

Introduction to Rigging

Rigging can often be related to solving a puzzle. You are given a model and an explanation of how it needs to be able to move and you have to solve the problem in the most efficient way, both in the way that the computer understands the control (so that the playback is fluid) and the way that the animator interprets the control so that it is intuitive.

Joint Chain

Joint chains are the most common method of driving a mesh object. Joints represent the object's skeleton and the object's mesh is bound to the joint chain to allow it to deform and conform to the shape of the chain as the joints are rotated.

Forward Kinematics

To achieve a forward kinematic movement it requires the individual movement of each singular joint and for it to be keyed correctly. This would mean if you wanted to make your character scratch his head you would need to key the shoulder, elbow and wrist movement individually. Although this sounds time consuming, because this is how our bodies actually work, it gives us much more realistic movements and helps an animator maintain correct arcs of animation.

Inverse Kinematics

Inverse Kinematics attempts to simplify the process by reverse-engineering our movements. After the character has been fully rigged (using the same example as above), all you would need to key is select the wrist and drag it towards your characters head and the movements of the shoulder, elbow and wrist would be automated. This is particularly beneficial if the character has to hold on to something because however the rest of the character is animated, the location of the hand (and the resulting shoulder/elbow/wrist rotations) will be locked onto the desired position, a door knob for example.

IK/FK Switch

Obviously it is not therefore desirable to only have access to one of these solutions, so we would usually set up a custom attribute to switch (or blend) the character between IK and FK control.

Constraints

Constraints allow you to constrain certain attributes of an object to another object. The most common example is a parent constraint. This treats the object that has been constrained as if

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it is a child, so if the main object is moved or rotated (not scaled) then the constrained object will follow.

The advantage of using a constraint is that it allows you specify which attributes are being constrained (only the Translate Y for example) and also allows a constraint weight value between zero and one which controls how much influence the constraint has. This means that we can set up a constraint that will move an object by half the value that another object is moved.

Various types of constraint exist, but the three other commonly used are:

Orient – constrains the rotation of an object to another.

Point – constrains the absolute translation of an object to 'pin' it to another.

Aim – also controls the rotation, but instead of mirroring the target's rotation is locks a specific axis to always point towards it (for example setting up eyes).

There are many other types of constraint, two more worth noting are *scale constraints* which lock the scale down (this is often combined with the parent constraint) and *pole vector constraints* which act similar to an aim constraint pinning the pole vector information of an IK handle to a specific object.

Direct Connections

By means of the Connection Editor, a single attribute can be directly link to another using what's known as a dependency.

Human IK

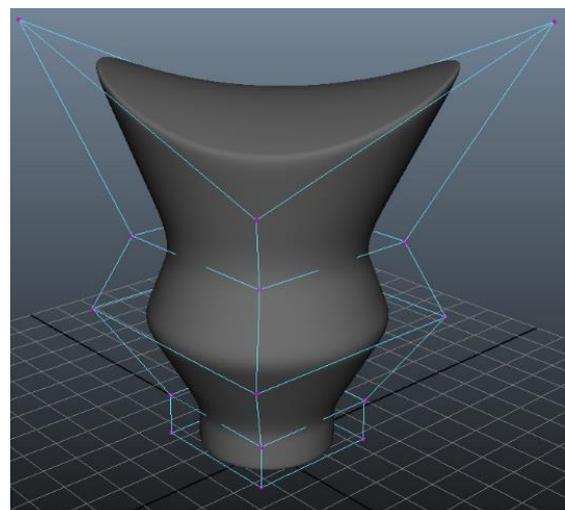
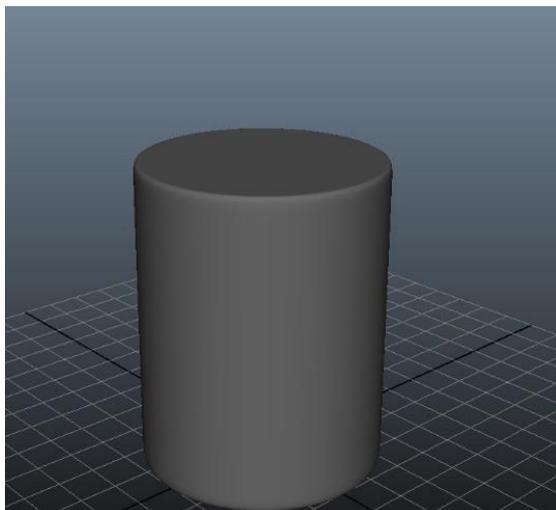
Something that we will not explore in this book, but may be worth making a note of is Maya's recent Human IK solution. This is Maya's automatic skeleton builder, which can very quickly build a powerful rig for your model ready for animation.

Deformers

Deformers (as their name would imply) deform the appearance of the object they surround or are attributed to. The most commonly used deformers are:

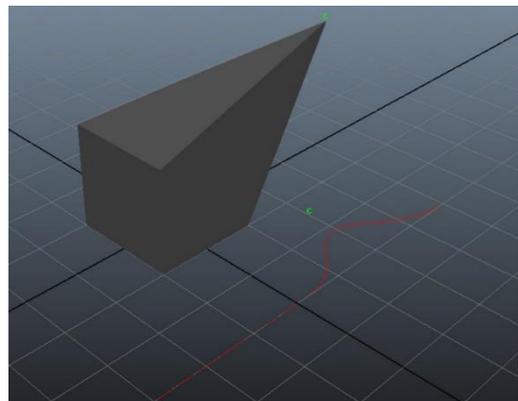
Lattices

A lattice is a frame that encompasses your object and allows you to deform it by manipulating the lattice points. Lattices are often used as modelling aids, to pull parts of model around in a smooth way however because they have a live connection with the objects that are inside them they can also be used to build complicated powerful rigging systems.



Clusters

Clusters are used to group points together. These can be vertices on a mesh, cvs on a curve or even lattice points, and this makes them very versatile. Their primary role is within the rigging realm as you will see later. The cluster will be assigned a handle and you can use this to manipulate them accordingly.

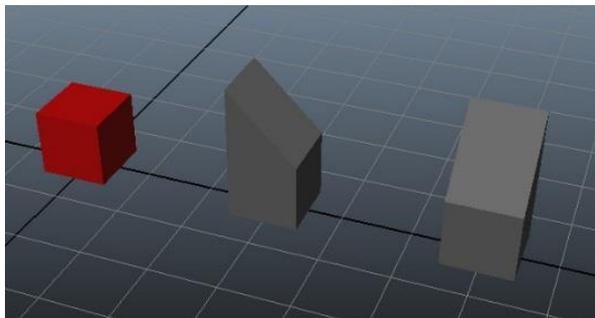


Blend shapes

Blend Shapes are used to deform an object, relative to its original state. You are able to control the level of influence a blend shape has, as well as combine multiple blend shapes at the same time giving you complete control of deformations. Blend shape applications are vast but most often used within facial rigging, where the smile, mouth open and other shapes are separated in order to be combined during the animation process. This being so they can also

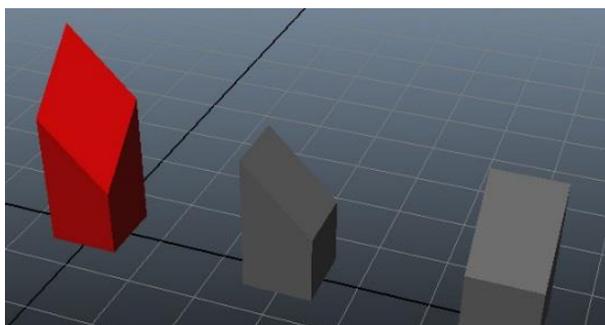
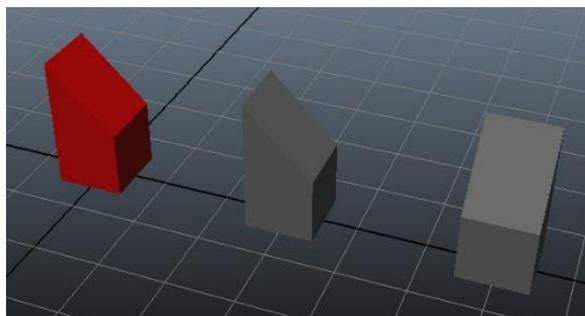
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be used in less obvious ways, such as manipulating the shape of a lattice object to give an object a very specific uniformed deformation.



This is our original object (red) and two blendshapes, created by duplicating and modifying the original.

We can use our blendshape node to add the changes of the first blendshape to our original object.



Now if we add the second blendshape information to our object you will see that both shapes are combined because it adds the relative change per vertex to your shape. This allows to huge flexibility and is especially valuable for facial animation.

Limiting End User Control

An animator's job is to animate, and therefore the only thing the animator wants to manipulate are the control objects. You can make this easier for them by limiting what the animator can select.

The first thing to do this is to ensure that anything the user should not be changing, such as deformers and joint chains, are in hidden groups, but you cannot 'hide' geometry. You can however stop the geometry from being selectable.

There are two ways to do this, you can put the geometry group into its own layer and set that layer to be (display layers on the bottom right) or you can override each piece of geometry's display attribute to be treated as referenced.

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In the attribute editor, go to the transform node and tick the Display | Drawing Overrides | Enable overrides box. You can then set the Display Type to reference.