

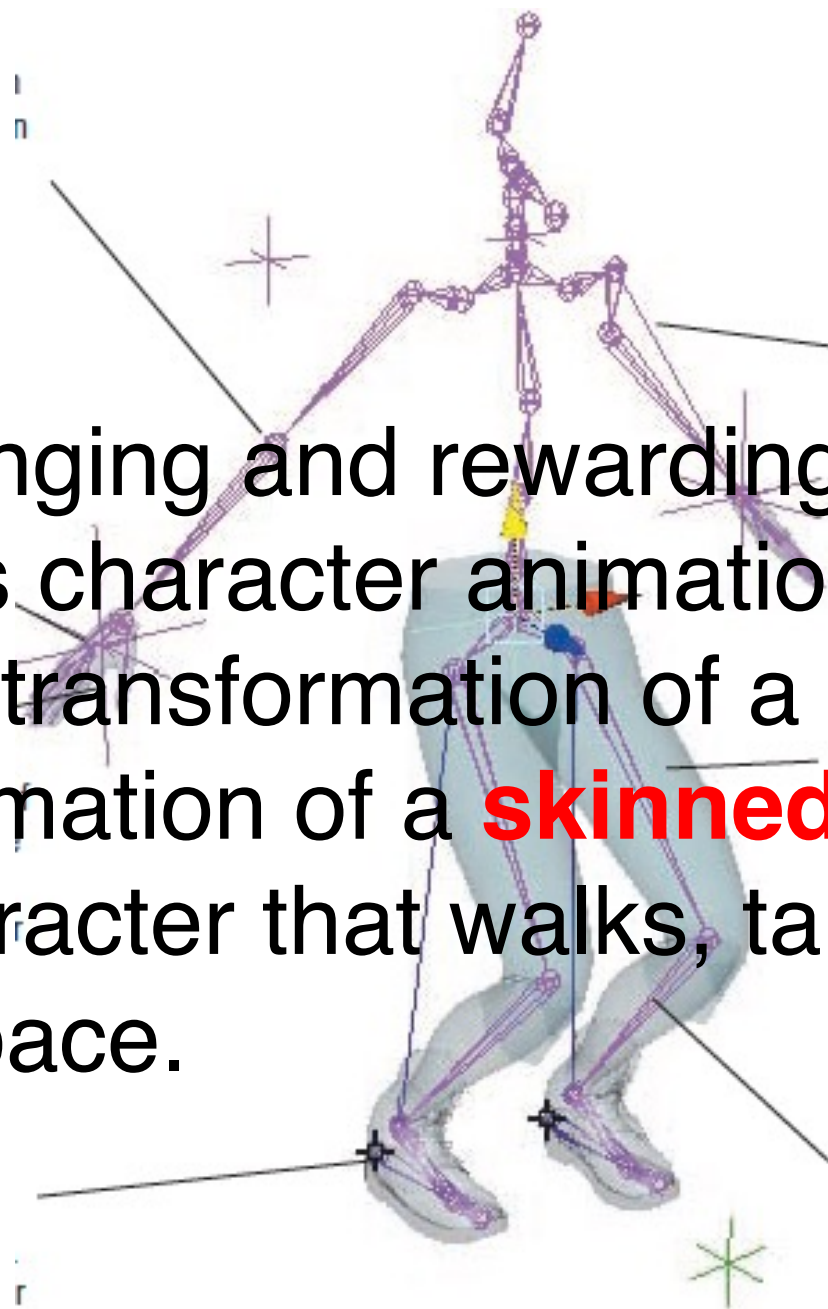
TECH TALK
**BRINGING
SKELETONS
TO LIFE FOR COCO**





What is Rigging

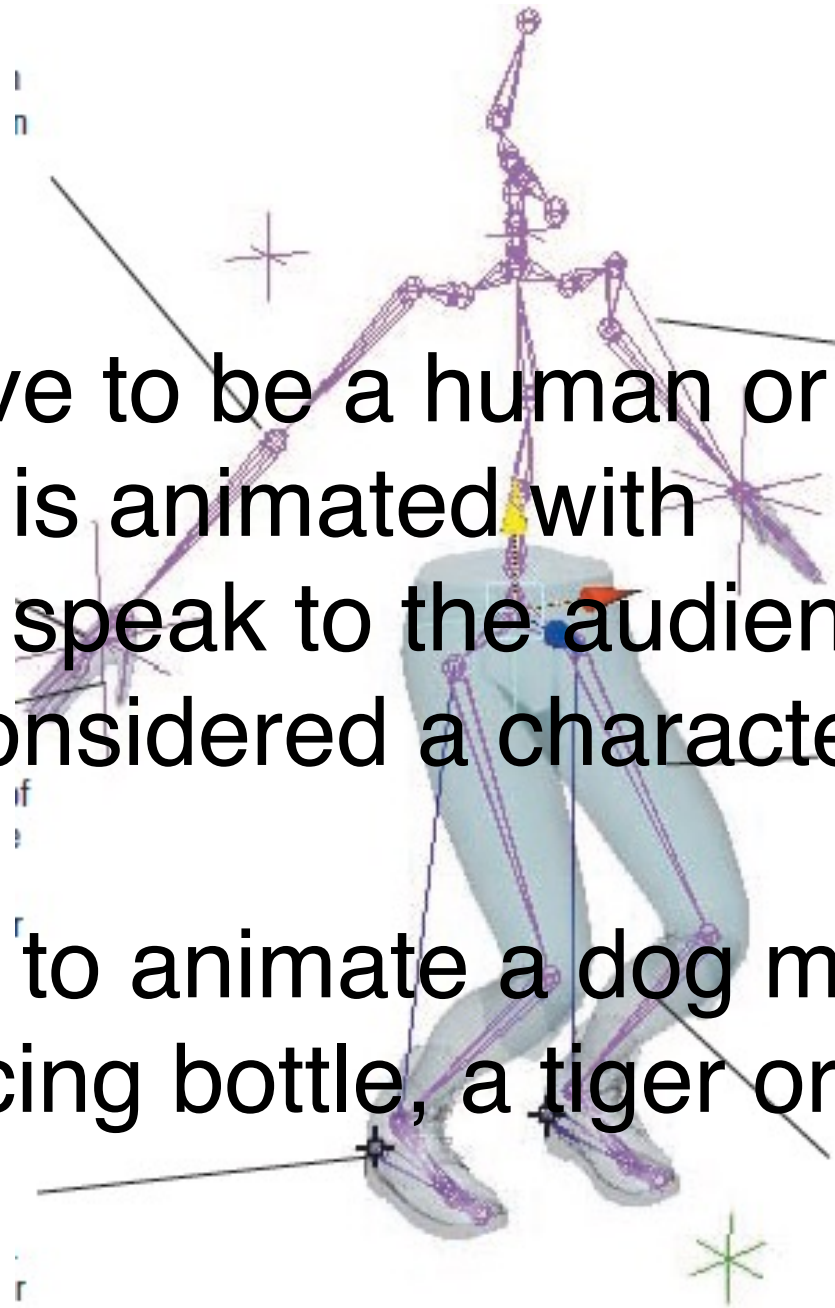
One of the most challenging and rewarding forms of computer graphics is character animation. 3D artists combine the transformation of a digital skeleton with the deformation of a **skinned** surface to set up a character that walks, talks and moves around in 3D space.



What is Rigging

A character doesn't have to be a human or an animal. Any object that is animated with expression and tries to speak to the audience through its actions is considered a character.

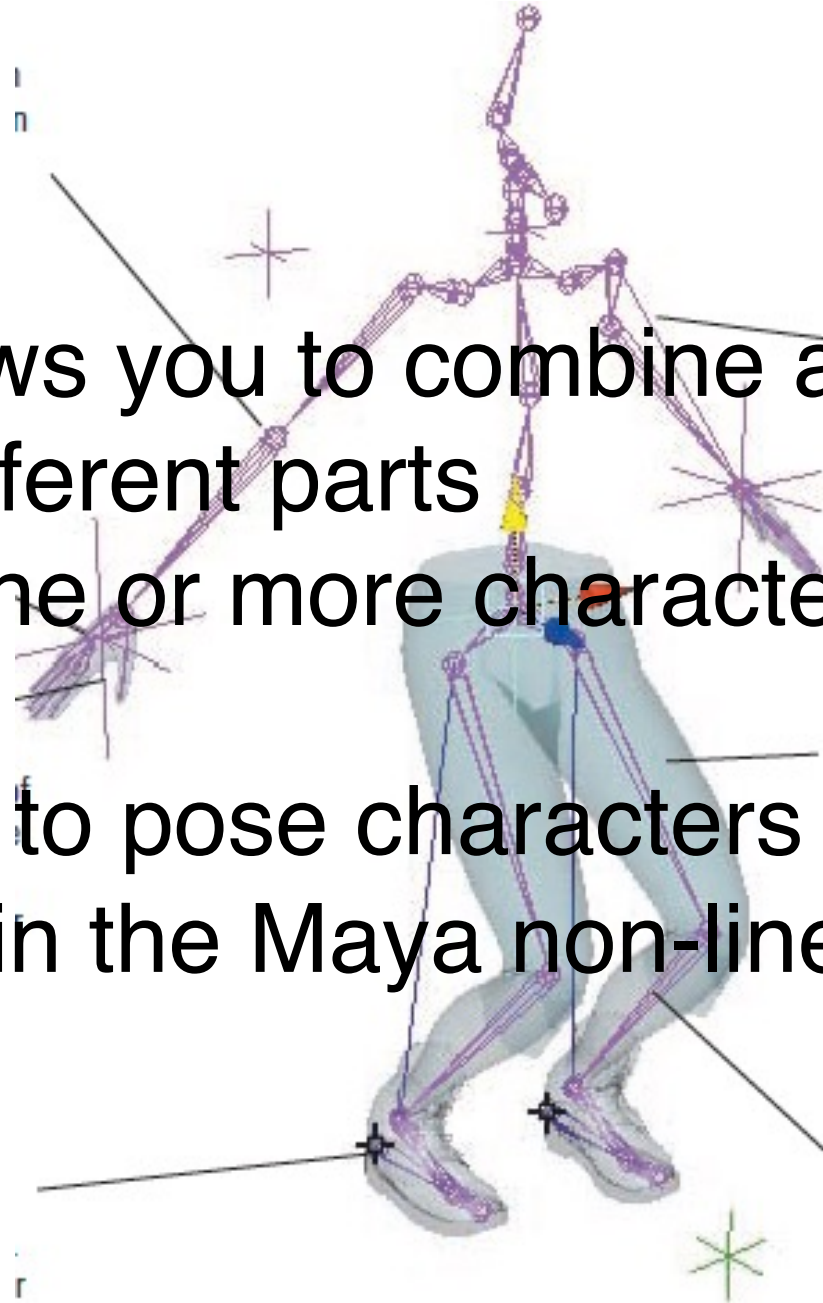
Same techniques used to animate a dog might be used to animate a dancing bottle, a tiger or a tree.



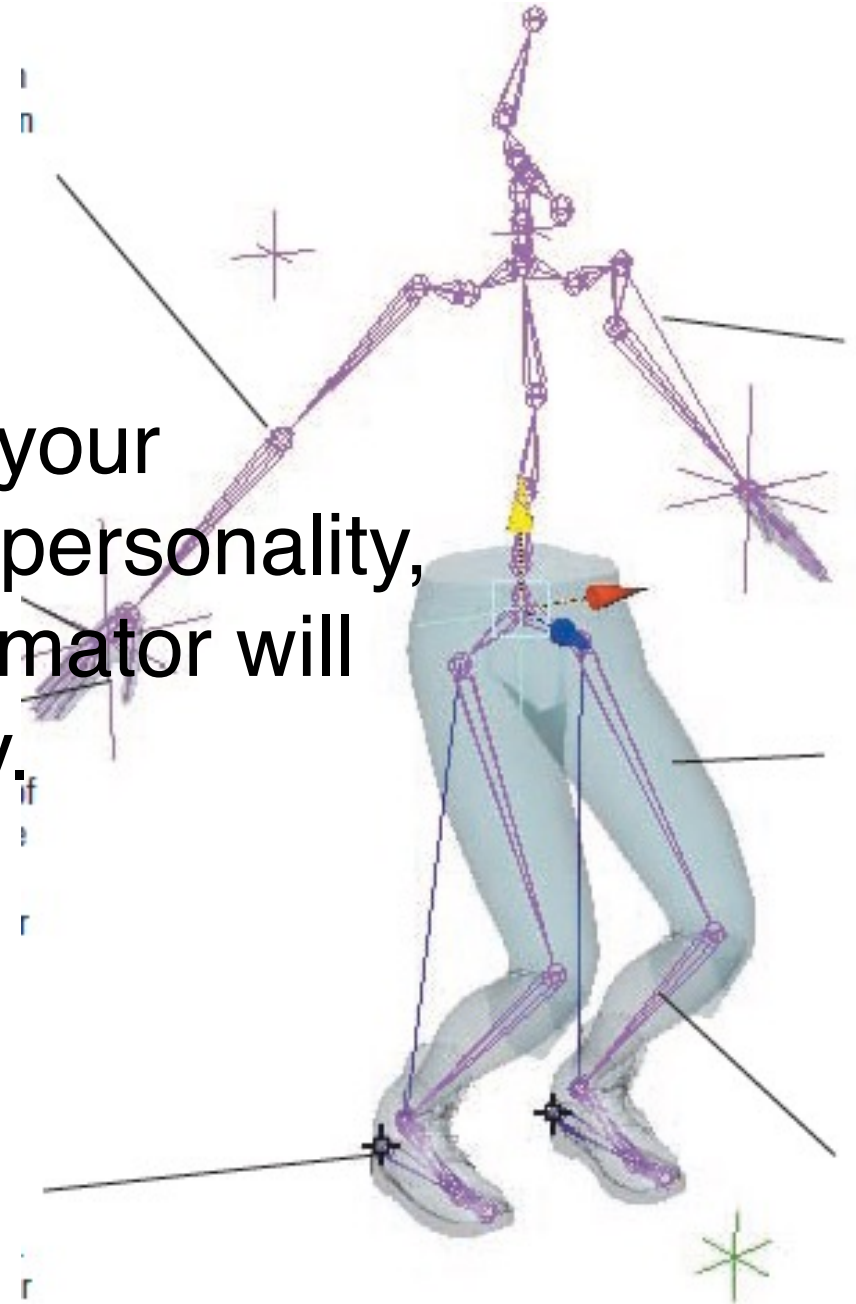
What is Rigging

Autodesk Maya allows you to combine all the controls found on different parts of a character into one or more character sets.

This makes it easier to pose characters and work with them in the Maya non-linear Trax animation system



3D character is a digital actor. Whether your character is a tin can that bounces with personality, or a photorealistic human being, the animator will need to control it easily and interactively.



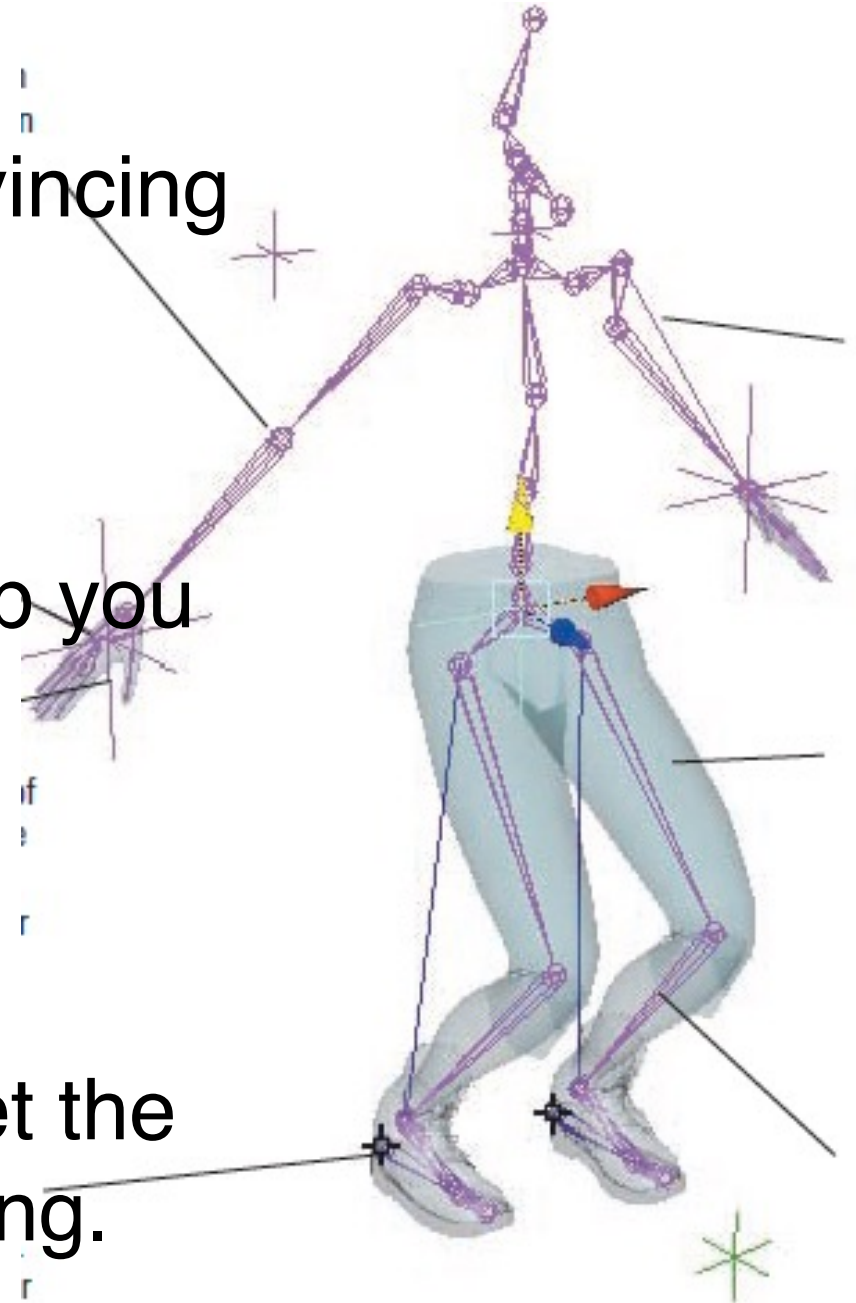


A Typical Character

The character's mechanics must be convincing to an audience and the skin and clothing must also move and bend properly.

Maya includes a number of tools that help you manage the parts that make up a typical character.

This process of preparing character controls is called rigging and is used to let the animator focus on the process of animating.



Skeleton Joints

Joints are used to create a framework for a character's hierarchy. The rotation of the skeleton joints defines the motion of the character. You can use inverse kinematics for even more control.

Character Controls

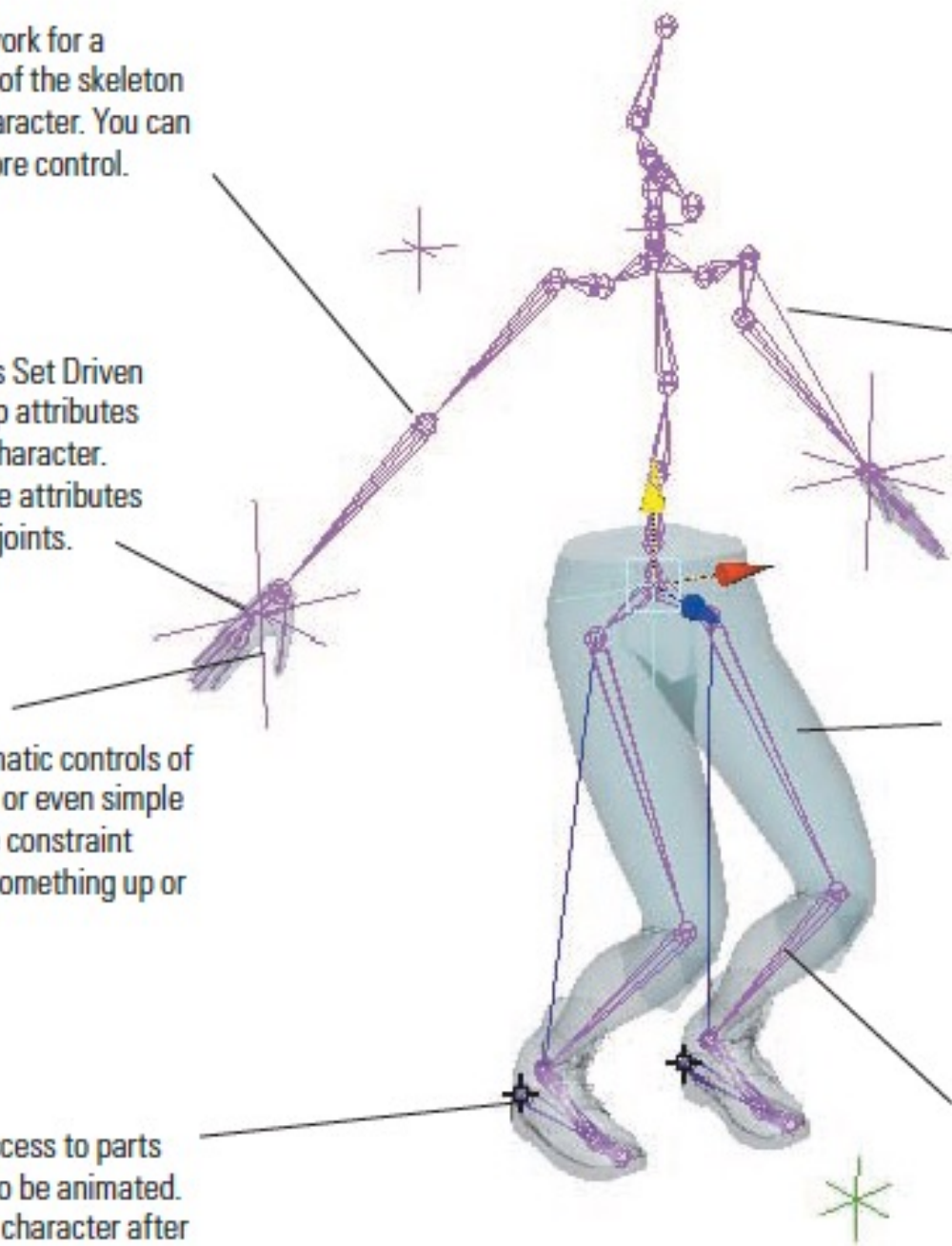
Using animation techniques such as Set Driven Key and expressions, you can set up attributes for controlling different parts of a character. For example, a hand joint could have attributes used to control the different finger joints.

Constraints

It is possible to constrain the kinematic controls of a skeleton to objects in your scene or even simple locators. You can then animate the constraint weights to make a character pick something up or grab hold of a fixed object.

Selection Handles

Selection handles give you quick access to parts of a character's hierarchy that are to be animated. This makes it easier to work with a character after it has been rigged up for animation.



Facial Animation

To animate facial features, you can use deformers such as BlendShape to create facial poses that can be used for talking and for showing emotion.

Kinematics

To control your skeleton joints, you can choose from forward or inverse kinematics. Forward kinematics allows you to set the joint rotations directly. IK allows you to position IK handles, which rotates the joints.

Bound Surfaces

Surfaces of a character's skin and clothing can be either parented or bound to the skeleton joints to make them move together. Binding places points from a surface into clusters that are then associated with particular joints.

Deformers

To help the surfaces bend realistically at joints, deformers such as flexors and influence objects can be used.

Character Resolution

A fully rigged 3D character includes many bound surfaces and deformers that can slow down the interactive manipulation and playback of the scene.



As you animate, you can use low resolution surfaces parented to your skeleton to achieve more interactivity while animating.

ANIMSCHOOL

WHAT IS RIGGING?

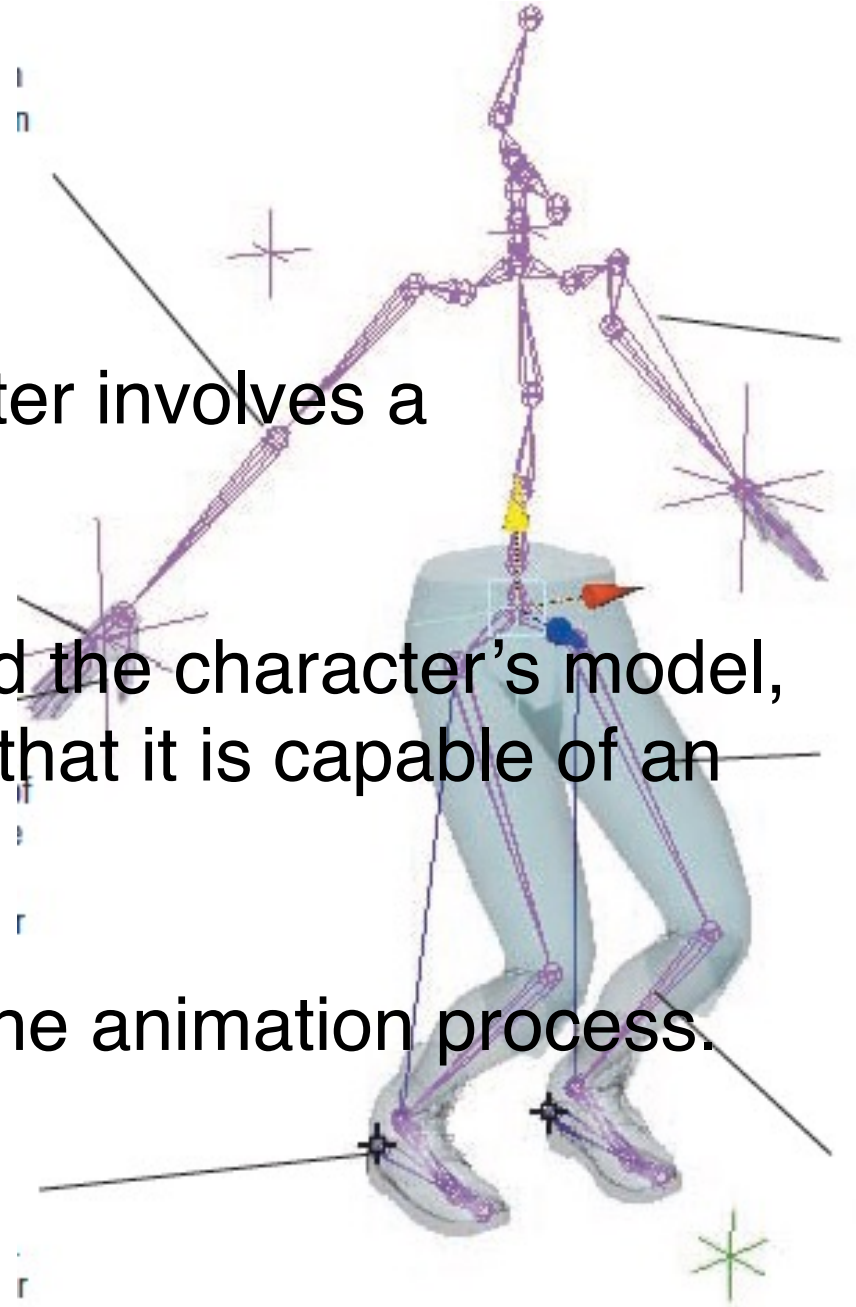


A Typical Character Animation Workflow

The development and animation of a 3D character involves a number of steps.

Once you have a design, you must begin to build the character's model, lay down skeleton joints and rig the skeleton so that it is capable of an appropriate range of motion.

Character controls can also be set up to assist the animation process.





Character Design

In support of the story, the character is designed using sketches, storyboards and in some cases, clay models. These visual aids give the 3D artist a clear understanding of the character and the character's range of motion and emotion.

Modeling

Using the sketches, a detailed model is built with an awareness of how it will be bound to the skeleton later.



Skeleton Rigging

Using sketches or the model as a guide, joints are drawn and kinematics and character controls are set up.

Binding Skeleton

The surfaces are bound to the skeleton and joint rotations tested. Deformers are used to enhance the final look.



Animation

A fully rigged model that uses low resolution surfaces parented to the skeleton can be used for initial animation studies.



Integration

The animation from the low resolution character is applied to a fully rigged skeleton with bound surfaces and deformers.

Rendering

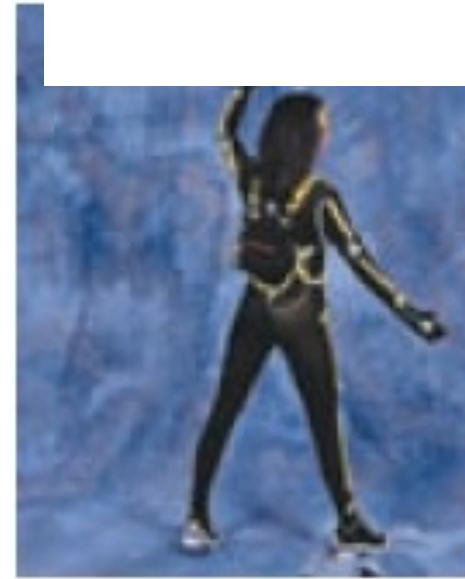
The character is rendered in its final setting. You might also render the character on its own, then use a compositing package to integrate it with the background.

Motion Capture

As an alternative to setting keys, you can use motion capture to simulate real-life motion on a character.

Generally, motion capture involves recording joint positions and rotations from an actor that are then applied to a skeleton.

Motion capture works well with non-linear animation where motion capture clips can be blended together.



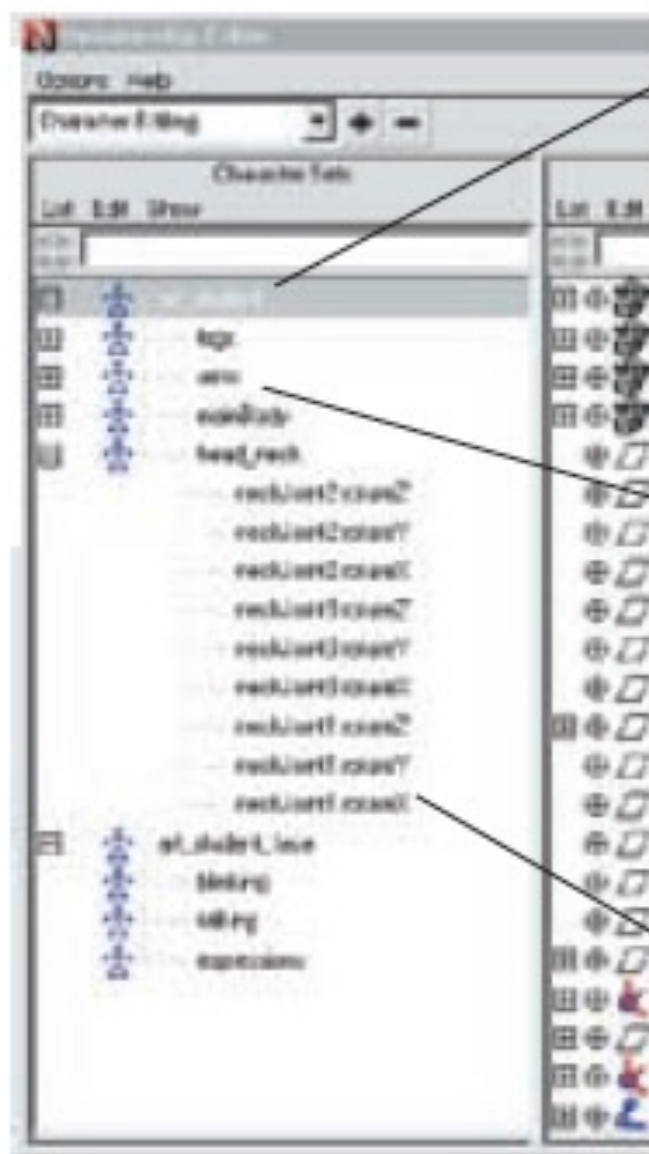
© 2000, Image courtesy of Ascension Technology



Motion capture offers realistic motion performances that can be imported as animation curves and applied to digital characters.



**WHAT IS?
MOTION CAPTURE**



Character Sets

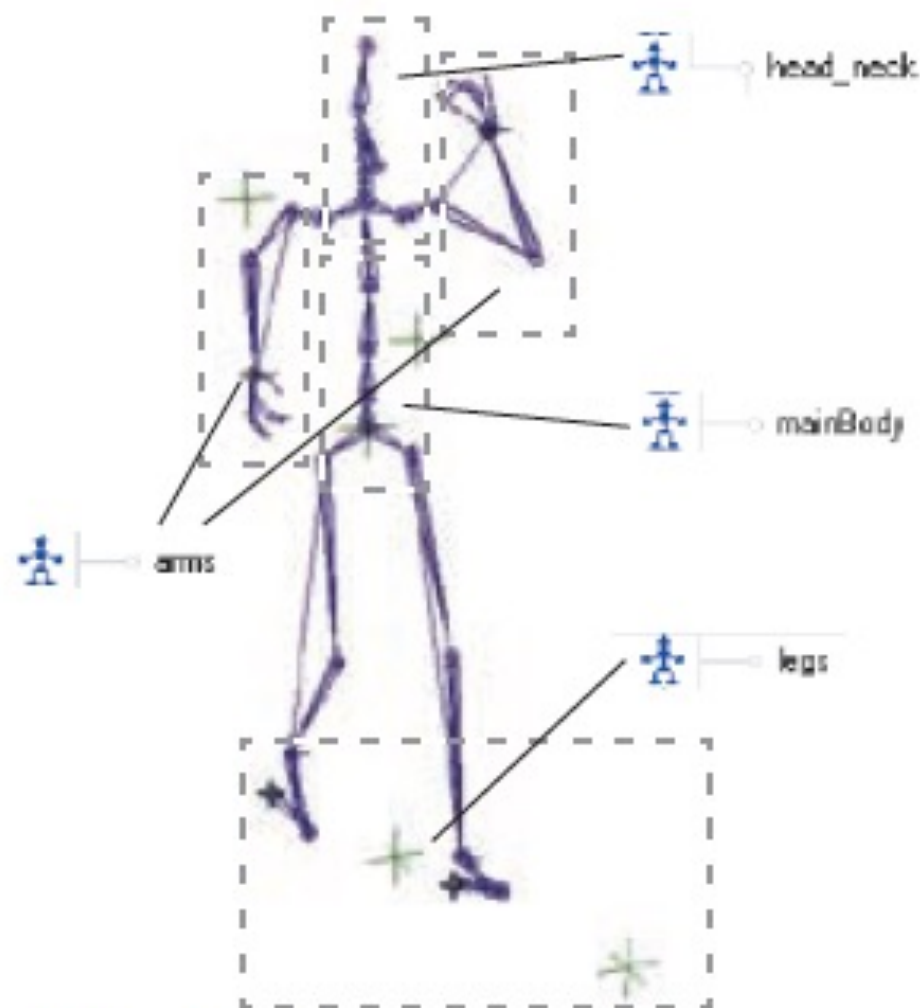
This set is the root of a character setup. You can have attributes assigned to the character or you can assign sub-characters to it. If you select this set and set keys, you also key the sub-characters.

Sub-Character Sets

These sets help break down a character into smaller parts in case you want to focus on one area. These sets can be set up to control specific body parts such as arms, legs and facial features.

Keyable Attributes

For each character and sub-character set, you can choose which keyable attributes need to be brought together to effectively animate the different parts of the character.



Sub-characters

Sub-characters can be created for different parts of a character to give you more control. These breakdowns should mimic areas that you want to animate as a group.

Character Set

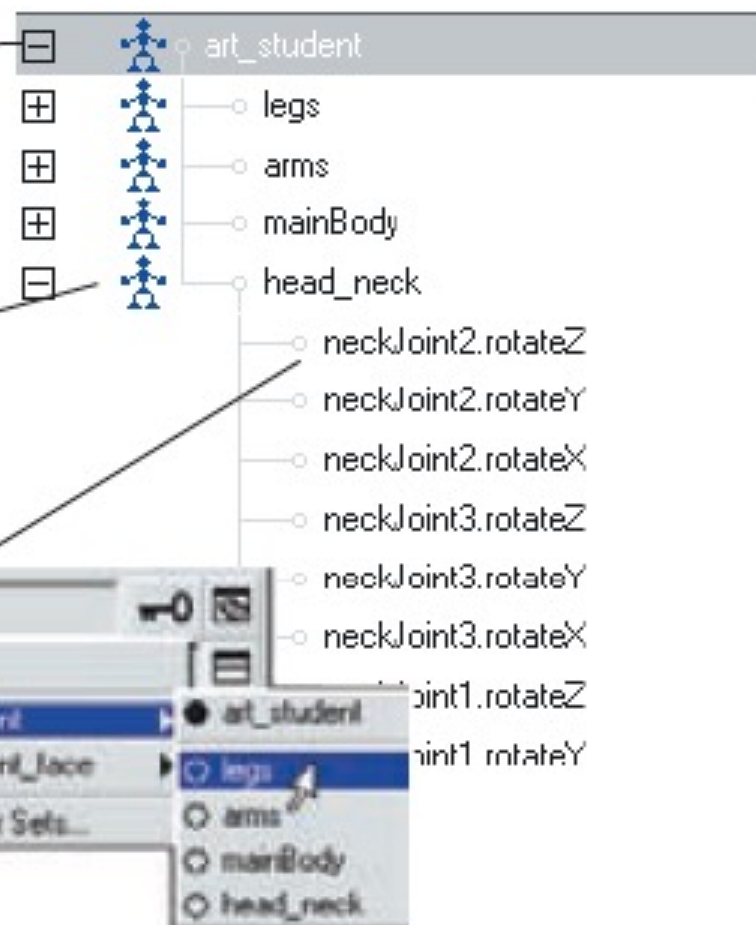
This is essentially the root set of a character. It may not contain any attributes if you are using it with Sub-character sets. Select **Character > Create Character** to create one of these sets.

Sub-Character Set

A Sub-character set is a typical character set that has been assigned to a character. Select **Character > Create Sub-character** to create one of these sets. It will be assigned to the highlighted character.

Attributes

Some attributes will be part of a character or sub-character when they are created. To add more attributes, you can highlight them in the Channel Box, then select **Character > Add to Character Set**. You can also use the Relationship Editor to add attributes to characters.



Character Pop-up Menu

This pop-up menu found next to the timeline in the lower right of the workspace lets you quickly select and edit characters and sub-characters. The character set highlighted here is the active character.

Constraints

Constraints allow you to control a character using other objects (such as locators). Constraints let you control parts of a character like the position of IK handles with a point constraint or the rotation of joints with an orient constraint.



Arm

A character's hands can be constrained using point and orient constraints. You may want to parent these to the shoulders so they move with the body. If you have any finger attributes, you may want to use the locator as a Control node.



Eyes

Aim constraints can be used to control a character's eyes. These would be parented to the head but could still be moved on their own to offset the gaze. It is a good idea to use a different locator for each eye to avoid having a cross-eyed look.



Elbows and Knees

A pole vector constraint can be used to control the positioning of elbows and knees. These locators help orient the IK handle's pole vector, which helps prevent the IK solution from flipping. Pole vector constraints can also be parented to parts of the body.

EPISODE 8

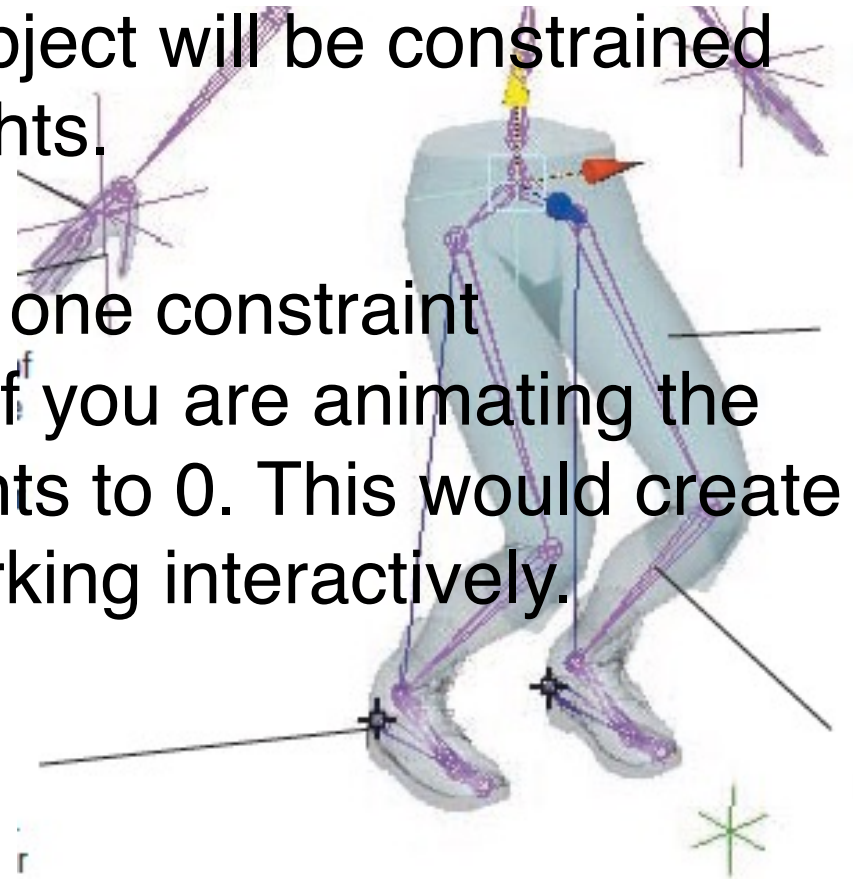
• **RIGGING
& ANIMATING**

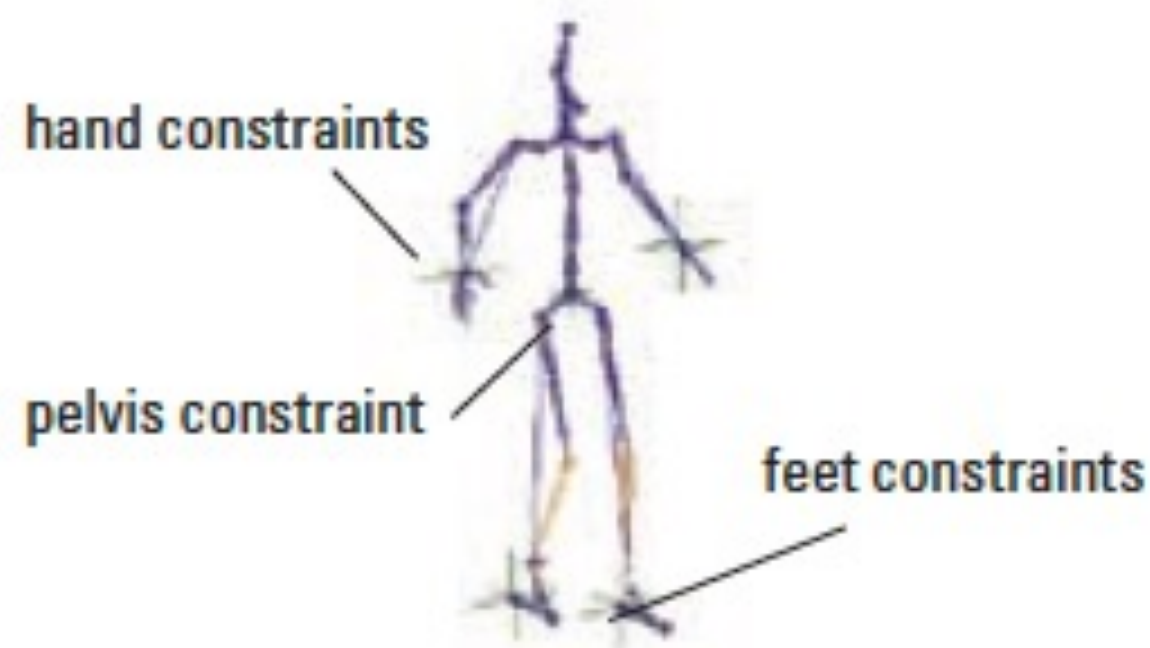


Animated Constraint Weights

You can use more than one constraint to an object. Each of these constraints is given a weight, and the object will be constrained based on the average of the constraints' weights.

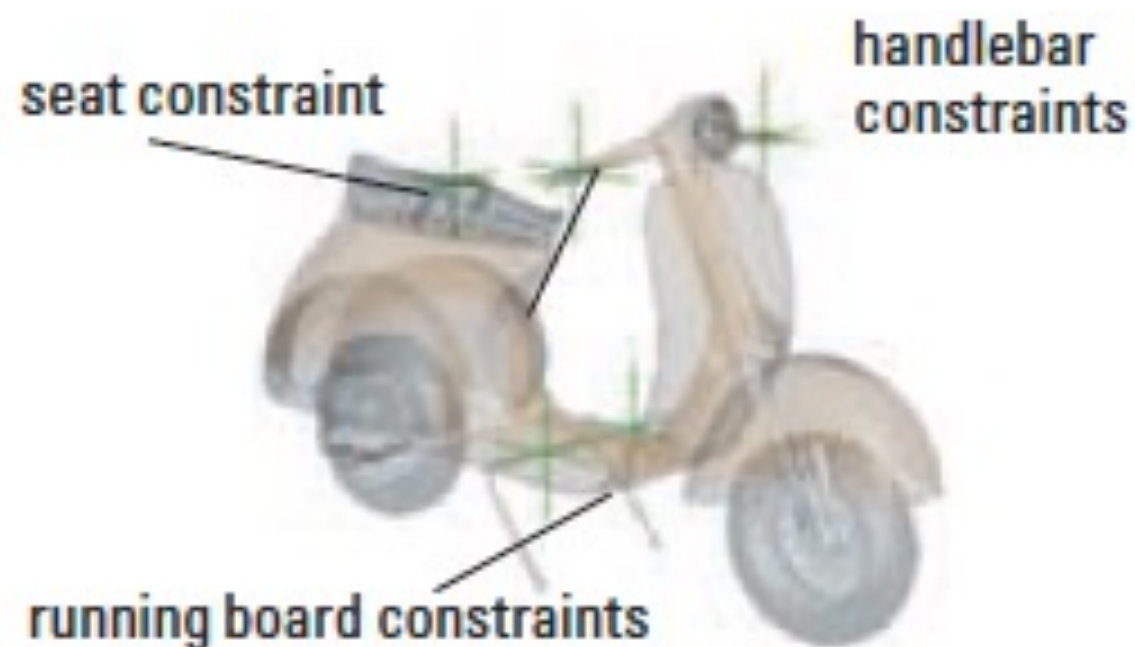
You can animate an object that switches from one constraint to another by keying the weights from 0 to 1. If you are animating the weights, make sure you don't set all the weights to 0. This would create a confusing situation for your object when working interactively.





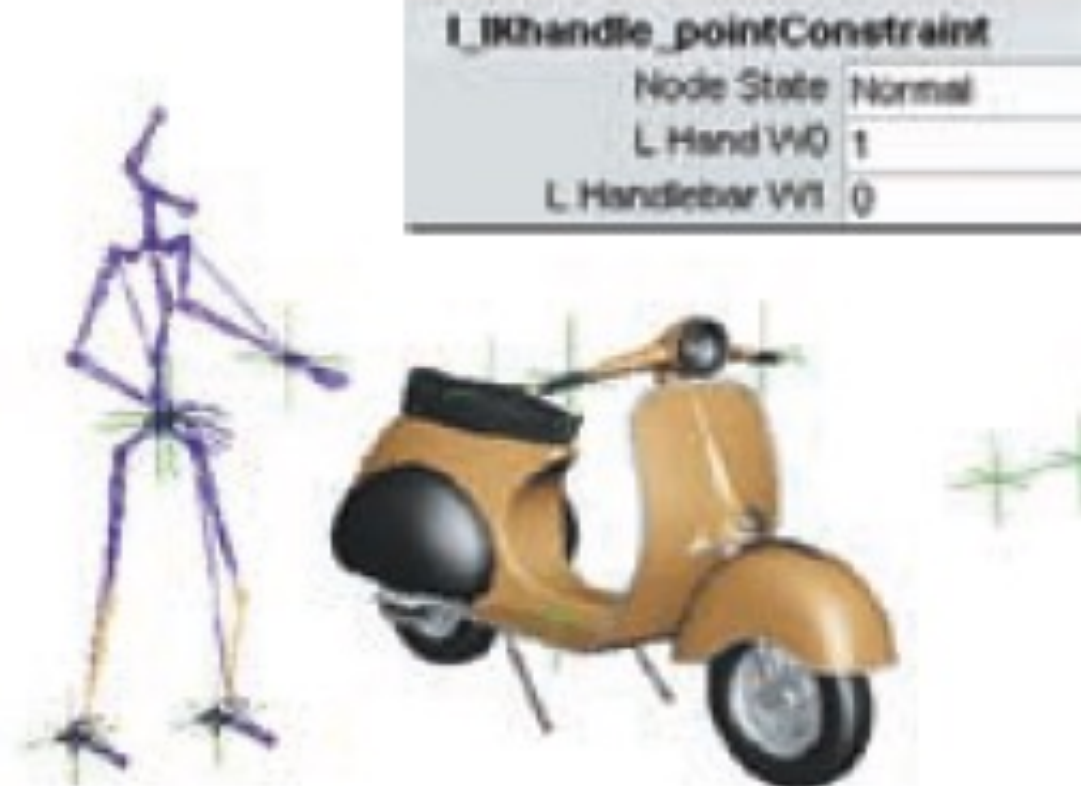
Step 1: Character Constraints

The character's pelvis, arms and legs are constrained to locators. The arm locators are parented to the shoulder so they move with the body, while the leg and pelvis locators are in world space. This lets you move the character freely without it being locked down.



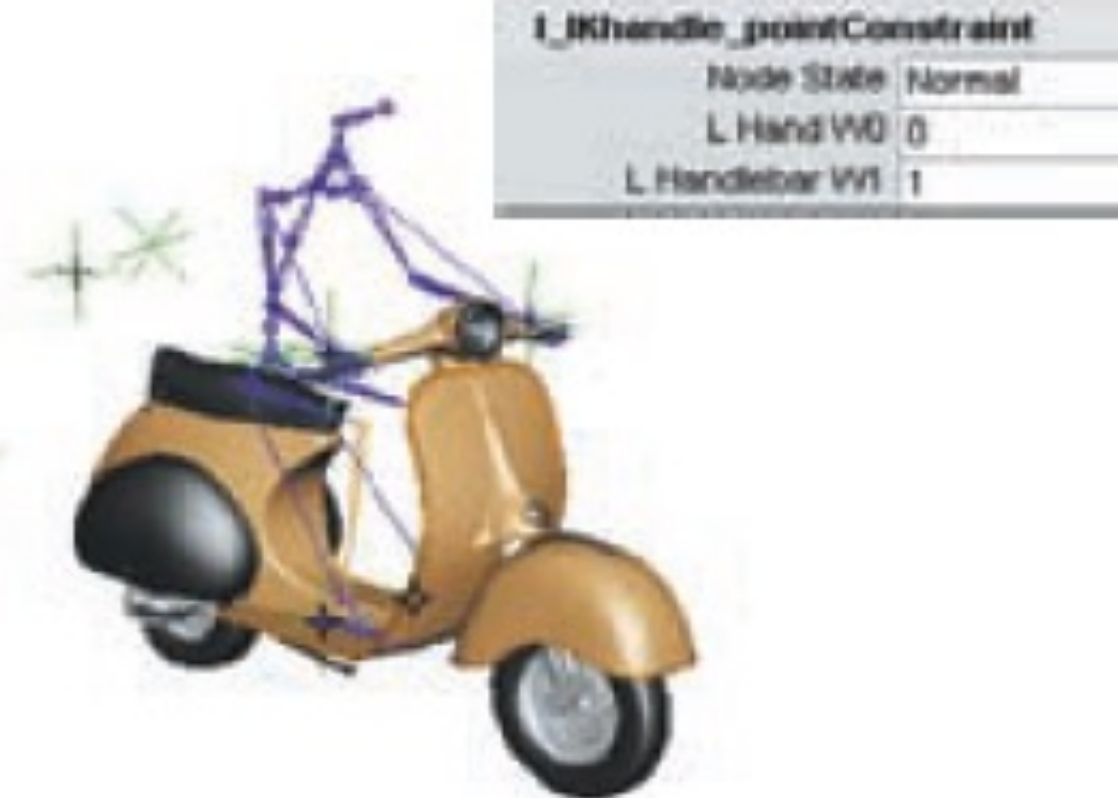
Step 2: Scooter Constraints

The arm locators are parented to the handle-bars so they rotate with the steering mechanism. The leg locators are parented to the running board and the pelvis locator to the seat. When the scooter moves, the character constraints will also move.



Step 3: Key Initial Weighting

While the character walks freely, the character constraints are keyed at 1 and the scooter constraints are keyed at 0. This puts the character constraints in control until the character sits down. You will want to add the Constraint node's weight attributes to a Character node to make sure they are keyed with the character.



Step 4: Key Final Weighting

As the character sits on the scooter, the character's constraint weights are keyed at 0 and the scooter constraint weights are keyed at 1. Now you can animate the scooter and the character will follow. You might want to animate the scooter constraint weight for the pelvis to move up and down as the scooter goes over bumps.

Control Nodes

You will not want to add every attribute to a character. Instead, you will want specific **Control nodes** that have custom attributes linked using reactive animation techniques (such as Set Driven Key or direct connections), to other attributes in the scene.



Control Nodes and Manipulators

Dynamic or custom attributes can be added to specific nodes to let you animate several other joints or attributes using one control. Some custom attributes could roll a finger while others could control an eye's pupil dilation. These attributes would later be included in a character set for automatic keyframing.