



Although other rigs can be used as well, this tutorial is intended for you to use the “Walking Ball” character setup created by the author.

You can find this rig at:
www.ewestlund.com/tutorial.html.

Once you have a copy of the rig we are ready to get started with this tutorial.

Basic Walk-Cycle Tutorial

by Erik Westlund

This tutorial is intended to teach new animation students a few basic animation techniques and workflow based on fundamental animation principles using Maya and a free character setup named *walkingBall_v2.3* created by the author. This character setup or “rig” has many useful features without being overwhelming to newer students. This tutorial assumes you have a basic understanding of how to navigate the Maya interface, find menu commands, and other basic computer file management skills.

This tutorial also assumes you are somewhat new to 3D software and animation concepts. We will be using a basic pose-to-pose approach of animation. Pose-to-pose animation is what its name implies, creating character movement by establishing primary positions, or poses, and methodically moving the character from one pose to the next. Different, but just as valid methods such as straight-ahead or layered animation are not described in this tutorial.

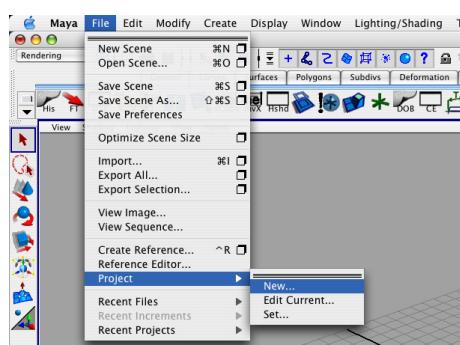
Step 1 Create a project in Maya

Powerful 3D applications such as Maya require a predefined location to save data and files while you are working. Large studio animation production lines typically create custom software for managing project file structures, to control naming conventions, and to track revisions. Absent such large studio resources we will use the method of organizing files and data that the developers of Maya created called a “Project”. The beauty of this is that you can have multiple projects simultaneously, each with its own set of resources.

1. Create a project in Maya

- Select **File > Project > New...**

A dialog box with many text fields will open.



- Replace **New_Project** in the **Name** field with **basicWalk**

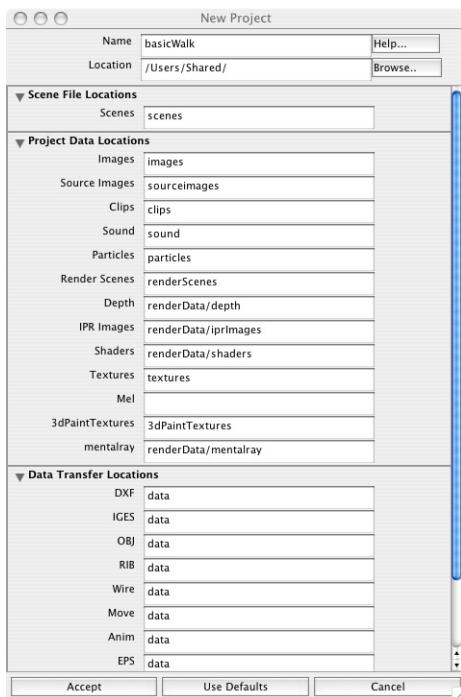
Notice there is no space in the name because the two words with a capital letter. While most computers can easily understand names that include blank spaces Maya doesn't internally allow you to use spaces in names for very good reasons that we don't have time for in this tutorial... To put it simply, just get in the habit now of naming things without using spaces.

- Click the **Browse...** button and determine the location for your project to be saved.
- Click the **Use Defaults** button

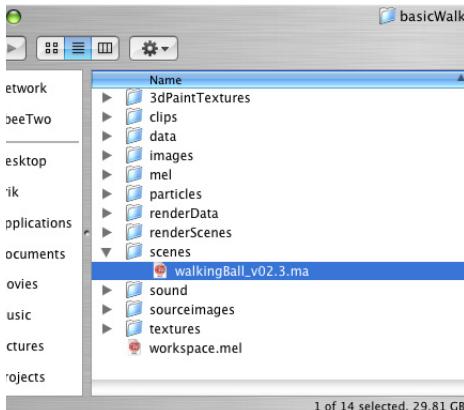
Names for subdirectories and file types will appear automatically.

- Click the **Accept** button
- Navigate to the copy of walkingBall rig you downloaded and place the file in the **scenes** folder of your project
- Return to Maya and select **File > Open Scene...**

Creating a new project in Maya is useful. Once created, Maya looks to the current project for, texture images, saving scene files, and other data.



The Use Defaults option creates a set standard subdirectories towards which Maya will be directed.

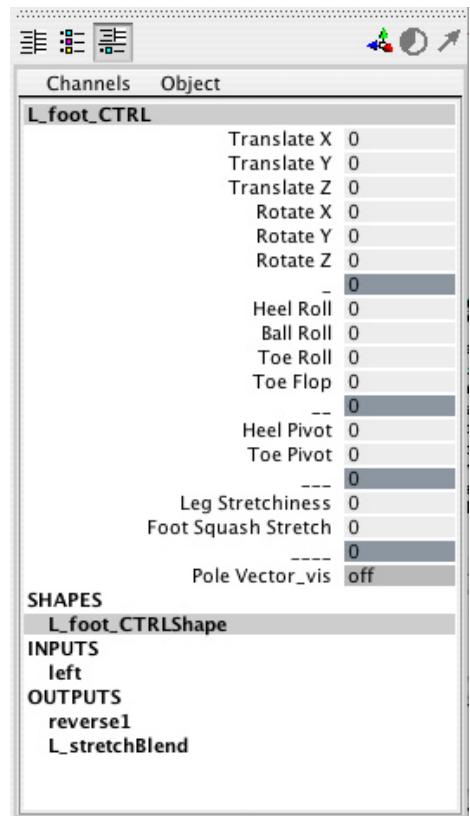
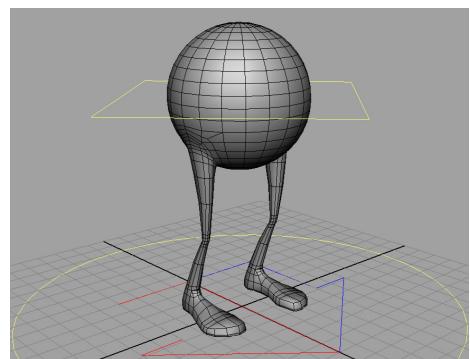


Placing a copy of the walkingBall rig inside the scenes directory allows Maya to easily find the file.

You will see the copy of WalkingBall rig inside the **scenes** folder of your new project.

- Select the Maya file and click **Open**

There are some details to look at with this rig. I recommend playing with the various controls, especially for the feet, in order to get familiar with what each control does. Beyond this point I will be referring to specific controls assuming you have familiarized yourself with how each is configured. The primary thing for you to notice is that the controls have simple values, mostly 0 (zero) or in the case of attributes such as “scale” value of 1. This is the “home” position. There are couple of other things we need to address regarding interface... shelves, selection, and tangents.



Most 3D character rigs have standard attributes like translate and rotate as well as custom control attributes created for specific purposes. Once you have the rig in a Maya scene it is a good idea to spend time getting familiar with the purpose of each control. Controls for any character rig should start at simple values such as 0.

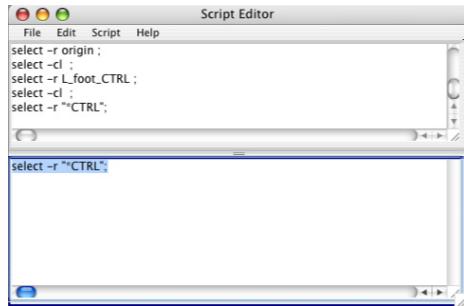
After playing with the rig for a while simply reopen the original scene file without saving changes.

Step 2 Selection and User Interface

Selection is critical to using any graphics based application. What you can select you can control and manipulate. In Maya, selection is based on names in a list. Therefore we are going to create a one line script to select the controls on the WalkingBall rig. Look to the bottom right corner of the Maya interface for the Script Editor button. (see image on left). Click the button to launch the Script Editor.



Launch the Script Editor for a hint of Maya “under-the-hood”. Simple instructions created in Maya’s Embedded Language or MEL can make quick work of repetitive tasks. This single MEL instruction will select several controls at once



The top half of the window is the “output” or what Maya has been doing. The strange looking text is Maya instructions written in Maya’s Embedded Language, or MEL for short. The bottom half, called the “input” is where you can type MEL instructions to tell Maya what to do next such as select the all of controls on your character.

1. Create a “select all” instruction

- Type the following line into the bottom half of the script editor exactly as you see it below including the semicolon.

```
select -r \"CTRL\";
```

2. Test your script

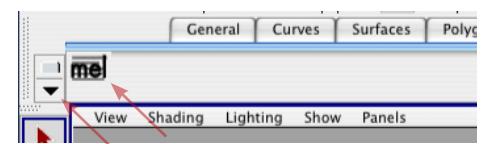
- Select the instructions, hold down the **CONTROL** key on your keyboard, and hit **RETURN**

All objects that have names ending with the characters CTRL will be selected. This will

include both foot controls that look like arrows and the diamond shaped control around the center of the ball. The large circle around the feet should not be selected.

3. Store script for later

- Select the instructions, drag, and drop the instructions over to your **Custom** shelf.

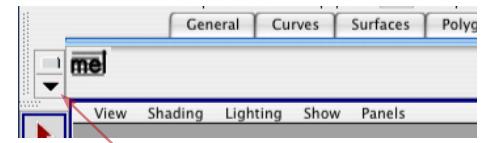


A mel button will appear on the shelf. Every time you click this button you will select all controls for your character at the same time.

Shelves are where Maya stores commonly used individual menu instructions in the form of simple buttons. Each shelf is editable and the one called **Custom** is for creating your own “single-click” button commands.

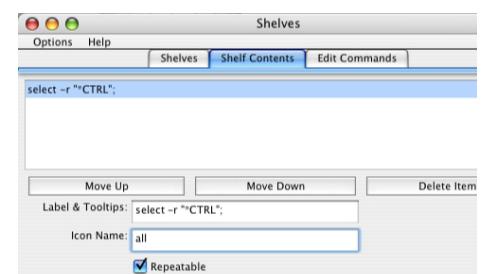
4. Name the MEL button

- Click the black arrow to the left of the shelf to open the Shelf Editor dialog box



Your new command will be selected.

- Type “all” in the **Icon Name** field.



- Click the **Close** button.

5. Edit Animation Preferences

- Select **Window > Settings/Preferences > Preferences...**

- Select **Animation** under **Settings** on the left and change the **Tangents** settings to **Linear** for **Default In Tangent** and **Stepped** for **Default Out Tangent**.

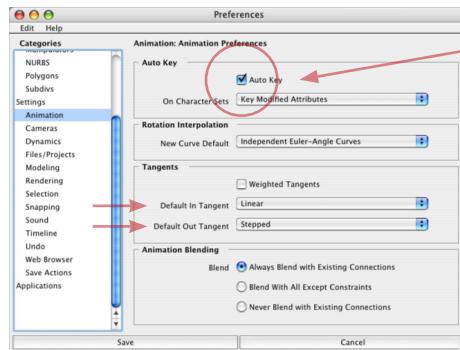
- Select **Auto Key** under **Auto Key**.

- Scroll down on the left and select the category **Timeline** and change the **Playback Start/End** to **1** and **25** respectively.

- Change **Animation Start/End** to **1** and **25** respectively as well.

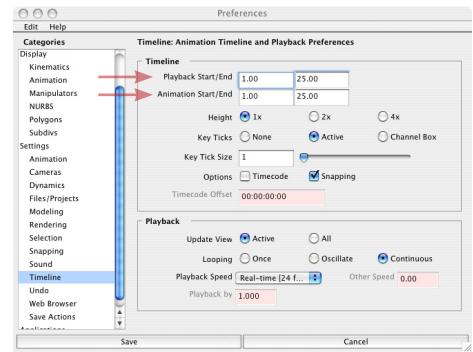
- Change **Playback Speed** from **Play every frame** to **Real-time [24 fps]**.

- Click the **Save** button.

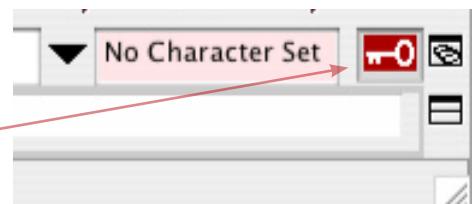


The preferences in Maya are now correctly configured to create key poses in the manner of traditional animation.

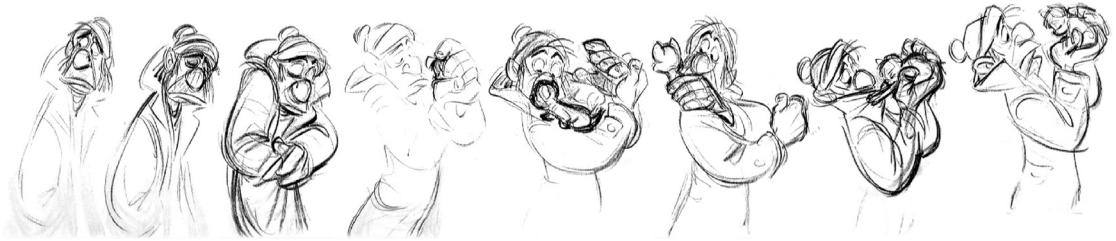
Maya will now have 25 frames in the timeline and hold each pose we create without allowing for automatic in between movement.



A note on terminology: tangent is the term used for the type of shape Maya uses to create function curves for calculating movement from one position to another. To start with we will turn off interpolation of movement for now and concentrate on posing the character. Later in this tutorial we will allow Maya to interpolate movement.



The red key icon in the lower right-hand corner of the Maya interface indicates that auto key has been enabled. This means once you have set an initial key frame all further changes will be recorded automatically. This is especially helpful for animations that require left and right sided versions of poses to be repeated.



The images above are a series of key poses and breakdowns created by animator Glen Keane. The method described in this tutorial is based on the same approach to creating a sequence of images that communicate life-like movement.

© Disney Studios

For over seventy years traditional animators (i.e. pencil and paper) have used a process for creating animated character performances for audiences called “pose-to-pose”. Using this method animators define extremes in movement with *keyframes*, the spacing of movement between keyframes with *breakdowns*, and then enhance the subtle changes and timing of movement with the number and placement of *inbetween* frames.

This description will work as a starting point for our purposes right now. You will apply this set of organized poses to create a basic walk-cycle. You will create your poses in passes. Pass 1: keyframes, Pass 2: breakdowns, Pass 3 inbetweens. Finally, you will put the finishing touches in the clean-up stage that begins with Pass 4. Roughly speaking, this is the same animation process developed over seven decades ago. Ok, first things first...

Step 3 Creating Key Poses

For the purposes of this tutorial we will use the moments of contact as our key poses in this tutorial. When completed, your walk-cycle will remain positioned in the center of the Maya scene giving the appearance that the character is walking on a treadmill.

Since you will be animating in multiple passes use a naming convention for saving your work at each stage of development. You should already have a copy of walkingBall rig open.

1. Select File > Save Scene As...

- Name your file basicWalk1.1
- Select the Format: mayaASCII (*.ma).
- Click the Save button.

The reason for two numbers in the name is keep track of both the current animation pass and allow for incremental saves. Saving files incrementally allows you to go back to a slightly earlier version of your work if something goes awry. Much better than having to start all over again. Now you will create the first key pose on frame 1.

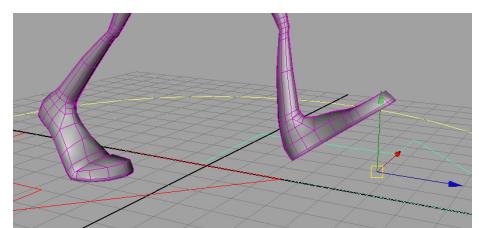
2. Translate foot controllers

- click on frame 1 in the timeline

- Select right foot controller (red arrow named **R_foot_CTRL**) and slide the foot backwards on the Z-axis.

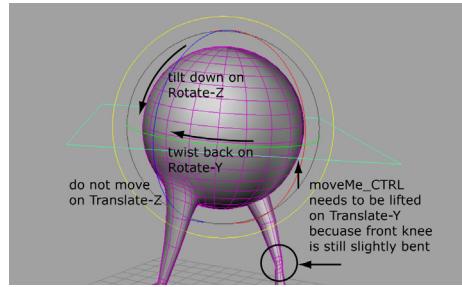
Use only the blue arrow portion of the manipulator to ensure that you are only translating the foot backwards on Z. Translating manipulators on all 3 axes at once can create unwanted results.

- Select the **Ball Roll** attribute name in the channel box and raise the heel by increasing the value above **0**.
- Select left foot controller (blue arrow named **L_foot_CTRL**) and translate foot forwards on the Z axis.
- Select the **Heel Roll** attribute of the left foot and raise the toes of the left foot.



You will want the left foot to have the toes up while the heel is still down on the grid. Likewise the front of the right foot will be on the grid while the heel is raised.

Another important part of the rig that needs to be positioned is the center or “ball”.



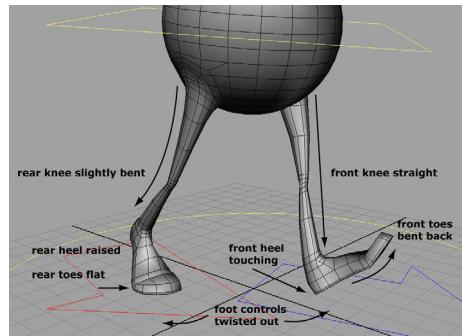
3. Position ball

- Select the yellow **moveMe_CTRL**
- Tilt ball forward (Rotate-X) to give the impression of forward movement.
- Twist ball (Rotate-Y) so the left hip is forward.
- Tilt ball slightly downwards on the right side (Rotate-Z).

4. Finesse foot positions

- Move front foot until knee is straight.
- Keep front heel on grid.
- Point feet outward (**Rotate Y**).
- Use **Toe Flop** attribute of the front foot to be bent toes backwards slightly.
- Make sure both foot controls are flat on the grid.

The images below show how your character should appear once it is in the correct pose.



You may need to adjust the ball position up-and-down on the Y-axis to keep the front knee straight. Do not translate the ball backwards or

forwards on the Z-axis. This will cause your walk-cycle to a very unappealing lurch.

- Save your scene with the name **basicWalk1.2.ma**

5. Set a keyframe

- Click MEL button to select all controls
- Type the letter **s** to set a keyframe

This is your first contact pose.

6. Create last pose

- Click on frame 25 in the timeline
- Type **s** again.

First and last keyframes are identical which will allow your animation to loop.

7. Create opposite contact pose

- Click on frame 13 in the timeline.
- Create the mirror version of your first contact pose on frame 13.

Repeat values from of the channel box from the right foot and paste them into the channel box for the left foot. Scrubbing back and forth between frames 1 and 13 you will be able to reverse the positions of the feet with just a few clicks. Next you should reverse the values for the ball (**moveMe_CTRL**) by changing the positive value for Rotate-Y to a negative value, and then changing the negative value for Rotate Z to a positive value. Review step 4 to make sure everything is correct on both sides.

- Click on frame 13
- Select controls with MEL button,
- Type **s** to set a keyframe.
- Save your file as **basicWalk1.2.ma**

8. Test results

- Click Time Controls **Play** button

This is your first pass in which all key poses have been created. These poses are also referred to as contact poses because they show the moment of contact between the front foot and the ground.

Step 4 Creating Breakdown Poses

Breakdowns are an extremely important part of animating pose-to-pose. While key poses define the limits (or extremes) in movement, breakdowns define the spacing between keyframes. Breakdowns also influence the style or feeling of the movement in animation.

1. Begin pass 2

- Save scene as **basicWalk2.1.ma**.

2. Change foot positions

- Click on frame **7** in the timeline.
- Select **L_foot_CTRL**.
- Return both **Heel Roll** and **Toe Flop** attribute values to **0**.
- Move **L_foot_CTRL** back to approximately **0** for Translate-X
- Select **R_foot_CTRL**.
- Return **Ball Roll** attribute value to **0**.
- Increase the **Toe Roll** attribute so that the right foot is pointing down.
- Change Rotate-Y value on **R_foot_CTRL** to **0**.
- Slide the **R_foot_CTRL** forward on Z.
- Lift **R_foot_CTRL** slightly on Y.
- Increase Toe Flop attribute so that the toe of **R_foot_CTRL** is bent downwards.

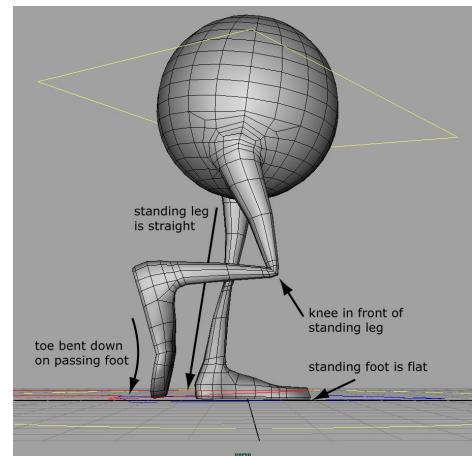
You should end up with **R_foot_CTRL** positioned so that the right foot is above the grid, the right foot is behind the left leg, the right knee is bent and in front of the left leg.

3. Move position of ball

- Move the **ball_CTRL** slightly on Translate-X towards the left leg
- Lift **ball_CTRL** up until the standing leg goes completely straight.

Keeping the standing leg straight is a very important part of creating this pose correctly. Do not lift the **ball_CTRL** so high that the left heel rises above the grid.

- Return Rotate-Y value for **ball_CTRL** to **0**.
- Tilt **ball_CTRL** down (Rotate-Z) towards the passing foot.



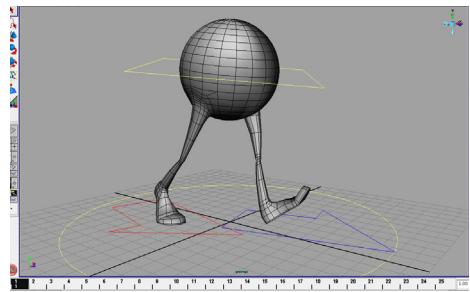
This pose should appear as if weight has shifted over to one side. It helps if the standing leg has a slight forward tilt.

- Select all and set a keyframe.
- Save your scene as **basicWalk2.2.ma**.

Next, you will create the mirror image of this pose on frame 19.

4 Create opposite breakdown

- Click on frame 19
- Create mirror version on frame 19 of pose created for frame 7.
- Select all on frame 19 and set a key.
- Save your scene as **basicWalk2.3.ma**.



Frame 1: key pose, the first contact position.

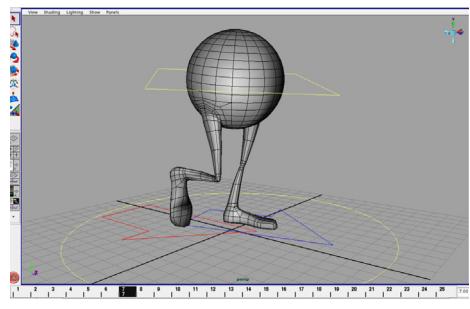
5. Test results

- Click Time Controls **Play** button

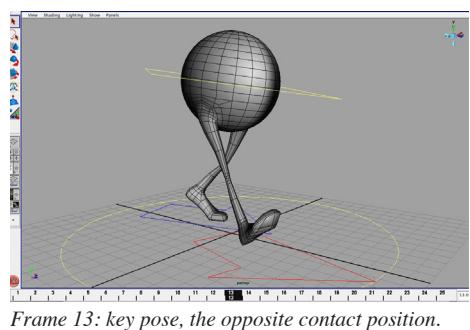
Some general points to watch out for:

- Front leg should be straight at contact.
- Standing leg should be straight on passing pose.
- Use the custom attributes on the foot controls to create angle of foot. There is no need to rotate the controller forward to make the toe point down.
- Central mass of ball should move from side to side, reaching extremes on the passing poses.
- Do not move the ball forward and back. The appearance of forward movement will come from the feet.

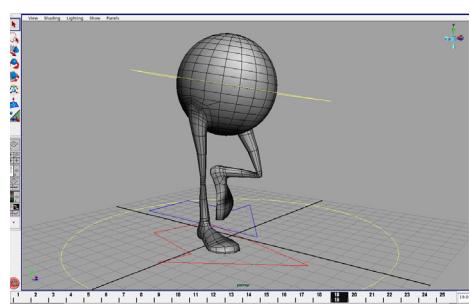
Examine the sequence of poses on the right and compare with your scene. Make adjustments as needed. It is a lot easier to fix the poses now that it will be to fix the animation later.



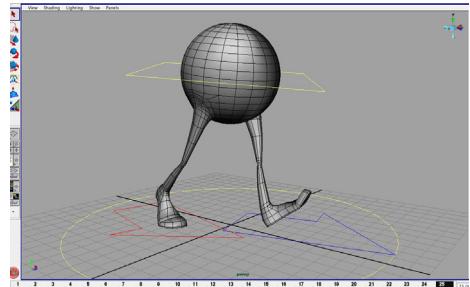
Frame 7: breakdown pose, the first passing position.



Frame 13: key pose, the opposite contact position.



Frame 19: breakdown pose, the opposite passing position.



Frame 25: key pose, the original contact position.

Step 5 Creating Inbetweens

Now we are going to create the poses that communicate weight in the movement. The inbetweening stage is dependent on movement that has been defined in the keys and breakdowns. In traditional animation this work is handed off from the experienced animators be done by the least experienced animators. The more experienced animators (or key animator's) create the keys and the breakdowns and then hand the work off to the "inbetweeners" to finish. Such distribution of responsibilities is not so relevant in contemporary, 3D work environments, but it does indicate how dependent the inbetweening stage is to the prior two stages of animation. In contemporary 3D animation some of the inbetweening is done by the computer. Computers, unfortunately, are very stupid and have to be told how best to create inbetweens.

1. Begin pass 3

- Save your scene as **basicWalk3.1.ma**.

The first inbetween pose we will create is a "weight-down" position. This is the pose were the character's weight settles on the front foot while the rear foot continues backwards.

2. Change foot positions

- Click on frame 4
- Select not just one, but both foot controls at the same time.
- Translate both foot controls backwards on Z-axis at the same time

The front foot is not quite under the character and the rear foot is clearly behind.

- Select **L_foot_CTRL** only.

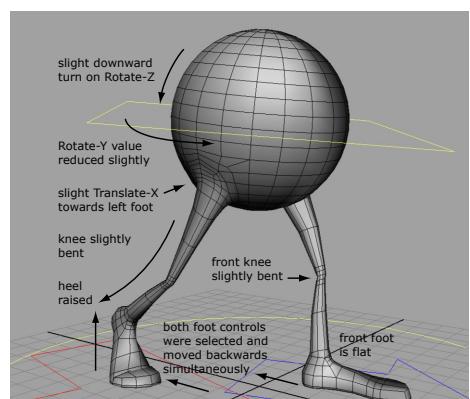
- Return **Heel Roll** and **Toe Flop** attributes to **0**.
- Select **R_foot_CTRL**.
- Increase **Ball Roll** value until right knee begins to bend slightly.

3. Move ball position

- Select **moveMe_CTRL**.
- Lower the **moveMe_CTRL** down to bend the front knee slightly.
- Reduce Rotate-Y value by half.
- Increase Rotate-Z value slightly
- Move towards left foot on **Translate X** slightly

4. Set a key

- Select all controls and type **s**. You may need to return to **R_foot_CTRL** and change the value of Ball Roll so that the knee bends only slightly.
- Save you scene.



Do not move moveMe_CTRL forwards or backwards on Translate-Z. Don't over-exaggerate this pose. Make sure you have moved both foot controls backwards on Translate-Z simultaneously. Do not move moveMe_CTRL forwards or backwards on Translate-Z.

5. Create opposite down pose

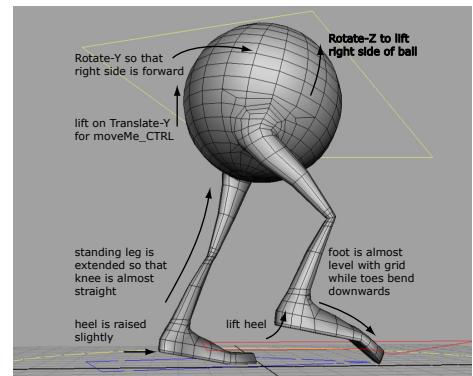
- Click on frame 16 in the timeline
- Create a mirror version on frame 16 of down pose on frame 4
- Select all controls and type s.
- Save your scene as BasicWalk3.2.ma.

Next you will build the weight-up position is from the passing pose.

6. Create up pose

- Click on frame 10.
- Select L_foot_CTRL
- Slide the foot backwards.
- Increase value of Ball Roll attribute.
- Select R_foot_CTRL.
- Slide foot forwards and up.
- Lower Toe Roll value until foot is almost level with the grid.
- Select moveMe_CTRL.
- Raise the moveMe_CTRL up slightly
- Reverse the sideways tilt on Rotate-Z.
- Twist on Rotate-Y so that the right side is slightly forward.
- Change Translate-X position slightly in the direction of the raise foot

You will need to readjust the value of Ball Roll for L_foot_CTRL to the standing foot so that the knee bends a very small amount. Its very important to have good extension of the standing leg with a clear sense the character is pushing off of the ground with force.



Notice how the R_foot_CTRL. The rig has been designed to create any number of different foot positions without having to tilt the foot control. This makes quick work cleaning up the animation later when Maya is allowed to interpolate between poses.

- Select all controls on frame 10 and set a key.
- Save your scene as BasicWalk3.3.ma.

7. Create opposite up pose

- Click on frame 22 in the timeline.
- Create a mirror version of frame 10 up pose on frame 22
- Select all controls and type s.
- Save your scene as BasicWalk3.4.ma.

8. Test results

- Click Play button in the time controls.

You should see an animated cycle that appears as if the character is walking on a treadmill. Your poses should be in the following order:

- Frame 1:** key pose, left foot forward
- Frame 4:** inbetween, weight-down
- Frame 7:** breakdown, left standing leg
- Frame 10:** inbetween, weight-up
- Frame 13:** key pose, right foot forward
- Frame 16:** inbetween, weight-down
- Frame 19:** breakdown, left standing leg
- Frame 22:** inbetween, weight-up
- Frame 25:** key pose, identical to Frame 1

Most to the work setting keys is done. From this point forward there are few reasons to set keys. Most of what remains is creating smooth transitions from one key to the next.

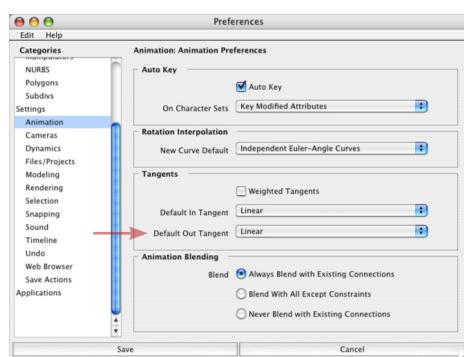
Step 5 Clean-up

The traditional method of animating with pencils and paper can get messy depending on the draftsmanship of the animators. Traditionally, very skilled artists would take the drawings created by animators, assistant animators, and inbetweeners, and partially or completely redraw each frame in order to remove sloppy, random, or erratic lines that have been left behind during the process of creation. Thank God we don't have to do that anymore! No, CG (computer graphics) animators have a different set of challenges at the clean-up stage. You see, we have these wonderful machines that help create additional inbetweens. Unfortunately, our wonderful machines are incredibly stupid and have to be told what to do down to the last detail.

First things first, let's adjust Maya's preferences to match the change in our workflow.

1. Change animation preferences

- Select **Window > Settings/ Preferences > Preferences...**
- Click on the category **Animation**.
- Change Default Out Tangent from **Stepped** to **Linear**.
- Click **Save**.



This will not change what you have created so far, but any new keys created at this point forward will have linear interpolation.

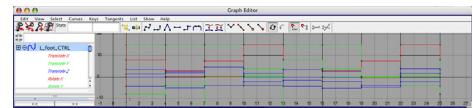
1. Begin pass 4

- Save your scene as **basicWalk4.1.ma**.

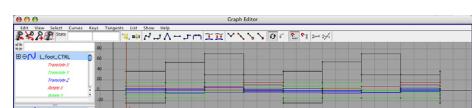
2. Convert to linear tangents

- Select all controls.
- Select **Window > Animation Editors > Graph Editor...**

The Graph Editor, which is a curves based animation editor, will open. More than likely it will show only a portion of your animation curves in the viewable area.

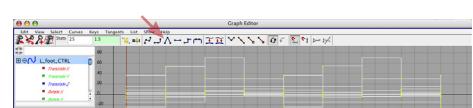


- Hold mouse over Graph Editor, type **f**.



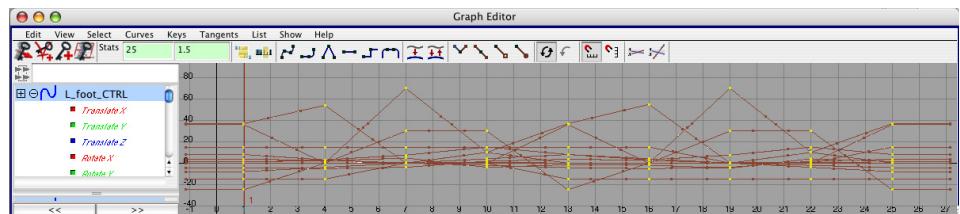
Curves will be framed in your view allowing you access to all of your animation at once.

- Select all curves in the graph area with your mouse.



- Convert stepped to linear by clicking on the icon that looks like an up-side-down V.

This converts the tangents on all curves from stepped to linear. The Graph Editor should look like the following...



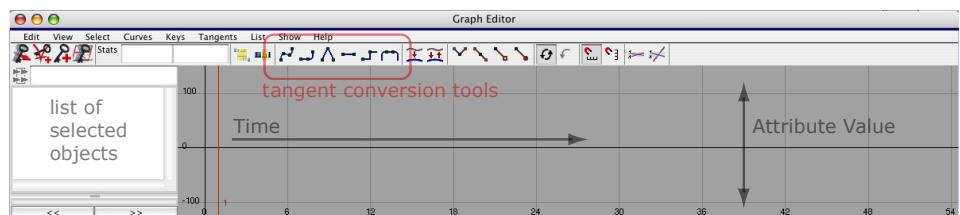
The stepped tangents have been converted to linear tangents. Maya is now attempting to be your inbetrueener.

- Click the **Play** button in the timeline.

If you like the results you see, then you did an excellent job creating poses. If you do not like the results, go back to earlier versions of your animation and check the poses. Sometimes

a simple problem with how the character progresses from one position to the next can cause dramatic and ugly results when Maya interpolates, or inbetweens, for you.

From this point forward, converting your original poses into finished looking animation requires practice. It helps if you understand a few things about the Graph Editor before we continue.



The Graph Editor symbolically represents transformation over time. This editor will represent animation data on selected objects. The selected objects will be represented on the left with each individual channel or attribute listed under the name of the selected object.

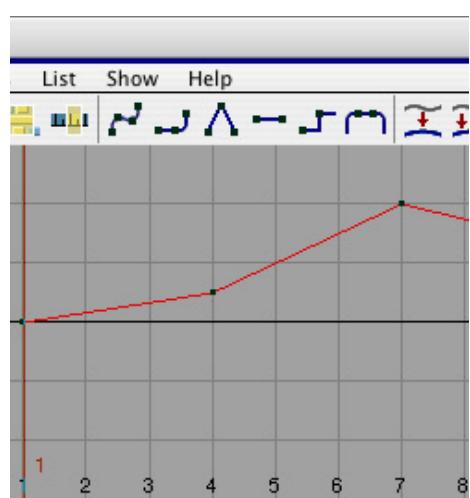
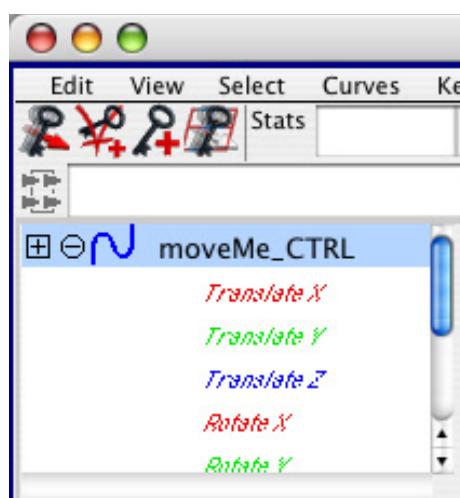
1. Edit moveMe_CTRL

- Select **moveMe_CTRL**.
- Open Graph Editor.
- Hold mouse over gray region of Graph Editor and type **f** to frame your view.

Below the name of the select items are the translate and rotate channels. The channels are identified by color as well as name. All channels that involve the X-axis are red, the Y-axis are green, and the Z-axis are Blue.

- Select **Translate X** in the left column.
- Type **f** to frame view in graph area.

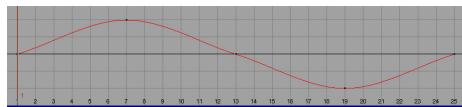
You will now see the translate values on the X-axis of **moveMe_CTRL** isolated in the Graph Editor. This is how you will edit the motion of your character... one channel at a time. The peaks and troughs in the red line, or



function curve (f-curve), are the extremes in movement. The black dots are the keys that you set while posing your character. Currently, the Graph Editor is showing you that Maya is creating a linear interpolation (straight lines) from one key to the next.

- Select the highest and lowest points (keys) in the graph.
- Select menu **Tangents > Flat**.
- Select keys on the following frames:
4, 10, 16, 22
- Type **Backspace** (delete key below F13).
- Select keys on the following frames:
1, 13, 25.
- Select **Tangents > Spline**.

The translate values for X-axis should now look like this:



Not all attributes require the same type of editing. Translate X of **moveMe_CTRL** is gently shifting from side to side.

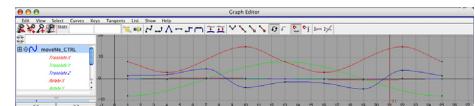
- Click **Play** button in the time controls.

Other channels on the **moveMe_CTRL** will need similar gradual transitions from one extreme to the next. The foot controls will require a very different type of appearance in the Graph Editor. Continue selecting X, Y, and Z channels of the **moveMe_CTRL** and edit each to have smooth transitions between high points and low points in the Graph Editor. Think carefully about what you change, some channels with have multiple extremes, others will remain completely flat. Continue using the follow this procedure remembering to save incrementally:

- Select the next channel.
- Type **f**.
- Select keys that define extremes.
- Convert tangents to flat.
- Select inbetween values and delete.

- Select first and last keys
- Convert tangents to spline.
- If all else fails, flatten the extremes and spline everything else.

Your **moveMe_CTRL** may look something like this when you are finished:



You can also display your animation continuing infinitely into the past and the future. This is very useful when creating cycles that loop seamlessly.

2. View infinity

- Select all controls
- Frame view in Graph Editor.
- Select Graph Editor, **Curves > Pre Infinity > Cycle**.
- Select **Curves > Post Infinity > Cycle**.
- Select Graph Editor, **View > Infinity**.

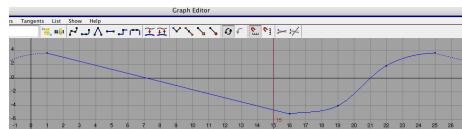
All curves will extend endlessly in both directions. In fact, your animation will continue infinitely as well. Hint: any sudden changes in direction at the beginning or end of each curve indicate a jump in movement that will be easy to spot in the Graph Editor.

3. Edit foot controls

- Select **L_foot_CTRL**.
- Select **Translate X** channel in Graph Editor.
- Frame **Translate X** curve in Graph Editor.
- Delete all keys between first and last.

Keys on horizontal lines (flat channels) are not needed and can be removed. This is one item to add to the procedure; *remove keys inbetween the first and last key of a flat channel*. You can also do this for portions of one curve that is flat. The one channel that has to be handled differently than others is Translate Z. This is the forward and back movement of the foot.

You will want the foot to travel backwards in a continuous (linear) manner, then slowly change direction forwards. Example:



- Click **Play** button in the time controls
- Perform the same editing process for **R_foot_CTRL**.
- Review and save your results.

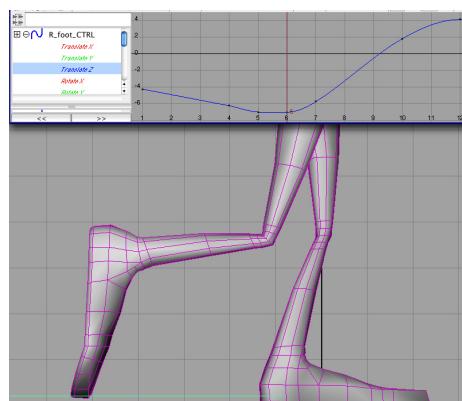
This is only the beginning since there are many more details that can produce a higher quality of movement. For those who are interested, the author strongly recommends researching the following items just to name a few:

- Editing Tangent handles
- Breaking Tangents
- Healing Tangents

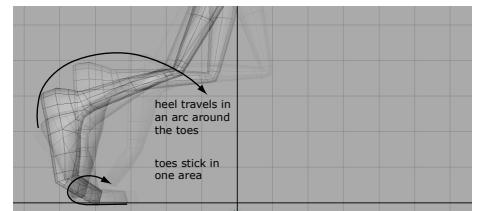
It will take too much time explain all of these items and many others involving the tools available in the Graph Editor which is merely a means to an end. Ultimately, animation is about creating appealing and believable performances for audience. What follows are a few hints.

Sticky feet and wobbly knees...

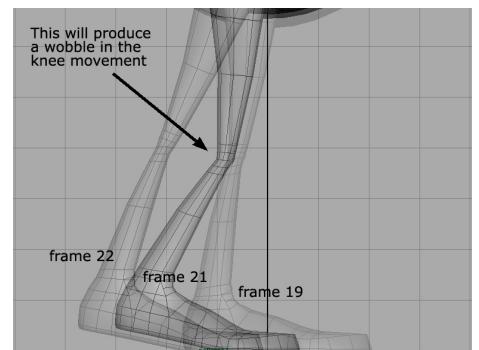
One of these you want and the other you don't. You want sticky feet. This gives the impression that gravity is pulling down on your character making it slightly difficult to pick feet up. This is especially important when the foot is farthest back in its movement. Many beginning animators will allow the foot to instantly change direction from backwards to forwards with little transition in between. Below is a screen capture of how this can be avoided.



Additional keys were added that cause the foot to continue traveling backwards after the down pose on frame 4. This was a little time consuming to create because it required lots of editing to make the foot point downwards at the correct moment.



When done correctly, the heel travels in an arc around the toes and the toes continue backwards while pointing towards the ground. This is called *overlapping action* and is an extremely important element in all good animation. The difficulty with creating this type of movement is balancing the foot angle and position relative to the hip without causing the knees to wobble.



The knees for this character are controlled using a standard system in 3D animation called inverse kinematics (IK). The IK setup in the leg automatically calculates the position of the knee based on relationship of hip to ankle. When you tilt the foot you move the ankle. When you move the **L_foot_CTRL** forwards or backwards you move the ankle. Likewise, for the hip when you change the position of the **moveMe_CTRL**. It is very easy to create positions for these controllers that cause the knee to bend, straighten, and bend again on successive frames. When played back the knees appears to be wobbling. Finding the best movement that avoids causing the knees to wobble is a balancing act that requires a process of trial and error.

And that is the last hint for now... animation is a process of discovery through trial and error. Persistence and observation are probably your two greatest tools. Hope this has been helpful.

Good Luck. -Erik