Chapter 7. Skinning the Low Resolution Mesh

In this chapter, we will be covering the following recipes:

- Parenting the Armature and Mesh using the Automatic Weights tool
- Assigning Weight Groups by hand
- Editing Weight Groups using the Weight Paint tool
- Using the Mesh Deform modifier to skin the character
- Using the Laplacian Deform modifier and Hooks

Introduction

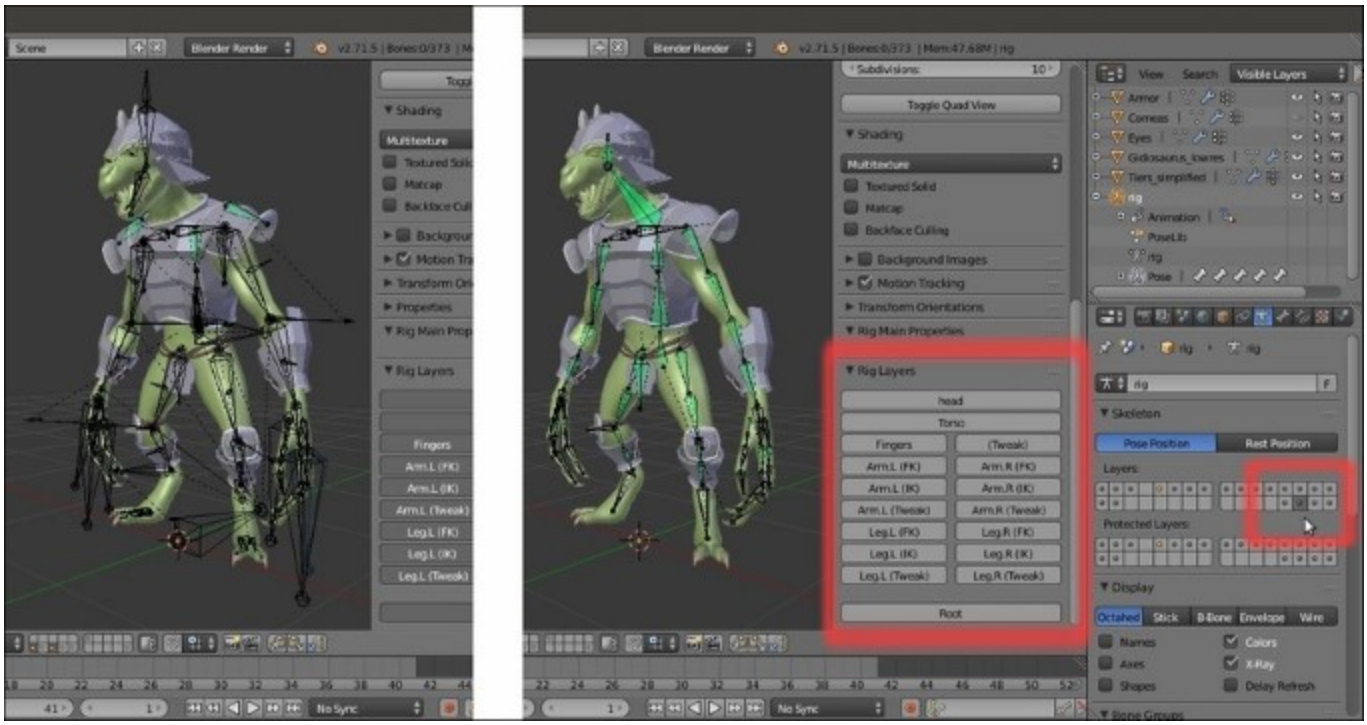
In the previous chapter, we saw the **rigging** stage, that is, how to build the character's rig (which in Blender is called an **Armature**) that will be used to deform the mesh for animations. In this chapter, instead, we are going to see quicker and more effective ways to do the **skinning** that is a necessary step to bind the bones of the **Armature** to the mesh's vertices so that they can be deformed.

To allow an **Armature** to deform a **Mesh**, they must be parented with some kind of relation; in Blender, usually you must select the **Mesh** and then *Shift* select the **Armature** and press *Ctrl + P* to parent them with different options.

This automatically makes the **Mesh** object a child of the **Armature** object and assigns the **Armature** modifier to the **Mesh**. In fact, the parenting would not be strictly necessary; it would be enough to assign an **Armature** modifier to the mesh and manually select the rig as a deforming object, but it's a good habit to use the *Ctrl + P* parenting to have the rig as a parent of the mesh, also in **Object Mode**. This way, whenever you move the **Armature** in **Object Mode**, the mesh will follow it automatically.

For the examples in these recipes, to skin the **Armature** to the **Gidiosaurus** mesh, we are going to use the final version of the rig we have built with our hands: the one saved as `Gidiosaurus_rig_from_scratch_02.blend`.

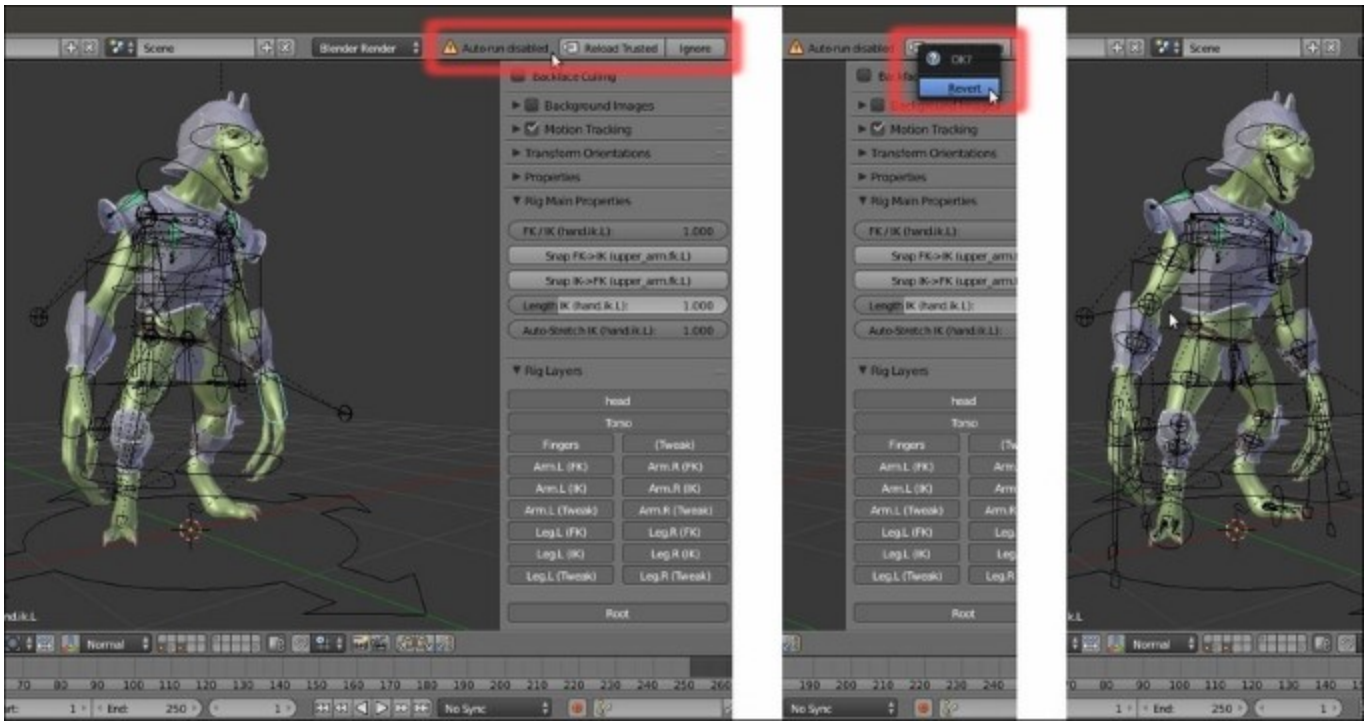
Anyway, if you want to put this to practice, in this chapter, with a more complex and complete **Rigify** armature (`Gidiosaurus_rigify_02.blend`), the procedure is exactly the same. In this case, even if not strictly necessary, remember that you can enable the **30th Armature layer** (in total there are **32**) to show the deforming bones; instead, disable the visibility of all the other bone layers also by the Python button interface in the **Rig Layers** subpanel under the 3D window **Properties** side panel:



The Rig Layers panel in the N Properties sidepanel and the Armature bone layers button in the Skeleton subpanel under the main Properties panel

Remember to check in your **User Preferences** panel (press *Ctrl* + *Alt* + *U* to call it) if you have, under the **File** tab, the **Auto Run Python Scripts** item enabled; otherwise, the rig based on Python scripts or expressions (like the rigs obtained through the **Rigify** add-on) won't work properly.

In this case, Blender will warn you through an **Auto-run disabled** message visible in the top main header; it's enough to click the **Reload Trusted** button to the right and then confirm by clicking on the **Revert** item in the pop-up menu that appears, to reload the `.blend` file with the scripts enabled and to have everything working as expected:



To the left, you can see several bones apparently missing in the rig because it is wrongly oriented, and the "Auto-run disabled" warning in the top main header; to the right, you can see the restored rig

Parenting the Armature and Mesh using the Automatic Weights tool

In this recipe, we are going to see one of the more commonly used parenting options: the handy **Automatic Weights** tool.

Getting ready

Start Blender and open the `Gidiosaurus_rig_from_scratch_02.blend` file.

1. Select the **Armature** item in the **Outliner** and press *Ctrl* + *Tab* to go out of **Pose Mode** and enter **Object Mode**.
2. Go to the **Armature** window under the **Properties** sidepanel to switch the **Display** mode from **Wire** to **Octahedral** and deselect the **Shapes** item.
3. Enable the third **Armature** layer by clicking on the **3rd** button under the **Skeleton** subpanel.
4. Disable the **13th** scene layer to hide the **Armor**.
5. Go in to **Edit Mode** and *Shift* multi-select the **MAIN** bone, the **pole** bones and the **ctrl** bones; in short, all the bones that don't have to deform anything, but are used to control the rig. Press *Shift* + *W* and in the **Toggle Bone Options** pop-up panel, select the **Deform** item to disable it for all of them at once:

Toggling the Deform item for all the selected bones at once

6. Now, deselect everything and select all the bones that, in the previous chapter, we had added specially to rig the **Armor** object, using the **Armature Layers** buttons: the **armor_ctrl** bone,

groinguard, **vanbrace.L** and **.R**, **greaves.L** and **.R**, **kneeguard.L** and **.R**, **spaulder.L** and **.R**; again, press *Shift* + *W* | **Deform** to disable the option.

Repeating for the Armor object bones

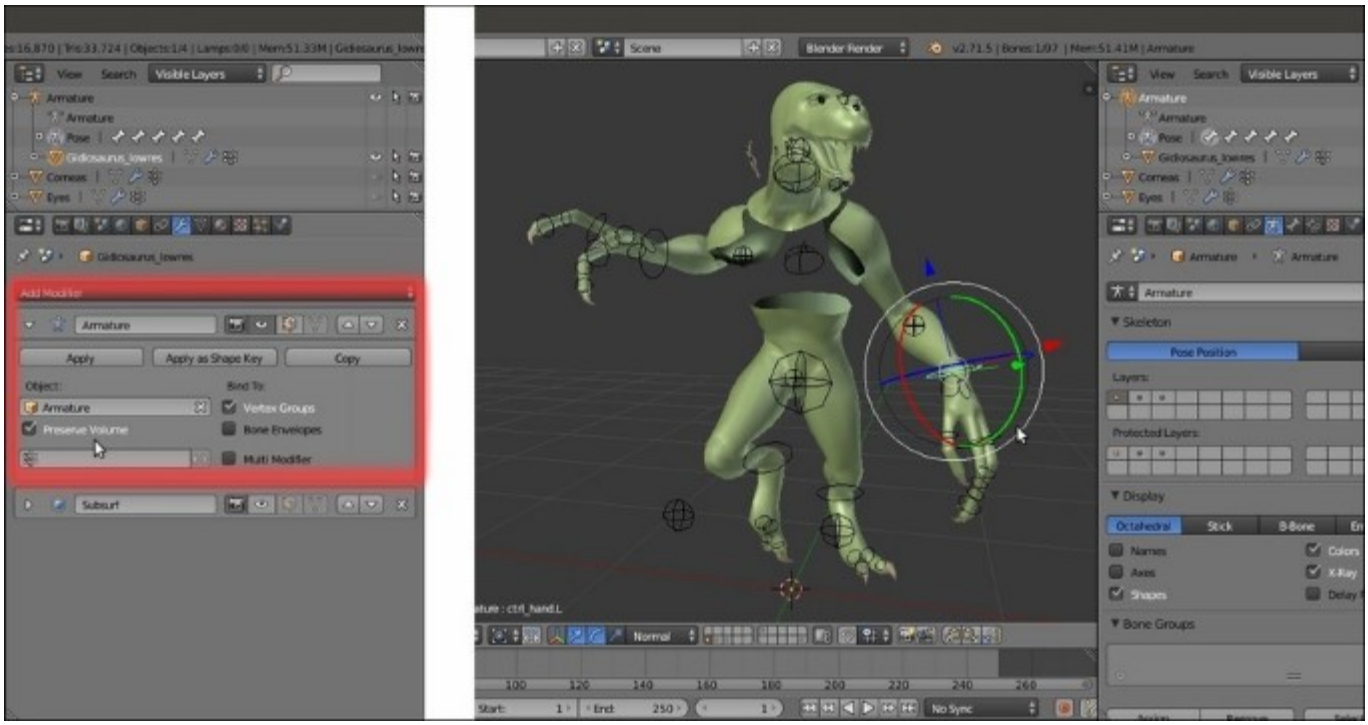
7. Don't *deselect* the **Armor** bones, simply switch from **Edit Mode** to **Object Mode**.

How to do it…

1. Select the **Gidiosaurus_lowres** object and then *Shift*-select the **Armature**, and press *Ctrl* + *P*; in the **Set Parent To** pop-up menu; select the **With Automatic Weights** item:

The Set Parent To pop-up menu

2. Reselect the **Armature**, go in to **Edit Mode**, and press *Shift + W* | **Deform** to re-enable the item for the still-selected **Armor** bones; then, go out of **Edit Mode**.
3. Now, reselect the **Gidiosaurus** object; go to the **Object Modifiers** window, move the newly created **Armature** modifier upwards in the stack, and enable the **Preserve Volume** item.
4. Disable the *Display modifier in viewport* button (the one with the eye icon) of the **Subdivision Surface** modifier to speed up the 3D viewport (sadly, Blender still has very bad real-time viewport performances, so even if you have a lot of RAM and a powerful workstation, it's wise to stay as light as you can).
5. Select the **Armature** and under the **Object Data** window, re-enable the **Shapes** item and hide the second and the third **Armature Layer**; press *Ctrl + Tab* to go in **Pose Mode** and try to select some of the control bones to move or rotate them and so control how they are deforming the mesh; temporarily, hide the **Eyes** object in the **Outliner**.



The Armature modifier subpanel and the posed mesh

To rotate the bones on their local axis, enable the **3D manipulator widget** in the 3D view toolbar (*Ctrl* + Spacebar), click on the **Rotate** icon, and set **Transformation Orientation** to **Normal**.

6. Save the file as `Gidiosaurus_autoweights.blend`.

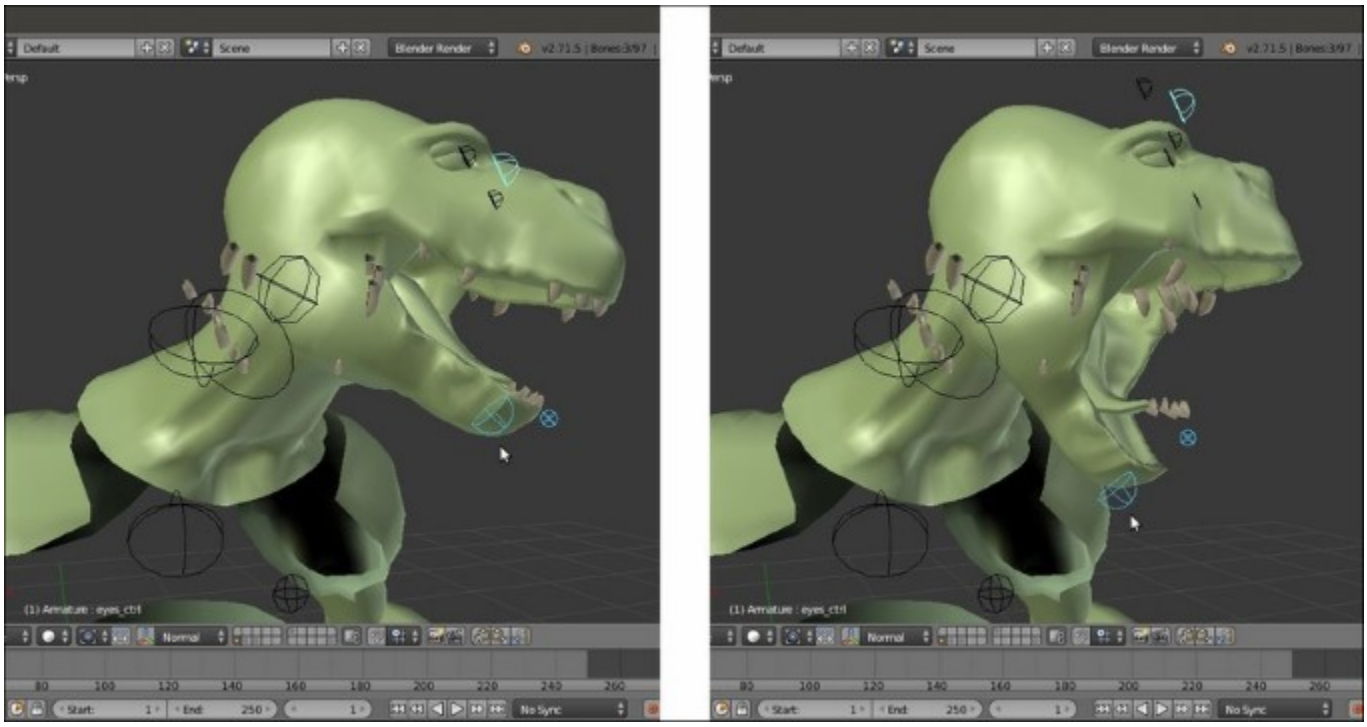
How it works…

The **Automatic Weights** tool creates the necessary **Vertex Groups** based only on the bones that have been set as **Deformers** in the subpanel under the **Bone** window. It then assigns weights inside a range from **0.000** to **1.000** to the vertices contained in these vertex groups, calculating their proximity to the bone with the same name. In short, the **arm.L** bone will deform only the vertices inside the **arm.L** vertex group, and with an intensity based on their weights.

Because we used the **Automatic Weights** tool to skin only the sole **Gidiosaurus** mesh (leaving the skinning of other objects such as the **Eyes** or the **Armor** for the next recipe and method), before the parenting we had to check for any bone erroneously left as a deformer (that is, one of the several control bones in the previous chapter), but, especially we had to temporarily disable the **Deform** item for the **Armor** bones, which otherwise would have also been evaluated by the tool for the **body**.

In most cases, the **Automatic Weights** tool can give quite good results without the need of further tweaking; however in some areas, for example the **head**, where the **head** bone length doesn't fully fit the upper part of the shape of the mesh and where there are also other deforming bones, it can easily fail.

Look at the following screenshot; at first, by rotating the **head** control, the only issue seems to be some of the **teeth** left out from the calculations but then, simply by moving the controls for the **eyes**, **tongue**, and **jaw**, it becomes evident that the tool assigned several vertices to the wrong bones merely based on their proximity to that part of the mesh:



The failure of the Automatic Weights tool parenting

Although at first sight this can appear to be a total mess, it's usually less complex to fix than one might think.

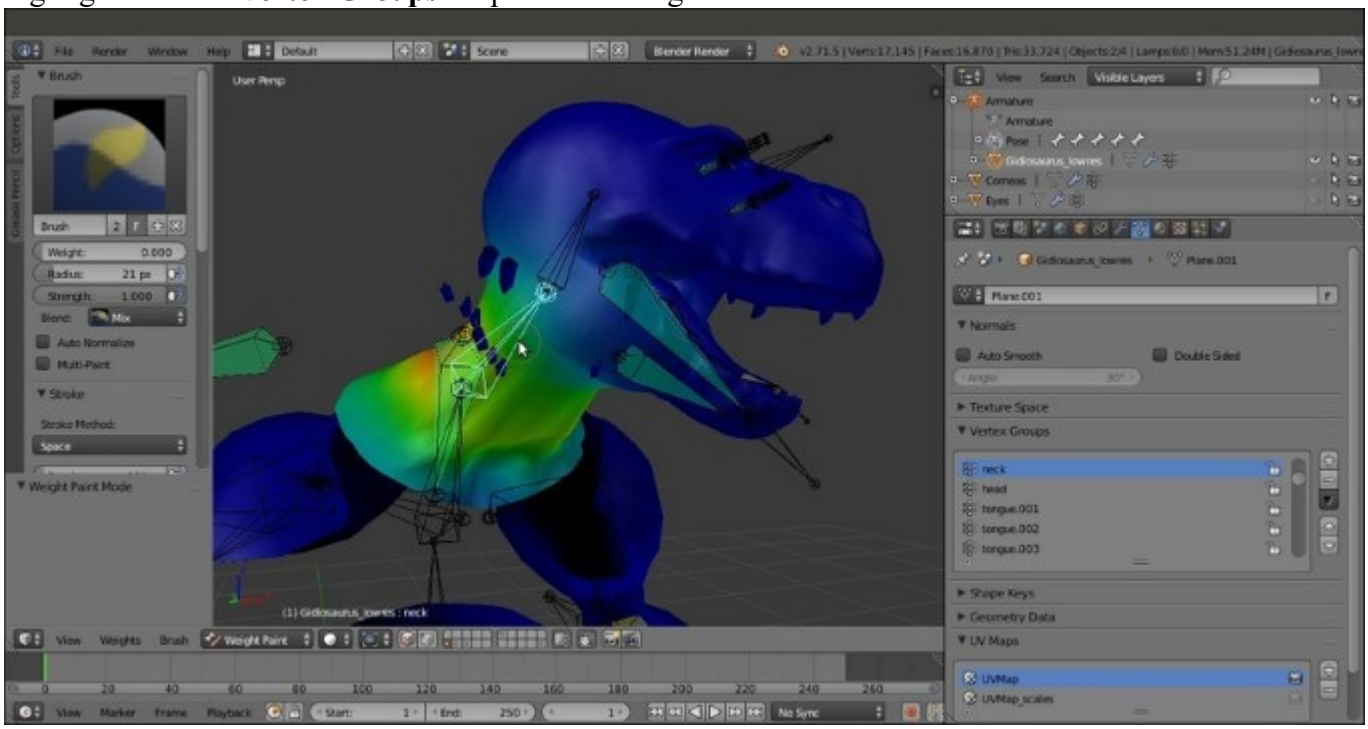
For the moment, by selecting the **Gidiosaurus** mesh and pressing *Ctrl* + *Tab*, we go in to **Weight Paint** mode, and by right-clicking on a bone (the **Armature** is still in **Pose Mode**), the weights of the corresponding vertex group became visible as colored areas on the mesh; the color **red** corresponds to a weight value of **1.000** and **blue** to a value of **0.000**, with all the intermediate hues corresponding to the intermediate values. For example, **green** = **0.500** and so on.

There's more…

Let's see all this step by step:

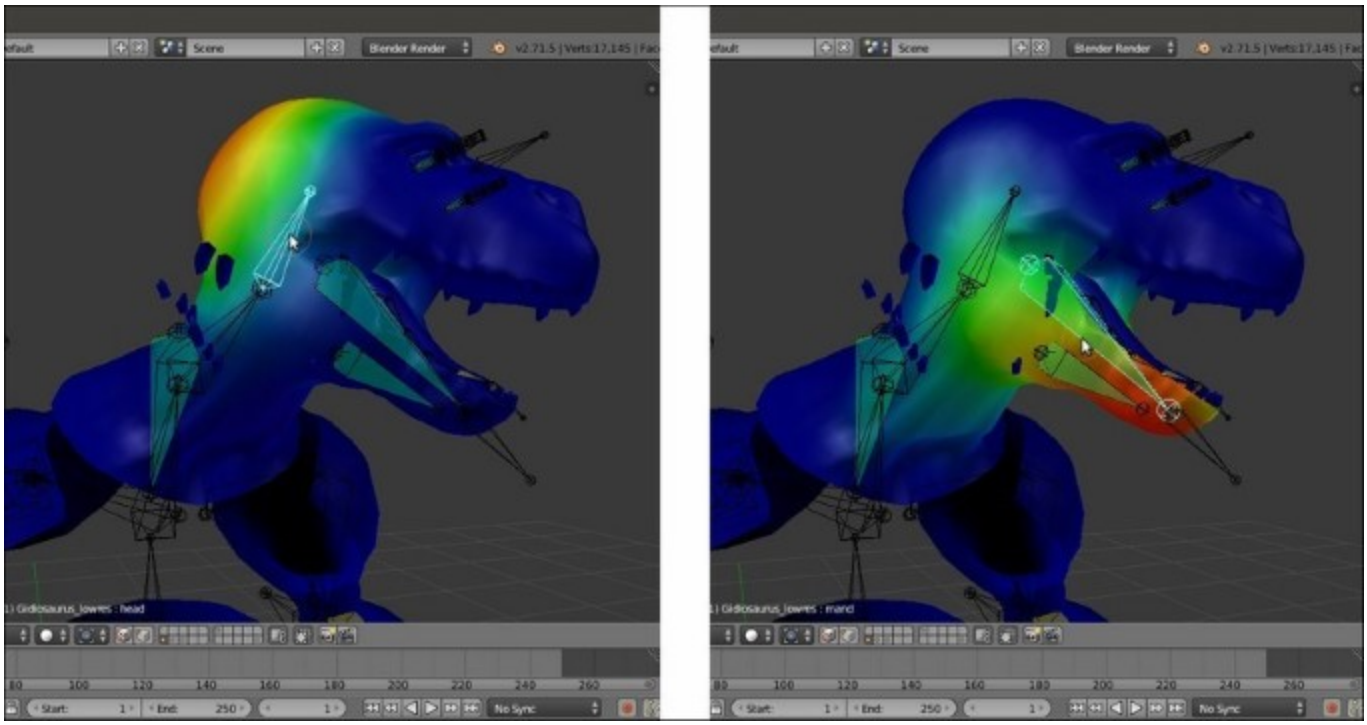
1. Select the **Armature** and, while still in **Pose Mode**, enable the visibility of the **third Armature layer** (and therefore of all the deforming bones) and then disable the **Shapes** item again.
2. Select the **Gidiosaurus** mesh and by pressing *Ctrl* + *Tab*, enter **Weight Paint** mode (or switch to it by the *object interaction mode* button on the toolbar of the 3D view).

3. Click on any one of the deforming bones, for example the **neck** bone, and notice that while the weights appear on the mesh surface, at the same time the corresponding vertex group is highlighted in the **Vertex Groups** subpanel to the right:



Visualizing the vertex groups on the mesh

By clicking on the **head** bone and/or the **mand** bone, the reasons for the bad deformations are immediately clear: the **Automatic Weights** tool didn't assign the whole upper part of the **head** of the character to the sole **head** vertex group (and therefore to the bone with the same name) with a full value of **1.000**; instead, it assigned part of the **head** mesh to the **eyes** bones, other parts to the **tongue.005** bone, some to the **mand** bone, and so on.



Different weights of the vertex groups associated with different bones

Obviously, this isn't the tool's fault, but it is an *unavoidable issue* due to the particular arrangement of the bones in the **head** area and can be quite easily fixed anyway; we'll see how in the next and the *Editing the Weight Groups by the Weight Paint tool* recipe.

See also

- http://www.blender.org/manual/rigging/skinning/obdata.html

Assigning Weight Groups by hand

This technique is the oldest way to assign weights to vertices groups in Blender. Although now there are quicker ways to do the same thing, in some cases it's still one of the best approaches, which can reveal itself to be quite useful mainly because you can precisely select individual or edge-loops of vertices to be weighted inside a group.

Getting ready

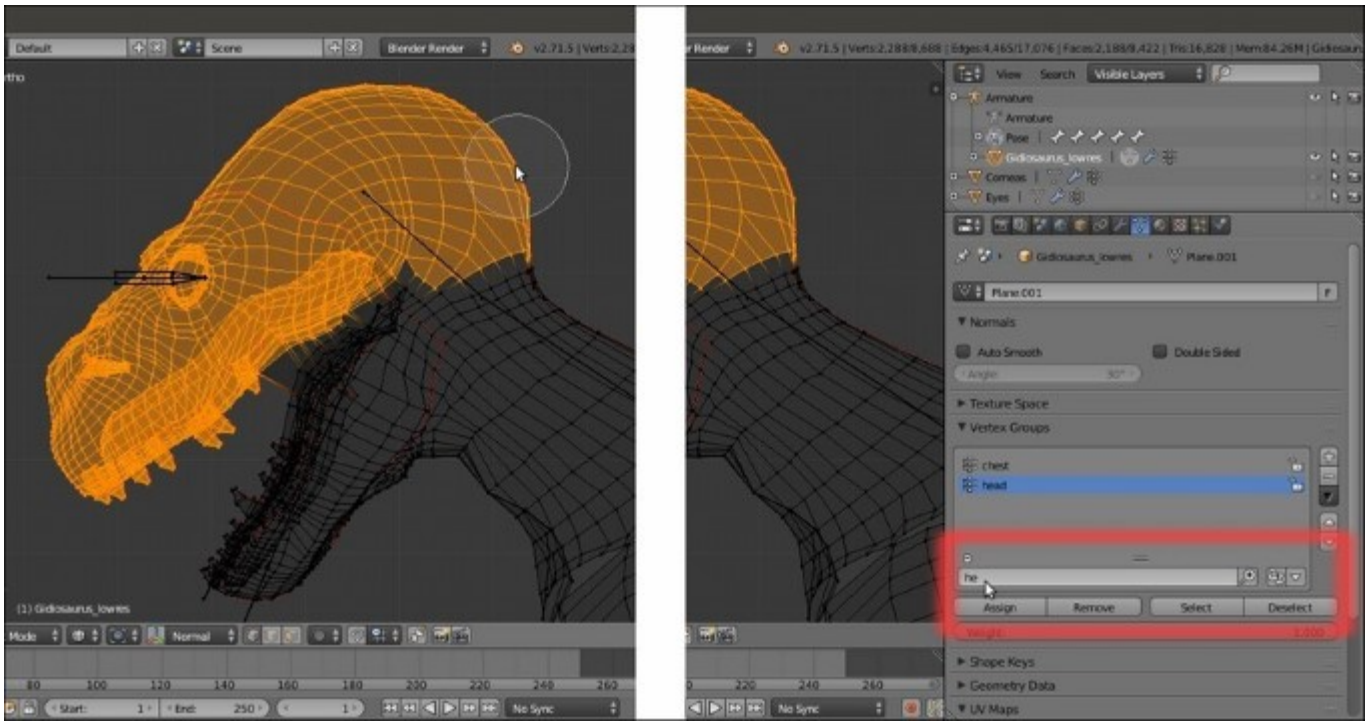
Open the `Gidiosaurus_autoweights.blend` file we saved in the previous recipe.

1. If necessary, press *Ctrl* + *Tab* to go out of **Weight Paint** mode.
2. Select the **Armature** (which should still be in **Pose Mode**), press the *A* key twice to deselect-select all the bones, and press *Alt* + *R* and *Alt* + *G* to clear any rotation or position and restore the default pose.
3. Press the *3* key on the numpad to go in to **Side** view; if necessary, the *5* key on the numpad to go in to **Ortho** view and the *Z* key to go in to **Wireframe** viewport shading mode.
4. Select the **Armature** and disable the **Shapes** item; switch the draw mode of the bones to **Stick** and enable the third **Armature** layer to show the deforming bones.
5. Save the file as `Gidiosaurus_skinning_01.blend`.

How to do it…

First, we are going to use this technique to fix the **head** deformation as follows:

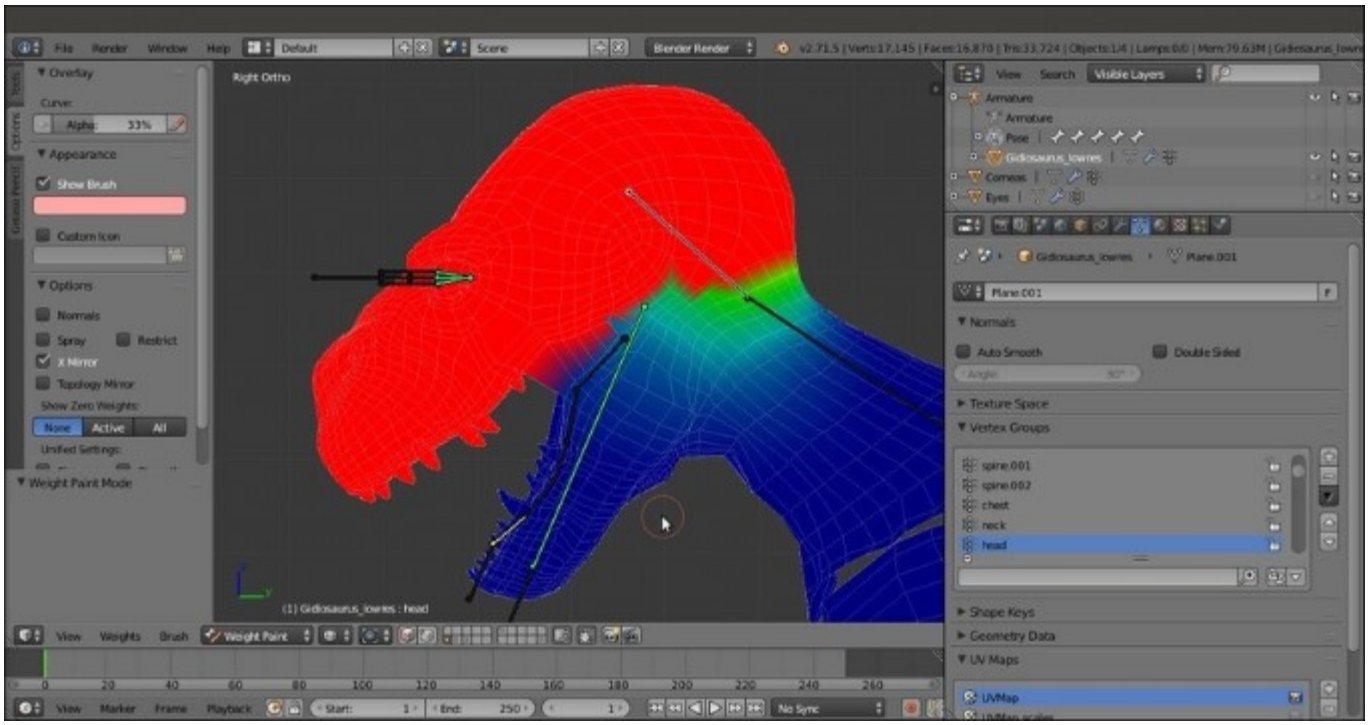
1. Press *Shift* + *B* to draw a box around the **head** of the **Gidiosaurus** mesh and automatically zoom to it. Select the mesh and enter **Edit Mode**.
2. Press the *C* key, through which the mouse cursor turns into a circle whose diameter can be set by scrolling the mouse wheel.
3. Start to *paint-select* the vertices you want to add to the vertex group; in this case, we must add the whole **upper head** to the **head** vertex group and also include the **upper teeth** that were missing in the group.
4. Be sure that the **head** vertex group is the selected one in the **Vertex Groups** subpanel under the **Object Data** window to the right, and that the **Weight** slider is set to **1.000**; then, click on the **Assign** button.
5. To quickly find a required vertex group, instead of slowly scrolling the list, just click on the grayed out little **+** icon at the bottom of the **Vertex Groups** window (just above the **Assign** button) to expand a blank search field and then write a few letters of the group's name followed by the *Enter* key:



The vertex group names search function

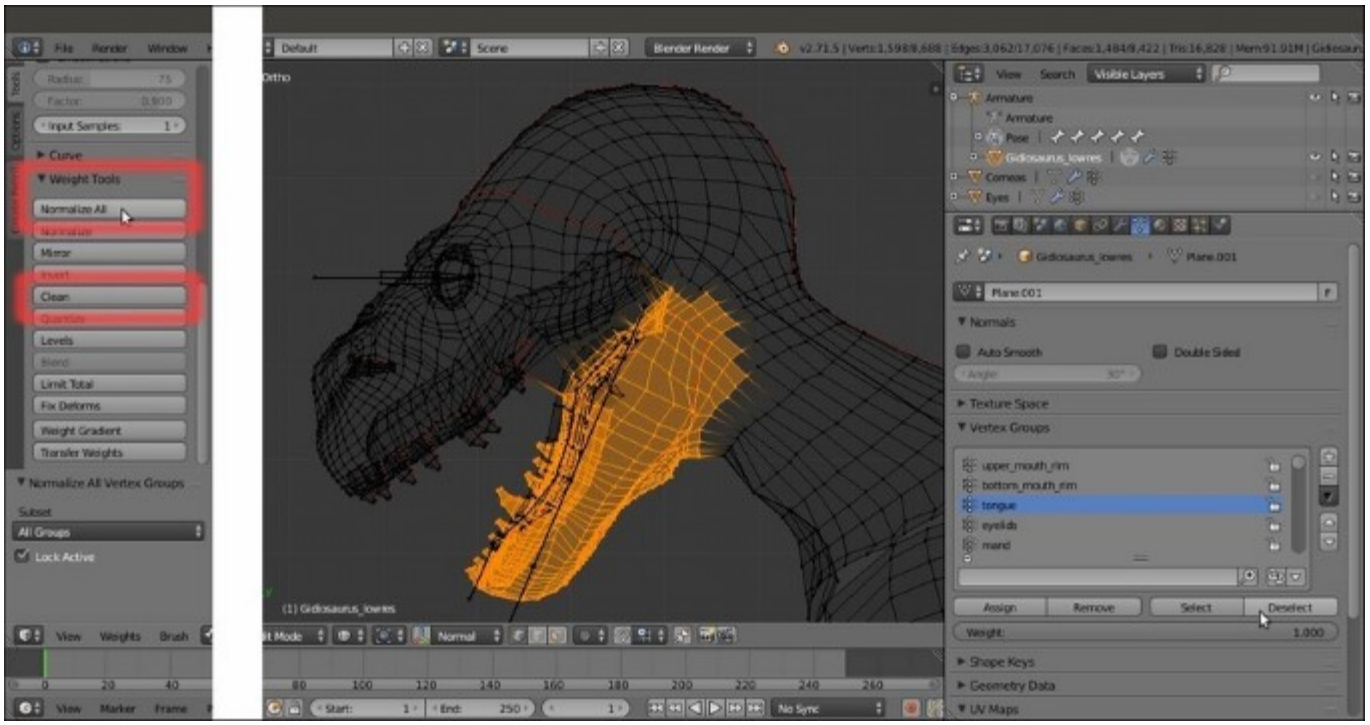
To get the complete list of vertex groups' names back, just erase the letters you wrote in the field and press *Enter*.

6. Now, switch from **Edit Mode** to **Weight Paint** mode again, where the **head** vertex group colors show a lot different than before:



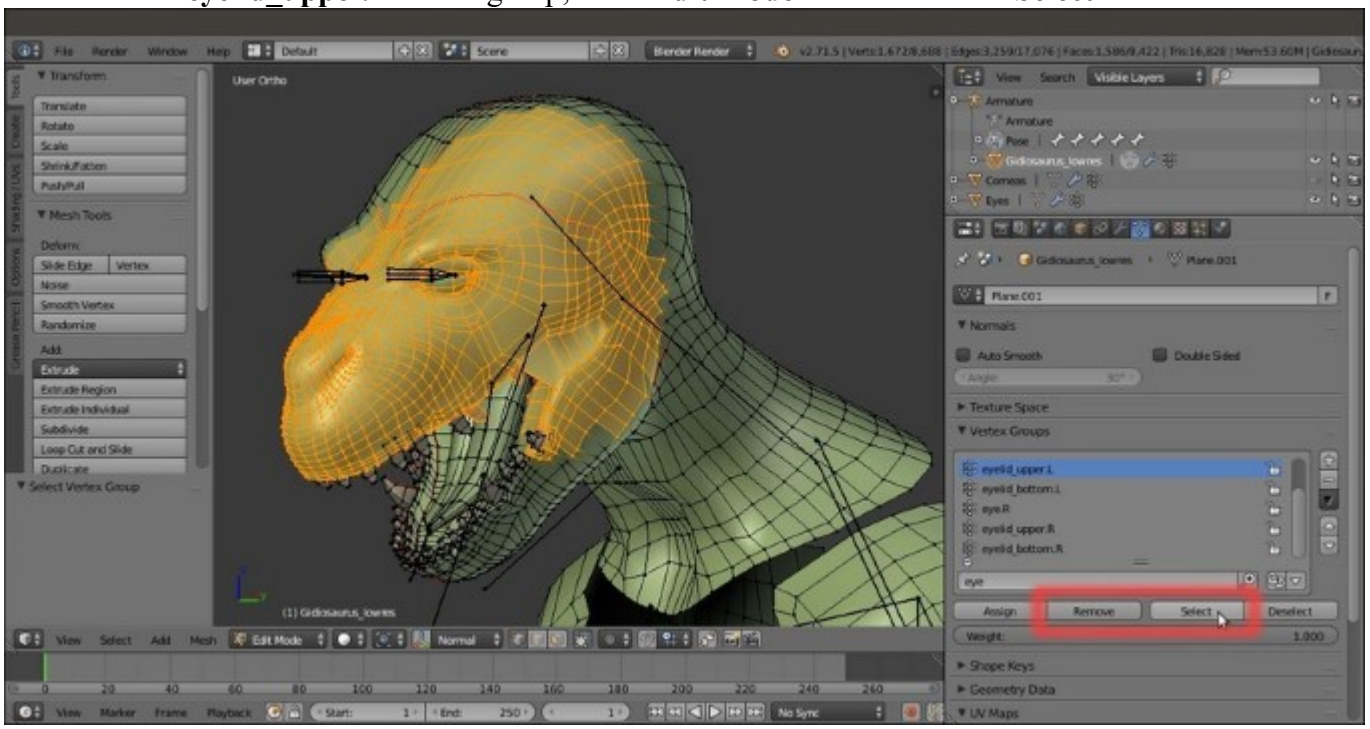
The modified "head" vertex group

7. Now, while still in **Weight Paint** mode, go to the **Tools** tab under the **Tool Shelf** to the left of the screen and, in the **Weight Tools** subpanel, first click on the **Normalize All** button and then on the **Clean** button.
8. Select the **mand** bone, go in to **Edit Mode**, and press *A* to deselect the vertices of the **head** vertex group. Select all the vertices of the **jaw**, including the **bottom teeth**; then go to the **Vertex Groups** subpanel to the right and deselect the **tongue** group by clicking on the, yes, **Deselect** button (we created the **tongue** vertex group chapters ago, during the modeling stage; otherwise, just deselect the tongue's edge-loops manually).
9. Find and select the **mand** group and click on the **Assign** button.
10. Go again in to **Weight Paint** mode and click on the **Normalize All** and **Clean** buttons under the **Weight Tools** subpanel:



The Weight Tools subpanel and the "mand" vertex group

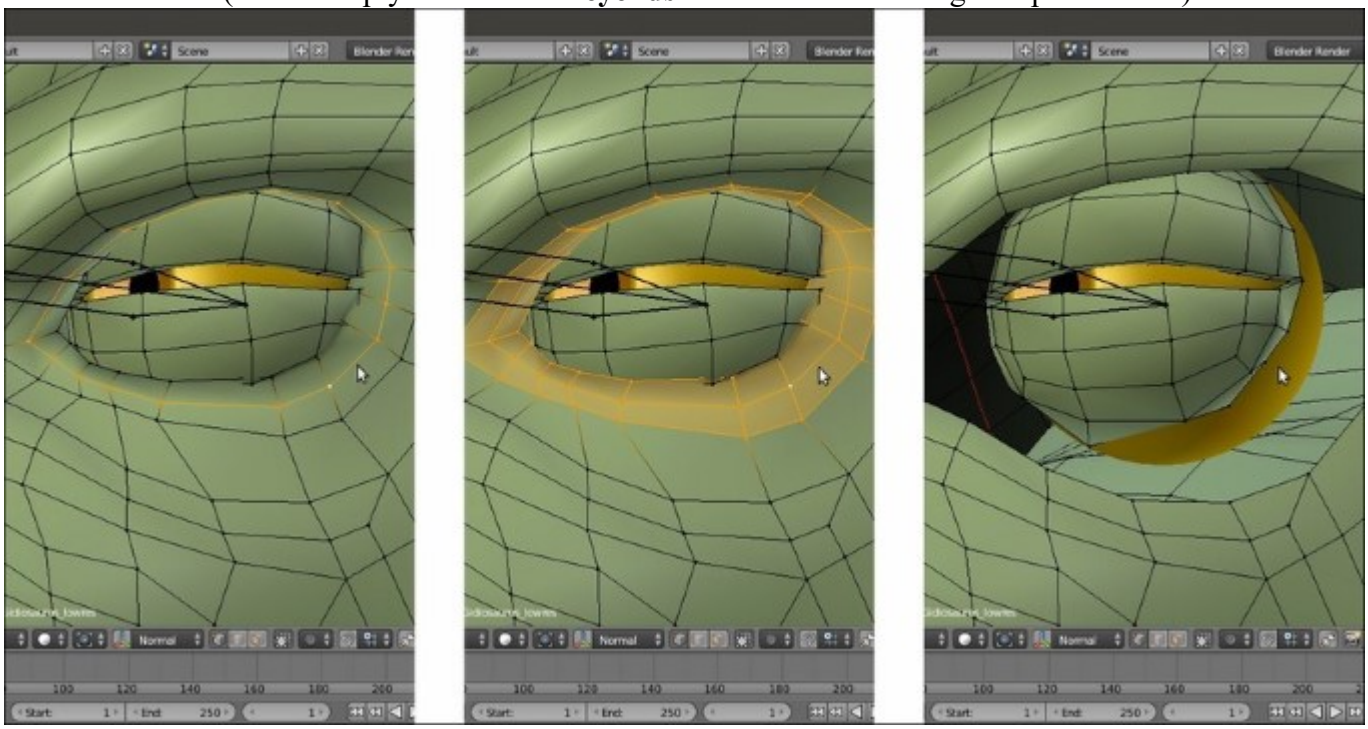
11. Now, go out of **Weight Paint** mode, select the mesh and, in the **Vertex Groups** subpanel, search for the **eyelid_upper.L** vertex group; enter **Edit Mode** and click on the **Select** button:



The selected eyelid_upper.L vertex group

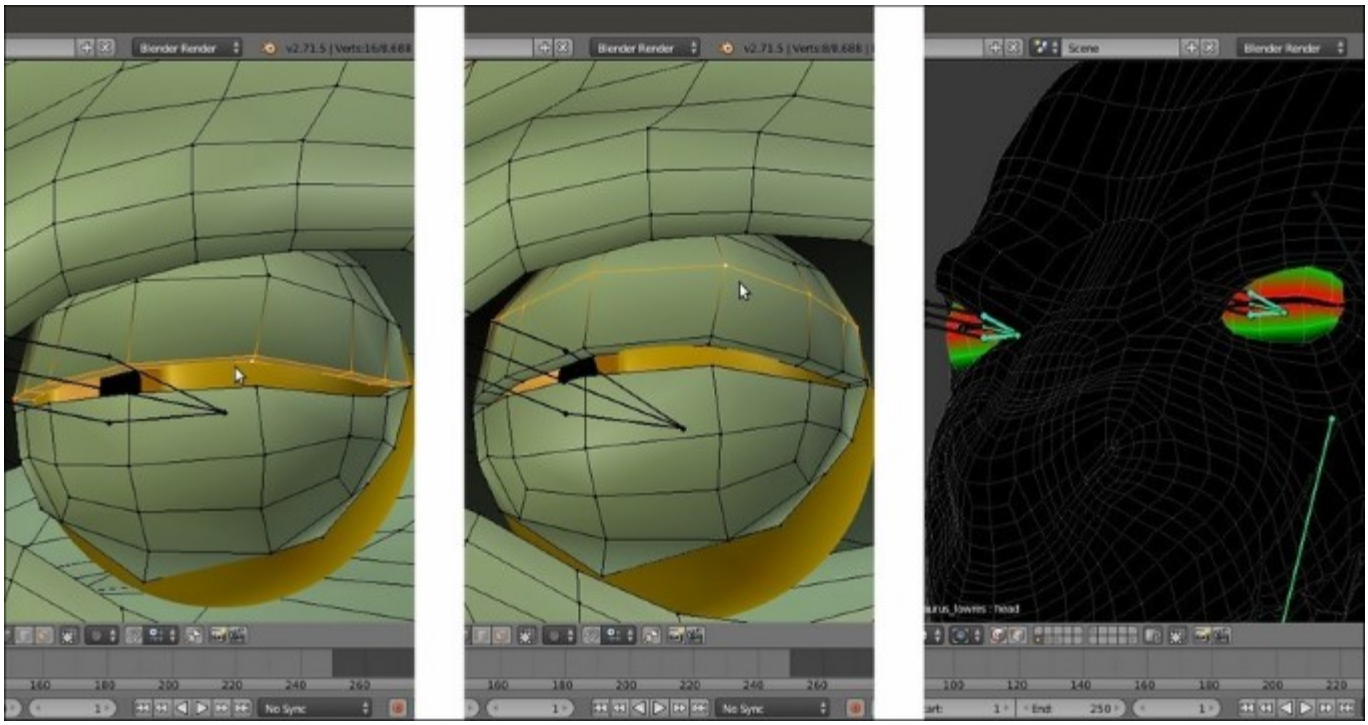
We must get rid of all these vertices erroneously assigned to the vertex group by the **Automatic Weights** tool.

12. Click on the **Remove** button and then press the *A* key to deselect everything.
13. Repeat this for the **eyelid_bottom.L**, **eyelid_upper.R**, **eyelid_bottom.R**, and also for the **eye.L** and **eye.R** vertex groups.
14. Zoom to the **eyes** area. Select an edge-loop (*Alt* + right-click) around the left **eyelids** and then press *Ctrl* and the + key on the numpad to extend the selection; press the *H* key to hide the selected vertices (this is simply to isolate the **eyelids** vertices for easier edge-loops selection):



Isolating the eyelids vertices

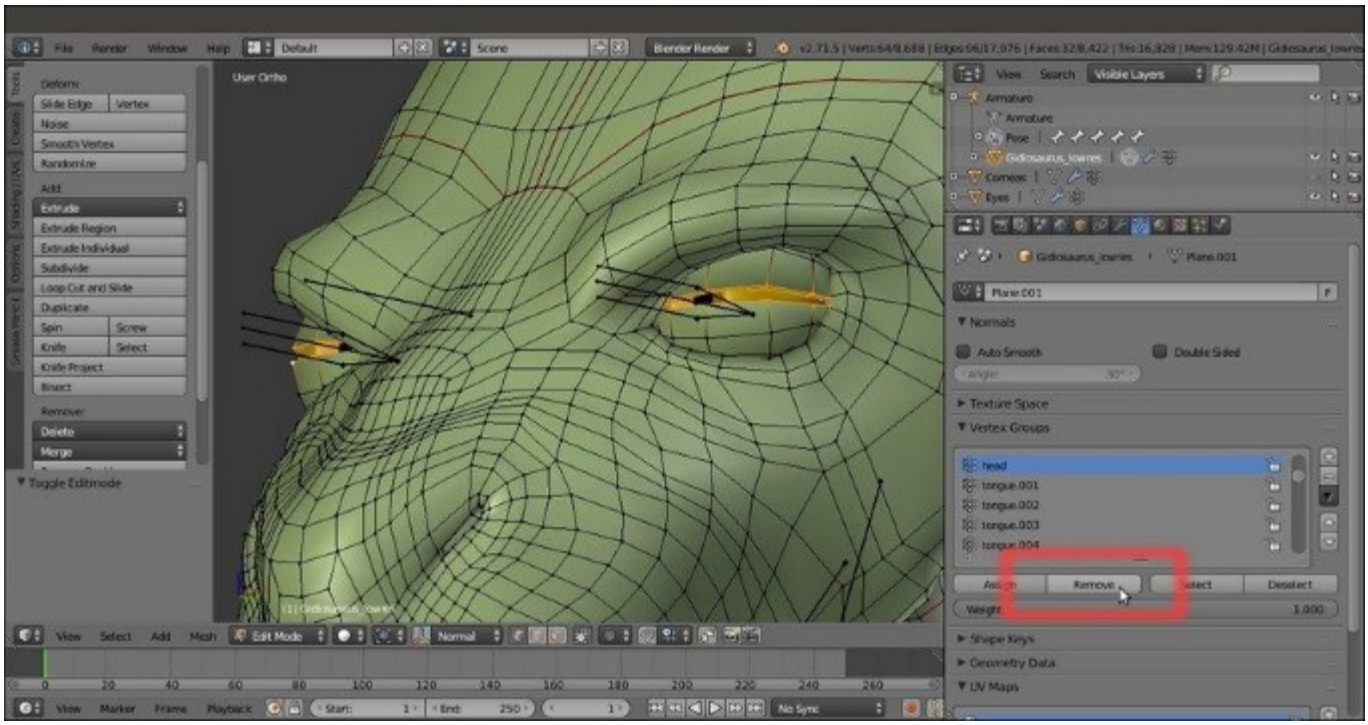
15. Select the border upper edge-loops and assign them to the **eyelid_upper.L** vertex group with a weight of **1.000**; select the second upper edge-loop and again assign it to the **eyelid_upper.L** vertex group, but with a weight of **0.500** (see the following screenshot).
16. Do the same for **eyelid_bottom.L**:



The visualization of the eyelids vertex group with different weights

In the preceding screenshot, to the right, you can see the weights of **eyelid_upper** and **eyelid_bottom** vertex groups on both sides, made visible at the same time by the **Multi-Paint** item enabled in the **Brush** subpanel under the **Tool Shelf**; here it is used only for visualization purposes.

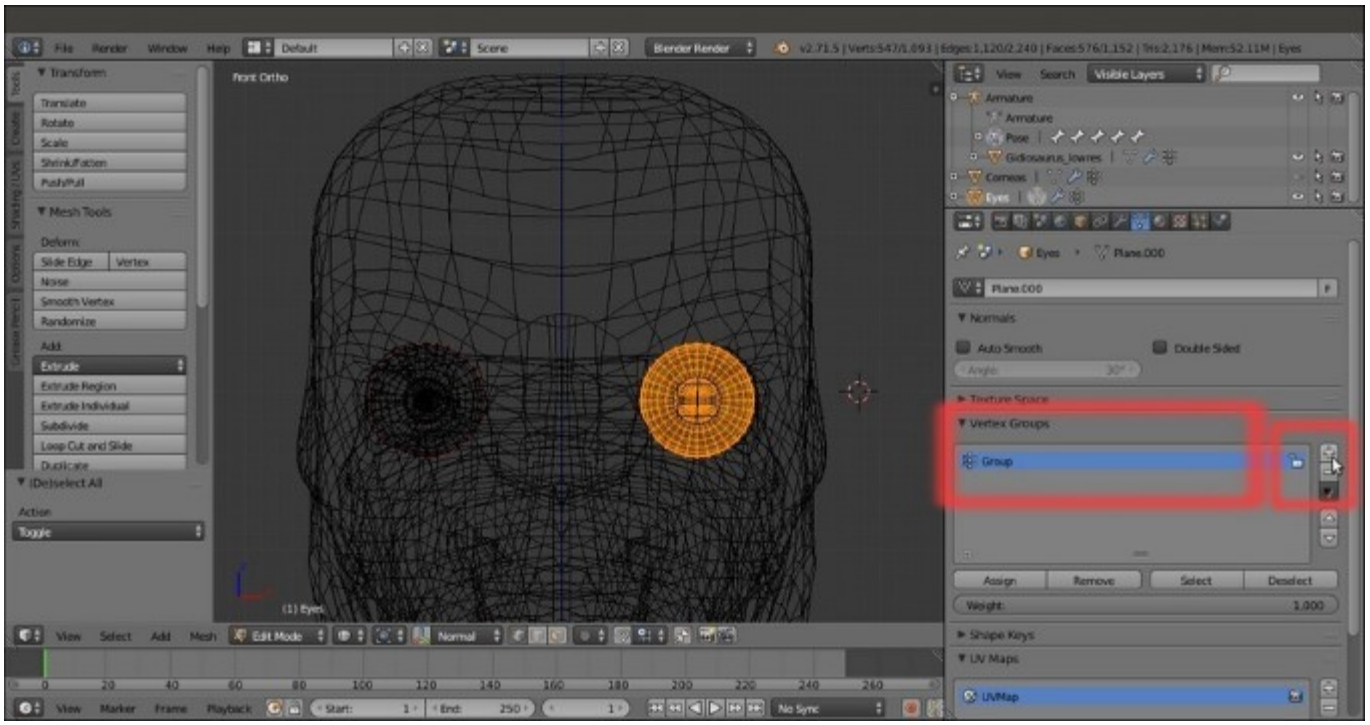
17. Repeat the procedure for the **eyelids** on the right side (**eyelid_upper.R** and **eyelid_bottom.R**).
18. In the **Vertex Groups** subpanel, select the **head** vertex group and then select the border edge-loops of both the **left** and **right eyelids**. Click on the **Remove** button to remove those vertices from the group's evaluation:



Removing the eyelids vertices from the "head" vertex group

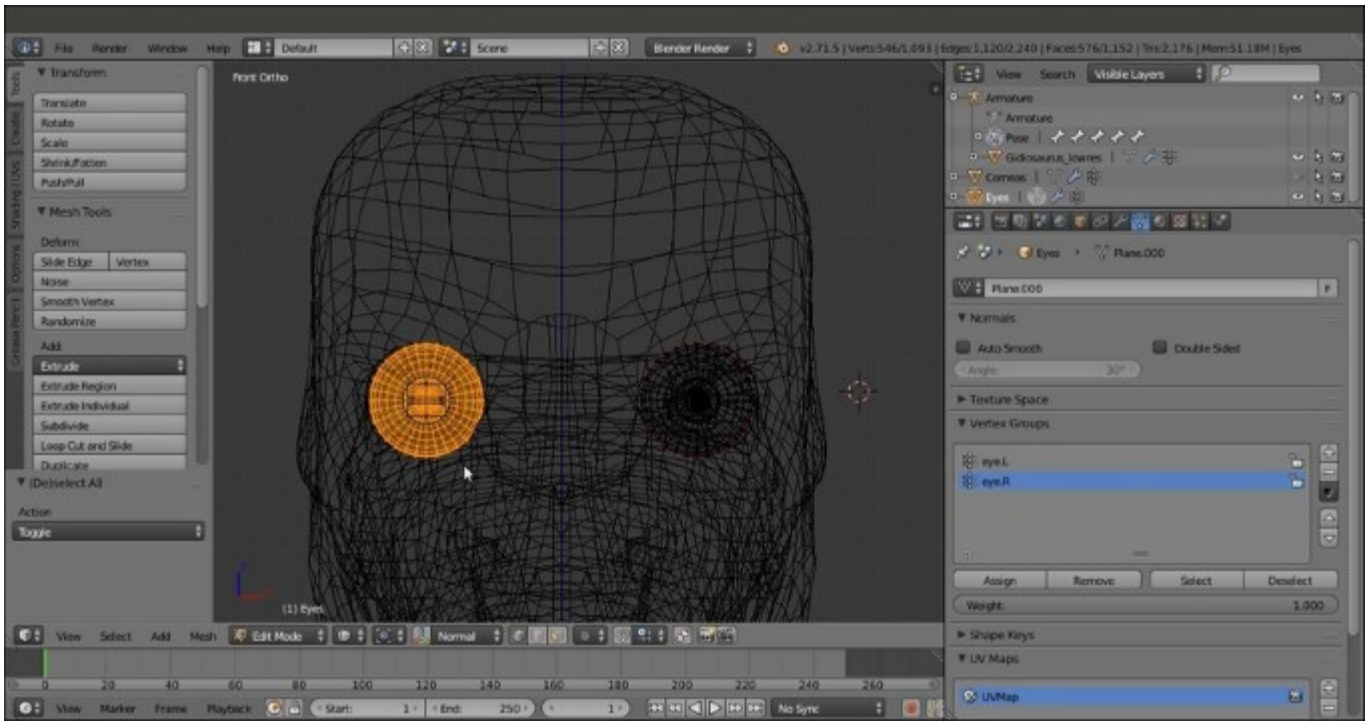
Assigning weights by hand can be a handy method also for other parts, for example, the **eyeballs**, which are separate objects from the **Gidiosaurus** mesh.

19. Go out of **Edit Mode,** and in the **Outliner** select the **Eyes** object; press *Tab* again to go in to **Edit Mode**.
20. Go in to **Front** view and box-select all the vertices of the **left eye**; then, go to the **Vertex Groups** subpanel under the **Object Data** window and click on the + icon to the right to create a new group:



Creating the vertex group for the eyeball

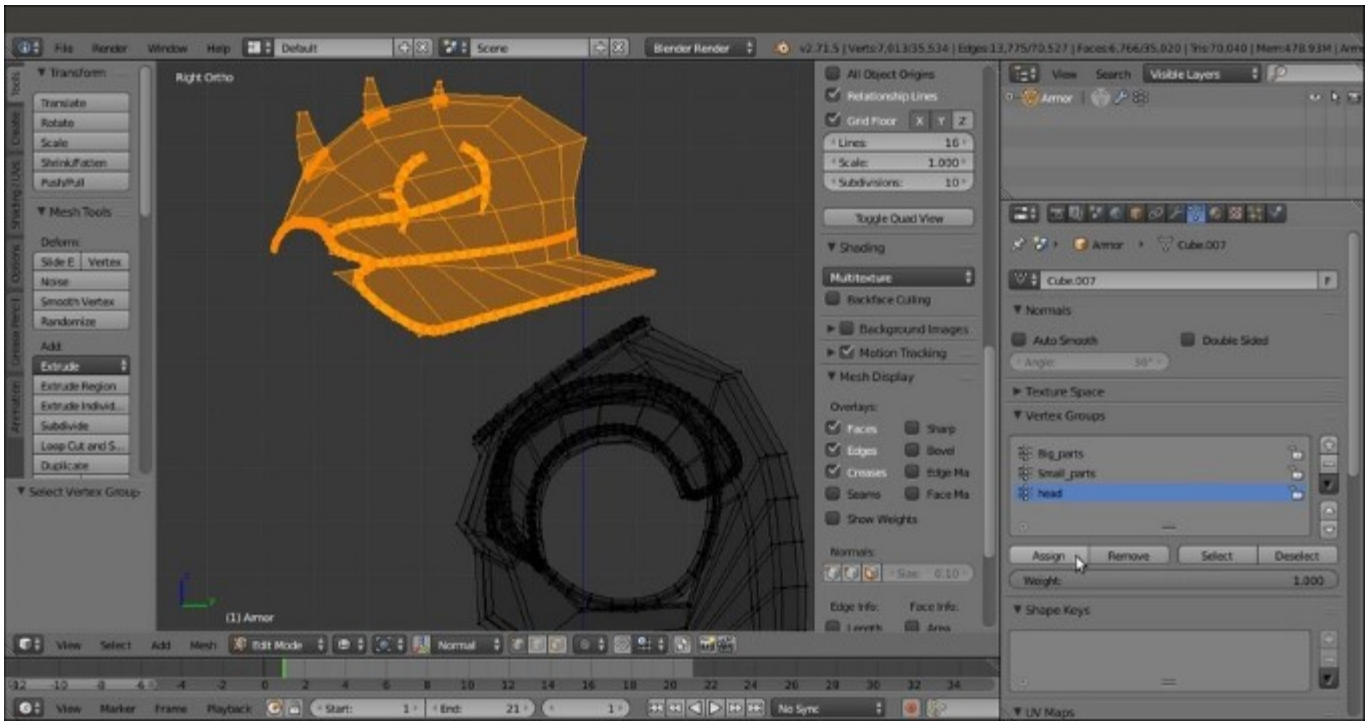
21. *Ctrl* + left-click on the name of the vertex group to rename it as **eye.L** and then click on the **Assign** button to assign all the selected vertices to the group with a value of **1.000**.
22. Deselect everything, select the vertices of the other **eye**, and create a new vertex group; rename it as **eye.R** and assign the vertices.



Creating the eye.R vertex group

23. Exit **Edit Mode** (*Tab*) and go to the **Object Modifier** window; assign an **Armature** modifier, move it upwards in the stack, and click on the **Object** field to select the **Armature** item as a deforming object.
24. Temporarily, unhide the **Corneas** object in the **Outliner** and repeat from step 19 to step 23, where we created the **eye.L** and **eye.R** vertex groups and assigned the appropriate mesh vertices and the **Armature** modifier.

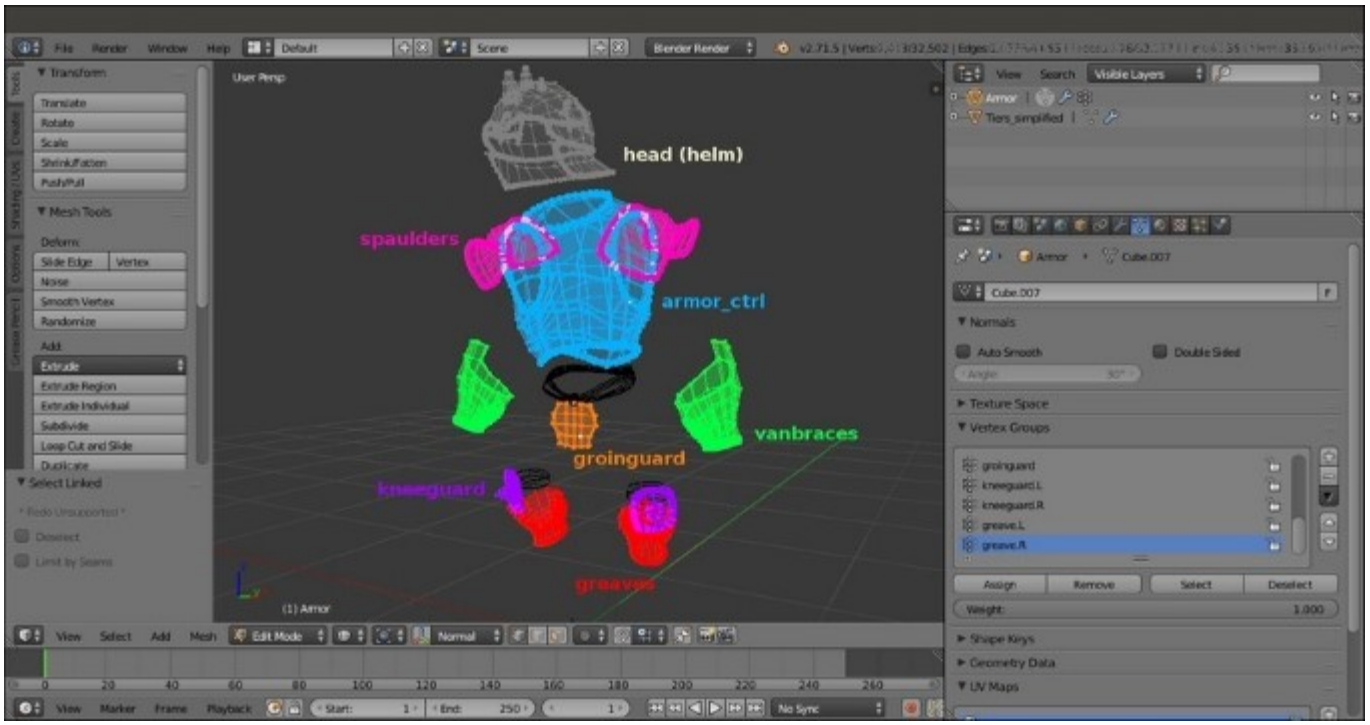
    The same process must be applied to the skinning of the **Armor** that, being a single object made of stiff elements, can be easily and ideally divided into different vertex groups; each one is skinned with the full value of **1.000**.
25. Click on the button to activate the **13th** scene layer and show the **Armor**; select it and enter **Edit Mode**.
26. Select all the vertices of the **helm**, including the **decorations**, create the **head** vertex group in the **Armor** mesh (remember that the name must be the one of the deforming bones), and click on the **Assign** button with a weight value of **1.000**:



The "head" vertex group for the Armor object

27. Repeat the operation with each part of the **Armor**, so creating, always with a weight of **1.000**, the vertex groups: **vanbrace.L** and **vanbrace.R** (covering the **forearms**), **greave.L** and **.R** (covering the **calves**), **groinguard** (the **front hips**), **kneeguard.L** and **.R**, **spaulder.L** and **.R**, and **armor_ctrl**.

    You can use the following screenshot as a guide:



The happy colorful Armor guideline

28. Go out of **Edit Mode**; then, go to the **Object Modifier** window, assign an **Armature** modifier to the **Armor**, move it upwards in the stack, and click on the **Object** field to select the **Armature** item as a deforming object.
29. Disable the *Display modifier in viewport* button (the one with the eye icon) for the **Subdivision Surface** modifier, to speed up the 3D viewport.

For the moment, ignore the **Tiers** (which have been separated by the **Armor** object and simplified by deleting several alternate edge-loops, this we'll skin in the next recipe) and *save the file*.

How it works…

The **Normalize All** button normalizes the weights of all the vertex groups so that their sum is not superior to **1.000**; because we had assigned a weight of **1.000** to the upper head vertices, the vertices in the other groups that were interfering with the **head** deformation have been automatically set to **0.000**.

The **head** group, instead, remained the same because it was locked in the **Options** bottom panel; the **Clean** button, then, took care of removing all the unwanted vertices in the active group, restricting the inclusion of its vertices only to those with a weight greater than **0.000**.

When assigning vertices to a group, the **Weight** slider under the **Vertex Groups** subpanel can obviously be set to any value between **0.000** and **1.000**, so it's also possible to select a single edge-loop or rows of vertices and assign them at different times to the same vertex groups, but with different weight values. For example, a central edge-loop of vertices with the weight of **1.000** can be surrounded by external

edge-loops with weight values of **0.750**, **0.500**, **0.250**, and so on. This is what we have done for the **eyelids** after the cleaning of the **eye sockets** area, thanks to the **Select**, **Deselect** and **Remove** buttons. Be aware that the same result can be obtained by painting and/or blurring the weights on the mesh, but we'll see this in the next recipe.

See also

- http://www.blender.org/manual/modeling/meshes/vertex_groups/index.html

Editing Weight Groups using the Weight Paint tool

Both the **Automatic Weights** parenting as well as the **Weight Groups** created and assigned by hand must, at a certain point, inevitably be edited for several reasons. As we have already seen, the parenting tool didn't do a perfect job, or maybe the transition between different weights is too sharp and must be blurred to smoothly deform the mesh. In any case, the ideal tool for this editing work is the **Weight Paint** tool.

Getting ready

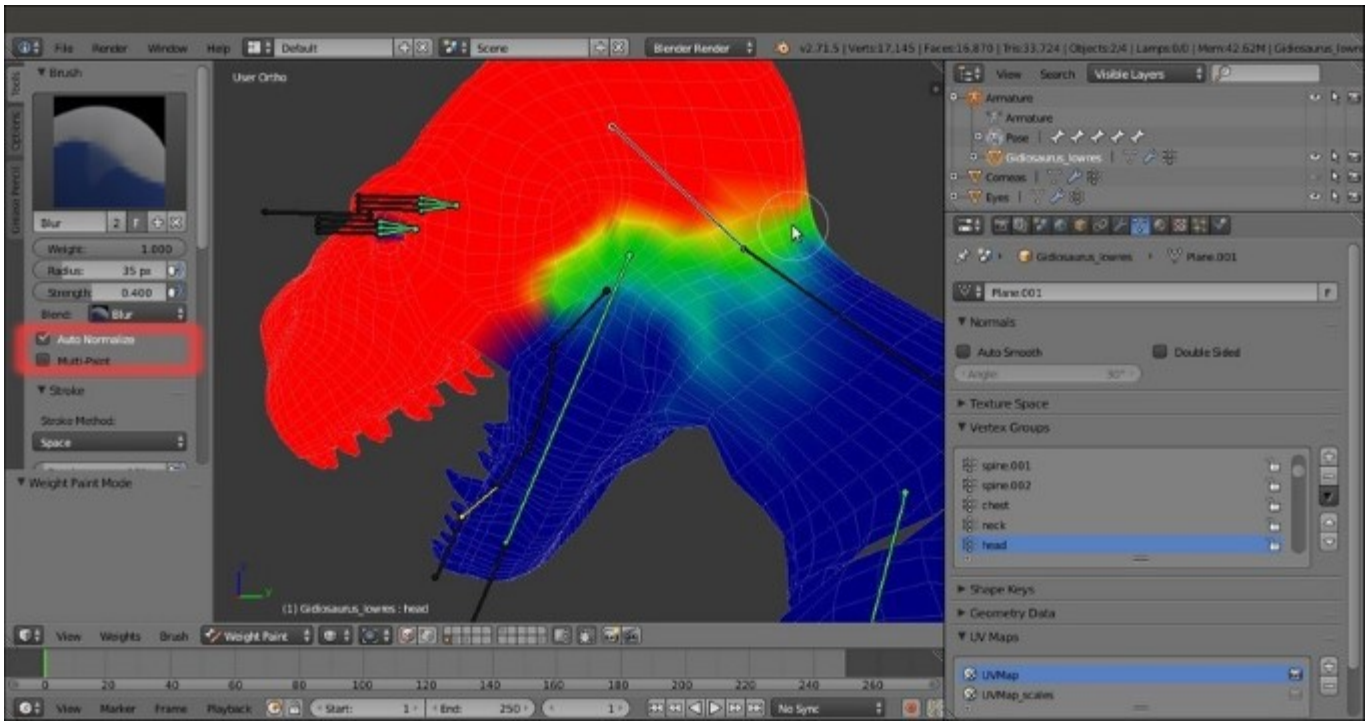
As usual, let's first prepare the scene to work on:

1. Open the `Gidiosaurus_skinning_01.blend` file and hide the **13th** scene layer.
2. Enable the 3rd **Armature** layer and then deselect the **Shapes** item.
3. Press the *3* key on the numpad to go in to **Side** view; if necessary, press the *5* key on the numpad to go in to **Ortho** view and the *Z* key to go in to **Wireframe** viewport shading mode.
4. Save the file as `Gidiosaurus_skinning_02.blend`.

How to do it…

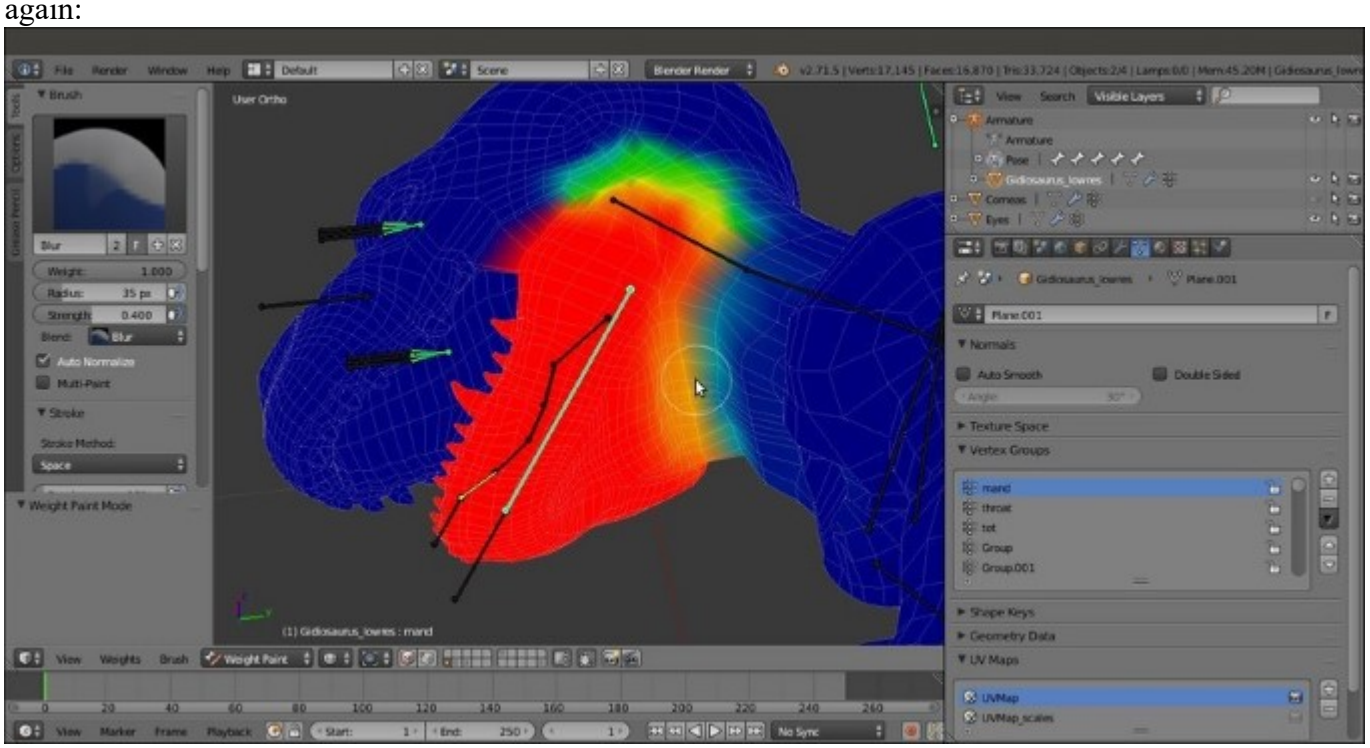
Also, now let's start with the **Weight Paint** tool itself:

1. Select the **Gidiosaurus** mesh and go in to **Weight Paint** mode; the tabs under the **Tool Shelf** on the left-hand side of the 3D window (press the *T* key in case they are not already present), change to show the **Weight Paint** tools.
2. In the viewport, right-click on the **head** bone to show the **head** vertex group on the mesh's surface.
3. Go to the **Tool Shelf** and click on the **Options** tab to verify that the **X Mirror** item in the **Options** subpanel is activated. Then, go back to the **Tools** tab and click on the big **Brush** window at the top to select a **Blur** brush; set **Weight** to **1.000** and **Strength** to **0.400**.
4. Select the **Auto Normalize** item at the bottom of the **Brush** subpanel.
5. Start to paint on the borderline of the vertex group, blurring the separation between the red and blue colors and trying to obtain, in general, a transition as smooth as possible:



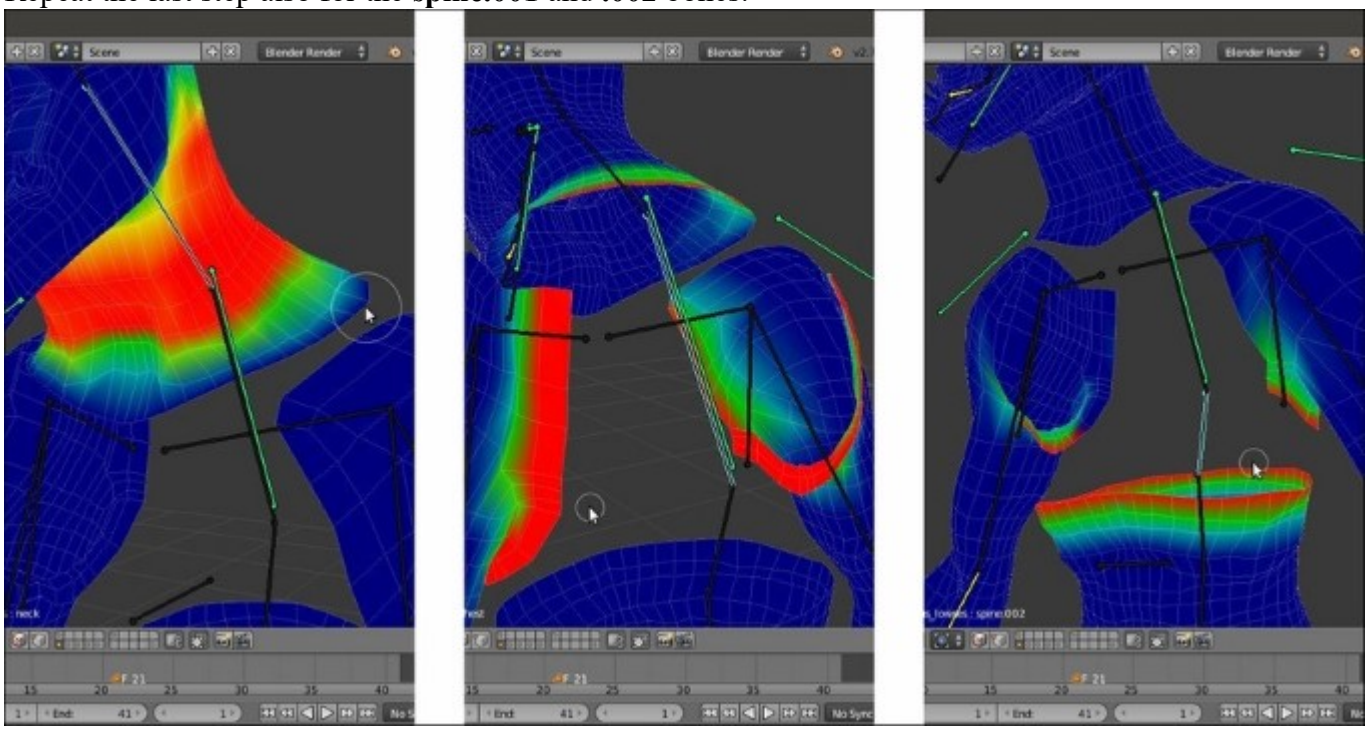
Blurring the edges of the vertex group

6. Switch to the **mand** vertex group by selecting the corresponding bone and smooth the transition again:



Smoothing the transition of the "mand" vertex group

7. If you need to reduce the weight of a vertex, switch the **Blur** brush with a **Subtract** one, and with a low **Strength** (**0.100** or even less) paint on it. Then, if necessary, blur the area again.
8. Alternatively, instead of using a **Subtract** brush, you can paint on the mesh with a **Mix** brush set with **Strength** = **1.000** and **Weight** = **0.000**.
9. Select the **neck** bone and reduce the weight of the vertices at the **neck** edges to **0.000**.
10. Select the **chest** bone and paint the vertices at the **chest** edges to **1.000**.
11. Repeat the last step also for the **spine.001** and **.002** bones:

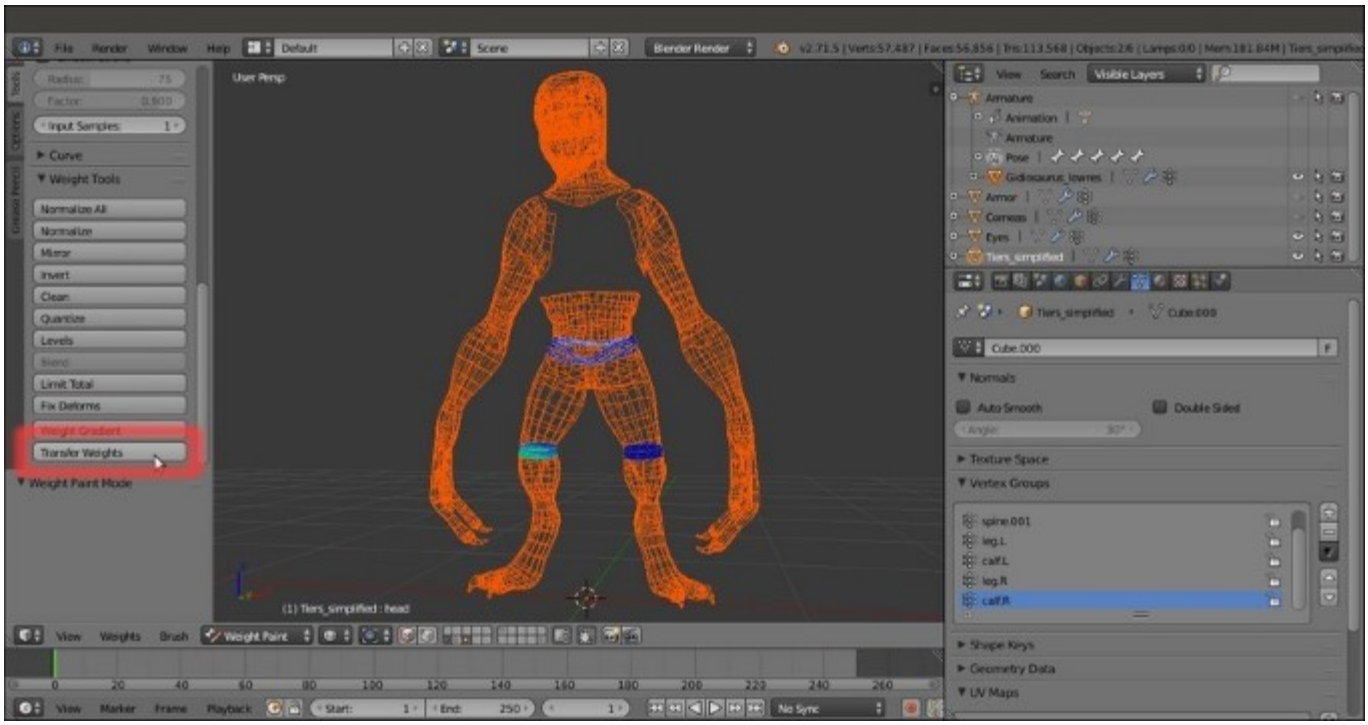


Other vertex groups

To look at exactly how the weights have been edited by the **Weight Paint** tool, open the `Gidiosaurus_skinning_03.blend` file, hide the **Armor**, select the **Gidiosaurus** mesh and press *Ctrl* + *Tab* to go in to **Weight Paint** mode, and then right-click to select the different bones.

One last thing still remains to be done: we must also skin the **Tiers_simplified** object.

12. Enable the **13th** scene layer to show the **Armor** and the **Tiers**; temporarily hide both the **Armature** and the **Armor** object by clicking on the respective eye icon in the **Outliner**.
13. Select the **Gidiosaurus** mesh, then, *Shift*-select the **Tiers** object and press *Ctrl* + *Tab* to go in to **Weight Paint** mode.
14. Go to the **Weight Tool** subpanel under the **Tool Shelf** and click on the **Transfer Weight** button, which is the last button at the bottom. After a bit of calculation, the weights of the vertices for the underlying **Gidiosaurus** mesh have been transferred to the corresponding overlaid vertices of the **Tiers** object and the vertex groups as well:



Transferring the vertex group weights from the Gidiosaurus mesh to the tiers object

15. Go out of **Weight Paint** mode and select the sole **Tiers** object. In the **Object Modifiers** window, assign an **Armature** modifier or, if you prefer, just join it to the **Armor** object (**Armor** as an active object and then press *Ctrl* + *J*). In both cases, just remember to enable the **Preserve Volume** item.
16. Save the file.

See also

- http://www.blender.org/manual/modeling/meshes/vertex_groups/weight_paint.html

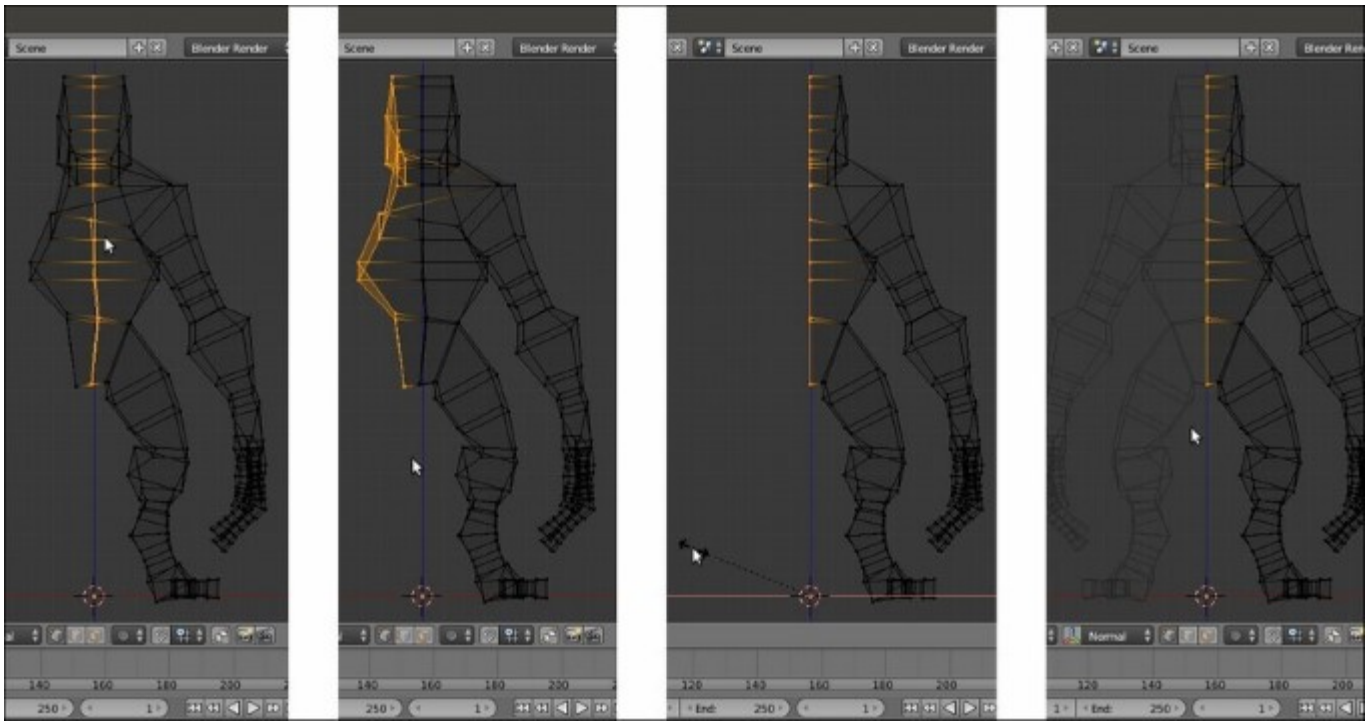
Using the Mesh Deform modifier to skin the character

The **Mesh Deform** modifier has been introduced in Blender for the production of the short open movie *Big Buck Bunny* and it's a very easy and quick way to skin medium and high resolution characters' meshes. Although the utility of this modifier really shows the skinning of fat, chubby characters, it will be useful to see the way it works even if applied to a quite skinny character such as the **Gidiosaurus**.

Getting ready

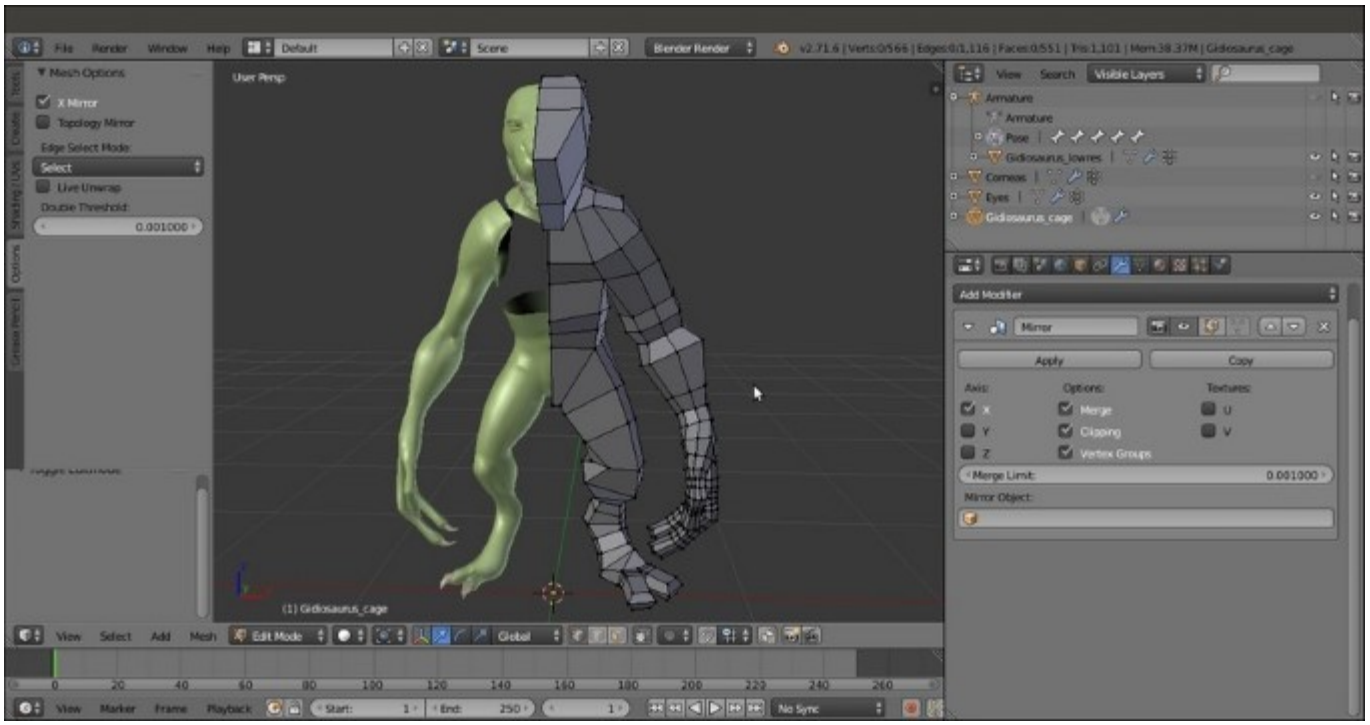
First, we must prepare the **deforming cage**, which is a simplified low poly mesh totally enveloping the character's mesh; to do this, in our case, we can start from an already made object:

1. Open the `Gidiosaurus_skinning_03.blend` file.
2. Click on the **File** | **Append** menu (or press *Shift* + *F1*), browse to the folder with all the project files, and click on the `Gidiosaurus_base_mesh_02.blend` file. Then, click on the `Object` folder and select the **Gidiosaurus** item.
3. Move the just-appended object to the first scene layer; then, go to the **Outliner** and rename it as **Gidiosaurus_cage**.
4. This is the base mesh we built in the first chapter of this module, so go to the **Object Modifier** window and apply the **Skin** modifier; delete the **Mirror** modifier and disable the **Subdivision Surface** modifier visibility in the viewport by clicking on the eye icon button.
5. Go in to **Edit Mode** and by pressing *Ctrl* +*R*, cut a median vertical edge-loop at the center of the mesh.
6. Select the vertices of the *missing* half and delete them; then, select the median edge-loop and, with **Pivot Point** set to **3D Cursor** (and the **3D Cursor** located at the center of the scene), scale them to **0.000** along the global *x* axis.
7. Assign a new **Mirror** modifier and enable the **Clipping** item.



Preparing the deforming cage

8. Now, enable the scene layer with the **Gidiosaurus** mesh, select it, and temporarily disable the **Armature** modifier by clicking on the *Display modifier in viewport* button (the one with the eye icon).
9. In the **Outliner**, click on the eye icon to hide the **Armature**.
10. Reselect **Gidiosaurus_cage**, enter **Edit Mode**, and start to edit. Basically, the cage must be large enough to totally include the character's mesh.
11. Select whole parts such as the **head** or a **hand** and scale the vertices on their normals (*Alt* + *S*) and move the vertices by hand.
12. Where necessary, add edge-loops (*Ctrl* + *R*) to refine the cage's shape, but try to keep it as simple and low resolution as possible.



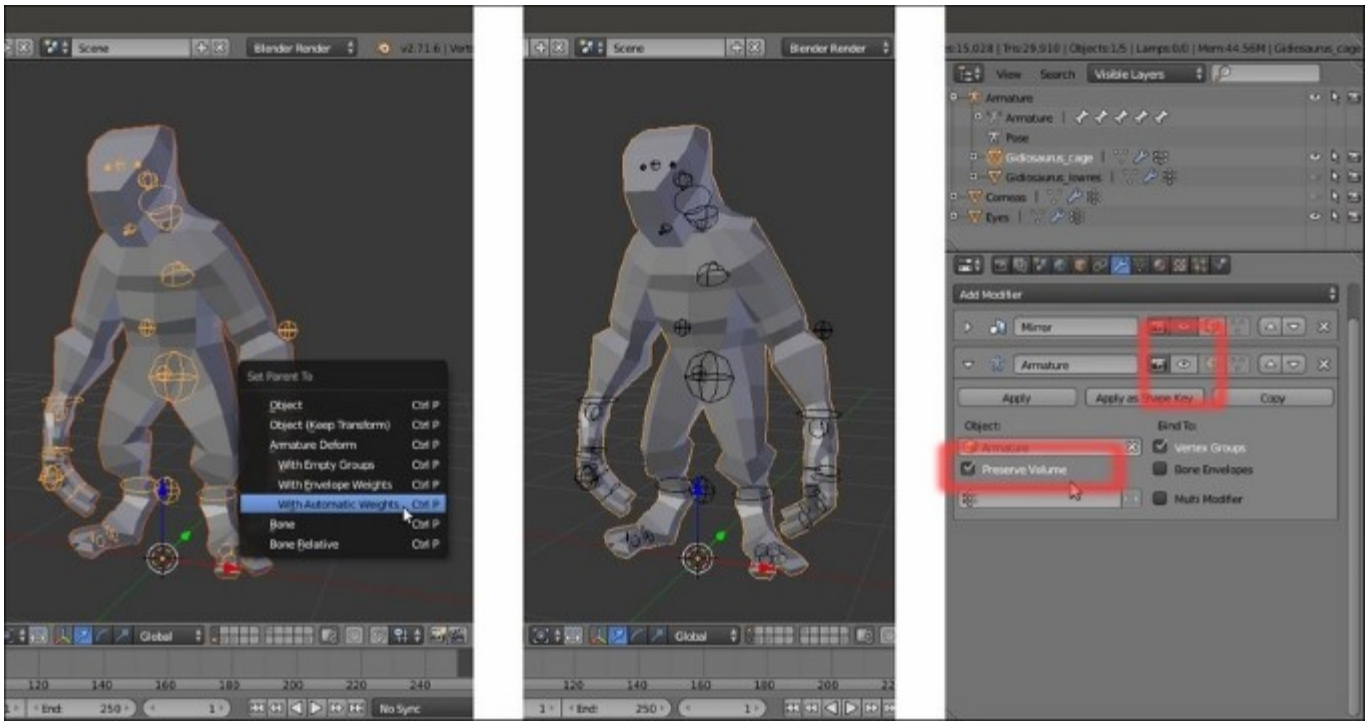
The cage mesh in Edit Mode

13. Once we have confirmed that the **Gidiosaurus** mesh is totally contained in the cage, we can go out of **Edit Mode**.

How to do it…

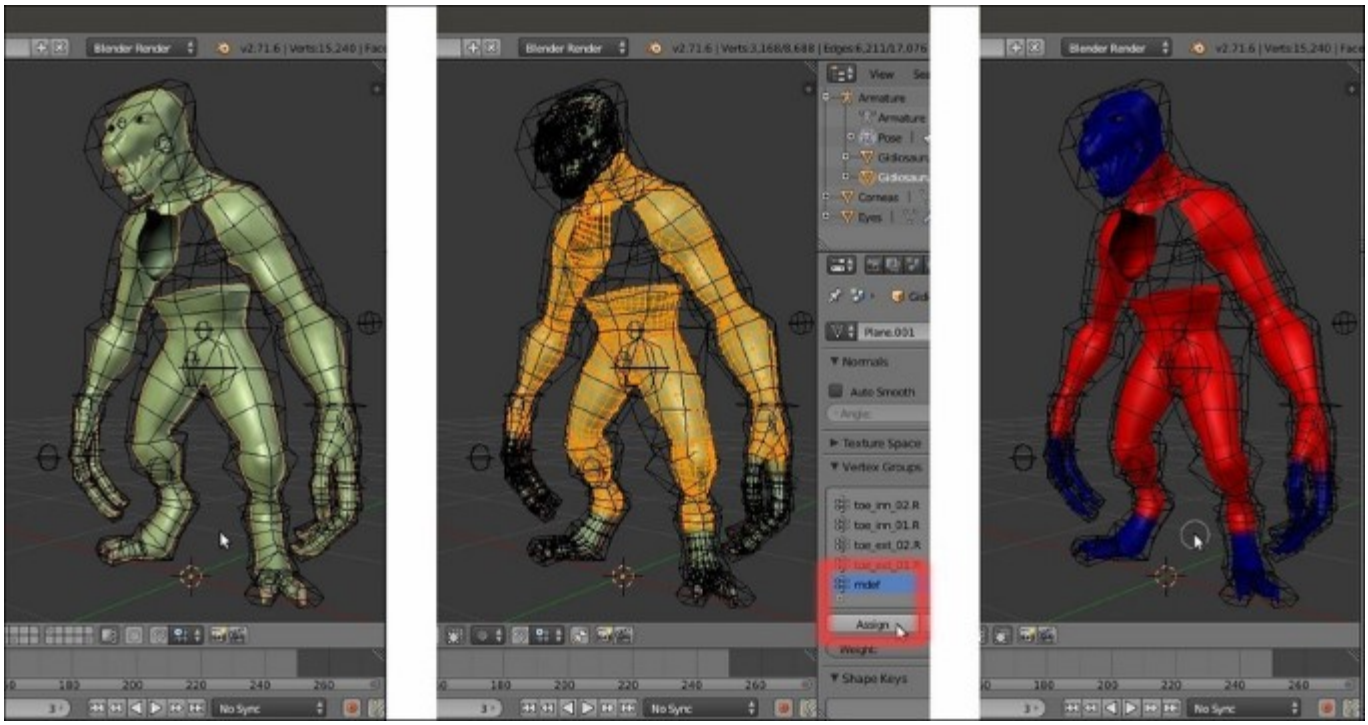
Now that the **deforming cage** is made, we can go on with the **skinning**:

1. Unhide the **Armature** and select it. Go in to **Edit Mode**, select the bones deforming the **Armor** (see the *Parenting the Armature and Mesh using the Automatic Weights tool* recipe in this chapter for this), and press *Shift* + *W* | **Deform**. Don't deselect anything because it will be useful later on to have the bones still selected, and go straight back to **Object Mode**.
2. Now, hide the **Gidiosaurus_lowres** object; then, select the **Gidiosaurus_cage** object, *Shift*-select the **Armature**, and press *Ctrl* + *P* | **With Automatic Weights**.
3. Select the sole **Armature**, go in to **Edit Mode** and press *Shift* + *W* | **Deform**, and then switch to **Pose Mode**.
4. Reselect the **cage** and go to the **Object Modifiers** window; in the **Armature** modifier, enable the **Preserve Volume** item, but temporarily disable the visibility of the modifier in the viewport (eye icon button):



Parenting the deforming cage to the Armature

5. Go to the **Object** window and click on the **Maximum Draw Type** button under the **Display** subpanel to select the **Wire** item. Unhide the **Gidiosaurus_lowres** object.
6. Select the **Gidiosaurus** mesh and go in to **Edit Mode**. In the **Vertex Groups** subpanel under the **Object Data** window, create a new group and rename it as **mdef**; select all the vertices of the **Gidiosaurus** mesh *except feet, fingers, and the head* and assign them to the **mdef** vertex group:



The "mdef" vertex group

7. Go to the **Object Modifiers** window; in the **Armature** modifier panel, click on the vertex group empty field at the bottom (*name of Vertex Group which determines influence of modifier per point*) to select the **mdef** vertex group and then click on the *invert vertex group influence* button to the left (the one with the two arrows pointing in opposite directions). Temporarily, disable the visibility of the modifier in the viewport (eye icon button).
8. Assign a **Mesh Deform** modifier and move it upwards in the stack, before the **Subdivision Surface** modifier but after the **Armature** one.
9. In the **Object** field of the **Mesh Deform** modifier, select the **Gidiosaurus_cage** item; in **Vertex Group** again, select the **mdef** vertex group, check the **Dynamic** item box, and then click on the **Bind** button.
10. Save the file as `Gidiosaurus_mesh_deform.blend`.

How it works…

The **Gidiosaurus_cage** is a very simple mesh. Therefore, it is very easily skinned to the **Armature** (we didn't do it in our case, but obviously, when necessary, the automatic weights assigned by the parenting can be easily edited as in the *Editing the Weight Groups using the Weight Paint tool* recipe) and is therefore deforming, through the binding of the **Mesh Deform** modifier, the more subdivided **Gidiosaurus** mesh.

In fact, if everything went right, now we should have the **Gidiosaurus** body correctly deformed by the **cage** only for the vertices that belong to the **mdef** vertex group, while the **Armature**, which also deforms the **cage**, is still taking care of the vertices outside the group; to check this, just try to pose the

rig and alternatively disable, in the **Object Modifiers** window, the viewport visibility of the **Armature** and **Mesh Deform** modifiers for the mesh.

Note that even we didn't apply the **Mirror** modifier to the **cage** object; the **Mesh Deform** modifier works correctly anyway, exactly like the **Armature** one.

The Gidiosaurus model posed through the Mesh Deform modifier

See also

- http://www.blender.org/manual/modifiers/deform/mesh_deform.html

Using the Laplacian Deform modifier and Hooks

One of the last modifiers introduced in Blender, the **Laplacian Deform** modifier shouldn't actually be considered as an effective tool to rig a character, but more as a tool to modify, change, or refine a default pose. Anyway, if set and used smartly it can often give interesting results, so it has been included in this chapter as well.

Getting ready

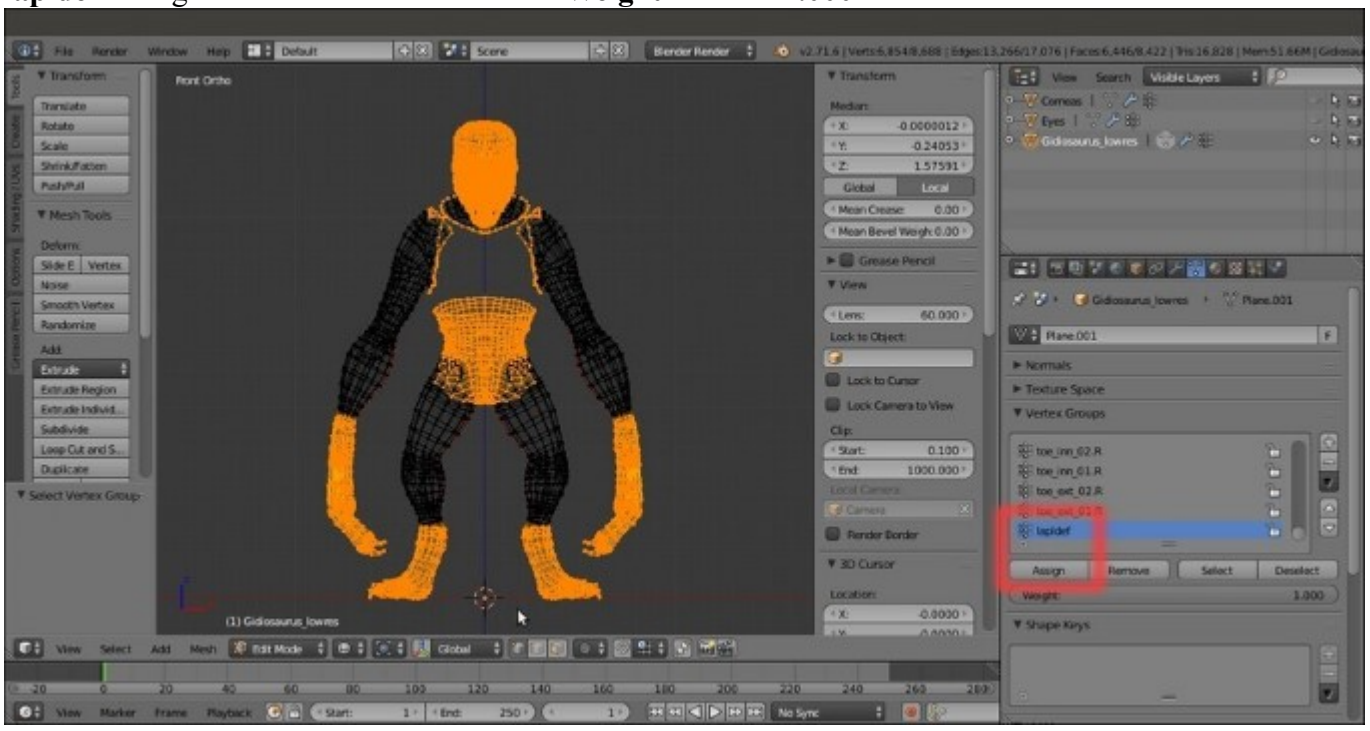
First, let's prepare the scene:

1. Open the `Gidiosaurus_rig_from_scratch_01.blend` file.
2. Select and then delete the **Armature** in **Object Mode**; then. select the **Gidiosaurus** mesh and delete the **Armature** modifier too in the **Object Modifiers** window.
3. In the **Outliner**, hide the **Eyes** object.
4. Press the *Z* key to go in the **Wireframe** viewport shading mode.

How to do it…

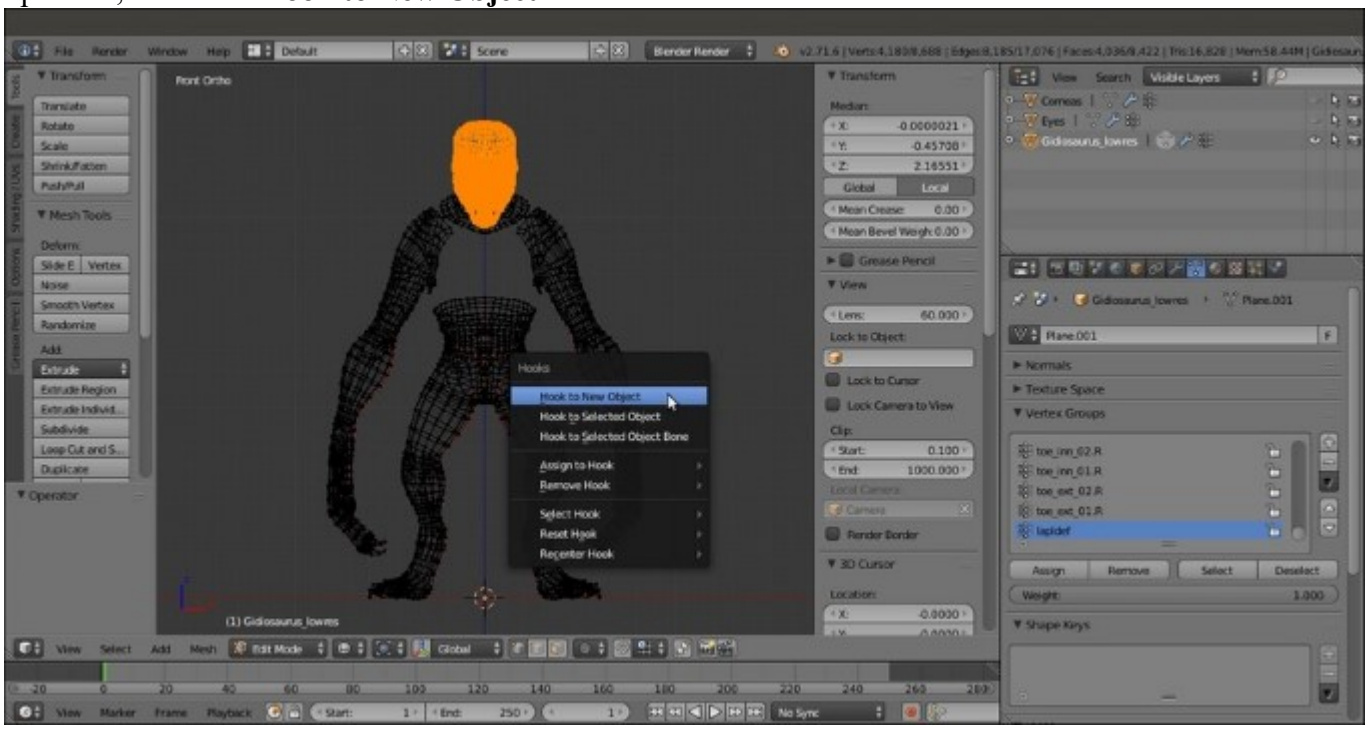
Now let's go with the **Laplacian** modifier setup:

1. With the **Gidiosaurus** mesh still in **Edit Mode**, select all the vertices of the **hands**, **feet**, **hip**, **head**, plus the **boundary edge-loops** where the mesh is missing (look at the following screenshot).
2. Go to the **Vertex Groups** subpanel and create a new group named as you wish; I named it **lapldef**. Assign the selected vertices with a **Weight** value of **1.000**:



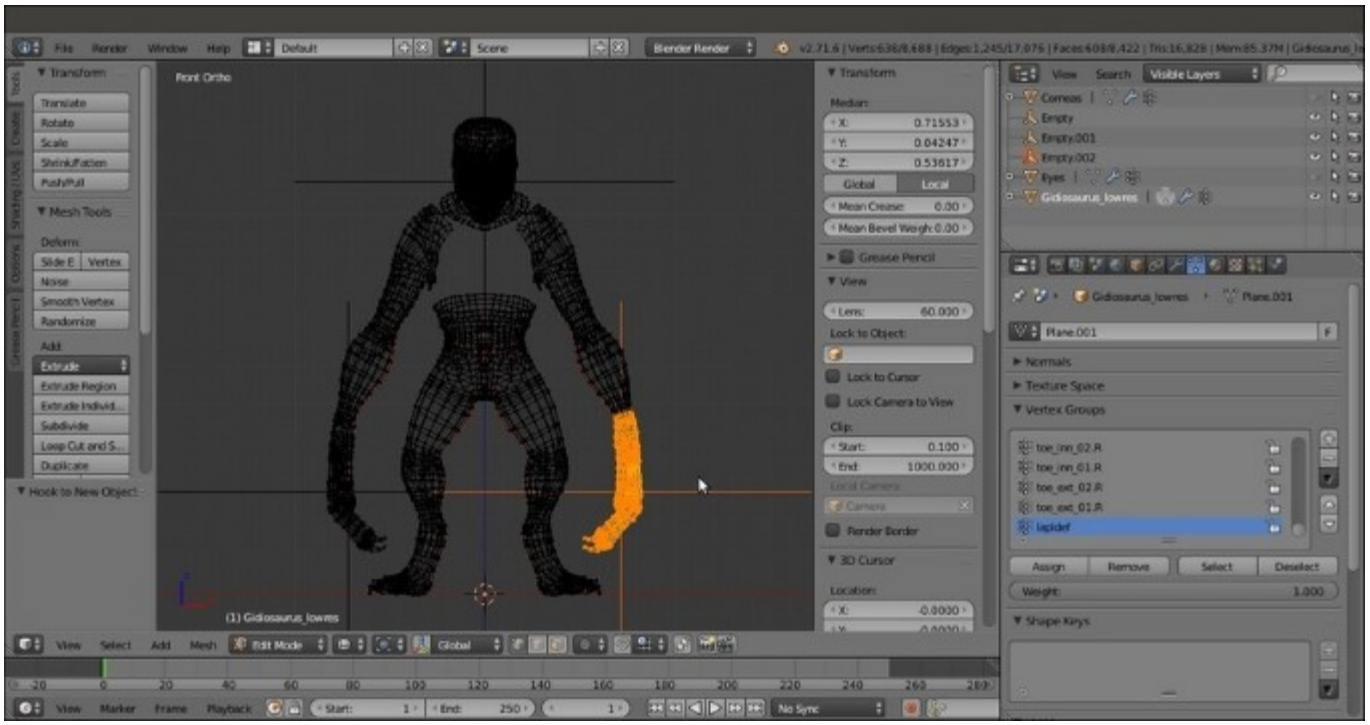
The "lapldef" vertex group

3. Now, box-deselect all the vertices, except the **head** ones; press *Ctrl* + *H* and in the **Hooks** pop-up menu, select the **Hook to New Object** item:



The Hooks menu

4. Click on the **Select** button under the **Vertex Groups** subpanel to the right of the screen and then deselect all the vertices, except the **right hand** ones. Again, press *Ctrl* + *H* and in the **Hooks** pop-up menu, select the **Hook to New Object** item.
5. Click on the **Select** button again, deselect all the vertices, except the **left hand** ones, and repeat the procedure:



The Hook assigned to the left hand vertices

6. Repeat the procedure separately for the left and the right **feet** and then go out of **Edit Mode**.
7. In the **Outliner**, rename the **Empties** (the **Hooks**) respectively as **Empty_head**, **Empty_hand.L** and **.R**, and **Empty_foot.L** and **.R**.

The Hooks assigned to the mesh's vertices

8. Select the **Gidiosaurus** mesh and go to the **Object Modifiers** window. Collapse all the five **Hook** modifiers for better visibility and assign a **Laplacian Deform** modifier; move it upwards in the stack, just before the **Subdivision Surface** modifier (*but* always after the **Hook** modifiers). Click on the **Anchors Vertex Group** to select the **lapldef** vertex group and then click on the **Bind** button.
9. For better visibility, select each **Hook** and in the **Object Data** window, set the size to **0.40**.
10. Enable the **3D manipulator widget** in the 3D view toolbar (or press *Ctrl* + Spacebar), *Shift*-click on the **Translate** and **Rotate** buttons, and set **Transform Orientation** to **Normal**.
11. Select the **Hooks** and start to move and rotate them using the **3D manipulator widget**, to pose the **Gidiosaurus** mesh:

The Gidiosaurus mesh posed through the Hooks and the Laplacian Deform modifier

12. Save the file as `Gidiosaurus_laplacian.blend`.

How it works…

Remember that because they don't work through joints, the **Laplacian Deform** modifier and the **Hooks** don't give a realistic deformation and should be used more to tweak a character pose only inside a limited range. Building a more complex rig, also with **Hooks** at the **elbows** and **knees**, is possible but probably more useful for other types of *unreal* characters' shapes.

It should also be remembered that the **Hooks**, once moved out of their location, can't be simply moved back to their original position by the *Alt* + *G* shortcut because this command would set them at their original **0, 0, 0** location. Instead, any rotation can be easily removed by the *Alt* + *R* shortcut.

In any case, the *Ctrl* + *Z* (**Undo**) shortcut can be used, but first check the number of **Steps** set in the **User Preferences** panel under the **Global Undo** item (there are only **32** by default).

See also

- http://www.blender.org/manual/modifiers/deform/hooks.html
- http://www.blender.org/manual/modifiers/deform/laplacian_deform.html

Chapter 8. Finalizing the Model

In this chapter, we will cover the following recipes:

- Creating shape keys
- Assigning drivers to the shape keys
- Setting movement limit constraints
- Transferring the eyeball rotation to the eyelids
- Detailing the Armor by using the Curve from Mesh tool

Introduction

In this chapter, we'll see how to create and add **shape keys** (the Blender term for **morphing**) to the model, to create facial expressions for the **Gidiosaurus** and to add shape modifications in a non-destructive way to the model.

Then, we'll see how to set a limit to the **Armature** bones' rotation using constraints and how to slightly transfer a portion of the rotation movement of the **eyeballs** to the covering **eyelids**.

Last, we'll add some detail to the **Armor** by quickly adding **rivets** through a simple and effective technique.