

New Features in Shake 3.5

New Warper and Morpher Nodes

The Warper and Morpher nodes give you the ability to easily create specific warping effects using tools very similar to those used by the RotoShape node. Using shapes, you can deform parts of an image to conform to shapes you draw in the Viewer. The Warper and Morpher both work by pushing and pulling the pixels of an image to move parts of the image defined by source shapes to a region defined by target shapes. When part of an image is warped, the surrounding area stretches to accommodate the change, as if the image were on a sheet of rubber that was being pushed and pulled to distort it.

The Warper node is useful for creating targeted deformations to alter the shape of a subject in an image. Examples might include making someone's nose grow, making an animal's eyes widen in surprise, or causing a bump to grow on someone's forehead. The warper can be used to make a static change to a subject, or it can be animated to cause dynamic changes in the subject's shape.

The Morpher node blends two images together to create the effect of one subject changing shape to turn into another. The Morpher node does this by performing two warping operations—one on the source image to warp it into the shape of the target image, and another to warp the target image from the shape of the source back to its own shape. Once both warping operations match the shapes of the source and target images to one another, a built-in cross-fade dissolves from the first warp to the second, providing the illusion that the first image is changing into the second.

For more information about the Warper and Morpher nodes, see Chapter 2, “The Warper and Morpher Nodes,” on page 7.

Improvements to Shape Drawing

Improvements have been made to shape drawing. For more information, see Chapter 3, “Shape Drawing Controls,” on page 51.

Improvements to Playback Caching

Caching logic has been improved to make it more predictable. These changes improve playback, subject to the speed of your computer and the amount of RAM available.

For more information about how Caching works in Shake, see Chapter 4, “Caching.”

Playback Limiting Has Been Added

Regardless of the speed of your computer, Viewer playback is now limited to the frame rate specified in the `timecodeMode` parameter in the Format section of the Globals tab.

Note: Assuming your composition is cached so that real-time playback is possible, this playback rate is not exact, but may vary by around 10 percent.

Improvements to QuickTime Import and Export

Improvements have been made to Shake’s handling of greater than 8-bit QuickTime clips. There is also improved support for importing and exporting QuickTime clips using the Apple Uncompressed 8- and 10-bit 4:2:2 codecs.

Note: When using the `FileOut` node to render uncompressed QuickTime movies, use the Apple Uncompressed 8- or 10-bit 4:2:2 codecs to obtain the highest quality.

Changes to the Handling of DPX Files

The reading and writing of DPX images has been improved for greater compatibility with more film recorders.

Upon *FileIn* of a DPX image, its header data is passed down through the node tree. If you *FileIn* a DPX image, process it with single input nodes, such as color, filter, or transformation nodes, and then render out the result as another DPX file with a *FileOut* node, the header data is passed through the node tree and written out to the resulting file. For more information about Shake’s support for custom file header metadata, see “Support for Custom File Header Metadata” below.

When rendering a DPX file with a *FileOut* node, an additional parameter allows you to specify the orientation of the output image as either Top to Bottom (default), or Bottom to Top.

Support for Custom File Header Metadata

New internal support for blind data allows for the preservation of metadata from custom file formats for facilities using special file translators.

If you design a file translator that places a file's header metadata into Shake's blind data container, it will be passed down through the node tree. For example, if you *FileIn* an image with custom metadata using such a file translator, process it with a series of single input nodes, and then render out the result into the same format with a *FileOut* node, the blind header data is passed through the node tree and written to the resulting file.

If two images with metadata in the blind data container are combined in a node, such as *Over*, *Outside*, or *Multilayer*, the data from the image connected to the node's left-most input (frequently labeled the foreground input knot) is propagated down the tree.

If, at some point in the node tree, you wish to assign the blind header data from one image to another, use the *Copy* node. This can be useful if you have a complex node tree that uses many layer nodes combining several images, yet you want the final file to render out with specific header data taken from one of the *FileIn* nodes.

To assign blind header data from one image to another:

- 1 Add a *Copy* node to the node tree, so that the nodes providing the RGBA data you want to use are connected to the Foreground input knot.
- 2 Attach a second *FileIn* node containing the blind header information you want to use to the *Copy* node's background input knot.
- 3 In the *Copy* node's Parameters tab, turn on the copyBData parameter.

The resulting output from the *Copy* node contains the blind header data from the second *FileIn* node. This operation replaces any header data that was originally in the image.

Customizing the FlipBook

The following arguments have been added to the flipbook executable as global plugs. This lets you specify an external flipbook to come up as the default. Specify these plugs using a .h file in the *startup* directory. The global plugs and their default values are:

```
gui.externalFlipbookPath = "shkv"; // the flipbooks name -- this
                                should include the full path

gui.flipbookStdInArg = "-"; // instructs the flipbook to take data
                             from StdIn

gui.flipbookExtraArgs = ""; // allows you to enter any extra arguments
                             the flipbook needs.

gui.flipbookZoomArg = "-z"; // sets the zoom of the flipbook

gui.flipbookTimeArg = "-t"; // the time range argument

gui.flipbookFPSArg = "-fps"; // the frames per second argument
```

Note: If the specified external flipbook doesn't support one of these arguments, setting its value to an empty string ("") prevents that value from being passed to it.

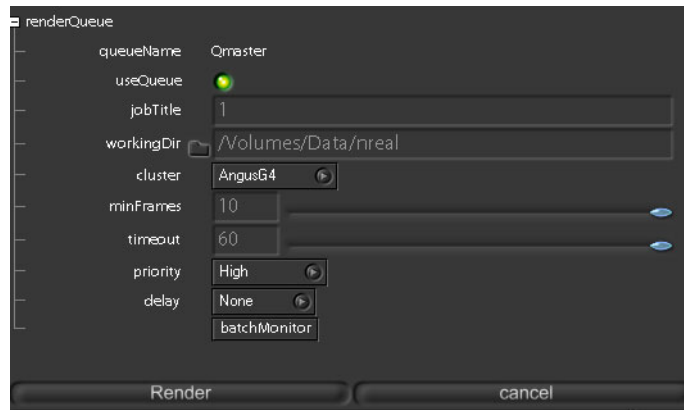
Additional Support for Shake Qmaster

You can enable additional support for Shake Qmaster by adding the following global plug to a .h file in the *startup* directory:

```
sys.useRenderQueue = "Qmaster";
```

This setting causes additional options to appear in the Render Parameters window when you choose Render > FileOut Nodes. These options become visible when you open the renderQueue disclosure control.

Note: If Shake Qmaster isn't installed but the sys.useRenderQueue plug is declared, a message is sent to the console upon startup, and the following options do not appear.



renderQueue Options

- *queueName*: The name of the render queue software being used. If Shake Qmaster is installed, "Qmaster" appears here.
- *useQueue*: When useQueue is turned on, the fileOut nodes specified by the renderFileOuts parameter are sent to the render queue when you click Render. By default, useQueue is turned off. Setting renderFileOuts to All sends all FileOut nodes to the render queue software. Setting renderFileOuts to Selected only sends the selected FileOut nodes to the render queue software.



- *jobTitle*: Enter the name you want to use to keep track of this job here.

- *workingDir*: The directory in which you want to store the temp script used by the render queue. The temp script is a temporary duplicate of your script that the computers in the specified cluster can access to perform the job.
- *cluster*: A pop-up menu that allows you to choose which cluster you want to use to perform the job. All clusters set up in your render queue software will appear here.
- *minFrames*: Use this field to specify the minimum number of frames you want to be processed by each computer in the cluster.
- *timeout*: The time, in seconds, a computer on a cluster can be idle before that part of the job is re-routed to another computer.
- *priority*: A pop-up menu that allows you to choose the priority of the job. The options are High, Medium, and Low.
- *delay*: A pop-up menu that allows you to delay when the render queue software starts the job you're submitting. The options are 15 minutes, 30 minutes, 1 hour, or 2 hours.
- *batchMonitor button*: Click batchMonitor to launch the Shake Qmaster Batch Monitor application.

The Warper and Morpher Nodes

Chapter Summary

- “About Warping and Morphing”
- “Creating and Modifying Shapes”
- “Using the Warper Node”
- “Using the Morpher Node”

About Warping and Morphing

Shake’s various linear transformation nodes, such as Move2D, Move3D, Rotate, and Scale, operate on entire images so that each pixel is moved, rotated, or scaled by the same amount. Even the *CornerPin* function applies the same transformation to every pixel—an amount defined by the location of each of the four corners. Shake’s warp nodes, including iDisplace, Turbulate, and Twirl, and the new Warper and Morpher nodes, differ from linear transformations in that each pixel’s transformation is calculated individually. Depending on the type and settings of the warp you’re creating, each pixel of an image can be moved independently of its neighbor. For this reason, warps can be referred to as “nonlinear transformations.”

Shake’s previously existing warp nodes are good for deforming one image using another as a guide, making rippling patterns, randomizing the texture of an image, and other similar effects. These nodes are quite powerful, but their main strength is in making wholesale image deformations while requiring a minimum of manual control, using either mathematical expressions or secondary images to define the warping being done. Using Shake’s shape-based warping nodes, the Warper and Morpher, you can easily create specific warping effects using tools very similar to those used by the RotoShape node. Using shapes, you can deform parts of an image to conform to shapes you draw in the Viewer.

Warper and Morpher Memory Usage

The Warper and Morpher nodes use a lot of memory when processing high-resolution images—using four image channels of the full image buffer in float space for each processing thread used. As a result, memory usage may become an issue when warping and morphing large images with multi-threaded processing enabled. In this situation, virtual memory usage may noticeably slow processing speed when the maximum available RAM is used.

For example, if you have 2GB of RAM in your computer, and Shake plus assorted OS operations use 300 MB, this leaves 1.7 GB of total memory left for image processing by the Warper or Morpher nodes for any given frame. You can calculate the RAM used for a frame at a given image size using the following formula:

$4 * (\text{image width} * \text{image height} * 4) * (\text{number of threads})$

Using this formula yields the following memory usage table:

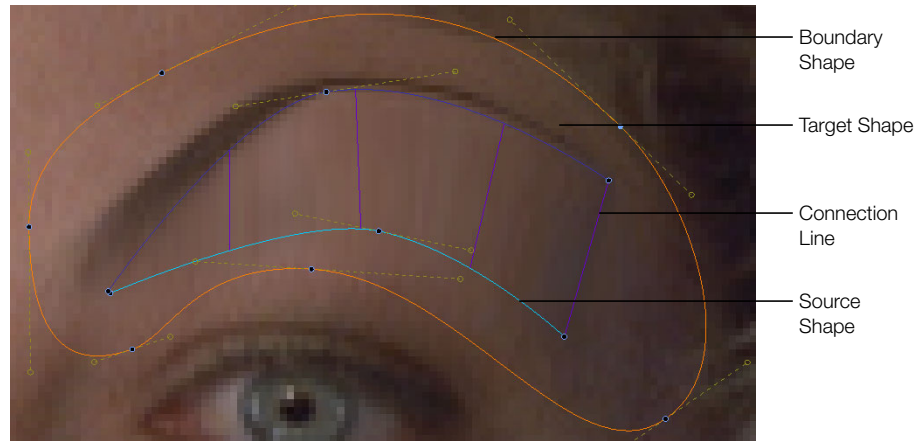
Number of Threads	2K Image Calculation	4K Image Calculation	8K Image Calculation
1	49MB	195 MB	778 MB
2	97 MB	389 MB	1.6 GB

If you don't have enough RAM to handle the resolution you're working at, switch the maxThread parameter in the Globals tab to 1. This reduces the memory requirements for this operation.

Using Shapes to Warp and Morph

Both the Warper and Morpher nodes allow you to use animated shapes to control and animate the deformation of an image. Both nodes work using four types of shapes that you draw. These shapes work together to define which parts of an image will be deformed to fit into shapes that you define.

Types of Control Shapes



- **Source Shapes:** These are shapes you draw that conform to the subject of the source image you want to deform. They generally follow well-defined contour lines of the subject—examples might include the edge of a person’s face, the contours of the eyes, eyebrows, nose, and mouth, or the outline of an arm or leg. Source shapes are light blue by default.
- **Target Shapes:** These are shapes you draw that define the shape you want the deformed image to conform to. For example, if you want to warp the eyes of a cat to make them appear to bulge on cue, you would create animated target shapes defining the new shape of the eyes. Target Shapes are dark blue by default.
- **Connection lines:** These are automatically created when you connect a source shape to a target shape, and indicate the correspondence of each point in a source shape to its destination on the target shape. It is by pairing source shapes with target shapes that Shake is able to create controlled deformations of an image. Although four connection lines are automatically created for each source/target shape pair, you can create additional ones to give you added control over the deformation. Connection lines are purple by default.
- **Boundary Shapes:** The Warper and Morpher nodes can sometimes create unwanted deformations in areas surrounding the parts of the image you intend to manipulate. Boundary shapes are essentially shapes that are both Source and Target shapes, which is how they keep affected pixels from moving. You can use boundary shapes to minimize the effect of a warp on surrounding parts of an image, either by excluding whole regions of the source, or by “pinning down” specific areas that you don’t want to be deformed. You can create as many boundary shapes as necessary, since it may take more than one to pin down an image completely. Boundary shapes are orange by default.

- *Displaced Target Shapes:* These are not shapes you either create or modify directly. Instead, they're indicators that show the amount of displacement in that region of the image, based on the Displacement parameter for that source/target shape pair. They're designed to help you see what the deformation will be without having to render the entire image. Displaced target shapes are pink by default.

Note: The colors of each control shape type can be modified in the shapeColors group of the guiSettings section of the Globals tab.

Source shapes and target shapes may be drawn separately, or you can duplicate the source shape you create and modify it to quickly create a target shape. It's not necessary for the source and target shapes to have the same number of points, since the actual path that an animated deformation will follow runs along the connection lines that appear once you connect a source shape to a target shape.

In both the Warper and Morpher nodes, you may create as many Source/Target shape pairs as necessary to deform various parts of the subject. Unlike the RotoShape node, which only allows for the creation of closed shapes, the Warper and Morpher nodes allow you to create closed shapes, open-ended shapes, and single-point shapes. This flexibility allows you to create any kind of deformation you need.

For more information about drawing and manipulating shapes, see “Creating and Modifying Shapes” on page 15.

Animating Control Shapes

Unless you're deforming a still image, it will probably be necessary to animate the source and target shapes you use to fit the motion of the subject you're deforming. For example, if you're creating a warp for an actor who's moving, you'll need to animate the source shape to conform to the outlines of the actor so that they follow his or her motion. You'll then need to animate the target outlines to follow the same motion.

Here's a shortcut that may save you some effort when you create a warp effect using an animated shape. First, animate the source shape that defines the area of the image you want to warp. Afterwards, you can duplicate and modify it as necessary to use as the target shape, without having to reanimate the entire shape.

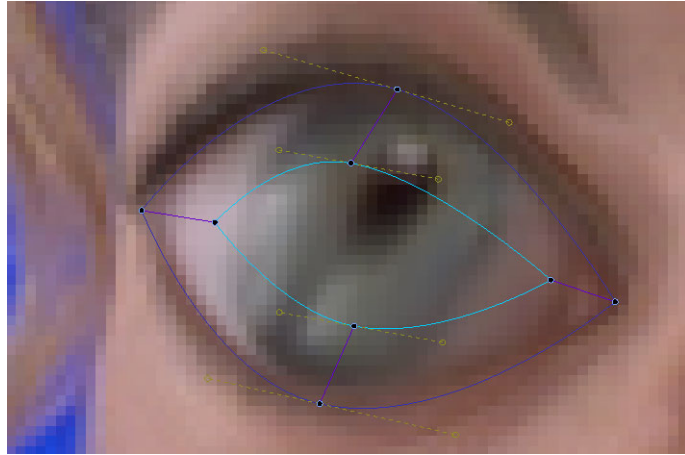
For more information about keyframing shapes, see “Animating Shapes” in chapter 15 of the the Shake Reference Guide, “Painting, Rotoscoping, and Other Image Functions.”

Using Motion Tracking to Animate Control Shapes

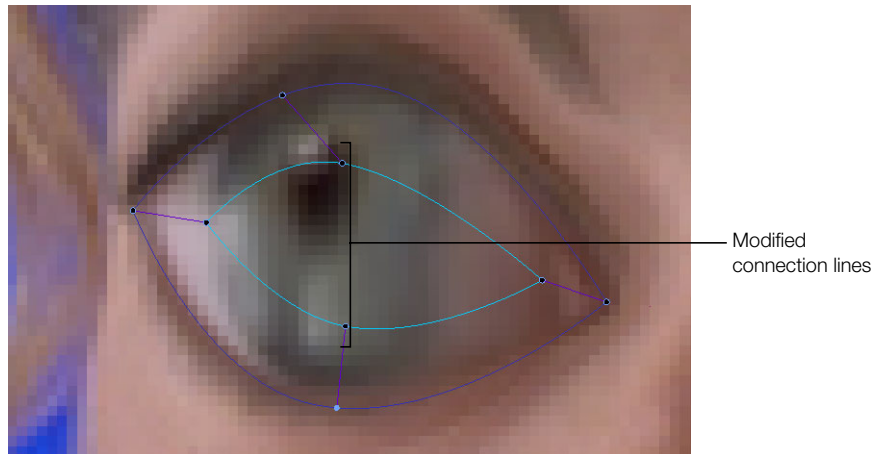
In addition to manually keyframing source and target shapes, you can attach Stabilize or Tracker nodes to either source or target shapes to aid you when rotoscoping moving features. This works identically to the way you attach Stabilize or Tracker nodes to shapes in the RotoShape node. For more information, see “Attaching a Tracker to a RotoShape” in chapter 15 of the Shake Reference Guide, “Painting, Rotoscoping, and Other Image Functions.”

Controlling Warp and Morph Deformation Using Connection Lines

When you first connect a source shape to a target shape in the Viewer, four connection lines appear that run from the source to the target shapes. These control lines serve two purposes. First, they show you which segments of a source shape correspond to which segments of its connected target shape. Second, their angles define the path the pixels of the image will follow when warping from their original position to the target position you've defined.



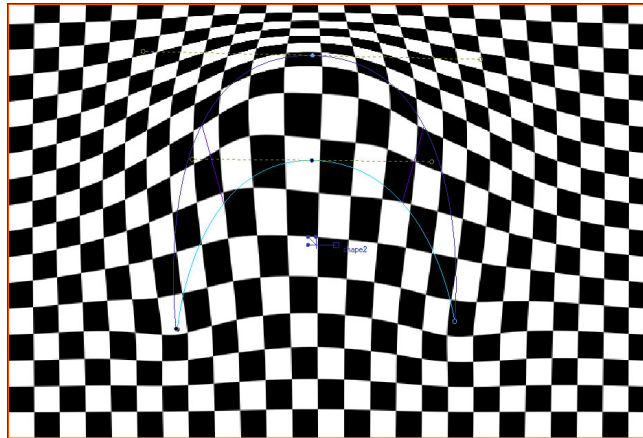
The start and end points of control lines that are connected to the source and target shapes can be moved by dragging them back and forth along the shapes themselves. Changing the angle of the lines by moving the in or out point of a control line independently allows you to redefine the angle of deformation for all pixels in that area of the warp.



Control lines can be moved, and even animated, to control the way the speed and direction of deformation. Additional control lines may also be created to give you more precise control over the deformation itself.

Using Boundary Shapes to Limit Deformation in an Image

The Warper and Morpher both work by pushing and pulling the pixels of an image to move parts of the image defined by the source shapes to the region defined by the target shapes. When part of an image is warped, the surrounding area stretches to accommodate the change, as if the image is on a sheet of rubber being pushed and pulled to distort it.



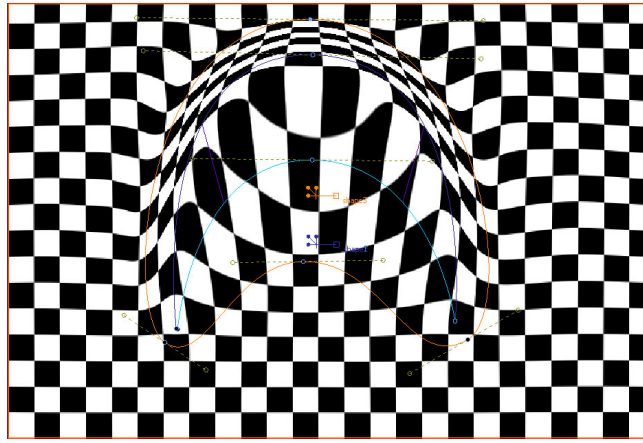
Warp without boundary shape

The region affected by the resulting deformation is not limited to the area defined by the source/target shape pairs. In fact, you'll notice that a significant area of the image surrounding each source/target shape pair is also deformed. While there is a 100 percent displacement at the actual position of the source and target shapes, the total area of deformation lessens gradually with the distance from the shape pair. This may result in a warp or morph not only affecting the intended subject, but also the surrounding background.

This aspect of the Shake warper is useful in that it helps to smooth the transition between the warped and unwarped parts of your image, resulting in a more realistic effect. It also means that sometimes it's not necessary to create as many source/target shape pairs as you might think—a single shape pair's area of influence may be enough to create the effect you want.

On the other hand, there are usually parts of an image that you don't want warped. For example, if you're warping someone's eyebrows, chances are you don't want his or her hair to be distorted as well. You exclude parts of an image from being affected by the Warper or Morpher nodes using boundary shapes.

It's important to understand that boundary shapes don't eliminate distortion from the surrounding image; they minimize it.



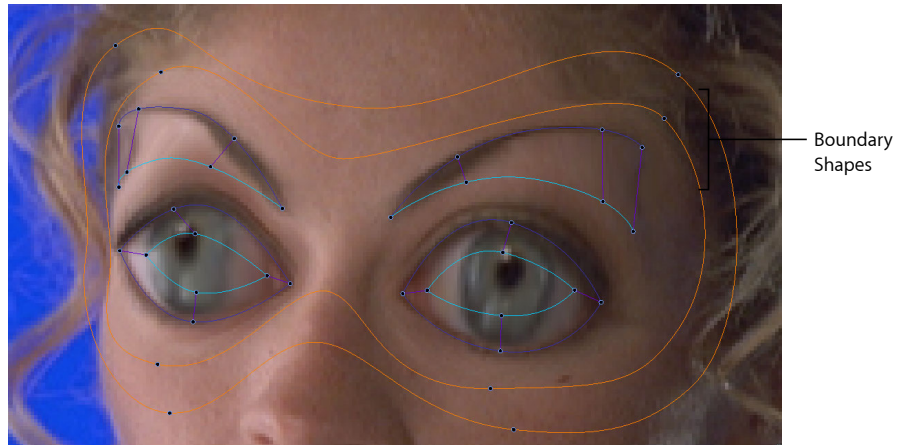
Warp with boundary shape

It may take more than one boundary shape to completely lock down an image. Fortunately, you can create as many boundary shapes as necessary to eliminate unwanted distortion in an image.

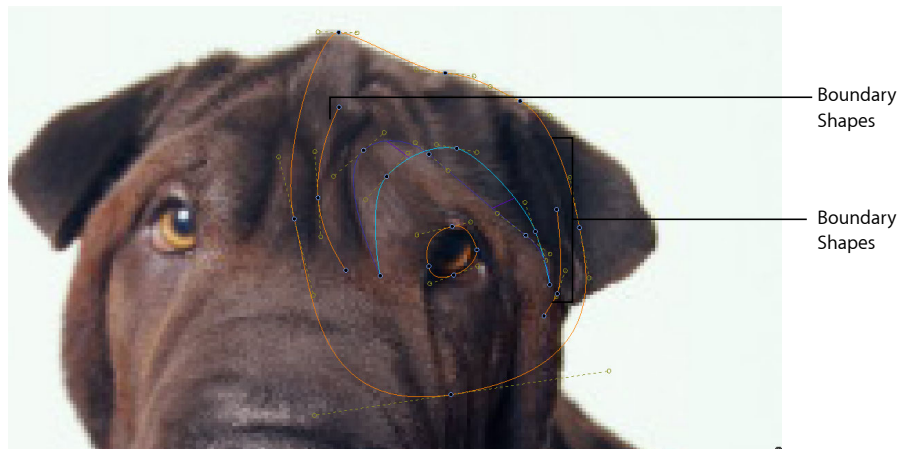
Important Target shapes should never cross boundary shapes. Doing so may create unwanted distortion and tearing in the resulting image.

There are many ways you can use boundary shapes to prevent parts of an image surrounding an area of deformation you've set up from being affected by a warp or morph effect. One is to use a closed shape to surround a pair of source/target shapes, which minimizes their effect on the surrounding area of the image.

For example, if you warp a subject's eyes so that they bulge open, but you don't want the effect to overly stretch the rest of the face, you can create a boundary shape to isolate the source/target shapes around the eyes. Sometimes, you may have to use several concentric rings of boundary shapes to completely lock down an area of the image.



You can also use boundary shapes to “pin down” specific areas of an image that you don't want to be affected by a warping effect. For example, if you were creating a warp effect to manipulate an animal's face, you could use a combination of open and closed shapes and single-point shapes to prevent the eyes and nose from being affected by the warp you're applying to the eyebrow area.



Note: By default, the outer edge of the frame is used as a boundary shape. This behavior can be disabled by turning off the `addBorderShape` parameter in the Parameters tab for the Warper or Morpher node you're adjusting, but this may produce unexpected results.

Isolating the Subject of Deformation Prior to Warping or Morphing

Even when you use one or more boundary shapes to pin down areas surrounding a warp effect, you may find that some of the surrounding image is still affected, however slightly. For this reason, it may be useful to isolate the subject of the image prior to using either the Warper or Morpher nodes. Ideally, the subject of the warp effect was shot against blue or green-screen, and can be keyed. If not, you can always rotoscope the image using a RotoShape node.

In either case, the Warper and Morpher nodes affect the alpha channel of the image along with the RGB portion, so you can always add either to the end of a node tree you've created to isolate your subject. This way, you can add a clean background no matter how extreme the warping effect is.

Creating and Modifying Shapes



Many of the shape controls of the Warper and Morpher nodes are identical to those of the RotoShape node, and all share the same methods for creating tangents, closing shapes, inserting and deleting points, etc. If necessary, you may refer to the RotoShape documentation for more information on creating and modifying shapes.

The Warper and Morpher Viewer Shelf




When a Warper or Morpher node is selected, the following buttons appear in the Viewer Shelf.



The Warper and Morpher nodes both have the following controls.

Button	Name	Action
	Add New Shapes	Creates new shapes. Closed shapes are created by clicking on the first shape point you created. Open shapes and single-point shapes are created by double-clicking when creating the last point, or by right-clicking in the Viewer and choosing Finish Shape from the contextual menu.
	Edit Shapes	Allows you to edit shapes.

Button	Name	Action
	Connect Shapes	<p>Clicking this control allows you to create a Source/Target shape pair by clicking first on the shape you want to be the Source, and then clicking a second time on the Target shape you want to link it to.</p> <p>To define a Boundary shape, click this control, then click twice on a shape you want to turn into a Boundary shape. This effectively makes a single shape into both a source and target shape.</p>
	Edit Connections	<p>Once two shapes have been joined with the Connect Shapes button, the location and angle of each Connection Line that links source to target shapes may be edited by clicking this control. With this control turned on, select one or Shift-click to select both of the source and destination points of a Connection Line to move them along each shape.</p>
	Show/Hide Tangents	<p>Toggles the Viewer among showing All shape tangents (the handles that allow you to manipulate Bezier curves), None, or Pick, which only shows the shape tangents of individually selected points.</p>
	Lock Tangents On/Off	<p>Locks or unlocks all shape tangents in the Viewer. If locked, shape points may still be moved, but the tangents defining the angle of curvature remain locked.</p>
	Toggle Shape/Line Mode	<p>Toggles selected points between being corner points and Bezier curves.</p>
	Delete Knot	<p>Deletes selected points on a shape.</p>
	Keyframe Current Shape/All Shapes	<p>Toggles between two shape keyframing modes. In All Shapes, all shapes are keyframed whenever any one shape is modified while auto-keyframing is on. In Current Shape, only the selected shape is keyframed while auto-keyframing is on.</p>
	Enable/Disable Shape Transform Control	<p>When turned on, this control makes the Shape Transform controls for each shape visible in the Viewer. Each shape can be manipulated as a whole using this control. When turned off, all Shape Transform controls are hidden, and cannot be used.</p>

Button	Name	Action
	Visibility Toggles	<p>These buttons toggle the visibility of specific types of shapes in the Viewer. From left to right, they control:</p> <ul style="list-style-type: none"> ■ Source Shape Visibility ■ Target Shape Visibility ■ Connection Visibility ■ Boundary (or lockdown) Shape Visibility ■ Unconnected Shape Visibility ■ Displaced Target Shape Visibility <p>Each control affects the visibility of all shapes of that type in the Viewer. Individual shapes may be made invisible using controls in the Parameters tab. However, the Visibility toggles in the Viewer Shelf supersede the Visibility settings in the Parameter tab.</p> <p>Each setting in the Select Display pop-up menu of the Warper and Morpher allow these controls to be toggled independently. For example, in the Warper, the visibility settings of the Source image can differ from those used by the Target.</p>
	Shape Lock Toggles	<p>These three buttons lock all Source, Target, and Boundary shapes in the Viewer, preventing them from being edited. Each control locks all shapes of that type in the Viewer.</p> <p>Individual shapes may be locked using controls in the Parameters tab. However, the Lock controls in the Viewer Shelf supersede the Lock controls in the Parameter tab.</p>
	Select Display Image	<p>The Source/Warped Image pulldown allows you to toggle the Viewer's display between the unmodified and modified images.</p> <p>You may quickly jump between views by pressing:</p> <ul style="list-style-type: none"> ■ F1 to view the original Source Image ■ F2 to view the original Target Image (Morpher only) ■ F3 to view the Warped Image

Drawing and Editing Shapes

The biggest difference between drawing shapes with the RotoShape node and the Warper and Morpher nodes is that while the RotoShape node only allows you to draw closed shapes, the Warper and Morpher nodes also allow you to create open shapes and single-point shapes. Open shapes make it very simple to define deformations for things like eyebrows, muscle outlines, and other contours that don't require a complete outline. Single-point shapes allow you to define deformations for small image details, and are also very effective as boundary shapes you can use to pin down parts of the image you don't want to be affected by nearby source/target shape pairs.

The Warper and Morpher nodes both warp the image using the same shape controls, and the methods used to create and edit shapes for use by each node are identical.

Drawing New Shapes

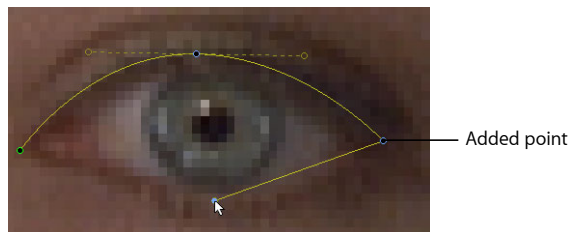
Drawing new shapes works the same whether you're creating a source, target, or boundary shape. In each case, you create a new, unassigned shape first, and you assign its type in a subsequent step. Unassigned shapes appear yellow, by default.

To create a new unassigned shape:

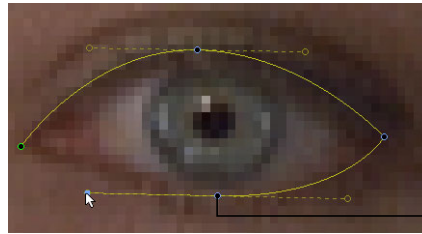
- 1 Click the Parameter control of the Warper or Morpher node you want to create a new shape with to load its parameters into the Parameter tab, and its controls into the Viewer Shelf.
- 2 In the Viewer Shelf, click the Add Shape button.



- 3 If necessary, zoom into the image in the Viewer to better trace the necessary features of the subject you want to warp or morph.
- 4 In the Viewer, begin drawing a shape by clicking anywhere on the image to place a point.
- 5 Continue clicking to add more points to the shape. Click once to create a sharply angled point.



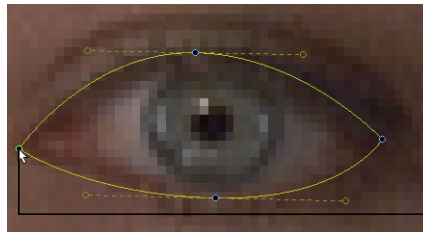
- 6 To create a point with tangent controls to make a Bezier curve, click and hold the mouse button down, and drag to one side of the point until the angled point becomes a curve.



Click and drag to create a bezier point.

Note: The distance you have to drag before the angled point becomes a curve is customizable via the `rotoTangentCreationRadius` parameter in the `shapeControls` section of the `guiSettings` group in the `Globals` tab. For more information on customizing Shake's shape creation tools, see "Customizing Shape Controls" on page 29.

- 7 There are three ways you can end shape drawing to create different kinds of shapes:
- To create a single point shape, right-click in the Viewer immediately after creating the first point and choose Finish Shape from the shortcut menu.
 - To create an open shape, either double-click when creating the last point of the shape, or right-click and choose Finish Shape from the shortcut menu after creating the last point of the shape.
 - To create a closed shape, click the first point of the shape you created.



Click the first point to close the shape.

Important You can only create single-point shapes and open shapes in the Warper and Morpher nodes. You cannot create these kinds of shapes in the RotoShape node.

Every time you create a new shape, an additional shape parameter appears in the parameter tab of the corresponding Warper or Morpher node. By default, each new shape parameter that's created is named "shape1Name," and the middle number is incremented with each new shape you draw. These names can be changed to more easily identify the specific parts of the subject you've isolated for individual manipulation later.



Editing Shapes

Once you've created a shape, there are several ways you can modify it. These techniques also work for keyframing shapes used for animated warping or morphing effects. For more information about keyframing shapes, see “Animating Shapes” in Chapter 15 of the Shake Reference Guide, “Painting, Rotoscoping, and Other Image Functions.”

When editing shapes that are close to other shapes, it may be helpful to turn off the Enable/Disable Shape Transform control in the Viewer Shelf, to hide Transform controls from other shapes that may overlap the shape you're editing. After your source/target shape pairs have been defined (page 26) it may also be helpful to turn off the visibility of shape types that you don't need to see. For example, turning off the visibility of all source shapes while you're editing their corresponding target shapes will prevent accidental adjustment of the wrong overlapping points. You can turn different groups of visibility controls on and off for each setting of the Select Display pop-up menu in the Viewer Shelf.

Important In order to edit Warper or Morpher shapes, it's important to make sure the Edit Shapes button is turned on.

To edit a shape:

- 1 Click the Parameter control of the Warper or Morpher node with the shape you want to modify to load its parameters into the Parameter tab, and its controls into the Viewer Shelf.
- 2 In the Viewer Shelf, click the Edit Shapes button.



- 3 Select one or more points you want to edit by doing one of the following:
 - Click on a single point to select it.
 - Shift-click additional points to add them to the selection.
 - Click in the Viewer and drag a bounding box over all the points you want to select.
 - Hold the Shift key down and drag to use another bounding box to add points to the selection.
 - Hold the Command or Control key down and drag to use another bounding box to remove points from the selection.
 - Move the mouse cursor over the edge, or the transform control, of a shape, and press **Control** or **Command + A** to select every point on that shape.
- 4 When the selected points are highlighted, rearrange them as necessary by doing one of the following:
 - To move one or more selected points, drag them where you want them to go.
 - To move one or more selected points using that shape's transform control, press the Shift key while you use the transform control.

Note: Using the transform control without the Shift key pressed modifies the entire shape, regardless of how many points are selected. For more information on using the Transform control, see page 22.

To add a point to a shape:

- 1 Click the Edit Shapes Mode button.
- 2 Shift-click the part of the shape you want to add a control point to.
A new control point appears on the shape where you clicked.

To remove one or more points from a shape:

- 1 Select the point or points you want to remove.
- 2 Do one of the following:
 - Click the Delete Knot button in the Viewer Shelf.



- Press the Forward Delete key.

Those points disappear, and the shape changes to conform to the remaining points.

To convert angled points to curves, and vice versa:

- 1 Select the point or points you want to convert.
- 2 Click the Toggle Shape/Line Mode button to convert angled points to curves, or curves to angled points.

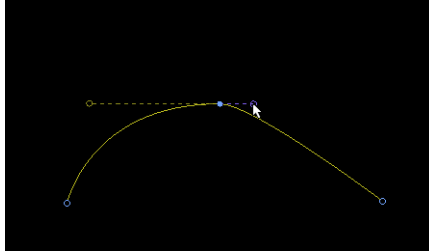


An optional step is to set the Show/Hide Tangents button to All or Pick to view tangents as they're created.

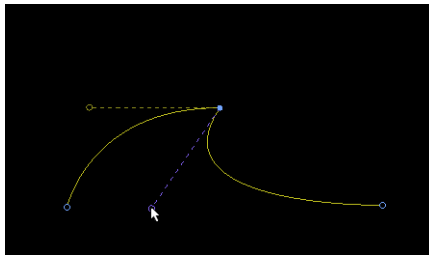
To change a curve by editing a point's tangent handles:

- 1 Make sure the Show/Hide Tangents button is set to All to view all tangents, or Pick to view only the tangents of points that you select.
- 2 Make sure the lock tangents control is turned off.
- 3 Do one of the following:

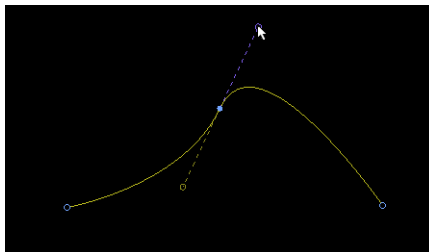
- To change the length of one of the tangent handles independently from the other, while keeping the angle of both handles locked relative to each other, drag a handle to lengthen or shorten it. You can also rotate both handles around the axis of the selected point.



- To change the angle of one of the tangent handles relative to the other, along with its length, press the Command or Control key while dragging a handle around the axis of the selected point. The selected tangent handle moves, but the opposing tangent handle remains stationary.



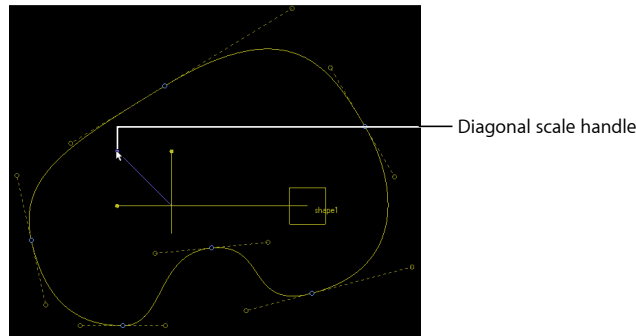
- To keep the angle of both tangent handles at 180 degrees relative to one another, keeping the lengths of each side of the tangent identical, press the Shift key while dragging either of the tangent handles around the axis of the selected point. If you **Shift**-drag tangent handles that were previously angled, they are reset.



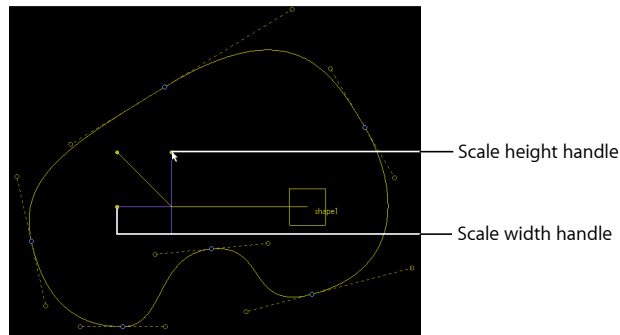
To edit a shape using its Transform control:

- 1 Make sure the Enable/Disable Shape Transform Control is turned on.

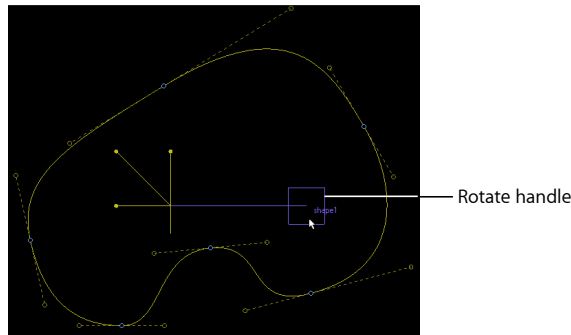
- 2 When you move, scale, or rotate a shape using its Transform control, each transformation occurs relative to the position of the transform control. To move a shape's Transform control in order to change the center point about which that shape's transformation occurs, press the Command or Control key while dragging the transform control to a new position.
- 3 To manipulate the shape, drag one of the transform control's handles:
 - Drag the center of the transform control to move the entire shape in the Viewer. Both the X and Y handles will highlight to show you're adjusting the X and Y coordinates of the shape.
 - Drag the Diagonal Scale handle to resize the shape, maintaining its current aspect ratio.



- Drag the X handle to resize the shape horizontally, or drag the Y handle to resize the shape vertically.



- Drag the Rotate handle (to the right of the transform control) to rotate the shape about the axis of the transform control.



Showing and Hiding Shapes

Individual shapes may be hidden, if necessary, to help you isolate one or more shapes you want to make adjustments to. Hiding shapes simply makes them invisible. Hiding a shape has no effect on the resulting warp effect, all source/target shape pairs continue to warp the image as before.

When a Warper or Morpher node is selected in the Node View, each shape in that node is labeled in the Viewer. By default, each shape is numbered in the order that it was created. These names can be customized in that shape's corresponding parameter in the Parameter tab. These names help you to identify which shapes are which when you're changing their individual visibility.

To show or hide an individual shape directly in the Viewer:

Do one of the following:

- Right-click anywhere in the Viewer to display the Viewer shortcut menu, then choose the Shape Visibility submenu, and select a label from the submenu that corresponds to the shape you want to show or hide. Shapes that are checked are shown, shapes that are unchecked are hidden.
- In the Parameter tab, click the Visibility control of the shape parameter that corresponds to the Shape you want to show or hide. These controls are linked to the settings in the Shape Visibility submenu of the Viewer shortcut menu. Changes made to one automatically apply to the other.

You can also show or hide all shapes of a particular type using the Visibility Toggles in the Viewer Shelf. Each control affects the visibility of all shapes of that type in the Viewer. The Visibility Toggles supersede the Visibility settings in the Parameter tab.

Each setting in the Select Display pop-up menu in the Viewer Shelf of the Warper and Morpher allow these controls to be set independently. For example, in the Warper, the visibility settings set when displaying the Source image can differ from those set when displaying the Target image.

To show or hide all shapes of a particular type:

- Click the Visibility toggle control in the Viewer Shelf that corresponds to the shape type you want to hide.

Duplicating Shapes

A fast and easy way to create corresponding target shapes once you've drawn a source shape is to duplicate it, and modify the duplicate. This is especially useful for instances where the general shape of the target shape you want to create is similar to the source.

To duplicate a shape:

- 1 Click the Edit Shapes Mode button to allow you to select shapes in the Viewer.
- 2 Move the mouse cursor over the edge, or the transform control, of the shape you want to duplicate so that it's highlighted, then right-click and choose one of the following commands from the shortcut menu:
 - Choose Duplicate Shape to simply duplicate the shape.
 - Choose Duplicate and Connect Shape (**Control** or **Command + D**) to duplicate the shape and automatically connect the duplicate to the source shape you clicked on.

Note: After using the Duplicate and Connect Shape command, locking or hiding the source shape immediately insures you won't accidentally modify it when making changes to the new duplicate.

Copying Shapes from a RotoShape Node

You can copy shapes from a RotoShape node and paste them into a Warper or Morpher node for use as a source, target, or boundary shape. This is especially useful in cases where you've already isolated the subject using a RotoShape node and you can use that shape as a starting point for your warp effect.

Important If you copy a shape with a soft edge from a RotoShape node, only the main center shape is pasted into a Warper or Morpher node. The Edge shape is not used.

To copy a shape from a RotoShape node:

- 1 With the mouse over the transform control of the shape you want to copy in the Viewer, do one of the following:
 - Right-click and choose Copy Shape from the shortcut menu.
 - Press **Command + C** or **Control + C**

Note: You can also **Control** or **Right**-click and choose Copy Visible Shapes from the shortcut menu to copy all shapes in that node that are currently visible.

Important When copying a shape, the mouse cursor must be directly on the shape you intend to copy. Otherwise you may not copy the correct shape.

- 2 Select the Warper or Morpher node you want to paste it into.
- 3 Do one of the following:
 - Right-click in the Viewer, and choose Paste Shapes from the shortcut menu
 - Press **Command-V** (or **Control-V**)

The pasted shape appears just like any other newly created closed shape, and you can modify or duplicate it as necessary.

Connecting Source and Target Shapes

To create the actual warp or morph effect, you need to connect each source shape you've created to a corresponding target shape. You can do so by either drawing two shapes separately and connecting them afterwards, or by drawing the source shape and duplicating it to use it as a starting point for the target (two shortcut menu commands, Duplicate Shape, and Duplicate and Connect Shape make this easy). Regardless of your intended use for the shapes you've created, until they're connected to one another they remain unassigned.

To connect a separately drawn source shape to a target shape:

- 1 Click the Connect Shapes Mode button.



- 2 Click a source shape.
- 3 Immediately click the target shape you want to connect to the source shape you clicked in step 2.

After they've been connected, the source shape appears light blue, and the target shape appears dark blue to indicate that the connection has been made. Purple connection lines appear between the source and target shapes to show which parts of each shape are connected.

In the Parameters tab of the corresponding Warper or Morpher node, an additional connection parameter appears for the connection you established. By default, each new connection parameter that's created is named "connection1Name," with the middle number incremented as each new connection is created. These names can be changed to more easily identify each specific connection for individual manipulation later on.



To disconnect a source shape from a target shape:

- In the Parameters tab of the corresponding Warper or Morpher node, click the Delete button of the connection parameter corresponding to the connection you want to break.



After disconnecting a source/target shape pair, both shapes become unassigned, and turn yellow by default.

For more information about the parameters of the Warper node, see “Parameters in the Warper Node” on page 32. For more information about the parameters of the Morpher node, see “Additional Controls and Parameters in the Morpher Node” on page 41.

Modifying Connection Lines

Once you’ve connected a pair of source/target shapes, connection lines appear to show the deformation path that pixels along the source shape will follow to conform to the target shape. These connection lines can be moved to change this path, and alter the look of the warp or morph effect. You can also add more connection lines to increase the amount of control you have over the warp or morph effect.

To move the start or end point of a connection line independently:

- 1 Click the Edit Connection Mode button.
- 2 Drag a connection point to another location on the shape. The connection point’s movement is restricted to the contour of the shape.

To move the entire connection line at once:

- 1 Click the Edit Connection Mode button.
- 2 Drag a bounding box or **Shift**-click each point to select both the start and end points of the connection line you want to move.
- 3 With both points selected, dragging one of them will move both at the same time. Both ends of the connection line are restricted to moving along the contours of the source and target shapes, and you can’t move a connection point past another connection point.

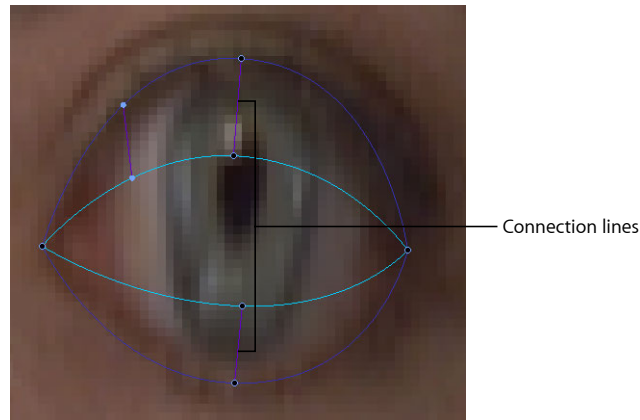
To add more connection lines to a source/target shape pair:

- 1 Click the Edit Connection Mode button.



- 2 **Shift**-click either a source or target shape at the location you want a new connection line to be created.

A new connection line is immediately created where you clicked. The other end of the new connection line is placed at the closest point of the corresponding shape in the pair.



Locking Source and Target Shapes

Once you've created one or more source or target shapes, you can lock them individually in a Warper or Morpher node's parameters tab, or all together using the Lock Source/Target Shapes buttons under the Viewer. This is useful if you're modifying source and target shapes that are very close together, and you want to make changes to one without accidentally moving the other.

To lock all source and/or target shapes in the currently selected node:

- Click the Lock Source Shapes button to lock all source shapes.
- Click the Lock Target Shapes button to lock all target shapes.
- Click the Lock Boundary Shapes button to lock all boundary shapes.

You can also lock individual source and target shapes using the lock control to the left of each shape parameter in that node's parameter tab. However, the Lock Source/Target Shapes buttons under the Viewer always supersede these individual shape-locking parameter controls. See "Parameters in the Warper Node" on page 32 for more information.

Defining Boundary Shapes

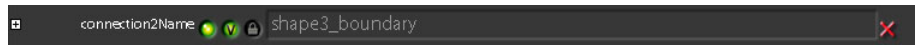
You can use any open or closed shape or single-point shape as a boundary shape to pin down areas of the image you don't want to be warped, or to exclude whole areas of the image from being affected by the source/target shape pairs you've created. You can create as many boundary shapes as you need to lock areas of the image you don't want to be warped.

Since boundary shapes are essentially shapes that are both source and target shapes simultaneously, you also define them using the Connect Shapes button.

To make an unassigned shape into a boundary shape:

- 1 Select the Warper or Morpher node you're working on, then create a new shape outlining the region of the image you want to lock down.
- 2 To turn this shape into a boundary shape, do one of the following:
 - Click the Connect Shapes button, then click the shape you've created twice.
 - Right-click the shape, and choose Set to Boundary Shape from the shortcut menu.

The shape turns orange by default to indicate that it's now a boundary shape, and a new connection parameter appears in the Parameters tab of the Warper or Morpher node. By default, each connection parameter that defines a boundary shape is named after the shape it corresponds to. For example, if the original shape was named "shape3," the connection parameter that defines it as a boundary shape is named "shape3_boundary."



Turning Boundary Shapes Into Unassigned Shapes

Once you've turned a shape into a boundary shape, the only way to turn it back into an unassigned shape is to delete the connection parameter that corresponds to it in the Parameters tab of the Warper or Morpher node using that parameter's Delete button.



Customizing Shape Controls

Several parameters in the guiSettings section of the Globals tab allow you to customize the color and behavior of shapes and shape controls in the Viewer.

To access the shape control parameters in the Globals tab:

- 1 Click the Globals tab.
- 2 Click the guiSettings disclosure control to open the guiSettings parameters.
- 3 To access different shape customization controls, do one of the following:
 - Click the rotoShapeColors disclosure control to edit the colors of each type of shape in the Viewer.
 - Click the rotoShapeControls disclosure control to edit the behavior of shape controls in the Viewer.

Shape Colors

By default, source shapes appear light blue, target shapes appear dark blue, connection lines appear purple, boundary shapes appear orange, and unassigned shapes are yellow. These colors can all be changed using the following parameters in the `rotoShapeColors` section of the `guiSettings` group of the `Globals`.

Parameter	Shape Type	Default Color
ShapeColor	Unassigned shapes	Yellow
sourceColor	Source shapes	Light Blue
targetColor	Target shapes	Dark Blue
connectionColor	Connection lines	Purple
boundaryColor	Boundary shapes	Orange
lockedColor	Locked shapes	Grey
displacedColor	Displaced Target shapes	Pink

To change the default color of a shape color parameter:

- 1 Click the color swatch of the shape color parameter you want to change.
- 2 Use the Color Picker tab to select a new color to use for that shape type.

All shapes of that type are now displayed with the new default color you selected.

Shape Editing Controls

Various behaviors for selecting points, creating Bezier curves, and adjusting each shape's transformation control may also be customized in the `rotoShapeControls` section of the `guiSettings` group of the `Globals`. You can modify how each of these controls works to better suit your working style or input method, for example, whether you use a graphics tablet or mouse.

Each parameter has a slider that adjusts the control's behavior.

- *rotoAutoControlScale*: An option which, when enabled, increases the size of the transform controls of shapes, based on the vertical resolution of the image to which the shape is assigned. This makes it easier to manipulate a shape's transform control even when the image is scaled down by a large ratio.
- *rotoControlScale*: A slider that allows you to change the default size of all transform controls in the Viewer.

Note: You can also resize every transform control appearing in the Viewer by holding the Command or Control keys down while dragging the handles of any transform control in the Viewer.

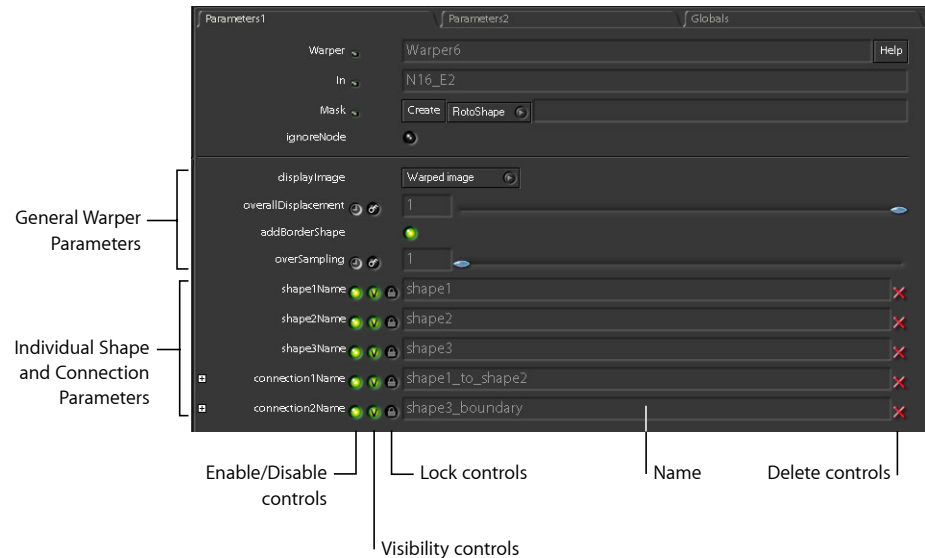
- *rotoTransformIncrement*: This parameter allows you adjust the sensitivity of shape transform controls. When this parameter is set to lower values, transform handles move more slowly when dragged, allowing more detailed control. At higher values, transform handles move more quickly when dragged. A slider lets you choose from a range of 1-6. The default value is 5, which matches the transform control sensitivity of previous versions of Shake.
- *rotoPickRadius*: This parameter lets you select individual points on a shape that fall within a user definable region around the cursor. This allows you to easily select points that are near the cursor which may be hard to select by clicking on directly. A slider allows you to define how far the cursor may be from a point to select it, in pixels.
- *rotoTangentCreationRadius*: This parameter lets you define the distance you must drag the cursor when drawing a shape point to turn it into a Bezier curve. Using this control, you can make it easier to create curves when drawing shapes of different sizes. For example, you could increase the distance you must drag to avoid accidentally creating Bezier curves, or you can decrease the distance you must drag to make it easier to create Bezier curves when drawing short shape segments.

Using the Warper Node

The Warper node is useful for creating targeted deformations to alter the shape of a subject in an image. Examples might include making someone's nose grow, making an animal's eyes widen in surprise, or causing a bump to grow on someone's forehead. The warper can be used to make a static change to a subject, or it can be animated to cause dynamic changes in the subject's shape.

Parameters in the Warper Node

A simple example of a Warp node used to warp an image with a single pair of source/target shapes would appear with the following parameters. For Warp nodes with more source/target shape pairs defined, there will be more shapeName and connectionName parameters listed.



- **displayImage:** A pop-up menu that allows you to choose whether the Viewer displays the Source image or the Warped image. The Warped image will be neither displayed nor rendered if this pop-up isn't set to Warped image.
- **overallDisplacement:** Defines the amount of displacement that is applied to all source/target shape pairs simultaneously. A value of 0 applies no displacement, .5 applies displacement halfway between the source and target shapes, and 1 applies the maximum displacement to match the target shape. It is also possible to set this parameter to a value greater than 1, although this results in an overlapping displacement which may not be desirable.

Note: When creating a warp effect, you may achieve a more realistic or organic effect if you adjust the displacement of each individual source/target shape pair separately, rather than relying on this single control to animate the displacement of every shape pair in the node.

- **addBorderShape:** A toggle control that allows you to use the border of the image as a control shape to limit the effect of the warping effect. By default this is turned on, and is the recommend setting for most cases. Turning this control off results in each source/target pair having a considerably more exaggerated effect on the image, and may necessitate the use of additional boundary shapes to control the effect.

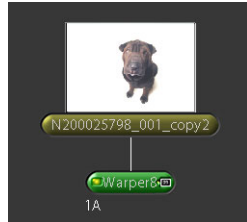
- *overSampling*: An integer value that represents the numbers of samples per pixel that are taken into account when performing a warp. This parameter is set to 1 by default, which results in faster rendering times. However, extreme warping effects may introduce aliasing artifacts that can be reduced or eliminated by increasing this value, up to a maximum value of 4. Increasing this parameter may cause render times to increase dramatically.
- Note:** Although the slider is limited to a range of 1 to 4, you can enter larger values into this parameter's text field.
- *dodPad*: A subparameter of *overSampling*. This slider lets you pad the DOD around the image affected by the Warper node by 0 to 100 pixels. The Warper node tries to automatically calculate a new DOD for the affected image, but in certain instances the resulting DOD may be too small. In these instances, the *dodPad* parameter lets you expand an incorrectly calculated DOD to avoid clipping.
 - *shape1Name*: In this example, the *shape1Name* parameter represents the source shape. Additional controls in all shape parameters allow you to turn the shape on or off, make the shape itself visible or invisible in the Viewer, Lock the shape to prevent any further changes to it, or delete the shape.
 - *shape2Name*: In this example, the *shape2Name* parameter represents the target shape. Each target shape has a corresponding *shapeName* parameter.
 - *connection1Name*: Connection parameters represent both connection lines that connect source shapes to target shapes, and boundary shapes that you've defined. Deleting a connection parameter deletes either the corresponding connection line, or turns a boundary shape back into an unassigned shape.
 - *connection1Displacement*: This subparameter of the *connection1Name* parameter defines the amount of displacement that is applied to the source/target shape pair defined by the *connection1Name* parameter. Each source/target shape pair has its own corresponding *connectionDisplacement* parameter, allowing you to animate each warp independently for a more organic, natural look. By default, each *connectionDisplacement* parameter is linked to the *overallDisplacement* parameter, so that they all animate together.

A Warper Node Example

The Warper node is extremely flexible, and can be used for a wide variety of image distortion or manipulation tasks. In this example, we'll use the warper to change a dog's facial features.

To warp an image:

- 1 Attach the Warper node to an image.



- 2 First, draw and, if necessary, animate your source shapes (see “Drawing New Shapes” on page 18).

These shapes define the parts of the subject you want to warp. When you’re ready to finish your shape, do one of the following:

- Click on the first point if you want to create a closed shape.
- Double-click when creating the last point to create an open shape.
- To create a single-point shape, immediately after creating your first point right-click and choose Finish Shape from the shortcut menu.

To add additional source shapes to define additional areas of the subject to warp, click the Add Shape button. Each shape you create using the Morpher node is yellow, indicating that it’s unassigned and does not yet have any effect on the image.

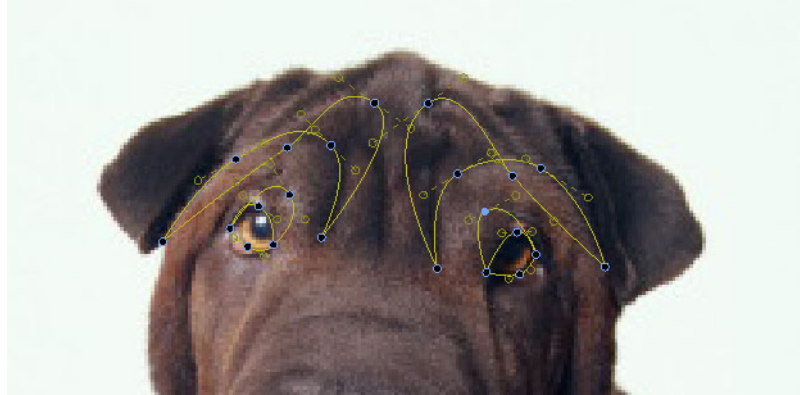


Unassigned shapes defining the area to warp

- 3 Next, you need to create a corresponding target shape for each source shape you created. Target shapes define the contour of deformation that the pixels identified by each source shape are moved to. You create target shapes using the same shape-drawing techniques you used to draw the source shapes in step 2.

Note: Another technique you can use to create a target shape quickly is to duplicate the source shape by right-clicking it and choosing Duplicate Shape from the shortcut menu. You can also choose Duplicate and Connect Shape (**Control** or **Command + D**), in which case you can skip step 4. If you're using either of these options, you may want to be sure you animate the original source shape first, as the copied shape inherits the animation. This could save you some keyframing (see "Duplicating Shapes" on page 25).

As you create target shapes for each source shape, they remain yellow to indicate that they're still unassigned, and have no affect on the image.



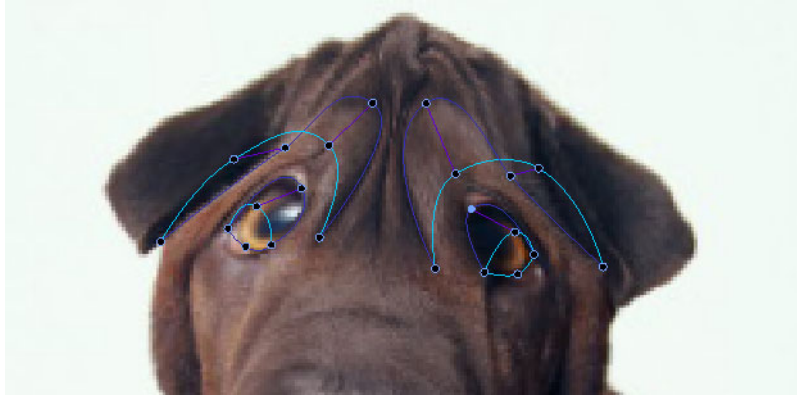
Unassigned shapes are yellow.

- 4 To create the actual warping effect, you have to connect the shapes you created a pair at a time. First, Click the Connect Shapes button.



Now, click a source shape that follows the actual position of the first feature you identified. Then, immediately click the corresponding target shape you created. After the second click the source/target shape pair is defined, the shape colors change, and a `connectionName` parameter appears in the Parameters tab. Since the `overallDisplacement` parameter defaults to 1, the effect is immediately seen (see "Connecting Source and Target Shapes" on page 26).

Once connected, source shapes become light blue, target shapes become dark blue, and the connection lines between them become purple. These colors can be customized, if necessary. For more information on customizing shape colors in the Viewer, see “Customizing Shape Controls” on page 29.

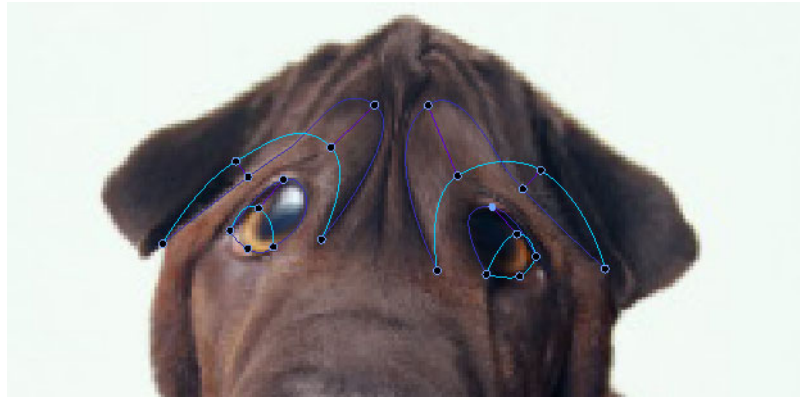


Once connected, source shapes are light blue and target shapes are dark blue.

- 5 If necessary, adjust the connection lines running between the source and target shapes by clicking the Edit Connections button.



- 6 Drag the source and target connection points and slide them along the shape to change the angle of deformation necessary to create the effect you need. In this example, the connection lines are straightened in the eyes (see “Modifying Connection Lines” on page 27).



Final adjusted source/target shape pairs with modified connection points

- 7 If necessary, adjust the amount of warp by modifying the `overallDisplacement` parameter in the Parameters tab. You can also adjust the displacement of each source/target shape pair individually using the `connectionDisplacement` parameter in that pair's `connectionName` parameter.

A value of 0 in the `overallDisplacement` parameter results in an unwarped image. A value of .5 produces a warp that's halfway in-between the source and target shapes, and a value of 1 results in a warp that completely conforms to the target shape.

To see the actual warp effect, choose Warped Image from the Select Display pop-up menu in the Viewer Shelf (you can also press the **F3** key).

Note: In addition to viewing the actual warp effect, you can make the Displaced Target Shapes visible in the Viewer Shelf to view the actual position of the displacement targets as defined by the overallDisplacement and connectionDisplacement parameters. These indicators are designed to help you see what the deformation will be without having to render the entire image. Displaced target shapes are pink by default.



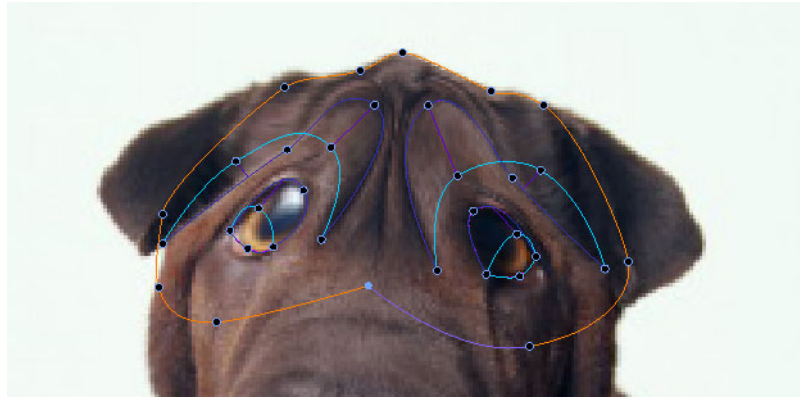
Pink displaced target shapes indicate the value of the displacement parameters.

This example displays a characteristic of the warper—it works as if the image is made of a sheet of rubber and you're actually pushing the pixels of the image around, stretching the surrounding image. In the above image, the pixels of the eyebrow are moved up because they lie directly on the source shape which defines the warp. You'll also notice that the right edge of the eyebrow appears to stretch back to the original position of the eyebrow. This is because the pixels surrounding the eyebrow are stretching to fill in the areas of the image where the eyebrow used to be. If the effect is not what you want, try experimenting with a differently shaped source shape to redefine the area of the image being manipulated.

- 8 You'll notice that, in addition to the eye and eyebrow being warped, a significant area of the face surrounding the source/target shape pair is also affected, and the top of the head is pushed upwards. To limit the warping effect to the region immediately surrounding the eyes and eyebrows, create one or more boundary shapes.

First, select the Source image from the Select Display Image pop-up menu in the Viewer Shelf. This allows you to draw your boundary shapes to match features in the original image. Draw more shapes identifying the areas of the source image you wish to lock down. Boundary shapes can be either open, closed, or single-point shapes, depending on how much of the image you want to lock down. In this instance, we want to exclude the entire image from the warp effect except for the eye, eyebrow, and surrounding region, so a closed shape is drawn surrounding this area. After it's drawn, it remains yellow to indicate that it's still unassigned and has no effect.

- 9 **Control** or **Command**-click the shape you just created, and choose Set to Boundary Shape from the shortcut menu. This effectively sets this shape to be both a source and target shape, which pins that area of the image down.



Boundary shapes are orange.

- 10 Now, you'll probably need to make adjustments to refine the effect you're trying to achieve. It'll probably be helpful to use the visibility and lock toggles to assist you when manipulating the shapes, to make sure you don't accidentally adjust the wrong points when two shapes overlap. You can use the controls in the Viewer Shelf to change the visibility and locking of all shapes of a given type simultaneously, or you can set the visibility and locking of each shape individually in the Parameters tab.

Using the Parameters tab controls for each individual shape, you may rename the shape, enable it, toggle its visibility, lock the curve so it is visible but can't be modified, or delete it. Additional parameters also appear for each connection line and boundary shape definition you've set up.

- 11** To create an animated effect, keyframe the overallDisplacement parameter to animate every source/target shape pair simultaneously. You can also animate the displacement caused by each source/target shape pair you've defined individually. Click the disclosure control next to a connectionName parameter to reveal its connectionDisplacement parameter. This can create a more organic-looking effect.



Before



After

Morpher Node Syntax

Synopsis

```
image Warper(  
    image In,  
    const char * version,  
    const char * displayImage,  
    float overallDisplacement,  
    const char,  
    int oversampling,  
    const char * viewerStateInformation,  
    int connections,  
    const char * encodedInformation,  
);
```

Script

```
image Warper(  
    In,  
    "version",  
    "displayImage",  
    overallDisplacement,  
    oversampling,  
    "viewerStateInformation",
```

```
connections,  
encodedInformation,  
);
```

Command Line

This node is not appropriate for command line use.

Using the Morpher Node

The Morpher node blends two images together to create the effect of one subject changing shape to turn into another. The Morpher node does this by performing two warping operations, one on the source image to warp it into the shape of the target image, and another warping operation to warp the target image from the shape of the source back to its own shape. Once both warping operations match the shapes of the source and target images to one another, a built-in cross-fade dissolves from the first warp to the second, providing the illusion that the first image is changing into the second.

Tips For Successful Morphing

Successful warps benefit from planning ahead during the shoot. Ideally, the positions of the source and target images match relatively well. If they need adjustment, resizing, or repositioning to help them match better, you can make these adjustments in your node tree prior to adding the Morpher node.

If the source and target subjects are moving, their movements should match one another so that the warping targets you set for both can line up properly. If the motions line up but the timing is off, you can select the offending clip's FileIn node and use the Timing tab parameters to remap its speed so that the motion lines up. For more information, see the "Retiming" section of Chapter 3 of the Shake Reference Guide.

Since morphing warps images the same way the Warper node does, it is essential to isolate the subjects you're morphing prior to adding the Morpher node. This way, the background won't change as the source image morphs into the target, nor will the warp being applied to the subject of each image affect the background incorrectly.

Additional Controls and Parameters in the Morpher Node

Most of the Morpher's controls are identical to those of the Warper. For instructions on how to use specific functions, consult the Warper node, above. The Morpher node does have some additional parameters and controls.

Additional Viewing Modes in the Viewer Shelf

In addition to the Source Image and Target Image options in the Set Display Image pop-up menu of the Viewer Shelf, the Morpher provides five additional viewer modes:

- *Morphed Image*: Shows the actual morph effect being created. This image is a combination of the source warped and target warped images being dissolved together. This is the end result of the Morpher node.
- *Source Warped Image*: Displays the warp effect being applied to the source image.
- *Target Warped Image*: Displays the warp effect being applied to the target image.
- *Dissolve Mask*: A greyscale image generated by the dissolve settings for each of the shapes. By default, since the dissolve settings for each individual `connectionName` parameter are linked to the `overallDissolve` parameter, this displays a solid screen where:
 - Black represents an `overallDissolve` value of 0, showing only the source image.
 - White represents an `overallDissolve` value of 1, showing only the target image.

If you've animated the individual `connectionDissolve`:

- *Dissolved Image*: Displays the dissolve between the source and target images, without any warping being applied. Appears as a simple cross-dissolve.

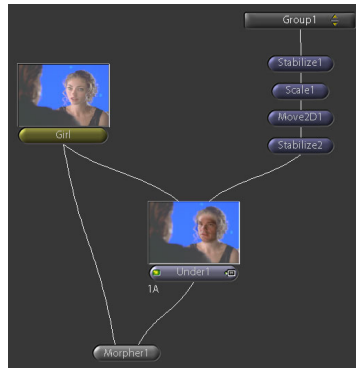
Additional Parameters in the Parameter Tab

Additional parameter appears in the Parameters tab of the Morpher node:

- *overallDissolve*: Controls if the color of the morphed image is taken from the Source image or the Target image. 0 represents 100 percent source image, .5 results in a blend between both, and 1 represents 100 percent target image.
- *connectionDissolve*: Each source/target shape pair has a corresponding `connectionName` parameter. Nested within each `connectionName` parameter is a pair of `connectionDisplacement` and `connectionDissolve` parameters that allow you to independently adjust the displacement and dissolve of each part of the morph. By default, each `connectionDissolve` parameter is linked to the `overallDissolve` parameter, so that they all animate together.

How to Morph Two Images

- 1 Create a Morpher node in the Node View, and attach two images to the Morpher node. The source image connects to input 1, and the target image connects to input 2.



In this example, we're creating the effect of the woman's face turning into that of the man. The image of the woman is the source, connected to the morpher1. In knot of the Morpher node. A composite of the man's face and the woman's head is used as the target, which is connected to morpher1. Target knot.



Source Image



Target Image

Note: Images courtesy of “Doppelganger.”

- 2 If the images need to be manipulated to make them line up, do this first. In this example, a series of transform nodes have been inserted between the FileIn and Morpher nodes to move, scale, and track the target image to align properly with the source image. This is essential to creating a smooth morphing effect.

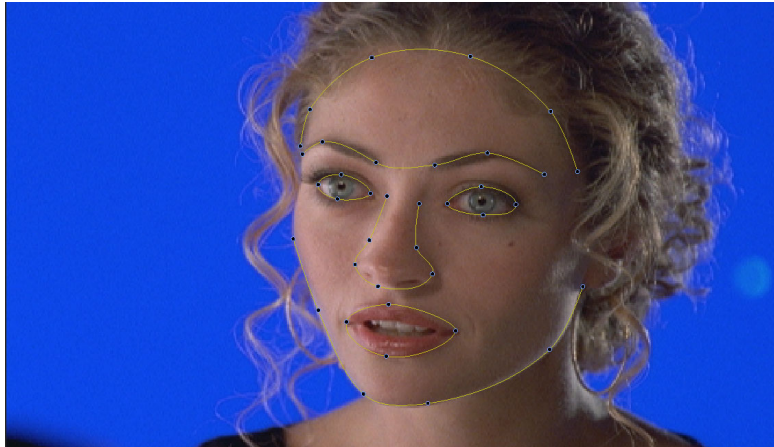
If it is necessary to isolate the subject of the source and target images by keying or rotoscoping, you may want to insert these nodes prior to the Morpher node also. In this example, the source image will be keyed. The target image has been rotoscoped to isolate just the face, and the isolated face has been composited with the woman's head to create the desired effect.

- 3 First, move the Playhead to the first frame of the clip where you want the morph effect to take place, set the Viewer to look at the Source image, and draw all Source shapes necessary to match the features of the subject, just as you would for the Warper. If necessary, animate your shapes to follow the animation.

Note: You can quickly jump to the Source image by pressing **F1**.

The more features you identify with source shapes, the more detailed the morphing effect will be. You should remember that warping affects the entire region of the image surrounding each source/target shape pair. While it's important to create shapes for each significant feature of the image, you don't have to go overboard creating shapes for every tiny feature of the subject image, unless it will enhance the effect you're trying to achieve.

When picking features to manipulate, keep in mind that the source shapes you define are pushing and pulling the corresponding image features into the shape of the target. Pick features that have a direct path to similar features in the target image if at all possible to avoid unwanted artifacts in the image.



New unassigned shapes defining the source features

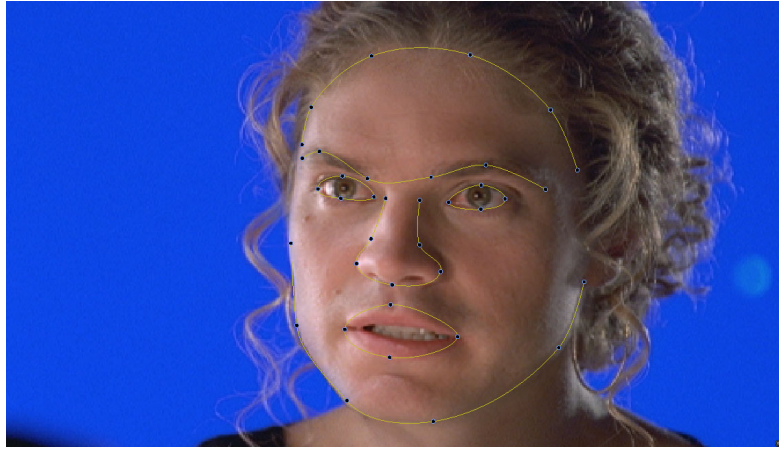
- 4 Once you've created all the source shapes you think you need, set the Viewer to display the target Image.

Note: You can quickly jump to the Target image by pressing **F2**.

To create a set of target shapes to connect to the source shapes you created in step 3, do one of the following:

- Manually draw more shapes over features in the target image that correspond to the features you identified in the source image. When you're done, you should make sure that you've drawn a target shape to correspond to every source shape.

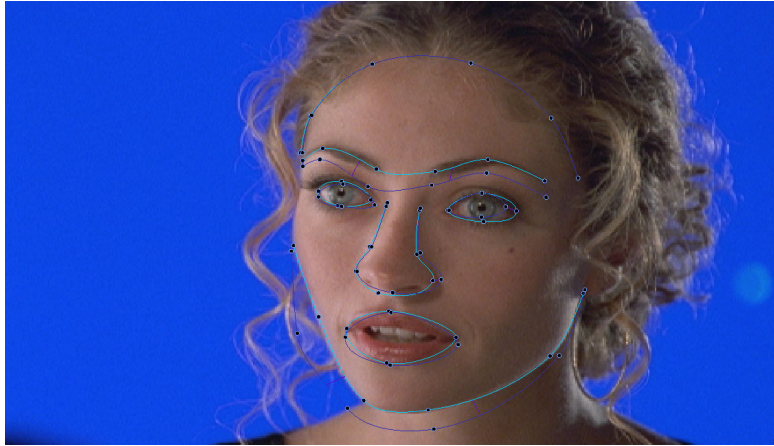
Next, connect each source/target shape pair together using the Connect Shapes button in the Viewer Shelf (see “Connecting Source and Target Shapes” on page 26).



New unassigned shapes defining the target features

- You may find it easier to right-click each source shape and select Duplicate and Connect (**Control** or **Command + D**). Afterward, you can hide all your source shapes by turning off the Source Shapes button in the Viewer Shelf to avoid accidentally moving them while you adjust the target shapes to line up with the appropriate features of the target image.
Note: It may also help to turn off the Enable/Disable Shape Transform Control in the Viewer Shelf, to avoid accidentally dragging Transform controls that overlap the shape you're trying to adjust.

When readjusting the target shapes you've created, the sheer number of shapes needed to create your morphing effect may make the Viewer a little crowded, making it difficult to adjust individual shapes. You may find it's easier if you hide every shape except the one you want to work on. You can hide all of the target shapes by right-clicking in the Viewer and choosing Hide All Shapes from the shortcut menu. Afterwards, right-click again and choose the first target shape you want to work on to show it again. Continue hiding and showing individual shapes as necessary until you've adjusted them all.



All source and target shape pairs adjusted and connected

- 5 If necessary, animate the target shapes you've just created to match any motion in the target image.

- 6 The overallDisplacement parameter controls how much warp is applied to push the pixels from the source shapes to the target shapes you've defined, and operates on all source/target shape pairs in the node simultaneously.



The morphed image with overallDisplacement and overallDissolve of .5.

- 7 To animate the morphing effect, keyframe the overallDisplacement parameter. To see the morphing effect in the Viewer as you adjust the overallDisplacement slider, you must choose Morphed Image in the Select Display pop-up menu of the Viewer Shelf. You can also set the Viewer to display the Morphed Image by pressing **F3**.

To add a new keyframe, move the playhead to a frame where you want to make an adjustment, click the auto-keyframing control for the overallDisplacement parameter in the Parameters tab, and adjust the overallDisplacement slider.

A value of 0 in both the overallDisplacement and overallDissolve parameters results in an unmorphed source image. A value of .5 produces a morph that's halfway in-between the source and target images, and a value of 1 results in the end of the morph, the final target image.

While you adjust these parameters, you can make the Displaced Target Shapes visible in the Viewer Shelf to view the actual position of the displacement targets as defined by the overallDisplacement and connectionDisplacement parameters, instead of viewing the actual warp effect. These indicators are designed to help you see what the deformation will be without having to render the entire image. Displaced target shapes are pink by default.

Note: As with the Warper, you may adjust the individual displacement of each source/target shape pair using the `connectionDisplacement` and `connectionDissolve` parameters nested within each `connectionName` parameter in the Parameter tab. Keyframing these with separate timings is one of the keys to creating an organic looking Morph effect, and usually creates a more sophisticated-looking effect than if you simply used the `overallDisplacement` to animate every shape pair at once.

- 8 If you want, you can keyframe the `overallDissolve` parameter separately from the `overallDisplacement` parameter to create different effects. Adjustments to the `overallDissolve` parameter control how the source image fades into the target image—this works exactly like a Mix node.

Note: By default, the `overallDissolve` parameter is linked to the `overallDisplacement` parameter, so keyframing one will automatically keyframe the other to the same value. Keyframing the `overallDissolve` parameter will break this link.

- 9 Test the resulting effect to see how well it works. If you see problems, toggle the Viewer between the Source Warped image and Target Warped image to see how successfully the warped source and target images are matching. Viewing each image independently makes it easier to spot unwanted artifacts stemming from poorly placed or inadequate numbers of source/target shape pairs.

If you see problems, either adjust the position and shape of the source and target shapes as necessary, or identify additional features to create source/target shape pairs for to increase the amount of control you have over the effect

Morpher Node Syntax

Synopsis

```
image Morpher(  
    image In,  
    image Target,  
    const char * version,  
    const char * displayImage,  
    float overallDisplacement,  
    float overallDissolve,  
    float overallWeight,  
    float tension,  
    const char * alpha,  
    int oversampling,  
    const char * viewerInformation,  
    int connections,  
    const char * encodedInformation,  
);
```

Script

```
image Morpher(  
  In,  
  Target,  
  "version",  
  "displayImage",  
  overallDisplacement,  
  overallDissolve,  
  overallWeight,  
  tension,  
  "alpha",  
  oversampling,  
  "viewerInformation",  
  connections,  
  encodedInformation,  
);
```

Command Line

This node is not appropriate for command line use.

Shape Drawing Controls

Several new features were added in Shake 3.01 to improve the process of drawing and manipulating shapes in the RotoShape node. Shake 3.5 adds further commands and controls.

Improvements to Shape Drawing

The following features may be used when drawing and manipulating shapes in the Viewer:

- Each shape's transform control now affects only that shape. For example, if a RotoShape node has three shapes in the Viewer, each of the three transform controls will only affect the shape it's associated with. This is true even if control points on multiple shapes are selected.
- Hold down the Shift key while you manipulate one or more selected points with the transform control to modify only the selected points, instead of the entire shape. Using the transform control without the Shift key pressed still modifies the entire shape, regardless of how many points are selected.
- Press the Command or Control key while you drag the center of a transform control to move it in relation to the shape it's associated with. This moves the center point around which shape transformations occur. For example, if you move the transform control of a shape to an area outside the shape itself, rotating the shape results in the shape moving around the new position of the transform control, instead of rotating in place.
- Each shape in a RotoShape, Warper, or Morpher node is labeled in the Viewer with a number based on the order in which it was created. Right-click any shape in the Viewer to display a shortcut menu with commands to hide that shape, hide other shapes, or show all shapes. Right-clicking anywhere in the Viewer displays a shortcut menu that allows you to show or hide any shape in that node by its label. Hidden RotoShapes aren't rendered.
- You can copy shapes, either partially or in their entirety, between RotoShape, Warper, and Morpher nodes. When copying a shape from a RotoShape node to a Warper or Morpher node, you can assign it as a source, target, or boundary shape. This is especially useful in cases where you've isolated a subject using a RotoShape node already and you can use that shape as a starting point for your warp effect.

Options to Customize Shape Drawing

Several parameters in the `guiSettings` section of the `Globals` tab allow you to customize shape-drawing behaviors and shape transform controls in the Viewer.

- *rotoAutoControlScale*: An option which, when enabled, increases the size of the transform controls of shapes based on the vertical resolution of the image to which the shape is assigned. This makes it easier to manipulate a shape's transform control even when the image is scaled down by a large ratio.
- *rotoControlScale*: A slider which allows you to change the default size of all transform controls in the Viewer when *rotoAutoControlScale* is turned on.

Note: You can also resize every transform control appearing in the Viewer by holding the Command key down while dragging the handles of any transform control in the Viewer.

- *rotoTransformIncrement*: This parameter allows you adjust the sensitivity of shape transform controls. When this parameter is set to lower values, transform handles move more slowly when dragged, allowing more detailed control. At higher values, transform handles move more quickly when dragged. A slider lets you choose from a range of 1-6. The default value is 5, which matches the transform control sensitivity of previous versions of Shake.
- *rotoPickRadius*: This parameter provides the ability to select individual points on a shape that fall within a user definable region around the cursor. This allows you to easily select points that are near the cursor which may be hard to select by clicking on directly. A slider allows you to define how far the cursor may be from a point to select it, in pixels.
- *rotoTangentCreationRadius*: This parameter lets you define the distance you must drag the cursor when drawing a shape point to turn it into a Bezier curve. Using this control, you can make it easier to create curves when drawing shapes of different sizes. For example, you could increase the distance you must drag to avoid accidentally creating Bezier curves, or you can decrease the distance you must drag to make it easier to create Bezier curves when drawing short shape segments.

Caching

An Overview of Shake Caching

The purpose of this chapter is to provide a high-level description of Shake's caching functionality and to provide guidance on how to customize Shake's caching behavior. Shake incorporates two separate caches: a processing cache and an image cache.

The processing cache is mainly used to store image tiles generated by nodes that need surrounding pixels to perform their image processing operations during a render. Example nodes include the Warp, PinCushion, and Twirl nodes. The processing cache also provides secondary functionality for caching rendering buffers (in particular for the QuickPaint node that utilizes a full-frame rendering buffer), color look-up tables, and transformation matrices. The global plugs used to control the processing cache are as follows:

- `cache.cacheMemory`
- `cache.cacheMemoryLimit` (Shake v3.5 and later)

The image cache is used to store output images that nodes produce. By storing the entire output image, the image cache can effectively “bake” portions of the processing tree, thereby saving re-computation time. Whether or not a node's image data is sent to the image cache depends mainly on the node's position in the node tree. When editing, the nodes directly above the node that is currently being viewed have the highest priority. During playback, the node currently being viewed has the highest priority. The global plugs used to control the image cache are as follows:

- `diskCache.cacheSize`
- `diskCache.cacheMemory`
- `diskCache.cacheMemoryLimit` (Shake v3.5 and later)
- `diskCache.cacheMaxFile`
- `diskCache.cacheMaxFileSize`
- `diskCache.cacheDebug` (Shake v3.5 and later)

Detailed descriptions of the global plugs listed above along with recommended settings are provided in the Image Cache section. Also provided is a description of the `cacheMode` setting (located in the GUI under Globals > `guiSettings`), which is used to customize Shake's image caching behavior.

Limits to Shake RAM Usage

Shake is currently compiled as a 32-bit application, which can theoretically address up to 4GB of virtual RAM. However, due to constraints imposed by the operating system and competition for RAM from other running applications (as well as the OS), most 32-bit applications have a practical limit of approximately 2GB of addressable RAM per process. This means that, even if you have a workstation that is loaded up with 4GB of RAM, each Shake process can only take advantage of about 2GB of that RAM. The good news is that if you launch a FlipBook while running Shake on a system with 4GB ram, the FlipBook (as a separate process) will be able to take advantage of the additional 2GB of RAM and will be less likely to cache to disk.

So does this picture change with Panther (a 64-bit operating system) and G5 workstations configured with 8GB of memory? The short answer is “partly.” A 32-bit application running natively on a 64-bit OS is still limited to approximately 2GB of addressable RAM. However, a G5 configured with 8GB of RAM running Panther can keep a larger number of applications in physical ram without having to swap out the application's memory to disk. And Shake is able to allocate larger contiguous segments of physical RAM, which means that large Shake scripts can be edited and rendered in less time.

The Processing Cache

As stated above, the processing cache is mainly used to store image tiles generated by nodes that need surrounding pixels to perform their image processing operations during a render. The processing cache has a fast RAM-based component and a slower disk-based component. If the memory limit of the RAM-based component is exceeded, Shake will “roll off” image tiles to disk using an algorithm that is based partly on when the image was last used. A point of interest is that there is no memory limit imposed on the on-disk component of the processing cache.

The size of the RAM-based component of the processing cache is set in the `nreal.h` file using the `cache.cacheMemory` global plug. The default size is 96MB and Shake internally sets a 256MB upper limit on the size of this cache. This “internal” upper limit can be modified using the `cache.cacheMemoryLimit` plug to values greater than 256MB. However, this is only recommended when working on systems with more than 2GB of RAM. The following general guidelines apply when setting the `cache.cacheMemory` plug:

- For scripts with image resolutions of 2K, or less, keeping the `cache.cacheMemory` at 96MB should provide good performance.

- For scripts with larger image resolutions (greater than or equal to 4K) or scripts that include a large number of nodes that perform warps and distortions, consider bumping the size of `cache.cacheMemory` to 256MB. However, you must first consider the amount of physical RAM installed in the workstation. If a workstation has 1GB (or less) of RAM, then it is not advisable to set `cache.cacheMemory` above 128MB.
- When running Shake on workstations with limited RAM (e.g. 512MB) or when running both a Shake GUI session and a background render on workstations with 1GB (or less) of RAM, then you may want to reduce `cache.cacheMemory` to 64MB.

A final point regarding the processing cache is that both the RAM-based component and the disk-based component are active in all of Shake's run modes: GUI sessions, background renders, and renders launched from the command line.

The Image Cache

The primary objective of the image cache is to enhance interactive performance when editing a Shake script. It does this by caching output image data from nodes in the compositing tree at, and near, the portion of the compositing tree being edited or viewed.

Similar to the processing cache, it has both a fast RAM-based component and a slower disk-based component. However, the disk-based component of the image cache is only active during GUI sessions (unlike the processing cache, which is active in all Shake run modes). In addition, the disk-based component of the image cache is limited in size and, when the disk cache fills up, Shake will discard image data using an algorithm similar to that used by the processing cache.

Not all of Shake's processing nodes incorporate functionality for caching their output image data. For example, image generator nodes such as ColorWheel and the FileIn node do not incorporate image-caching functionality. This is because these nodes can regenerate an image in a computationally efficient manner, so there is little to be gained by caching their image data. Also, some of the color operators not incorporate image-caching functionality because they are computationally efficient. Finally, Shake will not cache the image data for nodes where the ratio of the area of the DOD to the area of the ROI is greater than 4, as a large portion of the image data is not needed for the final rendered image.

For the majority of nodes that do cache their image data, Shake assigns the image data one of the following three priorities:

- Low (transient): Discard this image as soon as more space is needed in the RAM-based portion of the image cache. This priority is only assigned to image data from the node currently being viewed. The reasoning is that it will change very quickly (e.g. with editing or scrubbing). The exception is when Shake is in play mode. Then the currently viewed image is added to the image cache with a high or medium priority.

- **Medium (mem only):** Try to keep this image in the RAM-based memory pool as long as possible, but discard it when the RAM-based memory pool is full. This priority is assigned to images cached from nodes that are deeply rooted in the node tree. Also, when a node marked as “transient” has its image cache accessed multiple times, it can be promoted to a medium priority.
- **High (disk cache):** Try to keep this image in the RAM-based memory pool as long as possible, and then transfer the image to the on-disk portion of the image cache when the RAM-based memory pool is full. Medium priority cached images are promoted to high priority when they have been retrieved/accessed from the image cache two or more times.

The following subsections provide details on how to customize Shake’s image caching behavior.

cacheMode

This control is located in the GUI under Globals > guiSettings. Images are added to the image cache selectively based on (1) a node’s position in the node tree (nodes closest to the node currently being viewed/edited get higher priority) and (2) the current cacheMode setting (either regular, aggressive, or none). If the cacheMode is set to “none,” then Shake won’t perform any image data caching. If the cacheMode is set to “regular,” then Shake will attempt to cache the output image data of the nodes near the bottom of the currently viewed node tree. If the cacheMode is set to “aggressive,” then Shake will attempt to keep images in the cache, even when scrubbing back and forth in the Timeline. The following guidelines apply when setting the cacheMode:

- In most circumstances, the “regular” cacheMode setting should be used.
- Consider setting the cacheMode to “aggressive” when you are scrubbing back and forth between two or three frames (e.g. when tweaking tracking points).
- Only set the cache mode to “none” if you are running on a system with severely limited RAM and disk space resources. By setting the cacheMode to none, Shake is forced to re-compute each image that you select to view.

diskCache.cacheMemory

This global plug controls the size of the RAM-based component of the image cache. Larger values enable Shake to: (1) cache more of the node tree currently being edited/viewed—which enhances interactivity, especially when recursively viewing nodes both near the top and near the bottom of the node tree, or (2) cache a larger number of images during playback—which can greatly increase playback speed.

The default value for diskCache.cacheMemory is 64MB, which enables Shake to cache greater than 43 images (8bit @ 720x486) in the RAM-based portion of the image cache. The following guidelines apply when setting the diskCache.cacheMemory size:

- For interactive GUI sessions where you are editing large node trees, or you are working with higher bit depths (i.e. float), or when you are playing back the image sequence with great frequency, consider increasing the `diskCache.cacheMemory` size to 128MB or even 256MB. However, you must first consider the amount of physical RAM installed in the workstation. If a workstation has 1GB (or less) of RAM, then it is not advisable to set `cache.cacheMemory` above 128MB.
- When running Shake on workstations with limited RAM (e.g. 512MB) or when running both a Shake GUI session and a background render on workstations with 1GB (or less) of RAM, then you may want to reduce `diskCache.cacheMemory` to 32MB.

diskCache.cacheMemoryLimit

Internally, Shake sets an upper limit of 512MB on the size of the RAM-based component of the image cache. This global plug allows users to override this limit. However, we only recommended overriding (increasing) this value when working with scripts with large image resolutions (greater than 2K) and higher bit depths (float) on workstations with more than 2GB of RAM. Increase at your own risk.

diskCache.cacheSize

This global plug controls the size of the on-disk component of the image cache. Larger values enable Shake to keep more “high priority” images around that have been pushed out of the RAM-based component of the image cache. Remember that this component of the image cache is inactive during background or command-line renders.

- With modern workstations routinely shipping with disk drives that have more than 100GB capacity, there is no reason not to increase the `diskCache.cacheSize` to 1GB, or more. This will improve interactivity in large scripts and scripts that have high bit-depth images.
- The only motivation for reducing `diskCache.cacheSize` is if: (1) a workstation has very limited disk space or (2) the very unlikely scenario that the workstation is using a remote disk mounted over a network as its cache drive. Under these circumstances, the latency in retrieving cached images over the network may offset the computational advantages.
- Playback from the Timeline will also save images to disk. If you are using playback from the time line frequently or playing long sequences, increasing the `diskCache.cacheSize` to 1GB or more will allow multiple sequences to reside on disk.

diskCache.cacheMaxFile

This global plug sets the maximum number of files that will be created in the on-disk component of the image cache. Larger values allow Shake to store a larger number of images, since each cached image is stored in a separate file. However, some file systems have limits on both the maximum number of open files allowed and the maximum size of those files, so you can use this parameter to reduce the number of files being used in the image cache if a file system limit is being exceeded.

diskCache.cacheMaxFileSize

The global plug sets the maximum file size (in bytes) that can be stored in the on-disk component of the image cache. Larger values allow Shake to store larger images, since each cached image is stored in a separate file. However, some file systems have limits on both the maximum number of open files allowed and the maximum size of those files, so you can use this parameter to reduce the size of the files being used in the image cache if a file system limit is being exceeded.

diskCache.cacheDebug

This global plug is used to enable a mode in the GUI that indicates which nodes have cached their image data to disk. By default, this plug is set to 0. To enable image-caching diagnostics, set this plug equal to 1.

When image caching diagnostics are activated, Shake will print one of the following four messages in the GUI next to nodes that incorporate image caching functionality:

- *not cached*: image data is not cached.
- *disk image*: image data is cached with high priority and exists either in the RAM-based portion or the disk-based portion of the image cache.
- *mem only*: image data is cached in the RAM-based portion of the image cache and will not be rolled-off to the on-disk portion of the image cache. However, images marked as “transient” will be removed from the RAM-based portion of the image cache before this image.
- *transient*: image data is cached in the RAM-based portion of the image cache and will not be rolled-off to the on-disk portion of the image cache. In addition, this image data will be removed from the RAM-based portion of the image cache before nodes that are marked as “mem only.”

Note: During an editing session, the caching priority of a node can be changed (upgraded) if its data is accessed from the image cache multiple times.