6.0 Rigging

1. Open and initialize the Model
   Add an armature to a mesh, or open a model with armature. Note: Just because you have a model containing a mesh and an armature doesn’t mean the two are connected. That is what rigging does.

2. Optional: view bones in “Stick” mode
   a. in Object mode, select the Armature (RMB)
   b. open a Properties Window, click on the Armature icon (the little “man” icon) and in the Display section, select Stick

3. Add the Armature as the “Parent” of the Mesh
   a. in Object mode, select the mesh, then shift-RMB select the armature, so that both the mesh and armature are selected. It is important to select the mesh FIRST and then the armature.
   b. Open the “Parent select” menu (Object → Parent). Then select “Armature Deform → with Empty Groups”. This makes the armature the “parent” of the mesh, so that changes to the armature affect the mesh. It also adds an armature modifier to the mesh, and creates vertex groups to specify which vertices are attached to which bones. Initially, the vertex groups are empty.

4. Insure that the Armature Modifier is the highest priority modifier for the model. This is necessary in case the model already had another modifier attached (e.g. a Subsurface modifier). To do this,
   a. RMB-select the mesh
   b. in Properties Window, select Modifiers panel (the “wrench” icon)
   c. If there is more than one modifier shown in the panel, locate the armature modifier and click the “up arrow” to move the modifier to the top of the modifier stack, as shown in the diagram.
   d. It also is usually the case that you want to check the “Preserve Volume” box in the Armature panel. This causes Blender to attempt to minimize distortions when objects move.

5. Put the Armature in Pose Mode
   a. in Object mode, select just the armature
   b. select Pose Mode (use Ctrl-TAB or switch from Object mode to Pose mode). In Pose Mode, RMB-selecting a bone should show the bone highlighted in BLUE.
   c. select one bone, and drag it. Notice that the connected bones follow it, but the mesh doesn’t. This is because in step 3b we created “Empty Vertex Groups” – that is, we didn’t assign any vertices to the bones. To fix this we have to adjust the assigned bone weights. This can be done manually, or by weight painting.

6. Assigning Vertices to Bones Manually Using Vertex Groups
   a. in Object mode, select the mesh
   b. In the Properties Window, select the Object Data panel (the little triangle-connected-vertices icon)
   c. In the Vertex Groups panel, notice there is a vertex group for each bone-name; this is where we will put each group of vertices corresponding to that bone.
d. In the 3D View window, de-select everything (A key). You will also need to go into Edit mode.

e. Choose one of the vertex groups in the Object Data panel by clicking on it. Then back in the 3D window, select some set of vertices that you want associated with that bone. Once you have highlighted exactly the vertices you want associated with that vertex group, click the Assign button back in the vertex groups panel. This assigns the vertices you chose to the vertex group associated with the bone of the same name. You can confirm that the vertices were indeed assigned, by de-selecting all of vertices in the 3D window, selecting the vertex group name, and clicking the Select button in the vertex group panel.

f. Repeat step (e) for each desired vertex group. If at any time a vertex group shows highlighted vertices that shouldn’t be affected by the bone, you can remove those vertices by using the A-key to deselect everything, use the standard selection tools (RMB, box-select, etc.) to select the vertices to be removed, then clicking the Remove button on the Vertex Groups panel. Don’t forget to also check the back side of the model.

Caution: Assign and Remove apply their actions to all currently selected vertices. Be sure you have selected exactly (and only) the vertices you are interested in before clicking Assign/Remove. Also, clicking Assign/Remove does not deselect any selected vertices; it only assigns or removes them to/from groups. Further, switching to a different vertex group in the Object Data panel does not automatically deselect a previously-selected group’s vertices. Observe these things carefully while editing vertex groups, and make frequent use of the A-key to unselect everything before continuing with new selections and assignments.

g. Although it isn’t necessary for every vertex group to be assigned to a bone, it is important that every vertex be assigned to at least one vertex group. When you are done assigning vertices to vertex groups, select them all one by one to make sure every vertex has been assigned to at least one vertex group.

7. Pose the Skeleton and Observe the Mesh Following It

a. Select Pose Mode (described in steps 5a and 5b)

b. RMB-select a bone and drag to move it. The mesh vertices should now follow the bone movement.

c. RMB-select each bone and move it. If portions of the mesh move undesirably when a given bone is moved, it’s an indication that some bone has undue influence on vertices in that area. To fix this you will need to go back and edit the Vertex Groups.

Note: it’s important for animation that each vertex be assigned to at least one bone in the skeleton. If you have vertices that are not part of any bone vertex group (or equivalently, have no weight value assigned), they may not act properly during animation. If you find that some of your model animates as expected but other portions disappear, check in Blender to make sure you have assigned every vertex to at least one bone.

Here is a hint for ensuring that every vertex is assigned to a bone:

- select your mesh, and go into Edit mode. De-select all vertices.
- in the "Vertex Groups" panel, select each bone in turn (by name), and for each one click the "Select" button.
- If you do this successively for every bone, you will have selected all the vertices assigned to any bone.
- choose Select → Inverse from the 3D - this will invert the selection - that is, it will deselect all vertices assigned to a bone and select all vertices not assigned to any bone.
- You can then assign all those vertices to the Master bone.