Getting Started with Motion Studio

Last update: 09/13/2006
Email frank@frankladner.com if you have any questions.

In this tutorial, I will cover the basics of the Motion Studio plugin for trueSpace.

About MotionStudio

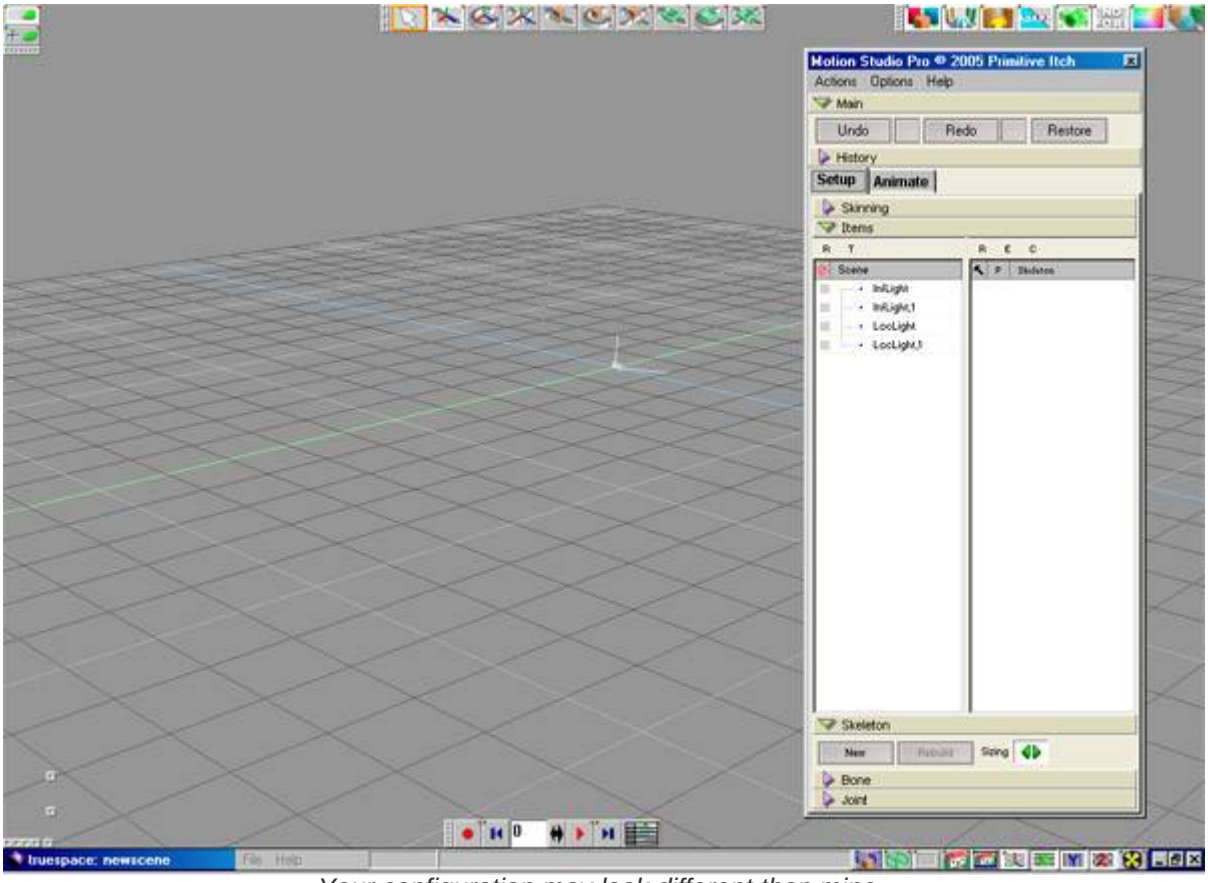
Motion Studio is a character animation plugin written for trueSpace by PrimitiveItch. There are many differences between this tool and trueSpace's native bones system.

Getting Started

Go ahead and run trueSpace if you haven't already. Once inside, load the Motion Studio plugin. This can be done by clicking the plugin icon  , locating the plugin file, and clicking the Open button.

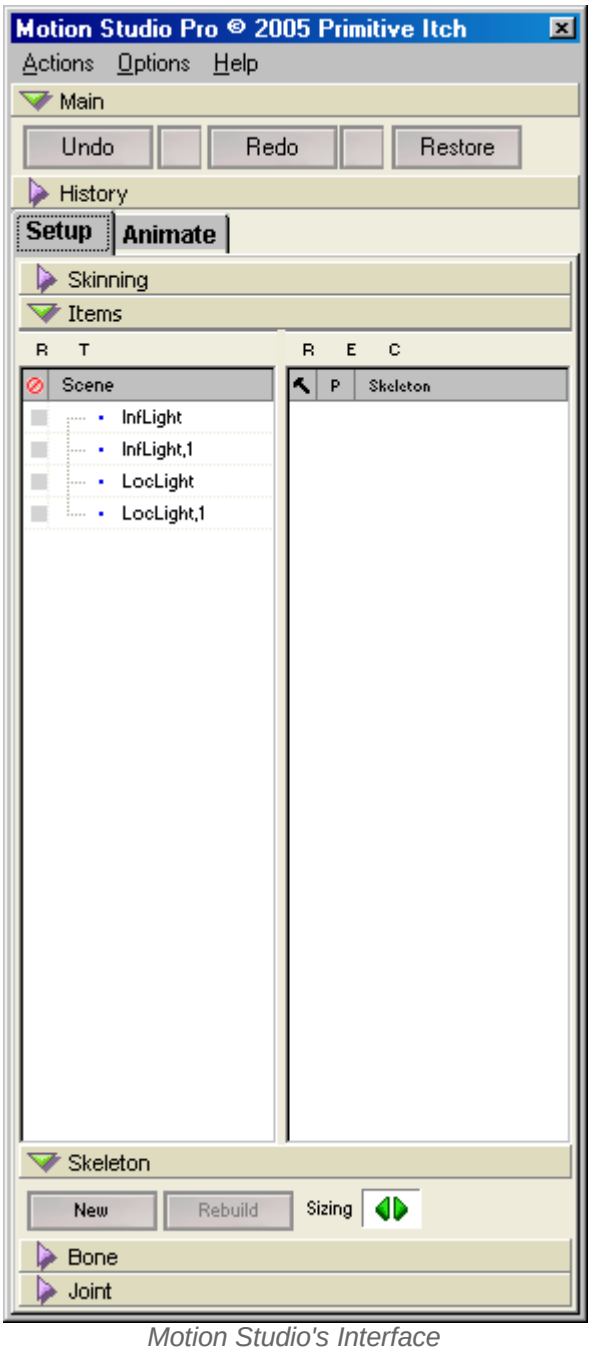
NOTE: This is typically C:\Program Files\MotionStudio\MotionStudio.tsx

Once loaded, you should see the MotionStudio icon  in trueSpace..



Your configuration may look different than mine.

Interface Overview



Motion Studio's Interface

Motion Studio is broken down into two sections, Setup and Animate.

SETUP

This is where the skeleton is built and adjusted, meshes and objects are attached, parenting is set up, and skinning is done.

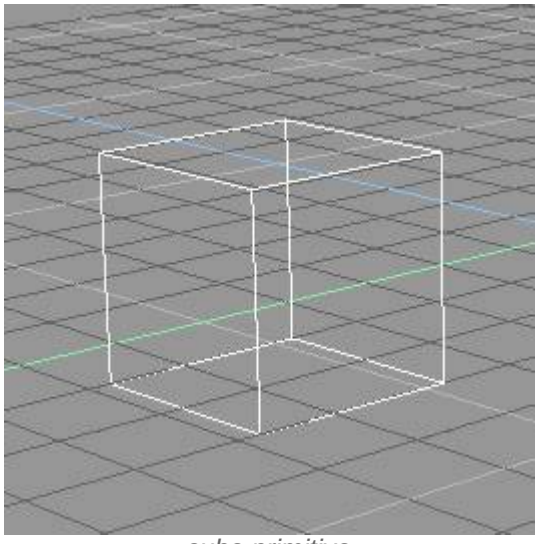
ANIMATE

This is where the skeleton is animated, keyframes are recorded, and poses are mixed. As with the Setup tab, skinning operations can be done here as well as certain skeleton adjustments (bone twist, for instance).

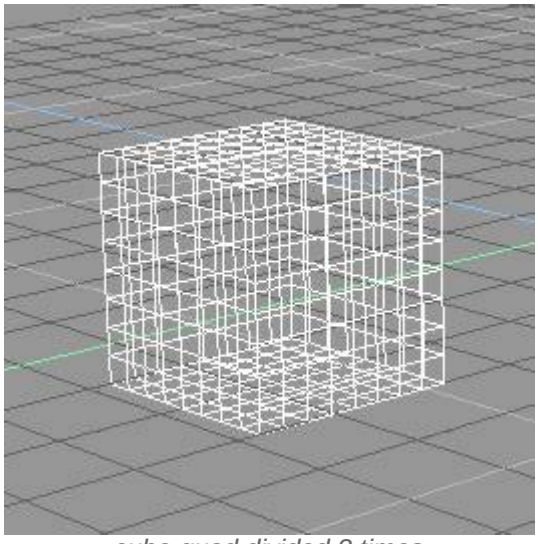
Building a Mesh

This is a very basic tutorial, so we will be using a primitive object for the examples.

Go ahead and load a cube primitive  and quad divide  it a few times.

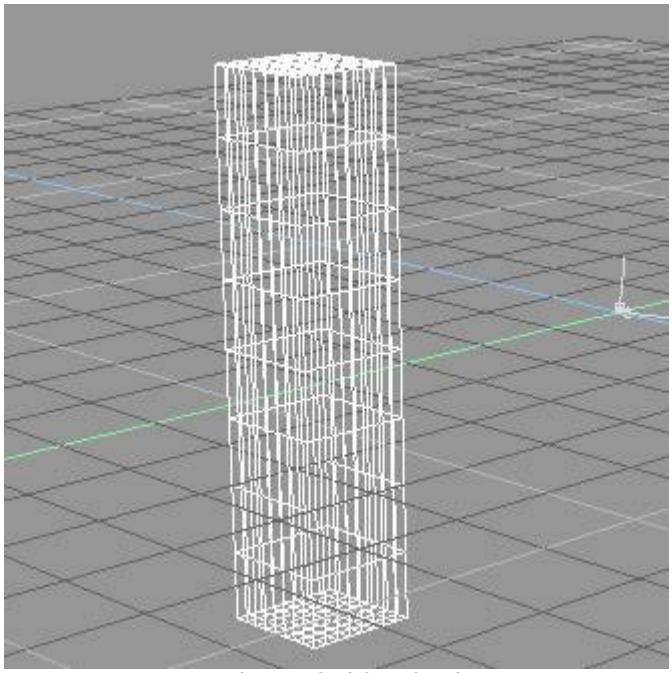


cube primitive



cube quad divided 3 times

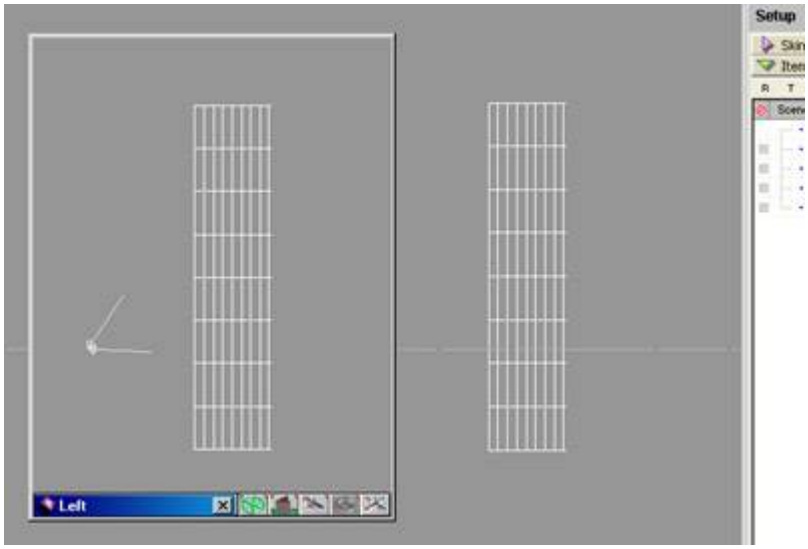
Scale  the object to look like the following.



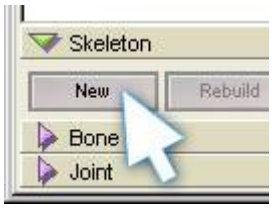
cube scaled / resized

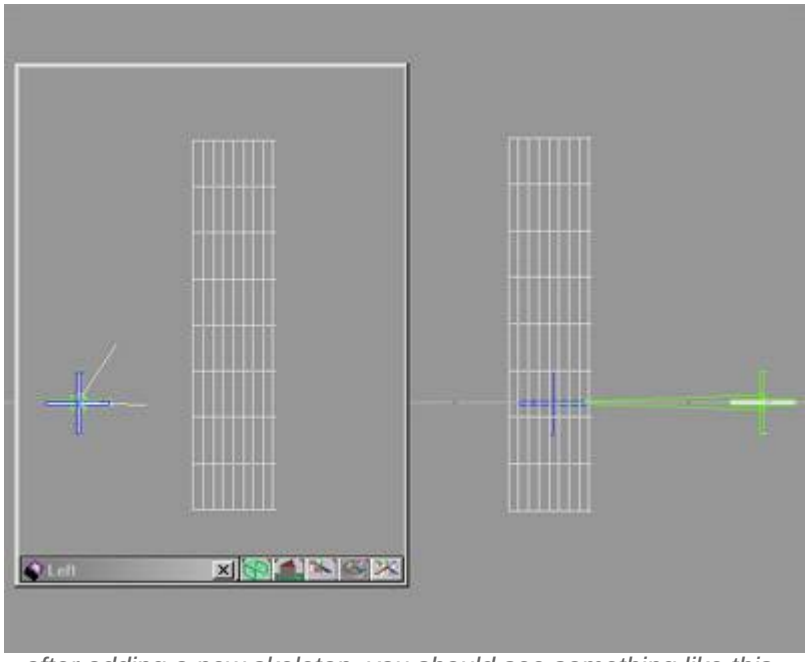
Building a Skeleton

Before building skeletons, it's a good idea to have a couple of windows open to be sure things are aligned properly. A front and side view will work just fine.



Now to add the skeleton.
Under the **Skeleton** section, click the **New** button.
NOTE: If your Skeleton section isn't expanded, click the purple pyramid icon to open it.

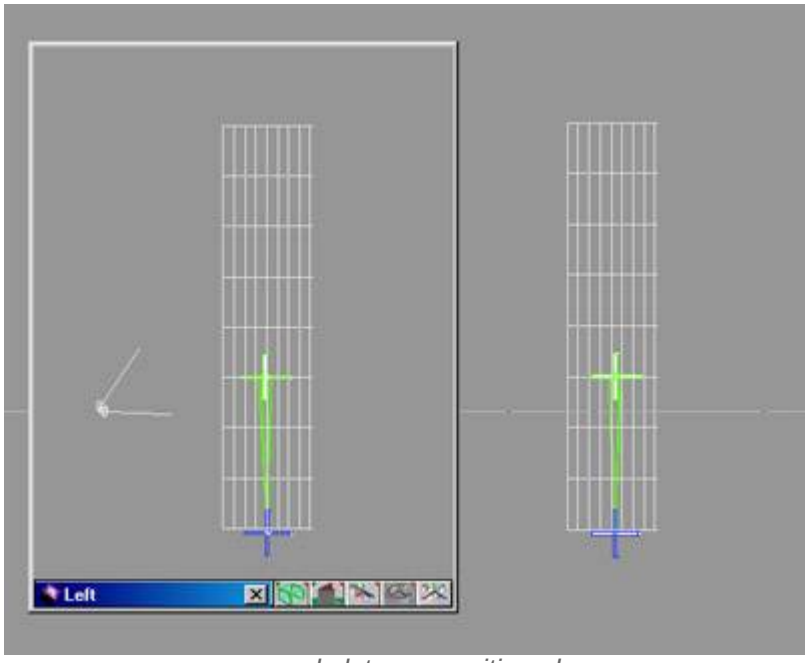




after adding a new skeleton, you should see something like this.

The cross-hair parts are joints. The connecting piece in the middle is a bone. When moving skeletons in MotionStudio, the **joint** is the part that is selected and moved.

Position the joints until you get the following result:



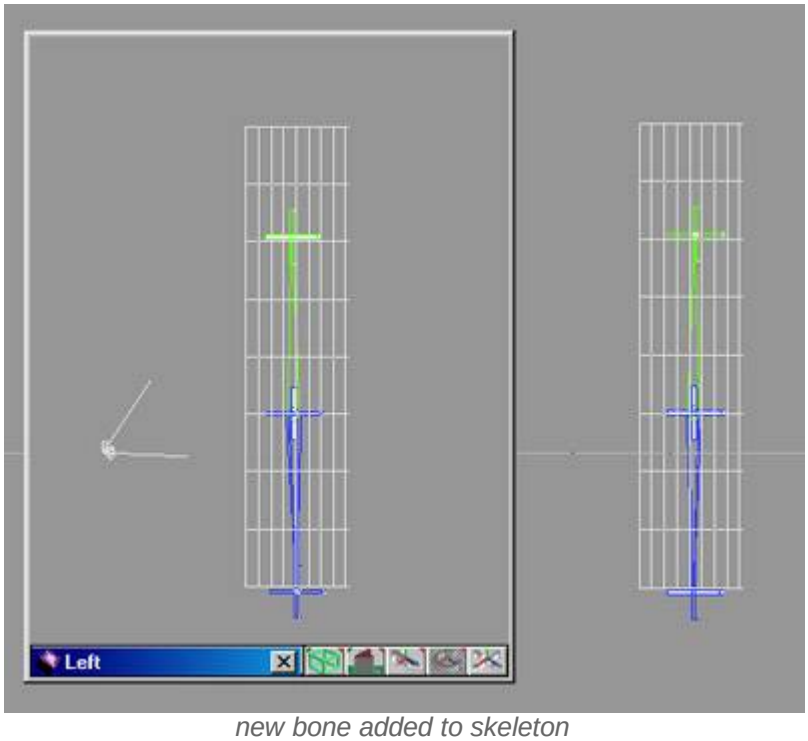
new skeleton, repositioned

*NOTE: It is easy to select the mesh object by accident. To save yourself the trouble of having to re-select the joint from the list in MotionStudio, be sure **Auto Drill-Down Select** is enabled under the **Options** menu.*

Next we will add another bone to the skeleton. Expand the **Bone** section and click **New**.

NOTE: You'll notice in my image the Skeleton section has been collapsed. This is to prevent accidentally adding a new skeleton instead of a new bone.

You should now have something similar to the following image. You may notice that when adding a bone, MotionStudio aligns it with the last bone that was adjusted. This helps speed the process along.

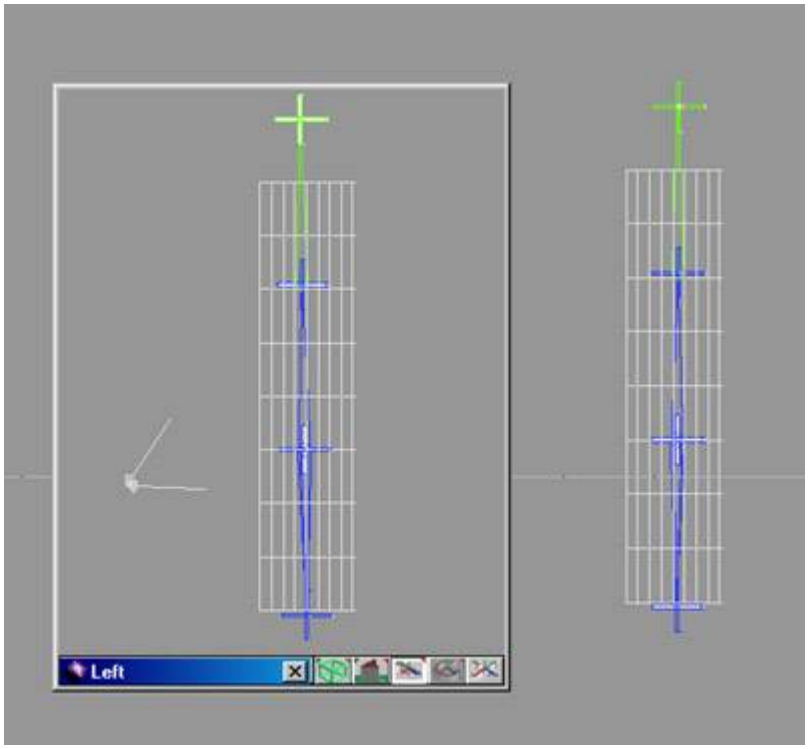


new bone added to skeleton

Go ahead and add one more bone.

You should now have a complex chararacter, as seen below, ready to be put into a short film

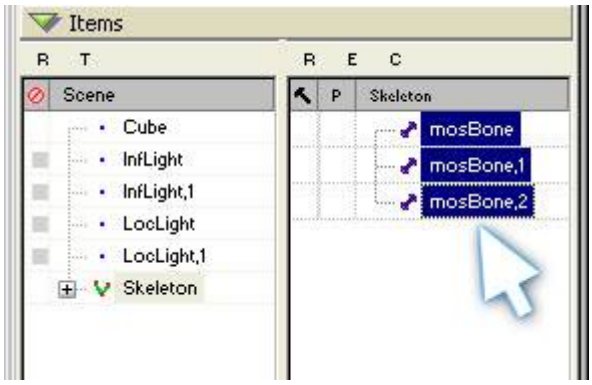
I am kidding mostly, but your results should look like this:



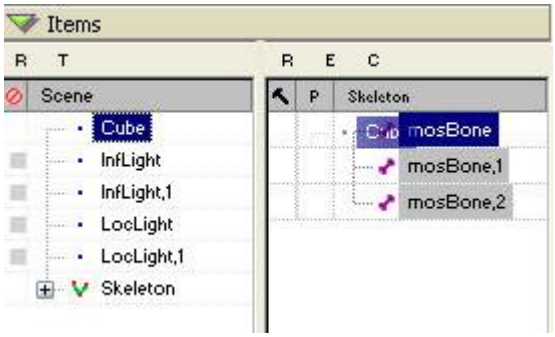
We will call the skeleton DONE and move on to the skinning part.

Attaching the mesh to the skeleton

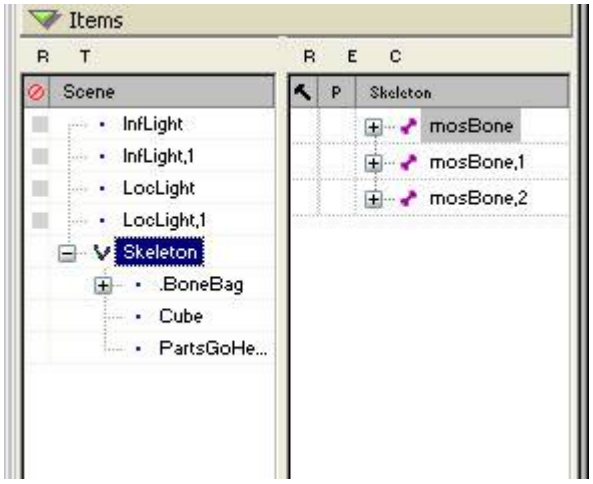
Highlight all three bone objects (**mosBone**, **mosBone,1**, & **mosBone,2**).



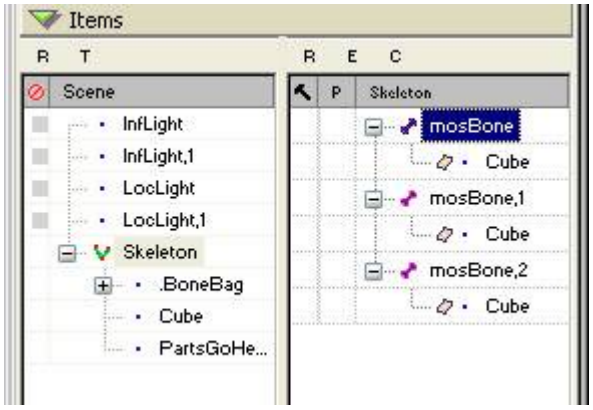
Drag the **Cube** object onto any one of the selected bone objects.



The Cube object should no longer appear in the Scene list, but if you expand the Skeleton, you'll see the cube listed below it.



If you expand the bone objects in the Skeleton list to the right, you'll notice they all have the Cube object attached. The average-caucasian-flesh-colored (...or maybe 'peach' colored. Not sure.) icon to the left of the object means that Skinning is enabled. By default, if you add any object/mesh to more than one bone, MotionStudio knows to enable skinning. If you add an object/mesh to a single bone, it will simply attach it with no skinning enabled.
NOTE: To manually enable skinning, right-click on the object and click 'Enable Skinning'.

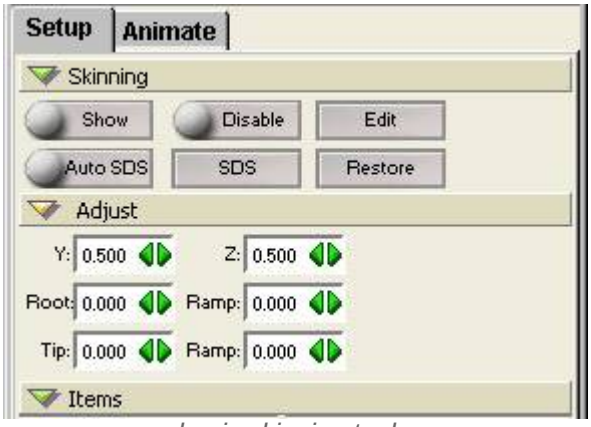


At this point, your object is attached to the skeleton. The next step is to adjust how the bones influence the mesh.

Skinning

Motion Studio gives you complete control over the effect each bone has on each and every vertex of the mesh. This is accomplished using the built-in Vertex Painter tool. But before we cover the Painter, let's look at one of the other ways we can adjust the vertice weight
NOTE: I know "vertex" = 1 and "vertices" = more than 1 vertex but I may still use the two interchangeably.

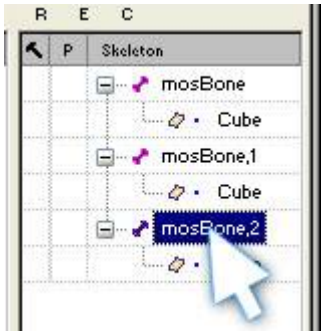
Expand the Skinning section and once open, expand **Adjust**.



basic skinning tools

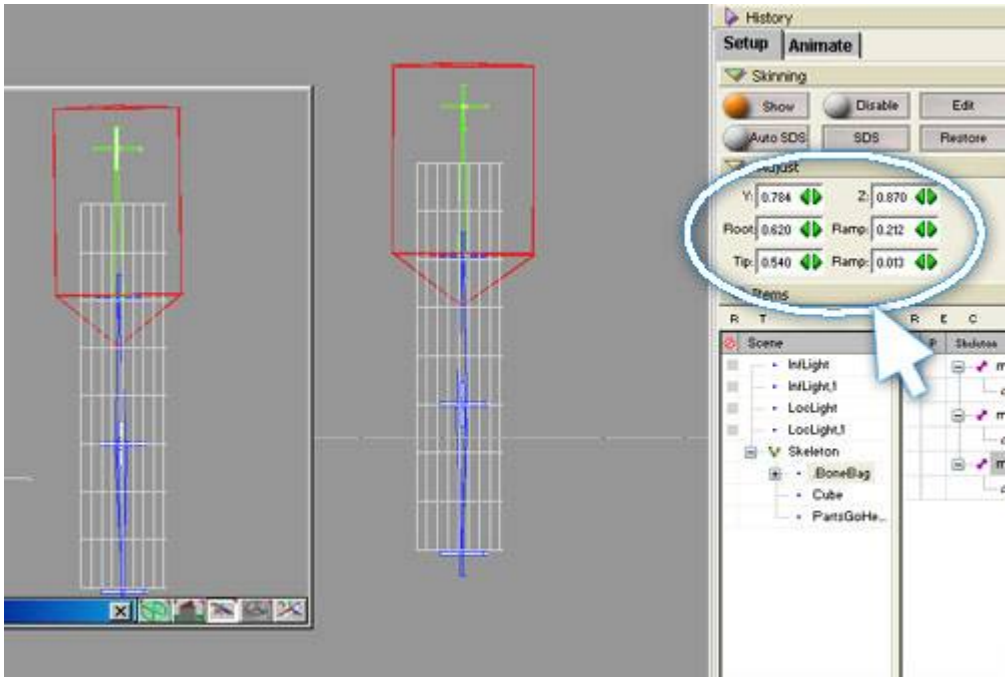
Click **Show**.

Select a single bone from the list (in this case, "mosBone,2").

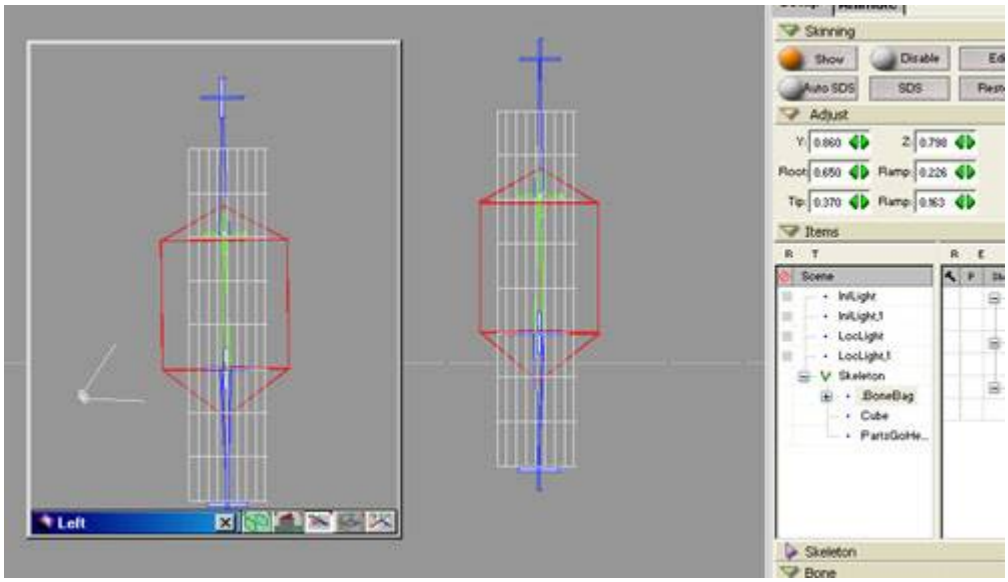


Start fiddling with the parameters in the **Adjust** section.
***Y**: Change size in Y direction **Z**: Change size in Z direction*
***Root**: Changes Root Location*
***Tip**: Changes Tip Location*
***Ramp**: Adjusts blend from Root or Tip into next bone.*

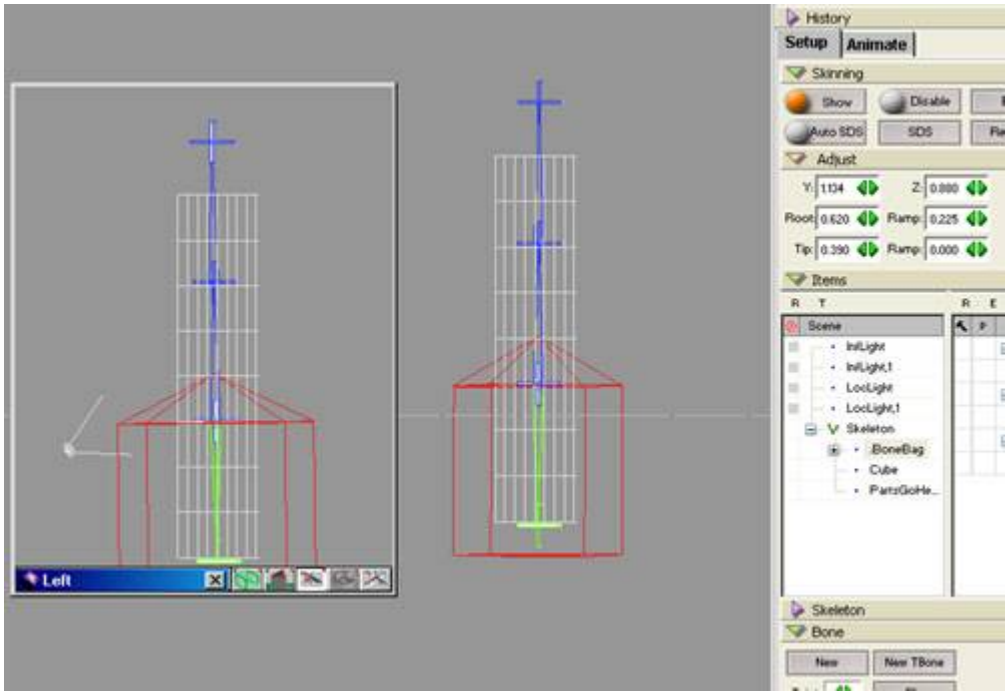
Adjust these settings until you have something close to the following:



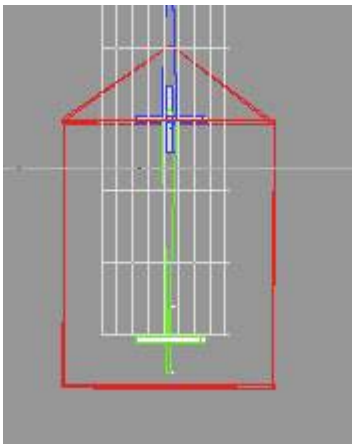
Next, select the middle bone from the list and adjust it's skinninglike so:



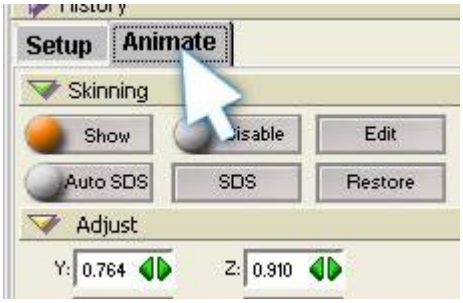
Finally, adjust the last bone's skinning.



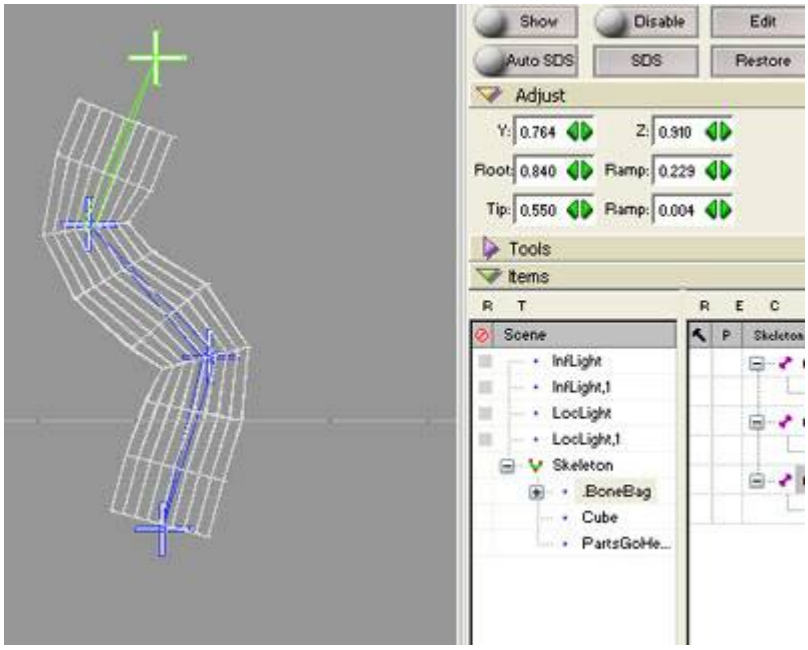
If your red box thing is rotated a bit, simply adjust the Bone -> Twist parameter until it is straight.



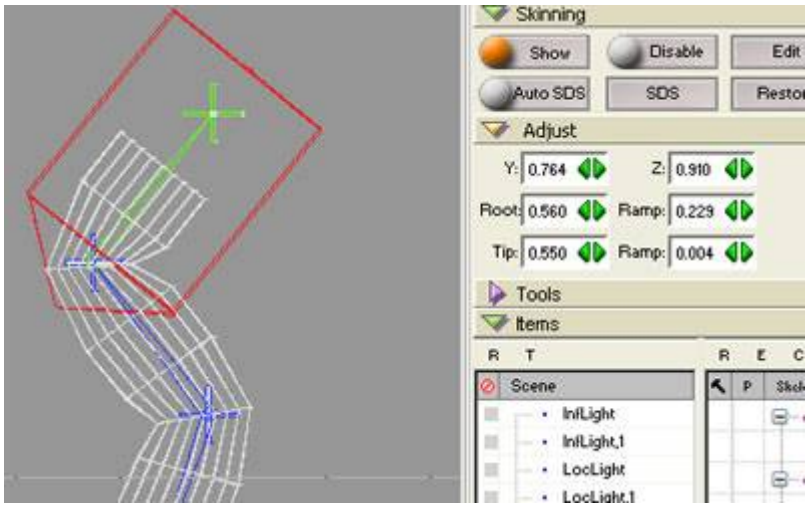
At this point, we should test the deformation of the object. Click the **Animate** tab.



Select the joints and move them around, paying attention to how the mesh bends.
NOTE: I have clicked the Show button in the Skinning section to turn off the skinning object display.



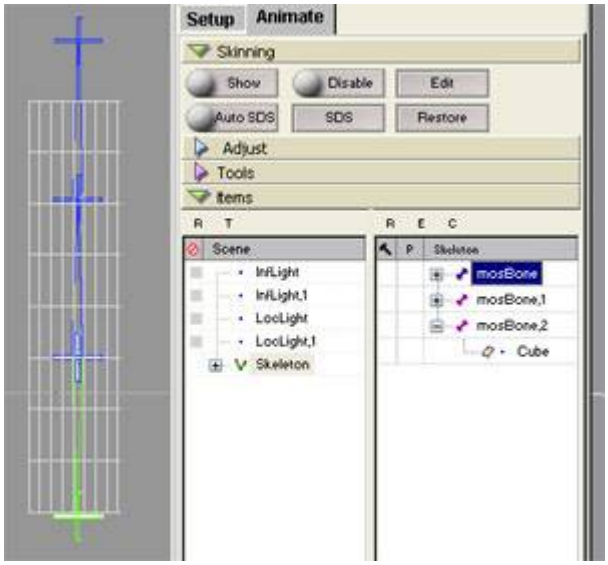
One neat thing about skinning in MotionStudio is the fact that you can adjust the parameters while the skeleton is in different poses, to see exactly how the skinning effects it. Once you are done and you want to return the object to its default/rest/normal pose - just change the keyframe (drag the keyframe scrubber, for instance).



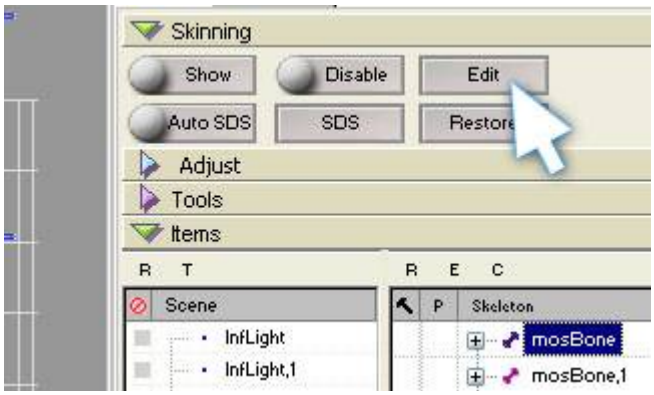
Vertex Painter

Be sure the **Skinning** panel is expanded. (NOTE: This can be done within either the Setup or Animate tab.

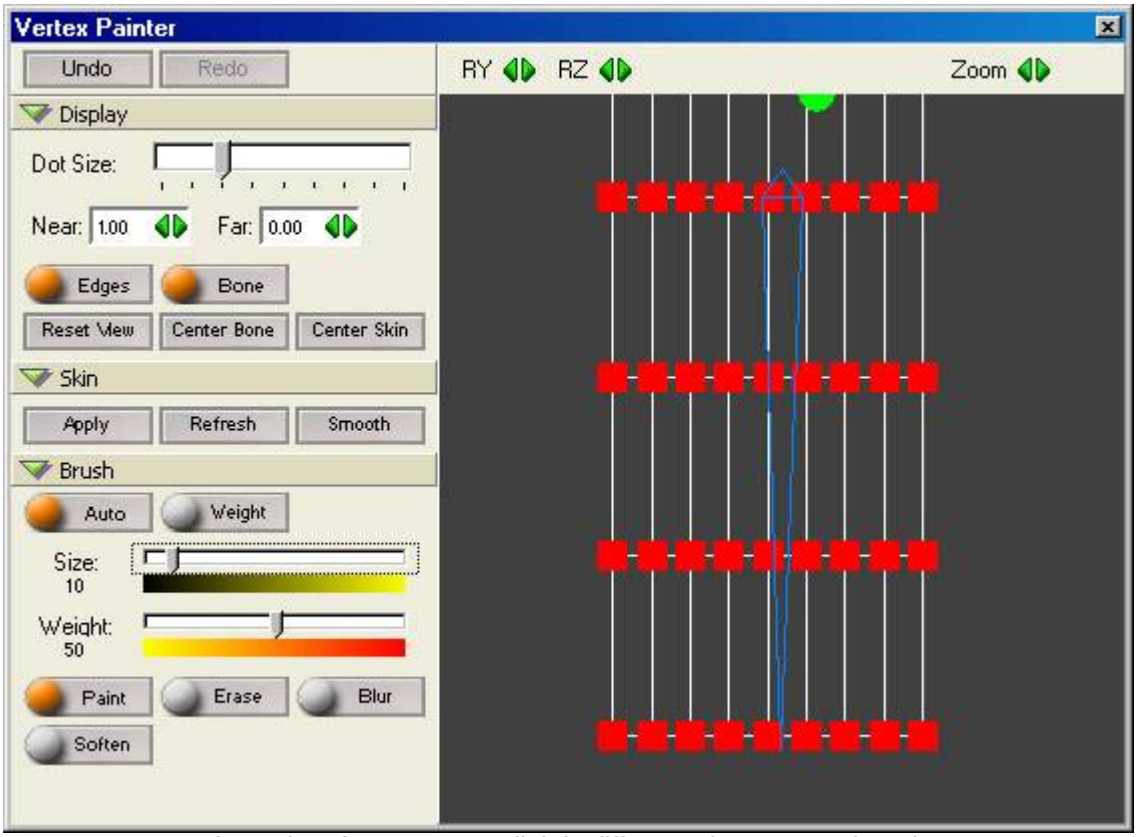
Select a bone (from the list or by directly clicking the object itself)



Click the **Edit** button.

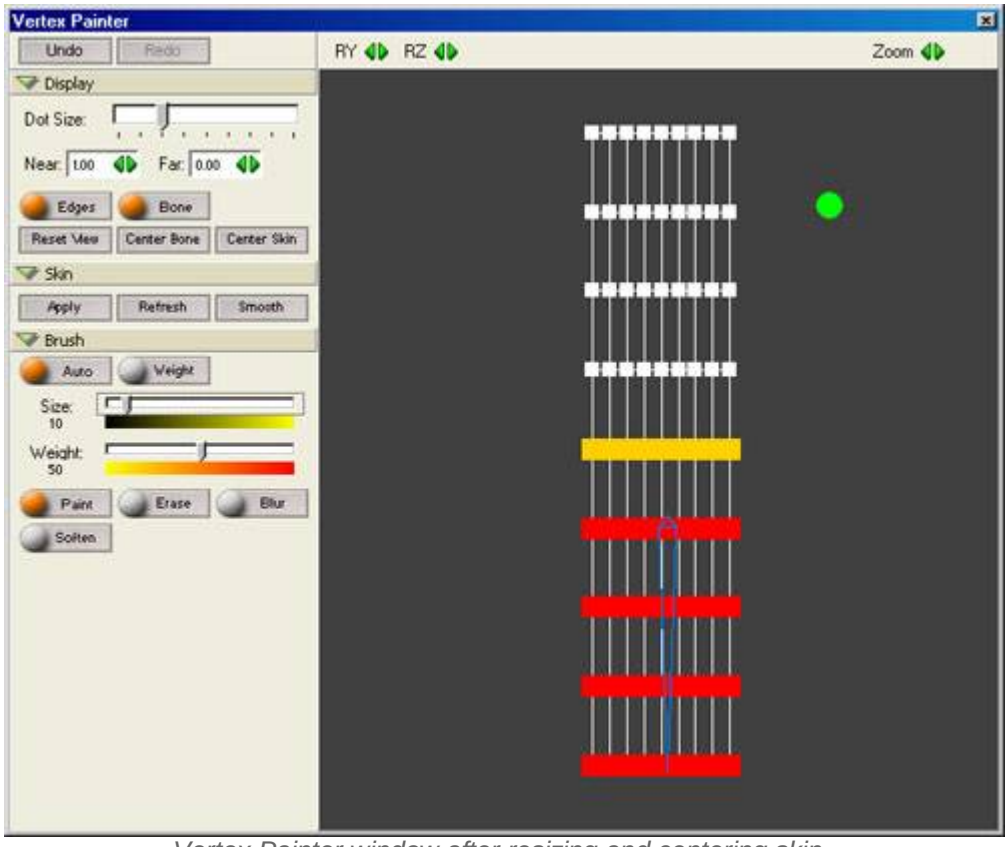


The Vertex Painter will load, and you should see something similar to this:



If your interface appears slightly different, don't worry about it.

The first thing I usually do after loading the Vertex Painter is expand the window by dragging the bottom-right corner, and click the **Center Skin** button.



Vertex Painter window after resizing and centering skin.

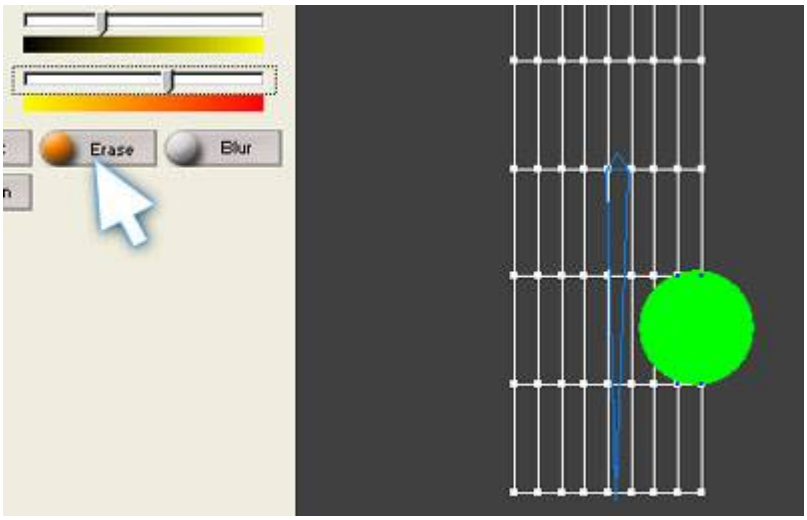
Brief explanation of settings / functions:

RY - Rotates view along Y axis
RZ - Rotates view along Z axis
Zoom - Zooms in/out
Dot Size - Changes the display size of the vertices
Near / Far: Changes vertice display based on distance
Edges - Toggles display of edges(lines)
Bone - Toggles display of bone object
Reset View - Resets to default view
Center Bone - Zooms mesh so that selected bone is centered & takes up most of view
Center Skin - Zooms mesh so that all of mesh is in view
Auto - If enabled, Motion Studio updates the mesh object within trueSpace as it is being painted
Weight - If enabled, only vertices with existing weights will be affected (ie. white vertices will not be painted)
Size - Changes the size of the brush
Weight - Changes the weight of the brush (yellow is 'light' while red is 'heavy')
Paint - Paints the vertices with weight
Erase - Removes weight from the vertices
Blur - Blends weight based on weight of neighboring vertices
Soften -'Lightens' vertice weight

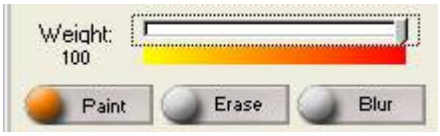
To **pan the view**, hold the right mouse button and drag.
If you have a mousewheel, this can control the **Zoom**.

Go ahead and change your brush size. Notice that the green, circular cursor in the window is your brush, and reflects the size.

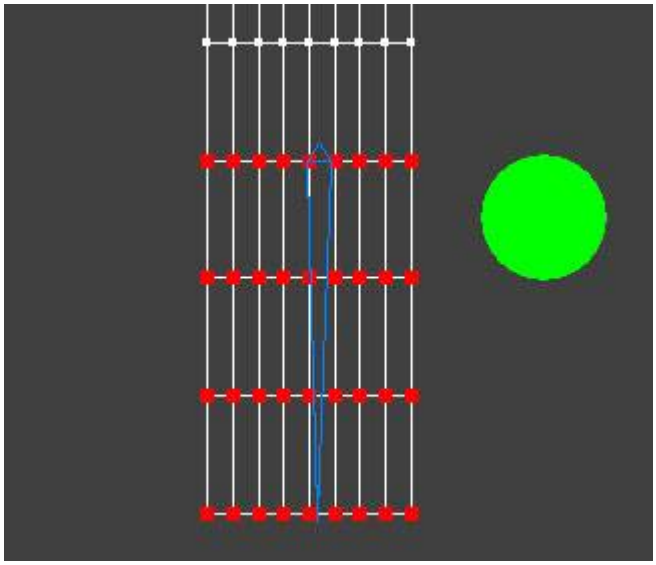
Click **Erase** and, using the left mouse button, drag over the painted vertices to erase their weights.



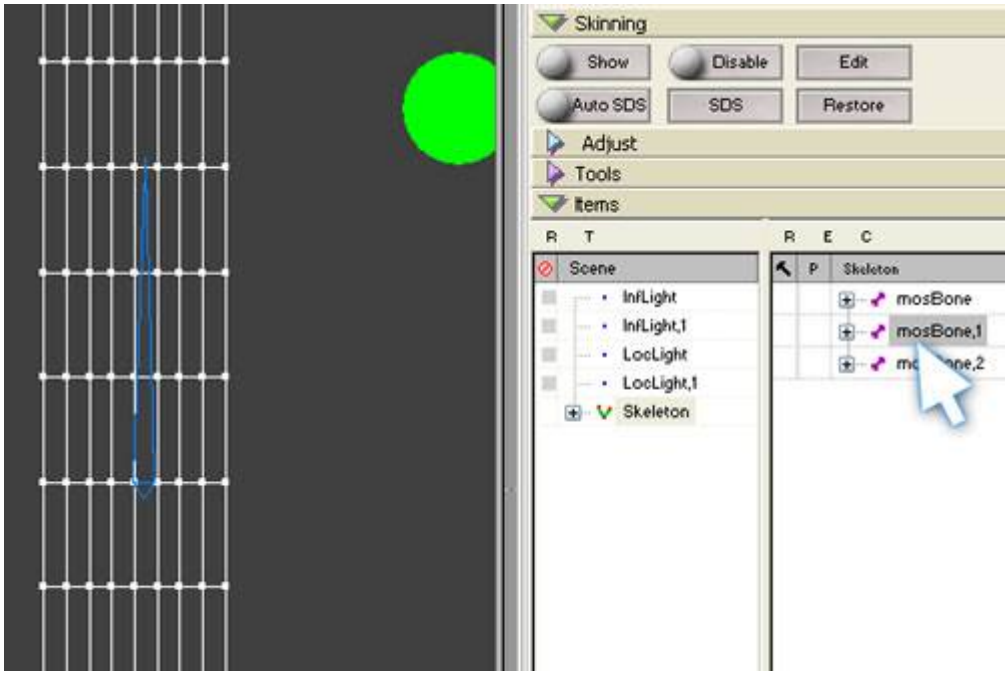
Now drag the **Weight** slider until it is on the right(red) side and click **Paint**.



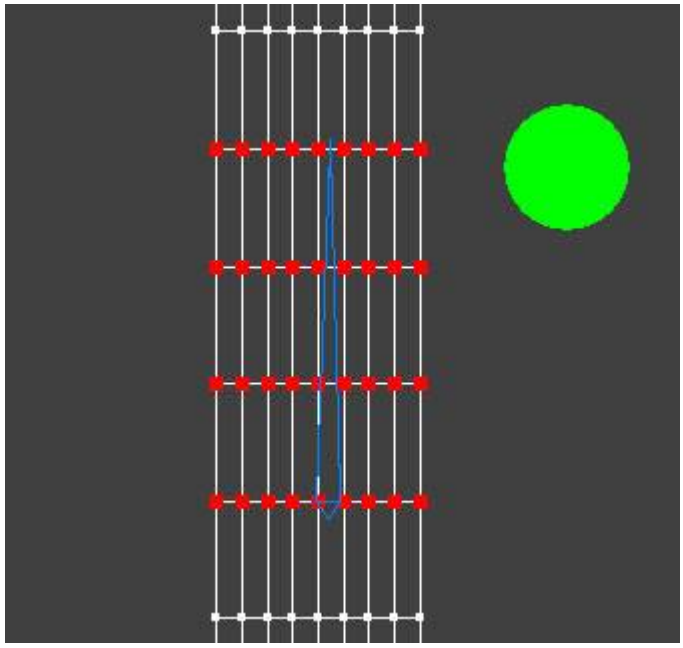
Paint the vertices surrounding the selected bone.



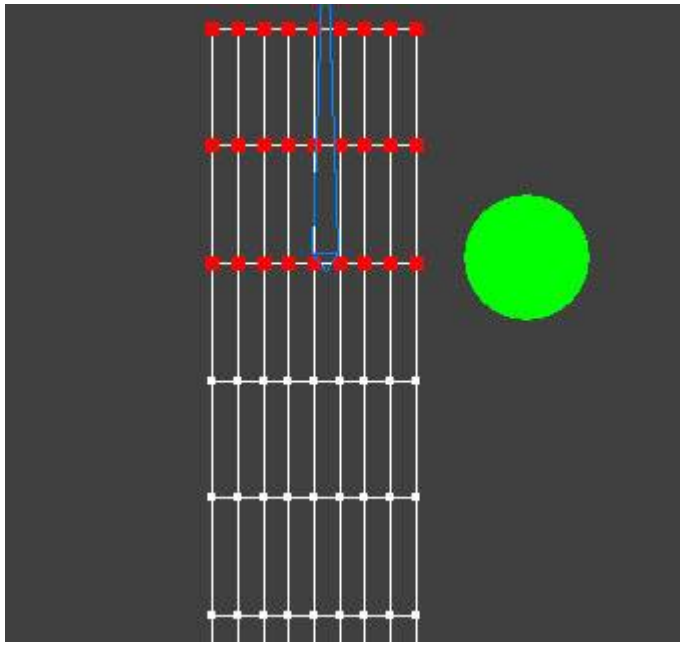
Now move to the next bone. To do this, simply select it from the list (you may keep the Vertex Painter open)



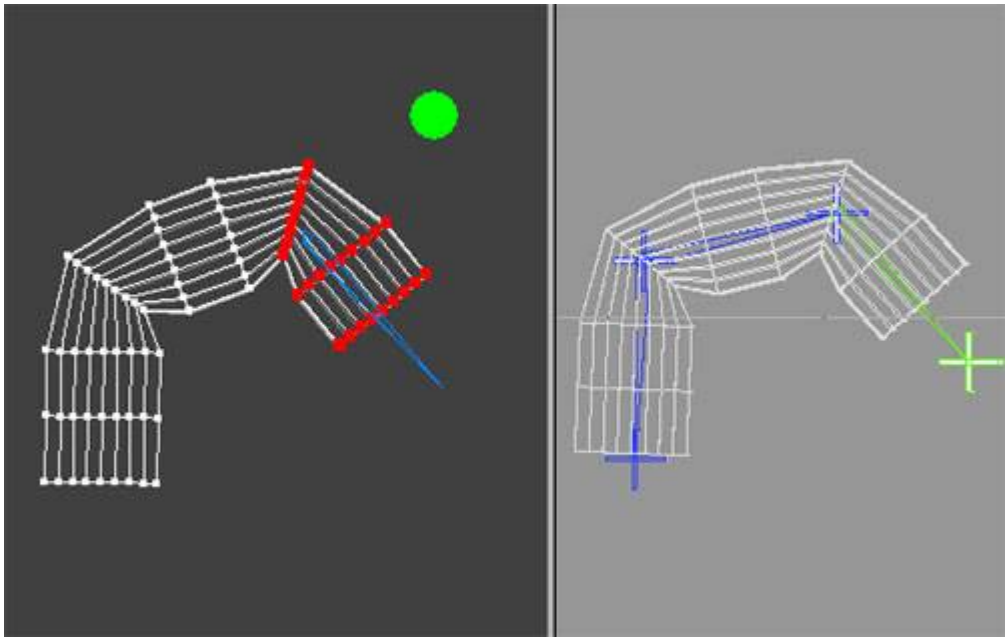
Paint the vertices surrounding this bone, as you did with the previous one.



Select the third bone and repeat the process.

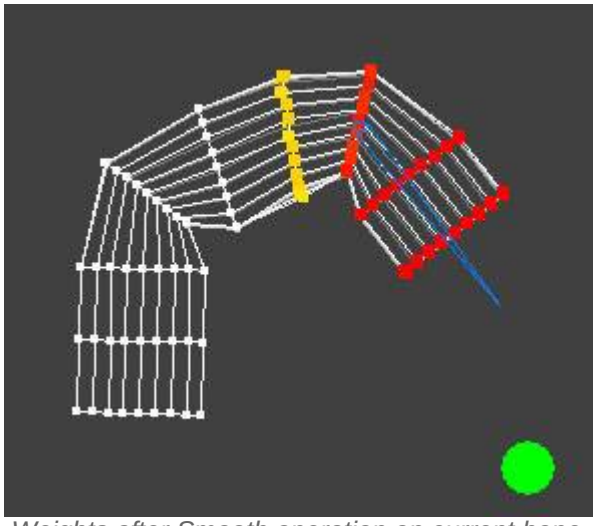


Move the Vertex Painter window to the side so that your object is visible. Drag a bone on your object and move it to see how the mesh deforms. **NOTE: To update the mesh in the Vertex Painter, simply right-click.**



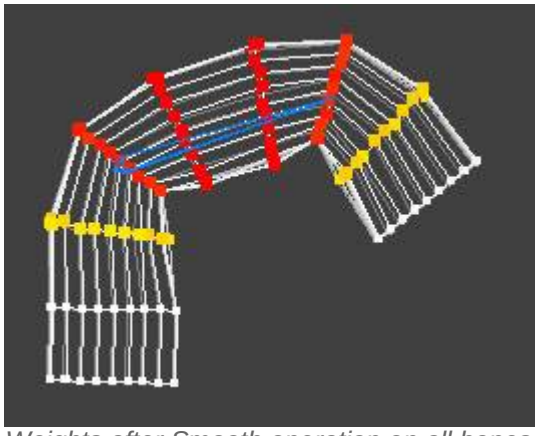
I will sometimes leave the object in a pose while adjusting the weights. This gives an immediate idea of how the mesh will behave.

At this point you may begin with the fine adjustments of the vertex weights. To get smoother blending at the joints select a softer weight and start painting the neighboring vertices, or simply use the **Smooth** function.



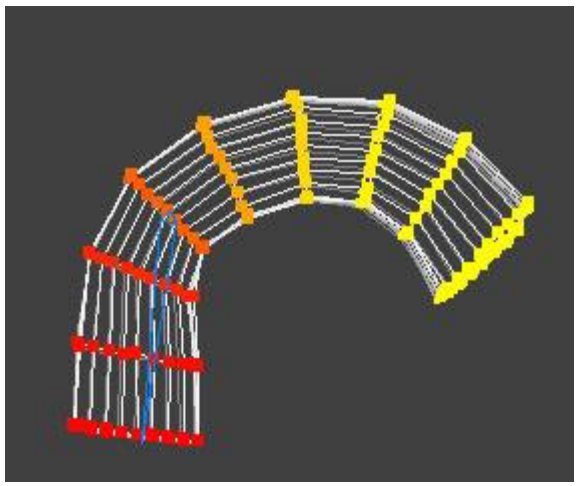
Weights after Smooth operation on current bone

Repeat the smoothing for each bone, if you like. Remember, you don't have to close the Vertex Painter window. Simply select a bone from the list or by clicking it directly within trueSpace.



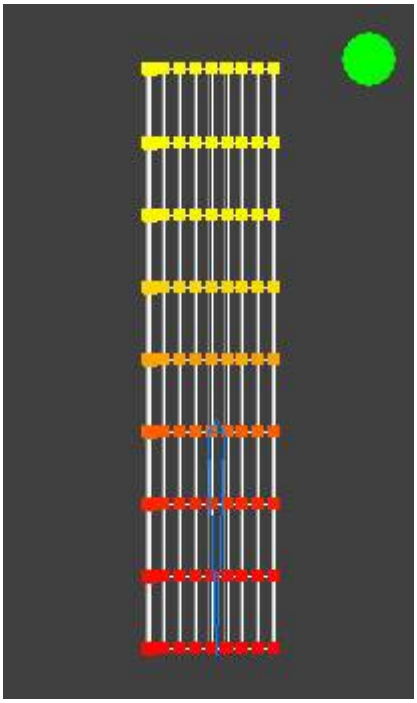
Weights after Smooth operation on all bones

It's easy to get carried away with the Smooth button. This is fine if you are animating a noodle, but for most cases you will only need to smooth the immediately-neighboring vertices. (ie. for human legs, arms, etc...)



Weights after several Smooth operation on all bones

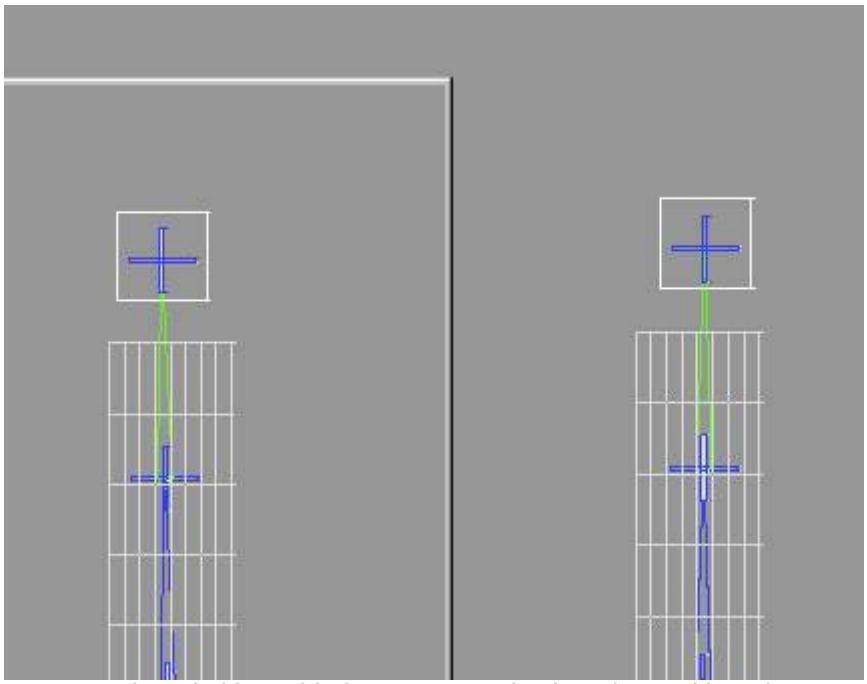
To reset your skeleton to the default / rest position simply change the animation time. You can do this by dragging the frame scrubber in trueSpace, or the one in MotionStudio.



Attaching Objects

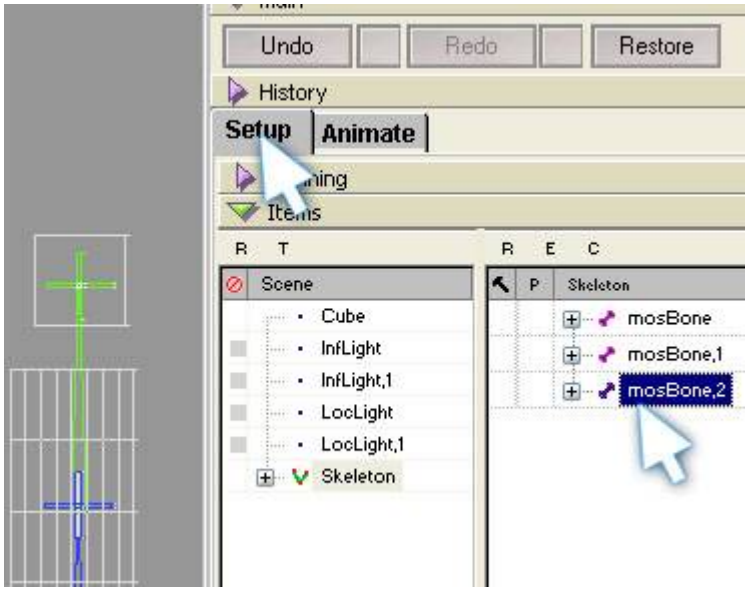
Attaching objects to Motion Studio bones is very easy. For this example, go ahead and load a cube primitive  .

Scale the cube and position it (again, using two views is helpful here) like so:

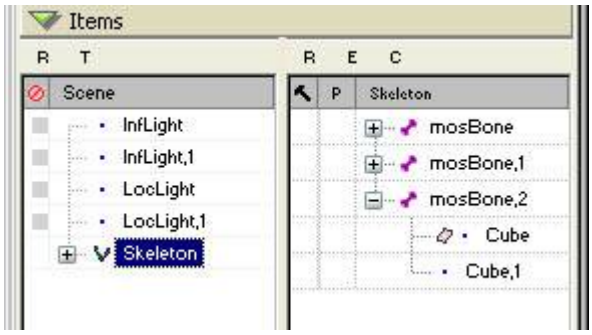


Cube primitive added to scene, resized, and repositioned

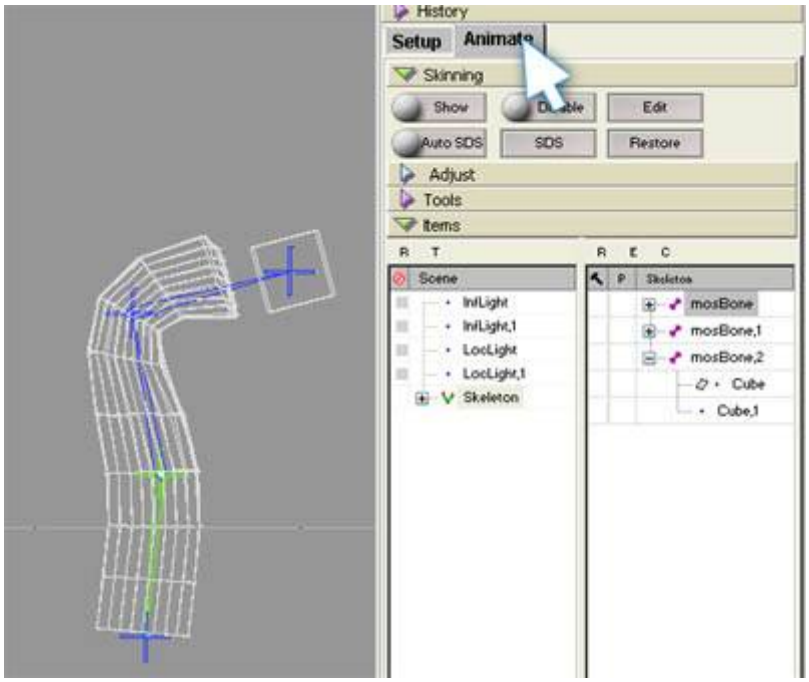
First, be sure you are in **Setup**, then select the bone that is nearest the cube primitive.



Drag the cube primitive to the selected bone.



The cube primitive should now appear underneath the skinned cube. To see how the object moves with the bone, click back into the **Animate** tab, grab the bone, and move it around.

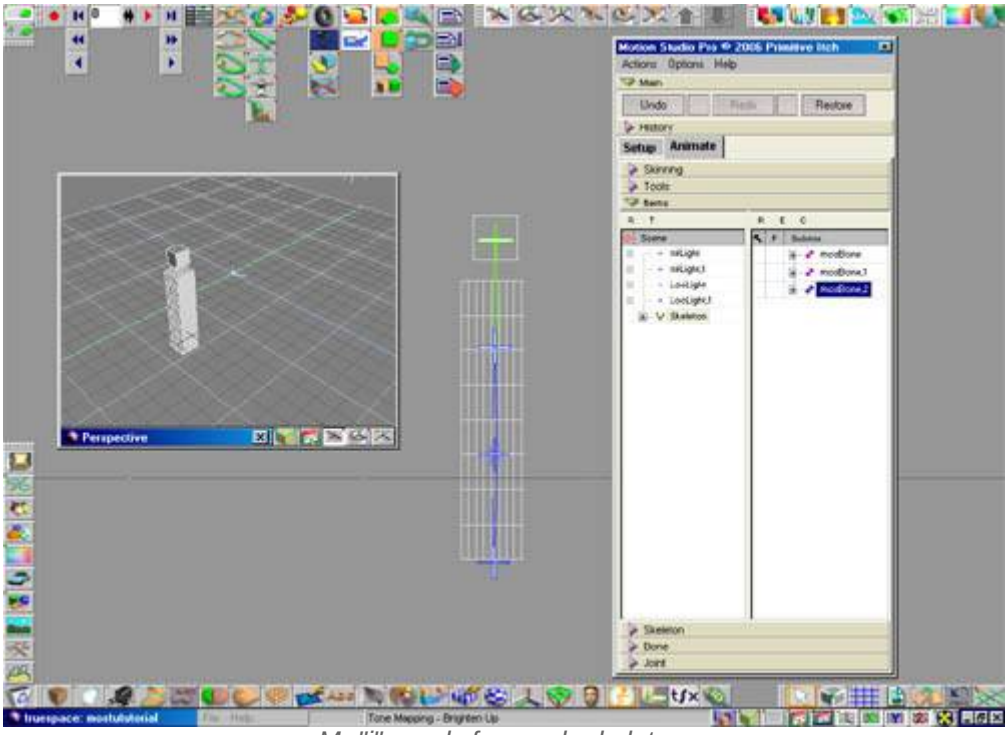


Now I should reveal my plan to you. This whole time you have been working toward building a lowercase letter "i" character. Ok, that was not my plan but if you wanted, this would make a good character!

Attaching Sub-Skeletons

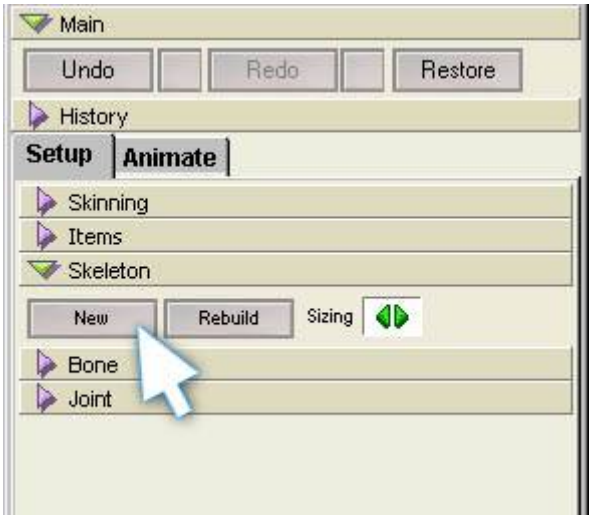
Attaching sub-skeletons in Motion Studio is about as simple as attaching regular objects.

In this example, I will be using the same object from the previous parts of the tutorial. If you have not saved this scene, you can download it here.

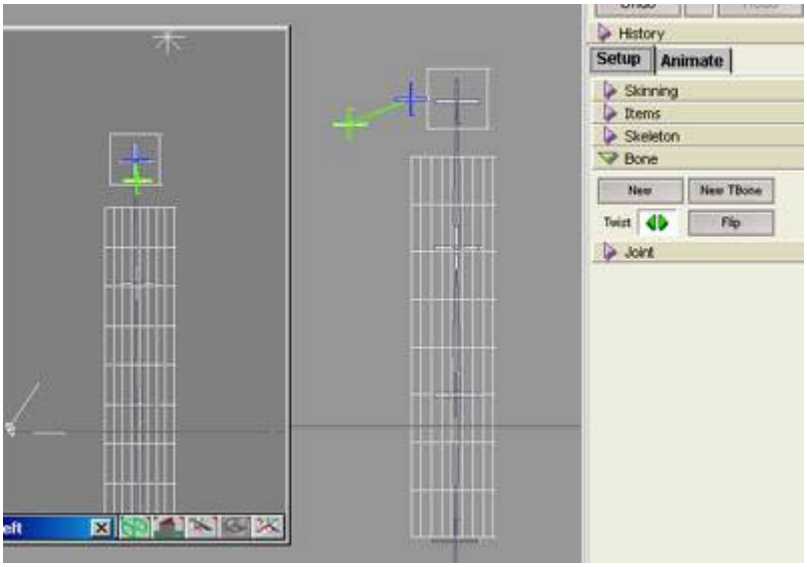


Mr "i", ready for a sub-skeleton

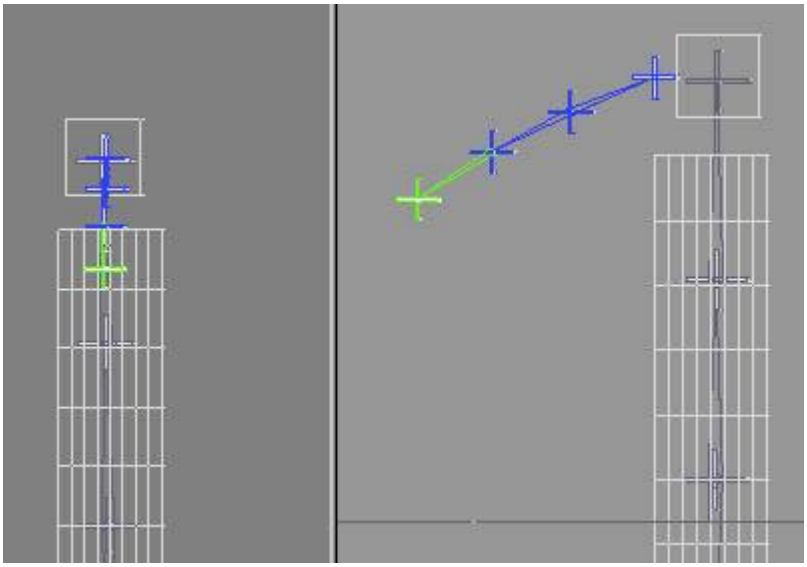
We want to build a new skeleton, so go ahead and click on the **Setup** tab. Next, click **New** from the **Skeleton** menu.



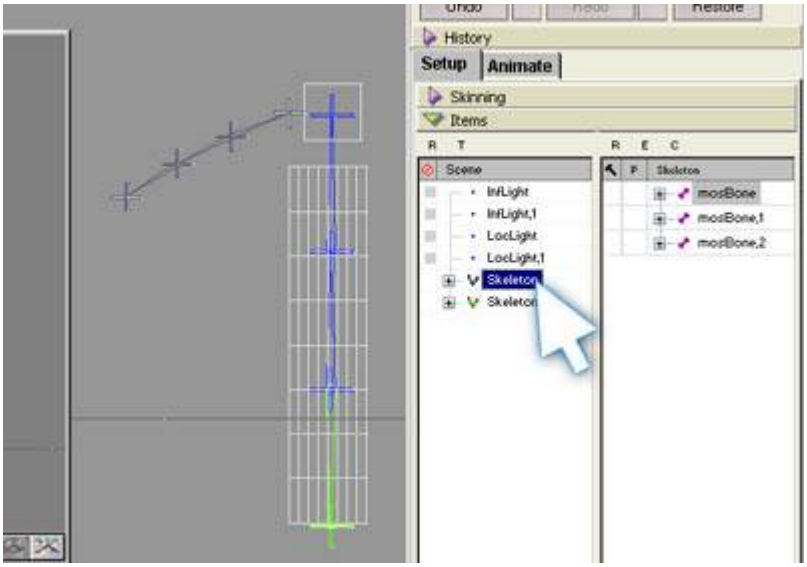
Position the new skeleton until it resembles the following image. ***TIP****: Collapse the Skeleton menu to keep from accidentally clicking New skeleton instead of a New bone in later steps.*



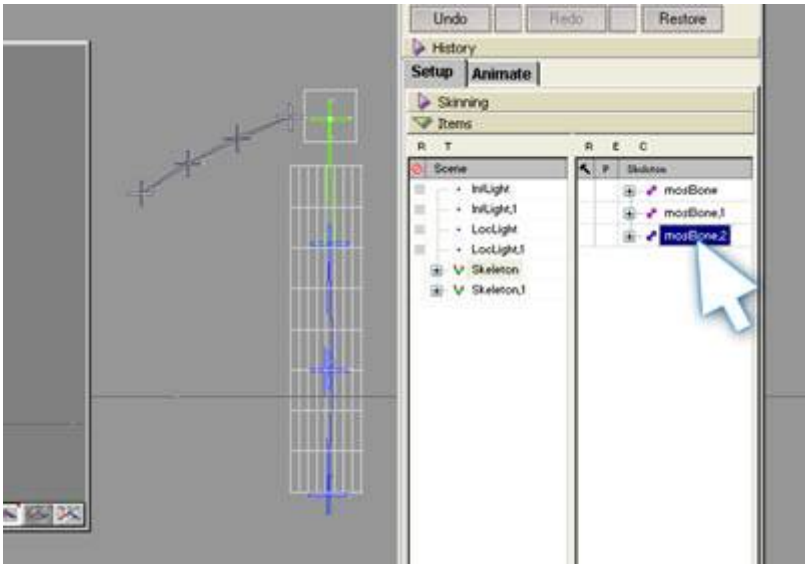
Add a couple more bones by clicking the **New** button in the **Bone** menu.



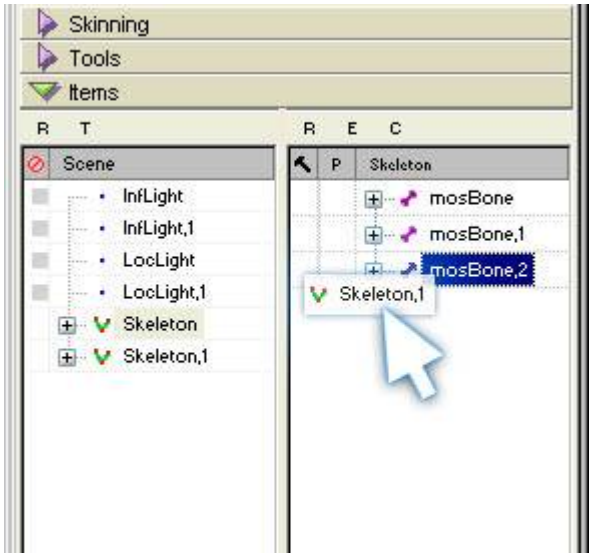
Next we will attach the new skeleton to the existing one.
From the **Items** menu, select the first skeleton. You should see the bones list update to the right.



Next, select the bone you want to attach the sub-skeleton to.



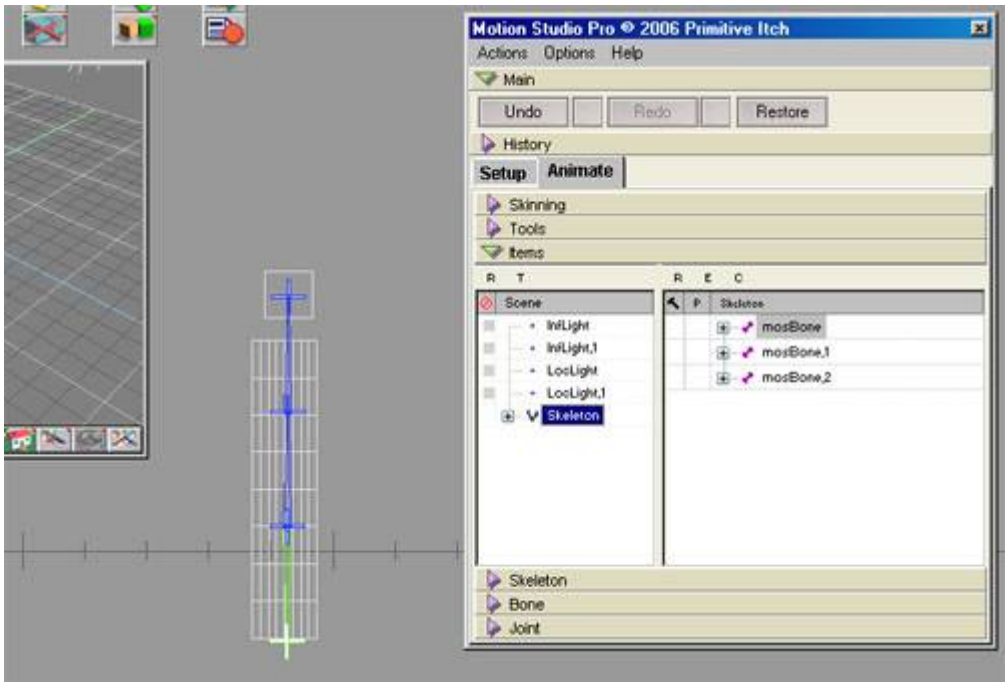
Click and drag the new skeleton to the highlighted bone in the first skeleton list. *It is important that you do not click the new skeleton and release, as this will update the bone list to the right.*



Now you have a subskeleton attached to your main skeleton. In this case it's a ponytail for Mr. Lowercase "i". Notice I didn't actually build a mesh object to use with the new skeleton. This can be done later.

Dope Sheet

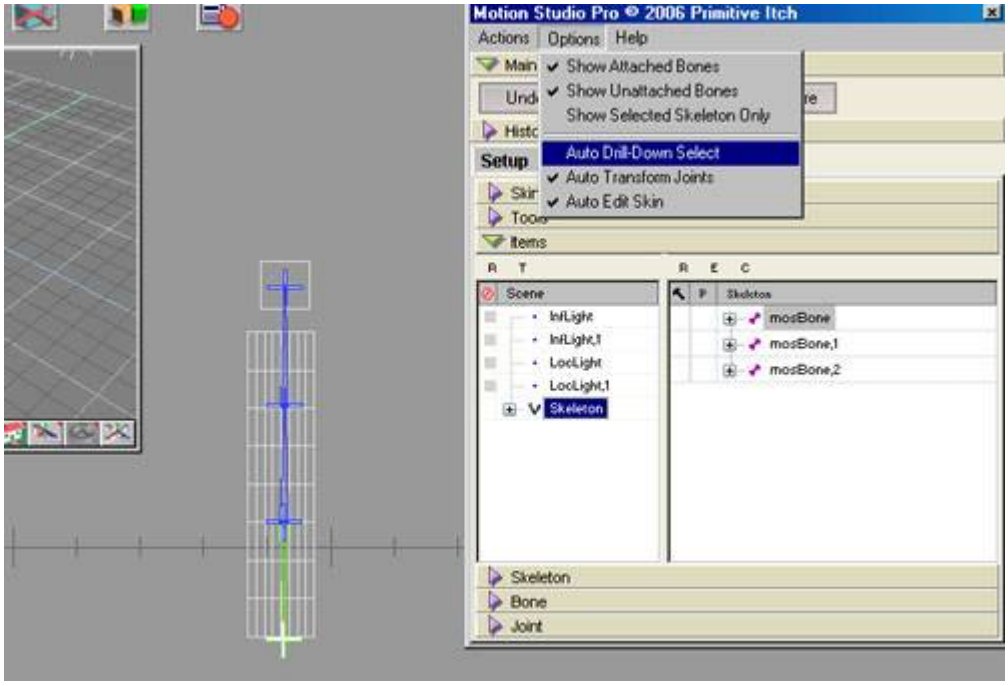
For this example, we will stick with our "Mr. Lowercase - I" character. If you need this scene, download it **here**.



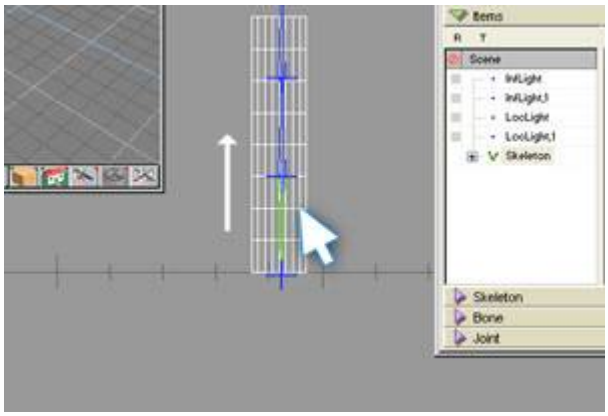
Mr. Lowercase - I, ready to be animated

The first thing we want to do is position the character so that his leg (poor guy) is on the grid line. Starting out this way gives us a guide for the rest of the animation, so we know where the "ground" is located.

If you click on the character now, you may notice that it automatically (depending on your settings) selects a bone. First, you must disable **Auto Drill-Down Select** in the **Options** menu.

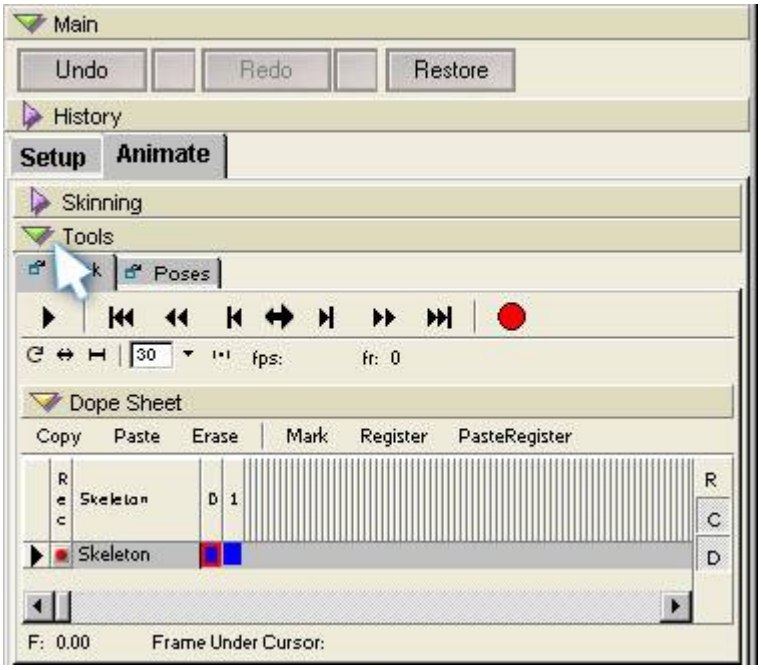


Once you have done that, select the character *(easy to just click "Skeleton" in the **Items** list)* and position him as shown below.

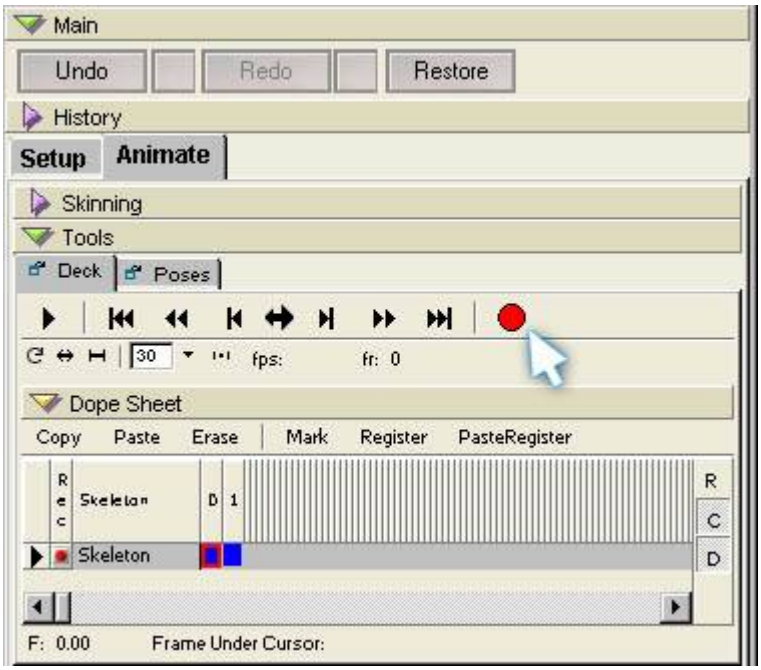


Now is a good time to point out a caveat of animating with Motion Studio. Any time you make a change to the character, and you want to keep that change, you have to click record in the dope sheet. (Motion Studio disables trueSpace's Auto Keyframe Recording. So, for instance, if you were to change the frame now the character would pop back down below the gridline.)

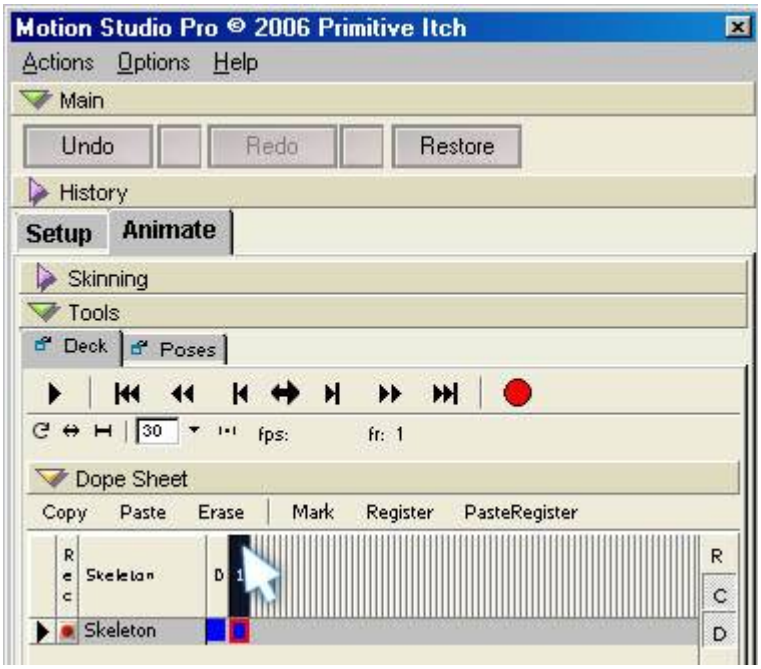
Go ahead and expand the **Tools** section.



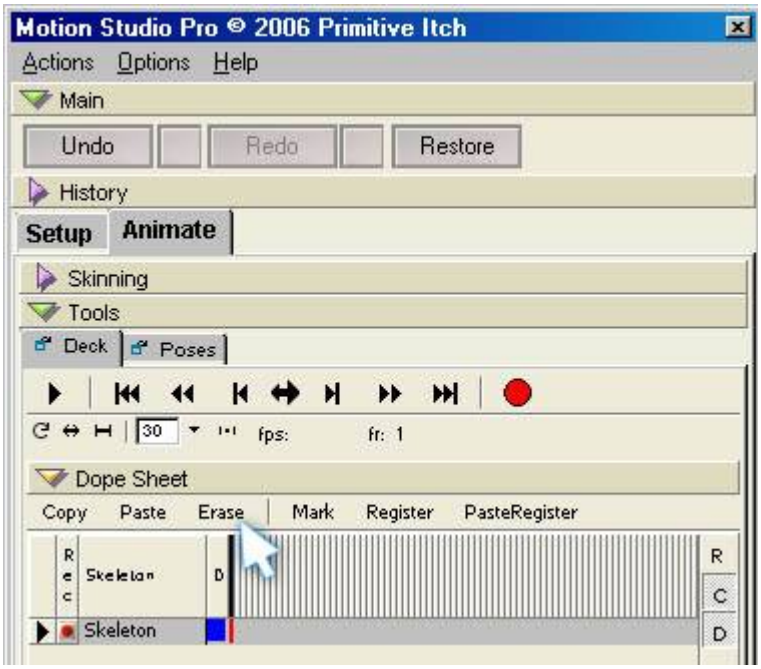
...and click the record button (red dot)



You'll notice there appear to be two keyframes in the Dope Sheet. Since you have recorded on frame 0, you may erase frame 1. To do this, simply select frame 1:

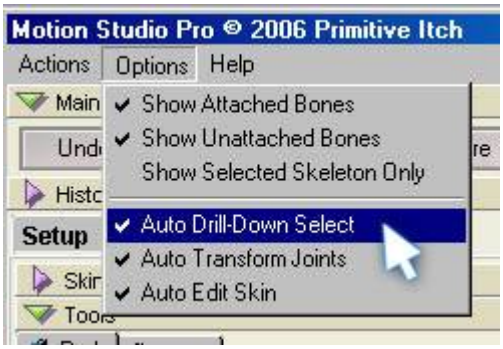


...and then click **Erase**.

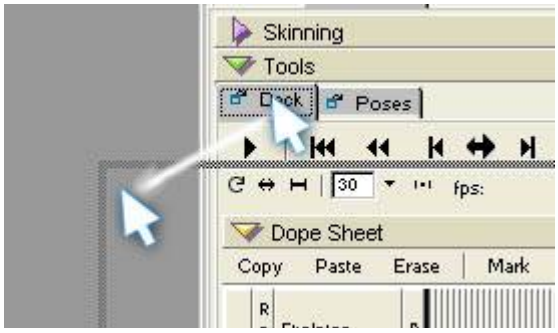


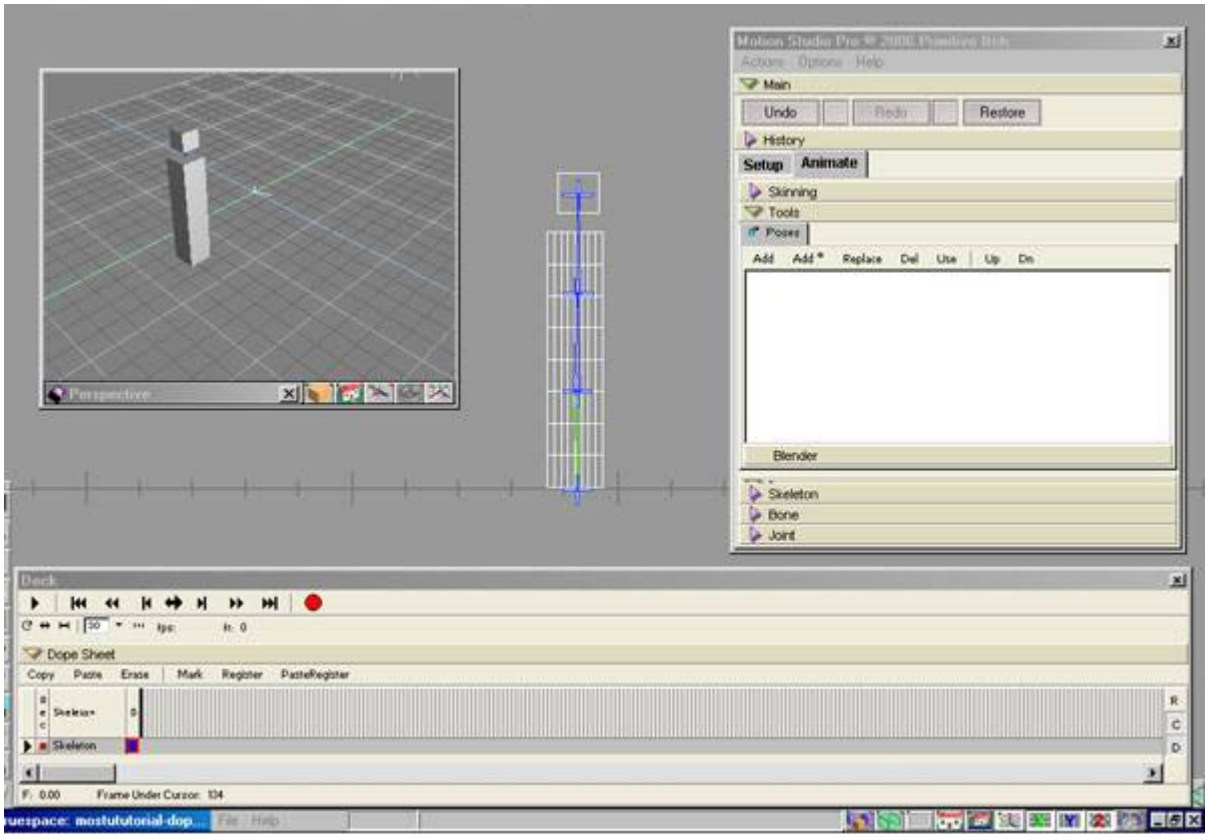
I will point out that some may prefer to instead ignor frame 0 and start recording on frame 1. Either way seems to work.

Now we are nearly ready to start making this guy move. But before starting, we need to set up a couple of things. Go ahead and re-enable **Auto Drill-Down Select**:



Also (and this is optional) go ahead and get the Dope Sheet positioned in a way that will make animating easier.



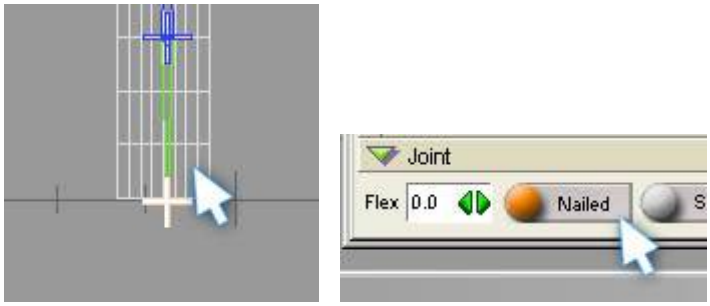


Here is how I typically configure my Dope Sheet - yours may vary.

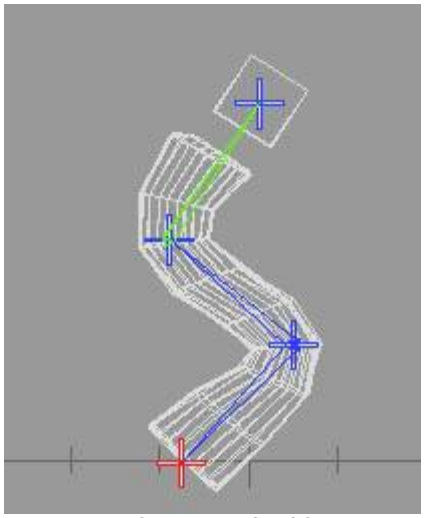
Alright, on with the animation part! To keep this tutorial simple, we'll be animating a simple hop.

Go ahead and select the very bottom joint. Next, expand the **Joint** section and click **Nailed**.

(NOTE: in Motion Studio, you actually select and move the joints. Bones just basically sit between the joints as connectors and are not actually acted on directly)

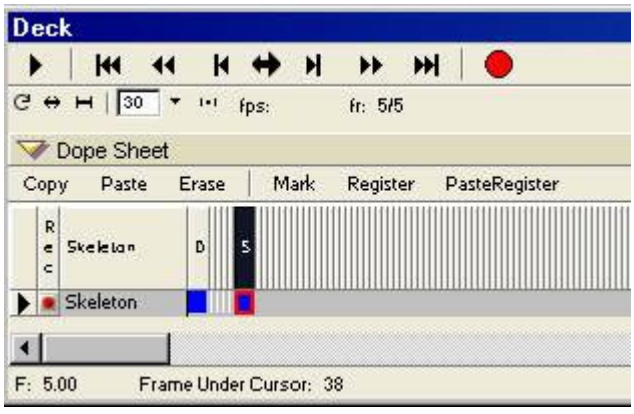


Pose the character so that he's crouching / bent, ready to spring...

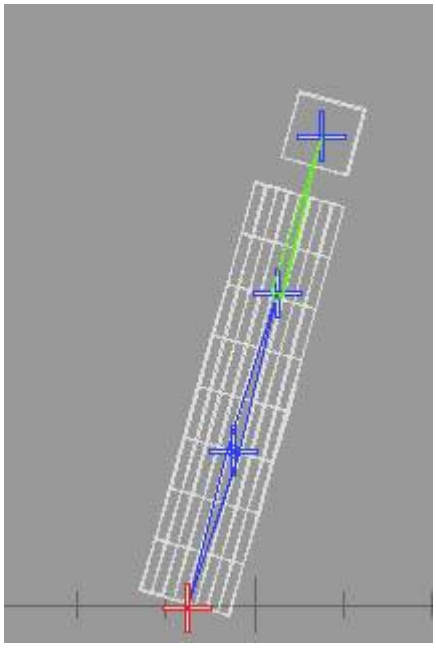


You'll notice how part of the character penetrates the ground. This can easily be prevented with a "foot" bone that would bend such that the bottom part of the mesh stays flat against the grid.

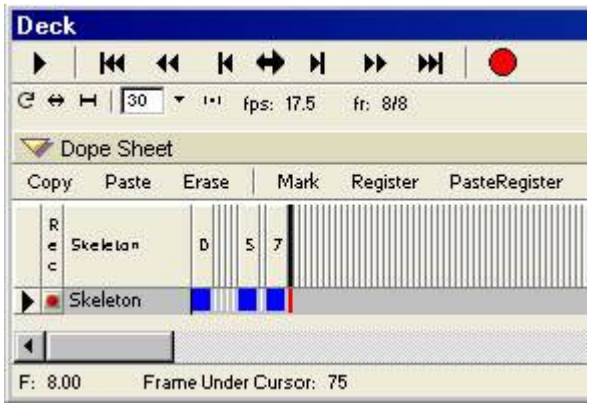
Using the **Next Frame** button in the Dope Sheet, move forward 5 frames and click **Record**.



Pose the character so that he's at the tip of the jump, just before the feet...er..foot leaves the ground.

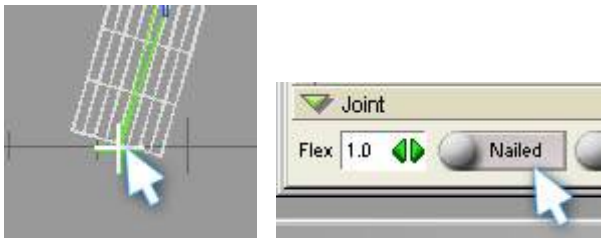


Using the **Next Frame** button in the Dope Sheet, move forward 2 frames and click **Record**.
Your Dope Sheet should now look like the following...



If you want, go ahead and click the **Play** button in the Dope Sheet to see how this looks. It's only 7 frames but it is very important to play, play, and replay the animation as you add keyframes, to see how the entire motion is building.

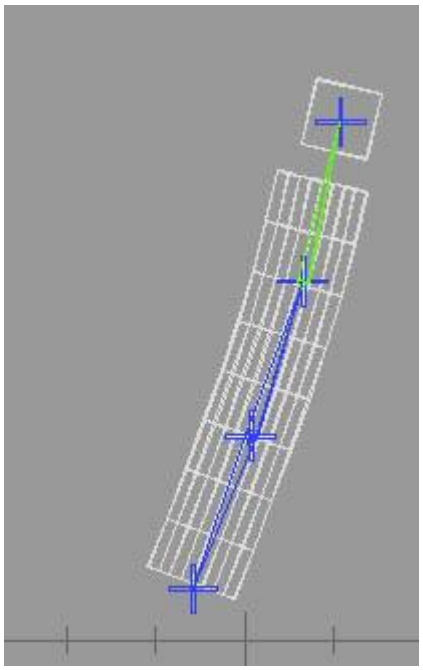
In the next frame, the character's feet will leave the ground. Select the bottom / foot joint and again click the **Nailed** button in the **Joints** section.

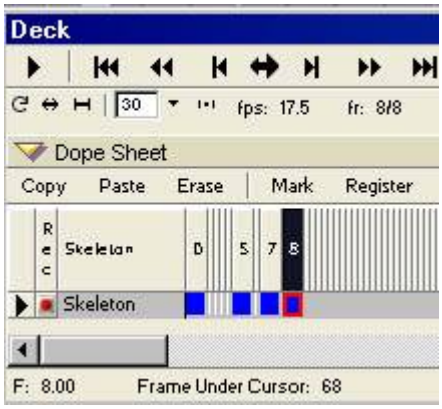


Now you want to move the entire character up and away from the grid, making sure he is headed in an upward/forward (to the right) motion.
NOTE: Since this is a simple character, with few joints, you can easily move him by clicking the head joint and dragging the whole works. In a more complicated character, or with a larger move, it would be best to disable Auto

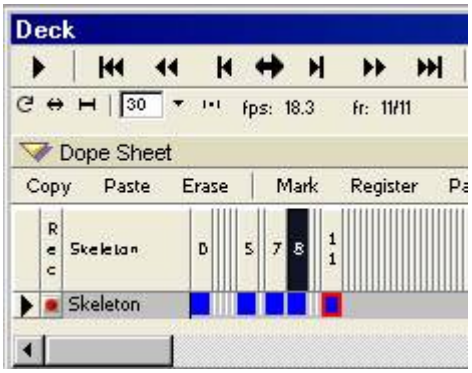
Drill-Down Select and move it all that way.

Here is how mine looks so far:

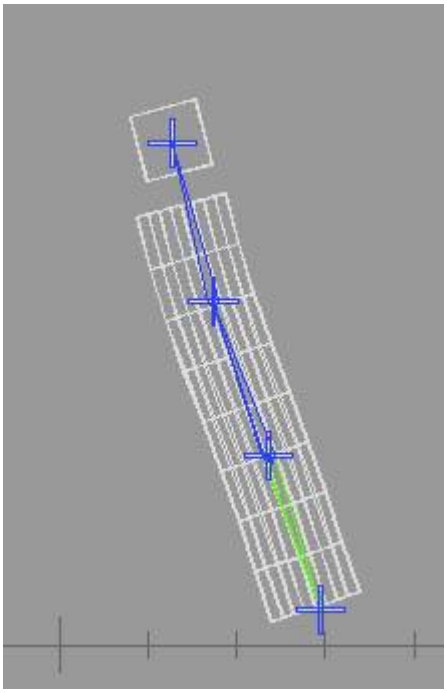


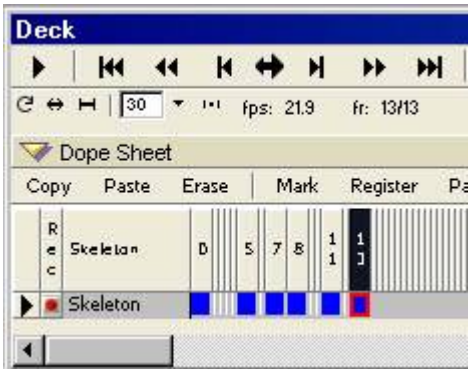


Next we will move the character up up and forward (mostly forward) in a bit of an arc...

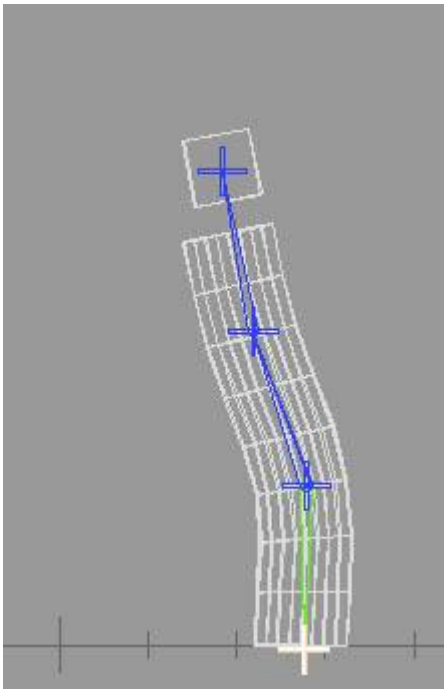


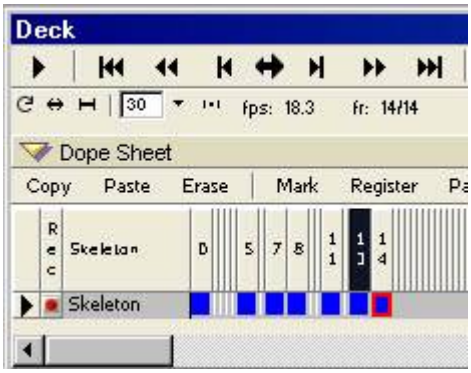
Then a couple more frames forward, just before contacting ground...



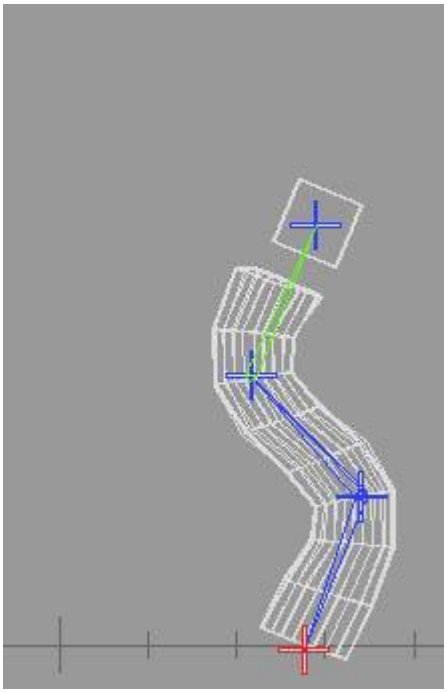


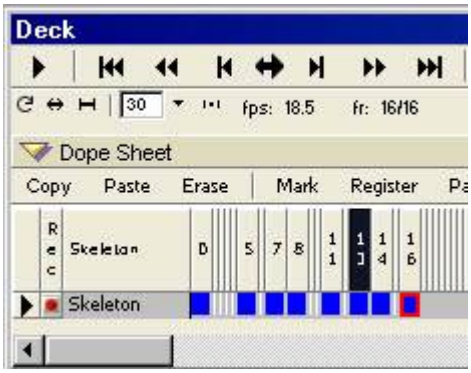
...and a single frame for the actual contact... (on this frame, go ahead and nail the bottom joint)





...and a couple more frames for the character to begin landing recovery...





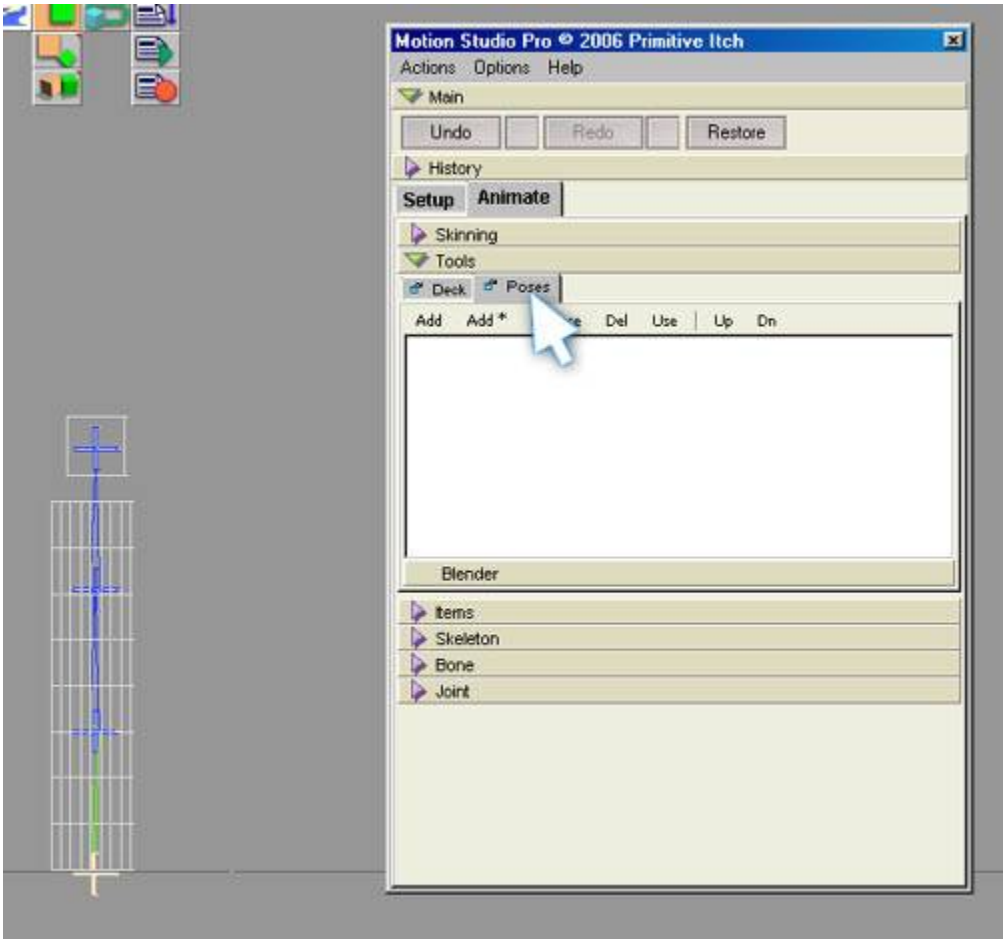
At this point, I would go back and finesse the keyframes, fine-tuning the sequence.

Poses & Pose Blending

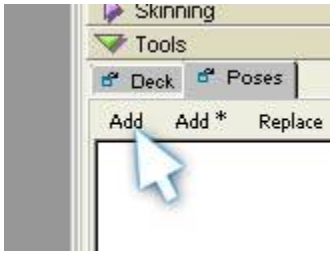
Click the **Poses** tab.

Oh, sorry - forgot the introduction: Poses and Pose Blending are very useful and time-saving features in Motion Studio.

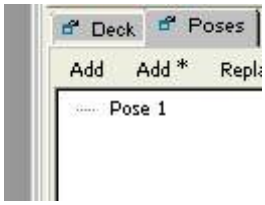
Now, click the **Poses** tab.



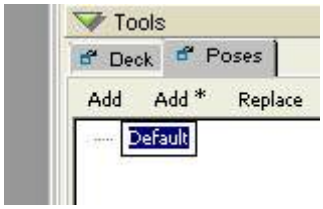
I usually add the default character pose in before adding anything else. In this case, it's Mr. "i" standing very straight. With the character (or part of the character) selected, click **Add**.



You should now have a pose in the list, named "Pose 1" by default.



Select "Pose 1" and press **F2**. Type "Default" and press **Enter**.

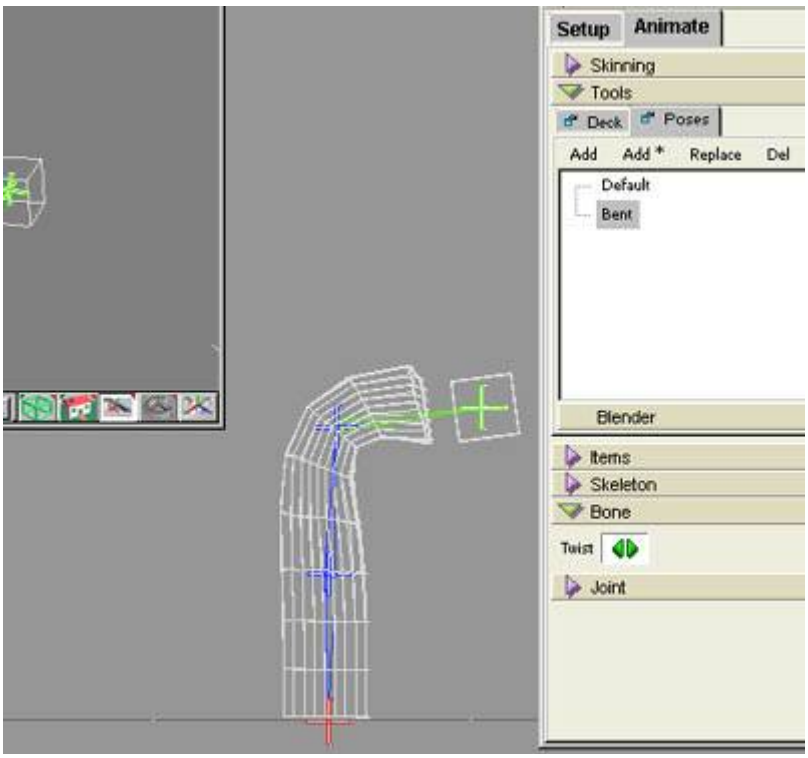


Now we want to make some other poses and start building the pose list.

(NOTE: We are pretty limited in the amount of poses we can get from this character but this should give a general idea of how Poses and Blending work.)

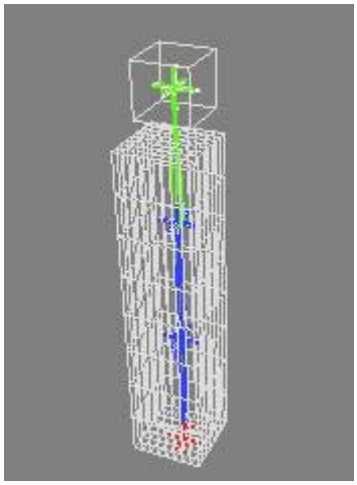
Go ahead and put the character into a pose and once you are satisfied with it, **Add** it to your list and rename it, as described before.

I built a simple Bend pose, as shown:



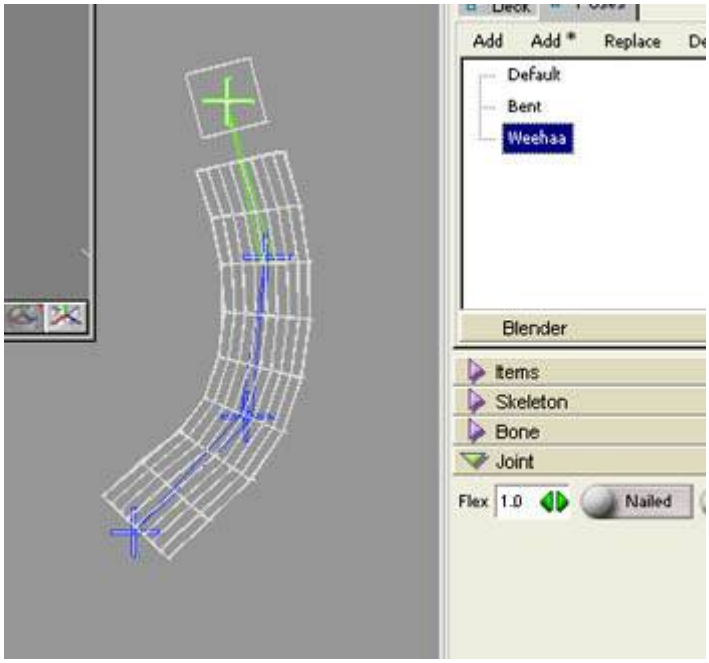
Now we want to add a new pose, but we want to start from the original / Default pose instead of bending the character back into default position. This can be done a couple of different ways. The easiest in this case is to simply **double-click the Default pose**. Mr. "i" should pop right back into the default pose.

(NOTE: Sometimes you may not want to start with the default pose, but would rather modify an existing pose. Any time you want to load a pose from the list, just double-click it.)



Give the character another pose and **Add** it to the list.

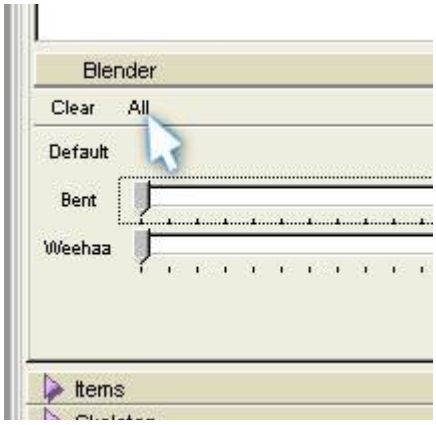
Here is my next pose and list so far:



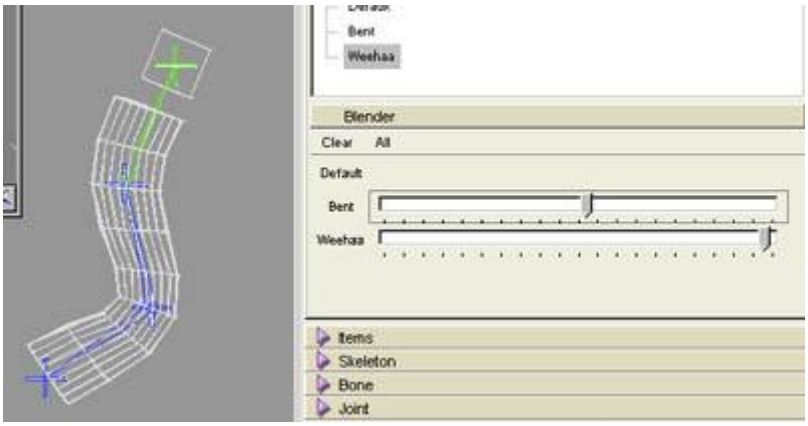
Let's blend these poses together and see what happens.

To access the **Blender**, click the INVISIBLE triangle to the left of the Blender text.

Click **All** to have all the poses added to the Blender.



Now drag the sliders around and you should get a mix of both poses.



From here you can keyframe this pose or add it as a new pose in the list.

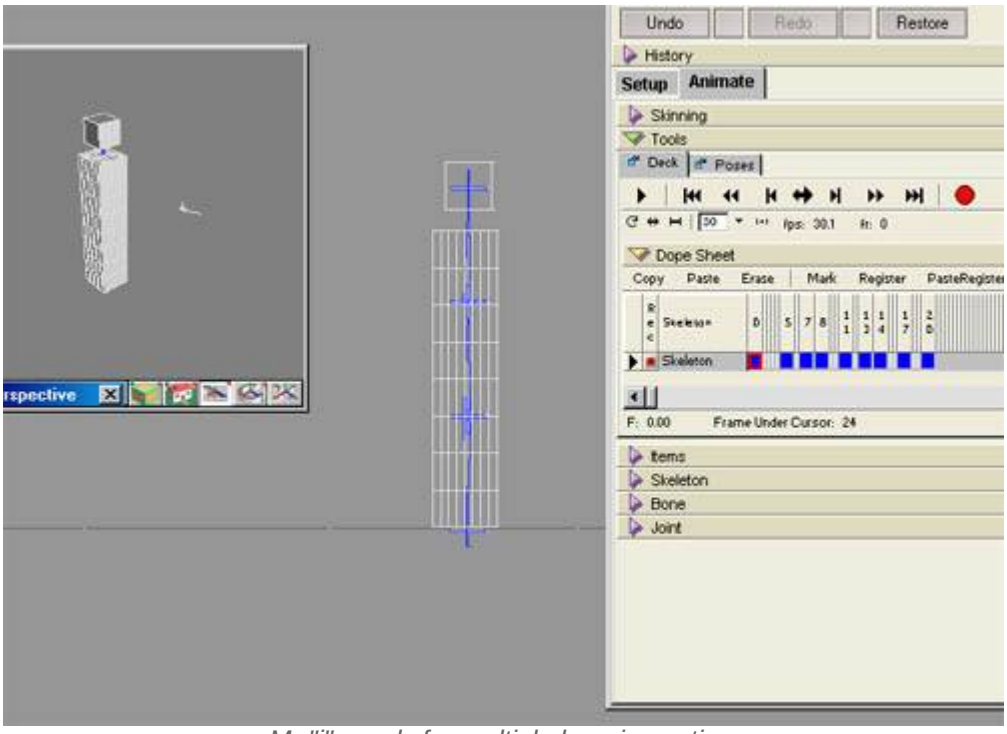
Additional notes:

- **Add *** is for adding 'Batch Poses' that save not only the pose for your selected skeleton but also all sub skeletons attached to that skeleton.
- If you want to change a pose, double-click it (if not already active), change it, and click **Replace**
- The Blender uses the first pose in the list as the Default pose. Keep that in mind before adding to the list.
- The benefits of Poses and Blending are move obvious with complicated character such as bipeds

Mark / Register

Here we will briefly cover the simple but VERY useful Mark / Register feature of Motion Studio. This is good for doing walk cycles, hops, or any other repetitive motions.

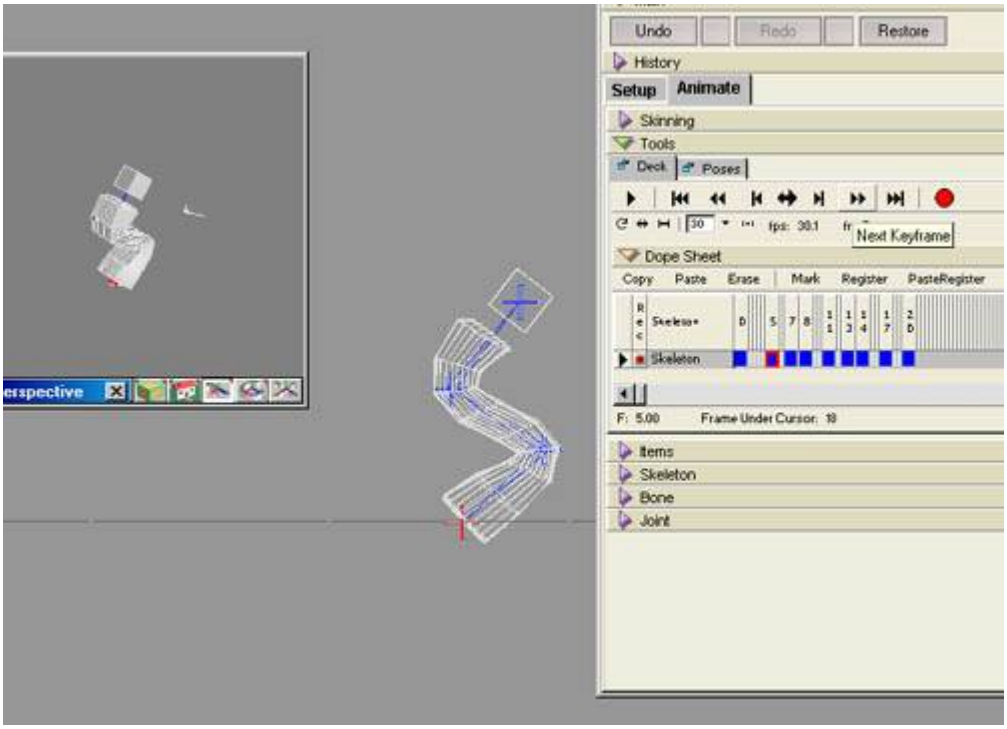
We will be using the scene as completed in the Dope Sheet / Animating tutorial. If you do not have this scene, you may download it HERE.



Mr "i", ready for multiple hopping action

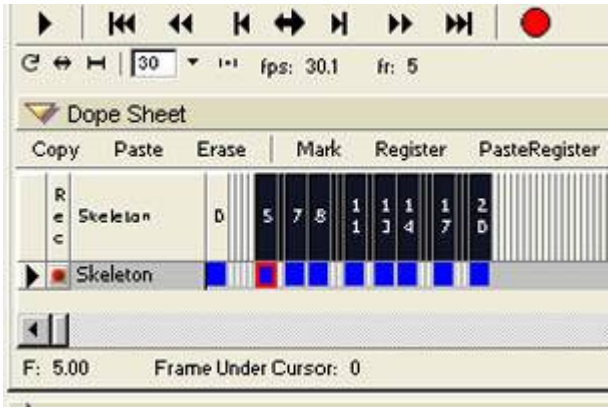
At the moment our character does a single short hop. The objective is to have the character hop several times, moving further along each time...and have his feet (or foot) Registered such that there is no unwanted foot slide.

The first thing to do is identify where the basic movement begins and ends. Think of a walk cycle, where you want the character to take a step with each leg, and have the foot end up exactly where it started so that it forms a seamless loop. Same thing goes for this "hop cycle". In keyframe 1, the character is standing straight up. We want the movement to be a series of quick hops so the character likely wouldn't look natural with a stiff standing pose between each hop. For that reason, we will ignore keyframe one and move to the next keyframe...

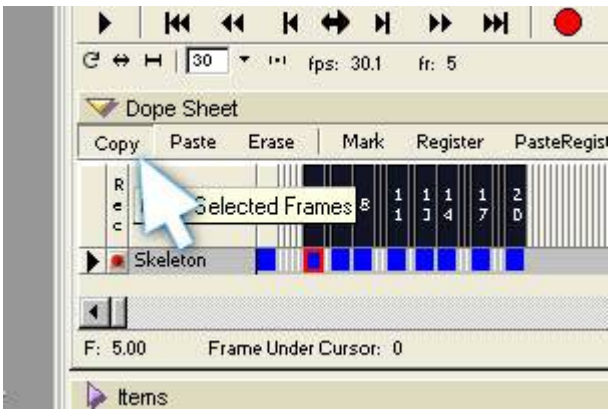


Keyframe 5 looks like a decent place to start the "loop". Why? Because here he is coiled, ready to spring up. Let's give it a try and see what happens.

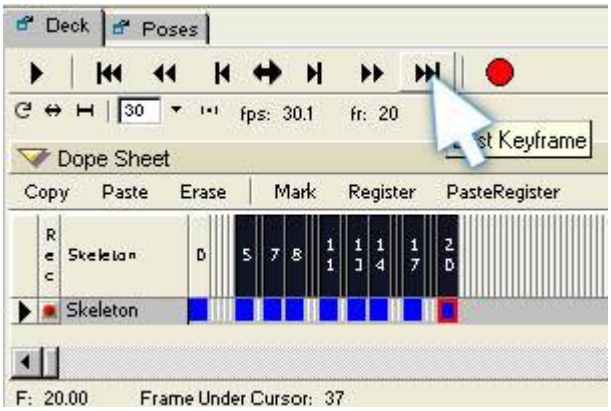
Select all keyframes from 5 onward...



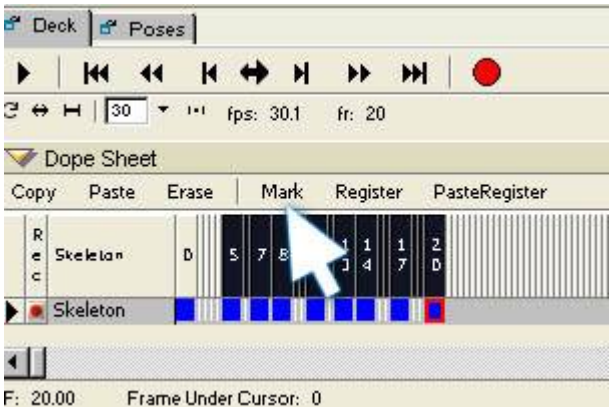
Click **Copy**.



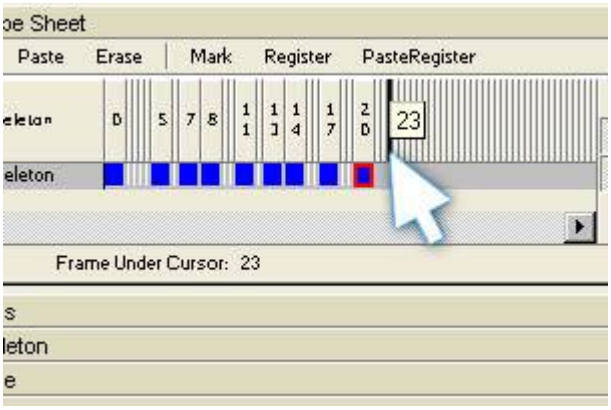
Click the **Last Keyframe** button to move to the end of the sequence.



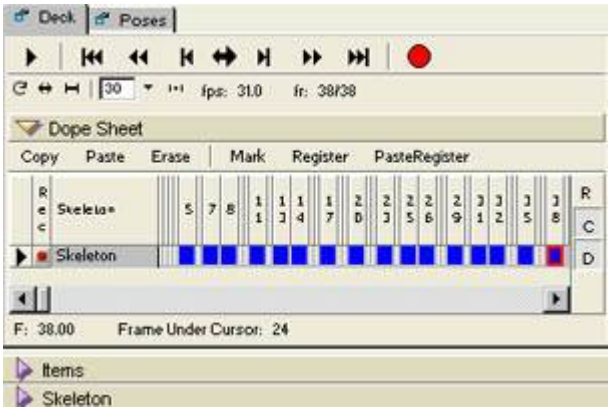
Select the foot joint and click **Mark**.



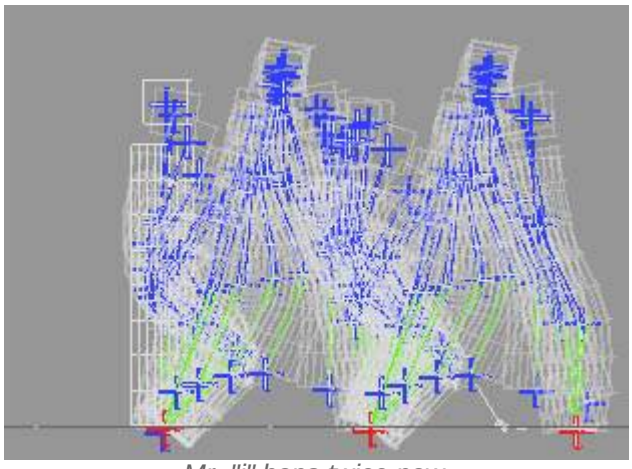
Select a frame a few frames away from the final keyframe.



Click **PasteRegister**.



If done correctly, Motion Studio will have built another "hop" motion for you, not only copying the IK/Bones keyframes, but ensuring the character moves along with his foot in the right location.



Mr. "i" hops twice now

If you want, select a new frame a few away from the final keyframe and click **PasteRegister** again. You'll have another loop added. *(NOTE: You do not have to click **Mark** again.)* You can do this multiple times.

Click HERE to download my hop mark/register animation.

You may notice there's a bit of a "bounce" between each hop. I actually like this but if you want consecutive, uninterrupted hops, simply edit or remove the last keyframe before duplicating the sequence and/or perform the **PasteRegister** operation closer to the end of the animation (as opposed to pasting a few frames away).

Facial Animation

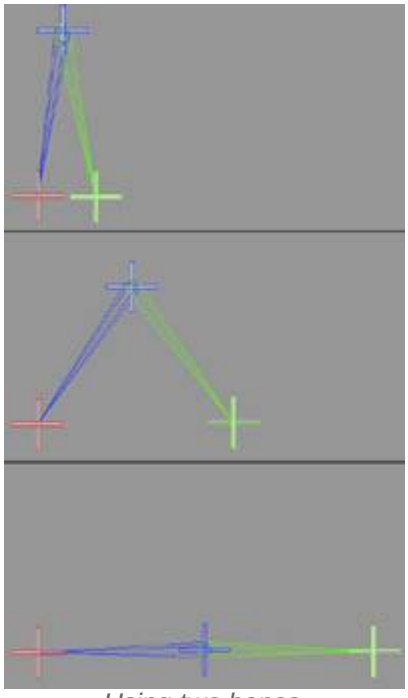
This will not be a walk-through tutorial like the past pages have been. Instead, it is more of a Tips-N-Theory page dealing with how to accomplish facial animation in MotionStudio.

First, **why do facial animation with bones** in MotionStudio?
Here are the reasons I came up with:

- Body and facial animation on a single mesh
- Quicker setup - no need to build 40+ morph targets
- Facial movement in arcs as opposed to linear interpolation of vertex blending (especially useful around the jaw area)
- Easy to add new poses (expressions, phonemes, etc.)

I was also inspired by the Cane-Toad face rig. Go here for more info: http://www.cane-toad.com/tuteRig_Facial.htm

The problem I ran into initially was getting the bones to be "flexible". My first attempts involved using two or more bones for each "point" so that I could get the proper extension - especially important for the lip areas.



Using two bones

This does give more freedom to move the end point in/out/around but the distance is still limited by the length of the two bones.
Another thing I tried was to use four bones, in an "M" shape. This gives a bit more "elasticity" but the rig gets cluttered very quickly.

The next thing I tried was to use multiple skeletons for each bone/node in the face. This gives you the ability to move the attached sub-skeleton bones in any direction, but it was just way too wonky since everything was on its own skeleton so selecting individual parts was a nuisance. Also, pose mixing was out of the question with this method.

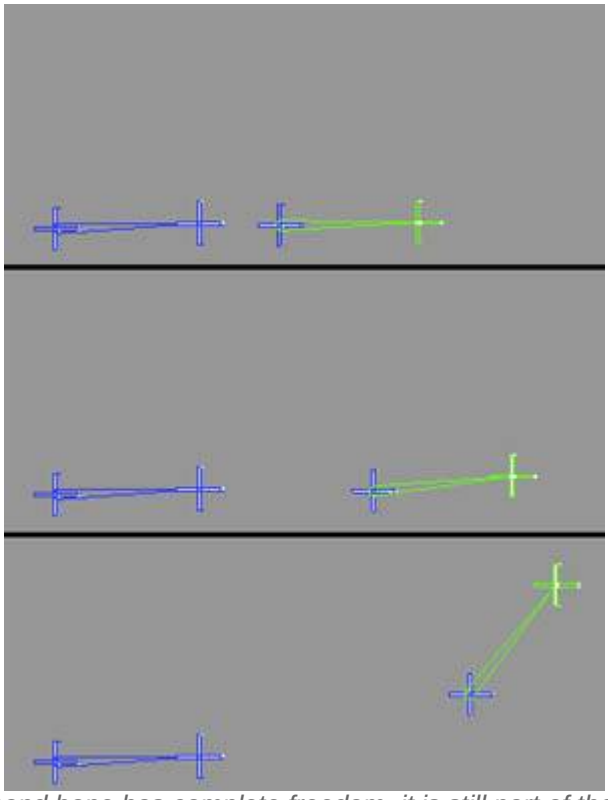
Enter the Humdinger...

I emailed a fellow MotionStudio enthusiast, Vinny (Humdinger) Carvalho, about how to incorporate "floating bones" for facial animation. Sure enough, he knew of a way to do it.

Here are the steps Vinny outlined for floating bones:

- Add Skeleton
- **Add Joint**
- Add Bone

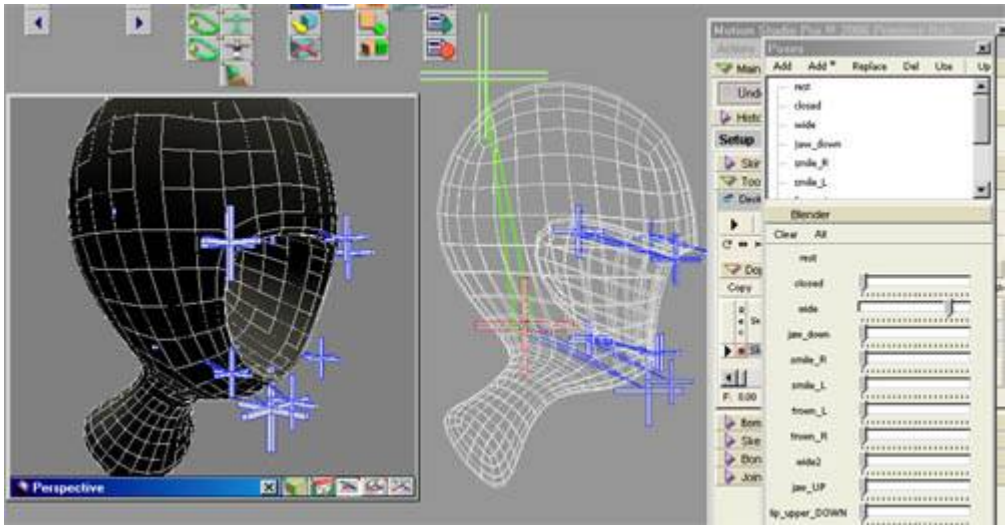
You should then wind up with something like the following:



Although the second bone has complete freedom, it is still part of the same skeleton.

Putting it to use

Armed with the knowledge of building "floating bones" rigs, I started experimenting.



Download this scene

See it in action

Other uses

Morph targets give you ultimate control over smaller details like skin creases since you make adjustments at vertex-level *(this too can be accomplished using only bones, but it would take more thought and precise setup with*

more bones than used in the above example)
...so some folks may wish to stick with morph targets. HOWEVER, you can use a bones face rig to quickly generate approximate facial expressions, save the mesh, and refine it further by manipulating the vertices.