Bongo™
animation for designers

Getting Started
Copyright © 2004 Robert McNeel & Associates and The Le Bihan Partnership Ay. All rights reserved.

Rhinoceros is a registered trademark of Robert McNeel & Associates, and Bongo is a trademark of Robert McNeel & Associates and The Le Bihan Partnership Ay.

14 July 2004
Overview

Bongo™ is an animation plug-in for Rhinoceros 3.0. It is simple to use but capable of complex multi-object and view animation. You can quickly and easily preview and demonstrate the animation from within Rhino in any shading mode. You can then output the animation to video using the Rhino viewport display or any Rhino-compatible renderer.

Bongo integrates completely with Rhino. Object and viewport animations are editable in the Rhino window using simple drag and drop operations. Modify your object and motion data without losing valuable time changing between programs. Develop your designs and see how they work at the same time.

Get Help

Support Newsgroup—24 hours a day, 7 days a week: news://news.mcneel.com/bongo.


Getting Started

Objects and views become animated when in Bongo’s animate mode.

Animation data is captured from object transformations and stored in keyframes at the current position of the Timeline Slider. These keyframes are displayed on the Timeline and can be edited by using the Edit Keyframe dialog box. Properties of objects and views are interpolated between the keyframes.

Object transformations always act around an object’s animation pivot.

In addition to carrying out their own transformations, objects can be parents of child objects, which causes the child to undergo the same transformations as the parents.

An animation can be output to video as images with either Rhino’s viewport display or any Rhino-compatible renderer.

To start Bongo

1. Install Bongo.
2. At the command prompt, type Bongo.
3. When you start Bongo, the Bongo menu and toolbar appear.

Other functions are contained in the Bongo Utilities toolbar.

To start using Bongo

- From the Bongo menu or toolbar, choose Timeline.
  
  The Bongo Timeline appears. The Timeline can be docked at the edge of your Rhino screen or floating.
The Bongo Timeline

Animation actions in Bongo are controlled through the Timeline. Nothing can be animated until you click the Animate button in the Bongo Timeline.

Using the Timeline, you can:

- Record keyframe positions for objects and views
- Mark the beginning and end of the animation
- Mark the beginning and end for looping to repeat actions
- Rotate and scale objects
- Play, pause, and stop the animation preview

Animate Mode

The Animate button toggles Bongo’s animate mode on and off. When in animate mode, objects and viewports remember their current location, rotation, scale, and other changes at the current Timeline Slider position.

When the Animate button is activated, the Timeline Slider and border of the current viewport change color to notify you that Bongo is in animate mode.

When the Animate button is activated, moving, scaling, or rotating an object creates a new keyframe at the current slider position. You can rotate or scale an object using Bongo’s rotate and scale mechanisms on the Timeline or by using Rhino’s own Rotate and Scale commands. You can move objects by dragging or with the Rhino Move command.

When the Timeline Slider is over an existing keyframe, you can interactively edit the movement, rotation, or scaling recorded by that keyframe for the selected objects.

Viewports can also be enabled for animation. Once enabled, you can move or change the camera for that viewport and the view changes will be animated. We will practice animating viewports in the section “View Animation” starting on page 22.

Timeline Slider

Moving the Timeline Slider changes the current position in the animation. Click the arrows on the left and right of the slider to move the slider forward or backward one tick at a time. Click on the slider and drag it left and right to scrub through the animation. The text on the slider displays the current and last tick numbers.

Copyright © 2004 Robert McNeel & Associates and The Le Bihan Partnership Aye.
**Timeline Ticks**

The Timeline is the area just below the Timeline Slider. The vertical marks represent each tick in the current animation. The blue current tick indicator marks the current tick.

In Bongo, time is measured in arbitrary units of time called ticks. Ticks can represent any amount of time you want them to—seconds, milliseconds, minutes, or hours.

**Timeline Markers**

Markers display on the timeline to show the position of various elements of the animation.

- Object keyframe markers (red) display the positions of recorded keyframes for the currently selected objects.
- View keyframe markers (yellow) display the positions of viewport keyframes.
- Animation extents markers (green) display the start and end of the animation to be rendered. Extents markers are automatically placed at tick 0 and tick 99.

**Pivot Icon and Axis Indicator**

Animated objects display a pivot icon. By default, the pivot is created at the center of the object’s bounding box or the insertion point of a block, but you can move the pivot to any location. Bongo rotation is applied around the x, y, and z-axes of the object pivot, and Bongo scaling is applied along the x, y, and z-axes of the object pivot.

**Tutorial: Move an Object**

To create your first animation in Bongo, you will start a new model and animate moving, rotating, and scaling a box.

Using the **Timeline** you will:

- Animate an object that moves, rotates, and scales around its pivot.
- Create keyframes automatically.
- Preview the animation.
Create an object to animate

1. Start a new model.
2. Draw a box.
   Make the box different dimensions on each side.

Start Bongo

- If the Timeline is not already displayed, from the Bongo menu or toolbar, choose Timeline.
  The Timeline appears. By default, it is docked at the bottom of your Rhino window.

Animate the box movement

1. In the Timeline, click the Animate button.

2. Move the Timeline Slider to tick 50.
3 Select the box.

4 With Ortho on, Drag the box to the right.
When an object is first animated, a pivot is added to the object. Bongo transformations take place only around or along the object pivot.

5 Click the Animate button to turn animate mode off.

6 Scrub the Timeline Slider to see the box move.
Scrubbing is dragging the Timeline Slider back and forth.
Animate mode can be on or off when you scrub the Timeline Slider.

Note: The object moves in real time in the active viewport. In other viewports, the movement lags behind.
Notice the object pivot x, y, z icon now attached to the object. Bongo adds the object pivot to each animated object.

7 You will use this model in the next section, so **save** it now.

**Tutorial: Rotate an Object**

An object rotates only around its x, y, or z pivot axis. For this example, we will use only the default rotation around the x-axis.

The transformation controls are activated when objects are selected and Bongo is in animate mode. In the Timeline, the transformation mode (rotate or scale) and the pivot axes about which the transformation will take place are activated.

The default action is to rotate around the x-axis. In the Timeline, the **Rotate** button and the **X** button are pressed in to show this.

While the Animate button is active, Rhino’s Rotate or Scale commands are replaced by Bongo’s own dedicated commands. Instead of allowing you to choose a base point for rotating and scaling, the BongoRotate and BongoScale commands use the object pivot as a base point.

**Rotate the box**

1 Select the box.

2 In the **Timeline**, click the **Animate** button.

3 Move the **Timeline Slider** to tick 60.
4 Start the **Rotate** command

5 At the **Angle or first reference point** (Axis MovePivot) prompt, choose the **Axis** option.

6 At the **Axis** (X Y Z) prompt, choose the X option.

7 At the **Angle or first reference point** (Axis=X MovePivot) prompt, enter **180** degrees.

8 **Scrub the Timeline Slider.**

The box will now move and rotate around the x-axis of its pivot. Since we have the box rotate 180 degrees, it will flip over.

Scrub the slider slowly and notice that the box starts to move and rotate at the keyframe at tick 0. The box stops moving at tick 50, but keeps on rotating until tick 60.

9 You will use this model in the next section, so **Save** it now.

**Tutorial: Scale an Object**

An object scales using its pivot as a base point. For this example, we will scale the object in the z-direction only.

**Scale the box**

1 Select the box.

2 In the **Timeline**, click the **Animate** button.

3 Move the **Timeline Slider** to tick **70**.
4 Click the Scale button.

5 Since we want the box to get bigger in only the z-direction, click the Z button.

6 Click the X button to deselect it.

7 Enter 3 in the Transformation Edit box.

   Either type the number in the edit box, or drag the Transformation Slider until the number in the edit box is 3.000.

   – Or –

   Use the Scale command to scale the object along the object pivot z-axis.

8 Scrub the Timeline Slider.

   In addition to moving and rotating, the box will now triple its size.

9 Scrub the slider slowly.

   Notice that the box starts to move and rotate at the keyframe at tick 0. The box stops moving at tick 50, but keeps rotating until tick 60, and keeps growing taller until tick 70.

10 You will use this model later, so Save your model now.
Preview the Animation

The animation preview plays the animation in the Rhino viewport using the viewport display mode that is currently active.

The Play and Stop buttons control the animation preview.

To start the preview

- Click the Play button to preview the animation.
  The Play button changes to a Pause button.

To pause the preview

- Click the Pause button.
  The Timeline Slider and the animated objects stop at the current tick.

To resume the preview

- Click the Play button.

To stop the preview

- Click the Stop button.
  Stopping the preview moves the Timeline Slider to zero.

Render the Animation

A common goal of creating an animation is to make a movie of the animation that you can show. The animation frames are rendered using your choice of rendering engine (Flamingo, Treefrog, Penguin, etc.) or current viewport display and video output settings.
To create a movie of your animation

1. From the Bongo menu or toolbar, choose Render Animation.

2. In the Bongo Render Animation dialog box, set the Viewport to render to Perspective.

3. Set the Target renderer to Viewport Display.
   The file name defaults to the name of your Rhino file, and the location defaults to the folder where your Rhino file is located.

4. Under File, set the File type to JPG.

5. Under Video Output, choose the Create video file checkbox.
   A numbered sequence of image files is produced when rendering. Bongo automatically adds numbers to the ends of the filenames. This is a standard method of saving animations and can be read by almost all video encoders and editors.

6. Under Video Output, choose the Delete individual frames checkbox.
   The individual files will be deleted after the video file is created.

7. Set the Video type to AVI.
   AVI or MPG file can be shown without further processing in a media player such as Windows Media Player or Apple QuickTime.

8. Click Render.

9. View your video file using a standard player such as Windows Media Player.
Tutorial: Edit Keyframes

In the first example, keyframes were created automatically when you animated your box object. In this section, we will examine keyframes in more detail and change the properties of the animation by editing the keyframes.

When you select objects or activate an animated viewport, Bongo displays the keyframe markers for all of the selected objects along the timeline. For unselected objects and non-current viewports, The keyframe markers dim.

To move a keyframe

- With an animated object selected, **drag** the keyframe marker to a different position on the timeline.

To copy a keyframe

- With an animated object selected, press the **Ctrl** key while dragging the keyframe marker to a different position on the timeline.

To delete a keyframe

1. With an animated object selected, **drag** the keyframe marker away from the timeline.
   - A trashcan icon appears.
2. Release the mouse button to delete the keyframe.

To start understanding how keyframes work, we will edit the keyframes in the animation you already created.

In the first animation model, the box moved along the x-axis, rotated 180 degrees, and scaled to three times its size. These transformations all started at tick 0, so it moved, rotated, and scaled all in one motion.

Now we want to change the animation so it moves from tick 0 to tick 50, rotates between tick 50 and tick 60, and scales between tick 60 and tick 70. So let’s look at the information stored on the keyframes to see how to manipulate the information.
Open the keyframe at tick 0

1. In the box model you created previously, select the box.

2. Right-click the red object keyframe marker at tick 0, and click Edit Keyframe.

The Edit Keyframe dialog box opens. This keyframe describes the state of the object at tick 0.

The Edit Keyframe dialog box displays a list of objects in the left panel that have keyframes at this tick. You can choose to edit either a single object’s properties or select more than one object to edit multiple objects’ keyframes. In this case, there is only one object in the list.

3. Click the Position tab.
   Notice the check in the Store position information box.

4. Click the Rotation tab.
   Notice the check in the Store rotation information box.

5. Click the Scale tab.
   Notice the check in the Store scale information box.

6. Click Cancel to close the Edit Keyframe dialog box.
Open the other keyframes

1. With the box selected, right-click the red object keyframe marker at tick 50, and click Edit Keyframe.

   The Edit Keyframe dialog box opens.

2. Click the Position, Rotation, and Scale tabs.

   The only information that is stored in this keyframe is Position.

   The Rotation and Scale information is not stored. Instead, the information is calculated by interpolation at this tick.

3. Open the keyframes at tick 60 and tick 70.

   At tick 60, only rotation information is stored. This is because we set the rotation to 180 degrees to be complete at tick 60.

   At tick 70, only scale information is stored because we set scaling to be complete at tick 70.
**Edit the rotation**

The goal for editing the rotation information is to make the rotation start at tick 50 and end at tick 60.

1. With the box selected, right-click the red object keyframe marker at tick 50, and click **Edit Keyframe**.

2. On the **Rotation** tab, choose the **Store rotation information** checkbox.

   The rotation information is now available for editing.

3. Under **Rotation**, in the **Around X axis** box, type 0.

   Now, instead of interpolating the rotation information from the keyframe at tick 0, the rotation will be 0 at tick 50 and 180 degrees at tick 60.

4. Click the **Play** button.

   The box will now:
   - Move and scale from tick 0 to tick 50.
   - Flip over (rotate) between tick 50 and tick 60.
   - Continue to scale between tick 60 and tick 70.

**Edit the scale**

The goal for editing the scale information is to make the scaling start at tick 60 and end at tick 70.

1. With the box selected, double-click the red object keyframe marker at tick 60.

2. In the **Edit Keyframe** dialog box, on the **Scale** tab, choose the **Store scale information** checkbox.

   The scale information is now available for editing.
3 Under **Scale**, in the **Around X axis, Around Y axis, and Around Z axis** boxes, type **1**.

Now, instead of interpolating the scale information from the keyframe at tick 0, the z-axis scale will be 1 at tick 60 and 3 at tick 70.

4 Click the **Play** button.

The box will now:

- Move along the x-axis between tick 0 and tick 50.
- Flip over (rotate) between tick 50 and tick 60.
- Scale between tick 60 and tick 70.

**Change the motion timing**

We want to move the keyframes to make the actions happen at different times. We will move all of the keyframes to make the movement happen sooner.

There are two ways to move keyframes: you can choose Move from the menu if you want to enter a tick number manually, or you can simply drag the keyframe marker to a different tick.

1 With the box selected, drag the red object keyframe marker at tick **50**, to tick **25**.
2 Drag the red keyframe marker at tick **60** to tick **40**.
3 Drag the red keyframe marker at tick **70** to tick **50**.

4 Click the **Play** button.

The box will now:

- Move between tick 0 and tick 25.
- Flip over (rotate) between tick 25 and tick 40.
- Scale between tick 40 and tick 50.

**Copy keyframes to duplicate motion**

Now we would like the box to scale back down, flip back over, and move back to its starting position. An easy way to do this is to copy the keyframes.

1 With the box selected, press the **Ctrl** key, click the red object keyframe marker at tick **40**, and drag it to tick **60**.
2 With the box selected, press the **Ctrl** key, click the red object keyframe marker at tick **25**, and drag it to tick **75**.
3 With the box selected, click the red object keyframe marker at tick **0**, and drag the keyframe to tick **99**.

**Note:** The keyframe marker at tick 0 is always copied, it is never moved. Holding down the **Ctrl** key to copy the keyframe is not necessary in this special case.
4 Click the Play button.

The box will now:
- Move along the x-axis between tick 0 and tick 25.
- Flip over (rotate) between tick 25 and tick 40.
- Scale up between tick 40 and tick 50.
- Scale back down to its original size between tick 50 and tick 60.
- Flip back over (rotate) between tick 60 and tick 75.
- Move back to its starting position between tick 75 and tick 99.

Delete a keyframe

Suppose we do not like the scaling after all, so we want to delete the keyframe with the scaling information.

1 With the box selected, click the red object keyframe marker at tick 50, and drag it away from the timeline. A trashcan icon appears.

2 Release the mouse button to delete the keyframe.

The box will now:
- Move along the x-axis between tick 0 and tick 25.
- Flip over (rotate) between tick 25 and tick 40.
- Flip back over (rotate) between tick 60 and tick 75.
- Move back to its starting position between tick 75 and tick 99.

Tutorial: Use Hierarchies to Link Objects

Animated objects can have parents and children. This is displayed in the Animation Manager on the hierarchy tree. Each object is either the child of the Animated Objects item or the child of another object. When an object is the child of another object, it is also transformed by the transformations applied to its parent in addition to its own transformations.

For example, if a car is animated moving in space, the four wheels can be made children of the car. The wheel objects will now move with the car and stay in the correct place. Rotation can then be applied to the wheels by selecting them and using the transformation slider to rotate them around the correct axis. They will then move with the car (using the parent’s transformation) and rotate around their own axes.
For the following animation tutorial, we will link parts together and control movements through these links. The box will rotate around its center 360 degrees, and the donut shape will follow the rotation of the box.

**Start Bongo**

1. Open the model *Tower.3dm*.

2. If the Timeline is not already displayed, from the **Bongo** menu or toolbar, choose **Timeline**.

The **Timeline** appears. By default, it is docked at the bottom of your Rhino window.

3. If the **Animation Manager** window is not already displayed, from the **Bongo** menu or toolbar, choose **Animation Manager**.
**Animate the Parts**

First we will animate the parts separately. We want the box to rotate once around its z-axis, and we want the donut shape to rotate twice around its center.

**Rotate the box**

1. In the *Timeline*, click the *Animate* button.

2. Set the *Timeline Slider* to tick 90.

3. Select the *Box*.

4. In the *Timeline*, click the *Rotate* button, and click the *Z* button.

5. Move the *Transformation Slider* to the right so the arm rotates 360 degrees.

*Note*: X, Y, and Z refer to the axes of the object pivot, not to the Rhino world or construction plane coordinate systems.
6 Scrub the **Timeline Slider** or click the **Play** button to see the results.

---

**Rotate the donut**

1 In the **Timeline**, click the **Animate** button.

2 Set the **Timeline Slider** to tick 90.

3 Select the **Donut**.

4 In the **Timeline**, click the **Rotate** button, and click the **Y** button.
5 In the edit box, enter **720** so the donut rotates twice.

**Note:** The donut is a Rhino block whose insertion point is the center of the donut. Bongo will automatically use a block insertion point as the object's pivot point.

6 Scrub the **Timeline Slider** or click the **Play** button to see the results.

The donut shape and the box both rotate, but you can see that the donut does not also rotate in relation to the box. We can easily link the two parts together.

**Link the donut to the box**

1 Select the box.

2 Set the **Timeline Slider** to tick **0**.

3 In the **Animation Manager** tree, click and drag **Donut** under **Box**.
4 Scrub the **Timeline Slider** or click the **Play** button to see the results.

Now the donut rotates along with the box.

---

**Add Another Child Object**

Using the parent/child relationships makes adding objects to your animation easy.

1. In the tower model, turn the layer named Ellipsoid.

   A blue ellipsoid appears in your view. It is not animated.

2. Scrub the timeline slider to see how it acts.

   We will make this object a child of the donut, so it will move with the donut.
3. Select the donut.

4. From the Bongo menu, choose **Utilities**, and then choose **Select Children**.

5. At the **Select children** (SnapIntoPlace) prompt, select the ellipsoid.

6. Scrub the **Timeline Slider** or click the **Play** button to see the result.

**View Animation**

View manipulation panning and zooming can be animated in Bongo. By default, views are not enabled for animation. This is so that you do not accidentally add keyframes to a view while zooming and panning in animate mode.

With the Animate button active, moving the camera in an animation enabled viewport adds a yellow **view keyframe marker** to the Timeline. To see the effect, add two or more keyframes. Adding only one keyframe will simply lock the camera to that keyframe.

Yellow view keyframe markers in the Timeline.
Tutorial: Animate a View

In this tutorial, you will animate a view. Animating views lets you pan, zoom, and rotate the view while the animation is running.

We will be adding simple view animation. The camera will zoom in on the cone during the animation.

Activate a view for animation

1. Open the model *TowerView.3dm*.

2. Scrub the Timeline Slider or click the Play button to see the current animation.

3. From the Bongo menu or toolbar, choose Animation Manager.
   - The Animation Manager appears with a list of your viewports in the hierarchy tree.

4. In the Animation Manager window, right-click the Start icon and from the menu, choose Animation Enabled.
A small rectangular reticle appears at the viewport's center, and the current tick displays in the lower right of the viewport.

When animation is enabled for a viewport, Bongo controls the view.

**Record the final view**

1. In the **Timeline**, click the **Animate** button.

2. Set the **Timeline Slider** to 90.

**Zoom in on the cone**

1. Zoom and pan your view until the end of the cone with the smiley face is centered in your view.
2 Scrub the **Timeline Slider** or click the **Play** button to see the results.

**Note:** If you try to zoom or pan a view that is animated, a warning dialog appears to let you know that Bongo has control of the view and allowing you to disable the view animation.

---

**Animate Object Properties**

In addition to moving, rotating, and scaling objects, you can animate some object properties, such as color, gloss, and transparency. Some object properties can be animated and will be recorded when changed in animate mode. These properties are available for animation:

- Object color
- Object visibility (Rhino Hide command)
- Render material color
- Render gloss finish
- Render gloss color
- Render transparency

**Tutorial: Animate Color Change**

You can set the color of an object with a keyframe. Rhino will transition the color smoothly between keyframes in the same way it smoothly transitions movement and rotation.

**Animate color change**

1. Open the model **TowerColor.3dm**.

2. Set the display mode for the viewport named **Render** to **Rendered Display**.
3 In the **Timeline**, click the **Animate** button.

4 Move the **Timeline Slider** to tick 90.

5 Select the box.

6 From the Rhino **Edit** menu, choose **Object Properties**.

7 In the **Object Properties** dialog box, on the **Material** page, under **Assign by**, choose **Basic**.

8 Set the render material color to **Green**.

9 Click the **Play** button.