

Creating an IK Chain

with Single Axis Internal Joints

by Roland Hess, aka Harkyman

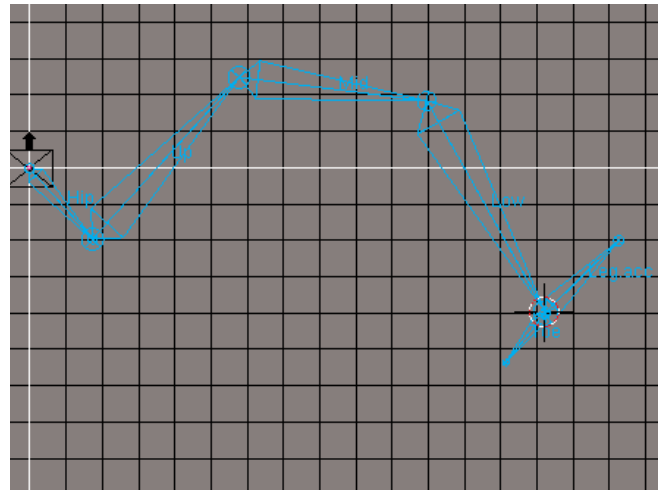
This tutorial applies to Blender Publisher 2.25.

Before I begin, I'll give you the setup. I make my rigs before I begin to model. Until I have a working rig, I'm not confident enough in my knowledge of the subject to model it properly. On all three of my "characters" that I've done, the bird, the chrome widow, and the jabberwock, I've always built the bone structure first, then modelled around it. It saves you from spending two weeks modelling something only to find out that you should have done it a little differently, because your rig deforms it wrong and then you're in the garage with the engine running and the door shut. So I rig first.

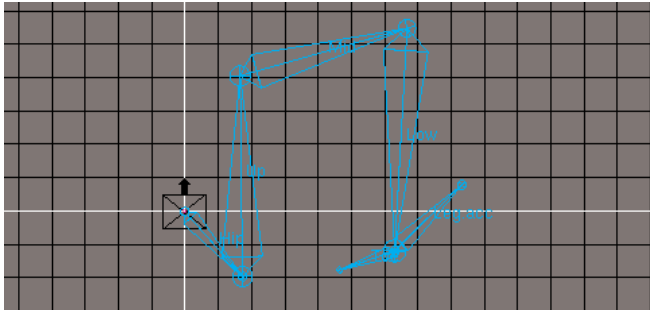
Once it's built, I use Publisher 2.25's nifty auto-orient bones feature (Alt-N from edit mode on your armature), and apply all sizes and rotations (Ctrl-A from regular mode) so that there are no surprises when I go to pose and move my model. By the way, if you're using pose mode to tweak your initial position, then think of a suitable punishment for yourself, go back to edit mode, and get it right the first time. You're only

going to cause yourself grief down the line.

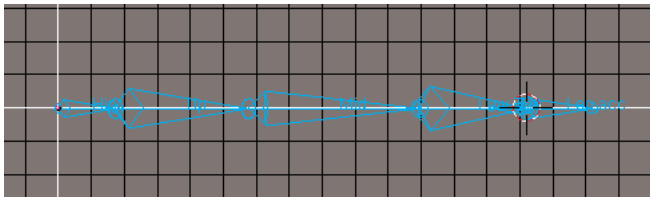
That said, here's the tutorial. Let's say that you built a nice spider leg armature, using an IK chain. Note that the link between the Up bone and the Hip bone is NOT IK, but a standard parent-child link. Toe is the last bone in the chain, and has a constraint to Leg.acc as it's IK solver.



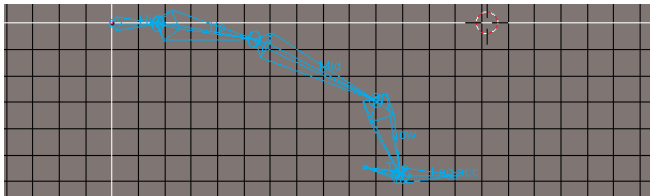
You move Leg.acc around in this viewport and things work just fine.



Switch to a top view, though...



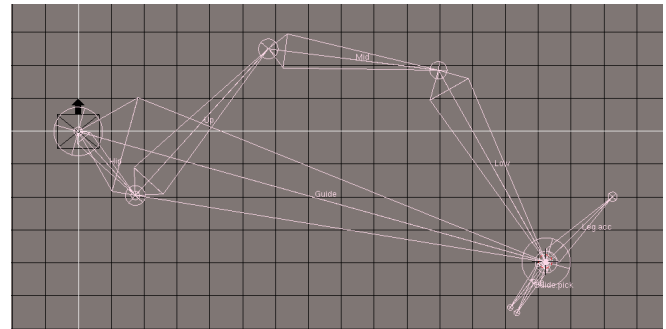
And things go awry when you move it. All of the joints bend and twist to follow the IK chain properly. This is cool if you're building, say, a human arm with a good



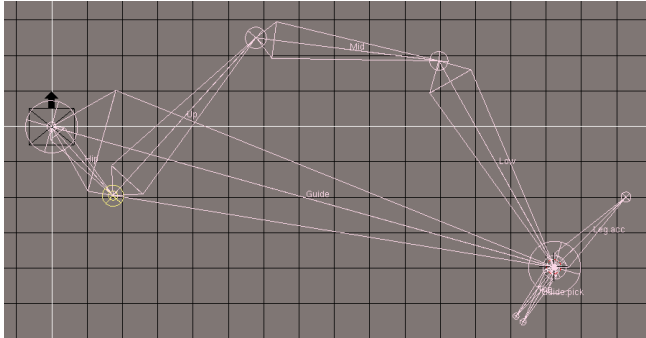
range of motion in all joints. It's bad, though, if you're building a mechanical spider, or a back-hoe, or anything that only allows certain joints to move along a single axis.

What you would like to do is this: allow the IK chain to move as seen in the forward view to the left, but to rotate as a whole when moved along any other axis. My friends, there is a way.

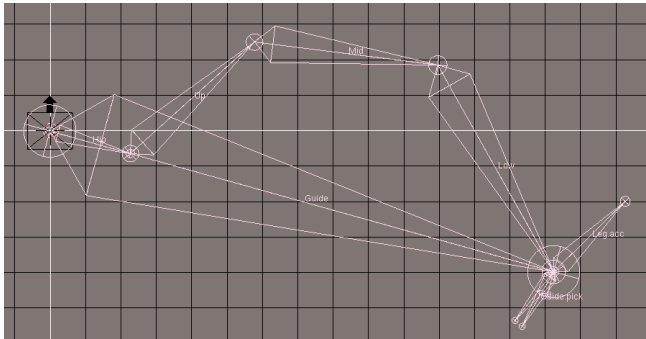
Here's what we do. Go to the origin of your IK chain. Start a new bone, pulling it toward your IK solver target, then extend this new IK chain by another, small bone. Use the cursor to position the endpoint of this new Guide bone concurrent with the origin of the IK target. Select the second bone in this new chain and constrain it *via* IK solver to the Leg.acc bone.



Now for the fun. Select the joint between Up and Hip



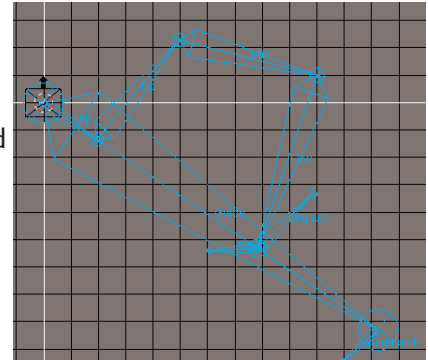
and bring it in line with the center line of the new Guide bone. You can eyeball this, or use one of a couple of tricks to get perfect alignment. The better aligned it is, the better this technique will work.



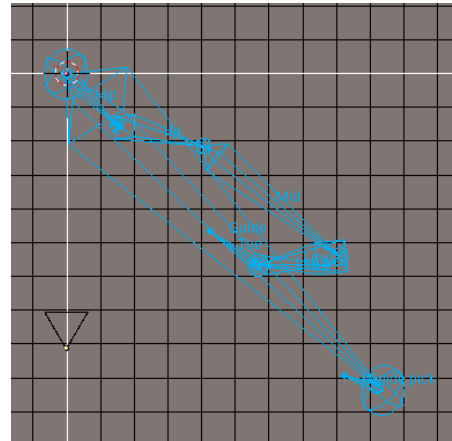
Select the Hip bone, and assign it two constraints, Copy Rotation and Copy Location, both targeting the

Guide bone. And magically, you're done.

Pull Leg.acc around in a front view, and everything works just right.



Move it around in a top or side view, and, although



the Guide bone rotates a bit, the original arm always stays in line with it!

Some final notes appear on the last page.

The ideal situation would be to use a track to constraint on one of the bones to eliminate the rolling of the guide bone. In my tests, though, the Track To constraint was unreliable when rotating the entire rig outside of pose mode.

This technique will preserve the interior single-axis joint relationships created by the mech-modelling style shown in S68's excellent tutorial. I used his modelling techniques for both the legs and the pistons for my chrome widow model, which can be seen at my web site. I developed this rigging method because I wanted to use IK on the spider's legs, and also as an attempt to get around Blender's lack of joint constraints.

I hope you find it useful!

Harkyman