 25.1

26. Copy the code starting with:

import pymel.core as pm

and ending with:

spiralAlongCurveUI()

27. In Maya, open the Script Editor by going to *Windows > General Editors > Script Editor* (Figure 27.1) or by clicking the icon in the lower right corner of the screen. (Figure 27.2)

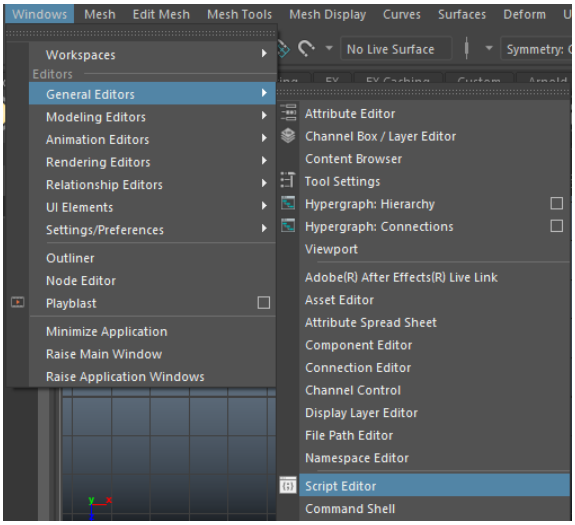

Figure 27.1

28. Switch to the Python tab, then paste the code into the box. To run the code, hit Enter on your numeric keypad or in the menu bar click *Command > Execute.* (Figure 28.1) A pop up will appear named *Spiral Along Curve.* (Figure 28.2) You can minimize this or put it off to the side for now, but don't close it. If you do by accident, run the code again to get it back.

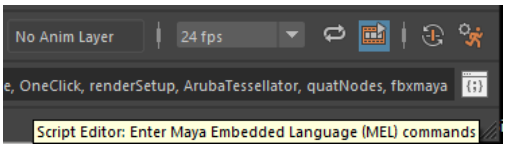

Figure 27.2

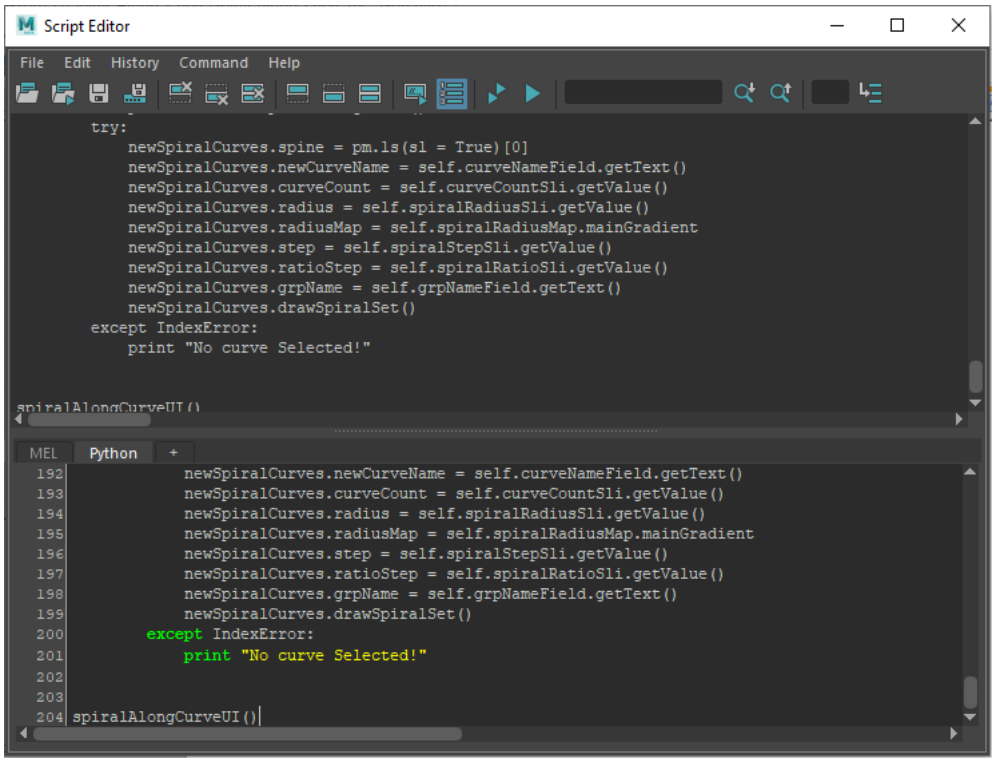

Figure 28.1

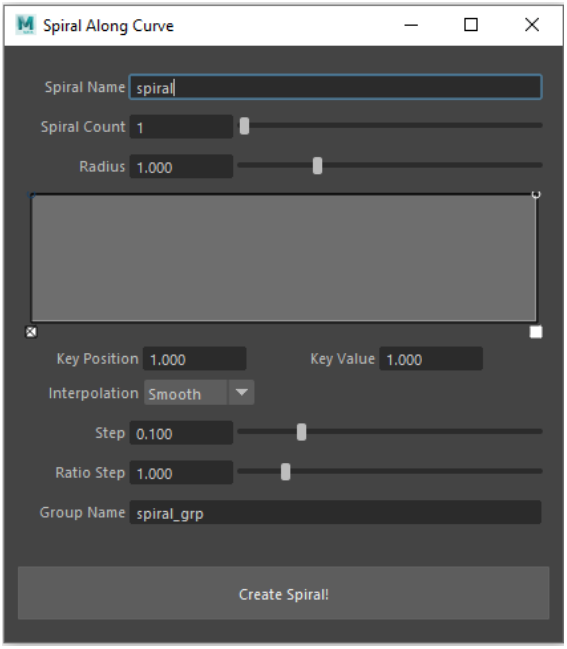

Figure 28.2

29. Now we need to set a few things up to ensure the plug-in works. Change to the front camera and move to the side of your character. In the menu bar, go to *Create > Curve Tools > CV Curve Tool*. (Figure 29.1) Create two large curves. (Figure 29.2)

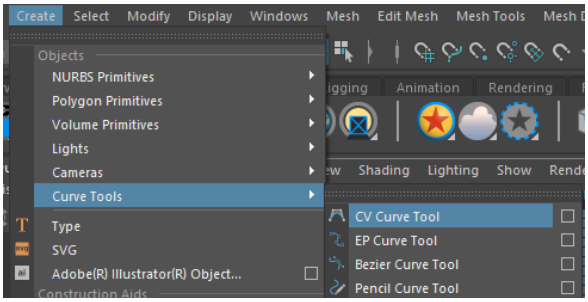

Figure 29.1

30. Select the first curve. In the Modeling menu set, go to *Curves > Rebuild > Option Box.* Change *Number of Spans:* to 44. Click *Rebuild.* (Figure 30.1)

I. *This number may vary in the end, but it is a good starting place.*

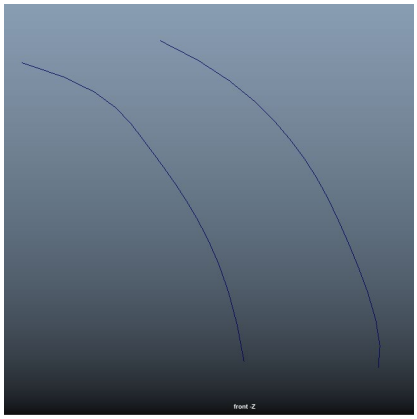

Figure 29.2

31. Go to *Curves > Curl > Option Box.* Change *Curl amount:* to 2.000. Click *Curl Curves.* (Figure 31.1) Your curl should look something like Figure 31.2. If it doesn't, repeat steps 30 and 31 with slightly different values. This part isn't critical by any means, but it helps create a base for the look of the curl.

I. *This number may also vary in the end, but it is also a good starting place.*

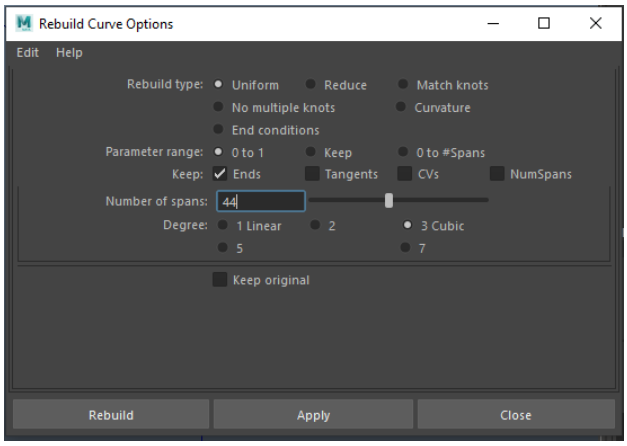

Figure 30.1

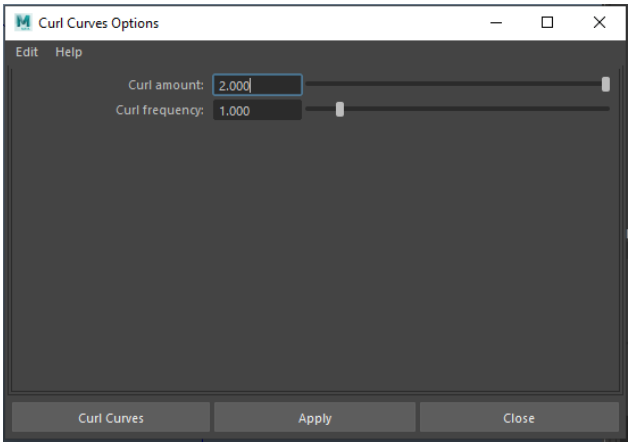

Figure 31.1

32. Select the second curve and go to *Curves > Rebuild.* Now bring back the *Spiral Along Curve* box. With the curve still selected, click *Create Spiral!* If another curve is created that curves or spirals around the selected curve, this means that it is working.

I. *If your plug-in doesn't appear to be working properly, click off the curve and reselect it, then try again. You can also try closing the plug-in box and running the script again.*

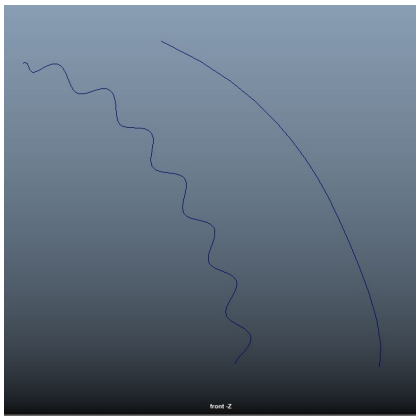

Figure 31.2

33. Delete the curve that has just been created. Every time that you create a new curve and want to try different settings, delete the old curve. This is very important! You will regret it if you don't. From now on, save your project often just in case.

34. In the *Spiral Along Curve* box, change *Radius* to 4.000, *Step* to 0.025, and *Ratio Step* to 0.400. Then change the slope of the graph to look similar to Figure 34.1. Select the second curve and click Create Spiral! Remember to delete any previous curve you made around the second curve. Your curve should end up looking something like Figure 34.2. If it doesn't, change the settings slightly.

I. *These settings may also vary in the end, but it is also a good starting place.*

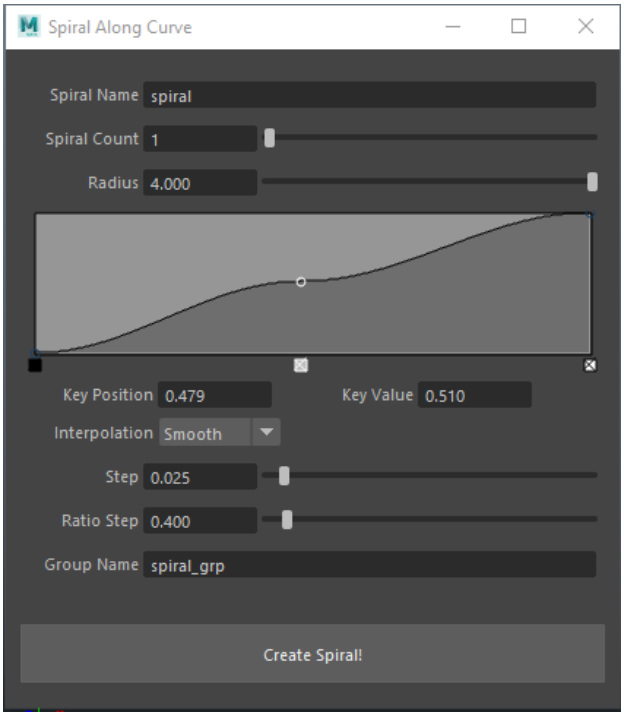

Figure 34.1

35. Select these three curves and hide them. Switch back to the perspective camera and find your character. In the Outliner, open the "hairSystem1OutputCurves" group and select the first curve in the list. Rotate your camera so the selected curve is visible in the viewport.

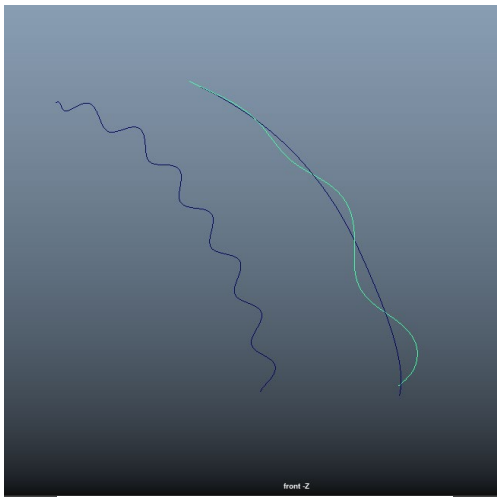

Figure 34.2

36. With the curve selected, click *Create Spiral!* in the *Spiral Along Curve* box. Most likely you will end up with a curve that looks something like Figure 36.1. This is okay because we are going to adjust the settings again. If you curve doesn't look like you would like for the hair, delete the curve you just made and reselect the first curve in the "hairSystem1OutputCurves" group.

37. In the *Spiral Along Curve* box, change *Radius* to 0.210, *Step* to 0.220, and *Ratio Step* to 0.552. Click *Create Spiral!* (Figure 37.1) I found that these parameters create a nice, soft, natural curl. Play around with the settings to create the curl you hope for.

38. This part takes a while. In the Outliner, click each curl one by one, clicking *Create Spiral!* in between. Do not try to grab them all at once—this will break Maya and the plug-in and your happiness. Your result will look something like Figure 38.1.

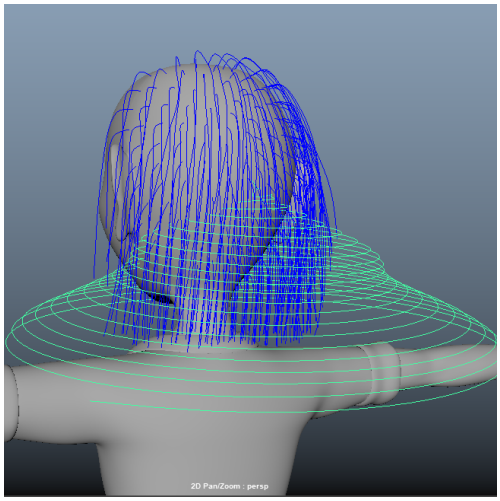

Figure 36.1

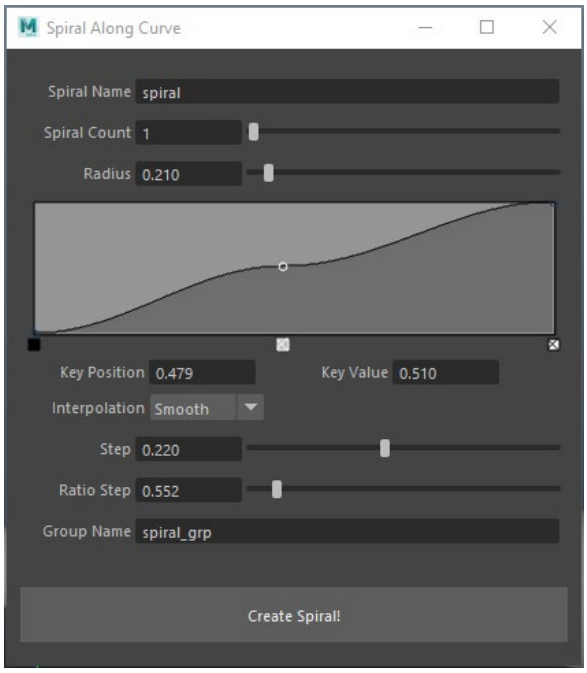

Figure 37.1

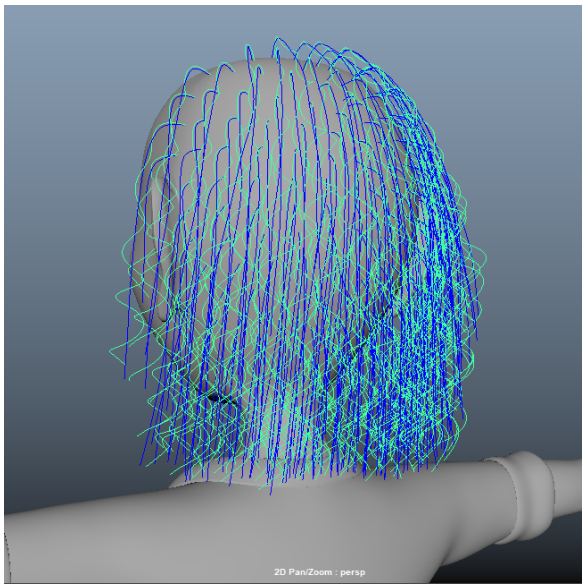

Figure 38.1

39. In the Outliner, hide the "hairSystem1OutputCurves" group. Open the "spiral_grp" group and select all the curves inside. Go to the menu bar and click *Bonus Tools > Modeling > Curve to Tube Mesh*. (Figure 39.1) You should end up with something like Figure 39.2.

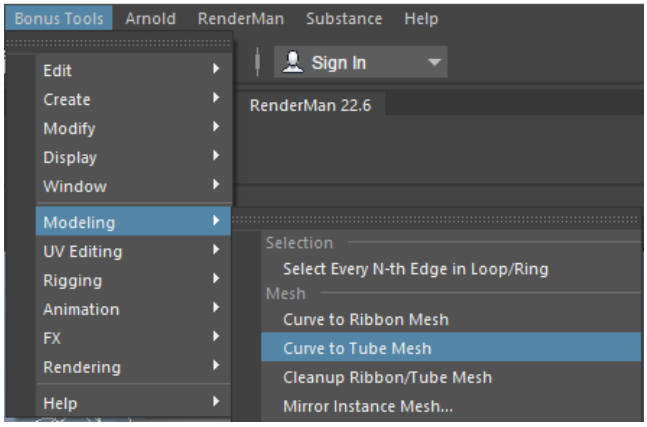

Figure 39.1

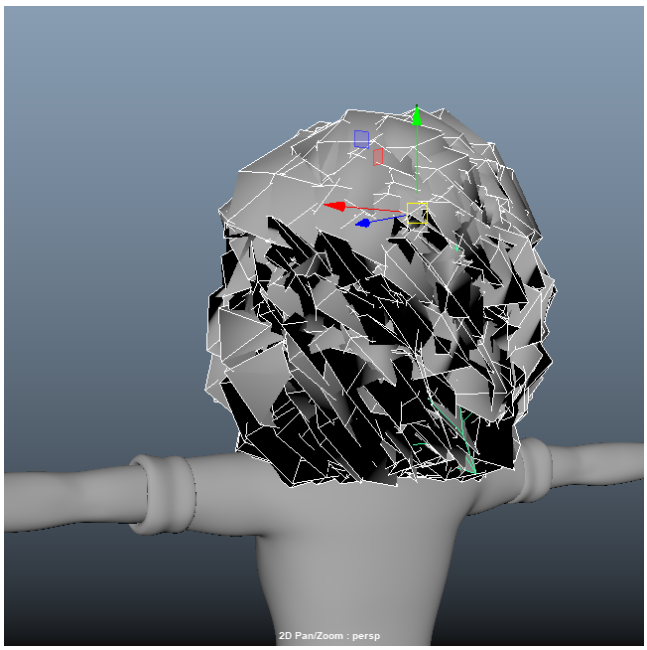

Figure 39.2

40. In the Channel Box/Layer Editor, change *Width* to 0.25, *Taper* to 0.3, *Length Divisions* to 20, and *Width Divisions* to 5. (Figure 40.1)

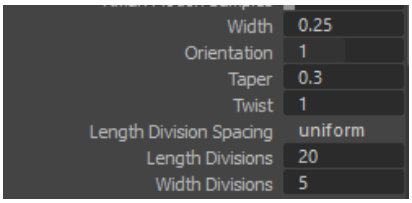

Figure 40.1

41. Some of the tubes appear black. (Figure 41.1) To fix this, select each tube that is black and in the Channel Box/Layer Editor, change *Orientation* to 180. Your result should look something like Figure 41.1.

I. *I found that this part is easier if you hide the head and body of the character and the "spiral_grp" group.*

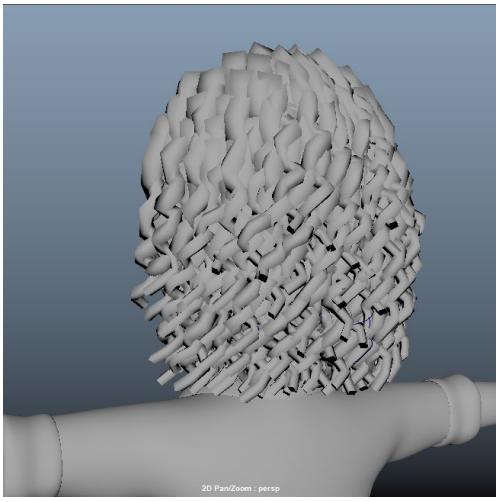

Figure 41.1

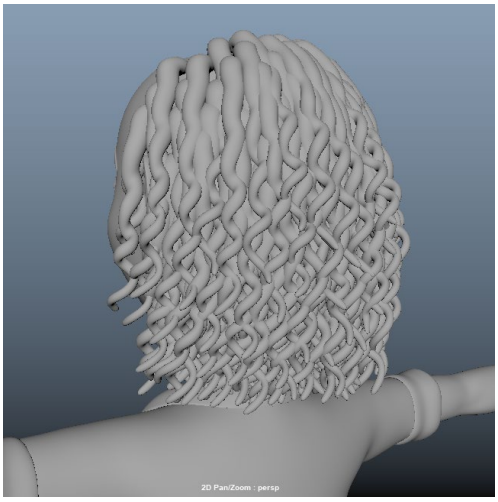

Figure 42.2

42. In the Outliner, hide the "spiral_grp" group. Open the "tubeMeshes" group and select all the meshes. In the menu bar, click *Mesh* > *Fill Hole.* (Figure 42.1) Re-click the "tubeMeshes" group in the Outline and hit 3 on your keyboard. This brings you into smooth preview where you can see how your hair is looking. (Figure 42.2) You can now delete "hairPiece" in the Outliner.

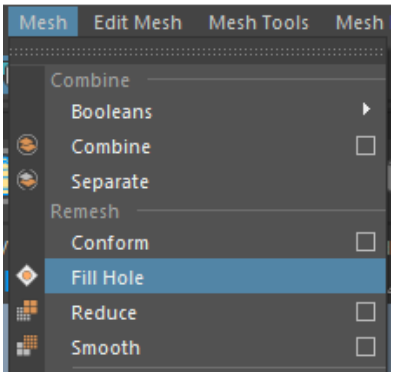

Figure 42.1

43. The rest is all about shaping. In vertex mode, use soft select to move around hairs and give them variation. On Persephone, I added her hat and bangs back, and I tried to get rid of as much interpenetration as possible by moving points by hand. I also deleted lots of strands that didn't have an impact on the shape of the hair. The figures below are the final result. Good luck!

Figure 43.1

Figure 43.2

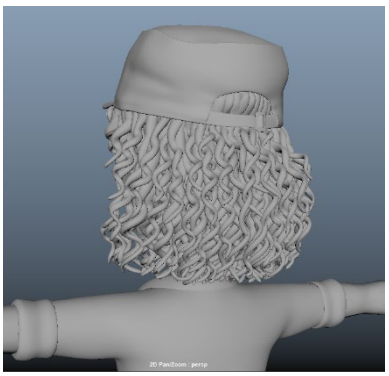

Figure 43.3