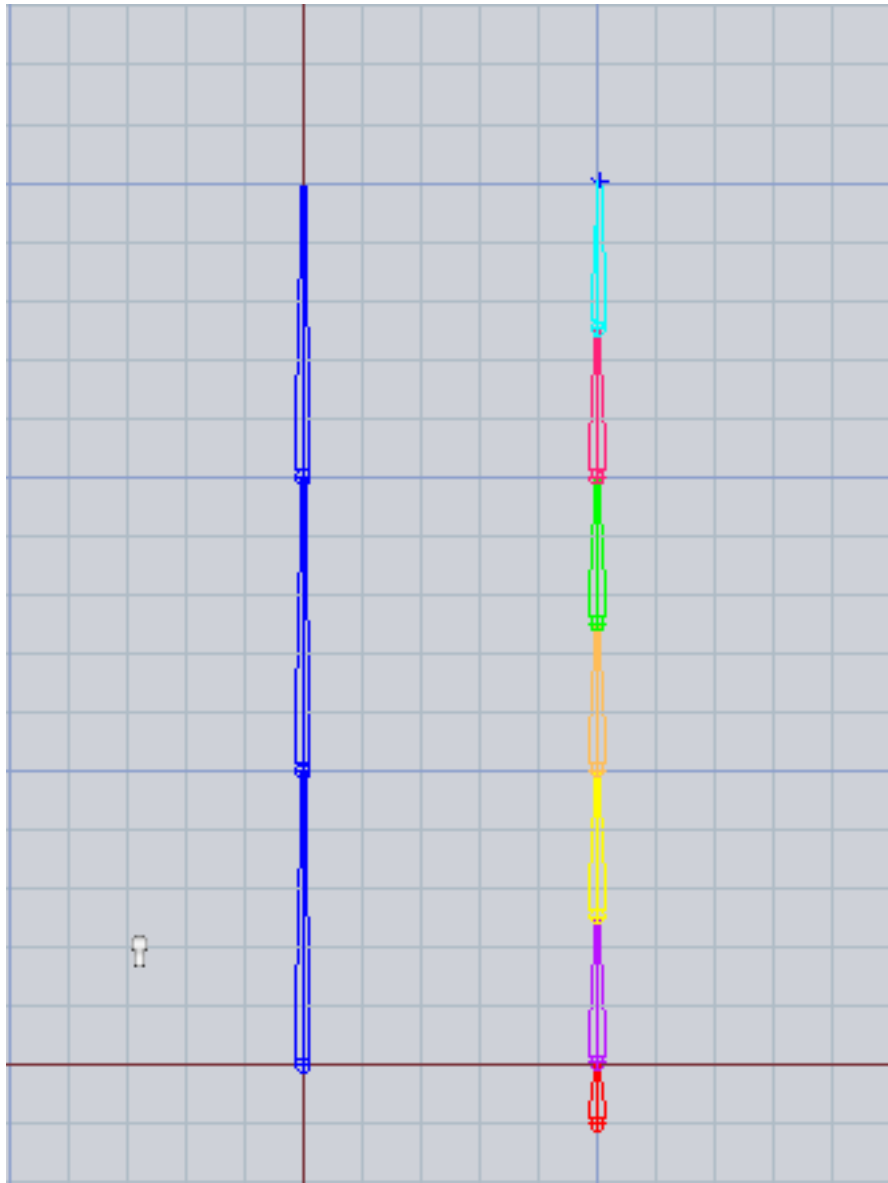


CONSTRAINT TUTORIAL 2

The purpose of this tutorial is to show the creation of complex constraint relationships to create a character's backbone.

1. Open up the project, "Constraint2.prj"

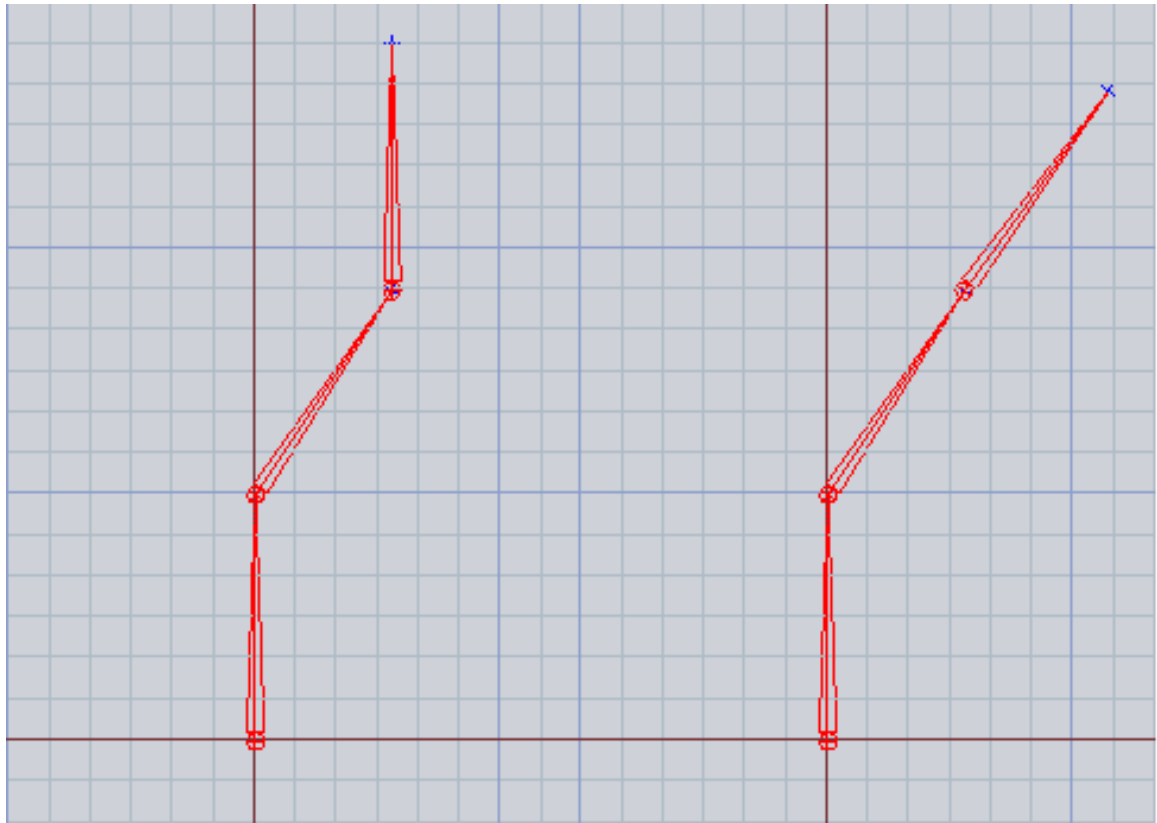
You will see a series of three skeleton effectors on the left for control and seven bones on the right that make up a character's spine. We will set up constraints so that we can use the skeleton to create 'natural' movement of the spine.



Front View

The bones on the right were added using the Create Bones command from the Character menu and clicking in the front view from bottom to top. The skeleton effectors on the left were added using the Create Skeleton command from the Character menu and clicking from bottom to top just twice. The two 'joints' thus created were duplicated twice and dragged in the top view to form the stack of three that you see above. This was done because we don't want a hierarchical relationship between the skeletons; we want constraint relationships instead.

The goal is to create a natural 'S-type' backbone rotation. As opposed to an unnatural 'bent' rotation.



S-type rotation (Left) and Bent Rotation (Right)

Look what is happening on the left side of the image above. As the Mid Back Control skeleton was rotated, the High Back Control didn't rotate. Instead it moved to a new position defined by the top of the Mid Back Control.

On the right, we have a standard parent child relationship. The rotation of the Mid Back Control caused the High Back Control to rotate and move.

What we want for our control is the Left case. We want the skeleton above to move, but not rotate. We can create this relationship using a position constraint. Specifically, we want the High Back Control's position to be constrained by the Mid Link Point effectors. We want the Mid Back Control's position to be constrained by the Low Link Point effectors.

2. Select the High Back Control from the Project window or Front View window.
3. Select "Position" from the Constraint menu
4. Click away the dialog box warning that pops up
5. Select the Mid Link Point as the target of this constraint
6. Hit CMD-. or esc to terminate the target selection process

7. Select the Mid Back Control from the Project window or Front View window.
8. Select "Position" from the Constraint menu
9. Click away the dialog box warning that pops up
10. Select the Low Link Point as the target of this constraint
11. Hit CMD-. or esc to terminate the target selection process

Now if you rotate any of the three back controls, you will see 'natural' movement. Make sure you set the controls back to vertical (in the Top View) before going on to the next step.

Controlling the Spine

Our controls now work by themselves but do nothing to control our spine. Lets go ahead and use constraints to create a relationship between the controls and the bones in the spine.

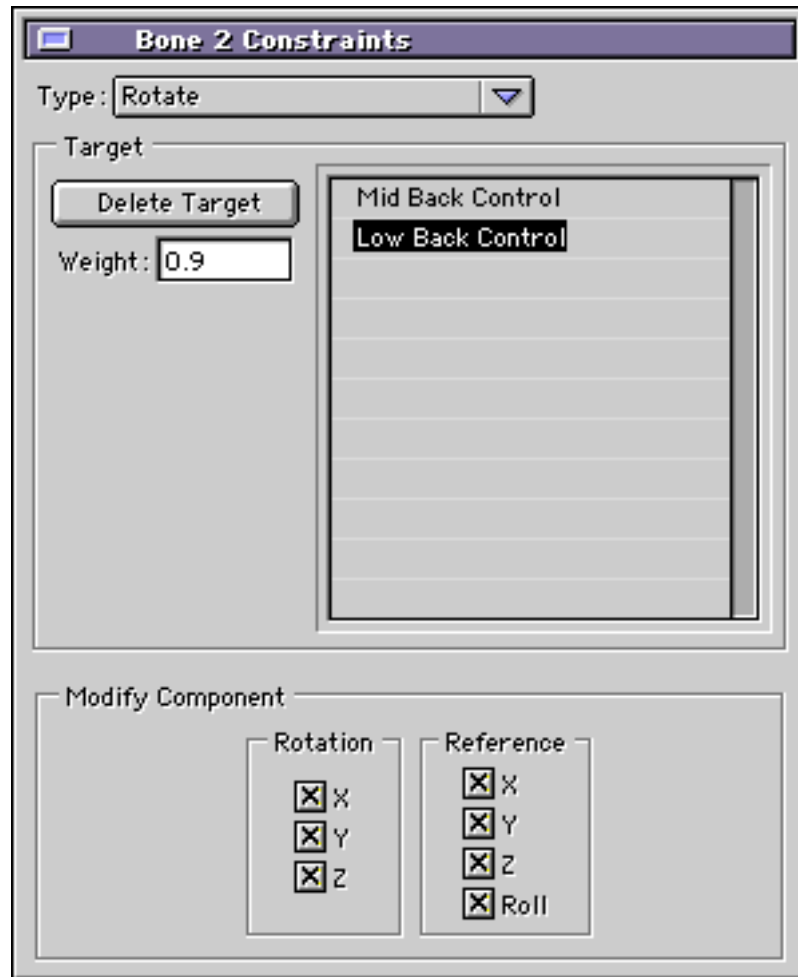
Since there are more bones than controls, we will use weighted constraints to spread the effect of the controls over the spine.

Bone 1 is going to form the root of our spine. We won't be rotating it so there is no reason to set up a constraint for it.

12. Select Bone 2 from the Project window
13. Choose "Rotation" from the Constraint menu
14. Click away the warning dialog
15. Choose the Low Back Control
16. Choose the Mid Back Control
17. Hit CMD-. or esc to terminate the target selection process

Bone 2's rotation is now constrained to both the Low and Mid Back Controls (targets). By default, the weight for each of these targets is 1.0. This means that the rotation of Bone 2 is the average rotation of the Low and Mid. Since Bone 2 is so low on the spine, it makes more sense that most of its rotation should come from the Low Back Control and only a little bit from the Mid Back Control.

18. Select Bone 2 from the Project window
19. Choose "Constraint Editor" from the Constraint menu
20. Highlight "Low Back Control" in the target list
21. Set the weight to 0.9
22. Highlight "Mid Back Control" in the target list
23. Set the weight to 0.1
24. Drag the Constraint Editor window off to the side but leave it open



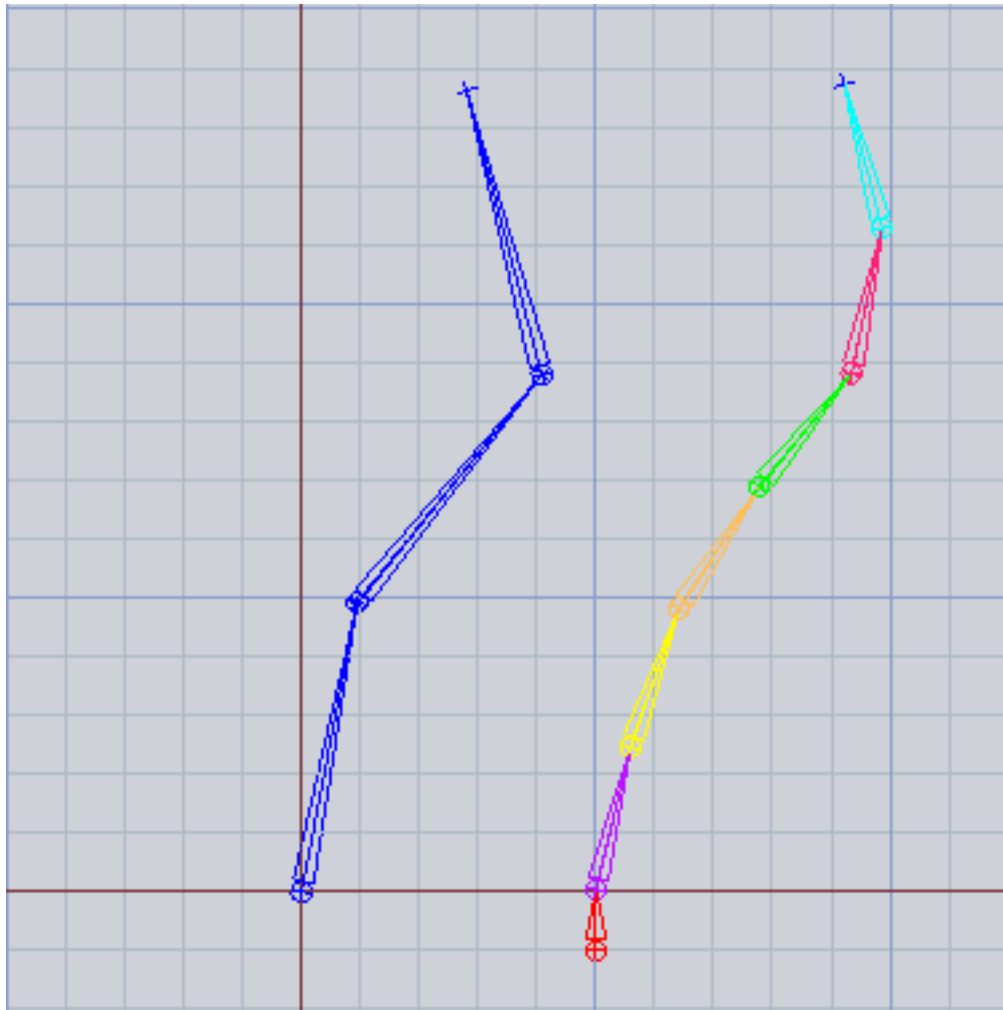
Constraint Editor for Bone 2

The rest of the setup will use shorthand to describe the constraint process. Follow along Steps 12 through 23 above for the other bones using the values below. Make sure you use constraints of type, “Rotation”.

25. Constrain Bone 3 to the Low Back (weight=0.7) and the Mid Back (Weight =0.3)
26. Constrain Bone 4 to the Low Back (weight=0.2) and the Mid Back (Weight =0.8)
27. Constrain Bone 5 to the Low Back ONLY (weight = 1.0)
28. Constrain Bone 6 to the Mid Back (weight=1.0) and the High Back (Weight =1.0)
29. Constrain Bone 7 to the High Back ONLY (weight = 1.0)

Now try rotating the Controls. Notice the nice, natural movement of the spine.

When you are done playing with the Controls, reset them in the vertical position.



Top View with Controls Rotated