

What hairy legs you have!

Mastering 3D Graphics ~ issue #3

Animation Master ~ Patrick Clarke

The Legend Continues

Spiders; our eight legged little friends. Throughout history, they have been considered evil, vile creatures. They are found all over the world, in all environments from harsh deserts to lush rain forests. They vary in form from the hard-shelled slick carapace of the Black Widow to the hairy soft shape of the Tarantula. However, they all have one thing in common... to most people, they are creepy.



Research is the key

The first thing that you have to do when you decide to make something from nature is to research it. One of the easiest and best ways to research something is to use the Internet. Doing a simple search on “Tarantulas” will find you many sites. I narrowed my search to “Tarantulas AND anatomy” to find more about how spiders are put together. If there is a specific breed that you are interested in, like the Mexican Redleg, you can narrow your search to that specific breed. Below are some general links that I have found to be the most beneficial for general information on Tarantulas:

<http://www.geocities.com/RainForest/Canopy/1782>

<http://dns.ufsia.ac.be/Arachnology/Pages/Tarantulas.html>

<http://torgo.cnhost.com/ats/>

<http://www.nationalgeographic.com/tarantulas/>

If your Internet connection is slow, another great place to find information is at the library. Most local public libraries carry many books on spiders. I have found that some of the best illustrations in books are in the children’s section, so don’t be afraid to venture over with the kids to find the many good books there.

Another good source of information (especially for animations and movies) is in the many offerings of Multimedia Encyclopedias. They aren’t that expensive and you will find that they often come in useful. In Microsoft’s Encarta, I found a couple of movies of spiders walking, as well as an anatomical diagram of a spider.

So, no matter where you find your information, just make sure that you’re getting as much as you can. It will make the modeling of any object easier if you have the proper data to help in its construction.

Using our knowledge to drive our direction

Now that we have information on our Tarantula, we can use it to make a 3D spider. I will be using Hash’s Animation Master 99 version 7.0. I will spend some time giving you some tips I have found make Animation Master run as good as it can. With all the new features being included in the latest version of the software you can eat up RAM quickly and cause your OS to become unstable. One of these new features to the world of Hash is the implementation of Fur. Fur is somewhat like a particle system, but Animation Master converts these “hair” particles into patches so that Dynamics and Forces can be applied to them. Since Fur adds geometry to your scene, it is a definite hit in processing and memory requirements.

Obviously, you want as much RAM as you can possibly put in a computer. You want the fastest processor known to man. However, we have to be realistic and understand that most of us don't have the best or fastest computer and we have to work with what we can afford. This tutorial was done on a 233 MMX Pentium PC with 100MB of RAM. This is by no means a super fast system, but the way I am going to show you how to apply Fur to our Tarantula will not only speed up the creative process of designing your fur, but will lessen the chance of potential crashing and memory bottlenecking on any configuration.

Here are just a few tips if you are having problems with memory or crashing. Go to the Tools menu and select Options, or hit the shortcut Ctrl + P. This will bring up the general options for Animation Master. You will see something like [Figure 1](#). By default, the Global tab is selected. Under it, two sections should concern us. The first is Undo. I recommend unchecking Unlimited and tell-

ing AM to only use 5-10 undoes. If you have more than 100MB of RAM, you can increase this number, but I find 5 undoes pretty good and this helps make Windows more stable. The other section that you should be concerned about under the Global tab is Memory. If you have had some crashes in the past with Hash's software, this might be a good area to change. With Windows, I usually find that once I am booted up and have Animation Master open; I have 50 to 75 MB of RAM left. Therefore, I put in limit max memory usage of 50,000 KB in this box. A last area to increase interactivity is to check limit max drawing time under the Interrupt Drawing section of Global. Which level of interactivity is up to you and some

experimentation is necessary for you to find the one that works best. This box can also be changed at any time in the modeling process so feel free to play with the options. All right, we've made our changes, so let's start building our spider.

Click on the New button, or go to File, New and choose Model. A series of new icons will have appeared in the

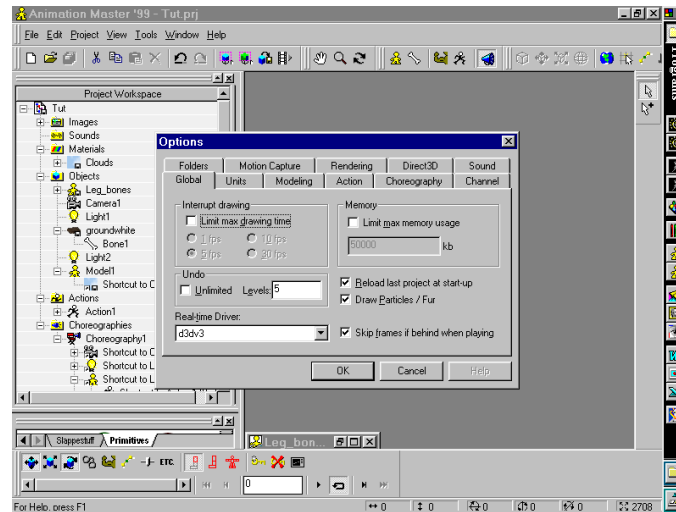


Figure 1: Understanding Animation Master's Options are the key to a productive work environment.

Project Workspace (PWS). If you can't see the PWS, just go to the View menu and make sure Project Workspace is selected. I have provided a Rotoscope that I found on one of the web sites that I mentioned earlier and we are going to use this to help create our spider. Right-click on your model in the PWS (Command Click on the Mac) and select New and then Rotoscope. It will bring up a requester that will prompt you to choose an existing image (of which we have none) or browse to find one. Click on Browse, and navigate to find the image that I provided called "ventview.tga". We need to select a new back color for this image so that it is not see-through, so right click on the ventview icon under Images in the PWS. When this window pops up, choose any color other than black for the Bk_Color. This will make it more usable as a Rotoscope by not clipping-out any of the color in the picture. This image will automatically be assigned to the Front view, but we want it to be in the Top view. We can easily change this to the Top view by right clicking on the Rotoscope icon in the

PWS and select Properties. Now select Top from the View section drop down of the Global tab. Now we can see the image in the Top view.

I build my models using Animation Master's rulers, which are turned on by clicking on the Show Rulers button in the Toolbar. In addition, since most spiders aren't very large, select Inches from the drop down in your modeling window, see [Figure 2](#). Now what we need to do is size our Rotoscope so that it is the relative size of a Tarantula. Our Tarantula will have a span of 6 inches. So, grab one of the selected corners (click on the Rotoscope icon if it is not already selected) and using the Shift key scale the image proportionally so that the legs are spanning 6 inches, see [Figure 3](#). Next, draw a spline (Shift A, or Add

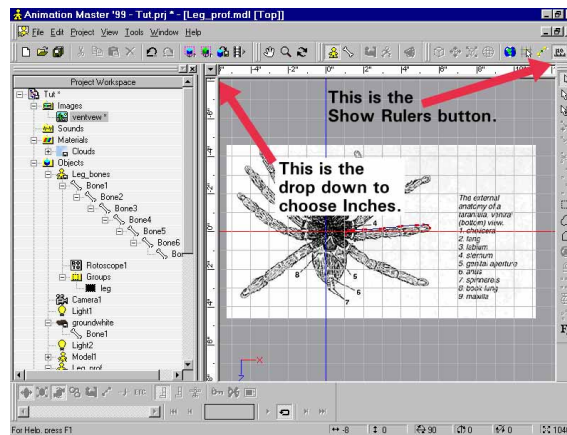


Figure 2: Animation Master's rulers make real-world modeling easier.

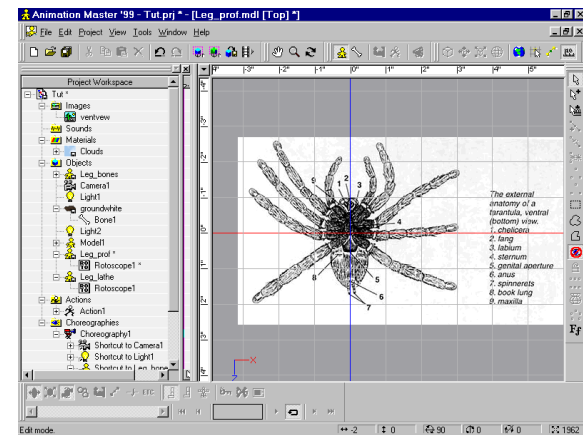


Figure 3: Scaling your Rotoscope to the proper size will speed up the modeling.

mode icon) that is roughly the shape of the middle right leg as shown in [Figure 4](#). We need to lathe this shape into the leg, so just click on a CP and hit the L button, or the Lathe button on the side toolbar. Hmm, didn't quite work out, did it? What did we do wrong? Well, Animation Master Lathes around the Y-axis of the object and we built our object around the X-axis so when we hit the Lathe button it spun our outline around the Y-axis. Okay, so how do we get it to lathe correctly? What we need to do is change the Axis of the object to reflect what we want to lathe. Animation Master uses the objects axis to determine its center point to lathe. We need to change this. Select the entire spline and hit the R button for Rotate, or select the Rotate button on the top toolbar. You might want to make your Rotate Snap (under Options) zero degrees for a free rotate. Rotate and move your object as shown in [Figure 5](#). You need to make sure that the endpoints of your spline are at zero in the Z direction. This is easily done by selecting the CP and then right clicking on it and entering 0 in the Z requester under the Selected CP tab.

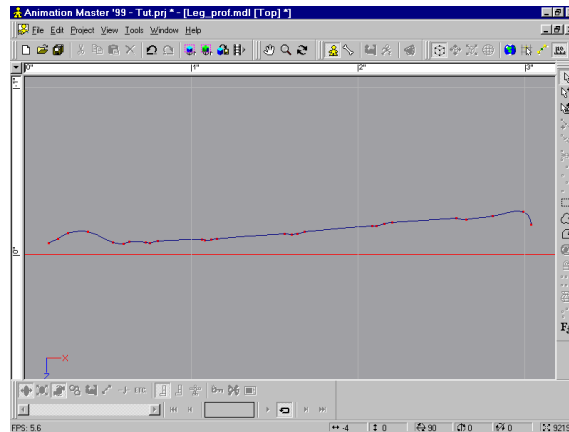


Figure 4: The resultant spline from the Rotoscope.

Repeat this procedure on the other endpoint and then we will tackle the spline's pivot.

Once your spline looks similar to [Figure 5](#), you need to move and rotate it's pivot so that we can lathe it correctly. Select your spline by clicking on a CP and then hitting the / key to select connected CPs of the spline. This is very important because if you lasso select or drag select, the Lathe won't work. Right click to bring up the Properties panel for the spline. Go to the Pivot tab and in the Position area type in zeros for all the numbers. This will position the pivot at the origin and line it up with the two endpoints of our spline. Now we need to rotate our pivot so that the Y-axis is in line with our endpoints. With the Rotate manipulator still selected, hit the T key (or go to the Turn button in the top toolbar). Get a

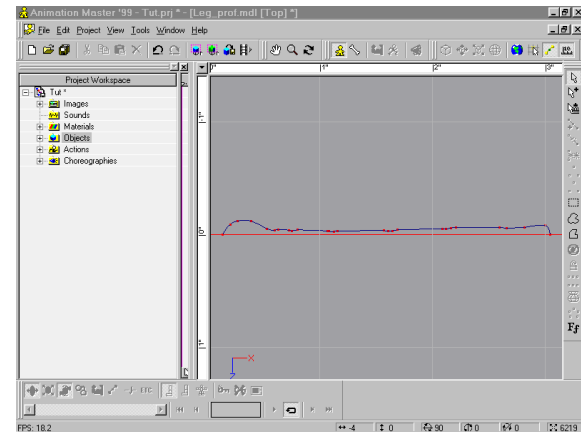


Figure 5: Lining up the profile for Lathing.

nice 3D view of the spline and the axis and you will notice that we have to rotate the axis around the Z-axis. Now type in -90 (or 90) in the box for Z. This will give you an axis ready to Lathe, see [Figure 6](#). Now hit the Lathe button and you should see something like [Figure 7](#). Look at the normals (Shift+F1) and make sure that they are pointing out. If not select the ones that aren't and hit the F key (or right click on the model and choose Flip Normals. As with most lathes there will be some tweaking of the resulting lathe, so alter your model to get it in a better overall shape. You can also undo the lathe right after you've done it (or however many times you have selected in your un-

does). Then alter your profile curve and re-lathe it. You will have to go through the previous steps to get the proper lathe since Animation Master resets its pivot with each selection. Once you have the shape that you want, save and then we will set up our spiders leg joints.

Adding bones is easy!

Now that we have a model of a leg built, we need to set up the bones. Spiders have seven segments to their legs, so we need to add seven bones to our leg. Go to the top toolbar and hit the Bones Mode button (F6). Using Add Mode set up your bones position as shown in [Figure 8](#). Now we need to assign

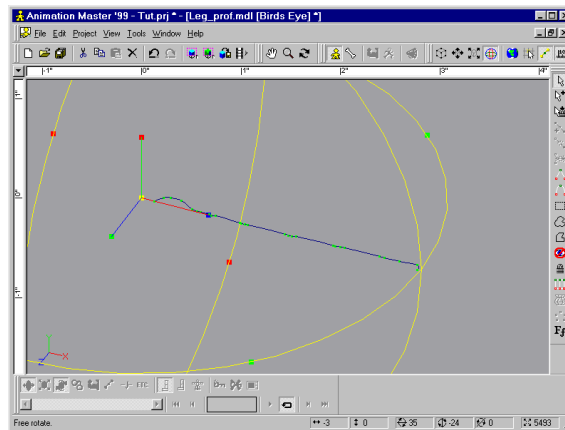


Figure 6: Changing your view will aid in setting up the Lathe.

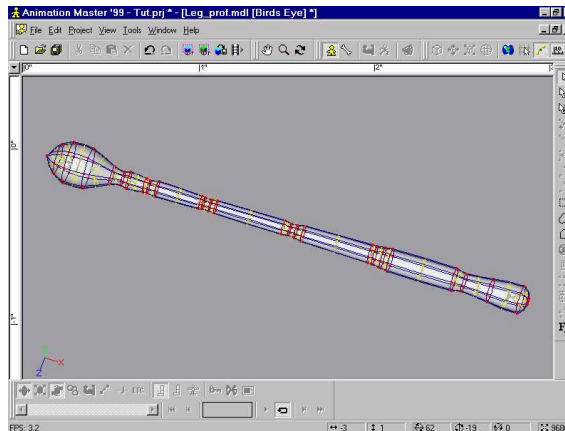


Figure 7: The first Lathe with Normals the wrong way.

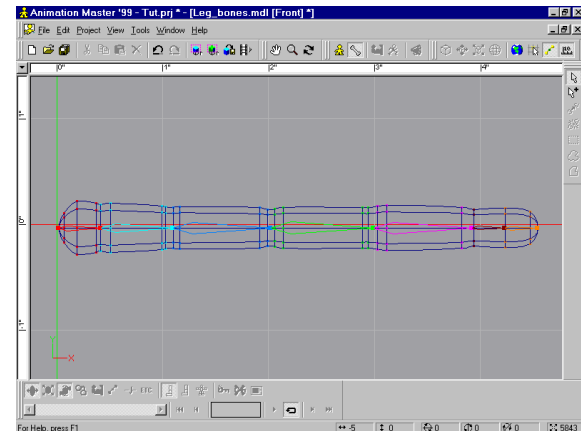


Figure 8: Use this to assign your bone grouping.

CP's to each bone. This is done by selecting the bone and then hitting the Group Mode button (or by hitting the G key). When you have activated the Group Mode, you need to select the CPs to be controlled by the bone. Refer again to [Figure 8](#) to get the proper assignments for the CPs. The way that your bones are set up is important for controlling how your object bends, so take your time and set this up carefully. To view how our newly assigned bones work we need to set up an Action to see it move. Right click on the Action folder in the PWS and select New Action. This will open a new window with your object in it. If you have more than one object in your Model folder, a requester will pop up asking you which model you want to use for the Action. If this is the case, select your leg model with bones assigned to it and the Action window will pop up with your boned model. If you select the end bone of your leg and move it around, you will notice that in some areas your leg will crease unwarrantedly. The nice thing about Animation Master is that you can update your model and the

Action will use the updated model. If a bone is acting strange, just go back to the bones mode of the model and fix it. Then when you go back into the Action, you will find that everything is updated. It is also okay to have a modeling window open and an Action window open at the same time to tweak and notice the changes right away. You might have to hit the space bar in the Action window occasionally to refresh the Action, but other than that, it is very simple and very powerful!

Adjusting the joints for proper bending

What we need to adjust now are some of the joints to minimize creasing. This is accomplished by going back into the modeling window and making some decisions. See [Figure 9](#) to see the joint that I used. It is a very simple

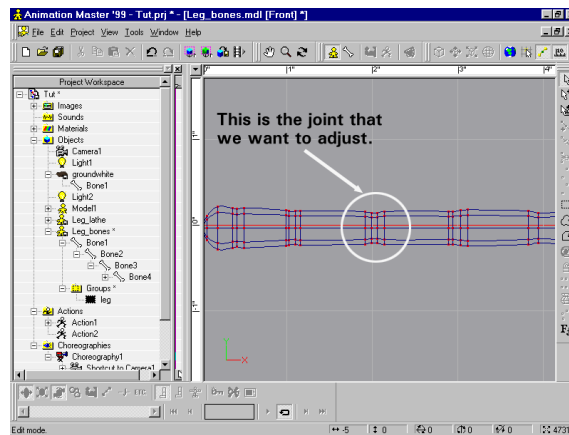


Figure 9: Creating proper joints will make the leg bend better.

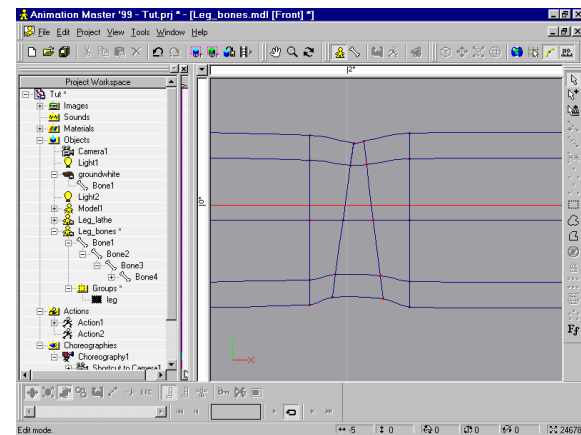


Figure 10: The adjusted joint for proper bending.

procedure, just figure which way the joint will bend and if it is mainly going to bend down, select the splines and adjust them like those shown in [Figure 10](#). If it needs to go the other direction more often, then just adjust the splines in the opposite fashion ([Figure 10](#)). Use your existing Action to test your changes. Let's save our project and we will continue.

A Patch is fine to save some time in making Fur

Now that we have the general setup for the leg, (we aren't going to worry about constraints right now) we need to create the general color of our leg and then make our Fur Material. To set up the general color we can use our leg, but when we set up our Fur for our spiders leg, we are going to do something a little different. To set up our leg, select the entire spline making up the leg and in the PWS under the leg model icon and under Group, you will see the group Untitled. We want to change this name to something a little more recognizable. Let's name it leg_black, or something like that. Now, when you right click on this icon the Properties window opens up and we can alter its base attributes. First, we have to make sure the group has attributes. To make the group have base attributes, look under the Options tab and check the Group has color box. You will notice that you have a

couple of new tabs. Click on the Color tab and let's select the base color under Diffuse. We want our spiders base color to be black, so click on the color chip and a selection of colors comes up. Go ahead and select the base black that is in the upper right hand corner. We will leave the Falloff alone at 100 and we need to change Amb (Ambiance) to zero. Why? Because Ambiance is the value that determines the brightness of an object when no light is hitting it. Therefore, at zero, when it is dark this object will be dark as well. Next on our list is Specularity. Under Color, let's choose a nice white and under Size let's make it 600. This will give a very large specular spot to enhance shininess found in the exoskeleton of the spider. We are going to leave the Intensity of our specular at 100. If you want a "hotter" specular highlight, just increase this number. If we rendered it right now, you would find a nice plasticity black surface with a big white specular highlight. This won't do. What we need to do is scatter the light across the surface a little more. That's where Roughness comes in. Now most of the time I wouldn't recommend using Roughness because it usually suffers from visual "chatter" in animation. However, in our model it will not be a problem because it will mostly be hidden by the Fur. We still need this function for the scattering of light, but the surface will not chatter because of the fur. We want a small size (Scale) and a small Height. We want this to be a subtle effect, so enter .5 for the Height and 5

in the Scale. Do a couple of Renders (Shift+Q) of the leg at different angles to get an idea of what we are doing, see [Figure 11](#).

We now have the general attributes for our leg, now we need to put some fur on them. We could just make our materials and then throw them on to our model, render and then tweak. We aren't going to do that though. To do testing of size and Fur color on our model would eat up precious time and render slowly. What we are going to do is make a 1 inch square patch of fur that can be easily updated and be very interactive.

You're so square

To make our square patch, choose New Model from the PWS and when the window opens choose the Add Points tool (Shift+A). Before you start making your spline, make sure that you select Grid Snap from the top tool bar. This will ensure that your patch is perfectly square. So, with your rulers still on and set to inches, make a vertical line 1 inch long. Now we

want to Extrude this line into a renderable square patch. But, we need to change our Paste/Extrude Offset. By default Animation Master is set up to offset your paste or extrude by -10 units in the Y. Since we want a perfect square, we want the offset set to zero in the Y. Now that we have changed this we can go ahead and hit E to Extrude our line. Drag this line (we still have Grid Snap on) out to make a square. Render this or turn on Shaded mode (right click in the modeling area and choose Shaded/Wireframe under the Draw Mode tab to see our newly created surface. Why didn't we just make a four point spline and then attach it? Because Animation Master does not make a surface out of a continuous 4 point

spline. This way it was only a 2 point spline that we then extruded to make a valid patch. Save your project and we will continue.

The Fur is flying

Now that we have a test "skin", you may be wondering why I didn't assign the base attributes of the leg to our test square. To me, it is much easier to concentrate on just the fur attributes and

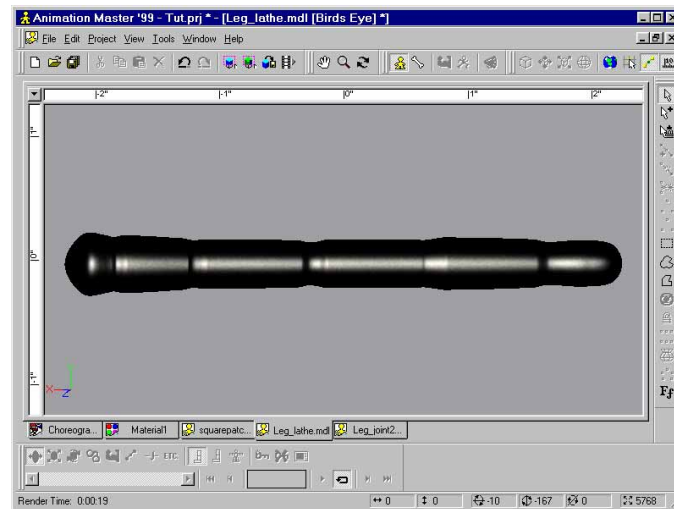


Figure 11: The underlying leg surface will enhance the "hairy" leg.

not be influenced by the dark surface of our leg. Once we get a good fur on our square, we will then concentrate on how this hair interacts with the leg.

The default color of our surface is a light gray, so we have a nice neutral color to attach our fur. Next, we have to make Fur. Real spiders have all kinds of specialized hairs on their bodies and I am going to show you how to make 3 different kinds of fur to simulate the different kinds of hair a Tarantula has.

The first kind of hair that our spider is going to have is a short, dark, thick type of hair. This is the main body hair and will be the thickest and most noticeable. The first thing we need to do is create a new Material. This is achieved by right clicking on the Material icon in the PWS and selecting New Material. A small window will open with a ball inside it. This won't help us much with hair and will slow our interactivity, so let's close it by clicking on the X in the model window next to it. Click the small + next to the Material and then right click on the Attribute

icon. Select Change Type To and then Fur. Your icon will now say Fur Emitter. You will now see another + sign next to Fur Emitter and when you click on it, Attribute will show up. We're not going to worry about the Attribute right now, so right click on the Fur Emitter icon and choose Properties. Our spiders main leg hair will not stick straight off the surface. Instead, it will flow down the leg. With the use of Forces, we are going to "sculpt" the hair so that they lie across the surface instead of sticking straight off. However, before we go changing numbers and adding Forces, why don't we see what the defaults look like? To assign this Material to our test square, select the Material in the PWS and then drag it onto the icon of our test square. In our modeling window, you will see

some sparse lines sticking up off the surface of the square patch (Figure 12). All right, now that we have a visual representation of our Fur, we can change things. Go back to the Properties of your Material and the first thing that we are going to do is to change the color of our Fur to be a dark brownish-black. Here are the color settings I used to make this color: R:71, G:46, B:31. After you

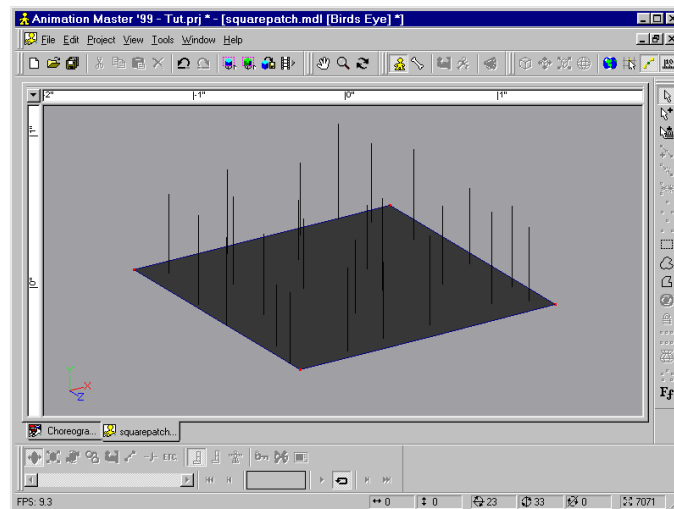


Figure 12: The default Fur Emitter on our single patch.

change the color in the requestor, you will see a change in the line color of the Fur in the modeling window. Change the Specularity to R:131, G:123, B:114. Leave the Intensity value at 100. This will give a nice mid-range specular highlight. In the Size box, put in a value of 50. Now that we have a color and highlight, lets make some changes in the properties of the Fur itself.

We want to have very thick fur, but instead of adding Density (which controls how much Fur is on the surface) we are going to adjust the other attributes and keep our speed and interactivity as fast as possible. Our Length is going to be pretty short, so put in .07". The Thickness is a tricky area and believe me, it takes some playing with to get what you want. It is very versatile and can be a bumpy, almost suction cup type of hair if the value is high. Alternatively, it can be thin and wispy if the value is low. We are looking for the thin and wispy kind of hair. Unfortunately, in my tests the hair had to be so thin (.005") that the display shows that it is zero. Well, the way to see

how thin it is to change our measurement to a smaller value. This is done by going to your ruler drop down and selecting Centimeters. Now we see that our Fur Thickness is .01cm. Now we need to sculpt our Fur with Forces. Sculpting with forces is simple; you just have to know how your model is oriented. To make our hair lay down along the length of the leg we just have to increase the Force value in X. Put in 7 for this value. I also put in the value of 1 in the Y direction. This will just "mess" the hair around a little. But, if you notice, our hair isn't laying down as nicely as it should. That's because we need to alter the last box, Stiffness. Put in 25 for this number and then look at your modeling window. You will notice in

the window that the hair is now laying down (Figure 13). Unfortunately, this type of Force is fine if this object never rotates or bends, but we want our leg to bend, and rotate. Animation Master's Fur forces act in a Global manner and therefore respect the world axis and not the object's axis. Rotate your object and observe how this works. That certainly puts a crimp in our plan, doesn't it?

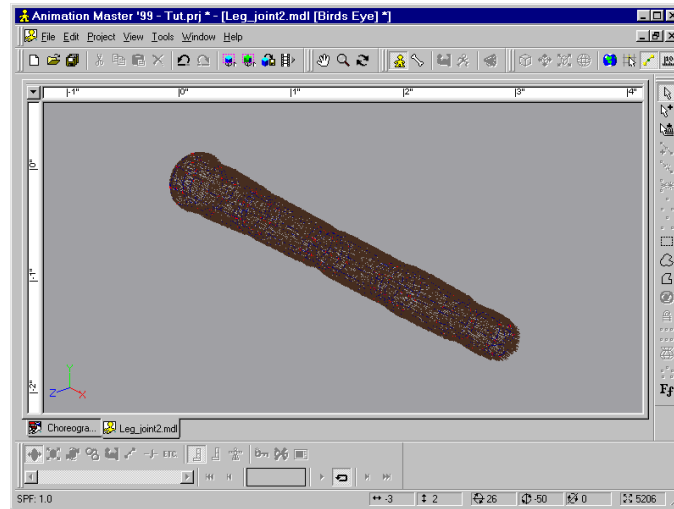


Figure 13: Our Fur with Forces "styling" the direction of the Fur.

What are we to do? Fortunately, Hash has put in the ability to add a separate Force object hierarchically that will rotate with the object. Bending is a separate issue and has not been totally resolved; I will talk about that after we set up our Force. For adding the Force, we are going to have to use our leg model. There is no way to transfer what we would do to our simple patch to our leg, so we will have to attempt it directly to our leg model. Put zeros in all of the Forces boxes and drop the material on our leg_group icon of our leg.

Right click on your leg model icon in the PWS and select New, and then Force. To be able to interactively change the position and rotation of our Force, we need to change to Bones Mode (F6). We could just enter numbers in Model Mode (F5) but it is essential to see the bone that controls the Forces direction and position. After you have entered Bones Mode, open the Properties for the object. We want our Force to totally encompass our leg and we have to account for bending as well. Think of your objects

range of motion when selecting the size of your Force. It is advisable to have some Actions already made for your object before you add your Force so that you know how big your Force needs to be to affect the Fur of the object the whole time. Change your Force Type to Box, Kind to Fan and enter a value of 10,000 in Magnitude. Under your Box tab, make sure you have no Softness for Width and Falloff. We want our box to have hard falloff so that our hair is affected equally inside the Force at all times. For size, please reference [Figure 13a](#). This is the best solution for Animation Master right now. You will notice that when you bend your leg, the fur at the bottom doesn't bend exactly correctly. Why don't we just build individual

Forces for each joint? That would be the best solution, but if you try it, you will see that there is no way to tell Animation Master to have these forces bend with the leg. Yes, they have bones, but there is no way to assign the Force bone to the legs CP's but you can't add Constraints to these bones either. Until Hash implements this type of feature, you will have to accept the limitations that we

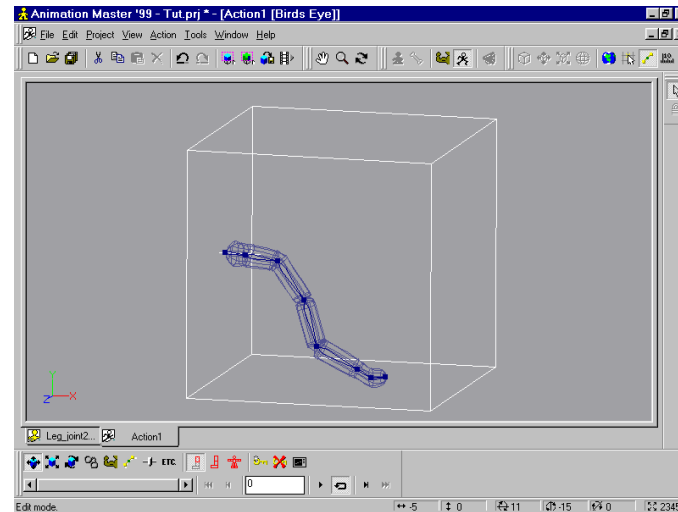


Figure 13a: Use a hierarchical Force that is large enough to encompass the objects range of motion.

have. Let's go back to our patch model and finish off the look of the Fur.

Now we need to bring up the value of the Density so that it covers the surface nicely, but doesn't totally cover it like carpet, because we want to be able to see the leg surface underneath. I found a Density of 300 to be sufficient. Why didn't we type in this value from the start? Well, I find that since Fur is very RAM intensive, it is easier to work on the color and the Forces first and then work on how much hair you need. You may be wondering why we didn't lower the Density and increase the Thickness. It actually takes longer to render thicker hair than it does to render more dense, thinner hair! This is the same with Animation Master's Particles as well, interestingly enough. So now you know that, save your project and do a couple of test renders if you want and then we will add another Fur Emitter.

The next Fur Emitter will be a secondary coloration hair. Add another Fur Emitter and enter these values. Forces: 7, 1, 0. Hair Length: .012". Thickness: .01" and Density: 150. This will give a slightly longer, thicker hair. In the color fields enter a redder color than our initial hair. Here is what I used: R:70, G:28, B:23, Specularity was at R:156, G:128 and B:109, with an Intensity of 100. For Stiffness, enter 25. Add this to your patch model and do a few tests.

The last Fur Emitter will be a totally different type of hair. This last type will be a long coarse type of hair. Here are the values: Color, R:71, G:46, B:31. Specularity: R:131, G:123, B:114. For the Fur settings, enter: Length: .25", Thickness: .005" and a Density of 45. By now you should understand what kind of hair this will give you even before you do tests, but feel free to do as many tests as you want after you have added this Fur to your patch. Save your project and we will continue by adding these Materials to our leg model.

Now comes the easy part

The fruits of all our labor are now going to put to use. We have done our tests on a single patch and that has kept are render times low, but now we need to put this Fur onto our leg. We have three types of fur that we need to put on to our leg and it is easily done by dragging each one to the group that we made for our leg. After a short time, we should have a very hairy leg in front of us. Make a new Action and pose your leg. You will notice it bends well and the hair is going in the right direction. Not bad! (Figure 14)

What have we learned? We have learned that research is the key to doing anything. You must have a plan before you go and start your project. Next, we learned how to optimize Animation Master to work best with Fur. By

altering a few things under the Options menu we have increased our interactivity and decreased the chances of having unwanted crashes. After we did that, we learned how to align splines properly to be lathed. We then adjusted these splines to bend better, thereby causing less creasing. After that, we used a single patch as a test base for our Fur assignment to increase interactivity and keep render times low. We examined the different attributes of Fur, what they all mean, how to design different types of fur and assign them to the same model to achieve a more realistic hair.

As you can see, there are many little things that help increase productivity and keep render times down. We didn't model anything complex, but we did learn the subtle nuances of how to do things efficiently, which makes the whole process of modeling the complexities to come, that much easier.

Now that you have the general skills of making a leg, you automatically have all eight legs. Your goal now is to use what you know to finish the body and assign Fur to it.

When you finish modeling, then we will have to tackle Constraints. Till then, experiment with Fur and make some cool, creepy insects!

Biography

Patrick Clarke is a Creative Illustrator in the 3D Graphics and Animation department of Lockheed Martin Astronautics, in Denver Colorado. He started out over 7 years ago with a little program on the Amiga called Imagine 1.0. He has a BFA in Computer Art from Bowling Green State University and has been a professional 3D animator for 5 years. At Lockheed he uses Alias | Wavefronts Studio and PowerAnimator, as well as

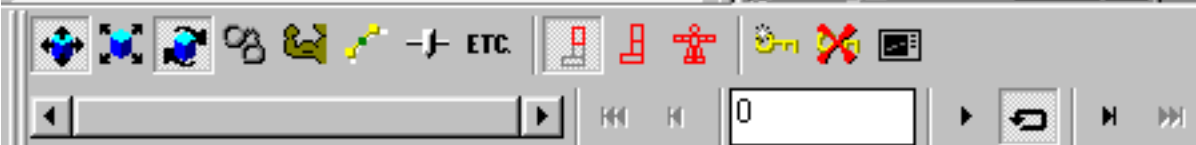
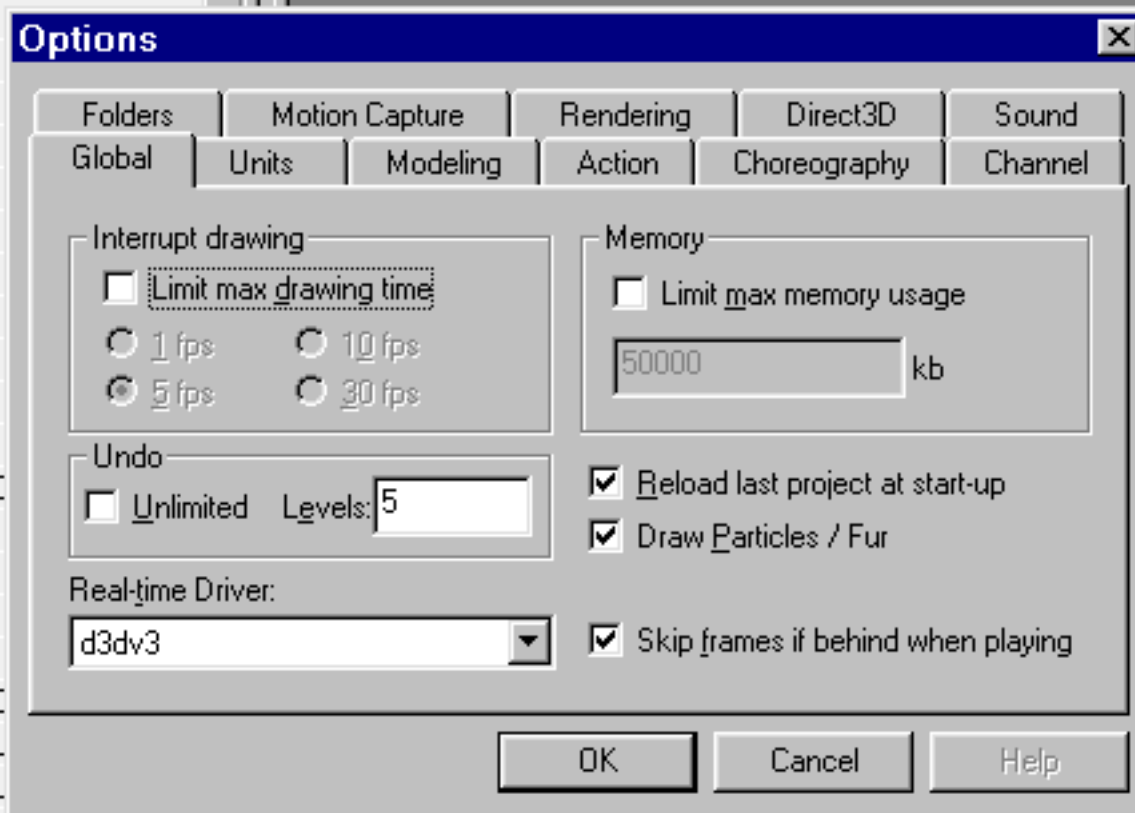
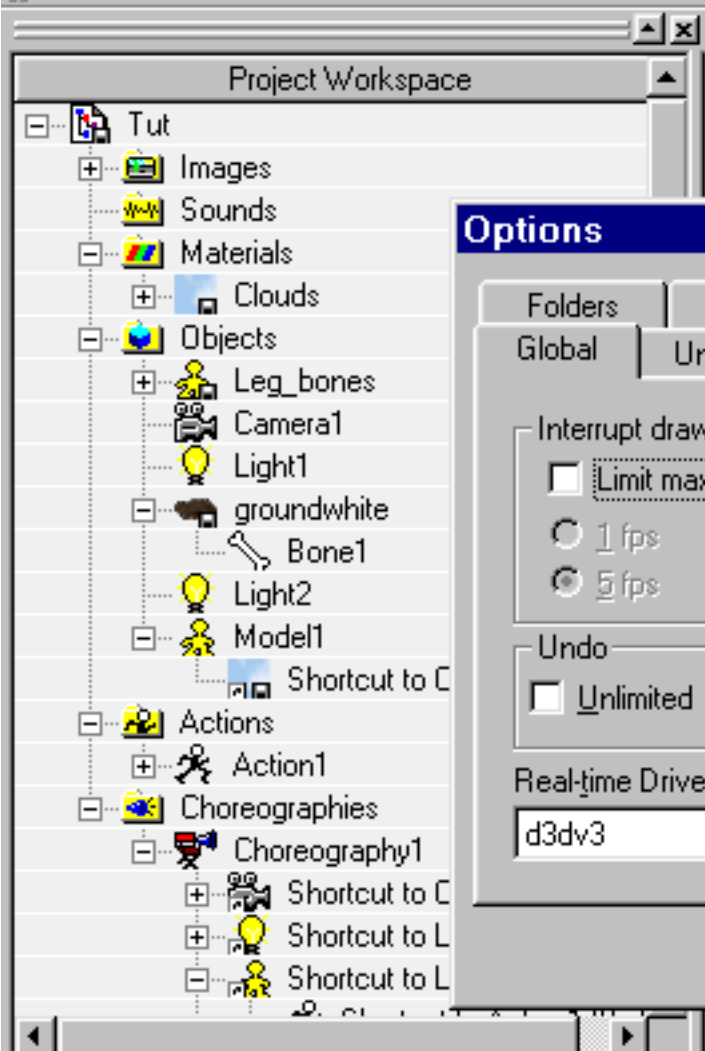
Imagine for animation and print work. At home he uses Hash's Animation Master, Impulse's Imagine and Newtek's Inspire 3D.

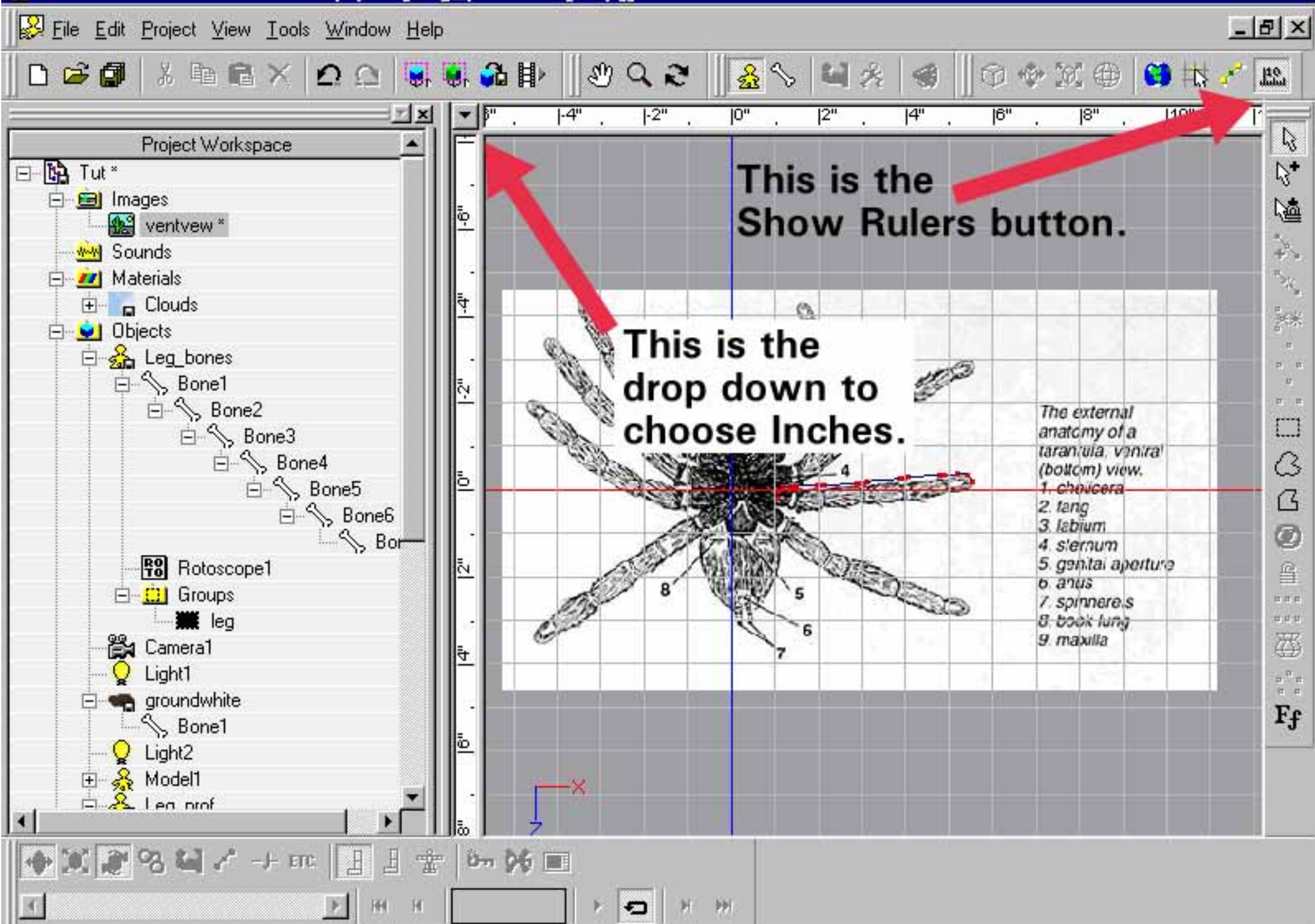
patrick.clarke@lmco.com



Figure 14: Our Final Rendered legs.







File Edit Project View Tools Window Help

Project Workspace

Tut *

Images

ventview

Sounds

Materials

Clouds

Objects

Leg_bones

Camera1

Light1

groundwhite

Bone1

Light2

Model1

Leg_prof *

Rotoscope1 *

Leg_lathe

Rotoscope1

Actions

Action1

Choreographies

Choreography1

Shortcut to Camera1

Shortcut to Light1

Shortcut to leg_bone

4" -3" -2" -1" 0" 1" 2" 3" 4" 5"

4" 3" 2" 1" 0" 1" 2" 3" 4"

1

2

3

4

5

6

7

8

9

The external anatomy of a tarantula, ventral (bottom) view.

1. *chelicera*

2. *fang*

3. *labium*

4. *sternum*

5. *genital aperture*

6. *anus*

7. *spinnerets*

8. *book lung*

9. *maxilla*

Edit mode.

X: -2 Y: 0 Z: 90 R: 0 T: 0 F: 1962

