

Painting Skin Weights in Maya – An Introduction by Paul Naas

Painting skin weights is a vital step in the rigging process. Appropriate skin weights, or the amount of influence a joint has on a given vertex, are crucial in creating a character rig that deforms the model in a pleasing and convincing way.

I've read a lot of books on Maya, and I've yet to come across a good explanation of how, exactly, to approach assigning weights to a mesh. At worst, the book will take you up to skinning, and then throw in a paragraph about how weights are important but beyond the scope of the book. Others touch on it briefly, but without the detail necessary to really tell you how it's done.

The purpose of this tutorial is to give you some basic, substantial information on how to assign skin weights. It's not the only way; merely the way I've learned how to do it. It also includes tips and hints from professionals who do nothing but rig all day long, so I figure that's good advice to pass along.

Before we get into the "how," let's tackle the "what" and "why" for just a bit. Yes, it's theory, (I promise it's mostly painless), but it's important information to understand before you set about weighting your model. Here we go:

First, every joint in a skeleton has the potential to influence every vertex on the surface of the model. In fact, every joint does influence every vertex on the model, but sometimes that influence is zero. The amount of influence a joint has over a vertex will determine how much that vertex is displaced (moves) when the joint is rotated.

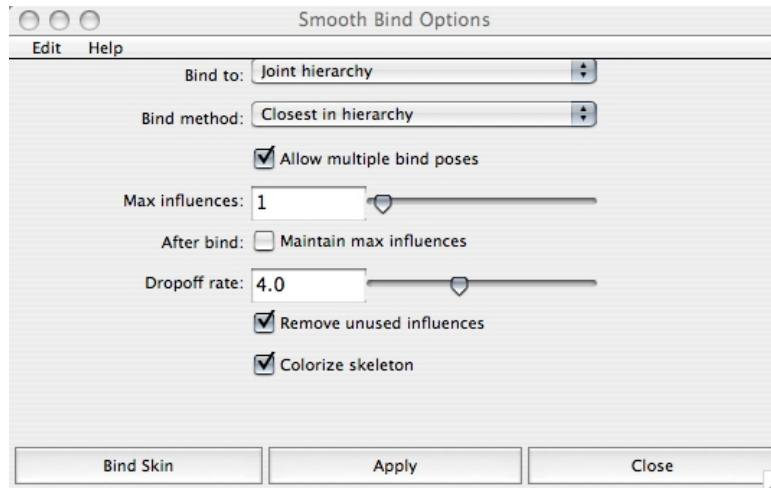
Every vertex on the surface of a model MUST have a TOTAL influence of 1, or 100%. It can't be any other way. That influence can be assigned to only one joint, a couple of joints, or many joints, but the TOTAL influence on a vertex can only be 1. So, if Joint1 has 70% influence on a vertex and Joint2 has 30% influence on the same vertex, then that vertex will be displaced significantly more when Joint1 is rotated than when Joint2 is rotated. If the influence on a vertex from a joint is 100%, then that vertex will move when that joint is rotated, and only when THAT joint is rotated. Other joints can be rotated to your heart's content, but THAT vertex won't be displaced at all. Don't worry if this doesn't make complete sense right now; we'll be returning to this idea shortly.

One more concept, then we'll get on with the practical stuff. When you're looking at a weight map on a model, only the black, white, or shade of gray that's directly under the vertex matters. There are shades of gray in the middle of the faces, and they are important visual aides, but joints only influence vertices (verts). If one vert has white under it and the vert next to it has black, that gray gradient between them is telling you that there's a transition in weight there, but it has no effect on how the verts behave when the joint is rotated. Again, don't worry if this doesn't make sense now - hopefully it will shortly.

Now, for some practical steps you can take to make your weight painting task much easier. By the way, there are new tools coming in the near future that will make this process easier, but for now we'll go with the tried and true.

When you first bind your character - that is, when you attach the skeleton you've created to the mesh geometry you've modeled - there are a few settings you want to be sure are set correctly. If you don't set these correctly, you're creating a lot of extra work for yourself at best, or you'll have to start over at worst, so take care when you do the initial binding.

To bind the skin, select the Animation menu set, then select Skin>Bind Skin>Smooth Bind>Option box. This will open the bind options menu, where the magic happens. There are many ways to bind the skin to the skeleton, but these settings will be the easiest to work with your first time out:



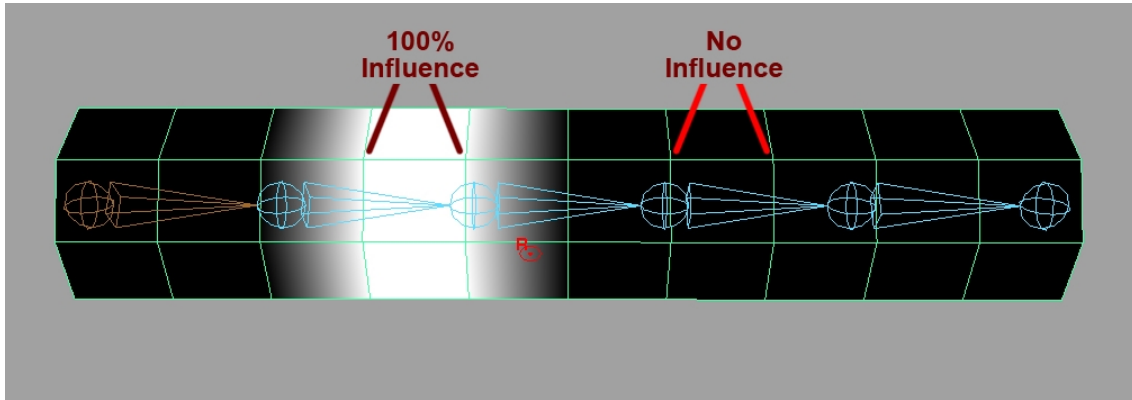
The most important settings here are the “max influences” and “maintain max influences” settings. Max Influences determines how many joints can initially move any given vertex. You want this set to 1 - we’re doing a “hard bind,” where only one joint can influence a vertex. It makes it easier later on to distribute joint weight (trust me). Since you want to distribute weight later on over two or more joints for a lot of your verts, you’ll want Maintain Max Influences UNCHECKED. If it’s checked, the most joints you can ever have influence any given vertex is 1, the number set in Max Influences. If you forget to uncheck Maintain Max Influences, you’ll have to start your bind and weight painting over, so double-check before you click on Bind Skin.

Once you’ve done the bind, click on the GEOMETRY and select Skin>Edit Smooth Skin>Paint Skin Weights Tool>Option box. This will open the tool, and bring up the Tool Settings panel, which you’ll need for weight painting. You’ll also see the Paint Skin Weights tool in the bottom space of the toolbox window - this is a handy way of getting back into the tool without going through the menu again.



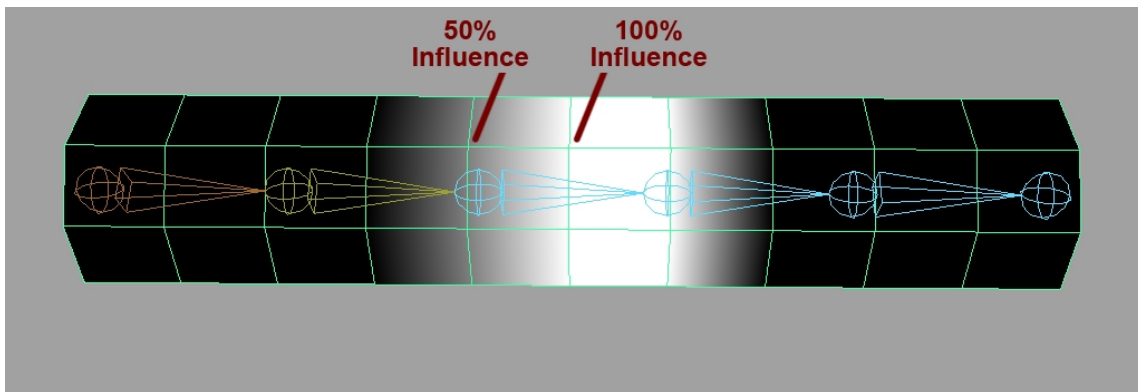
Take a look at the image below. What you’re seeing is a graphic representation of how the second joint in the hierarchy (second from the left) will influence the verts on the surface of the object. The verts that have white

underneath them will be influenced 100% by the joint, those with black under them won't be influenced at all. Because of the bind settings we used, this is currently the case for every joint in the skeleton - it either influences a given vertex or it doesn't. We're about to change that. By the way, Maya can be somewhat random in deciding what verts a given joint should influence, and it often doesn't make sense. It's important to remember that Maya doesn't know what an elbow, shoulder, or wrist is. All it knows are the number of joints and their proximity to the verts, and it makes its best guess based on that.

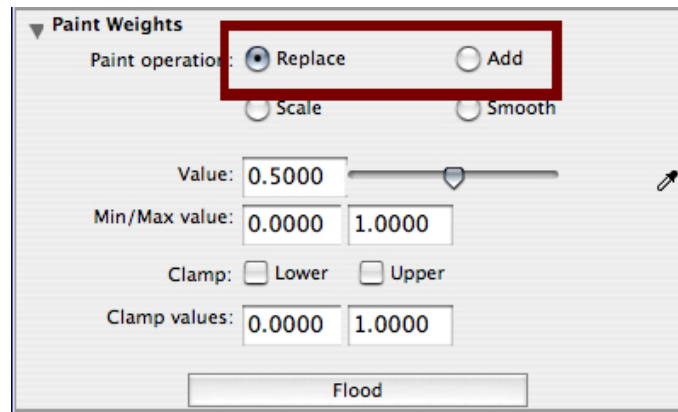


See the gray transition between the vertex points? That shows us that there is a ramping down of influence over that area, but since there are no verts there (remember - joints only influence verts) the gray is more of a visual aide than anything else.

Now, when there's gray under a vertex, that's when things get interesting. When the shading under a vertex is gray, it means that the selected joint is influencing that vertex at something less than 100%. The closer to white the gray is, the more the joint is influencing the vertex; the closer to black, the less the influence. So if we wanted joint three to have 50% influence on the verts, it'd look like this:



So how do you distribute weight over the verts so that your model deforms nicely? By using the paint weights tool in two specific modes: "replace" and "add":



“Replace” replaces whatever weight was on the vert with the value that’s currently set. “Add” adds the current value up to a value of 1.

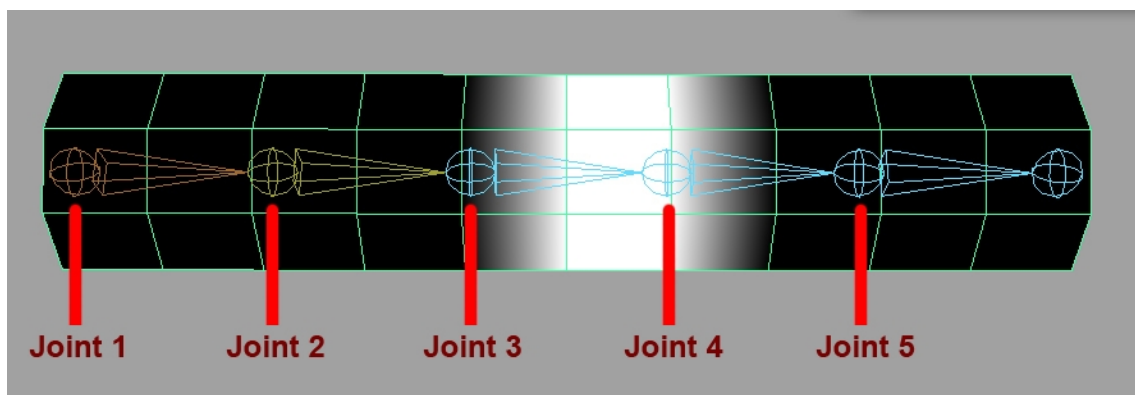
When you’re painting weights, it’s important to always ADD weight, never take it away. Remember that every vertex has to have a TOTAL weight of 1, or 100%. That weight can be spread out over several joints or all on one, but it has to total 1.

If you take weight away from a vertex by reducing the amount that’s already there, that weight has to go to some other joint elsewhere in the rig. It might go to a nearby joint, but it’s just as likely to end up on some unrelated joint waaaay on the other side of the rig. And once that weight has been assigned, every time the joint moves the vertex will move in response. The result is you end up with little movements on areas of your character that are unrelated to the joint you’re rotating, and you end up spending much more time fixing it than what you saved by removing weight.

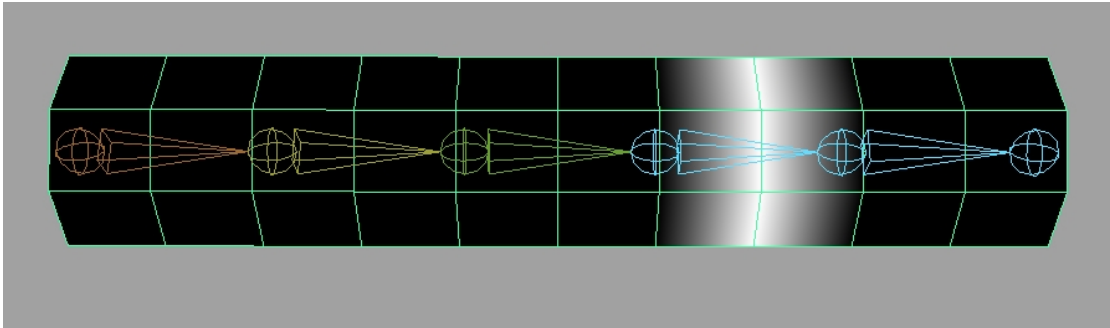
So how do you avoid this, since you’ll often want to reduce a joint’s influence on a part of the model? By adding weight to a nearby joint. Since every vertex must equal 1, if you need to reduce the influence of a given joint, put some weight on a nearby joint. By adding weight to a related joint, you’ll automatically reduce the weight on the joint that has too much on it and distribute the weight between the joints.

I know; confusing. Some illustrations should help...

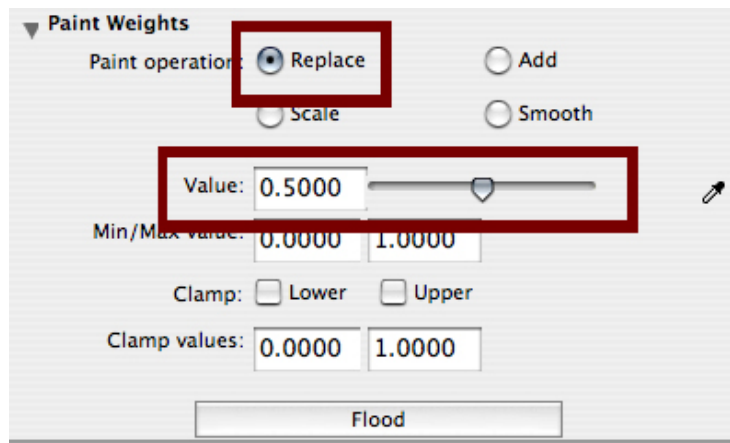
Here’s joint 3’s default weights.



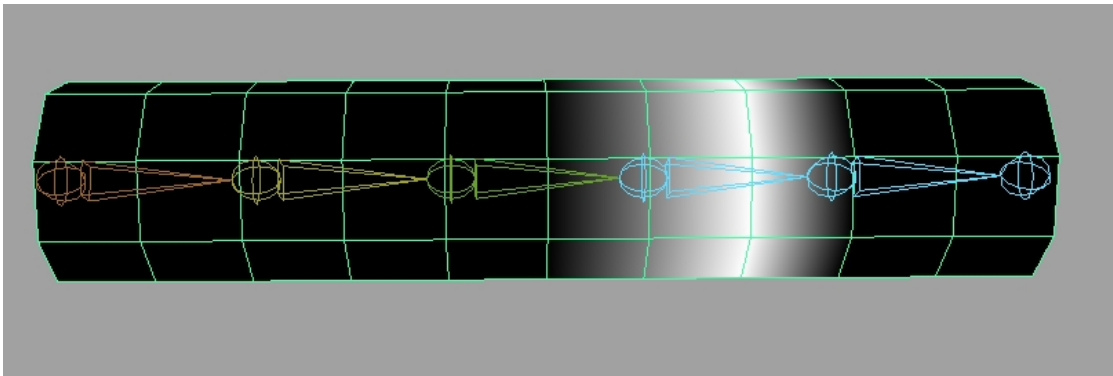
There’s probably too much weight on joint 3 over the rotation point of joint 4 for those verts to deform well when joint 4 is rotated. In addition, we’ll probably want those verts to move some when we rotate joint 4. So we’ll want to remove some of that weight from joint 3. To do that, we select joint 4..



...and add weight to the verts using the “replace” setting.

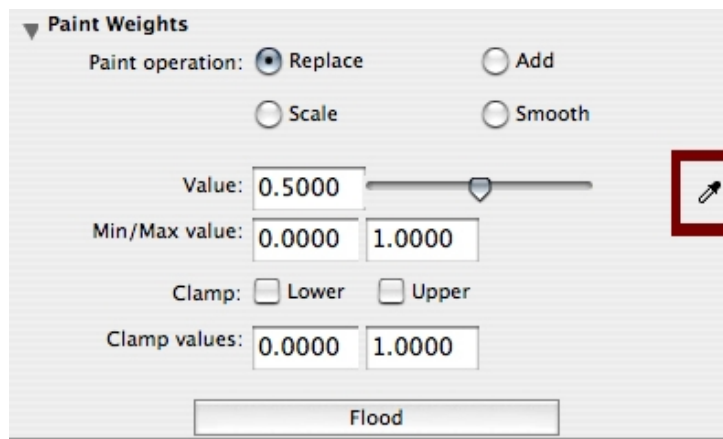


With the “replace” operation chosen and a value of 0.5, whatever vertex we paint on will have the value that's currently there replaced with a value of 0.5. After we paint the verts, the joint 4 weights look like this:



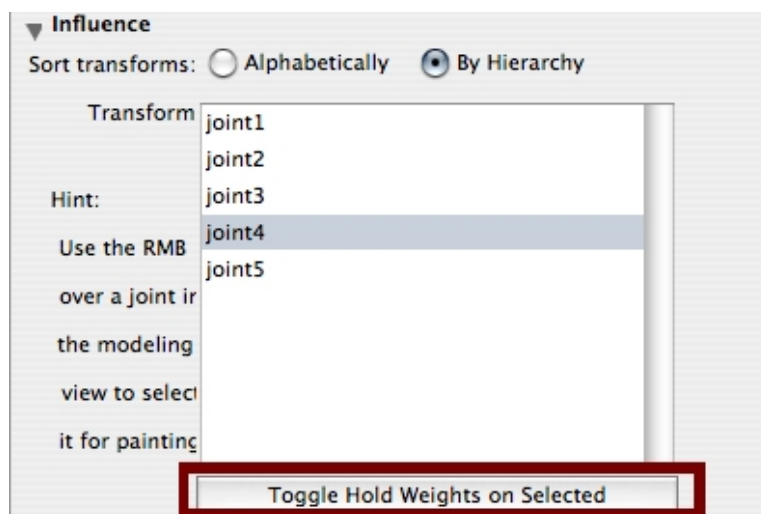
Again, make sure you're ADDING weight, not taking it away. You'll thank me later.

So how do you ensure you're adding weight? By sampling the weight on a vert using the eyedropper tool.



Click on the eyedropper, then click on a vert. The “value” setting will change to the current value of the vert you clicked on. Then just increase the weight value to the desired setting and paint away!

Once you’ve got the weights on a joint the way you want them, select the joint from the list in the tool settings window and click on “Toggle Hold Weights On Selected.” That will keep the weights as they are while you adjust the other joints.



A couple of final tips:

The size of the brush is important! Wherever the edge of the brush touches will be affected by the weight painting, so pick the correct size for the job. To resize the brush, place the cursor over the model so you can see the current size of the brush, hold down the “b” key, and left mouse click and drag side to side to increase or decrease the brush size.

Sometimes it’s easier to see how the weight values are affecting the joints by rotating the joints slightly from their rest position. When the joints are rotated slightly, you’ll see the effect that the change in weight has on the way the geometry deforms in real time. That’s why it’s very important to do a “freeze transformations” after you’ve created your skeleton. If you do, your rotation values will zero out, and when you’ve finished with your weight painting, you can reset the rotation values for the joint back to zero and the joint will go back to its rest position.

Some areas are tricky to get right - for example the shoulder area has several joints interacting in a fairly small area, and getting that area to deform well can be very time-consuming. Keep in mind that I'm not looking for perfection in this class, but instead I want to see that you've made an effort to smooth out the weights from the way they were after the bind. Get it as good as you can and move on.

Hope this helps. Let me know if you have any questions. And many thanks to Courtney Caldwell for editing my ramblings into something usable. -Paul