USING SOFT DEFORMERS

This tutorial explains how to use soft deformers on skins.

## ESTIMATED TIME REQUIRED

20 Minutes

LEARNING GOALS

In this tutorial you will learn:

• How soft deformers influence skin vertices

• How to add soft deformers to joints.

• How to switch between the use of lattice deformers and soft deformers.

• How to adjust the area of influence of a soft deformer

• How to interactively and numerically adjust the weight of skin vertices.

• How to adjust the weight of skin vertices using a magnetic falloff.

• What data related to soft deformers is exportable.

OVERVIEW

Skin deformers help prevent skin from shearing or intersecting with itself. They also let you precisely influence the manner in which skin responds to the rotation of a bone. For example, you might use a deformer to cause the skin to bulge slightly as a bone is rotated around a joint, simulating the flexing of muscle underneath the skin.

You can apply a skin deformer to any inferior bone on a skeleton. The figure below shows how bones on Mirai skeletons function as either "inferior" or "superior." You can see that the limb in the figure is formed by a chain of bones attached to the root. For any two bones in a chain, the bone that lies closer to the root acts as the superior; the bone that lies farther from the root acts as the inferior. When you apply a skin deformer to an inferior bone, it influences to varying degrees the skin vertices which surround the inferior bone and its superior.

root

superior bone

inferior bone
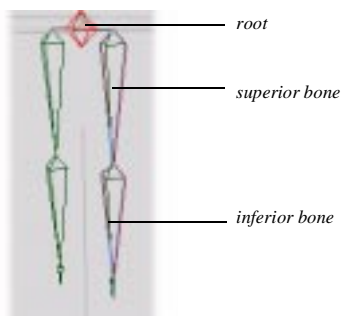
Mirai supports two types of skin deformers, lattice and soft skin. Each type of deformer uses a different method to influence skin vertices. Lattice deformers influence skin vertices using a 3D, scaffold-like structure which moves in unison with the inferior bone it surrounds. Control points on the lattice exert a magnetic influence over skin vertices which lie within the lattice. The closer a skin vertex is to one of the lattice's control points, the greater the control points' influence on the vertex. You cannot manually adjust the influence, or "weight," that the lattice has over a given vertex. However, you can add effects to vertices like bulging and pinching.

Soft deformers use a different method to influence skin vertices. Their area of influence is defined by a cylindrically-shaped icon. All skin vertices which are bounded by this icon are influenced to varying degrees by rotations on the inferior bone. When a soft deformer is initially created, enclosed skin vertices that are close to the skeleton's root are the least affected by a inferior bone's rotation (that is, their

weights are close to zero, at which value the bone's rotation has no influence). Enclosed skin vertices that are far away from the skeleton's root are more affected by the movement (that is, their weights are closer to one, at which value a skin's vertex moves in perfect unison with the bone). When using soft deformers you can override the default weight distribution by manually adjusting the weights on any of the vertices contained by the deformer. You can even assign weights to vertices that are greater than one, causing them to rotate at a greater angle than the corresponding inferior bone.
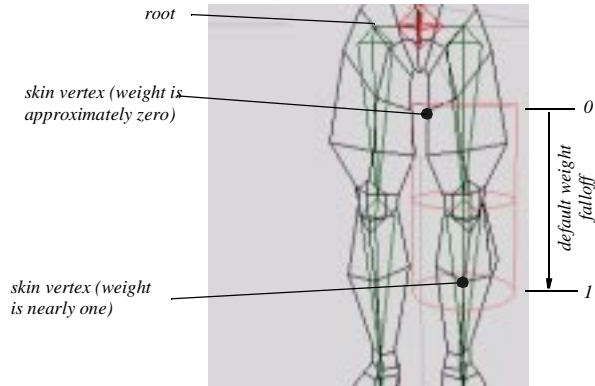
This tutorial will focus on the use of soft deformers. You can read about lattice deformers in greater detail in the Mirai's online help and in the *Mirai Workbook*.

ADDING AND REMOVING SOFT DEFORMERS TO BONES

1   Load the practice scene entitled "mirai-soft-skin-deformers-1.0".

2   In one of your configurations, open up the following windows:

   • The Geometry window

   • The Scene Graph

   • The Geometry Graph (Ctrl [R] on the Geometry window and select *New Graph.*)

3   Use the Geometry Graph to make the "Human Skeleton" and "Human Skin" objects visible in the Geometry window. Currently, this skeleton has no deformers on any of its joints.

4   Use the Geometry Graph to make only the "Human Skeleton" object sensitive.

5   [L] on the segment element sensitivity icon, then [R] on the skeleton's left lower leg bone.

6   [L] on the *Soft Deformer* command. Depending on the mouse click you use, this command lets you add or remove soft deformers from bones.

- [L] *adds* a soft deformer to the selected bone.

- [M] *removes* a soft deformer from the selected bone.

7   To see the icon for the deformer, you may need to adjust the skeleton's properties. [R] again on the skeleton's left lower leg, then [L] on the *Skeleton Properties* command.

8   [L] on the *Display* channel of the dialog box that appears. This lets you view the following properties.

9   Enable the *Skin Deformer* property by clicking [L] on its checkbox. The icon for the soft deformer becomes visible in the Geometry window. (You may need to truck the camera back slightly in order to see the entire icon.)


As discussed, all skin vertices which lie inside of this icon will be affected to varying degrees by rotations of the inferior leg bone.

SWITCHING DEFORMER TYPES

You can easily switch between soft deformers and lattice deformers. Note, however, when you switch from one deformer type to another, the deformer's properties revert to their default values. If you're switching from a soft deformer to a lattice deformer, this means that any weight assignments you have made to specific vertices will revert to their default values.

Try switching the soft deformer that you just added to the skeleton to a lattice deformer:

10 [L] on the *Skin Deformer* channel of the Skeleton Properties menu. This lets you view the following properties.
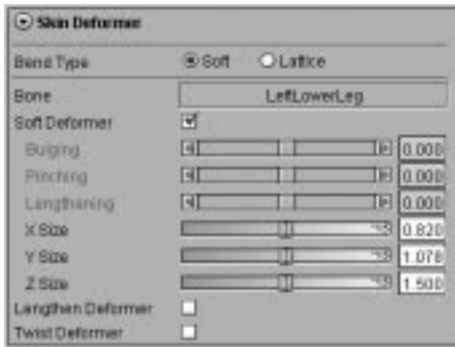
These properties function as follows:

- *Bend Type* lets you switch between deformer types. (This property affects the entire skeleton.)

- *Bone* lets you choose a bone on the selected skeleton for editing.

- *X, Y, and Z Size* let you scale the a soft deformer along the deformers local axes. It's important to note, however, that only the *Z Size* property affects the area of influence of the deformer. The *X Size* and *Y Size* property merely scale the deformer's icon.

- *Lengthen Deformer* toggles the use of lengthen deformers. These ensure a natural stretching of any attached skins when scaling a bone.

- *Twist Deformer* toggles the use of twist deformers. These ensure a natural twisting of any attached skins when rotating a bone around its local Z axis.

11 [L] on the radio button next to *Lattice* to switch the joint's deformer to a lattice.

12 A dialog box asks you to confirm the switch in deformer types. Click *Yes*. A lattice deformer replaces the soft deformer, as indicated by the lattice icon on the bone.
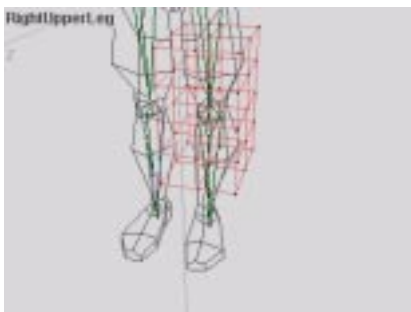
13 [L] on the radio button next to *Soft* to switch the deformer back to a soft deformer.

NOTE: *You cannot mix deformer types on a single skeleton. All bones with deformers must use the same type, either lattice or soft. If you attempt to add a deformer to a bone that is of different type than an existing deformer on another bone, Mirai will ask whether you wish to switch the existing deformer to the new type.*

ADJUSTING A SOFT DEFORMERS AREA OF INFLUENCE

As discussed, a soft deformer influences all of the skin vertices it encompasses. You can increase or decrease the number of skin vertices affected by a soft deformer by resizing the deformer. You can see the effect of resizing a soft deformer in the practice scene.

14 [L] on the point element sensitivity icon, then [L] on the skeleton's left knee joint. Press "a" to aim the camera at the joint.

15 Drag [M] to truck the camera in for a closer view of the joint.

16 Use *Options>Render Domain>Mirai* to view the objects in the Mirai domain.

17 [L] on the segment element sensitivity icon, then [R] on the skeleton's left lower leg bone.

18 [L] on the *X Rotate* command and move your mouse to the right to bend the knee.

19 Press the "Alt-s" hot key to turn the skin's shading on. A checkerboard texture appears that will help you see how the skin is stretching in response to the deformer.

20 Inside the *Skin Deformer* section of the Skeleton Properties menu, Drag [L] to push the *Z Size* slider slightly to the right. The deformer will increase slightly in length.

You can see that as the deformer lengthens, its area of influence expands so that it affects skin vertices farther up the thigh and farther down the calf.

21 Now pull the *Z Size* slider slightly to the left. The deformer will shrink in length.

As it shrinks, its area of influence decreases and affects fewer skin vertices.

NOTE: *As mentioned, you can use the* X Size *and* Y Size *sliders to scale a soft deformer along the corresponding axis. However, these sliders scale only the deformer icon itself. These properties do not affect the deformer's area of influence. Only the* Z Size *property affects the deformer's area of influence.*

22 Use the *Z Size* slider to scale the deformer back up, so it's approximately the same size as when you created it.

ADJUSTING THE WEIGHT OF SKIN VERTICES

As discussed, one advantage of using soft deformers is that they permit you to individually scale the weight of skin vertices. This lets you precisely scale the effect that a bone rotation has on a single vertex or a collection of vertices. By combining weight adjustments with skin displacements on the skin vertices around a joint, you can achieve realistic and organic skin deformations.

You can try a simple weight adjustment on the practice model. For example, suppose you want the left calf to flatten in response to the rotation of the lower leg bone.

NOTE: *When defining skin weights, it's a good idea to rotate the bone to the angle at which the maximum deformation should occur. This will permit you to immediately see the effect of the weight adjustment on the skin vertex. Your skeleton's left lower leg bone should still be rotated up around the X axis. If it is not, rotate this bone now.*

23 Use the Geometry Graph to turn on the "Human Skin" object's sensitivity.

24 Select a couple of skin vertices on the back of the calf, rotating the camera as necessary.


25 View the left leg along the X axis by pressing the "x" hot key.

26 [R] on the collection, then [L] on the *Set Skin Weight* command. This will let you interactively adjust the weight of the selected vertices.

27 Move your mouse slightly to the left. This reduces the weight of the collection to a value closer to zero. This means that the bone's lower leg bone's rotation will have less affect on the vertices. The calf should flatten in response to the weight adjustment.
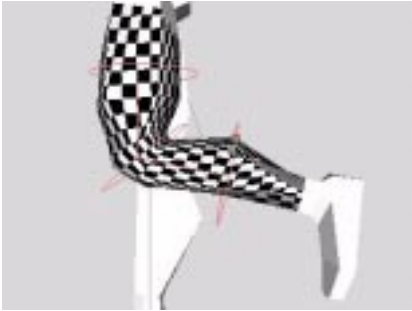
28 Use the *X Rotate* command to rotate the lower leg bone back and forth around the X axis, so you can see the dynamic effect of the weight adjustment. You'll see that as the bone is rotated, the calf gradually flattens.
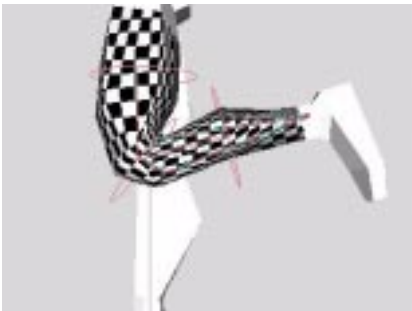


SETTING WEIGHTS WITH A MAGNET FALLOFF

When setting weights interactively, you can use a magnet option which lets you distribute weight in a falloff pattern across an area of influence. Try this on the practice model:

29 [R] on a point above the top of the knee, just inside the soft deformer.

30 Alt [L] on the *Set Skin Weight* command. Holding down the "Alt" key invokes the magnet option. Mirai then waits for you to select a point that will define the edge of the region to be affected by the weight adjustment.

31 [L] on a point on the lower calf, just inside the opposite edge of the deformer.

32 Move your mouse back and forth. You'll see that the weights of all the vertices within the defined region are affected. The vertices that are closest to the selected vertex undergo the greatest amount of weight change, and the vertices that are at the edge of the defined region undergo the least.
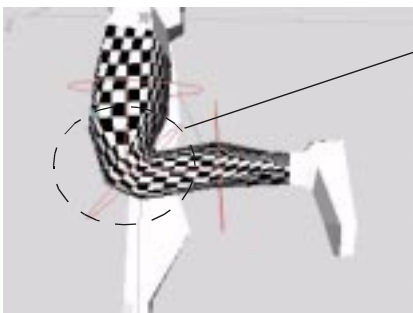

region affected by weight adjustment.
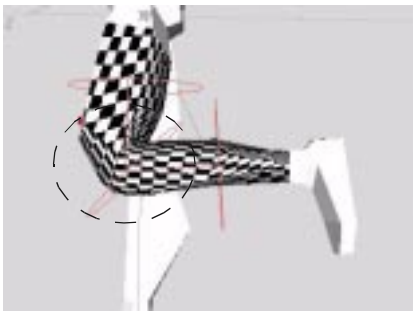
33 [R] on the Geometry window to abort the weight adjustment.

SETTING WEIGHTS NUMERICALLY

You can also set the weight of skin vertices numerically. To do so, click on the *Set Skin Weight* command while holding down the "Ctrl" key. This option is also convenient for viewing the weight distribution across the skin's surface. As discussed, skin weight values are by default lower near the root and higher far away from the root. Verify this for yourself on the practice model:

34 [R] on a point that is near the skeleton's root yet enclosed by the deformer. *Don't* choose one of the vertices for which you modified the weight above.
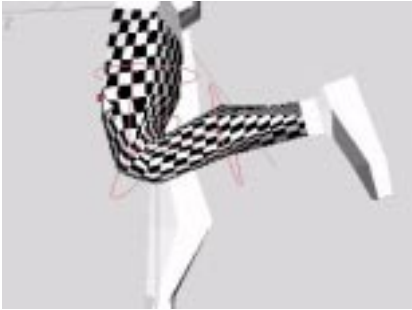

35 Ctrl [R] on the *Set Skin Weight* command. A dialog box appears which lets you input a weight numerically. There's no need to modify this value now. Just note that the value is very close to zero, as the vertex you select was one of the nearest to the root within the deformer.

36 Now [R] on a point that is far from the skeleton's root yet enclosed by the deformer.


37 Ctrl [R] on the *Set Skin Weight* command. Note that this value is very close to one, as the vertex you selected was one of the farthest to the root within the deformer.
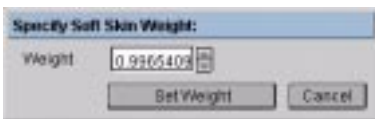
EXPORTING SOFT DEFORMER DATA

You can export a skeleton to Mirai's Game Exchange preserving all data related to soft deformers, including weight on assignments on vertices. Verify this by exporting the skeleton in the practice scene:

38 [L] on *File>Export>Game Exchange*. The following dialog box appears.
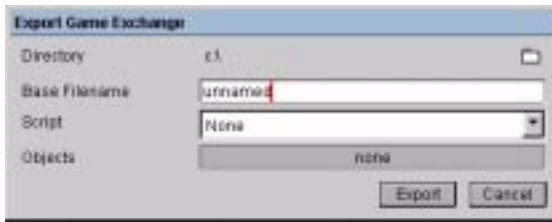
- [L] on *Directory* icon, then select a directory on your local or network drive where you can temporarily store the export files.

- Type in a base name for the export file in the *Base Filename* field.

- [L] on *Object* field, then select the "Human Skeleton" object.

- [L] on *Export* button to export the data.

39 In any text editor, open up the file called "Human_Skeleton.gsf". It will be stored in the directory which you specified in the previous step.

40 Inside the text editor, perform a search on the following string: "LeftLowerLeg".

41 Scroll down a bit and you'll see the data relating to the soft deformer under the heading "soft-parts:"

(vertex-index 210; weight 0.8467371;)

     (vertex-index 209; weight 0.82902867;)

     (vertex-index 208; weight 0.7250888;)

     (vertex-index 144; weight 0.96096635;)

     (vertex-index 80; weight 0.72315705;)

     (vertex-index 77; weight 0.8749511;)

     (vertex-index 76; weight 0.7613861;)

     (vertex-index 74; weight 1.0066675;)

You can see that the data include weight assignments for each vertex.

REVIEW

You've learned the following about soft deformers:

- You can add or remove soft deformers by clicking [R] on a inferior bone, then clicking on the *Soft Deformers* command. Clicking [L] on the command adds a deformer; clicking [R] on the command removes the deformers.

- You can switch a soft deformer to a lattice deformer using the *Bend Type* property in the Skeleton Properties menu, which you access using the *Skeleton Properties* command.

- You can scale the area of influence of a soft deformer using the *Z Size* property in the Skeleton Property menu.

- You can adjust the weight of any of the vertices that lie within the soft deformer by using the *Set Skin Weight* command. Pressing "Ctrl" when selecting the command lets you set weights numerically. Pressing "Alt" invokes the magnetic falloff option.

- All data related to soft deformers is fully exportable to Mirai's Game Exchange.