## What is Paint Weights

Paint Weights is a weight painting and editing tool for LightWave Layout. With various brushes, just like painting an object in the viewport, you can smoothly paint and blur vertex weights and can fill a region with any value or gradient at once. If points are selected, the unselected points will be masked and protected from painting. This tool is totally helpful for weight editing with various commands. For example, the BindMesh command allows you to bind your character object to the bones by automatically creating a vertex weight map for each bone. The Transfer command transfers vertex weights from the whole or portions of an object onto another. Weight smoothing, mirroring, normalizing, and other useful commands. Immediately after editing weight maps, you can get the results in the viewport, if your object contains any active bones, morphs and displacements, including all of those effects. You no longer have to return to Modeler for weight painting.
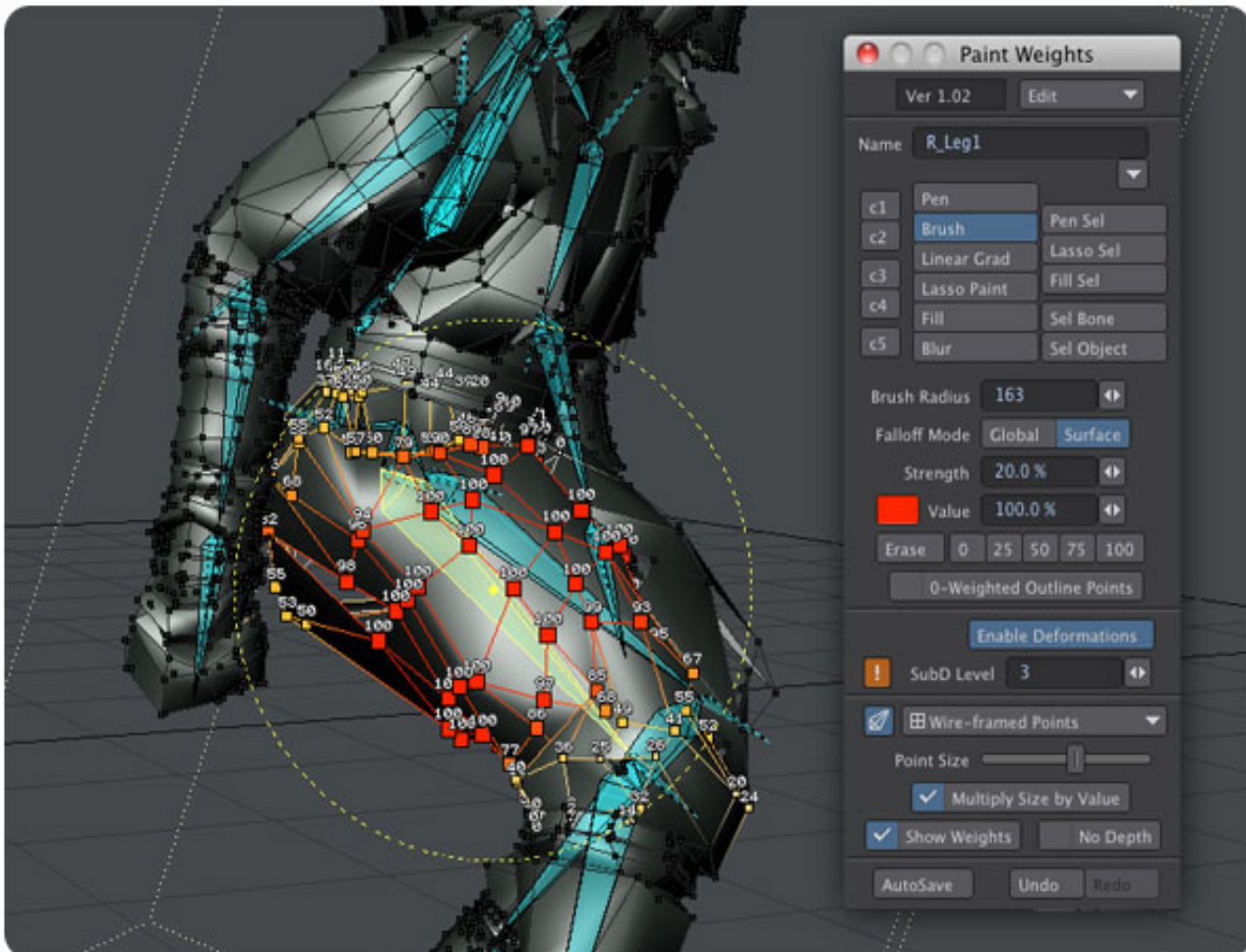
For best performance in the viewport

Because the scene objects are treated as a multi-layered or a single layered object in a LightWave .LWO file, If the object being edited is a multi-layered object with each object, all of the objects in the LWO file will be processed, and you may find a decrease in performance. It is recommended to use a single layered object as much as possible.

Because the meshes of subdivision surfaces need to be recalculated in LightWave Layout when editing a SubPatch or a CC(Catmull-Clark) patch object, a very dense subdivision surface model with a high polygon count could cause your viewport performance to degrade. If you feel uncomfortable while editing a subdivision surface object, try lowering the **Display SubPatch Level**. There is the **SubD Level** mini-slider on the Paint Weights panel. This is the same as the **Display SubPatch Level** on the Object Properties Panel. You can change the **Display SubPatch Level** for the currently selected object with this mini-slider. If the button ! appears on the left of the mini-slider, clicking on this button will set the **SubD Level** to zero. A **SubD Level** of zero means that the object will not be subdivided, which is strongly recommended for best performance.
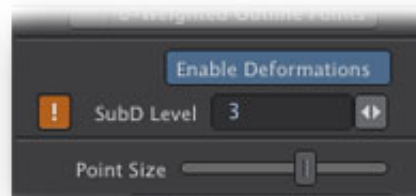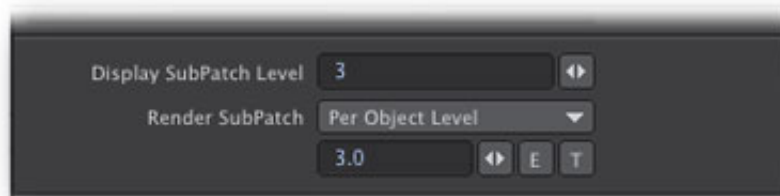
Limitation

This tool works on points, polygons, SubPatches and CC(Catmull-Clark) Patches. If your object includes other elements, such as curves, Skelegons and Metaballs, those elements will be ignored in every operation from beginning to end.

How to launch and quit Paint Weights

The Paint Weights tool only works in Object Edit Mode. With the selected object you want to paint weights, clicking on the **Paint Weights** button will open the Paint Weights panel and activate weight painting mode. After editing, you can exit weight painting mode by tapping the spacebar or closing the Paint Weights panel. Whenever you edit anything except vertex weights, it would be better for the Paint Weights tool to be closed. Basically, it is not recommended to use a Layout tool together with any other tool or command.
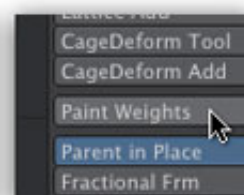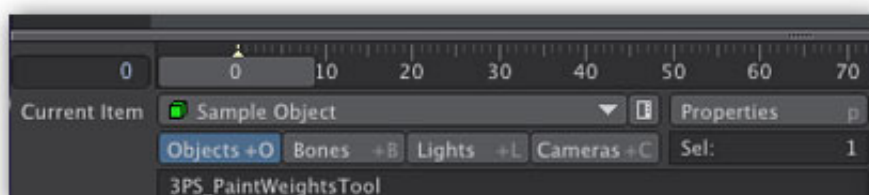
Controls

Name - shows the name of the currently selected weight map. You can choose an existing weight map from the drop down list ▼. If you need to create a new map, type a new name directly into the text field.

Tool Menu - Editing modes are as follows:

    Pen Sel - selects or deselects points within the brush's influence area. You can select or deselect the points by left-clicking and also add more points to the existing selection by right-clicking.

    Lasso Sel - lasso-selects or lasso-deselects the points of the selected object.

    Fill Sel - selects or deselects all points that are connected to the polygon you clicked on.

    Sel Bone - selects or deselects the bones of the selected object. In the same way you select or deselect points, you can select or deselect the bones by left-clicking and also add more bones to the existing selection by right-clicking. If there is any weight map assigned to the bone you selected, it will automatically become the current weight map.

    Sel Object - changes the current object. The object you clicked on directly in a viewport will be highlighted and become the current object. Of course, you can also use the usual Current Item dropdown at the bottom of the interface window.

    You can also cancel both point and bone selections at once by clicking in the blank space on this tool panel. When no points are selected, every point of the selected object is considered selected and is affected by editing. If points are selected, basically, only those points will be affected by editing.

Pen - assigns the current weight map to points within the brush's influence area with the current **Value**. This is what is called solid color painting.

Brush - paints smooth weights on the surface of the current object with the current **Value** and **Strength**. Unlike **Pen**, the effect(opacity) will fall off with the distance from the center of the influence area.
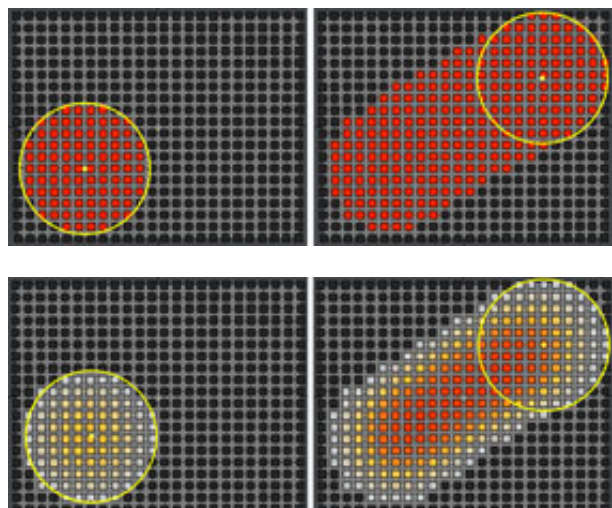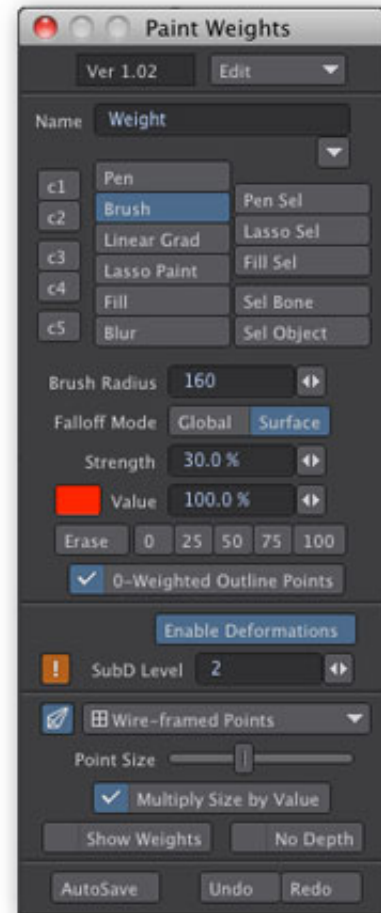
Linear Grad - fills the selected region or the whole object with gradient weights. You can decide on the direction and range of the falloff by left-clicking and dragging in any viewport. Right-clicking will constrain the angle to 15-degree increments. When you release your mouse button, the points will be assigned weight values.
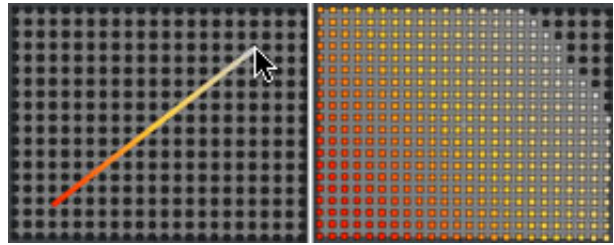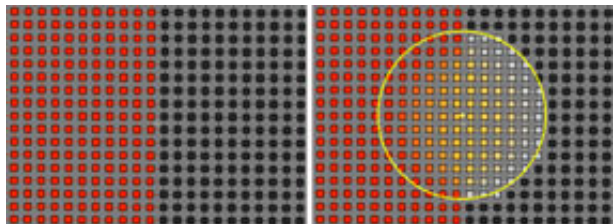

Lasso Paint - assigns the current weight map to points within the lassoed area with the current **Value**.
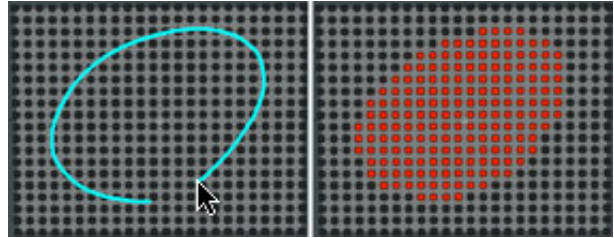
Fill - assigns the current weight map to all selected points that are connected to the polygon you clicked on.
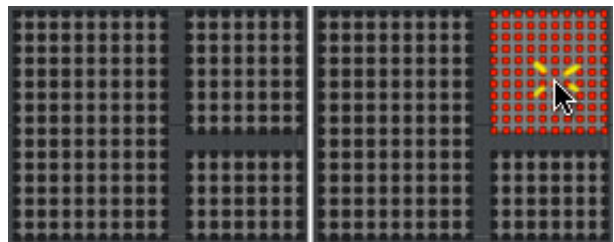
Blur - blurs and smooths weights of points within the brush's influence area by blending the weight value of each point with its neighbors'.

In **Pen**, **Brush**, **Blur**, **Lasso**, and **Fill** modes, right-clicking on a bone will cancel an existing bone selection and select only the clicked bone. If there is any weight map assigned to the newly selected bone, it will automatically become the current weight map. Switching between weight maps directly in a viewport is useful for painting weights for each bone. Also, in **Pen**, **Brush**, and **Blur** modes, you can graphically adjust the **Brush Radius** by right-clicking anywhere except bones and by dragging out a circle.

Custom Command buttons `c1` `c2` `c3` `c4` `c5` - executes the command user-assigned to each button. You can use these buttons to execute commands instead of choosing a command from the **Edit** drop down menu. For more information about how to assign a command to a custom command button, see the **Open Custom Command Buttons Panel** section below.

**Brush Radius** - shows and specifies the radius of the brush, in pixels. In other words, this is the distance between the position of the mouse pointer (center) and the boundary of the influence area.

Falloff Mode - has the following two options:

Global - The whole geometry of the current object will be affected by editing. The effect will fall off with the distance from the center of the effect in 3D space.

Surface - Only the geometry connected to the polygon you clicked on will be affected by editing. The effect will fall off with the distance from the center of the effect along the surface of the object.

If your mouse pointer is on the surface of the current object, the center of the effect will be taken from the current position of the mouse pointer on the surface. If not, from its current 2D position in screen space.
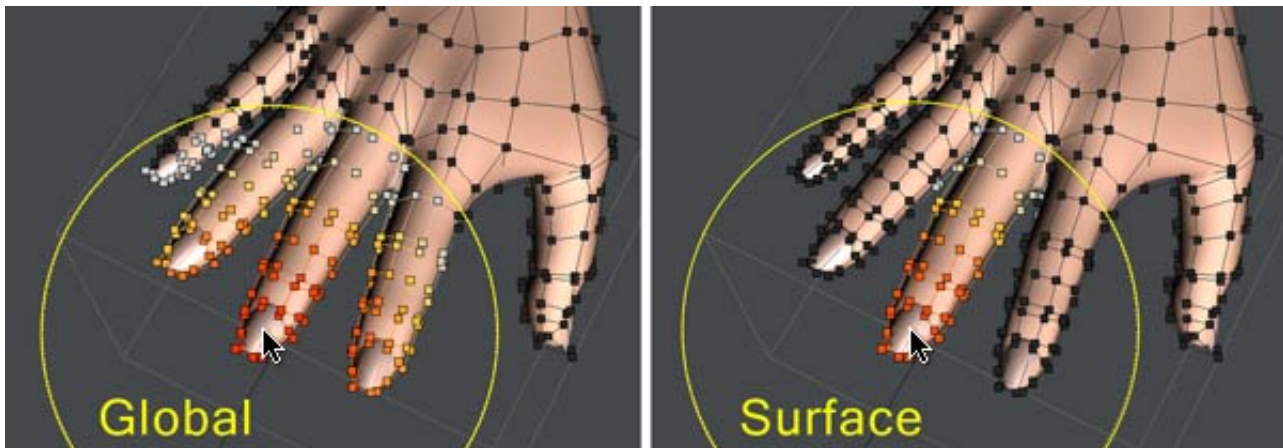

Strength - determines the intensity of the effect. Larger values of **Strength** cause the weight value of each point to reach the final result of the effect more quickly.

Value - specifies the weight value that you are going to assign to the points.

Erase - When active, the brushes work in Eraser mode. The absolute value of the current weight map of each point within the brush's influence area will decrease, and then when the weights of points reach zero, those points will be unassigned to the current weight map.

Constant Value Buttons [0] [25] [50] [75] [100] - You can use these buttons to set the **Value** to a usual and good value to paint weights instead of typing numbers in the **Value** field.

0-Weighted Outline Points - When checked, unweighted points adjacent to non-zero weighted points will be automatically assigned a weight of zero while you are editing weights. The reason why it is necessary to be assigned a weight of zero is that, depending on software, the weights of the interpolated points of subdivision surfaces may be influenced by zero-weighted points. In LightWave, if a patch contains unweighted points, its interpolated points will be unweighted, and the subdivided mesh will lose the smoothness and continuity of weights as a result of lack of weights. If you don't want such results, you can avoid it by checking this option.
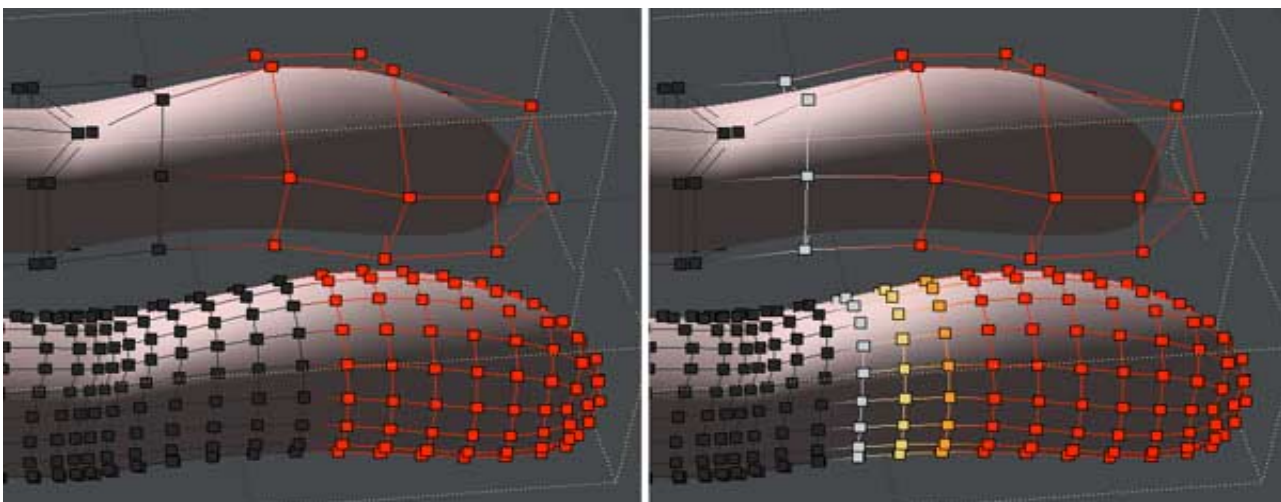
Enable Deformations - When you click on this button, the options that interfere with the bone setup (**Enable IK** and **Enable Deform** located under the Setup Tab) will be toggled off or on all at once. If there are already bones active in your object, the mesh of the object may not be able to be correctly bound to bones due to bone deformations, so it is necessary to turn these options off to temporarily disable deformations before performing mesh binding operations.

SubD Level - shows and specifies the **Display SubPatch Level** for the current object. If you find a decrease in performance with your subdivision surface model, lowering this level will improve performance. If the current object is a SubPatch or a CC(Catmull-Clark) patch object that needs to be subdivided in the scene, the button ❗ will appear on the left of this field. Clicking on this button will set the **SubD Level** to zero. A **SubD Level** of zero means that the object will not be subdivided, which is strongly recommended for best performance.

🖊 **Bone Toggle Button** - When this button is highlighted, the bones contained in the current object are overlaid on top, regardless of which option is actually enabled for visibility in Layout, and those bones are selectable in weight painting mode. Usually, you should have this option turned on in creating and painting bone weights for your character. However, if the bones interrupt your viewing of the character's motion, you may want to toggle this off to temporarily hide all of them.

⊞ Wire-framed Points ▼ **Visibility Drop Down Menu** - allows you to choose how the weights of the current object are shown in weight painting mode, from the following three options:

Wire-framed Points - shows the weight-colored points and polygon edges of the actual mesh. The polygons are not drawn. It doesn't completely cover and hide the current object with itself. If you want to paint weights on a subdivision surface object while checking the deformations of the subdivided mesh, choosing this option will be best.

Weight Shaded Solid - shows the weight-colored polygons of the actual mesh. This option gives you the simplest view that only draws the surface and silhouette lines of the current object. If you want to roughly paint weights as shown in the viewports without regard to the surface detail such as point positions, this will be useful.

Weight Shaded Solid Wire - nearly the same as **Weight Shaded Solid** but overlays the wireframe lines. This shows the actual polygon mesh so that you can paint precisely the points you want.


Wire-framed Points   Weight Shaded Solid   Weight Shaded Solid Wire
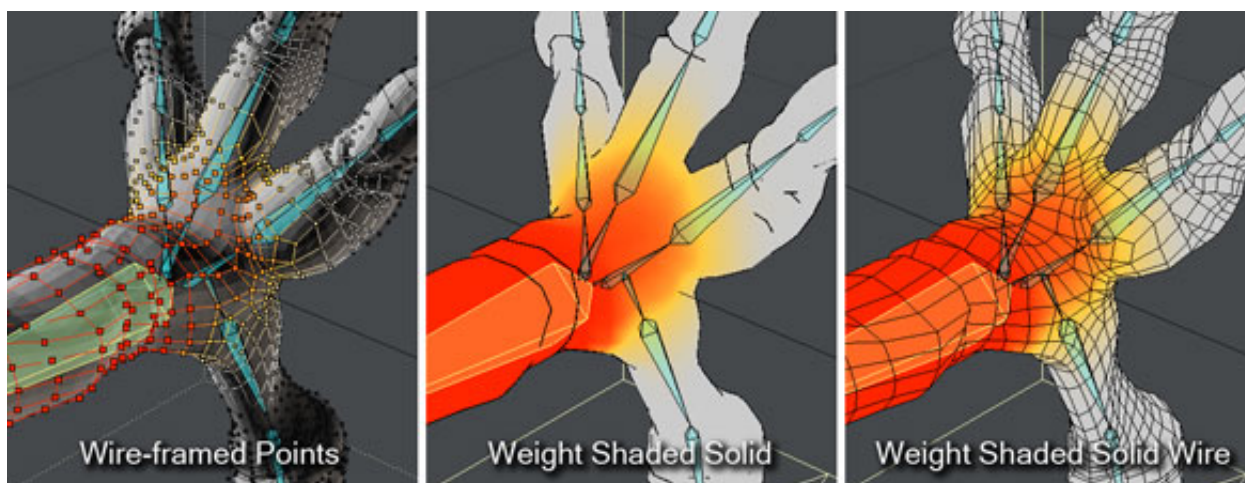
Point Size - adjusts the display size of points while increasing or decreasing the font size of characters for showing weight values.

Multiply Size by Value - When checked, the size of each point is multiplied by the absolute value of the current weight map of the point itself. Larger weight values of points will make their actual size on your viewport larger, and smaller weight values will make them smaller.
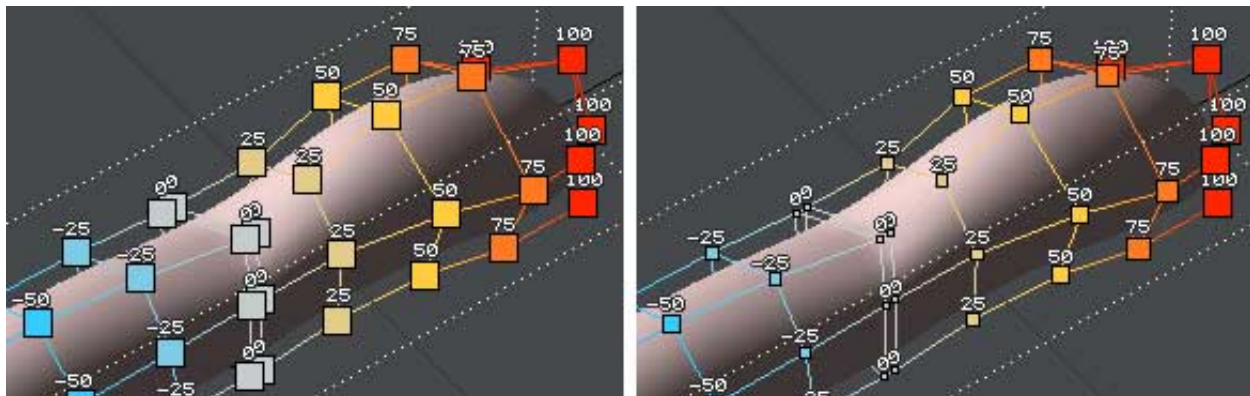
Show Weights - When checked, the weight value of each point is shown in mini-digits on top of the point itself.

No Depth - Checking this option causes every element in the current object to have no depth in your viewports. The important point is that this influences not only the appearance of view but also the weight painting on the viewports, that is, when this option is checked, you can paint any points in the current object, including points hidden behind the polygons. The influence of the brush is not determined in 3D space but in 2D screen space.
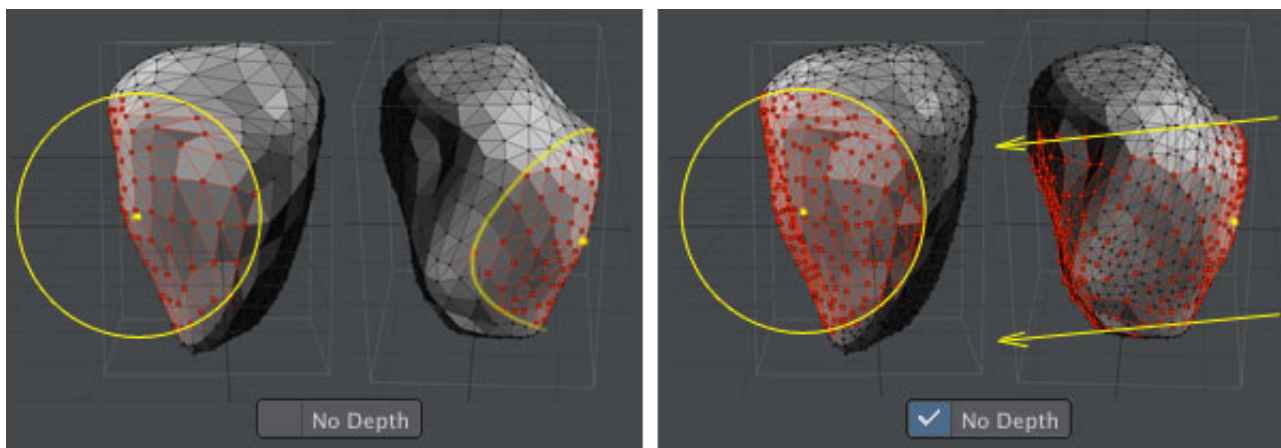
AutoSave - When active, all of the objects in a scene are automatically saved when you exit the Paint Weights tool. Activating this option prevents a user from forgetting to save the objects with changes. However, if you want to manually save the objects after painting weights, just leave this option inactive.

Undo/Redo - can undo and redo almost all of the changes you made while working with the Paint Weights tool. This tool has its own undo/redo mechanism in Layout but does not have access to the changes made in Modeler via the HUB. The undo/redo stack will be retained during having the tool panel open as long as there is enough free space in RAM, and it will be cleared when the tool closes.

Edit Drop Down Menu - The commands in this menu are as follows:

Select Connected - automatically selects all points that are connected to the currently selected points immediately after choosing this command and releasing your mouse button.

Select Weighted - automatically selects all points (weighted points) that are assigned to the current weight map.

Select Unweighted - automatically selects all points (unweighted points) that are unassigned to the current weight map.

Select Open - selects the points of open edges (one unshared by multiple polygons) and open points (one unshared by multiple two-point polygons).

Expand Selection - adds all points adjacent to the currently selected points to the existing point selection. The **Number of Times** determines how many times it should be applied to the mesh of the current object.

Invert Selection - Immediately after choosing this command and releasing your mouse button, the currently selected points will become unselected and the others will become selected.

Cancel Selection - cancels the existing point selection. Also, you can cancel both point and bone selections at once by clicking in the blank space on the Paint Weights panel.

Assign Value to Selected - Immediately after choosing this command and releasing your mouse button, the current weight map will be assigned to the currently selected points with the **Value** located in the middle of the Paint Weights panel.

Unassign Current Map to Selected - The current weight map will be unassigned to the currently selected points. In other words, it removes the weight values for the current weight map from the selected points, not giving points a value of 0.

Normalize Weights - automatically scales weight values so that the total value of weights assigned to each point will be equal to 100 percent. This command will always be applied to all the points of the current object regardless of whether or not points are selected. If the **Ignore Weights Unassigned to Bones** option is checked, the weight maps unassigned to bones will be ignored in the calculation and will be left without changes. When you are using the Bone Weight Map, the Weight Normalization (located on the Bone Properties Panel) is usually enabled, so you will not have to run this command if your work is going to be completed from beginning to end in LightWave only.
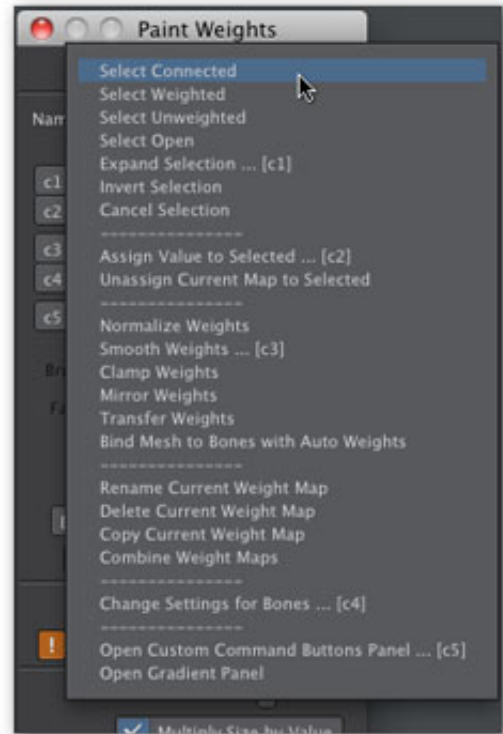
Smooth Weights - smooths the weights of the whole or portions of the current object by blending the weight value of each point with its neighbors'. If points are selected, only the selected parts of the current object will be affected. If there are not any selected points, the whole geometry of the current object will be affected.


You can choose to which maps the weight smoothing operation should be applied, from the **For** pop-up menu. This pop-up menu gives you the following options:

Current Weight Map Only - The effect is applied to the current weight map only.

Weights Assigned to Bones - The effect is applied to weight maps assigned to bones contained in the current object.

All Weight Maps - The effect is applied to all of the existing weight maps in the scene.

The **Strength** specifies the strength of the smoothing effect in percentage from 0% to 100%. The **Iterations** determines how many times it should be applied to.
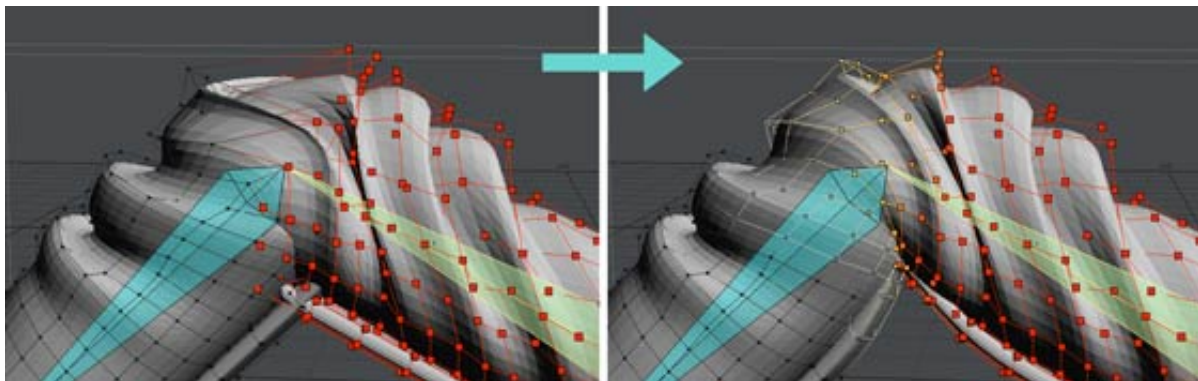
Clamp Weights - causes the number of weight maps assigned to each point to decrease to less than or equal to a user-specified number by eliminating negligible small weight values. This command will always be applied to all the points of the current object regardless of whether or not points are selected.

If the **Ignore Weights Unassigned to Bones** option is checked, the weight maps unassigned to bones will be ignored in the calculation and will be left without changes. The **Maximum Number of Maps** specifies the maximum number of weight maps that can be assigned to each point, for example, if you set this value to 4 and click the OK button, the four largest weight values assigned to each point will be retained and the others will be eliminated. Decreasing the number of weights for bones will improve the calculation speed and performance, especially in real-time character animation.

Mirror Weights - takes the weight maps that their own names contain a user-specified text string and creates a duplicate of each one that is reflected across the plane, zero value of a chosen axis. Because the duplicate maps are calculated based on the original undeformed geometry (base shape) of the current object in object space, you don't have to move the timeline slider to the initial frame (usually frame 0) that bone's rest position is determined on, or to temporarily disable deformations, before

performing weight mirroring operations. Also, even though your model is asymmetrical, this command can work well with it by finding the nearest surface point.

All Weight Maps - If checked, it will search through all of the existing weight maps in your scene, looking for weight map names with the specified text string. If not, the current weight map only.

Axis - specifies the axis, across which the weight maps are to be mirrored.

Type - specifies the type of text strings from the following options:

> **Suffix** - looks for any weight map names suffixed with the specified text string.
> **Prefix** - looks for any weight map names prefixed with the specified text string.
> **String** - looks for any weight map names that contain the specified text string.

Source String - specifies a text string for looking for the source weight maps.
**Target String** - specifies a text string for looking for the target weight maps.

In addition to choosing a pair of text strings that are usually used from the drop down list ![icon], you can also quickly swap two text strings of the **Source** and **Target Strings** by clicking on the **Swap** button.

The weight maps that their own names contain the text string of the **Source String** will be mirrored, and the names of the duplicate maps are determined by replacing the source text string in each original name with the target text string. Therefore, to efficiently use this command, you should give each weight map a unique and meaningful name in advance. It is recommended that the weight map names contain any meaningful text string, such as a string "_L" meaning the left side of the character's body and a string "_R" meaning the right side, the same way as the bone names. If the names of the duplicate maps don't exist in the list of weight maps, those will be newly created.
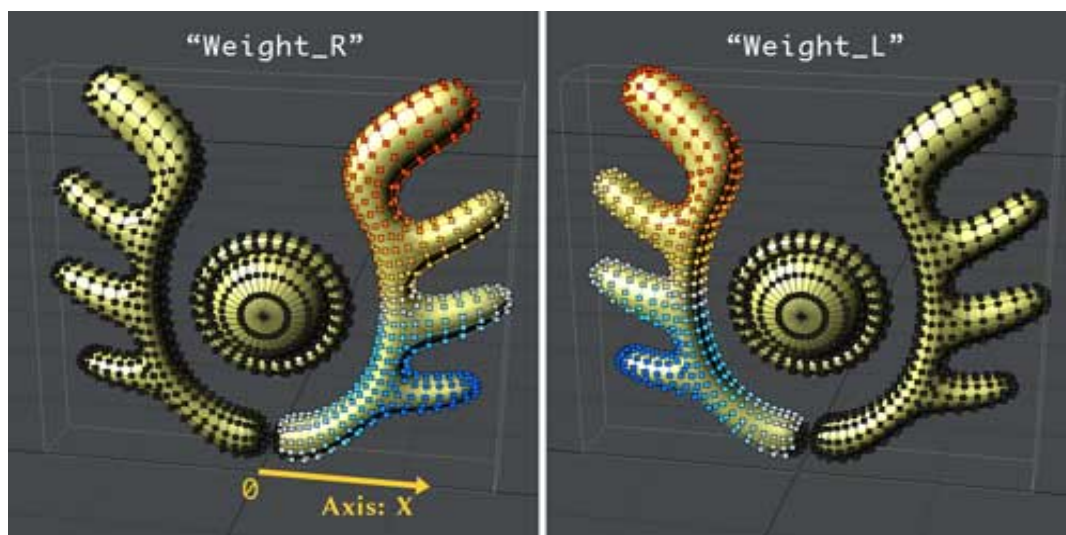
Transfer Weights - transfers weights from the source meshes, either the unselected parts of the current object itself or another object, to the selected parts of the current object by finding the nearest surface point and taking its weights. If no points are selected, the weights will be transferred from a specified source object to the whole geometry of the current object.
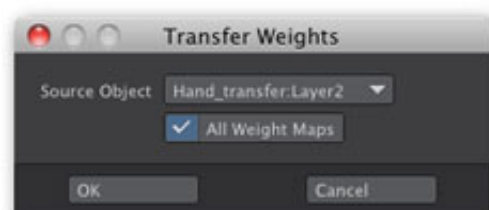
You can choose the object you want to use as a weight source from the **Source Object** drop down list. If "**(self)**" is chosen, the weights will be transferred from the unselected parts to the selected parts in the current object, for that, both selected and unselected points are required for transferring weights between the parts of the current object itself. If the **All Weight Maps** option is checked, it will perform weight transfer for all existing weight maps. If not, for the current weight map only.
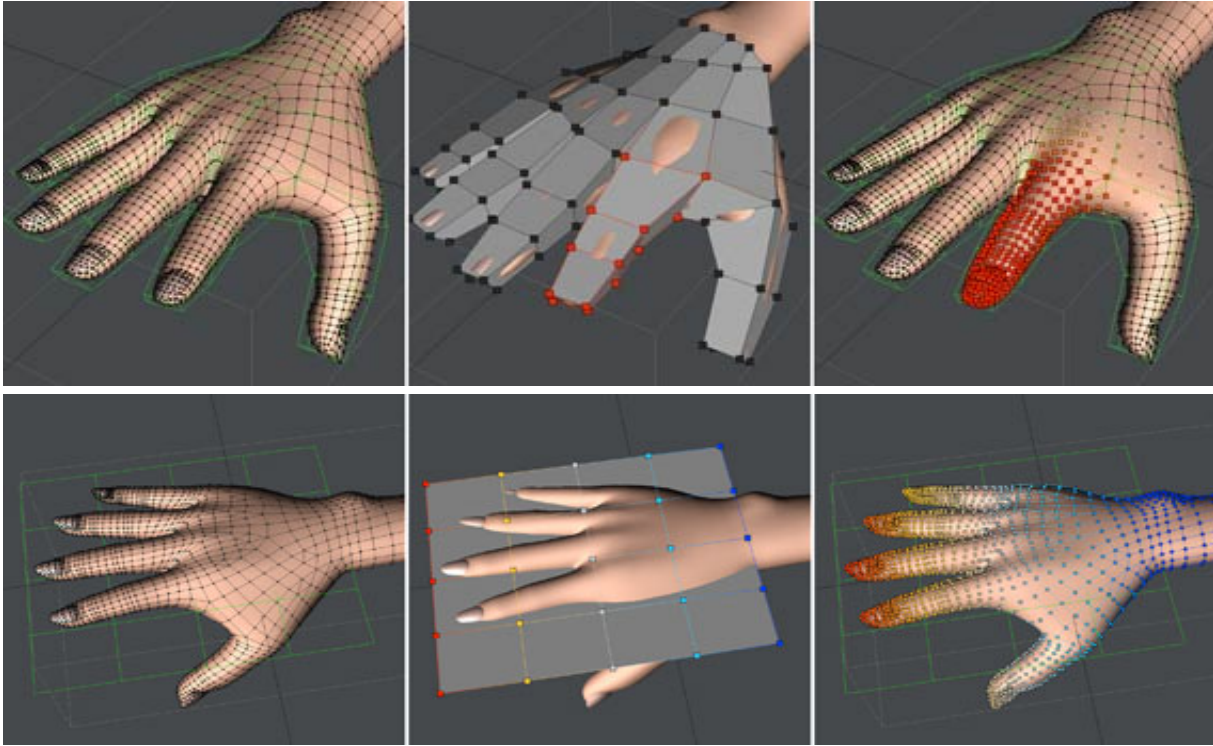

Bind Mesh to Bones with Auto Weights - automatically creates weight maps for bones by calculating the amount of influence the bones have on each point, which binds the mesh of the current object to its bones, to allow you to make your rigged character animatable quickly and easily.

You can choose a method of calculating bone weights from the **Method** pop-up menu. This pop-up menu gives you the following options:

   Distance - The bone influence simply falls off with the distance from the bone.
   Heat - The weight maps for bones are calculated using heat maps (heat diffusion algorithm).
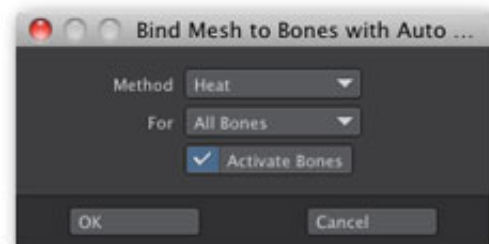
Also, you can choose the bones you want to bind the mesh to, from the **For** pop-up menu. The pop-up menu has the following options:

   All Bones - binds the mesh to all of the bones contained in the current object.
   **Selected Bones** - binds the mesh to the currently selected bones.

If the **Activate Bones** option is checked, the currently inactive bones will automatically become active, and the mesh will be bound to them, including bones that have been staying active. This can be useful when you want to bind the mesh to all of the inactive bones immediately after completing your character's bone setup. If not, the inactive bones will be ignored and cannot be bound.

The **Falloff Type**, the **Strength** and other settings on the **Bone Property panel** determine the influence of the bone, which are used for calculating bone influence weights. Giving

bones a **Strength** of zero causes the bones to have no influence and to be ignored in the calculation. If there are any bones that you don't want to bind, set their **Strength** to zero to make them act like nulls.

If there is any weight map assigned to the bone, the weight map will be recreated with its name. If not, the name of the newly created weight map will be taken from the name of the bone. For convenience, it is recommended that you give the bones unique and meaningful names in advance.

The two methods of calculating bone weights, **Distance** and **Heat**, are explained here. If **Distance** is chosen, the values of the created weight map are determined by the bone influence that falls off with the distance from the bone. This is about the same as bone deformations without weight maps, which is very simple and will take little time to compute the bone influence. Conversely, **Heat** is a more powerful and elegant method. Imagine that heat is emitted from each bone, which is blocked by the mesh of an object, and that heat absorbed by the mesh then travels along the surface.
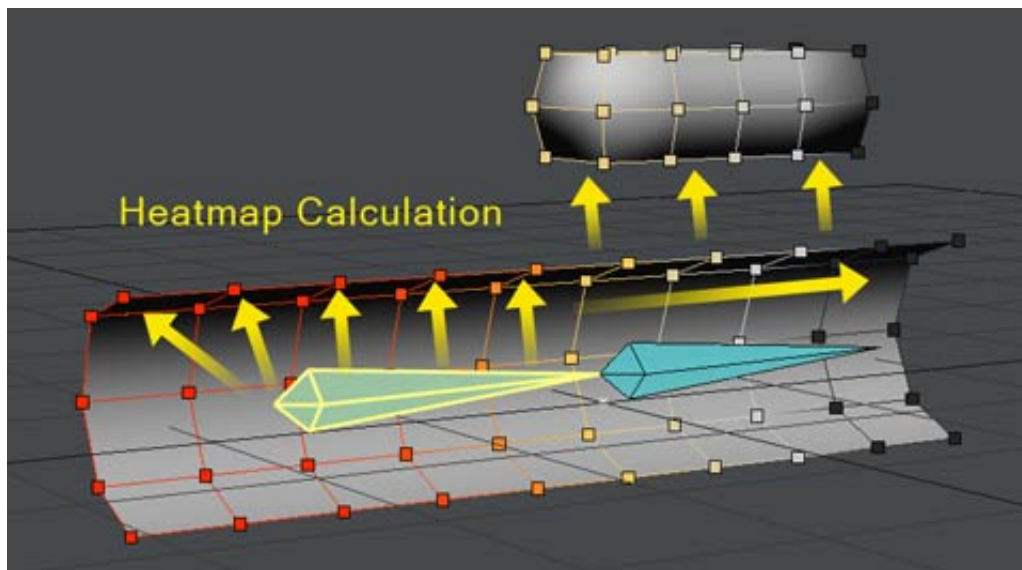
The heated body mesh becomes a secondary heat source, which emits heat from itself to unconnected parts outside of the body model, and the amount of heat each point has determines the influence the bone has on it. No matter how complex your object is, this method will give you the expected results without weights passing through the polygons. However, this requires greater computing power than the first one, **Distance**, so it is recommended to use a multi-processor machine. For some reasons, you may abort the calculation before it's finished, by pressing the **Esc** key or by clicking the **Abort** button.
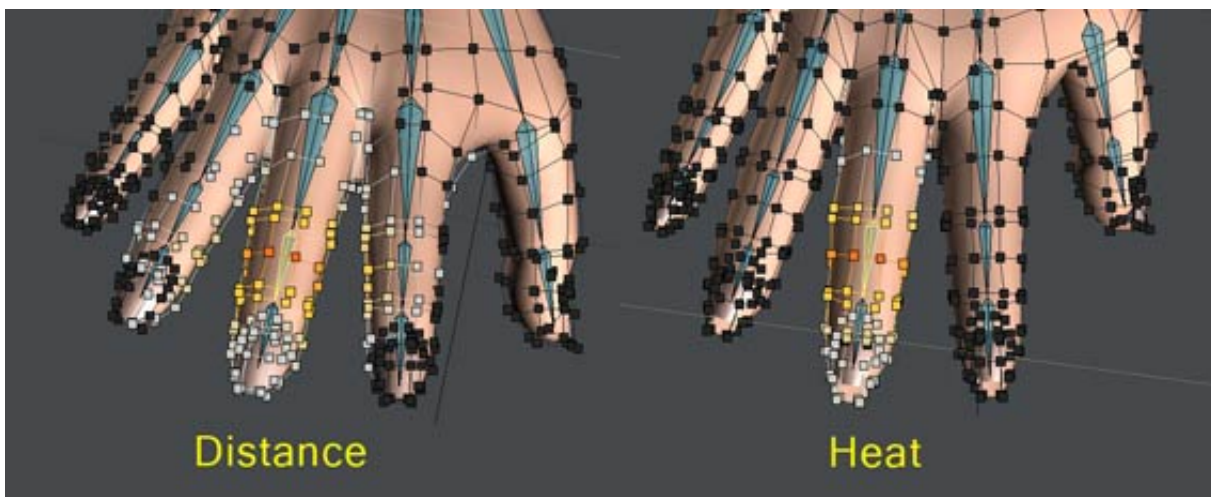
Rename Current Weight Map - changes the name of the current weight map. Entering the desired name in the **New Name** field and clicking the OK button will replace the name of the current weight map with the entered name.

Delete Current Weight Map - deletes the current weight map in the scene. After running this command, the currently selected weight map will be completely deleted from the current scene, and you will no longer be able to undo this step. If there are any other objects assigned to the current weight map, those weights will also be completely deleted. There is no way to recover deleted weights, except to reload the objects, so please make sure that the weight map is no longer needed before deleting it.

Copy Current Weight Map - makes a copy of the current weight map. You can determine what name is going to be given to the newly created copy by entering the desired name in the **New Name** field, the same way as the Rename command.

Combine Weight Maps - combines multiple weight maps you checked in the Weight Map list into the top one of them. All of the other checked weight maps will remain in the list, but all the points of the current object will be unassigned to them.
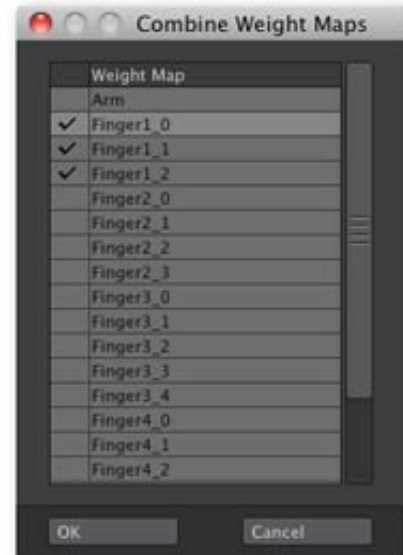
Change Settings for Bones - You can change some settings relating to the bone weight here. These are the same as the settings on the Bone Properties Panel. If there are some parts of settings you don't want to change, uncheck the **Change** options to disable them. Clicking the OK button will immediately change the settings for the currently selected bones, if there are not any selected bones, for all bones under the current object. You can also undo and redo this step by clicking on the **Undo** button, so you don't need to worry about making mistakes.
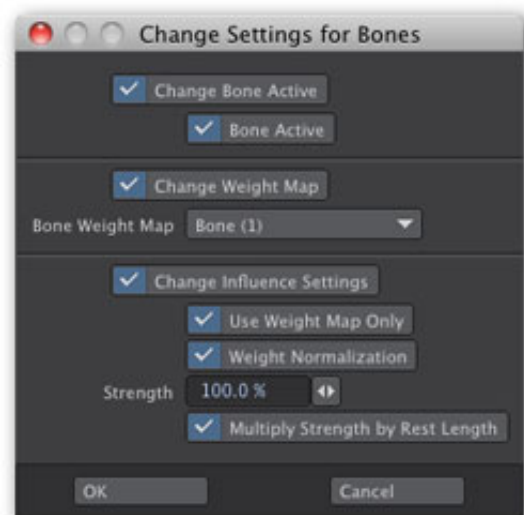
Open Custom Command Buttons Panel - assigns your desired command to each of the five custom command buttons. After assigning, you can run the command assigned to the button by clicking on it, instead of choosing a command from the Edit drop down menu. Because some of the commands can be executed without opening a panel, depending on what command is assigned, that can be useful for repeatedly running the same command several times. However, in that case, you will need to adjust settings on the panel in advance.
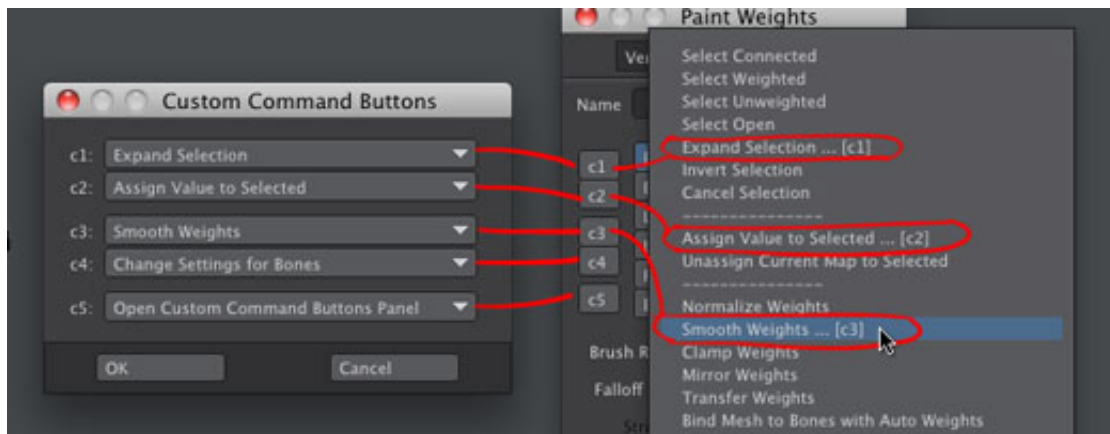
Open Gradient Panel - opens the Gradient Panel that allows you to create a custom gradient with multiple colors. The display color of each point is determined by evaluating the gradient at its weight value. The gradient settings are stored in a config file, which is reloaded when Layout is launched.
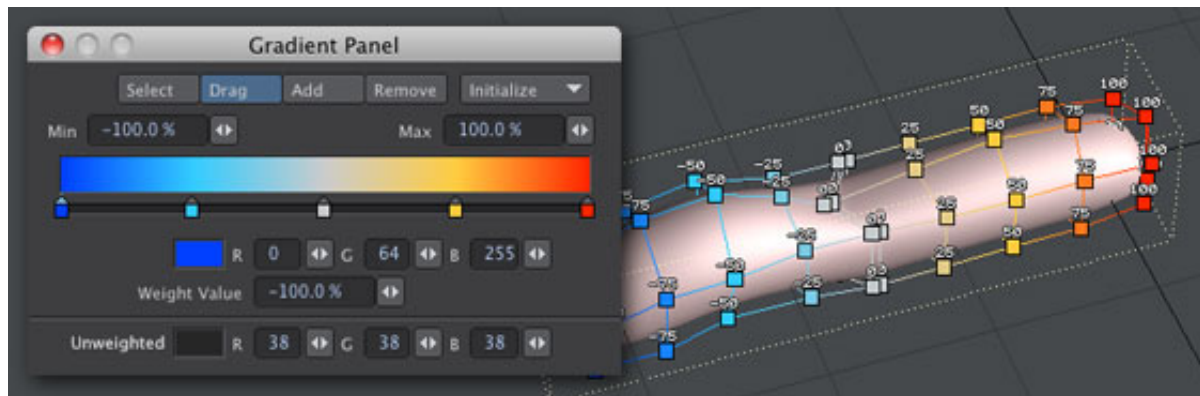
This panel offers the following four modes for editing key markers of the gradient.

Select - highlights the key that you clicked on.
Drag - refines the position of the key that you clicked and dragged.
Add - creates and inserts a new key at the position that you clicked on the gradient bar.
Remove - removes the key that you clicked on.

Also, right-clicking on the gradient bar will add a new key, and dragging and dropping a key out of the panel will remove it.

The **Min** specifies the minimum of the weight value range for the gradient, and the **Max** specifies the maximum of the range. On the bottom of the gradient bar, the **RGB** sliders will show and specify the color of the currently highlighted key, and also the **Weight Value** will show and specify its weight value. The **Unweighted RGB** sliders specify the display color of unweighted points (unassigned to the current weight map).

You can choose a built-in gradient to initialize the gradient settings from the **Initialize** pop-up menu in the top-right corner of the Gradient panel. This pop-up menu offers the following gradient settings:

LightWave-style - the familiar multi-color gradient, red(positive values) and blue(negative values).
**Spectrum** - the Rainbow Spectrum gradient.
Sunny Garden - the multi-color gradient, yellow, green, and blue.

## Example 1: Using the Heat Map Binding

Let's use our new weapon for automatically creating weight maps for bones right away. In Layout, we've loaded the "ClawHand.lws" file found in the content. The claw hand of an animal or an alien loaded in our viewport already contains bones, which has a motion of a clench, but the mesh of the object cannot be deformed because it has not been bound to the bones yet. So let's bind the mesh to the bones.
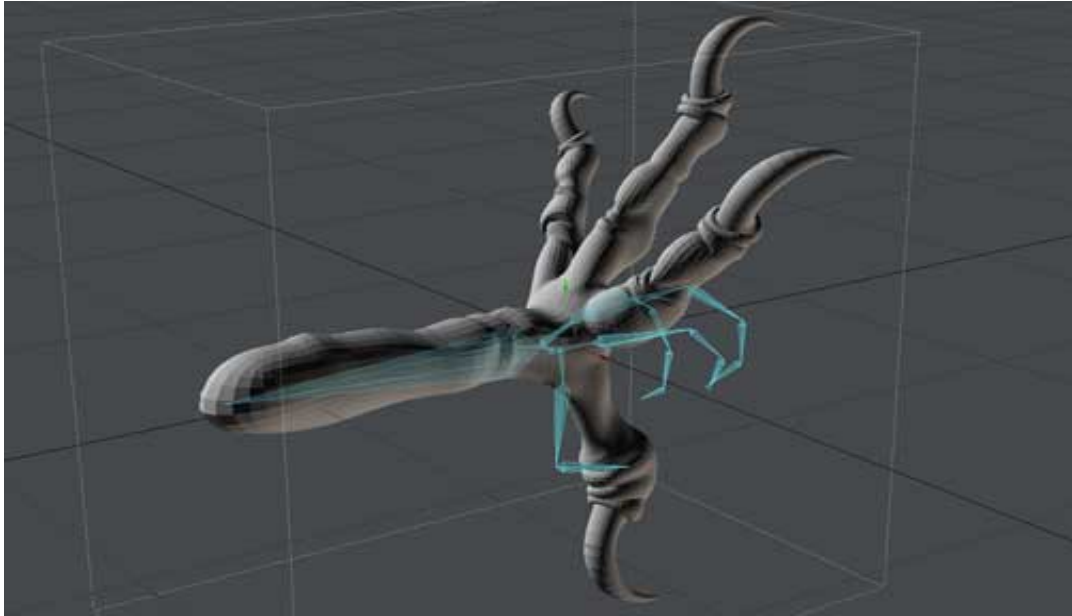

We've opened the Paint Weights tool with the "ClawHand" object selected. Then we've moved the timeline slider to frame 0 and chosen the **Bind Mesh to Bones with Auto Weights** command from the **Edit** drop down menu. With the **Method** set to "Heat", the option of "**All Bones**" chosen from the **For** pop-up, and the **Active Bones** checked, clicking the OK button will give us a result.
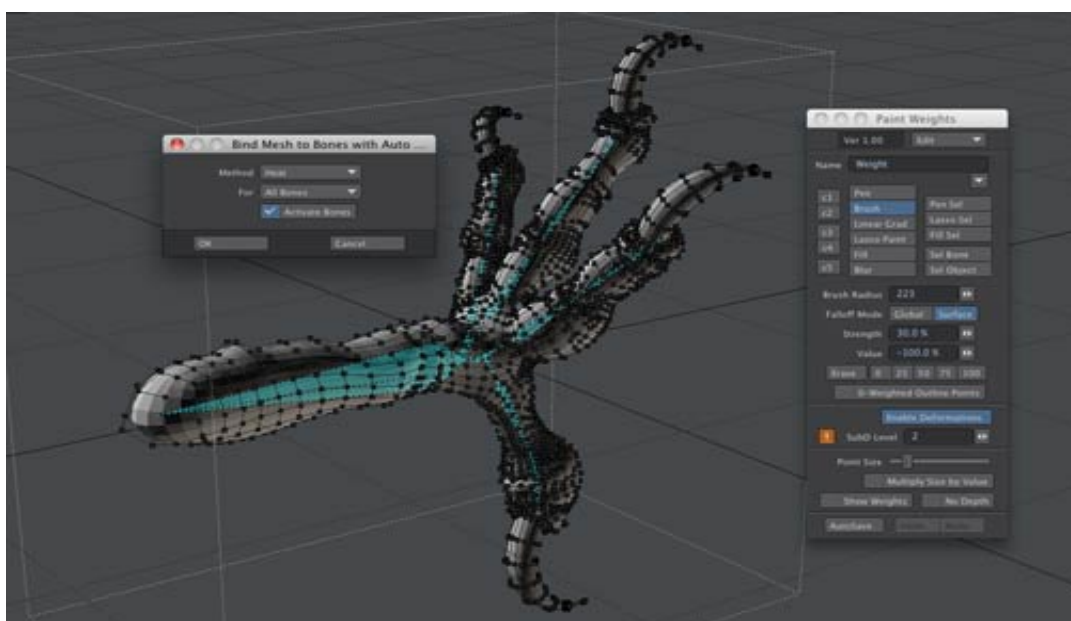
Yes, we've easily gotten the weight maps for all of the bones in our object without using difficult juggling tricks, and the object can be animated with the bones already active. We'll move the timeline slider to animate it. You may have noticed that the wireframe edges of bones have gone from dash to solid. This means that the weight maps have been assigned to the bones. When the edges of a bone are solid, there is a weight map assigned to it. When dashed, no weight map.
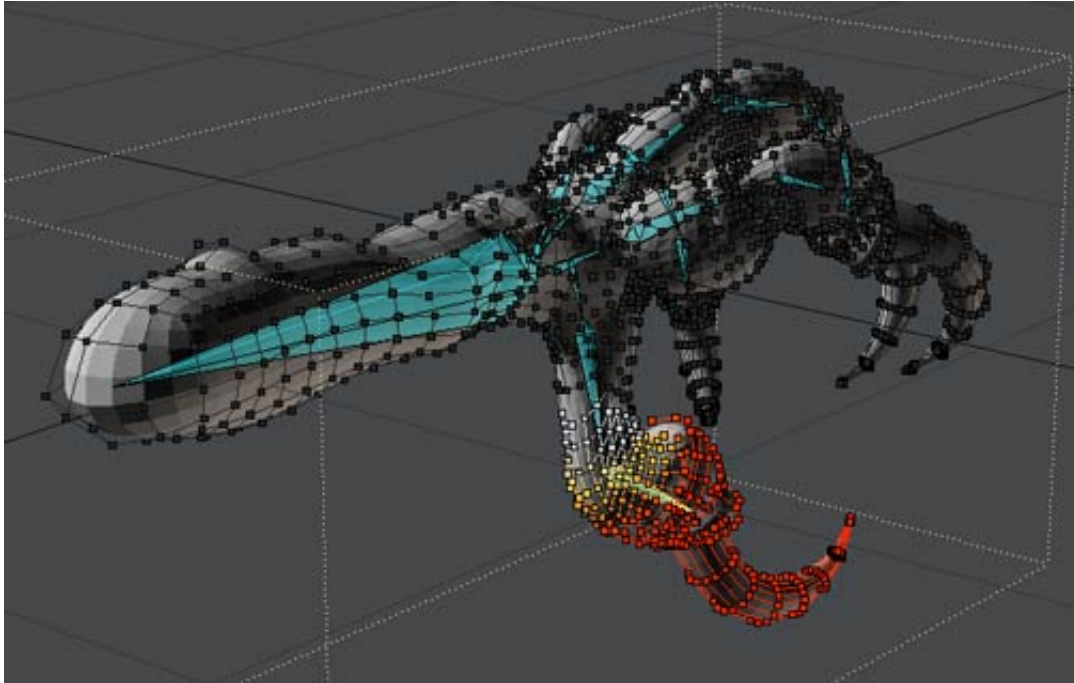

It seems that there is a self-overlapping part of the geometry due to lack of smoothness of the weights around the wrist.
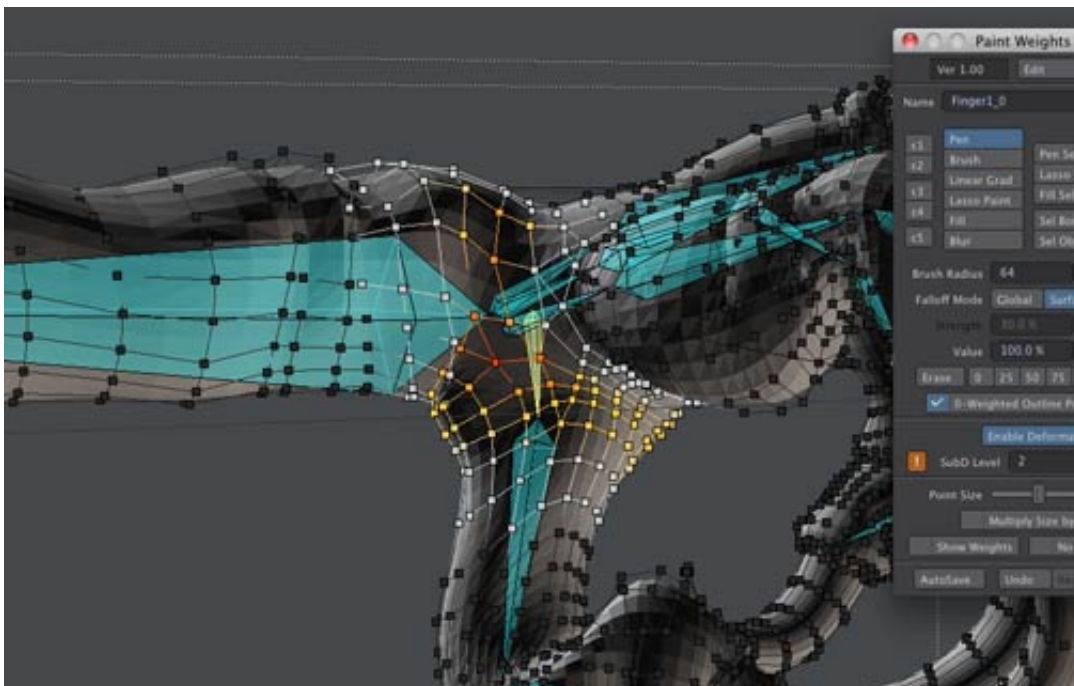
First, we've made sure the **Falloff Mode** is set to **Surface** and that the **No Depth** option is unchecked. To make the deformation soft and smooth, after switching to **Pen Sel** mode and adjusting the **Brush Radius**, we'll select the points of the overlapping polygons and select points around them by dragging on the surface of the object. Left-clicking and dragging will select or deselect points, and right-clicking and dragging will add more points to the existing selection.
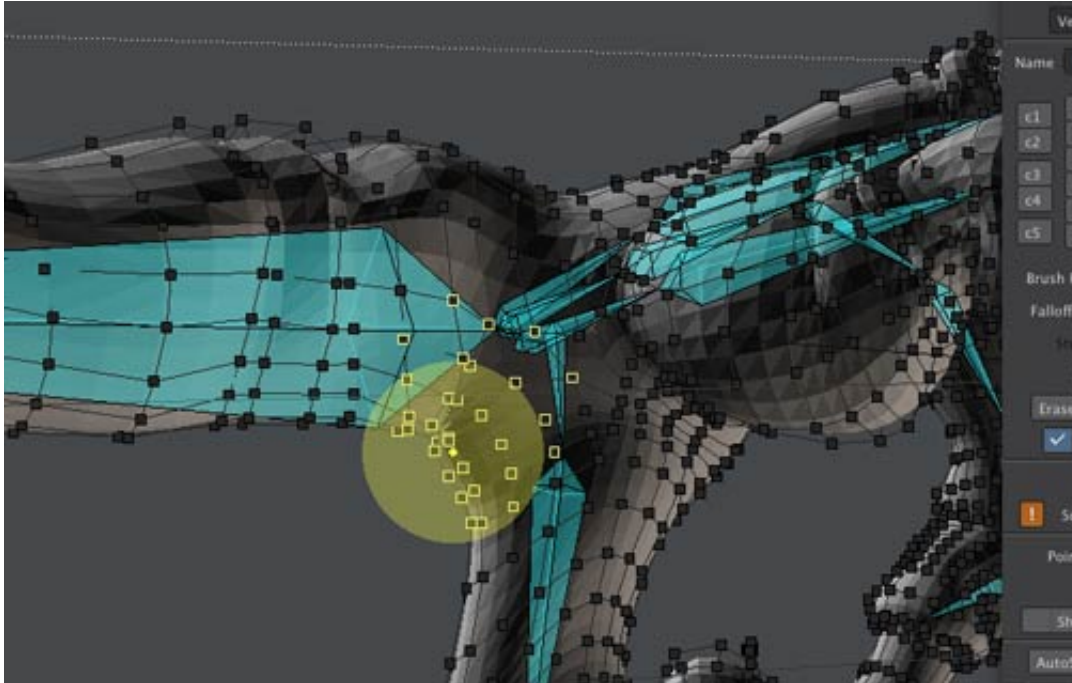
Then we've chosen the **Smooth Weights** command from the **Edit** drop down menu. With the option of "**Weights Assigned to Bones**" chosen from the **For** pop-up, a **Strength** value of 100% and a **Iterations** value of 8, clicking the OK button will give us an expected result.
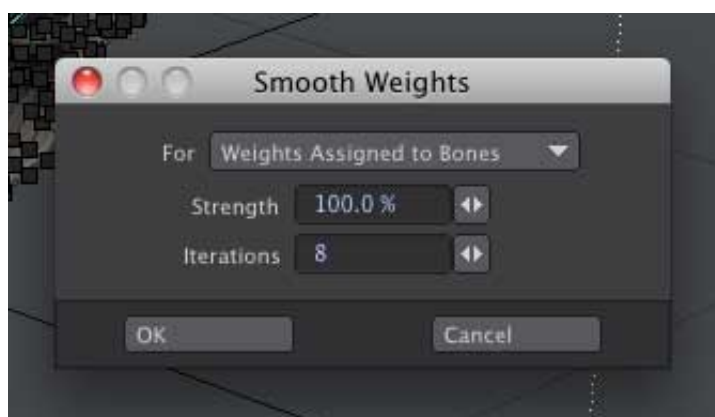
OK, it looks good. The deformation of the mesh has gotten softer and better. The overlapped polygons have been smoothed out with the smoothed weights. In addition, in some cases, we might want to use the **Blur** brush to refine weights.
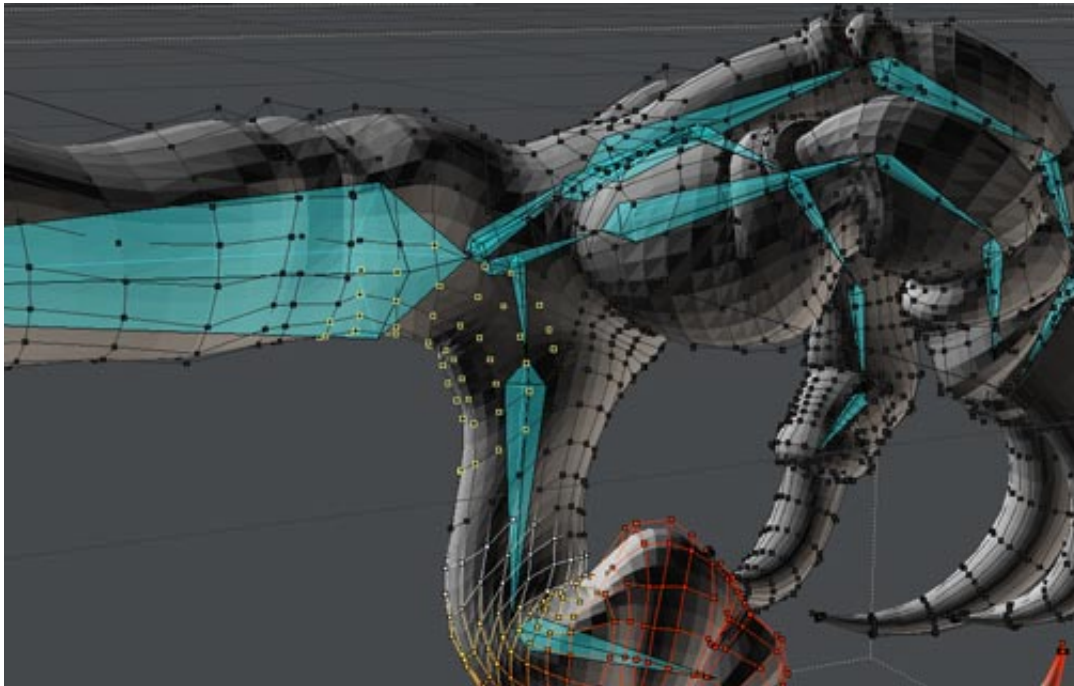

## Example 2: Transferring Weights between the Meshes of Objects

We'll keep the previous scene open and transfer the weights from the "ClawHand" object to another object this time. It's difficult to freehand paint separate parts of objects while also causing them to deform along each other, but fortunately there is a command for simplifying such hard work. First, we've closed the Paint Weights panel to exit weight painting mode because it is not recommended to use a Layout tool together with any other tool or command. Then we've loaded the "ClawHand_coat.lwo" file found in the content. We now want to put this finger coat on the "ClawHand" object.

With the "ClawHand_coat" object selected, we've opened the Object Properties Panel and set the **Subdivision Order** to **Last**, and then we've opened the Bone Properties Panel and chosen the "ClawHand" object from the **Use Bones From Object** pop-up menu. However, the coat object still cannot be deformed with bones because its points have no weights.
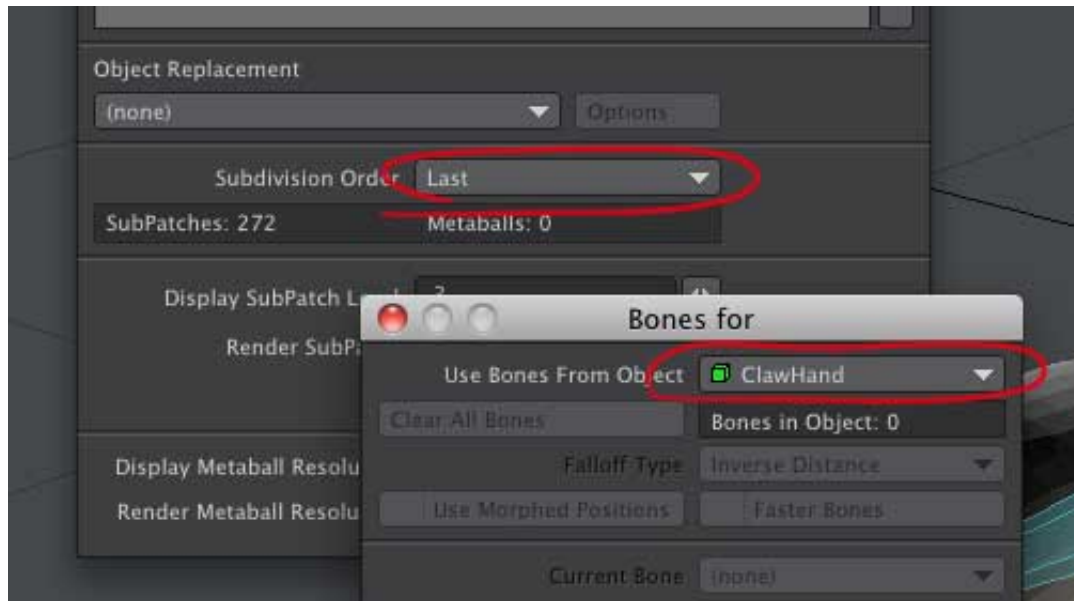
We've opened the Paint Weights tool again with the "ClawHand_coat" object selected. Then we've moved the timeline slider to frame 0 and chosen the **Transfer Weights** command from the **Edit** drop down menu. With the "ClawHand" object chosen from the **Source Object** pop-up and the **All Weight Maps** option checked, clicking the OK button will give the coat object a copy of the weight maps projected from the surface of the "ClawHand" object to the "ClawHand_coat" object.
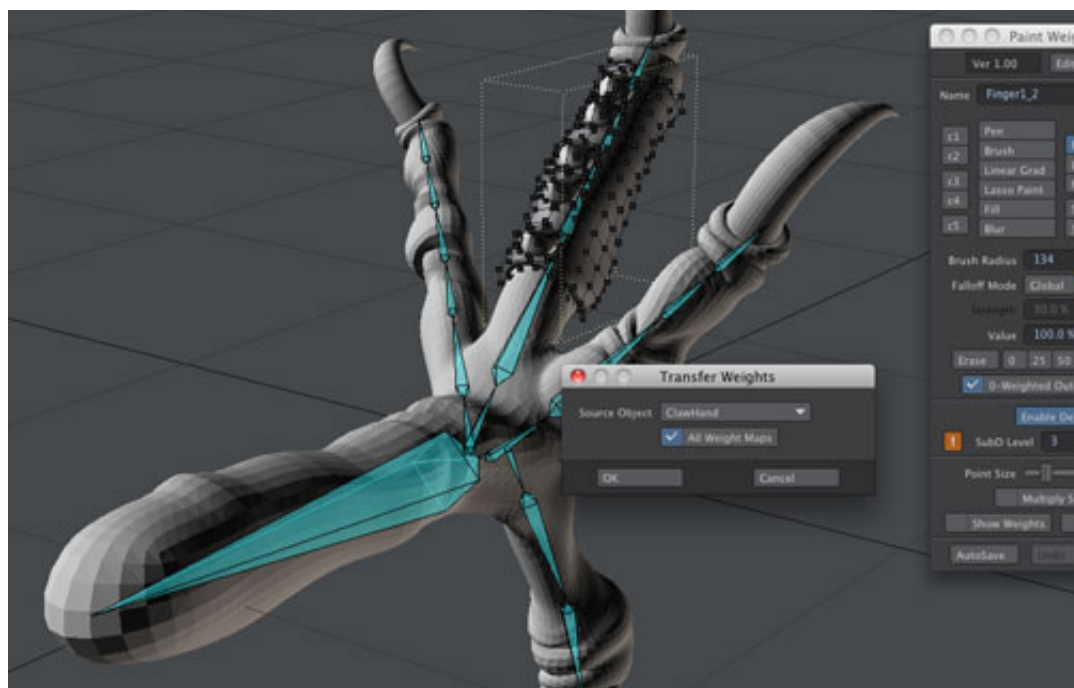
In our viewport, it can be seen that the coat object has certainly received the weights from the hand object without any issues.
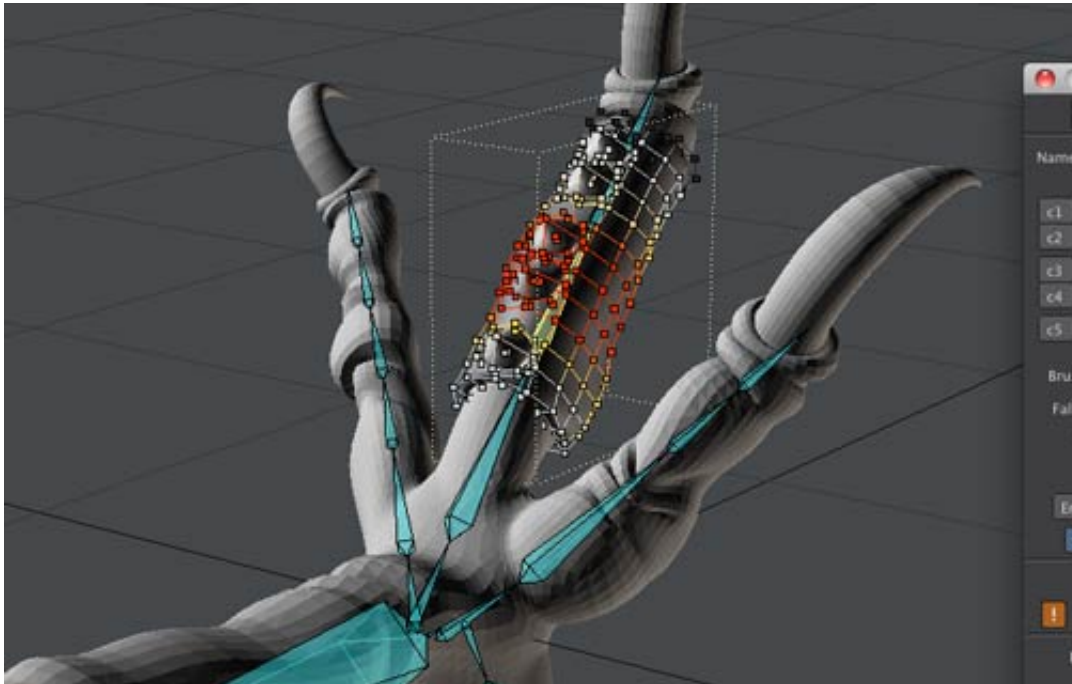
Let's move the timeline slider to see if the coat object deforms along with the hand object.