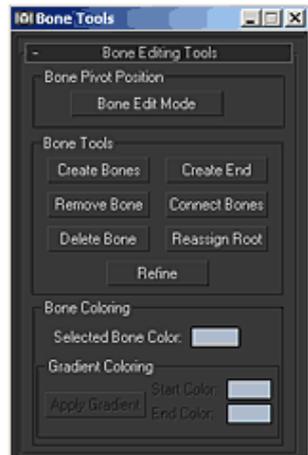


## The basis of IK/bones setup under 3dsmax5

■ Ok folks, you want to play with character animation under max ? So you will have to learn IK/bones setting up ! Although you can use Character Studio, which had a made setup for bipeds, I really think bones/IK are first more flexible (you can add the controls you want where you want), and then more helpfull, as you can setup some rig for any type of non-human creatures. And another advantage is that bones/IK setup are nearly the same on each 3d package.

Ok, start 3dsmax5 ! I consider here that you are already familiar with the max UI. As you can see, you have two usefull menus for character setup : Character, Animation (don't worry, others will be usefull too !)

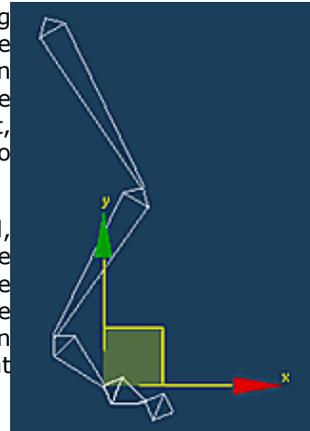
■ Go into Character | Bone tools.



Here you will create your bones chain. You will also be able to refine a chain, edit them, etc.

Click on "Create Bones", and draw a chain of bones in the left viewport, starting with the upper leg (look at the bottom of the page to see why). This is like drawing a spline, left click at the end of a bone, draw the next one, etc and then right click when it's done. When you right click, you see a last small bone created at the end of the chain. You will learn later that sometimes you keep it, sometimes you simply delete it. Max creates it by default. It can be usefull to apply a solver to the chain.

Ok now, play a bit with your bones ! About the design, go into Bone Tools panel, in the Fin Adjustment Tools roll-out. You see that you can adjust the size of the bone, and put some fins on. These fins are usefull for visual aid to see the orientation of the bones while animating. On the other hand, 3dsmax bones are volumetric ! This means that the default envelope for skinning will be based on the size/fins of the bone. But let's see this in a future article. Keep in mind that you can Edit bones after creation, to adjust them to better fit your mesh.



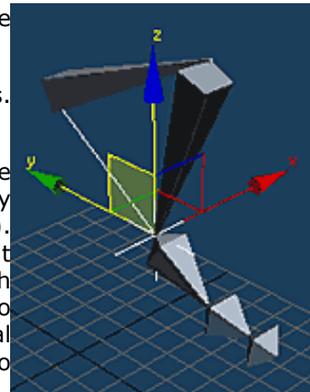
Ok, now select a bone, move/rotate it, do it with another one etc. As you can see, moving the first one (the upper leg) moves all the others. This means that the first one, is the parent of the chain ! The others move the next ones on the chain, but not the previous ones, and always stays attached by their first end. You can also note that double clicking on a bone automatically selects this bone and all its childrens.

Ok, so you can start animate it like that, but humm, I think we have better solutions ! Or should I say better solvers ? Maybe ... !

Select the Upper leg bone, go into Animation | IK Solvers | HI Solver, and click on the Bone03 (should be the first foot one).

You can see that max create a blue cross at the base of the foot. Move this cross, and see what happens. Whao, my leg moves like a ... leg !!

OOok, what is this "solver" thing ? A solver is a mathematical definition of how the bones which are "in" the solver will react together. Here you got the upper and lower leg into the solver, so the solver affects only these two bones. The foot is linked to the lower leg, it simply follow its parent (what a nice children !!). You have several solvers, for different uses. HI Solver is usefull for any chain (use this when you don't need to use another one hey !), and it is fast !! The IKLimb solver is nearly the same, working just with two bones chain. It's mainly used for games, because this solver is part of the Discreet open source so game engine can import it. The Spline IK Solver is usefull for long chain, like a tail, a snake, or the spinal column. The last one, HD Solver, is mainly used for mechanical animation. It's Historically Dependent, so better use it for short animations.



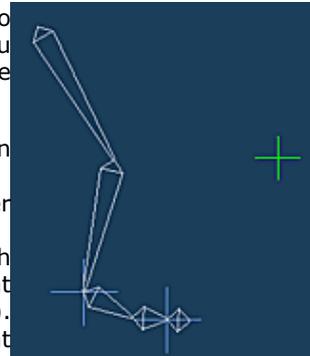
■ Ok, let's play further with our HI Solver.

First, you can add a second solver on your chain, for the foot : Select the bone03 (the first foot one), go into Animation | IK Solvers | HI Solver and click on the last bone. Then you got a solver for the foot. If you move the leg solver, you can see that now, the foot follow the leg, but it is always oriented towards the foot solver ! (You can still achieve the same movement than before by moving the two solver at once).

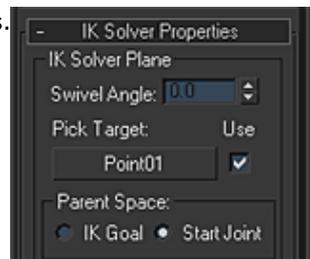
We will now add a control for the leg solver. Create a point helper in front of the leg like beside, then Select the leg solver, and go into Motion panel.

Here you have all the solver properties ! Into IK Solver Properties roll-put, change SwivelAngle spinner value on the fly and see what happens for your leg.

Mathematically, a plane needs only three points to be defined. The IK Solver Plane represent a plane which is define by the start of the first bone in the solver, the IK Goal of the solver (the blue cross), and a point in the world. Actually you Solver Plane is defined by the two first point, and an angle (the SwivelAngle). You will then add your point helper as the third point. Click on the Pick Target button and select your point helper. Then moving this point is like changing SwivelAngle. This is more usefull for animation to have this point represented in the scene.



Solvers can also be disabled. This is usefull at certain part of animation, and also to edit your bones. Disabling IK Solver is in the first roll-out into Motion Panel.



## ■ Introduction to helpers

You can then draw some spline/object for help you with less manipulations while animating. These splines/object are named helpers.

For example, draw a circle at the base of the foot. Center it on the leg IK Goal, and then link the two (leg and foot) IK Goals to this circle. Now move and rotate this circle. As you can see, it is now easier to move this circle than select/move the two IK Goals, and easier to rotate the circle to achieve a rotation of the foot. This circle is an helper !

Different tools/technics are used for create helpers, and it all depends of the creature and the setup you got to animate it. The different technics are link (like above), wiring, constrains, and Custom Attributes. More advanced users can then use scripting with expression to move one bone from translation/rotation of another ones, etc.

I think you should now experiment some small setup to understand how IK/bones works, and then go follow the next articles ,-).

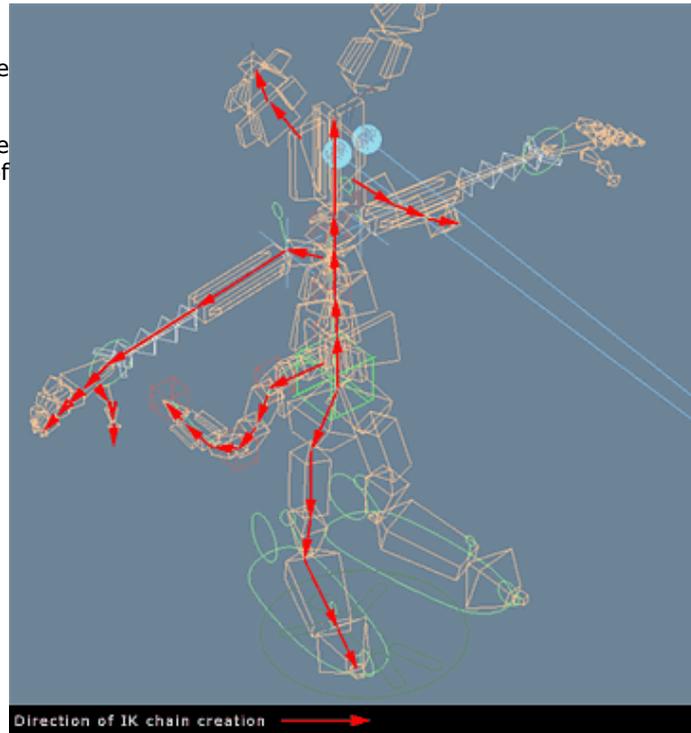
## ■ Symetric creation

When you have done one leg (or arm), you can create the other by symetry. Usually, you just need to select your IKGoals, swivel angles, and of course your helpers, then mirror. Not the bones ! If some bones don't have any IK solvers (like fingers for example), you must select them. So just double click on each first chain bone.

## ■ Direction od the IK chains

In which direction should you draw your IK chain ? We usually use the rule that the first bone should be the one which will move/rotate the less.

Here a small screen to see what this mean. The red arrows indicate the creation direction of the chain. I've took my cartoon character, cause of the ear and tail, to show all a biped can have.



### ■ ■ some rules !!

■ 1) Never scale a bone ! Or you will get strange deformation while animating

■ 2) Name your bones and helpers for quick recognition. Personally, I use these rules :

- B\_limb\_Rg or \_Lf for bones (Rg for right side and Lf for Left).
- IKsw\_limb\_Rg or \_Lf for SwivelAngles point helpers.
- H\_limb\_Rg or \_Lf for helpers.
- IK\_limb\_Rg or Lf for IK solvers.

■ 3) Also you can change default SwivelAngles, try to always create your bones chains into side viewport (left or right).