
U S I N G E L E C T R I C I M A G E

ElectricImage[™] 2.8 Supplement

WORK HARD, RENDER FAST, RETIRE YOUNG[™]

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Introduction

Welcome to ElectricImage™ 2.8!

Well, here it is, ElectricImage 2.8! Crammed with hundreds of incredible new features, such as a fantastic new user interface, including a totally new material and texture map interface, procedural shaders, and cool new character animation tools, we are sure that you will find this new version an essential component of your production arsenal.

So Many Features, So Little Time

There are so many new features in this version of ElectricImage, that one wonders if there is truly enough time to describe them all. However, always endeavoring to do our best, we will describe the new features to the best of our ability in this supplement. Tutorials which show you how to use all of the features, new ones and old ones alike, are offered as Adobe Acrobat files on the 2.8 installation CD. Additionally, as new tutorials are created, they will also be made available at the ElectricImage web site:

www.electricimage.com

For those users who may wish to contribute their own tutorials, please feel free to contact us at *tech.support@electricimage.com*.

New Materials and Shaders

ElectricImage now has state of the art material and surface support. Each group can have an unlimited number of textures and shaders attached to it. The Material editor has been completely redesigned both to make the process of dealing with materials an order of magnitude easier, and to conform to modern industry standards. New users will appreci-

ate the straightforward layout and functions of the materials, and power users can now concentrate on getting the right look, as opposed to wrestling with the limitations placed upon them by previous versions.

Procedural shaders are now fully supported in the interface. A procedural can be placed into any material channel, and used to great effect. As you might expect from ElectricImage, these shaders are *fast!* (*Shaders are covered in the Procedural Shaders chapter.*)

New Texture Placement Tools and Quality Controls

Unlimited textures can pose a problem if you can't handle them well. In ElectricImage 2.8, new placement controls allow for the ultimate in precision mapping, down to the polygon level. Each map has 256 levels of transparency, for multi-layered effects. Movie playback for mapping has never been easier, with new controls for how the playback works. Each map can have its own projection, and be any size or bit depth. New map filtering offers never before seen levels of incredible texture quality control. (*See the Materials and Textures chapter for more information.*)

Master Materials

Master Materials are listed in the project window, and can have an unlimited number of groups attached to them (groups have a limitation of one material each.) Master Materials let you cut down on the work required to create repetitive materials across multiple groups. Now you can create just one, and attach the appropriate groups to it. You can also immediately effect massive changes to many groups, just by changing the Master Material to which they are assigned. (*See the Materials and Textures chapter for more information.*)

Bones Deformations

Bones are commonly used in character animation. While they can be used to control facial movement, they are best used to create seamless skin animation. You have seen bones used to animate credit cards and tortilla chips in commercials, dinosaurs and other fantastic creatures in television shows and the movies. Bones can work with inverse kinematics

to get some fantastic results. (*See the Deformations chapter for more information on bones.*)

Morphing

Complementing bones is the Morphing feature. Great for character facial animation, the morphing control panel lets you selectively morph multiple objects for fantastic control. Sync dialog and a broad range of facial emotions are easy to animate with this versatile tool. (*See the Facial Animation with the Morph Window chapter.*)

Function Curve Editor

This new version of ElectricImage is all about control, control, control! And the best way to control the multitude of animation channels is the new function curve editor. Popularized by Softimage, the function curve editor uses splines and lines to drive virtually every animatable function within ElectricImage. You can easily copy and paste different “envelopes” between channels of totally different groups, or just the attribute next door. Complex behaviors can be built up simply and easily. New explicit keyframes even give you independent control over the separate X, Y and Z axes which make up object translation. (*See the Function Curve Editor chapter.*)

New Rendering Features

Where to start? Light Projection Maps, Depth of Field, Glows, Displacement Mapping, Clipping Maps, Glare, Colored Light Rays, QTVR Object movies, QTVR Panoramas, New Lens Flares, New Procedural Shaders, New Map Filtering, Glow Maps, Transmission Effects, Fresnel Effects, New transparency types, and, of course, even faster rendering!

New Look and Feel

In addition to all of the new features found in ElectricImage 2.8, parts of the user interface have undergone significant revisions to look and feel. In addition, virtually all of the functions found in ElectricImage have been significantly enhanced.

Many windows now sport a “folder tab” interface. These folder tabs enable many controls to be presented in a concise space, and have allowed us to clean up the interface experience quite a bit. Tab names reflect the tab contents as much as possible (space permitting, of course). To access a tab, just click on it.

Using Slider Bars

Many controls which allow ranges have been presented as a combination of edit boxes and slider bars. Many slider bars are set to “default” ranges, but some slider bars, ranges can actually be set by you. To do so, just type in a value greater (or less than) the value found in the edit box for the control. The slider bar will rescale to the new value. To reset the slider bar, just type in the original minimum or maximum value.

Not all slider bars are rescalable. Those that are not will simply refuse any value outside of its operational range.

New Color Picker

ElectricImage 2.8 contains a new color picker. This picker is dynamic, and offers several color models for your use.

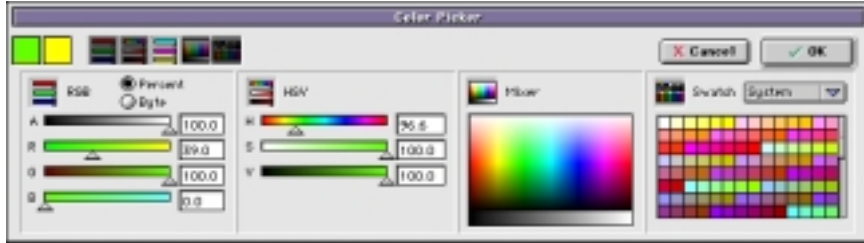


Figure 1 — Color Picker displayed horizontally

The color picker is divided into several work areas. These work areas are where you can drag individual color pickers. You can have any or all color pickers in the work areas — the picker area will expand or contract to make room. You can also adjust the display of the picker to work in horizontal (show above) or vertical (the default form of presentation.)

Overall, there are three basic color picker sections:

- Color Chips
- Picker Docking Area
- Color Picker Work Areas

Color Chips

The color chips show the Current color to the left, and the previous color to the right. If no changes were made, the colors contained within the chips will be identical.

Picker Docking Area

Unused color pickers are stowed in the docking area, next to the color chips. Pickers cur-

Introduction — Using the Color Picker

rently in use are displayed darker in the Docking Area. Pickers available for use are presented normally in the docking area. To add a picker to the work area, just drag next to any existing picker.

Color Picker Work Areas

The color picker is divided into several work areas into which pickers are placed. You drag pickers to the work area to use them.

Adjusting Color Picker Display Orientation

To display horizontally, drag any picker to the right or left of another. You do not have to add a new picker to the work area to do this. To display vertically, just drag a picker to the top or bottom of another. In each case, the display will then switch over automatically.

Using the Color Picker

Each color picker uses a particular type of color method. There are three types of color pickers:

- Color Method
- Mixer
- Swatch

Color Method

Color methods are mathematical formulas for displaying colors on a computer. You are probably the most familiar with the RGB method (Red, Green, Blue). This is the most common method in use today for computer color. It is the same method used by all computer monitors to display color images.

There are currently three color methods offered for your use:

- ARGB
- CMYK
- HSV

The default method presented when you first use the color picker is HSV (Hue, Saturation, Value). This method is the closest method to the way that color works in the real world, and is the most common method taught in the creative arts.

To add another color method, select and drag the color method to the work area.

You can set colors with the scroll bars or enter a numeric value for a color in the edit boxes next to the scroll bars. Certain color methods allow you to choose between real number color values (0.0 to 1.0) or “byte” values (0 to 255) by checking the appropriate button.

Mixer

The mixer is a complete color presentation which lets you choose any color in the display. To the top of the mixer, all colors go to white. Full color saturation is in the middle, and darker colors are presented towards the bottom of the display. A gray scale display is presented at the bottom for easy selection.

Swatch

The color swatch area stores specific color entries. These are equivalent to the palettes in Adobe® Photoshop®, and the palette files which you can save in Photoshop can be loaded into ElectricImage. Each palette entry can be loaded with the swatch menu.

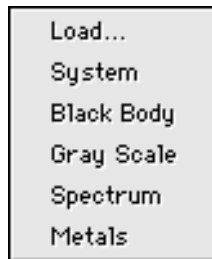


Figure 2 — Swatch Popup Menu

The Swatch popup menu contains six entries. Each entry is a different type of palette:

- Load...
- System
- Black Body
- Gray Scale
- Spectrum
- Metals

Load...

This option allows you to load color palettes saved in Photoshop format. A file dialog will appear, prompting for the location of the palette file that you wish to load. Pick a palette from the items in the file list. The display will now update with the new palette.

System

This option will load the 256 color Macintosh system palette. Choosing this option will replace the previous palette.

Black Body

This option will load a 256 color palette which ramps from black, through red, to yellow, to white. Choosing this option will replace the previous palette.

Gray Scale

This option will load a 256 shade gray scale palette. Choosing this option will replace the previous palette.

Spectrum

This option will display a 256 entry color spectrum. Choosing this option will replace the previous palette.

Metals

This option will load a 256 color palette which ramps from a low saturation dark blue gray to a low saturation cyan. Choosing this option will replace the previous palette.

To set the color selected in the picker, you must press the OK button. To refuse the color in the picker, press the Cancel button. The color picker is modal, which means that you will not be able to do anything else but pick colors while the color picker is visible.

Project Window Changes

There have been several minor changes made to the project window, which are covered in the project window chapter. The most noteworthy change is that several new items are now displayed in the project window list. These items are:

- World Object
- Object Model Files
- Master Materials
- Animate Checkbox
- Velocity Enable Checkbox

All of these items are covered in detail in the Project Window chapter. We will briefly discuss the Object Model Files and the Animate Checkbox, as these items will be of immediate use to you.

Object Model Files

As mentioned above, object model files are now displayed in the project window, where only groups were previously displayed. This change was necessary to correctly support the new morphing functions in ElectricImage. Morphs must often cross group boundaries, and thus require addressing geometry at a higher level than in previous versions of ElectricImage. It became necessary to include the model list in order for the morphing features to work properly. You cannot directly do anything with the listed objects.

Animate Checkbox

You will note that you cannot actually animate an object by default (a preference under Keyframes will let you change this behavior). The animate checkbox in the project window must be active in order to create an animation for the object or attribute. The checkbox is on if the green arrow is visible. The default state of the animation record is off, in order to consume less RAM and improve performance.

When creating an animation, there are many components in a scene which actually never animate. On occasion, you may accidentally move one of those parts, which causes the part to jump as it is rendered. Since most things in a typical scene will never move, the logical choice for this switch is off. Also, you can disable parts of your objects from animating. For example, you may not wish to move an object up or down, but rather just side to side. You could only activate the X and Z translation parameters, and not the Y, to contain the animation to that type of motion only.

Parking

One last project window feature worth mentioning here is the parking control. “Parking” allows you to change the default orientation of a group, and then zero out the values (so that you are effectively starting from scratch.) This is extremely handy when matching bones to motion capture data. Motion capture data does not always have a “neutral” or

“index” position. Instead, the files often begin at frame 1, where the model is already in a certain stance or pose, with all of the further frames stored as an offset from the first frame. By matching the bones skeleton to your motion capture effectors, and then parking the bones in the skeleton, the space in which the bones operate will be within the motion capture file’s space — matching one to one. This is a big time saver.

What’s really going on here is that the transformations are being removed from the groups, and then reset with zeros. The groups are allowed to keep the new orientation as zero, simplifying everything.

Be sure to read the Project Window chapter for additional details on these new features.

Selection Sets

One of the coolest new features in ElectricImage are selection sets. Selection sets are named collections of groups for use in a variety of ways. For example, to use the new glow layers feature, you must specify a selection set to assign a glow effect to. Also, you can use sets to make large numbers of groups instantaneously visible or invisible, assign the to master materials, and so on. There are currently four uses for selection sets:

- Light exclusion/inclusion lists
- Camera map sets
- Glow layer sets
- Sets used just for convenience (sets used for easy selection with the selection menu.)

Selection sets are stored in the project file.

New Preferences Window

All of the preferences found under the Edit menu have now been placed into one dialog window, with each preference item now presented under a separate tab. All of the preferences work the same as outlined in the Series 2 References and Supplements.



Figure 3 — New Preferences Window, with Preview & Render settings tab selected

More Reading...

Now that we have managed to whet your appetite, please continue on to the following chapters. Good luck!

The ElectricImage Team

Assigning and Using Cameras

Introduction

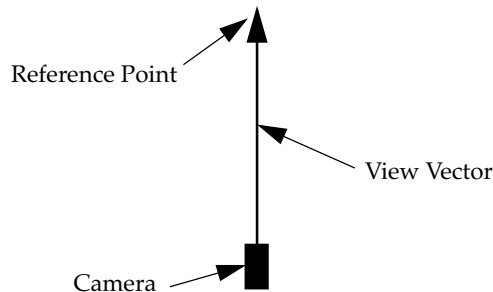
There are two basic points of view in ElectricImage, world views and camera views. The world views present the project environment from a “creator’s” perspective. You see everything in the project through these views. They assist you in the creative process, allowing you a variety of perspectives in which to view and work within your project. Camera views are used to actually record the results of your animation. It is the camera through which your audience sees your work.

You can have as many cameras as you want in ElectricImage. Each of the cameras can have independent settings, although the resolution and image filtering settings are global for all cameras. These settings are covered in the Render Information Window chapter.

There are two ways to add cameras into your projects:

- Choose *File>Add>Type>Camera*
- Select an existing camera (in the world or project windows) and duplicate it

In order to speed screen redraws, cameras are presented in an abstract fashion in ElectricImage, as illustrated below:



Assigning and Using Cameras — Introduction

The camera control has three separate components that you can directly interact with:

- Camera (body)
- View Vector
- Reference Point

Camera (body)

The black rectangle represents the camera body. Regardless of the window's zoom factor, the camera will always be presented at the same size for easy viewing and control. The shape of the body is designed for convenience. The actual focal point of the camera exists where the view vector intersects with the camera body. All of the position data for the camera body references this location.

View Vector

The view vector is the line drawn between the camera and the reference point. You can drag the entire camera control by this vector, leaving the orientation of the camera intact (a great time saver!) The distance between the camera body and the reference point, as represented by the view vector, is pertinent only when depth of field rendering settings are used.

Reference Point

Also called the target in some other programs, the reference point is the actual point of interest for the camera body. You can easily see and control the direction in which the camera is pointing by dragging the reference point to the desired position.

Both the camera body and the reference point have their own motion paths, and can be animated independently. This might cause you to “over-animate” the camera, resulting in “digital whiplash.” The best way to animate the camera is either to animate only one of the positions (not always practical) or insure that the motion paths for each point roughly match, both in keyframe times, velocity, and path shape. You can use the function curve

editor to further adjust these factors (*see the Project Window/Function Curve chapter for more information.*) Of course, there are far more controls for cameras than just the control icon. Like all objects in ElectricImage, cameras have their own “info windows.”

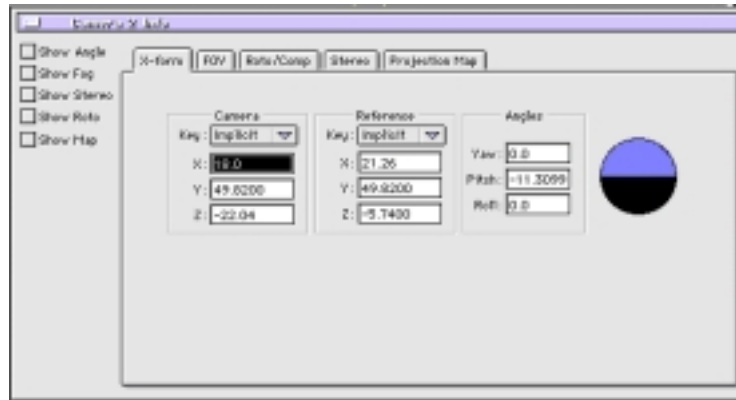


Figure 4 — Camera Info Window

Camera Info Window Overview

The camera info window contains all of the settings required to manipulate a camera in Electric Image, as well as view its current attributes. Each camera in a project maintains a separate set of parameters, found in its camera info window. There are two ways to access the Camera Info Window:

- Select the Camera and choose **File>Get Info** (or type **⌘-I**)
- Double Click on the Camera Icon in either the world views or project window

ElectricImage 2.8 brings a whole new look and feel to the Camera Info Window along with new features such as settings for explicit positioning, and depth of field as well as enhanced functionality in rotoscopying and projection mapping.

General Camera Settings

In ElectricImage 2.8 the camera window has been divided into 5 folder tabs. On the left side are check boxes used for enabling the various methods of displaying the camera in a view window. The X-form tab displays the position of the camera and it's reference point, as well as its current angle. The FOV tab is used for setting the focal length and field of view of the camera, as well as its shutter, and depth of field settings. The Roto/Comp tab is used for adding rotoscoping and compositing layers. The stereo tab allows for the rendering of stereoscopic images. Finally, the Projection Map tab is where camera maps are applied, allowing for the projection of custom images onto geometry from a camera's perspective.

Camera Display Options

On the left side of the camera window info are the display options which determine how the camera will be seen in the world view windows.

Show Angle

This checkbox toggles the display of the camera's field of view angle in the world views. When enabled, it will project 2 lines outward from the center of the camera to the reference point. The area inside these lines represents the field of view of the camera. This is what will be "seen" by the camera and rendered. The size of this area is changed by altering either the Focal Length in the FOV window, or by changing the aspect ratio in the Render window. Refer to the Focal Length section that follows for more information on changing the camera's field of view.

This display mode is very helpful for determining exactly which objects are within the field of view as you move the camera through the world view windows.

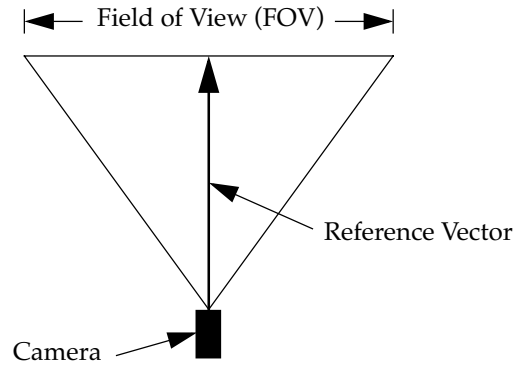


Figure 5 — Show Angle Result

Show Fog

This check box displays a projection of the fog radius used by the camera. This check box toggles the display of a fog region around the camera. The fog region is defined in the World object, listed in the project window. If no fog region has been defined, this check box will have no effect. The fog region is a spherical volume which emanates from the center of any camera in the scene. With this option selected, two circles are drawn around a selected camera in the world view windows. The darker, outer circle shows the outer extent of the fog boundary. No fog is rendered past this boundary. The lighter, inner circle represents the inner part of the fog boundary. No fog is rendered until the beginning of this circle is reached.

This fog type can be used for a “depth cueing” effect, wherein objects in the distance appear more hazy and clouded than objects in the foreground. *(For a more detailed explanation on fog, refer to the World Info Window chapter.)*

Show Stereo

When the Stereo rendering option is enabled, this checkbox provides a graphic display of the stereo separation parameters. Stereoscopic rendering creates two images for each frame in an animation, one for the left eye, and one for the right. Visually, this can be seen on the camera as a triangle (when using channel or reference convergence), or as an open box (when using infinity convergence). The base of the triangle or box, which emanates from the center of the camera, shows the amount of separation between left and right eye views in world units. The apex of the triangle or box shows the convergence point where the point of views of the two different images converge. *(For more information on Stereo rendering refer to the Stereo rendering section below.)*

Show Roto

This checkbox will cause any loaded background or foreground images to be drawn in the camera view window. These images are added to a camera via the Roto/Comp tab.

Show Map

This checkbox will cause any foreground image to be displayed in the camera view window.

Camera X-Form Tab

This tab is broken down into four sections:

- Camera Section
- Reference Section
- Roll, Pitch and Yaw Angles Section
- Roll Control

Camera Section

The camera section contains the Key popup menu (for controlling camera interpolation) and three position edit boxes. These edit boxes list the current position of the camera, in X, Y, and Z coordinates, which can be changed by you at any time.

Reference Section

The reference section contains the Key popup menu (for controlling reference point interpolation) and three position edit boxes. These edit boxes list the current position of the reference point, in X, Y, and Z coordinates.

Roll, Pitch, and Yaw Angles Section

The camera can also be controlled through more traditional roll, pitch and yaw edit boxes, and are expressed in degrees. The order of the boxes is actually presented as Yaw (X), Pitch (Y) and Roll (Z), and equates directly to X, Y, and Z.

Roll Control

The roll control is interactive, and can be dragged to create roll angles. Its presentation is reminiscent of the roll indicator found in aircraft avionics.



Figure 6 — Camera X-Form Tab

All of the numeric values presented in the edit boxes are dependent upon the editing mode set in the project window, and if the animate flag has been set for the camera object or a particular channel for the camera object. *(For an explanation of editing modes in ElectricImage, see the Electricimage Series 2 Reference Manual, Chapter 8, page 8-5)*

In **Index** mode, changing the values updates the value for the current keyframe you are editing. Index mode only allows for the editing of previously generated keyframes, rather than for creating new ones, so it is only possible to alter an existing keyframe while in index mode.

In **Frame** mode, changing the values in the x-form window creates a custom frame with those new values. Custom frames have an underline mark below their values in the project window. Custom frames are not affected by the interpolation and velocity of the frames around them. They are fixed values which will be implemented without regard to any other keyframes. If you can picture a smooth curve, custom frames are like spikes jutting out from the curve. They have no regard for the curve itself, or its shape (velocity). They simply pop to their value, and then return back to the curve when done. *(For more information on custom frames please refer to the Frame mode in the Electricimage Series 2 Reference Manual, chapter 8.)*

In **Keyframe** and **Time** modes, changing the values in the x-form window either creates a new keyframe (if none exists at the current frame), or updates the values of an existing keyframe.

A new feature to Electric Image 2.8 is the ability to display keyframe values in either **Implicit**, or **Explicit** values. Implicit is the way that Electric Image has always displayed vectorized quantities. When the camera is set to implicit, it will work as it has in previous versions, where dragging the camera in a window controls two of its positional measurements. The velocity is computed as a composite of these two vectors. For instance, by dragging a camera in the top view window, the X & Z coordinates will change, in the Front View the Y&X, and the Side View the Y&Z coordinates. Implicit controls always function on all axes simultaneously.

When a camera or object is set to explicit positioning, a new option for controlling positional values becomes available. Using the function curve editor, it is possible to control the values and velocity for all 3 components of motion (X,Y,Z) independently. *(For more information on using the curve editor please refer to the Function Curve Editor chapter.)*

FOV Tab

This tab controls the camera focal length, shutter angle, and depth of field options. It is divided into three sections:

- Focal Length Section
- Shutter Section
- Depth of Field

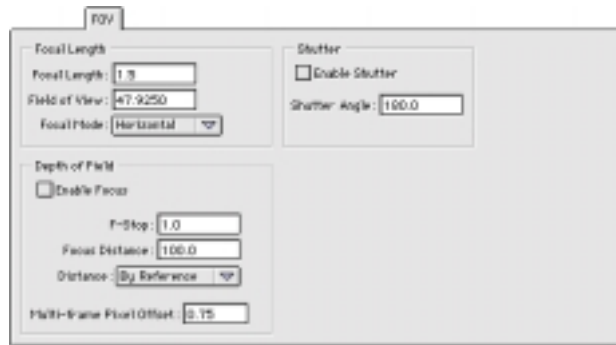


Figure 7 — Camera FOV Tab

Focal Length Section

In actual photography, where an image is exposed onto film or captured on video, light is collected through the camera's lens, and projected onto the focal plane. In film cameras, the focal plane is actually inscribed on the camera body, typically denoted by a circle with

a slash running down the middle. The distance between the first lens element in the lens body to the focal plane is referred to as *focal length*. In all professional camera systems, lenses are interchangeable, allowing the operator to have a variety of focal lengths to work with.

ElectricImage provides many controls to manage the lens characteristics of a camera. These controls are affected by the aspect ratio settings in the Render Info Window (*discussed in the Rendering chapter*.) The focal length section consists of the following three items:

- Focal Length Edit Box
- Field of View Edit Box
- Focal Mode Popup Menu

Focal Length Edit box

This edit box allows you to explicitly define the camera lens focal length. The number will change depending upon the aspect ratio setting in the Render Info Window. The default for that setting is “computer,” so the number that you are most likely to see is a floating point number, such as “1.0.” Changing the aspect ratio setting will result in a conversion of the number in the edit box to a new number. With the exception of the custom and computer aspect ratio settings, the number in this box will be expressed in millimeters. This allows you to match real world lens types to real world photography formats.

Note that if you do change the aspect ratio, the focal length will be adjusted to the new number, but the image in the viewing rectangle will appear relatively unchanged. Only the cropping areas will be affected, the image distortion will not.

The smaller the focal length, the wider the field of view. The larger the focal length, the narrower the field of view. Lenses with small focal lengths (6mm to 12mm) are called wide angle lenses, lenses with large focal lengths (75mm to 135mm) are called narrow or tele-photo lenses, and those in between (16mm to 50mm) are considered normal lenses. Focal

length is directly proportional to the size any object will appear in the frame. If the distance to the object remains constant, and the focal length is doubled, the object will appear twice as large in the frame.

Field of View Edit Box

Field of View (FOV) determines how much of the scene when viewed through the camera lens is visible to the lens. This value is expressed in degrees. The FOV is directly related to the focal length of the lens, the focal mode popup menu (discussed following) and the selected aspect ratio.

Many single lens reflex cameras (SLRs) include a 50mm lens. This lens most closely mimics the human eye for this 8 perf 35mm format (8 perf is also called “Vista - Vision” format when applied to motion picture cameras.) The field of view for this lens is approximately 40° in the real world (depending upon differing specifications by camera and lens manufacturers.) It should be noted that ElectricImage presents these values in true mathematical space, while real world cameras and lenses are incapable of meeting these tolerances, and will often vary by one or two degrees.

Perspective distortion is also driven by both the focal length and Field of View. The smaller the FOV, the more distortion will appear, creating a wide angle effect. The larger the FOV, the less distortion will appear creating a telephoto effect. You can use extremely large focal lengths if you wish to negate the effects of perspective altogether. For example, you may wish to render a view with no perspective in order to create the basis for a texture map the closely conforms to the shape of the group.

Focal Mode Popup Menu

This menu determines how the focal length and field of view calculations are performed. There are three choices:

- Horizontal
- Vertical
- Diagonal

Horizontal Focal Mode

This mode uses the sides of the frame to calculate the focal length and field of view. This is the default mode, and is the typical method for making such calculations in most motion picture camera systems.

Vertical Focal Mode

This mode uses the top and bottom of the frame as a basis to calculate focal length and field of view. Some computer imaging systems use this mode, but it is unlikely that you would need to.

Diagonal Focal Mode

This mode uses the frame diagonal as a basis to calculate the focal length and field of view. Many SLR cameras use this method.

Shutter Angle Section

All real world cameras have a shutter system. Film cameras have a physical shutter, and video cameras have electronic shutters. A shutter is used to create discreet frames, otherwise all we would see would be smearings of color. Discreet frames are necessary for our perception of imagery in motion, made possible by a phenomenon called “persistence of vision.” It is this phenomenon that enables us to see the discreet frames on film (or video fields) as a continuous motion.

Shutters actually keep parts of the film from exposing, rendering them black. A shutter is typically very fast, covering the focal plane for about half of the total exposure time. For example, in a 24 frames per second shot, the shutter will be closed for about $1/48$ of a second, and open for the same amount. During the time that the shutter is closed, the world is still moving. When the next frame is exposed, the subject matter will not necessarily be in the same place, and thus, its motion is imparted to the film.

This section contains two controls:

- Enable Shutter Check Box
- Shutter Angle Edit Box

Enable Shutter Check Box

Use this check box to override the global shutter settings in the Render Info Window. If this box is enabled, the value in the Shutter Angle Edit Box for this camera will be used instead of the global value.

Shutter Angle Edit Box

Use this edit box to set the angle of the open shutter in degrees. In the real world, the shutter angle would max out at far less than 360° , otherwise the images recorded would not make any sense to us. However, ElectricImage provides a “virtual shutter” that can be far greater than 360° . You can still view an image, because ElectricImage does not actually use a shutter to render the discreet frames, it does so automatically (one of the benefits of a synthetic camera!) As such, the shutter angle can be used for some really cool effects, such as ultra high speed motion (like a space warp drive.)

Instead, shutter angle is a major component of the motion blur effect. The size of the shutter angle will dictate the amount of perceived motion blur along the following rules:

- Larger shutter angles produce longer blur streaks
- Shorter shutter angles produce shorter blur streaks

Note that shutter angle has no apparent effect on the Depth of Field function. It is included in this section as an animatable control for motion blur only.

Depth of Field Section

3D programs like ElectricImage are all designed to mimic real world cameras, up to a certain point. The focal length section is used to approximate what a real world camera would see if the scene existed in our world. The basic physics are the same, with some added bonuses (such as, everything is always in focus.) Sometimes, however, that's not what you want. New to ElectricImage 2.8 is the ability to perform depth of field rendering. Depth of field mimics a real camera, whereby images are blurred according to the focal settings of the camera. Depth of field is defined as the distance from the nearest object in sharp focus to the farthest object in sharp focus.

Depth of field rendering is a multi-frame technique that requires the multi-frame button to be set in the Motion Blur tab of the Render window. For best results the number of Blur Frames should be set to 5 or higher.

The Depth of Field section contains five items used to control the options for this feature:

- Enable Focus Check Box
- F-Stop Edit box
- Focus Distance Edit box
- Distance Popup Menu
- Multi-frame Pixel Offset

Enable Focus Check Box

This check box enables the depth of field feature. It must be selected in order for the effect to be created.

F-Stop Edit Box

Use this edit box to set the f-stop for the camera lens. In real world terms, the light gathering power of a lens is called the speed of the lens. The more light that is available to a lens,

the larger the area it is able to keep in focus (the depth of field). This is expressed as an f-number, or f-stop. This number is the ratio between the focal length of the lens and its diameter (the aperture):

$$f\text{-stop} = \frac{\text{focal length}}{\text{lens diameter}}$$

As the lens diameter increases, so does the amount of light that passes through. As the focal length increases, the light is dispersed over a greater area and the amount of light available decreases. This is often expressed as a faster lens allowing more light through, and a slower lens allowing less light. Lenses of about $f/2$ and lower are considered fast.

Additionally, inside the lens is an iris diaphragm which can open or close to change the amount of available light. Thus, the actual term, f-stop, is determined by a series of “stops” along the lens aperture:

$$f\text{-stop} = \frac{\text{focal length}}{\text{diameter of lens aperture}}$$

The standard series of stops is: 1, 1.4, 2, 2.8, 4, 5.6, 8, 11, 16, 22, 32. Each stop represents the halving (or doubling) of the amount of light that the lens passes. At low f-numbers, the diaphragm is open wider and more light enters the lens.

As in actual photography, smaller f-stops result in a shorter depth of field. Objects outside of the focus distance will appear soft and out of focus. Larger f-stops will result in a longer depth of field. Objects outside of the focus distance will be in sharper focus. Unlike real world cameras, the actual amount of light required to illuminate the scene will not change. Only the depth of field will be affected, not exposure.

Focus Distance Edit Box

This edit box determines the distance from the camera in which the object will be in sharp focus. Objects not in the area of the focus distance will appear out of focus, depending upon the f-stop setting. The focus distance can also be set to use the reference point of the camera. This is controlled by the distance popup menu, covered below. If the reference point method is used, the value in the Focus Distance Edit Box is ignored.

Distance Popup Menu

The two options in this popup menu selects the method for calculating the depth of field:

- By Channel
- By Reference

By Channel

When setting the focus distance by channel, the focal target is determined by the value entered in the Focus Distance edit box. This value emanates from the center of the camera, and is expressed in world units. For instance, a number of 50 would focus the lens on an object 50 units from the focal plane of the camera.

By Reference

When setting the focus distance by reference, the focal target is the end point of the reference vector. This provides an easy way to determine exactly what the focal object is. Just drag the reference vector out or in until it is sitting over your target object. This is the default method.

Multi-frame Pixel Offset

This value represents what is known as the circle of confusion. The point at which the focus distance is set, is said to be the area of critical focus. Everything on this plane is in focus. Objects that are nearer and farther from this point are said to be in the circle of confusion. Depending on the f-stop and focal length, many of these objects will also be in variable states of focus even though they aren't located at the exact focus distance.

For example, when the focus distance is set at 15 units, we might find that the depth of field where objects remain in focus ranges from 12 units to 20 units. Thus, the total depth of field here would be 8 units. Since “being in focus” is a subjective judgment, in order to determine what is defined as in focus, a permissible circle of confusion must be set; the circle of least confusion. In ElectricImage, this value is the multi-frame pixel offset, and it uses this number to determine the acceptable range of sharpness when performing depth of field calculations. The following rules apply:

- Smaller offset values produce sharper images
- Larger offset values produce blurrier images

Effectively, the offset is an additional control to determine how blurry the objects in the scene will appear.

Roto/Comp Tab

Rotoscoping (“roto”) is a term used to describe the process of incorporating information from previously exposed (or rendered) footage into a shot. One might wish to match the camera movements or other objects from live action footage, or have a rendered model follow the movements of an actor. Compositing (“comp”) is a process of including foreground or background images or movies into your rendered scene. Composite layers are added above the 3D action you create in ElectricImage, and background layers appear behind your renderings in the final image or movie. In order for compositing to work properly, the images or movies that you use will need to contain an alpha channel mask.

Your roto and comp footage can be any resolution, but it is best to match the final resolution to which you are rendering. If your background or foreground maps are smaller than your target render resolution, then they will be enlarged. This will reduce the quality of the images used for compositing. If the footage is a greater resolution, then the footage will be down sampled to fit in the image rectangle. This will not decrease the quality of the imagery used for compositing, but will add somewhat to the render time.

Assigning and Using Cameras — Roto/Comp Tab

The Roto/Comp tab contains controls which allow for background and foreground image compositing within a rendering, and display of these images in the camera view window. There are several items in this tab:

- Render Rotoscope/Composite Check Box
- Background Map List
- Foreground Map List
- X-Form Tab
- Properties Tab
- Info Tab
- Crop Tab



Figure 8 — Camera Roto/Comp Tab

Render Rotoscope/Composite Check Box

This check box enables the images in the background and foreground map lists to be rendered and/or composited into the final image. (Maps can also be individually enabled or disabled within the map lists.)

Background Map List

This list contains all of the images used as backgrounds for the active camera. Each camera renders its own map lists separately — what appears in the background list for one camera will not be present for another, unless you insure that the lists are the same for each camera. Each image can be enabled or disabled by clicking the active icon next to the name of the map. The background maps will appear in the final rendered image only if the active icon next to the image name in the list is present, and the Render Rotoscope/Composite check box is enabled. Background images can be animated and scaled in XY screen space with the X-form tab next to the map list.

To add a background image to the list:

- Click the Add button
- Choose an image or movie from the file list
- Click the Open button

The background image you selected will now appear in the list.

To delete a background image from the list:

- Select the image
- Click the Delete button

The image will be removed from the list.

You can reorder the maps in the list by dragging the map to its desired location. You can **Edit>Copy** (command-c) and paste maps between lists by selecting the map and choosing copy, then selecting the destination map list, and choosing **Edit>Paste** (command-v).

Maps will be layered by the order in which they appear in the list. If the maps do not have alpha channel masks, then the top-most map will be the only map that will appear as a background image for this camera.

Foreground Map List

This list contains all of the images used as foregrounds for the active camera. Each camera renders its own map lists separately — what appears in the foreground list for one camera will not be present for another, unless you insure that the lists are the same for each camera. Each image can be enabled or disabled by clicking the active icon next to the name of the map. The foreground maps will appear in the final rendered image only if the active icon next to the image name in the list is present, and the Render Rotoscope/Composite check box is enabled. Foreground images can be animated and scaled in XY screen space with the X-form tab next to the map list.

To add a foreground image to the list:

- Click the Add button
- Choose an image or movie from the file list
- Click the Open button

The foreground image you selected will now appear in the list.

To delete a foreground image from the list:

- Select the image
- Click the Delete button

The image will be removed from the list.

You can reorder the maps in the list by dragging the map to its desired location. You can **Edit>Copy** (command-c) and paste maps between lists by selecting the map and choosing copy, then selecting the destination map list, and choosing **Edit>Paste** (command-v).

Maps will be layered by the order in which they appear in the list. If the maps do not have alpha channel masks, then the top-most map will be the only map that will appear as a rendered image for this camera, hiding any 3D objects that you intended to render.

Note — to view any image in the background of the Camera window, the option to show the image must be on (found in the Roto/Comp Properties Tab, Show in Camera View check box) and the Paint Image button must be set to the image name desired.

The following illustration indicates the roto/comp controls that are displayed in the camera view window. These controls are visible only when the option to display an image in the camera view is active.

Paint Image Icon

This icon will draw the foreground/background image in the camera view. To use click on the button. A popup menu will appear, with the names of the loaded images listed. Choose the image that you wish to view. You cannot preview composites in this window. You must perform a “preview snap” rendering or complete rendering to do so.

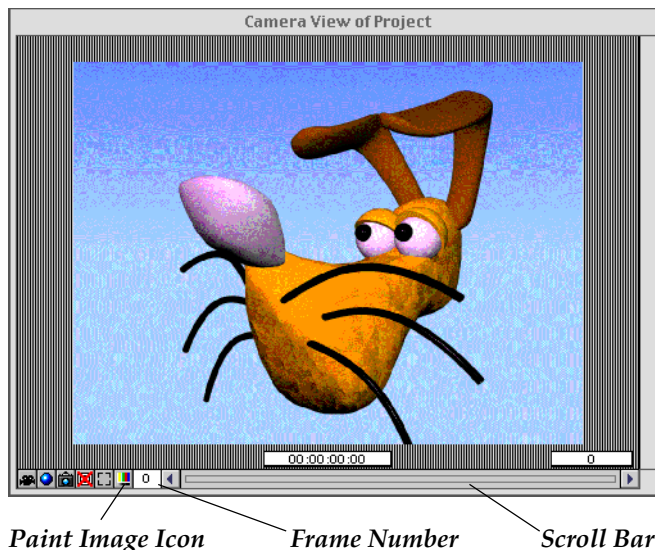


Figure 9 — Camera View Roto/Comp View Tools indicated

Frame Number

This box displays the current frame number. If the Sync with Time option is selected in the Roto/Comp Properties Tab, then this number will match the current frame number of the project.

Scroll Bar

The scroll bar allows you to scroll through the movie file to find the appropriate frame for use. This bar will have no effect on a single frame image.

Roto/Comp X-form Tab

This tab provides position, scale and alignment information used by the currently selected map in either list. Each map in each list can be positioned, scaled and aligned independently from the others. These functions are presented in 3 areas in the X-form tab:

- Position Edit Boxes
- Scale Edit Boxes
- Alignment Popup Menu



Figure 10 — Roto/Comp Tab Foreground/Background Image X-form Tab

Position Edit Boxes

These boxes control the position of the selected image in either of the foreground or background map lists. Maps can be positioned in X and Y space only (acting as flat layers.) The default value of 0.0 will place the map in the center of the frame. X and Y values of 1.0 or greater for each position attribute will place the map offscreen (Values may vary depending upon the aspect ratio of the map as it relates to the rendered image.)

Scale Edit Boxes

These boxes control the scale of the selected image in either the foreground or background map lists. The default scale of 1.0 fits the map to the extents of the rendered image rectangle. The alignment popup, covered below, governs which axis is used as the “fit” axis, that is, which axis is used to fit correctly into the frame at a scale of 1.0. Values of less than 1.0 in will reduce the size and values greater than 1.0 will increase the size of the image.

Align Popup Menu

This menu is used to determine how the map will fit into the rectangle of the rendered image. There are three choices:

- Both
- Horizontal only
- Vertical only

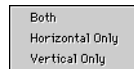


Figure 11 — Align Pop Up Menu

Both

This option will fit both axes of the image into the aspect ratio of the rendered image rectangle. If the aspect ratio of the image does not match the aspect ratio of the rendered image rectangle, the image will appear stretched or squeezed.

Horizontal Only

This option will fit just the horizontal axis of the background or foreground image into the rendered image rectangle. The vertical axis may extend past the rendered image extents or end within view of the frame if the aspect ratios of the foreground/background image doesn't match the rendered image rectangle.

Vertical Only

This option will fit just the vertical axis of the background or foreground image into the rendered image rectangle. The horizontal axis may extend past the rendered image extents or end within view of the frame if the aspect ratios of the foreground/background image doesn't match the rendered image rectangle.

Roto/Comp Properties Tab

This tab is used to control the foreground/background image rendering and display properties. This tab is comprised of several items:

- Camera View Section
- Image Tiling Section
- Anti-Alias Check Box
- Invert RGB Check box
- Invert Alpha Check Box
- Samples Edit box
- Blur Edit Box
- Opacity Edit Box



Figure 12 — Roto/Comp Properties Tab

Camera View Section

This section contains controls which govern the display of the foreground/background image in the camera view window. There are three sub items listed in this section:

- Show In Camera View Check Box
- Synchronize with Time Check Box
- Display Mode Popup Menu

Show in Camera View Check Box

This control enables the display of the image in the camera view window.

Synchronize with Time Check Box

This control insures that the foreground/background images will match the time reference of the project scene time.

Display Mode Popup Menu

This popup menu determines which channels of the image will be displayed in the camera view window. This feature does not affect the rendering quality of the foreground/background images. There are four choices:

- RGB Only
- Alpha Only
- RGB + Alpha
- RGB + Color

RGB Only

Displays only the RGB channel of the foreground/background image in the camera view window. If the image has an alpha channel, then the display of the image in this mode will appear to have ragged edges (the anti-aliasing information is in the alpha channel).

Alpha Only

Displays only the Alpha (mask) channel of the foreground/background image in the camera view window.

RGB + Alpha

Displays a properly anti-aliased foreground/background image in the camera view window. (Uses the alpha channel information to mask in the RGB channel.)

RGB + Color

Displays the RGB channel of the image with the selected background color (set in the World Info Window).

Image Tiling Section

This section contains two popup menus which control the way the foreground/back-ground images are tiled when viewed or rendered. There are four choices:

- None
- Hold
- Repeat
- Mirror

None

Disables mirroring of the the image on the specified map axis. Choosing None for both axes will cause the image to be displayed only where you positioned it, nowhere else.

Hold

Applies the colors found at the image edges outside of the actual image rectangle. (The image will appear once as positioned, with the border colors of the image extending beyond the image rectangle, covering the frame.)

Repeat

Repeats the image along the specified axis. Choosing Repeat for both axes will cause the image to repeat continuously.

Mirror

Mirrors the image along the specified axis. Choosing Mirror for both axes will cause the image to flip flop about both axes.

Anti-Alias Check Box

This check box enables foreground/background filtering. If you are not scaling your foreground/background images, and if they match the aspect ratio of the rendered image rectangle, then this setting can be disabled.

Invert RGB Check Box

This option will negate the RGB color space of the image.

Invert Alpha Check Box

This option will negate the alpha channel of the image. This is useful if you decide that you need to mask the area opposite of that represented by the alpha channel.

Samples Edit Box

This edit box lets you determine the sampling quality of the image. The default is 5.0. Numbers greater than 5 will cause the image to be sampled more often, slowing down render time, but increasing the quality of the image. Numbers less than 5 will cause the image to be sampled less often, speeding up render time, but decreasing the quality of the image. Numbers greater than 10 might be prohibitively slow. 5 is a good default, and you will likely not need to deviate from that amount.

Blur Edit Box

This edit box lets you blur the image. The default is 1.0. This value will present the image as is. Values of greater than 1.0 will blur the image. For example, a value of 2.0 will produce a blur of two pixels for every one encountered in the image. Values less than 1.0 will sharpen the image, although it will also introduce aliasing (jagginess) into the image.

Opacity Edit Box

This edit box controls the opacity of the foreground/background image. The default is 1.0, where the image is completely opaque. Values of less than 1.0 will make the image more transparent, ending at 0.0 where the image will be invisible. Values of greater than 1.0 are ignored.

Stereo Tab

The stereo tab is used to set up stereo image rendering in ElectricImage. This technique lets you create true “3D” images, when properly assembled and viewed through polarized glasses. (ElectricImage does not support the anaglyph (red/blue) stereo effect, just “right eye/left eye” stereo.) To accomplish this, ElectricImage creates separate image files for each eye. You will need a third party program to assemble the images into viewable 3D imagery or movies.

The stereo tab consists of a few simple controls to accomplish the stereo effect:

- Enable Check Box
- Stereo Separation Edit Box
- Stereo Convergence Edit Box
- Convergence Popup Menu
- Render Popup Menu

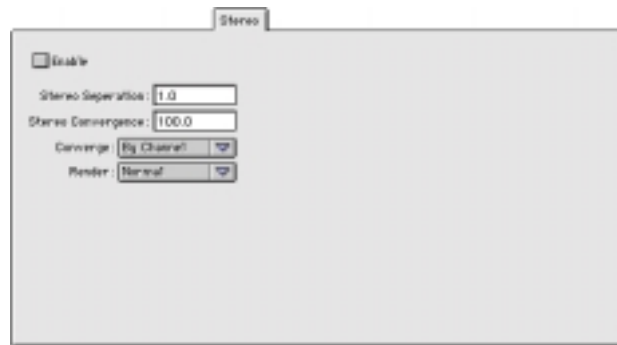


Figure 13 — Stereo Tab

Enable Check Box

This box enables the stereo effect. You can play with settings without actually rendering them by disabling this check box.

Stereo Separation Edit Box

This edit box controls the distance between the two cameras. (If you would like to see the distance indicated on the camera, enable the “Show Stereo” check box in the Camera Info Window’s Camera display control area to the left of the window.) The default value is 1.0. This may or may not be appropriate for your needs. Essentially this control is attempting to duplicate the distance between the human eyes. How much scale you want something to have will depend upon the size of this value. Unfortunately, the relevance of this number is directly related to the scale of the objects in your scene, so we can offer little guidance here.

Stereo Convergence Edit Box

This edit box controls to focus point of the stereo effect. Beyond this point, no depth will be perceived. This value is used only if the Convergence Popup Menu is set to “By Channel.”

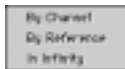


Figure 14 — Convergence Popup Menu

Convergence Popup Menu

This menu controls the type of convergence that will be used when the scene is rendered. There are three choices:

- By Channel
- By Reference
- In Infinity

By Channel

Causes the stereo effect to use the value found in the Stereo Convergence Edit Box.

By Reference

Causes the stereo effect to use the reference point as the point of convergence.

In Infinity

The perception of depth will extend into infinity.

Render Popup Menu

This menu controls what image files are created at render time (if any) for the stereo effect. There are four choices:

- Normal
- Left Only
- Right Only
- Left & Right



Figure 15 — Stereo Render Popup Menu

Normal

This option will render the scene normally, producing only one, “flat” image file.

Left Only

This option will render an image file for the left eye position only.

Right Only

This option will render an image file for the right eye position only.

Left & Right

This option will render two image files, one for each eye. In this instance, render times will be twice as long, as complete scenes for each eye must be rendered.

Projection Tab

This tab is used to control map projections from the camera position. A projection map is a texture that can be projected onto many groups at once from the same location in space. Both lights and cameras can project maps. Lights project maps exactly like a slide or movie projector. Camera projection maps work a little differently. These maps are typically projected onto objects which are fully self-illuminated (meaning that the objects are always at full brightness, as are any maps applied to them).

Here's a real world analogy to this process — imagine that you have a photograph of a building. The camera is inside of an alcove, with walls on the sides, and an arch to the rear. Now, imagine that you have a model that is roughly scaled to the objects in the photograph. In essence, you have walls and then an arch at the end of the walls. The model is painted white to accept the slide of the photo. Now, setup a slide projector that can project the photo onto the model. Position the projector so that it approximates the position of the camera that took the original photograph. As you bend down and look at the model from the same point as the slide projector (or as close as you can get to the lens) what you would see would appear to be very close to the original photo. However, the farther away from the projector that you move — either side to side, up or down, or in and out — you would notice that what you are seeing is almost a true 3D representation of the original photo! This is a special effects technique that has been used for many years.

The first known use of this technique on a computer was performed by Mr. Yusei Usegi, an extremely talented matte painter, on the film "Hook." He painted an overhead view of the Neverland Island, and had the computer department create a rough model of the island and ocean. As the map was project from his point of view created in the painting, as soon as the recording camera moved off axis, the painting suddenly appeared to have a three dimensional feel. Since then Mr. Usegi and a variety of very talented artisans have used this technique to great effect in such films as "Spawn," "Star Wars Trilogy Special Edition," "101 Dalmations," and so on.

The true benefit of camera projection maps is that in many cases what would have required complex models before can now use rather simple models. The complexity instead is found within the details of the painting — a process many find easier than modeling.

The Way it Works

Camera maps are applied to either all groups in a scene or groups within selection sets. (*See the Selection Sets chapter for more information on selection sets.*) Each map in the list can be set to project in different manners (“applied as”), and each map can be set to project to a different selection set (“applied to”). Typically, camera projection maps are applied as “luminance” maps (the default), so that the map appears at full brightness. This method allows the scene that is rendered and the original map image to have the same brightness levels. In other words, the rendered scene would look like the photograph of the map. It is not uncommon to also use clip and transparency map methods to isolate elements in the map image, such as people, trees, or other details.

After applying a camera map and aligning the projecting camera, you should lock the projecting camera, so that registration is maintained.

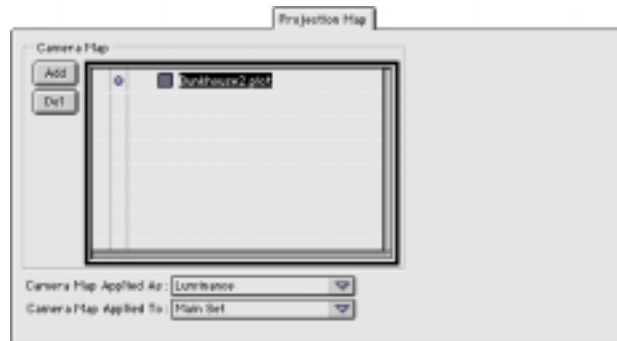


Figure 16 — Camera Info Window Projection Map Tab

The Projection Map tab consists of three items:

- Camera Map List and Controls
- Camera Map Applied As pop up menu
- Camera Map Applied To pop up menu

Camera Map List and Controls

The camera maps list is where you add camera projection maps. You can put as many maps as you like in this list. Maps can be single frames or movie files, and can be any bit depth desired.

To add a camera projection map to the list:

- Click the Add button next to the Camera Map list
- Select a map from the file list
- Double click the map, or press the Open button

The camera map will be added to the list. To configure the map, double click on the map name in the list. To reorder the map in the list, just drag it to its new location. (*See the Materials and Textures chapter, section “Using Texture Maps” on page 178 for more information on working with maps in the map list.*)

To delete a camera projection map from the list:

- Select the map from the file list
- Click the Delete button next to the Camera Map list

The map will be removed from the list.

Camera Map Apply As Pop Up Menu

This menu allows you to set the method in which the map will be applied to items in the selection set. All map channel methods described in the Materials and Textures chapter are found here. You can use any of the methods that you wish, although in practice you may find just the few described above to be of any real use in the map projection process.

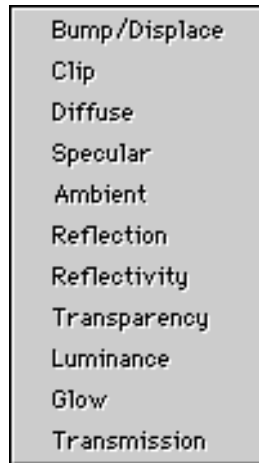


Figure 17 — Camera Map Apply As Pop Up Menu

There are eleven methods in the list in which the map can be applied. Applying camera maps to any of these channels acts as if the map has been applied to that group's corresponding material channel (*see the [Materials and Textures](#) chapter for a full explanation of map properties*):

- Bump/Displace
- Clip
- Diffuse
- Specular
- Ambient
- Reflection
- Reflectivity
- Transparency
- Luminance
- Glow
- Transmission

Bump/Displace

The projected map will act as a bump / displacement map for the items listed in the Applied To pop up menu. This option is not typically used as a camera projection map.

Clip

The projected map will act as a clip map for the items listed in the Applied To pop up menu. This option is great for isolating elements easily by masks.

Diffuse

The projected map will act as a diffuse map for the items listed in the Applied To pop up menu. This option is not typically used as a camera projection map, as the groups receiving a camera map from this method would shade normally, without self-illumination. (in other words, requiring standard scene lighting)

Specular

The projected map will act as a specular map for the items listed in the Applied To pop up menu. This option is not typically used as a camera projection map.

Ambient

The projected map will act as an ambient map for the items listed in the Applied To pop up menu. This option is not typically used as a camera projection map.

Reflection

The projected map will act as a reflection map for the items listed in the Applied To pop up menu. This option is not typically used as a camera projection map.

Reflectivity

The projected map will act as a reflectivity map for the items listed in the Applied To pop up menu. This option is not typically used as a camera projection map.

Transparency

The projected map will act as a transparency map for the items listed in the Applied To pop up menu. This option might be useful for some effects, or to isolate some elements of target groups.

Luminance

The projected map will act as a luminance map for the items listed in the Applied To pop up menu. This is the default setting, as it allows for the projection map and the original image to have the same brightness (in other words, the rendered image will appear virtually identical to the original map image in terms of brightness).

Note that the groups receiving maps from this method do not accept shadows when this setting is used. Self-illumination means that the groups are effectively not shaded, rather presented at full brightness levels. If you wish to cast shadows from other scene groups upon a projection mapped group with this method, you will be required to render an additional image, with the same groups, but with the map projections disabled, and the group shadow settings for the projection mapped groups (found in the group info window, shadow tab) set to “generate shadow mask.” You would then need to composite the two images together, using the projection mapped image as the background, and the shadow mask image as the foreground.

Glow

The projected map will act as a glow map for the items listed in the Applied To pop up menu. This option is not typically used as a camera projection map.

Transmission

The projected map will act as a transmission map for the items listed in the Applied To pop up menu. This option is not typically used as a camera projection map.

Camera Map Applied To Pop Up Menu

This menu determines which groups in the scene will receive the selected camera projection map. There are three choices for this menu:

- None
- All
- “Set List”

None

No groups in the scene will receive the selected camera projection map.

All

All groups in the scene will receive the camera projection map. This option should be used if you will not be introducing items that are not intended to be components of the map, as every group in the scene will receive the map projection.

“Set List”

Actually, after the All menu item, you will see the entire list of selection sets that exist within the project. If no selection sets exist, then there will be no items presented after the All menu item. Selection sets are the most controllable way of using camera projection maps. By use of a set or series of sets, you can determine exactly which groups will receive the selected camera projection map. Using sets, you can mix and match groups which do and do not receive projection map effects.

All of the maps can be further adjusted using the standard set of texture mapping tools. See the Materials and Textures chapter, “Using Texture Maps” on page 178 for further information.

Using and Animating Groups

Introduction

In ElectricImage, geometry that is animated and rendered are referred to as groups. Typically, a single group corresponds to a single layer or object within a model file. Groups can exist as independent entities, or within a hierarchy. Groups can be translated (moved, rotated and scaled), deformed, have its materials animated, and so on. Groups can be imported from other programs (into the native ElectricImage FACT format) or the ElectricImage Modeler, or be created by a variety of plug-in programs. A group can have as many as 250 or more animation channels, many of which can be individually enabled or disabled (others by the class of animation channel). Each channel can be controlled independently by you. All of the channels can be placed into the function curve editor for animating, or you can pick individual channels. *(See the Project Window/Function Curve chapter for more information.)*

Each group can contain an unlimited amount of points, lines and polygons and texture maps. There are no limits to the amount of groups that you can have within a project, memory permitting.

To add a FACT model into a project:

- Choose File>Add>Model>FACT...
- Select the Model name from the file list
- Double click or press the Add button
- Click the Done button when finished

The model will now appear in the world view windows, and the file name of the model will appear in the Model File section of the Project Window. The model's groups will appear in the group section of the Project Window.

Using and Animating Groups — Introduction

Model formats from other programs can be imported into ElectricImage. There are currently over 30 different import formats supported.

To import a model into a project:

- Choose File>Add>Model>Other...
- Select the Model name from the file list
- Double click or press the Add button
- Click the Done button when finished

The model will now appear in the world view windows, and the file name of the model will appear in the Model File section of the Project Window. The model's groups will appear in the group section of the Project Window.

There are several import options available to you. These options are covered in the ElectricImage Series 2 Reference Manual, pages 1-22 through 1-30.

In addition to adding and importing models into ElectricImage, you can also create font models from Adobe® PostScript® Type 1 fonts or Apple® TrueType™ fonts. The font outlines are converted into polygons, and depending upon your choices, extruded into 3D and even bevelled.

To add a 3D font into a project:

- Choose File>Add>Model>Font...
- Select a Font from the file list (a font does not need to be installed in the system in order for it to be converted into 3D — the fonts can reside on any disk)
- Type in the font letters that you desire in the edit box
- Set the extrusion height and bevels and element colors (if desired)
- Click the Add button
- Save the font model

The font model will now appear in the world view windows, and the file name of the model will appear in the Model File section of the Project Window. The model's groups will appear in the group section of the Project Window.

For more detailed information on importing PostScript Type 1 and True Type fonts, see the ElectricImage Series 2 Reference Manual, pages 1-17 to 1-21.

As mentioned previously, groups can exist individually, or as part of a hierarchy. Hierarchies enable complex motions to be created, using groups linked in “chains” or “trees.” Hierarchies are also required if you wish to animate your groups with inverse kinematics. For more information on these topics please consult the following chapters:

- Effectors
- Hierarchies and Constraints
- Group Linkage Window

Group Info Window

Like all other object classes in ElectricImage, groups have an information window associated with them that allow you to control a variety of options. The group info window contains basic non-material attributes for the group (such as position, rotation, scale, and so on), as well as an access point to the group's material record. (*See the Materials and Texture Maps chapter for more information.*) Like so much else in ElectricImage 2.8, the Group Info Window has undergone a complete overhaul. The window has many familiar elements from previous versions, but it also has quite a few enhancements. Like many new interface enhancements, the group info window is divided into conveniently organized folder tabs, each containing the controls and functions indicated by the name of the tab. To access the contents of a tab, just click on it.

Using and Animating Groups — Group Info Window

The group info window is divided into the tab section, Material ball icon, and configuration check boxes. The four folder tabs are:

- X-Form (Transformation)
- Shading
- Shadow
- Info

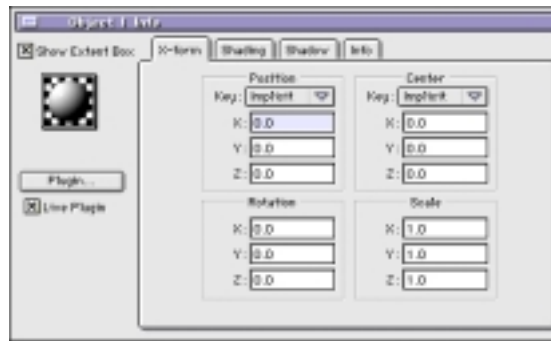


Figure 18 — Group Info Window

Base Options

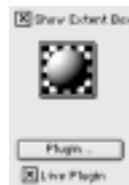


Figure 19 — Material Ball

On the left side of the window you will see either two or four options, depending on what type of object it is. They are not linked under a folder tab, and remain visible at all times.

Show Extent Box

This checkbox toggles on and off the display in the project windows of group bounding boxes.

The Material Ball

The material ball shows shading properties that are set for the current group (it is does not show texture maps or procedural shaders.)


The following two options will only appear if the group's geometry is generated by an active plug-in.

The Plug in Button

When a group is comprised of data generated by a plug-in, clicking this button will open the plugin's configuration window.

Live Plug in

This checkbox toggles on and off the active recalculation of a plugin's parameters when the time thumb is moved (a great time saver.)

For example, if you have a Mr. Nitro group in your project, every time you move the time thumb Mr. Nitro will recalculate the position of the group's fragments. A particle system will do exactly the same thing. Unchecking Live Plug-in will disable this calculation, removing the need for you to type -. (Command-Period) to prevent recalculation.

The X-Form Tab



Figure 20 — X-Form Tab

The X-Form (Transformation) Tab contains spaces which contain X, Y, and Z values for the four geometric transform values of a group:

- Position
- Rotation
- Center
- Scale

Each of these values functions exactly the same as they did in previous versions of ElectricImage. (See *the ElectricImage Series 2 Reference Manual, chapter 13, for more information.*)

In the position and scale sections, you will see a popup menu where you can select Implicit or Explicit keyframe interpolation. The following section will explain the differences in these two types of interpolation. Following this section we will continue with the explanation of the Group Info Window.

Implicit and Explicit Interpolation

As you may have already noticed, all vectorized quantities in ElectricImage (position, reference, center, etc.) now have an extra pulldown menu in their info windows. This pulldown controls whether the quantity is Implicitly or Explicitly translated. Implicit translation is what you have been using in past versions of ElectricImage. Explicit translation allows separate control in our new curve editor for each of the three components (X,Y,Z).

Implicit Translation Example

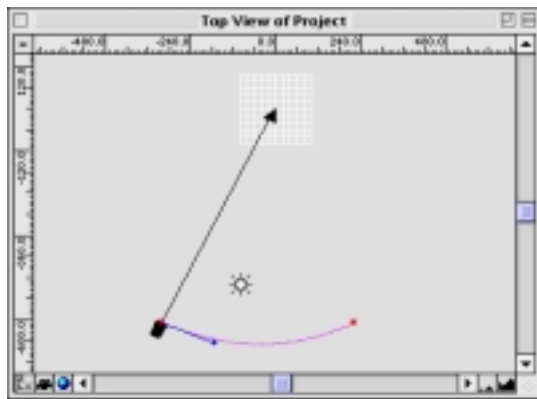


Figure 21 — Top View in ElectricImage

The illustration above shows us the top view of a basic motion path, as you were used to seeing in prior versions of ElectricImage.

The Camera's motion path, as seen above is really a composite of the Z and X channels of the Camera motion path transform. When you drag the Camera in the top view, the Z and X values change but Y does not. Velocity is computed on the composite vector (The vectors of X and Y.) There is no curve available to adjust one of the three components by itself.

Explicit Translation Example

By making the Camera's transformation Explicit, velocity calculations are removed and you are free to independently manipulate the three component vectors of the motion (X,Y,Z).

To make an object's Translation explicit:

- Open the Group Info window for a given object. Make sure that the X-Form window is in the foreground.
- Change the translation of the particular Transformation characteristic from Implicit to Explicit.

The illustration below shows the Position translation being changed to Explicit.

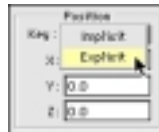


Figure 22 — Changing Implicit to Explicit

The translation value for the object's position is now explicit. Repeat these steps for any other value to change its transformation.

The Shading Tab

The shading tab contains attributes which let you specify the shading behavior of the group.

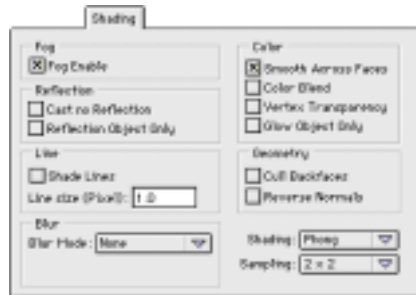


Figure 23 — Shading Tab

The Shading Window is divided into seven sections:

- Fog Section
- Reflection Section
- Line Section
- Blur Section
- Color Section
- Geometry Section
- Shading Pop up Menu Section

Fog Section

Fog Enable

This checkbox enables the group to be affected by any of the global fog settings in the World Info Window's Fog Tab. When this box is unchecked, the object will not be affected.

Reflection Section

The items in this section are pertinent only when automatic reflections such as mirror or environment maps are used somewhere in the scene. They are otherwise ignored.

Cast No Reflection

Enable this check box if you don't want the group to cast a reflection onto another group.

Reflection Object Only

Checking this box will force the group to not render in the scene, but other objects will be able to see it in their reflections.

Line Section

The attributes in this section affect wireframe shading options only. They do not affect the cell/outline shader settings found in the geometry tab of the Material Info Window. (*See the Materials and Texture Maps chapter for further information.*)

Shade Lines

When a group's shading popup is set to wireframe, this check box enables the material attributes assigned to the group to actually shade the wireframes of the group. Very cool.

Line Size (pixel)

Use this value to set the line thickness in pixels for wireframe shading. A value of 0.0 will use the global line thickness settings in the Render Information Window instead.

(Motion) Blur Section

Blur Mode Popup

There are three options for motion blur for every group:

- None
- Point / Line
- Motion Vector

None

No blur is used for the group (default)

Point/Line Motion Blur

This blur option should be used if you wish to blur groups containing points and lines. The line size value is also used by this option when active.

Motion Vector Blur

A very high quality fast motion blur that most closely approximates real photographic motion blur. This setting is the best to use in about 90% of the cases you will come across. At times, the effect does break (such as a fan inside a cage). At those times, you can set the Motion Vector setting at the group level, and choose both the Frame Multisample (set the sample value to 2 and increase as necessary) and Motion Vector settings (use the default) in the Render Information Window. The combination of these two blurs can usually satisfy all but the most ardent critics!

Color Section

Smooth Across Faces

Enables the shading of the group to smoothly blend across the faces that make up the group's shape. If you want to see the individual faces defined, disable this check box.

Color Blend

Blends the color of the vertexes of the group together. Typically, the vertexes of a group are a single color, rendering this option useless. However, you can create some nifty special effects if you have the ability to color individual polygons (most modelers do) and use this feature. For example, you can create a tail cone of a jet with black colored polygons around the edge of the cone closest to the outlet, and the color the polygons around the section closest to the body gray. Enable this checkbox and shade. See how the colors blend together? For added realism in this example, don't color all of the polygons black around the outlet, leave some gray. It looks even better now. This is basically a throwback to the old CGI days, before texture mapping was common.

Vertex Transparency

Certain new plug-ins are able to set transparency values for geometry on a polygon by polygon basis. This will be very useful for plug-ins that simulate fire and other such effects. This type of transparency will be used by the render if this is checked.

Glow Object Only

This option will not shade the group, but will allow its glow settings to be used by the renderer. When combined with particle systems, for example, what you essentially end up with are “fuzzy particles.”

Geometry Section

This section contains controls which directly affect the group's geometry during the rendering process.

Cull Backfaces

Removes back facing polygons (those not seen by the camera) so that they are not shaded at render time. This speeds up rendering (didn't think we could get any faster?) and is great for eliminating the double specular effect present with transparent objects.

Reverse Normals

You can reverse the normals of a group with this option enabled. Unlike most rendering engines, ElectricImage understands that polygons have two sides regardless of the normals for the polygons and will shade the model accordingly. You can turn the group inside out with this feature, or better yet, combine it with the Cull Back faces option. Try this: add a model (don't use the standard shapes plug in with this feature) of a sphere and enable both of these features. When you render, you will see the inside of the back of the sphere. Combine this with edges set to transparent (*see the [Materials and Texture Maps](#) chapter for more information*), and you have yourself the beginnings of a planet atmosphere!

Shadow Tab

The shadow tab controls the shadow casting properties of the group. There are five checkboxes in the tab:

- Cast Shadow
- Receive Shadow
- High Precision Shadow
- Generate Shadow Mask
- Shadow Object Only



Figure 24 — Shadow Tab

Cast Shadow

Enables the group to cast a shadow onto other groups. Defaults On.

Receive Shadow

Enables the group to receive shadows from other groups. Defaults On.

High Precision Shadow

Improves the quality of the shadows that fall upon this group. Defaults Off, because it is usually not needed. If you do not like the way a shadow appears as it falls upon this group, high precision shadow's alternative filtering method might improve the look of it.

Generate Shadow Mask

Creates a “shadow cutter” using this group. The group effectively becomes a mask whenever a shadow from another group would fall upon it. The sections of the group outside of the shadow would be rendered with a value of zero (black) in the alpha channel of the image. You can use this to assist in realistic compositing of rendered objects into real world scenes, and so forth. Use the diffuse color channel to determine the color of the “shadow” that this group becomes. Defaults to Off.

Shadow Object Only

Forces the group to be rendered only during the shadow pass, not during the final render. With this feature you can create low resolution shadow casting groups to make things render even faster! Defaults to Off.

Info Tab

This tab stores information about the group's creation date, the amount of points, lines and polygons in the group, and the extent of the group's volume.

Working with Lights

Introduction

As with real world photography, 3D computer graphics programs need light to properly render an image. It is in lighting that one truly sets the mood of the composition. ElectricImage offers a variety of different light types and lighting effects to help you set the mood you envision. You can animate all of a light's characteristics — there are over 450 channels to work with for a single light (including all of the special effects). The interface is very straightforward, to the point that you don't realize just how much control you have over the light.

Like groups, lights can exist individually or as part of a hierarchy, although they are best placed at the end of a chain or strange results will occur. (*See the chapters on Hierarchy and Constraints, and Effectors and Inverse Kinematics for more information on hierarchy.*) Sometimes you will want to add lights into a hierarchy for scene illumination, other times you may wish to add them for visual effects. Some of the many visual lighting effects available are lens flares, visible lights and light rays, and light projections (where you load an image or movie and it is then “projected” into a scene.) You can also tell lights to include or ignore groups in a scene with selection sets. And you can even tell a light to *remove* light from a scene, by setting its intensity to a negative value!

By default, all projects in ElectricImage start out with one radial light so that you won't be left in the dark. (*For an explanation of the different lighting types, please consult the ElectricImage Series 2 Reference Manual and Addendums.*) Typically you will use many lights in a scene to achieve a desired effect. There are three ways to create new lights in a project:

- Lights can be added from the File menu
- Lights can be added from the Object Palette
- Existing lights in a scene can be duplicated

Working with Lights — New Lighting Features in 2.8

To add a light to a project from the File menu:

- Choose File>Add>Type>Light
- Click and place the light into the scene
- Drag the light into the desired position

To add a light from the Object Palette:

- Click on the light icon in the palette
- Drag the light into the scene from the palette
- Continue to add as many lights as desired

To duplicate an existing light:

- Select the light to be duplicated in either the project window or world windows
- Choose Edit>Duplicate (command-D)
- Drag the duplicate to the desired position

New Lighting Features in 2.8

In addition to the other functions found in the Light Info Window (documented in previous addendums and the Series 2 Reference Manual,) ElectricImage 2.8 offers these new lighting features:

- Illumination lists
- Projection maps
- Lightflare plug in

Illumination lists use the new Selection Set feature to control a light's effect on a particular group of objects. (*See the Selection Sets chapter for more information.*) These lists are

used to either illuminate or ignore only the objects in the list. In other words, if you assign an illumination list to a light, the light will then “see” only those objects in the lists assigned to it for the specified behavior.

Projection maps allow a light to work as a slide or movie projector, up to an including creating light rays colored by the projection map. You can also use this feature to mimic real world lighting, such as “gobos.” (Gobos are patterns placed in front of a light to break up the light in a particular way.)

The Lightflare plug in is a new type of lensflare. It has different properties than the Lensflare, and mimics the lensflare of some other 3D programs. It is provided for your convenience.

The following pages discuss these new features and the new Light Info Window in depth.

Accessing the Light Info Window

Like all Info windows in ElectricImage, the Light Info Window can be accessed using any of the following methods:

- Double click on the light in the World View or Camera Windows
- Double click on the light name in the Project Window
- Choose “Get Info” from the File menu, with the light previously selected

Basic Layout

Below we have an illustration of the Light Info Window. To the left of the Light Info Window you will see a Light Type pulldown menu and a series of check boxes. To the right are a series of named tabs, each containing the controls and functions indicated by the name of the tab. To select a tab, just click on it to bring it forward.



Figure 25 — Light Info Window

The popup menu allows you to select the type of light you want this light to be, and the eight check boxes activate visual representations of specific attributes within the world view and camera view windows. The checkboxes allow the user to have quick visual feedback regarding the parameters of the lights sources without having to render out scenes. Generally, users should use the checkboxes while setting up a scene but be careful to only turn on those references as they refine the attributes. Turning on too many of the attributes at the same time can be a little confusing.

Two new checkboxes have been added in ElectricImage 2.8:

- Show Flare Dropoff
- Show Volume Dropoff

Show Flare Dropoff

This checkbox draws a circular Flare dropoff extent in the world view and camera view windows when selected, and represents the furthest distance from the light that the lens

flare effect will be visible. You can access installed lens flares through the Flare tab in the Light Info Window.

Show Volume Dropoff

This checkbox draws a circular volume dropoff extent in the world view and camera view windows when selected. The volume dropoff compensation will occur inside of the dropoff extent. The volume drop off setting is an edit box located in the properties tab of the Light Info Window (see “Volume Dropoff Edit box” on page 72.)

X-Form Tab

The X-Form (Transformation) tab displays the value of the light’s position, reference, and angles at the current scene time. The roll control is also available here. The functions of these attributes are identical to previous versions of ElectricImage and are covered in the ElectricImage Series 2 Reference Manual and Addendums.



Figure 26 — X-Form Tab

Properties Tab

The Properties tab contains the basic illumination features of the light. These features are covered in the ElectricImage Series 2 Reference Manual and Addendums. ElectricImage 2.8 presents some new features:

- Inner Cone is Offset Check Box
- Volume Dropoff Edit Box
- Illumination Lists

Inner Cone is Offset Check Box

This check box let's you create a great looking spot light cone by typing in just one value instead of two. When you enable this option, an edit box will appear to set the offset distance. 5 ° is a good value for starters, but feel free to experiment. Once enabled, whenever you set the outer cone of the spotlight, the inner cone will adjust to its new value based upon the offset that you provide.



Figure 27 — Properties Tab

Volume Dropoff Edit box

The Volume Dropoff setting is used to improve the look of both glow and fog lights. The purpose of this feature is to prevent spotlight beams from washing out surfaces which

they intersect. The illustration below clearly shows the benefits of using volume dropoff. Most would argue that the image on the right appears more natural than the one on the left. With the exception of enabling the volume dropoff feature for the image on the right, both images use identical values. There is no significant render time penalty to use the volume dropoff feature.

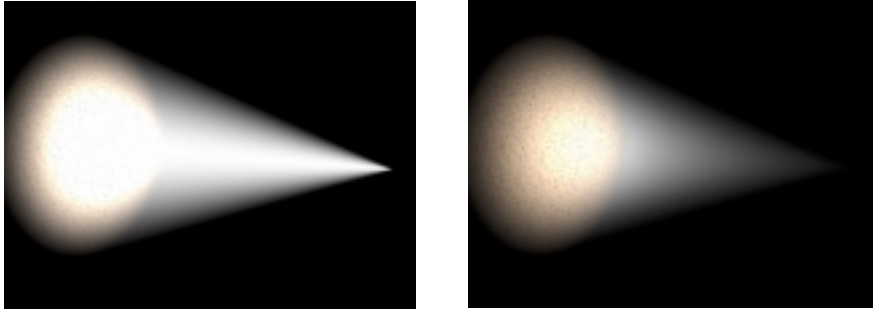


Figure 28 — To the left, Volume Dropoff is disabled, to the right image Volume Dropoff is enabled. All other values are the same.

Smaller values set the dropoff towards the light source, larger values set the dropoff closer to the illuminated object. The Volume Dropoff value represent distance in scene units. Using the ruler bars (command-m) will help to choose the best distances.

Dropoff values visible inside of the glow or fog regions will appear as a parabolic mach band within the region. This effect is similar to seeing a spotlight beam focused in smoke. If this effect is undesirable, increase the dropoff value beyond the range of the glow or fog region. The effect will no longer be visible.

Illumination Lists

Illumination lists provide a way to control which objects receive light from a particular light source. Which objects receive or are excluded from the illumination of a particular

light source are determined by selection sets. (*For information on sets and how to create them please refer to the Selection Sets chapter.*)

Adding Illumination Lists

To add an illumination list to the light, use the following method:

- Click the Add button.
- Select the set from the list window that appears.
- Click the Add button in the list window

You will now see the name of this selection set listed in the Illumination List window.

Enabling/Disabling Illumination Lists

Sets in the Illumination lists are enabled or disabled by clicking on the solid circles to the left of their names (defaults to enabled.) Once clicked, the circle becomes hollow, indicating that the set member will be ignored. This feature works in the same manner as the checkboxes to the left of each group name in the project window.

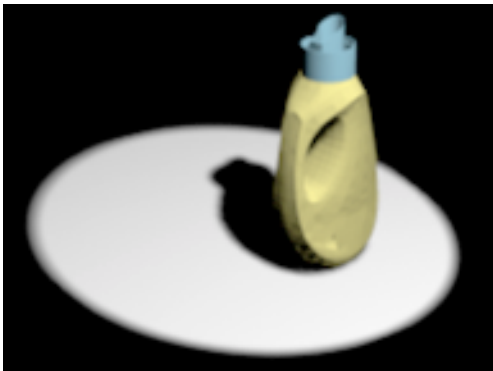


Figure 29 — Normal Render



Excluded Render

Illumination Lists and Light Behavior

Once you assign an illumination list to a light, the light “sees” only those items contained within the selection sets listed for the specified behavior. If the Illumination List is set to be excluding, then those selection sets in the illumination list are not lit by the lightsource. All other objects in the scene will be lit normally. If the Illumination List is set to be including, then only those items contained within the selection sets will receive illumination from the lightsource. All other objects in the scene will be ignored by the light.

Lights can only offer include or exclude behavior, regardless of the number of selection sets within the illumination list. Behaviors cannot be mixed and matched. If such is desired, you would need to create a new light with the corresponding selection sets and settings.

Flare Tab

The flare tab contains all of the parameters to control lens flares for the lightsource. Installed lens flares are available from the popup Flare menu (flares are plug ins and need to be installed into the EI Sockets folder to be available to a project.)



Figure 30 — Flare Tab

Working with Lights — Flare Tab

Previously, Enable Obscuration was the only Lens Flare option. ElectricImage 2.8 provides several more, offering more control.

- Enable Offscreen
- Enable Distance
- Enable Background
- Enable Fog
- Enable Intensity

Enable Offscreen

This checkbox enables the flare to gradually diminish as the origin of the flare moves off-screen. With this option on the flare behaves as the real photographic artifact behaves. The lightsize setting in the Properties tab is used to control the effect.

Enable Distance

This checkbox enables the flare to diminish over distance. The lightsize setting in the Properties tab is used to control the effect.

Enable Background

Allows the lens flare to “glow behind” all objects in the shot. As such, this feature ignores the Enable Obscuration setting. You can add some dramatic backlighting effects to your scene with this feature.

Enable Fog

Causes the flare intensity to diminish as the flare moves into the fog (the fog feature is available in the World Info Window.)

Enable Intensity

Uses the Light intensity setting to calculate the flare intensity. The Light intensity setting is available in the Properties tab. The Dropoff setting for the light will effect the lensflare if this setting is active.

Glow Tab

This tab contains all the information to control the glow properties of your light source. *(These features are all covered in the ElectricImage Series 2 Reference Manual and Addendums.)* ElectricImage 2.8 adds a new feature, Volume Falloff.



Figure 31 — Glow Tab

Volume Falloff

The Volume Falloff checkbox enables the volume dropoff value in the Properties tab to be used when shading the glow or fog region. *For more information, see “Volume Dropoff Edit box” on page 72.*

Fog Tab

This tab contains all the information to set the fog properties of your light source. *(All of the features are discussed in the ElectricImage Series 2 Reference Manual and Addendums.)* ElectricImage 2.8 offers a new item, Volume Falloff, and works exactly the same as Volume Falloff in the Glow window. (See previous tab description.)



Figure 32 — Fog Tab

Projection (Map) Tab

Projection maps are controlled from this tab. Projection maps are single or multiple frame image files, which are projected along the a light's direction vector. Any light that can cast a shadow can cast a projection map. Each shadow casting light is allowed one projection map only

Light projection maps are simpler than camera projection maps (*see “Projection Tab” on page 44 for information on camera projection maps.*) Light projection maps can be used to simulate movie or slide projectors, bulb patterns that are common with flashlights, and so on. In fact, you can think of them as texture maps for lights. Some of the texture map controls are also used in the projection map sub-tabs, covered below.

To Add a Projector Map

- Click on the Add button
- Select an image file
- Double click the file or click on the Open button

The map is now ready for use.

This tab contains several sub tabs:

- X-form
- Properties
- Info
- Crop

Projection Map: X-Form Tab

The Projection Map X-Form (Transformation) tab is used to control the position of the map in the light's local space. The position edit boxes control the X and Y position of the map. The scale edit boxes control the X and Y scale of the map. The Align popup menu (shown extended in the figure below) eases map alignment and fitting. They are discussed below.

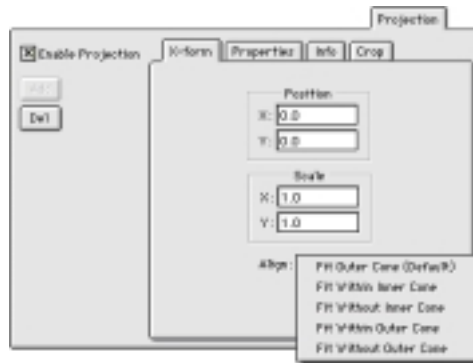


Figure 33 — Projection (Map) Tab: X-Form Tab

- Fit Outer Cone (Default)
- Fit Within Inner Cone
- Fit Without Inner Cone
- Fit Within Outer Cone
- Fit Without Outer Cone

Fit Outer Cone (Default)

This option distorts the projection map to fit inside of the outer cone of the spotlight. Do not use this option if you wish to maintain the map's aspect ratio.

Fit Within Inner Cone

This option fits the rectangular extent of the projection map to the inside of the inner cone of the spotlight. The map's aspect ratio is presented without distortion.

Fit Without Inner Cone

This option fits the rectangular extent of the projection map to the outside of the inner cone of the spotlight. The map's aspect ratio is presented without distortion.

Fit Within Outer Cone

This option fits the rectangular extent of the projection map to the inside of the outer cone of the spotlight. The map's aspect ratio is presented without distortion.

Fit Without Outer Cone

This option fits the rectangular extent of the projection map to the outside of the outer cone of the spotlight. The map's aspect ratio is presented without distortion.

Projection Map: Properties Tab

The Projection Map: Properties tab is used to control the properties of the projection map. Illustrated below, the tab is divided up into several components: Tiling popup menus; Samples edit box; Blur edit box; and a series of checkboxes.

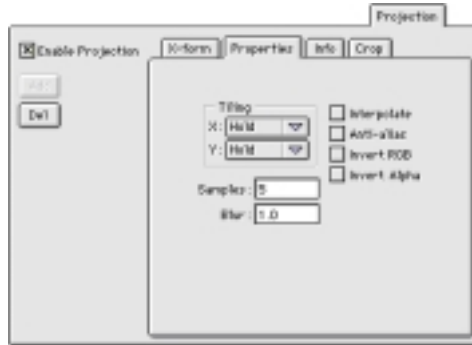


Figure 34 — Projection (Map) Tab: Properties Tab

Tiling Popup Menus

The tiling section controls the repeat functions of the map if it is scaled at less than 1.0 (scale functions are found in the Projection Map: X-Form tab.) There are four options for each popup menu:

- None
- Hold
- Repeat
- Mirror

None

Disables mirroring of the the map on the specified map axis. Choosing None for both axes will cause the map to be displayed only where you positioned it, nowhere else.

Hold

Applies the colors found at the map edges outside of the actual image rectangle. (The map will appear once as positioned, with the border colors of the image extending beyond the image rectangle, covering the frame.)

Repeat

Repeats the map along the specified axis. Choosing Repeat for both axes will cause the map to repeat continuously within the cone of the light, depending upon the scale of the map.

Mirror

Mirrors the map along the specified axis. Choosing Mirror for both axes will cause the map to flip flop about both axes.

Samples Edit box

This edit box lets you determine the sampling quality of the map. The default is 5.0. Numbers greater than 5 will cause the map to be sampled more often, slowing down render time, but increasing the quality of the map. Numbers less than 5 will cause the map to be sampled less often, speeding up render time, but decreasing the quality of the map. Numbers greater than 10 might be prohibitively slow. 5 is a good default, and you will likely not need to deviate from that amount.

Blur Edit Box

This edit box lets you blur the map. The default is 1.0. This value will present the map as is. Values of greater than 1.0 will blur the map. For example, a value of 2.0 will produce a blur of two pixels for every one encountered in the map. Values less than 1.0 will sharpen the map, although it will also introduce aliasing (jagginess) into the map.

Quality Control Check Boxes

There are four check boxes which let you control the quality of the map:

- Interpolate
- Anti-Alias
- Invert RGB
- Invert Alpha

Interpolate

Enables map filtering. Necessary to avoid moire patterns in the map as it rotates off axis.

Anti-Alias

An additional level of filtering for image quality. Not always necessary, and can soften the look of the map.

Invert RGB

Negates the RGB channels of the map for special effects.

Invert Alpha

Negates the Alpha channel of the map. This feature comes in handy when you aren't sure how to design the alpha channel of the map.

Projection (Map): Info Tab

The info tab contains information about the projection map, as well as any cropping that you may have performed on the map.



Figure 35 — Projector(Map): Info Tab

Projection (Map): Crop Tab

The crop tab displays a reduced version of the map and allows you to crop within it, so you can use just a section of the map. To crop, click anywhere on the “crawling ants” border around the edge of the map in the rectangle. Clicking on the edges of the map will drag the entire side of the map. Clicking on the corners of the map drags the corner inward. To reset the map, drag the borders to the extents of the image.

Backdrops, Fog and the World Info Window

Introduction

Backdrops and fog help to create a variety of locations, times of day and weather conditions. Used in conjunction with other rendering features, backdrops and fog can produce striking results. ElectricImage puts these controls in the World object, along with background image color, scene ambient values, and global reflection maps. Unlike other objects in ElectricImage, the world object is more like a “meta object.” Rather than occupying a particular location, the world object exists everywhere in the scene. Like other object classes in ElectricImage, the attributes in the world object can be animated. There are more than 100 potential animation channels for the world object, and even more when you add global reflections.

The world object does not officially occupy a space. It cannot be included in a hierarchy. It has no groups included within it. The world object is listed only in the Project Window.

World Info Window Overview

The World object is included in every project, and is presented at the top of the Project Window List. Like other objects and groups in ElectricImage, the world object has its own information window.



Figure 36 — The World icon in the Project window

There are two ways to access the World Info Window:

- Double click the World icon in the Project Window
- Select the World Icon in the Project Window and choose *File>Get Info (command-I)*

Fog/Ambient/BG Tab

The Fog/ Ambient/ BG window contains three sections:

- Fog controls
- Ambient Color control
- Background Color control

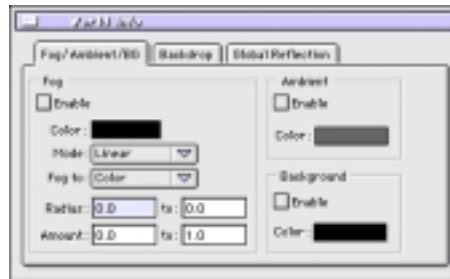


Figure 37 — World info window

The Fog Controls



Figure 38 — Fog control window

Fog, or Fog Projection, simulates atmospheric depth cuing. Atmosphere has depth because of particles contained within it, which gives Fog the appearance of being more

dense the further away it is from the Camera. While it can simulate distant haze or fog in a landscape, it does not induce atmospheric effects such as visible light shafts or shadows.

There are a number of items in the Fog Controls section:

The Enable checkbox

This checkbox enables the Fog effect. It defaults to off.

The Color Box

Clicking this box will bring up the ElectricImage color picker. There, you can select a color for your fog.

The Mode menu

This menu determines the type of transition that will occur between the region in which the fog effect starts, and the region in which the fog reaches its maximum density. (The fog region starts at the center of the active camera body and extends outward in all directions by the specified distance.) There are two choices under this menu:



Figure 39 — The Mode Menu

The default option, Linear, gives an even increase in the density of the fog region. The rate in which density increase will be constant throughout the length of the fog region, as defined by the Radius boxes (below.)

The second option, Exponential, will calculate the density of the fog in a more realistic, non-linear fashion. This option renders results similar to Pixar's RenderMan[®] fog shader.

Fog To Menu

This menu determines the type of fogging technique to be used. There are three choices under this menu:



Figure 40 — The Fog Menu

The default option, Color, will calculate fog to the color specified in the Fog Color box. As the fog gets further and further away from the Camera, it will become closer and closer to the specified color. This is exactly the same as doing a gradient fill in a paint program, where the gradient tool is set to fade from transparent to a color. No matter what color you may have selected for a Background Color, the fog will calculate to the designated fog color.

The illustration below shows us a linear fade from transparent to blue. The further away from the camera the fog is, the more dense it becomes.



Figure 41 — A linear fade to color

The second option, Alpha, will calculate the fog to an alpha value of 0, which is totally transparent. When this is digitally composited over a background image, the objects enveloped by the fog will eventually fade out to the composited background.

The illustration “A linear fade to a transparent alpha value” on page 89 below shows this principle at work. On the left the fog has an alpha value of 100, which is totally opaque. As the fog gets further away from the camera, the alpha value decreases to 0. This does not fog itself transparent - the fog value actually fades the the objects in the scene itself.

Think of the check pattern as the objects in your scene. On the left the fog is 100% opaque. The farther to the right the fog goes, the more it's alpha value begins to get closer to 0. As it does so, the check pattern begins to become transparent, allowing the background image to show through (which in this case is set to white, to match the white color of the page.)



Figure 42 — A linear fade to a transparent alpha value

The final option, Background, calculates the fog to the background color, as set in the Background Color box (see below.)



Figure 43 — shows us a fade to a background color.

This is essentially the same as the first option, Color. The difference, however, is that while Color calculates the fog to the color designated in the fog color box, Background calculates the fog to the designated Background Color.

The Radius boxes

These edit boxes contain values that define the inner and outer fog radii of the camera. The first box represents the point where the fog will begin, and the second box designates where the fog will end. These two values are known respectively as the Inner Radius and Outer Radius.

The inner and outer fog radii are drawn in the world view windows as two circles which enclose the camera controls. These circles are only visible if the camera is selected, and if Show Fog is checked in the Camera Info window.

The illustration “The Inner and Outer Radii” on page 90 shows us these two circles, with a red fade pattern added to illustrate the principle. From center point (the camera) out to the

first circle, which is a dashed circle, the fog effect is not seen. This first circle is the Inner Radius circle. From the Inner Radius circle to the second, large solid circle, the fog value fades from the Inner Radius value to whatever Fog To option (Color, Alpha, or Background) has been selected. This second circle is known as the Outer Radius. From the Outer Radius onward to infinity the fog is at full value.

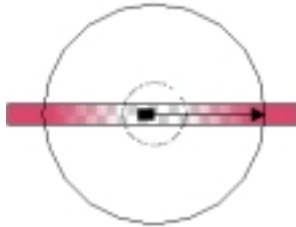


Figure 44 — The Inner and Outer Radii

The Amount Boxes

These boxes function in essentially the same way as the fog radius boxes. However, instead of determining the start and stop points of the fog radius, they determine the opacity value of the fog at the start and stop points. These values in these boxes range from 0 to 1, with 0 being 100% transparent and 1 being 100% translucent.

While it is possible for you to enter a higher value than 1, you will not ever get a value higher than 100%, so make sure you don't enter a value of anything other than numbers between 0 and 1 in these boxes.

The first box shows the fog opacity value between the camera and the inner radius. The second number designates the opacity value at the outer radius and beyond.

The illustration "A fade from 0.2 to 0.9." on page 91 shows this effect. Let's assume we have a dark green color selected for our fog. Instead of going from 0 to 1 (transparent to opaque) we will go from 0.2 to 0.9.

From the camera to the first arc (the Inner Radius) the light green value is solid. From the Inner Radius to the second arc (the Outer Radius) the dropoff occurs. From the Outer Radius onward the fog is at full value.



Figure 45 — A fade from 0.2 to 0.9.

The Ambient Color Controls

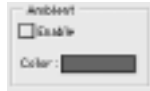


Figure 46 — The Ambient Light Control

The Ambient Color Controls set the color of global ambient light in a scene. There are two items in this section:

The Enable checkbox

This checkbox enables the ambient light effect. The default is off.

The Color Box

Clicking this box will bring up the ElectricImage color picker. There, you can select a color for your ambient light.

The Background Color Controls

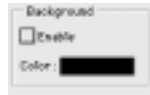


Figure 47 — Background Color Controls

The Background Color Controls set the color of the background in a scene. When unchecked, the default black background will be rendered in your scene.

The background color is actually colorizing the alpha channel of the image. If you import a 32 bit ElectricImage file into an application such as Adobe ®Photoshop®, the background will appear black, regardless of the color you have set. This occurs because Photoshop does not support colorized alpha channels.

There are two items in this section:

The Enable checkbox

This checkbox enables the background color. The default is off, which produces a background color of black.

The Color Box

Clicking this box will bring up the ElectricImage color picker. There, you can select a color for your background.

Backdrop Tab

The World Info Window contains new features under the backdrop tab that procedurally generate ramped color sky and ground planes. This feature can be used while initially setting up your project to give your test renderings a better sense of scale.



Figure 48 — The Backdrop Tab

There are two main sections in this window:

- Sky
- Ground

The Sky Controls

The Sky Controls give you the ability to designate custom background colors sky. There are four items in this window:

The Enable Check Box

This checkbox enables the sky color effect. The default is off.

The Horizon Color Box

Clicking this box will bring up the ElectricImage color picker. There, you can select a color for the sky at the horizon line.

The Zenith Color Box

Click this box to enter a color value for the sky at the Zenith line.

The Horizon is the point at which the sky meets the ground. The Zenith is the upper region of the sky that is positioned directly above the camera.

The Transition Box

This value sets the midpoint of the transition between the Horizon Color and the Zenith Color. Higher values move the midpoint closer to the horizon, thus showing more of the zenith color. Lower values, such as the default 1, will show more of the horizon color.



Figure 49 — The default sky colors



Figure 50 — The sky colors with a transition of 3

The Ground Controls

The Ground Controls function in exactly the same manner as the Sky controls do. There are four items in this window:

The Enable Check Box

This checkbox enables the ground color effect. The default is off.

The Horizon Color Box

Clicking this box will bring up the ElectricImage color picker. There, you can select a color for the ground at the horizon line.

The Nadir Color Box

Click this box to enter a color value for the ground at the Zenith line.

The Horizon is the point at which the ground meets the sky. The Nadir is the lower region of the ground that is positioned directly below the camera. The Nadir is diametrically opposed to the Zenith.

The Transition Box

This functions in exactly the same manner as the sky transition box. Higher values move the midpoint closer to the horizon, thus showing more of the nadir color. Lower values, such as the default 1, will show more of the horizon color.



Figure 51 — The default ground colors



Figure 52 — The ground colors with a transition of 6

When both items are enabled at the same time, the following image appears when rendered:

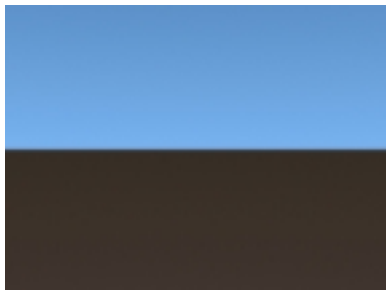


Figure 53 — A rendering with the default settings

The Global Reflection Tab

The third tab contains a list of Global Reflection maps that are accessible in each group's material interface.



Figure 54 — The Global Reflection Tab

To add a reflection map to this window, click the Add button. A standard Open dialog will appear. Simply navigate through your computer, find the map you wish to add, and select okay.

When setting an object's reflectivity value in the Material Info window, you will notice a checkbox called Use Global Reflections. Any object that has this item checked will reflect the reflection maps added to this window.

Please see the Materials and Textures chapter for more information.

Rendering

Introduction

Rendering is the process in which all of the elements in a scene (models, lights, cameras, textures, etc.) are combined, and used to generate a final picture or movie. It is analogous to the photographic exposure of a scene recorded by the film in a camera. ElectricImage is known to have the world's fastest 3D rendering engine. That is not an idle boast. From time to time we often compare the variety of 3D software programs with our own, comparing features and timings. In most cases with the most popular of our competitors, ElectricImage is typically 6 to 15 times faster to create the same image. Often our image quality is superior, as faster render times let us perform better anti-aliasing.

The ElectricImage rendering engine, Camera, was designed from the ground up as a motion picture production rendering system. It can handle an incredible amount of data (currently topping out at 30,000,000 polygons, although this is an artificial limit) in a very short amount of time. With the introduction of Motion Vector blur in version 2.0, ElectricImage achieved a design goal of supplanting motion control model photography in many studios for most situations.

Newer features and faster rendering speeds are always packed into subsequent versions, each time setting the pace for the other packages to follow.

Rendering is very different from ray tracing, a common rendering technique used by many hobby level programs and some production renderers. Rendering requires more hands on attention from you than ray tracing, especially when dealing with shadows, and to a lesser degree, reflections. As advances in hardware make ray tracing more practical on a production basis, ElectricImage will incorporate those functions into the renderer. Until then, a little extra attention to shadows and reflections will yield very good results, in an order of magnitude less time than ray tracing.

Rendering — Render Info Window

Technically speaking, the rendering engine of ElectricImage (the Camera application) transforms the models into optimal segments for rendering speed, caches the texture maps to RAM (or the hard drive), generates shadow maps and color buffers, and then applies the desired shading algorithm and render settings to the geometry in the scene. It is also during this stage that effects like anti-aliasing, motion blur, and glow are applied. All of these complex processes take place transparently to you after clicking on Go to launch the render. It is in the Render Information Window that the settings which control all these various rendering parameters are applied.

Render Info Window

In order to give the user maximum control over all aspects of the rendering process, the Render window in ElectricImage 2.8 has been divided into folder tabs. This chapter will explore each of these sections and explain what their functions are, as well as how these settings affect other group and object settings.

There are two ways to access the Render Info Window:

- Choose File>Render...
- Type command-r

The Render Info Window will then appear.

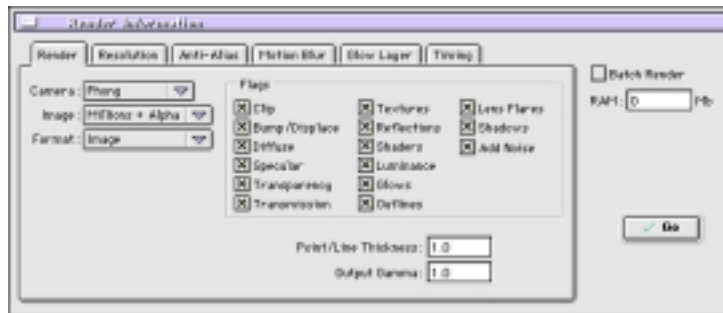


Figure 55 — The Render Info Window

This is the window where general rendering parameters are set, such as the global shading level, color depth, and the image format. This is also where global rendering flags are set, allowing the user to enable and disable specific parameters on a per-render basis. Each of these areas is explained in depth in this section.

The Render Tab

The render tab in the Render Information Window contains global shading level attributes for shading method, image quality, format, activation flags and gamma control.



Figure 56 — The Camera shading popup menu

The Camera Menu

This menu sets the maximum shading level for a render. The default is Phong shading, and this will provide the highest quality rendering for most projects. If this global shading level is set to a lower quality than an individual group or object's shading level, the global setting will be override the objects' setting. For instance, if an object is set for Phong shading and the global is set for Flat shading, the object will be rendered using flat shading. This allows the user to render an entire scene quickly using a lower quality shading level for motion tests and other previews. However, if the global is set to a higher quality shading level, individual objects in the scene can still be set to render at any of the other lower shading levels on a per object basis. This allows for a mixture of shading methods (i.e., wireframe objects with Phong rendered objects) in the same scene.

There are four basic shading algorithms currently available in ElectricImage. Listed by increasing quality and render time they are:

- Wireframe
- Flat

- Gouraud
- Phong

Wireframe

Wireframe rendering is the fastest of the four rendering methods, and renders out a simple wireframe mesh image. This option will override any of the other shading methods set at the group/object level.

To control line thickness enter a value in the Point/Line thickness box. Higher numbers result in thicker mesh lines (see illustration “The Point/Line Thickness Box” on page 109). Here are examples of Wireframe shading using various Point/Line Thickness settings:

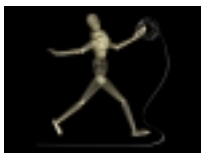


Figure 57 — P/L Thickness: 1.0 P/L Thickness 3.0

P/L Thickness 5.0

Flat Shading

Flat shading is the fastest, but lowest quality, solid rendering algorithm. Solid rendering allows for full hidden surface elimination, which is helpful for quick test renders in order to make sure objects aren’t intersecting with each other improperly. Flat shading, also known as constant shading, applies a light source to only one point on each face of a model. This can give a rendered image a faceted, blocky appearance. Using this global setting, individual objects can use both flat, and wireframe shading, at the group/object level. It will however, override the shading level for any group/object that is set for Gouraud, or Phong shading.

Gouraud Shading

Gouraud shading results in a higher quality solid rendering than Flat Shading, but is slightly slower. Rather than applying a light source to only one point on each face of a

model, Gouraud shading calculates the light source based on the vertices of the polygons that make up a face. These values are then interpolated to give a slightly smoother appearance than flat shading. The net result is that for a slight increase in render time, objects appear smoother and more naturally shaded than they do with Flat Shading. With this global setting, individual objects can use wireframe, flat, and Gouraud shading at the group/object level. This global setting will however, override the shading level for any group/object that is set for Phong shading

Phong Shading

Phong shading, the default, is the most time consuming solid renderer, using an algorithm that creates the most natural, smooth shaded images. Phong shading calculates the light sources from multiple points across the surface of a model, instead of just at the vertices of the component polygons. The result is more realistic specular highlights on surfaces as well as the most natural shadowing and light sourcing of any of the shading methods. This global shading level allows for all shading types to be active at the group/object level for the maximum amount of control.

The Image Menu

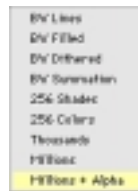


Figure 58 — The Image popup menu

The Image popup menu determines the final bit depth of the rendered image. Bit depth represents the number of colors used in the palette of an image. Black and white images are 1-bit (black or white), 256 Color and grayscale images are 8-bit, thousands of colors are 16-bit, millions are 24-bit, and millions + alpha are 32-bit. These color depths are all processed as a post-rendering effect, as all ElectricImage rendering algorithms are initially

computed in the 32-bit color (Millions+Alpha) Image format. After rendering the image in 32-bit color, ElectricImage then converts the image to one of the settings defined above. Thus, it is important to note that there will be NO savings in render time or speed by rendering in less than 32-bit color. It may actually take longer to render in one of the other modes, as there is an extra step which takes place after the render is complete.

The options for this pop-up are:

BW Lines

Renders an image with lines only, in black and white only.

BW Filled

Renders an image with filled polygons, in black and white mode, similar to flat shading.

BW Dithered

Simulates a smooth shaded image using a fixed dither pattern, in black and white. The dither is similar to the dither patterns found in the original MacPaint program from 1984.

BW Summation

Renders a black and white image using summation dithering, a higher quality dithering. This dither uses randomly placed dots to make the image appear to be more smoothly shaded. From a distance, the image appears as a continuous tone.

256 Shades

This option converts the image to 256 shades of gray (8-bit). No histogramming is required for 256 Shades as it is converted directly to gray scale from the original 32-bit palette. Therefore, there is no rendering time penalty for this option.

256 Colors

This option converts the image to an optimized 8-bit color palette. 256 Color animation's

are histogrammed from the original 32 bit IMAGE file, resulting in a consistent frame-to-frame color palette. This means that a 256 color animation will maintain the same color palette throughout the entire animation. There will be a time penalty for the histogram process to occur, and the amount of time required is directly related to the amount of frames in the movie file.

Thousands

This option converts the image to a 16-bit color palette (32,768 colors) after rendering. As noted above, this does not speed up render time as the image is initially created in 32-bit.

Millions

This option renders the image in 32-bit color and discards the alpha channel, resulting in a final 24-bit image.

Millions+Alpha

This option renders the image in 32-bit color, creating a 24-bit RGB image with an embedded 8-bit alpha channel.

The Format Menu

The Format pop-up menu determines the file format for the final, rendered image.

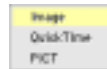


Figure 59 — The Format Menu

Image

The original file format, used since the origin of ElectricImage. The Image format is a robust, 32-bit color format. It is also natively supported by many other, high-end graphics packages such as Adobe Photoshop® and After Effects®. Files stored in the Image format

can be displayed within ElectricImage by using the display option in the File menu, or by using the separate Projector application. Additionally, a utility program bundled with ElectricImage, ImageToQuickTime, will convert an Image file to a QuickTime movie.

QuickTime

Created by Apple Computer[®], QuickTime[™] is a digital movie format that has become a standard across multiple platforms. Choosing the QuickTime format brings up a dialogue that offers the choice of any installed hardware or software compression CODEC's.

It should be noted that settings made in the CODEC window will override both the frames per second, and the Image Depth, settings in the Render window. For instance, even if you set the Image Depth to Millions+Alpha in the Render window, if you choose millions only in a QuickTime CODEC the image will be stored in millions of colors, WITHOUT the alpha channel. Also note that any slave machines used for rendering must have the same QuickTime CODEC installed as selected on the host machine.

PICT

The PICT file format is another cross platform image format which began on the Mac. Unlike QuickTime, the PICT format is used for single frame images, rather than animations. If PICT is chosen for a multi-frame render, a series of sequentially numbered PICT files will be saved. PICT files have the same CODEC options as a QuickTime movie.

Flags Section

These check boxes are used to turn on and off various effects for rendering. Any box that is checked enables that function. This has no effect on the settings of a given group or object, but simply turns off that function temporarily during the render. Any objects that use these effects (i.e., reflections or shadows) will still maintain their settings, and will render properly when the appropriate flag is re-enabled. This allows the user to enable and disable specific effects and functions on a global, per render basis. For instance, while

doing a test render it might not be necessary to calculate shadows, so the Shadows box can be unchecked to save time until a final render is needed.



Figure 60 — The Flags section

At many professional effects houses a trick that is often employed is to render out the same image using multiple passes, and then compositing the different passes together to form the final image. One render will be made just for the reflections, while another will be done for the diffuse light, another for glows, and so on. Then, in a post-processing program these layers can be combined with the utmost accuracy and flexibility, even changing over time.

The Flags control the following functions:

Clip

This check box controls whether or not clip maps are rendered. This option defaults to on.

Bump/Displace

This check box controls whether or not bump and displacement maps will be rendered. This option defaults to on.

Diffuse

This checkbox controls whether or not the Diffuse channel will be used during rendering. This option defaults to on.

Specular

This check box controls whether or not specular maps will be used in the rendering process. This option defaults to on.

Transparency

This check box controls whether or not transparencies or transparency effects will be rendered. This option defaults to on.

Transmission

This check box controls whether or not transmission effects and maps will be rendered. This option defaults to on.

Textures

This check box controls whether or not any texture maps will be rendered. This option defaults to on.

Reflections

This check box controls whether or not any reflection maps will be rendered. This option defaults to on.

Shaders

This check box controls whether or not procedural shaders will be rendered. This option defaults to on.

Luminance

This checkbox controls whether or not Luminance effects will be rendered. This option defaults to on.

Glows

This check box controls whether or not glow effects are applied to the render. This option defaults to off.

Outlines

New to ElectricImage 2.8, this check box controls whether or not the Cel/Outline shader functions are enabled. It defaults to off. By enabling this check box, and by also activating the Cel/Outline shader options in a groups' material window, a variety of effects can be achieved. The Cel/Outline shader allows for separate color and thickness to be assigned to polygons, edges, and silhouettes of models. *(For more information on this please refer to the Materials and Surfaces chapter.)*

Lens Flares

This check box controls whether or not lens flare effects will be rendered. This option defaults to off.

Shadows

This check box controls whether or not shadows will be calculated and rendered for an image. This option defaults to on.

Add Noise

This check box adds random noise to rendered images to reduce mach banding (very discernible differences in what should be smooth color transitions), especially prevalent in darker colors of the 32-bit color space. This option defaults to on.

Point/Line Thickness

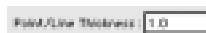


Figure 61 — The Point/Line Thickness Box

Rendering — The Resolution Tab

When a scene is rendered in wireframe, the Point/Line Thickness edit box allows the user to specify the thickness of points and lines in pixels. The default is 1 pixel. Higher numbers will give the wireframe mesh thicker lines. (See the illustration “P/L Thickness: 1.0 P/L Thickness 3.0 P/L Thickness5.0” on page 102 for an example.)

Output Gamma

Gamma is a technical term used to describe the intensity of different levels of gray as they appear on an output device; usually either a computer monitor or video screen. Standard gamma settings range from 1.0, up to 2.2 depending on the output device. Mac monitors are often much brighter, and thus have a higher gamma level than PC monitors. If you intend to render for target devices other than the Macintosh, consider using a gamma of 2.2, as it is the most common. NTSC, many film recorders, and many print devices use a gamma of 2.2.

The Resolution Tab

The Resolution Settings tab is where all of the parameters for the resolution of the final rendered image are set. In this window there are options for setting the aspect ratio, resolution, cropping, and VR rendering functions.



Figure 62 — The Resolution Tab

The Aspect Ratio Menu

The Aspect Ratio popup menu defines the relationship between the x and y pixels of the image. This relationship is known in technical terms as the aspect ratio. This ratio is commonly stated as “x resolution in pixels: y resolution in pixels”, simplified to the lowest common denominator. Therefore, a standard Macintosh screen with a resolution of 640 pixels horizontally (x) and 480 pixels vertically (y) has an aspect ratio of 4:3. Usually, when discussing film resolutions, the aspect ratio is specified as a ratio with y always equal to 1. For instance, IMAX film requires a very square 1.22:1 ratio, while 70mm uses an ultra wide 2.20:1 ratio. There are a number of preset aspect ratios defined in ElectricImage, or the user may choose to enter their own Custom aspect ratio. What aspect ratio you choose depends solely on the final format required for output. By choosing one of the pre-defined aspect ratios, the rendered image will be constrained to the proper pixel ratio for that format.



Figure 63 — The Aspect Ratio Menu

An important consideration when using one of the preset aspect ratio's is how it affects the field of view of the camera. Not only does film stock vary in aspect ratio, it also correspondingly varies in the amount of information it can record, or the Field of View. One way to consider how the field of view relates to the aspect ratio is to visualize a physical piece of film stock. When you look at it, it has a tangible measurement of x inches horizontally, and y inches vertically. One factor is the relationship of these two measurements to each other. Those measurements will give you the aspect ratio, and determine how wide or square an image will appear when projected. The other factor is the physical size of the

film stock itself. Although both Super 8mm film, and 35mm Full format film have the same aspect ratio (1.33:1), you can see a lot more on 35mm film, shooting the same subject at the same distance, and using the same lenses. In other words, if you put the exact same lenses on both cameras, say 25mm, and shoot from the exact same distance, the 35mm film will have a significantly wider field of view and you will see more information recorded on the film. Why? Because 35mm film is physically larger and has about 4 times the surface area of Super 8mm film on which to record an image. So it is very important to remember that you are determining not only the width, or aspect ratio, of an image, but also it's relative field of view. Of course, in 3D you can use any lens, regardless of the aspect ratio, in order to create a specific field of view, but the film stock is an important factor in this equation. *(For more information on Focal Length and Field of View, please refer to the Assigning and Using Cameras chapter.)*

Note that the aspect ratio is locked to the X resolution. Any number entered in the X box will automatically calculate the proper Y resolution based on the currently selected aspect ratio. However, numbers can be entered manually in the y resolution and do not automatically convert the x value to the correct aspect ratio. Therefore, if you want the aspect ratio to be automatically calculated, always enter your resolution in the X edit box, and let ElectricImage calculate the proper Y resolution.

For reference information, the field of view in horizontal degrees, assuming a 37 mm Focal Length lens, is given with each preset choice (we have rounded up from 36.8699). The aspect ratio choices are as follows:

Custom

This option brings up a dialogue box for entering a custom aspect ratio. The pop-up menu on the right allows the user to specify the measurement system in millimeters, centimeters, or inches. Then, simply enter the specific film gauge measurements in both x and y dimensions, or enter an aspect ratio in the Frame Aspect edit box.

This dialogue box is very useful for entering custom measurements when you are trying to match a film stock that is not one of the presets, or you need to match a particular aspect ratio from another 3D package, or to suit a specific programming need.

Computer

This option (the default) specifies the 4:3 aspect ratio of a standard 640x480 computer screen. The horizontal field of view using a 25 mm lens is 3.0 degrees.

If you are doing multimedia work for a standard computer screen, this is the setting that you would use most often.

Super 8mm

This option specifies the 1.33:1 aspect ratio of Super 8mm film. The horizontal field of view using a 25 mm lens is 12.1 degrees.

16mm

This option specifies the 1:38:1 aspect ratio of standard 16mm film. The horizontal field of view using a 25mm lens is 23.2 degrees.

Super 16mm

This option specifies the 1.7:1 aspect ratio of Super 16mm film. The horizontal field of view using a 25mm lens is 28.1 degrees.

35mm

This option specifies the 1.37:1 aspect ratio of standard 35mm film. The horizontal field of view using a 25mm lens is 47.4 degrees.

35mm Full

This option specifies the 1.33:1 aspect ratio of 35mm Full format film, also known as Academy Aperture or “four perf,” for the amount of sprocket perforations used per frame as

Rendering — The Resolution Tab

the film runs vertically through the camera. The horizontal field of view using a 25mm lens is 52.9 degrees.

VistaVision

This option specifies the 1.5:1 aspect ratio of VistaVision format, with 8 horizontal perforations per frame. The horizontal field of view using a 25mm lens is 74.1 degrees.

65mm

This option specifies the 2.28:1 aspect ratio of 65mm vertical 5 perf film. The horizontal field of view using a 25mm lens is 92.8 degrees.

IMAX

This option specifies the 1.22:1 aspect ratio of 65mm horizontal 15 perf IMAX film. The horizontal field of view using a 25mm lens is 109.25 degrees.

70mm

This option specifies the 2.20:1 aspect ratio of 70mm film running vertically through a motion picture camera. The horizontal field of view using a 25mm lens is 88.3 degrees.

TechniScope

This option specifies the 2.35:1 aspect ratio of TechniScope film. (TechniScope is also referred to as “two perf,” as it divides the vertically oriented 4 perf standard 35 mm frame into two frames, each using two sprocket perforations.) The horizontal field of view using a 25mm lens is 88.3 degrees.

Image Resolution Menu

The Resolution popup menu determines the final number of pixels to render for an image. This resolution will be constrained by the chosen Aspect Ratio.



Figure 64 — The Resolution menu

The resolution of an image has little effect on the amount of memory required to render, but does increase the number of passes needed, due to the additional pixels, and increases render time.

You should note that the resolution has no effect on the field of view. You won't be able to see twice as much of a scene by doubling the resolution. In order for the camera to "see" more of a scene, it is necessary to either change the aspect ratio and/or the focal length of the camera. The resolution setting merely renders more or less pixels in a given image. The amount of information seen by the camera is the same, regardless of the resolution.

The choices for image resolution, based on a Computer aspect ratio of 4:3, are:

- 260x200
- 320x240
- 640x480
- 1024x768
- 1280x960
- 2048x2048
- 4096x4096
- Main Screen (the default): This setting uses the resolution of the primary monitor.
- NTSC: (720x486) The standard television resolution used in North America and Japan.

Rendering — The Resolution Tab

Pixel ratio =.9 (See below for explanation of Pixel ratio)

- PAL: (768x576) The standard television resolution used in many European countries, including England, and Germany.
- HDTV: (1920x1280) The mythical, high definition television format that may appear in the United States one day, but most likely not at this resolution and no longer called HDTV.
- Abekas NTSC: (720x486) Resolution used by Abekas direct disk recorders at NTSC resolution. Pixel ratio=.9.
- Abekas PAL: (720x576) Resolution used by Abekas direct disk recorders at PAL resolution. Pixel ratio= 1.0667.

X and Y Edit Boxes

These edit boxes allow the user to directly enter values for resolution rather than choosing from the resolution pop-up menu. The X value will automatically constrain the Y value to the chosen aspect ratio, but not vice-versa. The maximum theoretical resolution is 32,760 pixels by 32,760 pixels.



Figure 65 — The X and Y Edit Boxes

Pixel Aspect Ratio

This edit box allows the user to control the aspect ratio of each rendered pixel. Most computer screens display square pixels, at a pixel ratio of 1.0. However, broadcast television signals, including NTSC, PAL, and HDTV do not use square pixels. Therefore, by altering

the pixel aspect ratio, non-square pixels can be rendered. The value in this box will automatically change when specifying a resolution in the resolution popup.



Figure 66 — The Pixel Ratio box

Rendering with rectangular pixels will tend to make images look stretched out when viewed on a computer screen, but after being properly processed and sent to video tape they should appear normal.

Image Cropping

New to ElectricImage 2.8, is the image cropping function. This allows for only a portion of an image to be rendered. There are two ways to use the new cropping feature. First, the enable cropping check box must be checked in the Render window. Next, values from 0 to 1 can be entered directly in the text boxes in the cropping area, where 0 represents left / top, and 1 represents right / bottom. When the image is sent to render, only the area within the cropping guidelines will be rendered.



Figure 67 — The Image Cropping options

More usefully, the crop region can be seen and interactively set. By option-clicking on the title/safe pulldown symbol at the bottom of the Camera View and selecting Crop, a visual guide will appear in the camera window. This region can now be interactively resized using the Drag Cropping tool found under the tools pulldown menu. When the render is sent, only the area within the visual cropping guides will be rendered.

Rather than just a temporary selection, like the method of rendering Selected Size, the Crop region can be saved, turned off and on, and easily moved and resized.

This kind of selective rendering option can be extremely useful when you have a scene set up, and you need to preview specific areas of the scene, but don't want to wait while the computer renders everything in the scene. Rather than turning a bunch of objects off and on, or setting up multiple cameras, you can selectively set a cropping region around the object you wish to and render. There is also a new shortcut under the preview render icon, Cropped Size, that allows you to instantly render the cropped selection, or to render a selection within the cropped area, Selected Cropped Size.

QuickTime VR Image Format

The options for outputting a QTVR image are as follows:

QuickTime

When using this option in the image format pop-up menu, ElectricImage generates a final, diced, compressed QTVR movie. You can play it back, distribute it, or use it as a basis for creating a multi-node movie. When using the QuickTime option, you will be prompted to select a CODEC for compressing the QTVR movie.

It should be noted that ElectricImage can only generate single node movies. You will need to obtain additional tools, either from Apple or a third party, in order to create multi-node, or other special QTVR movies.

PICT

When using this option in the image format pop-up menu, ElectricImage will generate a final, stitched, warped panoramic image in the Pict format. Warped PICT files are then used with other authoring tools to create QTVR nodes and movies. One major advantage to this method is that the finished image can be touched up and rotoscoped, prior to being

compressed and included in a node. You should be aware, however, that this format does not create a QTVR movie, and you will need other software to make a finished QTVR node.

Image

When using this option in the image format pop-up menu, ElectricImage will generate a final, stitched, warped panoramic image in the Image format. There are no real differences, aside from the format, between this and a warped pict file.

QuickTime VR Object Movies

New to ElectricImage 2.8 is the ability to create object movies through the VR pop-up menu. A Quicktime VR Object movie is a VR movie that tracks a single object around a 360 degree axis. Rather than the viewer panning and tilting across a panorama, an object movie allows the viewer to spin and rotate a single object around it's own axis.

Simply place the object you want to rotate at 0,0,0 on the global axis. Then, select Object from the VR popup menu. This will bring up an additional dialogue box allowing you to set the number and angle of Horizontal (Latitude) and Vertical (Longitude) samples needed. By default an object movie will utilize a 360 degree axial rotation, starting at 90 degrees Latitude, 0 degrees Longitude and rotating to 90 degrees Latitude, and 360 degrees Longitude. To create a smoother object movie, more samples can be created per rotation, by entering a value in the Sample edit box.

Unlike QTVR Panoramas, QTVR Object movies do not have set requirements for FOV or Resolution. These are left up to the user.

The Anti-Alias Tab

The anti-alias tab contains all of the settings which control final image quality.



Figure 68 — The Anti-Alias tab

The Anti-Alias Menu



Figure 69 — The Anti-Aliasing popup menu

The Anti-Aliasing popup menu determines the type of anti-aliasing used when rendering. The choices are:

None

This option specifies that no anti-aliasing will be used on the image. Edges and outlines may have a jagged, rough appearance.

Adaptive

This option specifies that adaptive anti-aliasing be performed on the render. This produces a softer image than None, and a sharper image than the Oversample. Thin, sharp lines may cause artifacting when rendering for video output, and using Oversampling may be more effective in these cases.

Oversampling

This option (the default) specifies that Oversampling be performed on the render. This produces the softest images with the smoothest edges, and significantly reduces video artifacting caused by jagged edges.

The Anti-Aliasing Levels Menu



Figure 70 — The Anti-Aliasing Levels menu

4x4

(The default) This setting is generally sufficient for most images. Lines and edges maintain a sharp, detailed appearance. High contrast vertical and horizontal edges can cause artifacts, and moire patterns, for which the 8x8 setting may work better.

8x8

This setting is useful when a slightly smoother, softer look is required. Lines and edges will appear less crisp than when using the default, and may reduce moire patterns and artifacts. Be aware, however, that this setting may slow down rendering time significantly over the default 4x4.

16x16 (and higher)

These settings should only be used in specific instances where a very high level of anti-aliasing is needed. For the vast majority of renders, these sampling levels will produce an image that is indistinguishable from one rendered at a 4x4 or 8x8 level. However, rendering time goes up dramatically when using these levels.

The Sampling Levels Menu

Object sampling levels are set in the group info window for each object. The values in the sampling level menu are used to determine the maximum amount of sampling allowed at render time. If some of your groups are set to 4x4 sampling, and the sampling menu is set to 2x2, sampling will be limited to up to 2x2 maximum as the image is rendered.



Figure 71 — The Sampling Levels Menu

1x1

(The default) This setting is sufficient for lower detail objects, or models that appear at a moderate distance from the camera. However, when viewing images rendered at this setting up close, jagged edges may be apparent. This is also not a good setting for high resolution images.

2x2

This is a good, general setting for most objects and groups. Render time compared to 1x1 sampling may be only slightly higher, and the extra detail is generally worth the time, especially with high detail texture maps. This setting may also help animations that exhibit flashing, or stair step patterns on playback.

4x4

This setting, although slower than 2x2, is useful for objects which require a high amount of sampling detail. This includes objects with intricate texture maps that are in close proximity to the camera, or that involve complex effects passes (smoke, fog, glow). Very high resolution images may also benefit from this sampling level.

16x16 (and higher)

Like anti-aliasing levels, these setting should only be used in specific instances where a very high sampling level is required. Render time at these levels increases by a huge amount, and for the majority of renders will show no noticeable improvement.

When rendering at any typical resolutions (720x486 and less), leave your anti-aliasing level at 4x4. Unless you see a problem in the render this setting will be more than adequate and allow you to render as quickly as possible. For sampling levels, consider using a global maximum sampling level of 4x4, and individually setting the sampling levels on a per object basis. Therefore, if you have an object with a complex texture map very close to the camera you can set it's sampling level to 4x4, while objects that only appear in the distance can be set for 1x1. This approach gives you the maximum control over the 2 major issues in a production setting; quality and render time.

Adaptive Sampling Threshold



Figure 72 — The Sampling Threshold boxes

The Min and Max edit boxes contain values that control the type of adaptive comparison filtering to be performed between adjacent pixels of different color values. If the difference in the pixels is less than the minimum value, the image is sharper (less filtering, more jaggy). If the difference in the levels is greater than the maximum value, the image is softer (more filtering, less jaggy). If the difference falls between the minimum and maximum values, adaptive anti-aliasing is performed. The higher the difference, the softer the image; the lower the difference, the sharper the image.

The Motion Blur Tab



Figure 73 — The Motion Blur Tab

This section of the Render window is used to control the motion blur features of ElectricImage. Motion blur is the simulation of the kind of effect that occurs when recording a moving object on film. As an object moves across a frame of film it naturally blurs, depending on the speed of the film, and the object's velocity. These controls allow you to mimic that behavior in ElectricImage. Note that in order for blur effects to be rendered, it is also necessary to set the blur mode for each object/group that you wish to blur under that object's group info window. *This setting defaults to no motion blur. You will need to change the blur mode to the desired setting per object blur or motion blur will not be rendered.*

Shutter Angle



Figure 74 — The Shutter Angle Box

This edit box contains a value in degrees that represents the circular angle at which a camera shutter is open. A value of 360 degrees simulates a shutter that is always open, whereby all moving objects leave a continuous streak across the frame. A value of 180 degrees (the default) simulates a shutter that is open for half a frame, mimicking a motion picture camera. The higher the angle, the longer the shutter will stay open, creating longer

streaks and more blur. Note that only moving objects create blur, or streaks, as the streak length is computed by the distance an object moves within the field of view from frame to frame. Hence, objects that are far away from the camera will streak very little regardless of their velocity, while very close objects will streak dramatically with very slight movement. Values higher than 360 ° will create dramatic streaking, even on slow moving objects. Great for that “warp speed” effect.

Blur Intensity

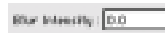


Figure 75 — The Blur Intensity checkbox

This edit box is used in conjunction with the Point/Line blurring technique (see below). This value controls the brightness of the streaks left behind by points and lines. A value of 0.0 (the default) imparts a constant value regardless of the length of the streaks. Larger values produce brighter streaks, while smaller values produce dimmer streaks. New to ElectricImage 2.8, a separate blur intensity can be set for each individual object/group in that group’s info window. This edit box automatically appears after selecting the Point/Line blur mode.

Blur Noise



Figure 76 — The Blur Noise checkbox

This edit box is used in conjunction with the Motion Vector blurring technique (see below). This value controls the number of blur samples per pixel. The higher the number, the less visible noise in the streak. By using a value of 0, ElectricImage will automatically compute the optimal number of samples for a streak based on its length. A value of 4 (the default) renders quickly and produces high quality results. Values over 10 are unproductive, and will drastically slow the rendering process.

Blur Frames

This edit box is used in conjunction with the Multi-Frame blurring technique. This value represents the number of individual frames that are rendered prior to averaging the frames together to generate a single frame. For instance, if this value is set to 3, for each frame of an animation, ElectricImage generates 3 images, the frame ahead of the current frame, the current frame, and the frame behind. It then averages these images together to make a single frame, with blurring based on the distance moved between all 3 frames. If this value is set to 2, ElectricImage calculates two frames for averaging; the current frame, and one after the current frame.

Point/Line Blurring



Figure 77 — The Point/Line Blurring checkbox

This check box, when enabled, activates the point/line motion blur technique at the global level. Individual objects still need to be set for this type of blurring at the group/object level. In this mode, only points and lines leave streaks behind. This is most useful for the motion blur of star streaks and particle systems. Normal polygonal models will not streak using this method.

Motion Vector



Figure 78 — The Motion Vector checkbox

This check box, when enabled, turns on the Motion Vector motion blur technique at the global level. Unlike the point/line method which only blurs points and lines, this method induces blur on all objects which have been set for motion vector blurring. This includes points, lines, and polygons. It should be noted that blurred lines are always linear, and are never curved when seen in a single frame. This is a fast and versatile technique which works for most objects.

Multi-Frame



Figure 79 — The Motion Vector checkbox

This check box, when enabled, allows for multi-frame sampling for motion blur. It can be used in conjunction with the other blur techniques (point/line or motion vector). The number of frames to be sampled is set in the Blur Frame check box. Strobe like effects are produced if too few sample frames are used with this option alone. It is best applied to a section of an animation where there is complex or rapid motion (like spinning fan blades, or the tires of a quickly moving car). Combining this technique (set to 2 sample frames) with Motion Vector blur produces great results for those times when Motion Vector isn't quite enough.

The Glow Layer Tab

New to ElectricImage 2.8, are glow layers. Any group can be given a gaussian glow that emanates outward from that object. Additionally, groups of layers can be defined, each with its own glow radius and intensity.



Figure 80 — The Glow Layer Window

There are three sections in the glow tab:

- Glow Layer List
- Glow Layer Members List
- Configuration Section

Glow Layer List

A glow layer contains glow attributes which apply only to members of that layer. To add a glow layer:

- Click the Add Button Next to the Glow Layer list
- Name the layer
- Click OK

A new glow layer is added to the list.

Glow Layer Members List

Glow layer members are selection sets. In order for groups to use their glow effects (applied as a material), the groups need to be in a selection set contained within a glow layer. To add a selection set to a glow layer:

- Select a glow layer
- Click the Add button next to the glow layer member list
- Pick a selection set from the list
- Click the Add button

The selection set is now added to the glow layer.

Glow Configuration Section

The appearance of the glow layer is a combination of the material attributes of the glow, as well as the settings in the Glow Radius and Glow Intensity edit boxes, shown below.

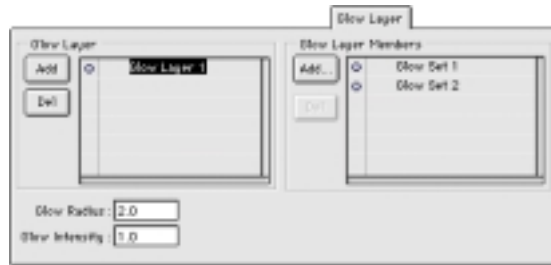


Figure 81 — The Glow Layer Window with Glow Layers and Layer Members

Glow Radius

The pixel area of the glow. This is the area of the image that will have a glow effect applied to it. Smaller values are good for objects that you wish to appear brighter in a scene, while larger values are better for simulating effects such as glare.

Glow Intensity

This value controls the brightness of the glow. Glows are added on top of the rendered scene, therefore a value of 1.0 would produce a glow that is twice as bright as the original image without glow.

Although glow layers and sets may seem a bit complex at first, once you get the hang of it you will begin to understand the potential. Rather than having to manually tweak settings for each separate glow effect you can simply define a series of standard effects and apply those to the appropriate sets at render time. For instance, you could come up with a set of glow layers to simulate fire, candles, tv monitors, spaceship exhausts, light bulbs, etc. Once you have a series of defined glow layers they can easily be assigned to any set of objects you've created. Additionally, since Glow radius and intensity can vary by layer, a series of complex effects and layered glows can be created.

The Timing Tab

The timing tab contains start and stop information, and playback information.



Figure 82 — The Timing Window

Start and Stop Times

This edit box defines the start and end times for a project, in seconds. These settings are also represented visually in the project window by the green (start) and red (end) arrows, and can be changed by dragging them interactively. Any changes made in the project window will be reflected here, and vice versa. These boxes define the total range of frames for a given project. Animation keyframes can still exist outside of the range of frames for a project, but will not be rendered.



Figure 83 — The Start and Stop Boxes

Note: It is possible to set the start time to a negative number. This can be very helpful if you've already created a complex animation starting at 0.0 seconds, and you later realize you need to add a sequence prior to the start of the animation. Rather than attempting to drag all of your keyframes to the right, simply use a negative number as your start time. Be aware, however that while this works in most cases, negative frame numbers may not work with simulation plug ins such as particle systems.

Total Frames



Figure 84 — The Total Frames box

This edit box displays the total number of frames in an animation. This number is generated automatically based on multiplying the delta (difference) of the start and stop times by the number of frames per second and adding 1. For instance, if a project is set for 10 seconds, and the frame rate is 30 frames per second, the total number of frames rendered will be 301. This extra frame is due to the fact that ElectricImage counts frame zero as the first frame in an animation. This number is displayed primarily for reference, although by setting the Total number of frames directly in the edit box, the Stop Time will be updated accordingly in both the Stop edit box and the project window.

Nth Frame



Figure 85 — The Nth Frame box and checkbox

This edit box is used to specify that an animation is only rendered out with every nth frame. In other words, if this box is set to 2, then every 2nd frame will be rendered. If the start frame is 0, the following frames will be rendered: 0, 2, 4, 6, 8...etc. In order for this to work, the Enable Nth frame checkbox must be checked. This setting works independently of the Render frames pop-up. The Nth frame is always used if selected, whether an animation is rendering all frames, or a selected range of frames. For instance, if a render is set for a range of frames from 100 to 150, and Nth frame is set to 3, then the following frames will be rendered: 100, 103, 106, 109...etc.

The Nth frame box is extremely useful for doing test renders. Instead of having to render out every single frame of an animation, it is often sufficient for a rough motion test to only render out every 2nd or 3rd frame.

FPS

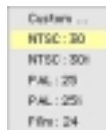


Figure 86 — The Frames Per Second (FPS) Menu

This edit box is used to specify the number of frames per second (fps) to be rendered for an animation. This figure determines the total number of images that are drawn per second. Note that it is important to set this number prior to doing any animation in a project, as all animation keyframes that are created will be based on this number of frames per second. By changing this value later, velocities and keyframe attributes may be thrown off. The pop-up menu contains the following choices:

Custom

The Custom setting allows the user to enter any number of frames per second, as well as choose whether or not the image will be interlaced. Interlaced rendering splits each frame into two fields, with the odd field dominant unless the Even Field check box is enabled. Interlaced fields are necessary for some broadcast video output cards. You should consult with your video output devices manuals to determine if interlaced fields are necessary.

NTSC: 30, 30i

This setting specifies the NTSC video standard of 30fps. This is what all broadcast television in the US is shown using, and consists of a 60Hz signal, being shown in 2 fields. Combining both fields into 1 frame results in a frame rate of 30fps. NTSC: 30i is output as interlaced frames, with the odd field dominant.

PAL: 25, 25i

This setting specifies the PAL video standard of 25fps. This is most common for European broadcast television, and differs from the US in that it operates at 50Hz, shown in 2 fields. Combining both fields into 1 frame results in a frame rate of 25fps. Pal:25i is output as interlaced frames, with the odd field dominant.

Film: 24

This setting specifies the motion picture standard of 24fps.

The Render Menu

This pop-up menu is used to select the range of frames that are to be rendered. The choices are:

Current Frame

This option (the default for single frame projects) causes only the current frame in the animation to be rendered. The current frame is defined as whatever frame is currently displayed in the camera window. This is selected by moving the timebar in the project window.

All Frames

This option (the default for multi-frame projects) causes all frames in an animation to be rendered. The total number of frames is defined by the Start and Stop times, mentioned above.

Range of Frames

This option opens a dialogue box which allows for setting specific frame numbers to be rendered. Using this tab, any portion of an animation within the Start and Stop times can be rendered. This is very helpful when working in a large project, with multiple animation sequences. Using this setting, only a specific range of frames needs to be rendered. You can also use Range of Frames to render your animation in reverse order, by typing reverse values in the edit boxes.

Even Field

This checkbox specifies that when rendering interlaced animation files, the Even field will be rendered out as the dominant field. This defaults to off, because the RS-170A specifica-

tion for NTSC calls for odd field dominance. Some video cards break this rule (programmers always start on even numbers, such as zero, instead of odd numbers like one) and this option is present for those conditions. *Be warned, even if your setup is even field dominant, all production houses are odd field dominant — you might need to re-render!*

How To Render a Project

The little button on the right side of the render window looks simple doesn't it? Well, it actually features two modes of operation which turns it from a simple start button into a powerful selective rendering feature.

Go

To simply begin rendering a project, click the Go button. If you haven't saved, you will be prompted to do so. Following that, ElectricImage will quit, launch the camera application, and begin rendering.

Control-Go

One of the great, "hidden" features of ElectricImage is the Control-Go option. By holding down control when clicking Go, ElectricImage prompts you to locate the Camera application. This allows you to select a camera from any mounted drive, including networked machines, for rendering. Thus, by doing a Control-Go, instead of a standard go, you can send a render to launch on a slave camera on any network machine. Also, when using this method, ElectricImage launches the selected camera application as a separate process. So, if you have enough memory you will never need to quit ElectricImage when sending a render. Similar to the Preview Render option, control-go allows you the utmost in flexibility when sending a render.

Network Rendering

You can render to as many Macintosh computers as you wish (*assuming they meet minimum performance requirements.*) Renderama, the ElectricImage network control application, must be available in the same folder as ElectricImage, and properly configured. (*See the Renderama chapter in the 2.5 Supplement for further information.*)

Selection Sets

Introduction

Although this chapter is deceptively short, it discusses a seemingly simple part of ElectricImage that grows in importance with the complexity of the project: selection. Just as image-editing and illustration applications have multiple methods of selecting elements based on their attributes, then acting on them in ways unique to the selection process, we have widened the scope of how selections are made in ElectricImage — of how they are used to organize a project, and how they can be used to create special effects.

To move an object or access the material attributes of a group, you must first select the object or group. This is done by clicking once on the object, either in the world views or Project Window, or by dragging a rectangle around one or more groups. To facilitate selections which are larger in scope, the Select menu was added in version 2.7.5. That menu allowed you to select models and groups by a variety of methods.

In ElectricImage 2.8, the Select Menu has a new selection type added, By Set. A set is simply a defined collection of groups from within a project. The By Set menu option allows you to edit selection sets, or select items in the project that already belong to an existing set. The hierarchical menu below By Set initially contains a single entry, Edit Sets. As sets are created their names will appear in this space.

Selection sets are used for light inclusion/exclusion lists, glow layers and, of course, typical selections. Selection sets will come in very handy as you work with ElectricImage.

Select by Set

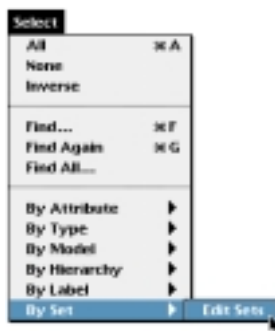


Figure 87 — Select Menu

Sets have four purposes in ElectricImage 2.8.

- To select groups of items within the project
- To include or exclude groups from a light's illumination
- To control the glow radius and glow intensity for a set of models
- To control which objects receive projections from Camera Maps.

To Create a Set

- Choose Edit Sets from under the Select menu.
- The Sets window, shown below in the illustration “Selection Sets Window” on page 137, opens.
- In the Selection Sets column, click Add. When prompted, create a name for your set.

The name of the selection set will be appended to the *Select>By Set* menu.

The Selection Sets Window

Selection Sets

The left column, Selection Sets, contains the names of all existing sets. Once you create your set its name will appear in this column. New sets can be created and old sets can be deleted using the Add and Remove buttons. The Sort pull down gives you the option of viewing the list of sets alphabetically or in their creation order.

Members

The right column, Members, shows the members of the set that is highlighted in the left column. To add members to an existing set, go to the Project window and highlight the names of the groups to be added. Then return to the Selection Sets window.

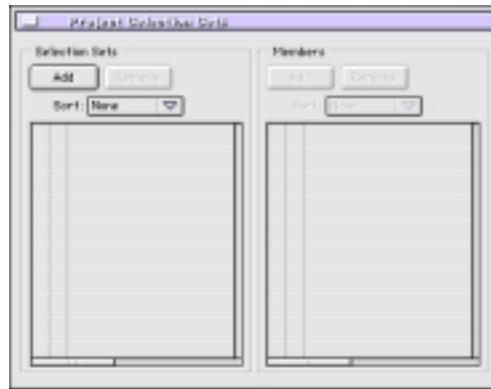


Figure 88 — Selection Sets Window

In the left column, highlight the set name to which you wish to add the objects and click on the add button on the right side of the dialog box. Members of sets or whole sets can be removed by highlighting the item and clicking on the remove button.

Materials and Texture Maps

Introduction

In this chapter we will discuss the new Materials and Texture Map features in Electric Image 2.8. Materials are what the rendering engine uses to give shading and detail to a group. Textures are a component of Materials (new to ElectricImage — previously textures were treated separately). *Procedural Shaders are also a component of Materials, but are covered in the Procedural Shaders chapter.*

Great effort has been spent conforming to industry standard material terms and behavior wherever possible. This was done to allow you to take advantage of the myriads of books and publications which cover the topics of 3D which are now available, and to make ElectricImage even easier to use than ever before.

Overview of New Features

The following highlights will give you an idea of the radical changes to the Materials and Texture Map capabilities of ElectricImage 2.8.

- Master Materials (materials that groups can subscribe to)
- Materials Can Be Saved To Disk
- Industry Standard Material Controls
- New, Easy to Use Interface Design
- Displacement Maps
- Clipping Maps
- Procedural Shaders
- Unlimited Texture Maps
- Precise Texture Mapping Controls

Materials Defined

Materials are a collection of shading attributes, called *channels*, that you create and apply to a group (or groups.) Materials can also contain texture maps and procedural shaders. You can apply materials from saved material files on disk, from materials created in the Material Info Window, or from Master Materials.

Master Materials

Master Materials are new to ElectricImage 2.8. They are visible in the Project Window, and can have many groups linked to them. Master Materials will replace all of the attributes of the groups linked to them (an exception to this rule applies to locked maps.) You will still have to tweak the texture map alignment to fit each particular group for the best results, unless the groups are similar in shape. You can have as many Master Materials as you wish in a project. To add a Master Material to a project, choose **File>Add>Type>Material**. You will now see the Material at the top of the item list in the Project Window.

Groups must be linked to Master Materials in order to use them. You can link as many groups as you like to an individual Master Material. A group may be linked to only one Master Material in a scene.

To link a group to a master material:

- Select the group (or groups) that you wish to link to the Master Material
- Click on the Link Material icon in the Project Window tool bar
- Click on the desired Master Material in the Project Window List

The selected groups are now linked to the Master Material. You can confirm this by setting the Project Window display icon to “By Material.” The Project Window display will change to show the groups that are linked to the Master Materials displayed as children to the Master Material.

Accessing the Material Info Window

In order to create or edit a material or Master Material, you need to get to the Material Info Window. There are four ways to access the Material Info Window:

- Select the Group, and click the Material Info Window icon in the Project Window
- Command double click on a Group in any window
- With the Group Info Window open, click on the Material Ball icon
- Double click a Master Material in the Project Window

The Material Info Window

There are two variants of the Material Info Window, one for group materials, and one for Master Materials.

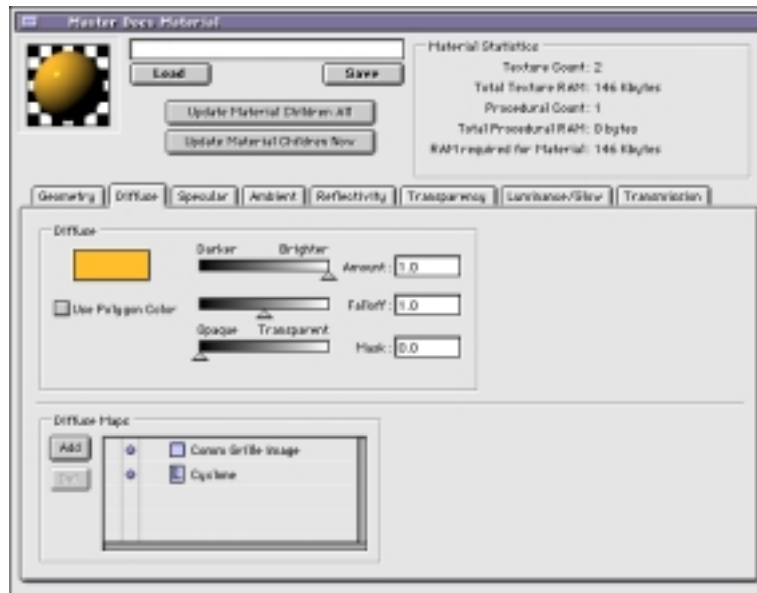


Figure 89 — Master Material Info Window

Materials and Texture Maps — The Material Info Window

The primary difference between the Group Material Info Window and the Master Material Info Window are the material management buttons, located above the tab area. The following discussion applies to both window variations.

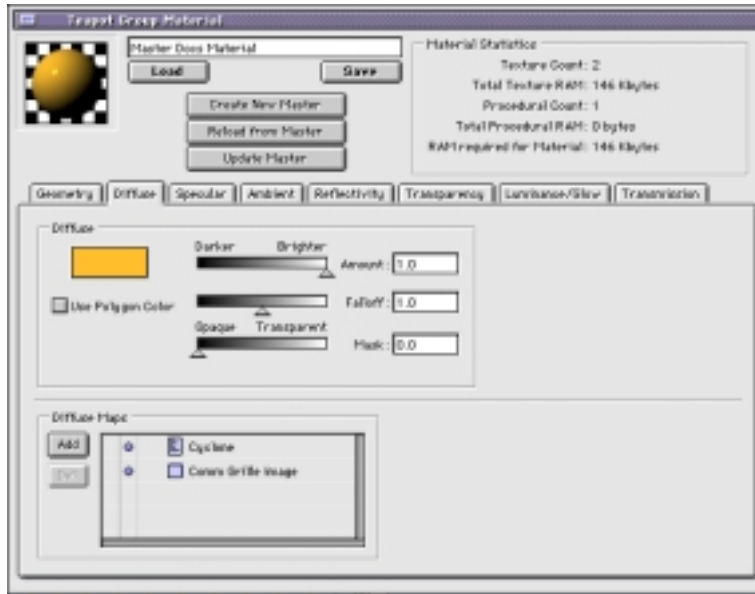


Figure 90 — Group Material Info Window

The Material Info Window sports a totally new look and feel. All of the material channels now have their own tabs, with each tab containing the controls and functions indicated by the name of the tab. To access the contents of the tab, just click on it.

Above the tabs you see the material ball icon to the left. The material name edit field is just to the right of that. Below are the Load and Save Material buttons, and below them is the Create New Master button. To the right of the buttons is the Material Statistics section, which illustrates the makeup of the material.

The material ball icon shows a live preview of the settings of the various material channels. To copy a material, select the Material Ball Icon and choose Copy. To paste a new material into this material record, select the Material ball icon, and choose paste. (You can change the background color of the material ball icon by option clicking in the background of the icon, and choosing the preferred background display pattern or color.)

Loading and Saving Materials

One of the most powerful new features is the ability to create a material and save it to disk to be called up any time it is needed. The material is saved to a directory within your ElectricImage directory called “EI Material.” The saved material contains the settings of the various material channels (diffuse, specular, etc.), as well as, external references to texture maps and procedural shaders.

To load a material

- Click the Load button
- Choose a material from the directory
- Double click the material or click the open button

The material is now applied to the group. Groups can only have one material assigned to them, whether you assign a material to a specific group, or whether you assign a group to a master material.

To save a material

- Make sure that the material is named
- Click the Save button

The material is then added to the EI Material directory. ElectricImage does not provide any indication that the material has been saved. To check this you can save it again, if you like. When you do, you will then be asked if you wish to replace the material (indicating that it was previously saved.)

Creating New Master Materials

You can create new Master Materials from the Material Info Window of a particular group, or you can add them to a project as described previously. Groups can be linked to them with a special material link command described in the Master Materials section. Groups can be passively linked to a Master Material, or they can be “live linked.” Passively linked groups will require a manual update to receive any changes that are made to the Master Material they are assigned to. Live linked groups will be updated immediately upon any change to the Master Material they are assigned to.

To create a Master Material:

- Set up your material
- Click on the Create New Master button
- A dialog will appear, prompting you to name the material.

A Master Material version of the material you were editing now appears in the Project Window item list. You will note that two new material management buttons have now been added to your material, just below the Create New Master button: Reload from Master and Update Master.



Figure 91 — Material Management Buttons

Reload From Master

This button appears in groups that are passively linked, not live linked, to a Master Material, and reloads the material properties from the Master Material. This is useful if you are exploring a change to a material but decide you prefer the original.

Update Master

This button appears in groups that are passively linked, not live linked, to a Master Material, and replaces the Master Material with the current material. Groups that are live linked to the master will be immediately updated.

New Material Interface

With ElectricImage 2.8, the Material Info Window now presents all material channels in a tab context. This makes all of the shading attributes of ElectricImage very accessible and easy to use. It should not take very long to get acclimated to the new interface.

To edit a particular channel within a material, just click on its tab. A material channel is a shading component, referred to as “surface attribute” in the ElectricImage Series 2 Reference Manual. We are calling them channels now to more appropriately reflect their nature and how you can use them. There are eight material channel tabs:

- Geometry
- Diffuse
- Specular
- Ambient
- Reflectivity
- Transparency
- Luminance/Glow
- Transmission

Each channel tab contains the many attributes which are controlled by the channel, including texture maps and procedural shaders.

The Geometry Tab

The geometry tab contains all of the material channels and attributes which affect the apparent geometry of a group and how it is shaded. You can add outlines to the group, add bump and displacement maps for more detail, or punch actual holes into the group with clipping maps (and shadows do see these holes.)

The geometry tab is organized into three basic sections:

- Cel/Outline Shader section
- Bump/Displacement Map list
- Clipping Map list

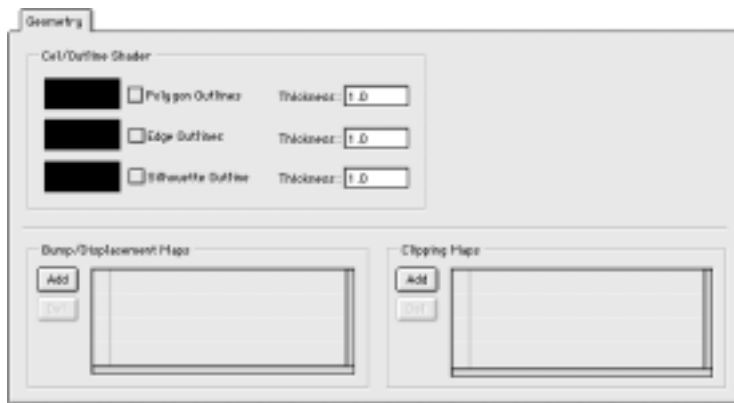


Figure 92 — Geometry Tab

Cel/Outline Shader Section

In this section you assign color and thickness to polygon outlines, edge outlines and silhouette outlines. Used in conjunction with the Cartoon procedural shader, the look of traditional 2D cel animation can be achieved. There are three types of line effects:

- Polygon Outlines
- Edge Outlines
- Silhouette Outlines

Polygon Outlines

Activating this setting causes all of the polygons in the group to receive an outline. This is similar to wireframe shading, except that the polygon will also be shaded.

Edge Outlines

Activating this setting will cause certain edges to be defined with lines. As the group or camera is in motion, the definition of the edges will change, similar to the effect you see in traditional 2D animation. The silhouette feature should be active with this feature.

Silhouette Outlines

This setting causes the silhouette of an object to be drawn in lines. On occasion, the silhouette is not clearly resolved, so it is best to use this feature with the Edge Outline feature enabled.

To activate the particular line effect you wish you must click in the check box. You can color the lines by clicking on the color swatch and choosing a new color from the color picker. To adjust line thickness, type in a new value in the edit box to the right of the line type (values are in pixels.)

The way the model is constructed is very important with this feature. If the polygons of the model are not properly welded, the edge outline feature will find and render all edges, creating unwanted lines within your rendered image. If you notice this happening, re-import the model with the Combine Coordinates feature turned on (*see the **ElectricImage Series 2 Reference Manual pp.1-25 and 1-26 for more information on welding vertexes.***)

Bump/Displacement Maps List

The Bump/Displacement Maps list is where you add maps of these type. You can add as many maps as you like to this list. Along with the standard bump map, displacement maps are now supported. Displacement maps actually move the vertexes in the group using the map to determine how much displacement is applied.

With bump maps the illusion of depth or relief can be created such as the bark on a section of log. The limitation to bump mapping is that the silhouette or edge of the log is perfectly smooth and the closer to the edge the more obvious the cheat. With a displacement map the geometry is actually moved, so the edge of the log shows relief as well as the center. It is important that there be enough vertex points in the group to achieve a satisfactory effect. It might be necessary to apply the Dicer plug-in to the group to achieve best results. *(Dicer is covered in the ElectricImage Version 2.5 Supplement, chapter 8.)*

Bump maps and displacement maps can be either a grayscale bitmap image or movie file or a procedural shader. Any bitmaps of greater than 256 colors will be converted to gray scale by the rendering engine to achieve the effect. If an alpha channel is present, it can be used to control the bump instead. *(See the section “Map Alpha Channels” on page 179 for more details on the alpha channel.)*

To add a bump or displacement map

- Click on the add button next to the bump map list
- Choose the Map
- Double click on the map or click on the open button

The map will be added to the list. You can configure the map by double clicking on the name of the map in the map list. *(See the section “Using Texture Maps” on page 178 for more details.)*

Controls for the strength of the bump and displacement are found under the Special Tab in the Texture Info Window *(“Special Tab” on page 193,)* and these controls can be ani-

mated. Setting Bump Factor to 0 will disable the bump calculation. Setting Displacement to 0 will disable the displacement calculations.

Clipping Maps List

The clipping maps list is where you add clipping maps to your group. You can add any amount of clipping maps or procedures to this list. Similar to transparency maps, clipping maps are a quick and efficient way of cutting holes into a group. Unlike a transparency map, the clipped region is anti-aliased independent of resolution. Zooming in close, the clipped object will still exhibit very clean edges. Clipping maps actually remove geometry, so they will create appropriate shadows.

Clipping maps can be either a grayscale bitmap image or movie file or a procedural shader. Any bitmaps of greater than 256 colors will be converted to gray scale by the rendering engine to achieve the effect. If an alpha channel is present, it can be used to control the clipping instead.

To add a clipping map

- Click the Add button next to the Clipping Map list
- Select the map or procedural from the dialog
- Double click the map, or click the open button

The Clip factor edit box is found in the Texture Info Window under the special tab, and controls the strength of the clipping map, where 0 is fully transparent and 1 is fully opaque.

The Diffuse Tab

The diffuse tab contains all of the material channels and attributes which affect the diffuse channel of a group. The diffuse channel is where color is applied, and you will note that

Materials and Texture Maps — The Diffuse Tab

there is no longer a surface color attribute. *(This was done to more closely conform to industry standard guidelines. By conforming to as many industry standards as possible, much of the information available in magazines and books which cover the 3D spectrum will be applicable in ElectricImage, making it easier to learn and use.)*

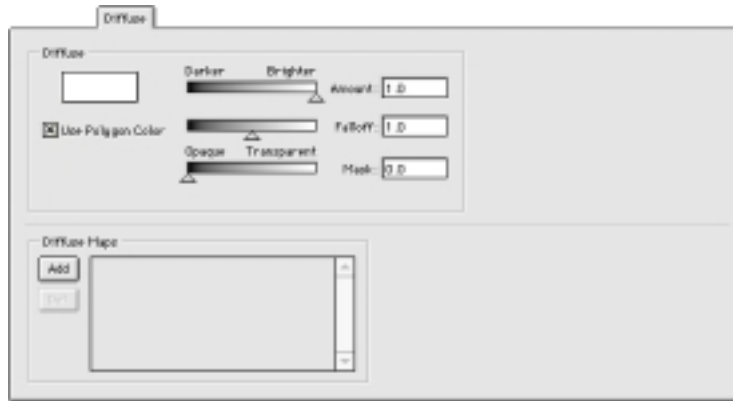


Figure 93 — The Diffuse Tab

The diffuse tab is organized into two basic sections:

- Diffuse parameters
- Diffuse Maps list

The diffuse parameters section contains a color swatch, slider bars for controlling the amount of energy transmitted by the group, the falloff of that energy, and the mask opacity for the group. There is also a checkbox that allows you to use the original polygon colors of the group *(some modeling programs let you assign unique colors to individual polygons, which you may want to keep.)*

Color Swatch

To choose a diffuse color, click on the swatch and pick a new color from the color picker.

Use Polygon Color

This check box forces the renderer to use the color assigned to the individual polygons of the group when it was created. Assigning a color to the group with the swatch will ignore all of the polygon colors in the group. You can revert back to the original color of the group with this checkbox.

Amount

Use this slider to darken the group's color. The slider bar will use the color in the swatch (or the polygon colors if Use Polygon Color is active) as top end of the range (brighter). You can also type in a value in the Amount edit box. The Amount slider is a nifty way of keeping your diffuse color intact while adjusting the brightness levels of the group.

Falloff

Falloff was formerly called Shading Dropoff, and sets transition value from fully shaded to not shaded. Larger objects to have sharper falloff values (such as planets, where .25 is a good falloff value.) Smaller objects should have falloff values closer to 1.0.

Some sliders will accept values of greater than 1.0, or less than zero. You can adjust the value by typing in the value that you wish in the edit box to the right of the slider. Falloff is one of the attributes that allow this.

Mask

This slider affects the alpha channel for the group (often called a Mask or Matte) in the final render. This feature can be used in conjunction with a compositing effects. If you want the group to appear normally in the scene, then leave the value at 0.0 (opaque on the slider.) If you want the group to act as a cutter, removing its shape from the scene, then set the value of the mask attribute to 1.0 (transparent on the slider.) Note that a true hole will be left behind, if the group is obscuring another object if this setting is anything more than 0.0.

Materials and Texture Maps — The Specular Tab

Diffuse Maps list

The diffuse maps list is where you add color maps, procedural shaders, or diffuse value maps. You can put as many maps as you like in this list. Maps can be single frames or movie files, and can be any bit depth desired.

To add a diffuse map to the list:

- Click the Add button next to the Diffuse Map list
- Select a map or procedural shader from the file list
- Double click the map, or press the Open button

The map will now be added to the list. To configure the map, double click on the map name in the list. To reorder the map in the list, just drag it to its new location. (*See the section “Using Texture Maps” on page 178 for more information on working with texture maps.*)

The Specular Tab

The specular tab contains all of the material channels and attributes which affect how the various specular attributes of a group will shade. The specular tab is organized into two basic sections:

- Specular Attributes
- Specular Map List



Figure 94 — The Specular Tab

The Specular Attributes section contains a color swatch, slider bars for controlling the amount of specularity, gloss, size and falloff, and a diffuse bias check box.

Color Swatch

The color swatch is used to set the color of the specular highlight. To choose a color, click on the swatch and pick a new color from the color picker. This setting is ignored if the Diffuse Bias setting is active.

Diffuse Bias

This check box forces the specular color to be equal to the diffuse color. The color of the highlight is added to the diffuse color, making the highlight brighter than the surrounding area. This is analogous to the way that highlights work in the real world, and defaults to on (which ignores the color in the color swatch.)

Amount

The Amount slider controls the brightness of the specular highlights that appear on the group. A value of 0 turns off the highlight.

Gloss

The gloss slider adds a gloss or sheen to your group. It imitates what the group would look like if it were a bit reflective, removing color from the surface around the highlight. It can create an odd look, so you might want to use this sparingly.

Size

Controls the size of the highlight on the group. The smaller the number, the larger the highlight. Values of greater than 1.0 can be typed into the Size edit box.

Some sliders will accept values of greater than 1.0, or less than zero. You can adjust the value by typing in the value that you wish in the edit box to the right of the slider. Specular size is one of the attributes that allow this.

Falloff

Controls the sharpness of the highlight. Larger numbers give a sharper, more abrupt transition, and smaller values produce a smoother and less defined highlight.

Specular Maps List

A specular map controls the area in which the specular highlight is visible on a group, as well as the value (brightness) of the highlight or the color of the highlight. Specular value maps can be either a grayscale image or movie file or procedural shader. Any bitmaps greater than 256 shades will be converted to gray scale by the renderer for specular value maps. If an alpha channel is present, it can be used to control the specular instead of the RGB channel. *(See the section “Map Alpha Channels” on page 179 for more details.)*

To add a specular map to the list:

- Click the Add button next to the Specular Map list
- Select a map or procedural shader from the file list
- Double click the map, or press the Open button

The map will now be added to the list. To configure the map, double click on the map name in the list. To reorder the map in the list, just drag it to its new location. (*See the section “Using Texture Maps” on page 178 for more information.*)

The Ambient Tab

The ambient tab contains all of the material channels and attributes which affect the ambient shading characteristics of the group. Ambient is a simulation of ambient fill light, and you can make the ambient take a different color cast than the diffuse channel.



Figure 95 — The Ambient Tab

There are two basic sections to the ambient tab:

- Ambient Attributes
- Ambient Map List

The ambient attributes section contains a color swatch and a slider bar.

Materials and Texture Maps — The Reflectivity Tab

Color Swatch

Controls the color cast of the ambient fill light on the group. To change the color, click on the color swatch and pick a new color from the color picker.

Amount

Controls how the group responds to ambient light. Larger numbers will make the group appear to have more fill color, and be a little less defined. Higher fill values would be appropriate for objects in sunlight. Lower fill values would be more appropriate for night time or deep space shots.

Ambient Map List

Ambient maps can affect the color of the ambient effect, the value of the effect, and the areas of the group that receive the ambient effect. You can have as many ambient maps as you like in the material. An ambient map can be an image or movie file or a procedural shader.

To add an ambient map to the list

- Click on the Add button next to the Ambient Map List
- Select the map
- Double click the map, or click the Open button

The map is now added to the list. To configure the map, double click on the map name in the list. To reorder the map in the list, just drag it to its new location. (*See the section “Using Texture Maps” on page 178 for more information.*)

The Reflectivity Tab

The reflectivity tab contains all of the material channels and attributes which affect how

and what the group will reflect. The reflectivity tab is one of the more complex tabs in the Material Info Window. There are four main sections to the reflectivity tab:

- Reflectivity Configuration (*How* the Group Reflects)
- Reflection Configuration (*What* the Group Reflects)
- Reflectivity Map List
- Reflection Map List

Both the Reflectivity Configuration section and the Reflection Configuration section are comprised of additional subsections.



Figure 96 — The Reflectivity Tab

The Reflectivity section resides within the left side of the tab, and the Reflection section resides on the right side of the tab.

Reflectivity Configuration Section

The reflectivity configuration section contains the basic reflectivity controls and specialized edge attenuation controls.

Materials and Texture Maps — The Reflectivity Tab

Amount

The Amount slider is used to control overall reflectivity amount of the material. The valid ranges are 0.0 to 1.0.

Color Swatch

The color swatch tints the group's reflection. It is disabled if the Reflection Bias checkbox is enabled.

Reflection Bias

This check box forces the reflected color to be equal to the diffuse color. The reflection is then added to the group by whatever percentage is set in the Amount attribute. This is more realistic than setting the color of the reflection manually, and defaults to on.

Edge Control (Attenuation) Section

Edge control allows you to attenuate the reflection across the surface of the group (this is also called the Fresnel effect.) Objects in the real world tend to reflect more intensely towards the edge, and less so towards the center as seen from the viewer's point of view.

To illustrate this effect, set the reflectivity amount to .5, edge amount to 1.0 and falloff amount to 1.0. Note that the center of the material ball shows no reflection, but the edges are quite reflective.

Amount

The amount value controls the amount of reflection along the edge of the group. It is factored into the overall reflection amount. This value is unused if the edge falloff amount is set to 0.0.

Falloff

The Falloff value controls how the reflection will fall off towards the center of the group. The higher the number, the less reflection you will see at the center of the group. This value is not considered if the Edge Amount value is 0.0.

To the right of the edit boxes is a graph area, which shows the relationship of the Edge Amount and Falloff values. With the Edge Amount set to 1.0, and the Edge Falloff set to 0.0, the graph will appear as a white square (the default.) This indicates that the reflection will appear evenly across the surface of the group. As you adjust the relationships between the two values, you will see the graph change to reflect the new values.

Reflectivity Maps List

A reflectivity map controls how the group will reflect any reflection maps assigned to it in the Reflection Map section. It can also control what areas of the group receive a reflection, and how much of it. Any bitmap image, movie or procedural shader can be used as a reflectivity map.

To add a reflectivity map to the list:

- Click the Add button next to the Reflectivity Map list
- Select the map or procedural shader from the file list
- Double click the map, or press the Open button

The map will now be added to the list. To configure the map, double click on the map name in the list. To reorder the map in the list, just drag it to the new location. (*See the section “Using Texture Maps” on page 178 for more information.*)

Reflection Map Configuration Section

Reflection maps are what the group is actually reflecting. Reflection maps can be bitmaps, either still or movie files. **Procedural shaders cannot be used for reflection maps.** Reflec-

tion maps can also be automatically generated by ElectricImage. These are called mirror maps, which are flat, and environmental maps, which are cubic. The controls for the automatic maps are in the Environment Reflection subsection.

In the main Reflection Map Configuration section, there are three check boxes:

- Use Global Maps
- Use Bitmap Reflection
- Use Environmental Reflection

Any or all of these settings can be selected at any time. Each map has an amount slider that allow maps to be less than full intensity. This allows reflections to be added together, say global maps with bitmap reflections. The effect is additive, which may not be desired.

Use Global Maps

This check box enables the reflection maps applied under the World Info Window located in the Project Window as a reflections for the group. This setting allows as many groups as you wish to use the same reflection. This map can also function as a “default” reflection map, removing the need to physically assign a reflection map to the group.

Use Bitmap Reflection

This check box enables the group to reflect maps from the reflection map list.

Use Environment Reflection

This check box enables any of the selected Environment Reflections specified in the Environment Reflection subsection.

Environment Reflection Subsection

There are three choices in the subsection:

- None
- Mirror
- Environment

None

No map is selected. This is the default condition.

Mirror

Mirror maps are flat, and automatically render an exact mirror reflection, relative to the established mirror plane. You control the mirror plane through the Configure... button in the subsection. It is necessary to establish a plane to guarantee expected results. (*See the section "" on page 181 for more information.*)

Environment

Environment maps are cubic reflection maps that are automatically created by the rendering engine. The rendering engine creates six images representing the faces of the cube. These images then form the basis of the reflections on the group. You can control the resolution of the environment map with the Configure... button. The resolution settings are in an edit box available under the Projection tab. (*See the section "Map Projection Tab" on page 184 for more information.*)

Please note that environmental reflections and mirror reflections can add up rendering time if you use a lot of them. These methods provide a much faster reflection than ray traced reflections, as long as they are not abused. Overuse of these types of reflections can engender render times equal to or greater than ray traced reflections available in other programs.

To save render time, you can set an automatic environment map to calculate its reflection only once. This setting is available through the Configure... button, in the Filter tab. (*See the section "Calculate Once (automatic reflections only)" on page 190 for more details.*)

Reflection Map List

The reflection map list is where you add the bitmap images or movies that you wish the group to reflect.

To add a reflection map to the Reflection Map List

- Click on the Add button next to the Reflection Map list
- Select a map from the file list
- Double click the map, or press the Open button.

The reflection map is added to the list. To configure the map, double click on the map name in the list. To reorder the map in the list, just drag it to its new location. (*See the section “Using Texture Maps” on page 178 for more information.*)

The Transparency Tab

The transparency tab contains all of the material settings and attributes which affect the transparency of the group. Several improvements and modifications have been incorporated in the transparency calculations used by the rendering engine, and industry standard presentations of the transparency attributes have been incorporated into the interface wherever possible.

Please note that the specular highlight and reflection calculations for the group are not affected by the transparency settings. If you wish to lessen their impact on a transparent group, you will need to adjust these values separately.



Figure 97 — The Transparency Tab

The transparency tab contains four sections:

- Transparency Attributes section
- Edge Characteristic section
- Transparency Map list
- Transparency Edge Map list

Transparency Attributes Section

The transparency attributes section contains controls for setting the actual transparency of the group. The slider bar controls the amount of transparency. The three buttons to the right of the slider control the type of transparency applied to the group:

- Filter
- Color Filter
- EI Filter

Filter

Filtered transparency groups are mathematically “averaged” into the scene, meaning that they do not change the appearance of any groups that fall behind them, with the exception of dimming the brightness values of those groups by the value set for the transparency. This effect does not reflect how transparent objects behave in the real world, and tends to be used primarily for special effects.

Color Filter

Color filter transparencies are either subtracted from the scene or added to the scene, depending upon which choices you make in the filter mode subsection. *(The filter mode subsection is visible only if this option is selected.)*

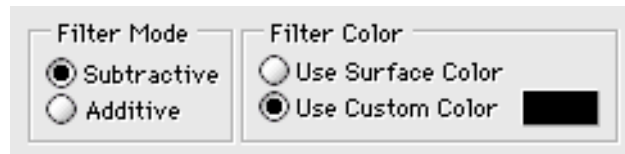


Figure 98 — Filter Mode Subsection

The filter mode subsection is divided into two areas:

- Filter Mode
- Filter Color

Filter Mode

Filter Mode determines the method by which the transparency will be applied to the scene.

Subtractive transparencies most accurately mimic the effect of transparent objects in the real world. Groups which pass behind a subtractively transparent group will be tinted to color of the transparent group, as the color of the transparent group is subtracted from whatever is behind it.

Additive transparencies are typically used for special effects purposes, such as glowing balls of energy and so forth. Groups which pass behind additive transparent groups will appear brighter, as the color of the transparent group is added to whatever is behind it.

Filter Color

Filter color is used to determine the color that will be used for the filter effect.

The Use Surface Color option will use the Diffuse channel and all attributes assigned to it for the filtering process set by the Filter Mode switch. This is the most realistic setting, and the default.

The Use Custom Color option will use the color in the swatch next to the item as the filtering color. It will ignore all of the attributes in the Diffuse channel. To change the color of the swatch, click on it and pick a new color from the color picker.

EI Filter

This setting is included for project file compatibility with previous versions of ElectricImage. (See the *ElectricImage Series 2 Reference Manual p. 8-14 for a discussion on this type of transparency.*) The color filter transparency method offers far more control and ease of use than this method. Consider ingoring this method when you are creating new projects from scratch.

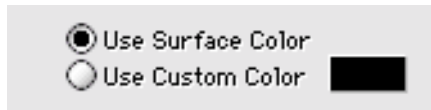


Figure 99 — EI Filter Options

When this option is selected, the EI Filter options subsection appears. It consists of two items:

Materials and Texture Maps — The Transparency Tab

- Use Surface Color
- Use Custom Color

Use Surface Color

This option will use the diffuse channel and all attributes associated with it as the filtering process for the transparency. This item is new to ElectricImage 2.8.

Use Custom Color

This option will use the color in the swatch as the filter color. This is analogous to the methods used by previous versions of ElectricImage. To change the color in the swatch, click on it and pick a new color from the color picker.

Transparency Map List

Transparency maps can be applied to modify the amount of transparency or to modify the color of the transparency (*see “Use Channel Popup Menu” on page 191 for more information*). You can have both types of maps in the list. Maps can be bitmap images and movie files, or procedural shaders.

To add a transparency map to the list:

- Click on the Add button next to the transparency map list
- Choose a map from the file list
- Double click on the map, or press the Open button

The map is added to the list. To configure the map, double click on the map name in the list. To reorder the map in the list, just drag the map to its new location. (*See the section “Using Texture Maps” on page 178 for more information.*)

Edge Characteristic Section

The items in this section control the effect of the edge of an group, regardless if the group is set to be transparent or opaque. For transparent groups, you can adjust the opacity of

the edge, and the falloff when the edge gets more opaque. For opaque groups, you can adjust when the edge of the object becomes more transparent.

A notable difference between ElectricImage 2.8 and previous versions is that the Edge Color value has been removed. Instead, the edge color is derived from the color of the diffuse channel. If a colorless transparent glass look is desired, set the transparency method to color filter, select subtractive, and the custom color option. Click on the color swatch to set a new color, perhaps a lighter variant (close to white) of the diffuse color selected (remember, we are using that value to give the edge some color.) Because you have selected the subtractive transparency mode, the white will be removed, leaving no color contamination behind, as more saturated colors will do. This will give a result equivalent to earlier versions of ElectricImage.

There are two sliders which affect the look of the edge:

- Amount
- Falloff

The Edge Characteristic sliders work similarly to the Edge Reflection sliders (*covered in the section “The Reflectivity Tab” on page 156.*) The type of effect achieved is determined by the three edge control buttons described following the Amount/Falloff discussion.

Amount

This slider determines the amount of edge transparency or opacity applied to the group. The falloff value (described below) must be set to a value other than 0.0 to see the effects of this slider. The range of this slider is 0.0 to 1.0.

Falloff

This slider determines how the edge will intrude into the body of the group. The Edge Amount slider must have a value other than 0.0 to see the effect. This slider has an infinite upper range, however, you may find numbers greater than 5 of no useful effect.

Edge Graph

To the right of the sliders and edit boxes is the edge graph, which shows the relationship of the Amount and Falloff parameters in graphic form. It updates in real-time as these values are edited. You will note that the more white area in the graph, the more powerful the defined edge will be, as represented in the material ball. The curvature plotted in the graph represents the actual mathematical function plotted by the values in Amount and Falloff

Edge Control Buttons

There are three radio buttons which control the treatment of the edge of the group:

- Normal
- Opaque
- Transparent

Normal

No edge characteristic is applied. The transparency effect is carried evenly through the group. This often yields a group with less definition, and is considered less realistic for transparencies.

Opaque

The edges of the group will be opaque, using the parameters set by the Amount and Falloff sliders. For transparent objects, this option yields the most realistic results, with the Amount and Falloff values set to your preference.

Transparent

The edges of the group will be transparent, using the parameters set by the Amount and Falloff sliders. Opaque objects can be made to have clear, fluffy edges, and can be used for such things as clouds, cotton balls, or planet atmospheres.

Transparency Edge Map List

Transparency edge maps work the same as the transparency maps and can affect the value or color of the transparency at the edge of the group.

To add a transparency edge map to the list:

- Click on the Add button next to the transparency edge map list
- Choose a map from the file list
- Double click on the map, or press the Open button

The map is added to the list. To configure the map, double click on the map name in the list. To reorder the map in the list, just drag the map to its new location. (*See the section “Using Texture Maps” on page 178 for more information.*)

The Luminance/Glow Tab

The luminance/glow tab contains all of the material channels and attributes which affect the luminosity and glow effects that a group can have applied to it.



Figure 100 — The Luminance/Glow Tab

The luminance/glow tab is divided into four sections:

- Luminance Color
- Glow Color
- Luminance Map List
- Glow Map list

Luminance Color Section

The luminance value controls the group's self illumination. (This value does not actually cause the group to emit light, but rather glow like an LED would glow.) The slider controls the amount of self illumination of the group, using either the color in the color swatch, or the diffuse shading channel of the group. Texture maps can also be used to control the luminescence of the group.

Use Color Button

The use color button will cause the group to luminesce with the color in the color swatch. To change the color in the swatch, click on it and pick the color from the color picker.

Use Shading Button

The use shading button will cause the group to luminesce with the values found in the diffuse channel.

Luminance Map List

Luminance maps can be either value maps or color maps. In the case of grayscale the white areas of the map will illuminate to white and black areas will not illuminate. In the case of a color map the illumination will possess the colors of the map.

To add a map to the luminance map list:

- Click the Add button next to the map
- Select a map from the file list
- Double click the map, or press the Open button.

The map will now be added to the list. To configure the map, double click on the map name in the list. To reorder the map in the list, just drag the map to the new location. (*See the section “Using Texture Maps” on page 178 for more information.*)

The map will now be added to the list. To configure the map, double click on the map name in the list. To reorder the map in the list, just drag the map to the new location. (*See the section “Using Texture Maps” on page 178 for more information.*)

Glow Color Section

The glow effect causes groups to apparently emit a glowing area around the group. The glow is a compositing effect added at the end of each rendered frame (and as such the effects of the glow settings are not represented in the material ball icon.) Glowing groups will not effect the appearance of other groups in the scene. Setting up glows properly requires the following procedure:

- Setting the glow attribute in the group’s material
- Assigning the group to a selection set
- Adding a the selection set to the glow layer tab in the Render Information Window
- Set up the glow layer

Setting the Glow Attribute in the Group’s Material

In the Glow Color section, you can control the amount that an object will glow, the color or shading of the glow, and whether the group will actually glow, or have a glare on the brighter areas of the group (which you can control.)

Glow

The Glow radio button will use the color swatch as the glow color. The value of the glow is set by the Glow Amount slider. To change the color in the color swatch, click on the

swatch and pick a color with the color picker. The actual area of glow is determined by the attributes of the Glow Layer, found in the Glow Layer tab of the Render Information Window. If the group is not part of a selection set contained within a Glow Layer, then the group will not appear to glow in the rendering.

Glare

The glare button will use the diffuse channel to create a glare around the group. The amount slider determines the brightness cutoff for the glare. Typically, a fairly subtle cutoff is desired, as glares tend to be less overpowering than glow effects. 50% is a good value for the brightness cutoff to begin with. You can have the entire group “radiate” by setting the slider to 0.0. This makes the group appear to be heavily over-exposed, depending upon the settings in the glow layer to which the group’s selection set is assigned.



Figure 101 — Teapot without glare on the left, Teapot with glare on the right

Any pixels which fall within the specified tolerance set by the Glow Amount attribute will be blurred by the amount specified in the Glow Radius attribute of the Glow Layer, and then added back onto the scene by the amount specified in the Intensity attribute of the Glow Layer to which it is assigned. Glow Radius values of 50 pixels or greater, plus a Glow Intensity of 1.5 will give you a good starting point for a nice glare effect (as shown in the illustration.)

The actual area of the glare is determined by the attributes of the Glow Layer, found in the Glow Layer tab of the Render Information Window. If the group is not part of a selection set contained within a Glow Layer, then the group will not glare in the rendering.

To assign the Group to a Selection Set:

- Select the group
- Choose Select>By Set>Edit Sets
- Click the Add button in the Selection Sets section of the window that appears
- Type in the name of the set and hit return
- Select the name of the set that now appears in the list
- Click the Add button in the members section of the window
- Close the window

All of the selected groups will now be part of that named selection set. (*For more information on Selection Sets, see the Selection Sets chapter.*)

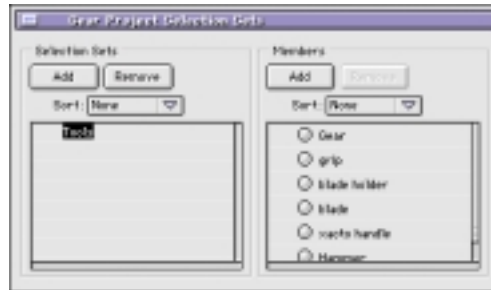


Figure 102 — Edit Selection Sets Window

Add the Selection Set to a Glow Layer:

- Open the Render Information Window (File>Render...)
- Select the Glow Layer tab
- Click the Add button in the Glow Layer Section
- Type in Glow Layer name in the edit field and hit return

- Select the Glow Layer in the list
- Click the Add button in the Glow Layer Member section
- Select the desired selection set from the list that appears, and click the Add button

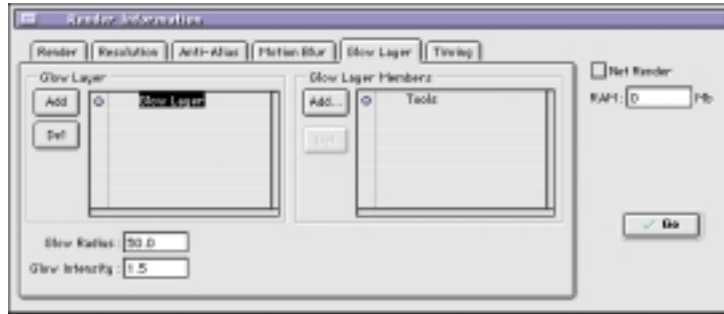


Figure 103 — Glow Layer Tab of Render Information Window

The selection set is now added to the glow layer. (See the *Chapter on the Render Information Window* for more details about working with Glow Layers.)

Set Up the Glow Layer

- Select a Glow Layer from the Glow Layer List
- Type in a value for the Glow Radius in pixels
- Type in a value for Glow Intensity

The smaller the pixel number in the Glow Radius edit box, the more defined and brighter the glow will appear. Larger values in the Glow Radius edit box might require an adjustment to the Glow Intensity value to achieve the desired effect (larger intensity values for a stronger glow, smaller intensity values for a weaker glow.) Glow effects will typically be 2 or greater in intensity, while Glare effects will probably not be brighter than 1.5, but feel free to experiment.

The previous steps cover typical glow and glare usage. (For more information, see the *chapter on the Render Information Window, Glow Layer* section.)

Glow Color Maps List

Glow maps can be applied to control the amount of glow, and to control the color of the glow. Glow maps can be a bitmap image or movie file, or a procedural shader. You can have as many glow maps as you like.

To add a map to the glow color maps list:

- Click the Add button next to the glow color maps list
- Select a map from the file list
- Double click the map, or press the Open button

The map will now be added to the list. To configure the map, double click on the name of the map in the list. To reorder the map, just drag the name to the desired location in the list. *(See the section “Using Texture Maps” on page 178 for more information.)*

The Transmission Tab

The transmission tab contains all of the material channels and attributes which affect the transmission characteristics of the group. Some objects in the real world can allow light to go through them to a degree. This effect can be seen if you were to hold up a leaf to the sun. You would notice the spidery vein network as darker shapes, and the thinner parts of the leaf would appear brighter. The transmission channel lets you correctly reproduce this phenomena.



Figure 104 — The Transmission Tab

The transmission tab is divided into three sections:

- Transmission Color Section
- Transmission Edge Control Section
- Transmission Maps List
- Edge Transmission Maps List

Transmission Color

This attribute determines the transmission amount and color. The best transmission color is white, as it will conform to the color of the group and any maps, plus the lightsource.

Edge Control Subsection

Transmission edge control works the same as with edge transparency (*see “Edge Characteristic Section” on page 166,*) allowing you to build less translucent edges to curved groups the way they would appear in the real world.

Edge Amount

Controls the transmissiveness of the edge. The Edge Falloff slider must have a value other than 0.0 to see the effect.

Edge Falloff

This slider determines how the edge will intrude into the body of the group. The Edge Amount slider must have a value other than 0.0 to see the effect.

Edge Graph

To the right of the sliders and edit boxes is the edge graph, which shows the relationship of the Amount and Falloff parameters in graphic form. It updates in real-time as these values are edited.

Transmission Maps List

Transmission maps are used to control the value and color of the transmission. Transmission maps can be a bitmap image or movie file, or a procedural shader. After a map is assigned, the slider no longer has any effect as all the transmission information is derived from the value of the map.

The best way to achieve a natural look is to assign a standard color map under the Diffuse tab and then a grayscale transmission map under the Transmission Tab.

To add a map to the transmission map list:

- Click the Add button next to the transmission maps list
- Select a map from the file list
- Double click the map, or press the Open button

The map is now added to the list. To configure the map, double click on the name of the map in the list. To reorder the map, select the name and drag it to the desired location. (*See the section “Using Texture Maps” on page 178 for more information.*)

Edge Transmission Map List

Edge transmission maps are used to control the value and color of the edge of the group. Edge transmission maps can be a bitmap image or movie file, or a procedural shader. After a map is assigned, the slider no longer has any effect, as all the transmission information is derived from the value of the map.

To add a map to the edge transmission map list:

- Click the Add button next to the edge transmission maps list
- Select a map from the file list
- Double click the map, or press the Open button

The map is now added to the list. To configure the map, double click on the name of the map in the list. To reorder the map, select the name and drag it to the desired location. (*See the following section on Texture Mapping for more information.*)

Using Texture Maps

ElectricImage 2.8 introduces unlimited texture maps per group. Texture maps are an integral component of a material — not separate, as in previous ElectricImage versions. Texture maps do different things, depending upon the tab and map list in which they reside. The same map can be used in many different channels, and each channel can have an unlimited amount of maps as well.

All of this power can come at a price if you are not frugal with your map management. Be careful not to waste maps and map memory. If you just need a grayscale value for a bump map, then you would be wasting over 1 MB of RAM (for a typical map) if that same map also had RGB channels associated with it (and was unused elsewhere).

New map placement controls have been added that allow face to face precision of map placement. These tools augment the original projection mapping approach found in previ-

ous versions of ElectricImage. Multiframe maps can be easily controlled with start and stop times and stop ranges. Most of the map functions described in this section can also pertain to procedural shaders, another new addition to ElectricImage 2.8.

Map Lists

Maps are managed within map lists. Each material channel contains a map list where appropriate. Map lists are a jumping off point to map configuration and management.

Map Order

Map order is very important, as some effects may not be obvious if maps are out of order. Fortunately, reordering maps within a channel is easy — just drag the maps to whatever order you wish.

Map Alpha Channels

Alpha channels now take on a more specific meaning in ElectricImage 2.8, both to make the process of using texture maps easier, and to conform to industry standards. There are essentially three ways to use an alpha channel within a texture map:

- Ignored
- As Value
- As Mask

(see “Alpha Channel Configuration” on page 193 for more information.)

They Way it All Works

Maps add into the list from the top. Think of the list being stacked on top of the group. The map at the top of the list is the uppermost one, while the map at the bottom is innermost, nearest the actual surface of the group. The maps can be reordered by dragging them up or down in the list.

Materials and Texture Maps — Using Texture Maps

The circle next to each map is a checkbox that can be used to enable or disable the map. This feature is very useful while developing new materials. The empty space next to the circle is the map lock toggle. This can be set to prevent this map from being over-written by a Master Material assigned to the group.

Texture maps can be copied and pasted from one map list to another. To copy the map, highlight the map, select Copy Texture from the Edit menu. To paste the map, select the list you want paste it into by clicking somewhere in the list box. The list box will show that it has been selected with a thick black outline (*as shown below*). Use the Paste Texture command from the Edit menu to complete the operation.

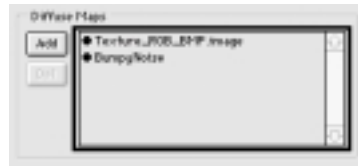


Figure 105 — Diffuse map list box

To configure the texture map, double-click on the name of the map in the list box. The Texture Info Window will open. This window displays the group to be textured and the map projection (on the right) and has a series of tabs and buttons for controlling texture scaling, tiling, etc. (on the left).

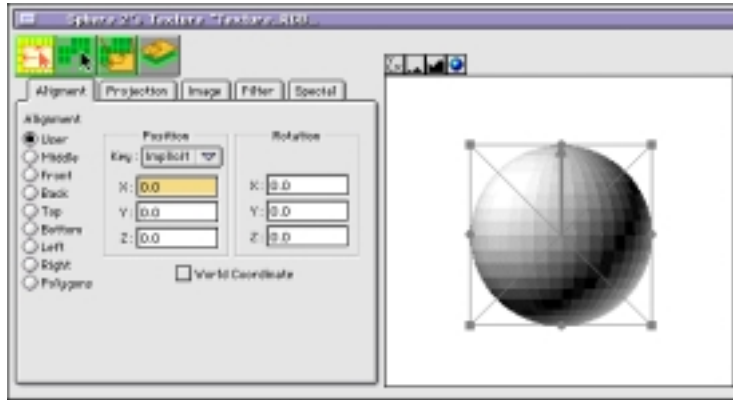


Figure 106 — Texture Info Window

Map Alignment Buttons

There are four map alignment buttons at the upper left of the window assist in map placement, in addition to the projection map methods from earlier versions of ElectricImage. These buttons are:

- Move
- Select Polygons
- Fit to Selected
- Align Map Plane (to Polygon)

Move

This (default) button allows you to move the map projection around in the window for proper placement on your model. Drag left or right at the edges of the projection to scale the map. Hold down the control key and drag to rotate the map.

Select Polygons

This button is used to select polygons by clicking on individuals or drag a rectangle for multiples. Shift click to add or remove polygons within the selection.

Fit to Selected

This button sets texture projection to the extent of the polygons selected with the Polygon Selection Button.

Align Map Plane (to Polygon)

This button sets map plane any polygon, regardless of the polygons you may have already selected with the Select Polygons tool. Unlike the Fit to Selected tool, the size and aspect ratio of the map is maintained with this tool. Align Map Plane is a very powerful feature for aligning the map projection icon to tricky curved surfaces. This feature is also available while in Move mode by Command-clicking on a polygon.

Map Alignment Tab

The alignment tab contains the position and rotation information for the texture map. The map alignment tab is divided into three sections:

- Alignment Radio Buttons
- Position Information
- Rotation Information



Figure 107 — Map Alignment Tab

The Alignment Radio Buttons

These buttons provide a straightforward way of aligning the texture map:

- User
- Middle
- Front
- Back
- Top
- Bottom
- Left
- Right
- Polygons

These projections will align and scale the map along the axis noted by the radio button. They are used to set the initial map alignment. You can use the map alignment buttons to more precisely locate the map to the group.

Position Information

The position information section contains X,Y, and Z readouts for map position, as well as a popup menu to control the motion path interpolation method for the map position channel. You can change the map position by dragging, or by typing values into the edit boxes. *(For information about the use of Implicit and Explicit keyframe control, see the Function Curve Editor chapter.)*

Rotation Information

The rotation information section contains X,Y, and Z readouts for map rotation, as well as a popup menu to control the motion path interpolation method for the map rotation channel. You can change the map rotation by rotation tools and keyboard shortcuts, or by typing values into the edit boxes. *(For information about the use of Implicit and Explicit keyframe control, see the Function Curve Editor chapter.)*

World Coordinates Checkbox

When this checkbox enabled, the map will reside in world space instead of local space. Effectively, the map becomes fixed in space at the coordinates specified (you can always animate its position, of course), and the group would then be perceived as moving *through* it's map if the group were moved. (See the *ElectricImage version 2.8 Starter PDF file* included on the installation CD for more information on World Space and Local Space.)

Map Projection Tab

The projection tab is used to determine the type of mapping primitive that the map will project, as well as the tiling method and map scale. There are four types of map tiling:

- None
- Hold
- Repeat
- Mirror

None

Disables mirroring of the map on the specified map axis. Choosing None for both axes will cause the map to be displayed only where you positioned it, nowhere else. You can choose this option along with another to constrain a map to hold, mirror, or repeat along a single axis.

Hold

Applies the colors found at the map edges outside of the map area. The map will appear once as positioned, with the border colors of the map extending beyond the map rectangle, covering the object.

Repeat

Repeats the map along the specified axis. Choosing Repeat for both axes will cause the map to repeat continuously, depending upon the scale of the map relative to the group.

Mirror

Mirrors the map along the specified axis. Choosing Mirror for both axes will cause the map to flip flop about both axes.



Figure 108 — Map Projection Tab

Map Type Popup Menu

Map projections use simple primitives to process and align the texture map for rendering. There are four types of map projections:

- Flat
- Cylindrical
- Spherical
- Cubic

Pick the projection which most closely matches the shape of the group. (*For more information on Map Projections, see the ElectricImage Series 2 Reference Manual pp. 14-10 to 14-13.*)

Map Scale Edit Boxes

The map scale edit boxes can be used to fine tune the scale and fit of the map on the group. There are separate values for X, Y, and Z axes.

Image Map Tab

The image map tab contains thumbnails of the RGB and Alpha channels of an image map, some statistics about the map, the map cropping rectangle, a Replace Map button, and movie playback information for multi-frame map files.



Figure 109 — Image Map Tab

RGB and Alpha Thumbnails

The RGB and Alpha thumbnails give you a quick visual reminder of the contents of the map channels. If you click on the thumbnail, a larger image will appear in the view window to the right of the tab. If you double click on the image in the view window, the actual image will be displayed in a separate image display window. (See *the ElectricImage 2.75 Addendum, chapter 10, for information on Image Display.*)

Replace Image Button

Allows you to replace the current texture file without losing the placement, scaling, and other settings.

Cropping Edit Boxes

These coordinate boxes allow you to crop the texture map to any size or portion of the map you wish to use. You can crop interactively by first clicking on the RGB or Alpha win-

dows, to bring up the image in the texture window, and then drag the crawling ants border.

Map Playback Controls

These controls will appear whenever you have selected a mutli-frame map as a texture. You can adjust the end behavior, at what frame the movie will start, how many frames to play back, and the playback rate.

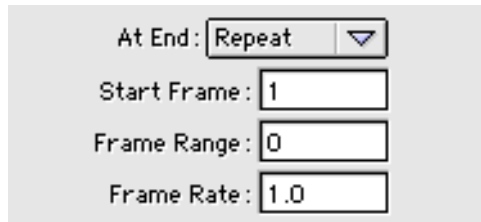


Figure 110 — Map Playback Controls

End Condition Popup Menu

This controls how the movie will behave when the end of the file is reached. There are three choices:

- Repeat
- Oscillate
- Hold

Repeat

Repeats the movie when the end of the file is reached.

Oscillate

Cycles back and forth through the movie when the end of the file is reached.

Hold

Holds the movie at the last frame when the end of the file is reached.

Start Frame

The first frame of the animated texture to be used. The first frame of the animated texture is considered frame 1 not frame 0. Choosing a value other than one will cause the animated texture to begin at that frame. Combined with the Frame Range edit box, you can choose to render just a section of the animated texture map.

Frame Range

This value sets the number of frames to use for the animated texture map. When combined with the Start Frame value, this feature can be used to render just a section of the animated texture map. The default value is 0, which causes all frames in the animated texture map to be used.

Frame Rate

Controls the number of animated texture frames to increment for every frame of the output animation. The default is 1.0. Smaller numbers will speed up the apparent playback of the texture when viewed at speed. Larger numbers will make the texture appear to be slower. Extremely large numbers will make the texture appear to be “step framed.” You can fine tune the playback by using real numbers (numbers with decimals.)

Map Filter Tab

The map filter tab contains the image filtering and map strength controls for the texture map. This tab also is used to select how the different RGB and Alpha channels will be processed. The filter tab is divided into several sections:

- Map Filter Check Boxes
- Map Quality Edit Boxes
- Map Strength Slider
- Use Channel Popup
- RGB Channel Configuration
- Alpha Channel Configuration



Figure 111 — Map Filter Tab

Map Filter Check Boxes

These check boxes enable map filtering, and the Negative Z function. There are a total of three check boxes:

- Interpolate
- Anti-Alias
- Negative Z
- Calculate Once (automatic reflections only)

Interpolate

Interpolation filters the map as it is applied to the model. It cuts down on aliasing, but can also soften the image (especially as the map grows larger than 1.0 in scale.) Disabling this feature will sharpen the map, but doing so is not recommended.

Anti-Alias

Texture anti-aliasing is another form of map filtering. With this option enabled, the map is effectively anti-aliased twice, first, during the stage in which the map is applied, then, as the entire image is anti-aliased. This can cause a loss of high frequency detail in the map, which some consider objectionable. Disabling this feature will cause some aliasing, but the overall image anti-aliasing might hide the artifacts. Use at your discretion.\

Negative Z

Causes the texture map to be projected along both the positive and negative Z axis. The map will be projected along only the positive Z axis if this checkbox is off. As an example, imagine a flat map placed on a nearly flat disk. If the Negative Z checkbox is on, the map will appear on both sides of the disk. If the checkbox is off it will appear only on the front side.

Calculate Once (automatic reflections only)

Causes a mirror or environmental reflection map to be rendered only once in the animation. This feature can save much rendering time, although it must be used wisely, as the reflection will not update after the first frame.

Map Quality Edit Boxes

These edit boxes offer even more control over the quality of the texture. There are two values to do so:

- Blur
- Samples

Blur

Allows you to degrade the map sharpness. This tool is useful for blurring a bump map that is too sharp and not giving you a clean bump, or taking the edge off of a reflection that might appear too busy otherwise.

Samples

Controls the quality of the map. For the most part, 5 samples will yield acceptable results. If you wish to improve the quality of your maps even more, just increase this value. Higher values will increase rendering time, however.

Map Strength Slider

This slider controls the amount of affect the current texture has on the group. Use this slider when you have multiple texture maps on one group to mix together several maps. This value can be animated to cause maps to fade in/out over time.

Use Channel Popup Menu

This popup is used to specify what image map channels you wish to use and for what purpose. You can choose RGB, Alpha or both and then specify if you want it used as color or as value and if you want to invert it. There are three choices:

- RGB Only
- Alpha Only
- RGB + Alpha

RGB Only

Uses the RGB channel only for the map. The options field changes when this item is selected, offering you the ability to use the map as a color map, or as a value map (in which case the map will be automatically converted to gray scale.) There is also a button to the invert the map.

Alpha Only

Uses the alpha (mask) channel only for the map. The options field changes to the invert map button, allowing you to reverse the alpha channel.

RGB + Alpha

Uses both the RGB and Alpha channels. When this option is selected, the options field displays configuration sections for both the RGB and alpha channels, which allow you to modify the behavior of these two channels. These configuration sections are described in detail below.

RGB Channel Configuration

There are three items in the RGB channel configuration section:

- As Color
- As Value
- Invert

As Color

This option sets the RGB channel to be used as color only. The color of the map will be passed through to whatever shading channel the map is applied to (note that some channels, such as Bump/Displace and Clipping, do not use RGB colors.)

As Value

This option uses the RGB colors as values (think of it as an automatic gray scale map conversion.) Effectively, the RGB channel can be used to drive value-based effects, such as bump and displacement maps, clip maps, transparency value maps, and so on.

Invert

This option negates the colors of the RGB channel. The map can still be used either As Color or As Value. This option often prevents a quick trip to Photoshop!

Alpha Channel Configuration

There are three items in the Alpha channel configuration section:

- Ignore
- As Mask
- Invert

Ignore

Ignores the alpha channel altogether.

As Mask

This option enables the alpha channel to be used as a mask.

Invert

This option negates the colors of the alpha channel.

Special Tab

Depending upon the type of map, this tab may be empty or may contain controls for bump/displacement maps, as well as controls and buttons to show or save procedural shaders.

Procedural Shaders

Introduction

Procedural shaders are little “C” language programs which Camera can use to shaded pixels with a variety of effects. Well written shaders are typically very fast and efficient.

Shaders can be added to any material channel you choose (diffuse, specular, etc.) they will affect this channel and may optionally affect several others as well (shaders do not perform displacements at this time.) Most often, you will add the shader to the diffuse channel. Shaders are located in the EI Shaders folder, in the same directory that ElectricImage is installed.

The shaders have animatable parameters. The numeric entry boxes and the colors can be animated to create some very striking effects. (As an example, add the Cammo shader to a teapot and animate the Density value over time). ***Note — Changes you make in these interfaces are made at the current project time. To prevent unwanted texture animation, disable the Texture Map item for the group in the Project Window.***

A shader is added to a material channel using the add button in the Material Info Window. Once added, you can double-click on the shader to bring up its Texture Info Window. Under the Special Tab you will find two new buttons: Procedural... and Save Procedural as... The Procedural button brings up the interfaces shown in the rest of this chapter. The Save Procedural As button saves a copy of the procedural with the current settings as default. This means you can create a shader with unique set of parameters that you like and save it out with those parameters imbedded in it.

Some procedural shaders are designed to work as 2D projections, others as 3D projections. Those that work in 2D will appear to stretch along the depth of the projection. Also, some shaders are not anti-aliased within the shader. You can increase the group sampling to 2x2 to compensate.

Working with Procedural Shaders

All of the interfaces presented for each shader are simple dialog boxes, listing parameters and values, plus a shader preview area. The preview area fits within the face of the cubic projection that ElectricImage supplies for procedural shaders. Whatever you see in your preview, will be what you see in the area occupied by the face of the cube, with one caveat: the cubic projection must be equalateral, that is, the scales of the X, Y, and Z axes must be the same. If not, the procedural will appear distorted by the amount of the scale values. The position of the shader is also influenced by the position of the cubic projection icon. You can use this to fine tune procedural placement if necessary.

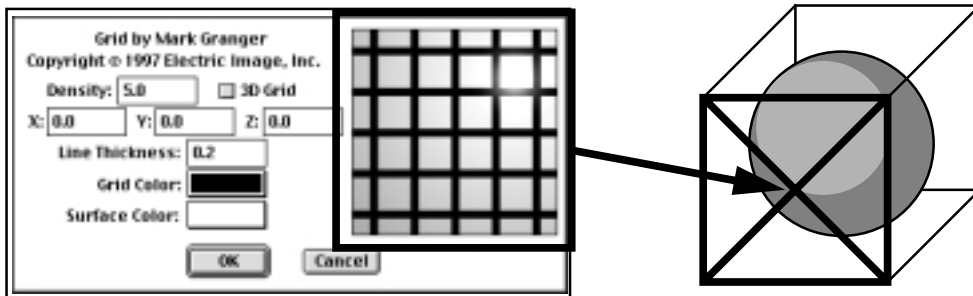


Figure 112 — Relationship of Preview Area to Cubic Projection Icon

You can also adjust the “lighting” in the shader preview area by clicking the location in the preview area that you would like to see the light shine on the preview (it defaults to the top right of the preview area.) This can help you to get a better feel for the look of the shader before you render. Some shaders can generate holes in surfaces. The preview area will show a non-rendering checkerboard in that case.

You can set color values to alpha 0.0 to use the diffuse color of the group for that component, instead of the color swatch. Some shaders, such as Random Dots, do this automatically.

Bricks

This 2D shader creates a brick pattern on any group it is added to.

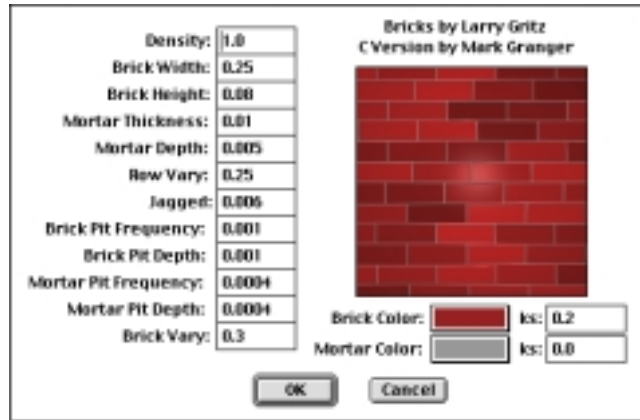


Figure 113 — Bricks Shader Interface

Apply only to the Diffuse Channel. Will affect the Diffuse, Bump, and Specular Channels.

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in.

Brick width

The width of each brick. A value of 1.0 will yield bricks as wide as preview window.

Brick Height

The height of each brick. A value of 1.0 will yield bricks as high as preview window.

Mortar Thickness

The width and height of the mortar that separates the brick.

Mortar Depth

The mortar is an inset procedural bump. This controls how deep it is.

Row Vary

Controls brick alignment. If set to 0.0, the alignment between alternate rows of bricks will be perfect.

Jagged

Larger numbers than the default will cause extreme variation of the height and length of the bricks in a wave like fashion.

Brick Pit Frequency

The bricks themselves have a rough surface due to a procedural bump. This value controls the number of pits on each brick surface. Useful values are between .001 and .009.

Brick Pit Depth

Controls the depth of the pits on the surface of the bricks. Useful values are between .01 and .0001.

Mortar Pit Frequency

The mortar also has a rough surface due to a procedural bump. Useful values are between .0001 and .0009.

Mortar Pit Depth

Controls the depth of the pits in the mortar. Useful values are between .0001 and .0009.

Brick Vary

This controls the color variation of the bricks. Useful values are between 0 and 1.

Brick Color

The RGB color of the bricks.

Mortar Color

The RGB color of the mortar.

Ks

The Specular value for the Bricks and Mortar. 0 is no specular, 1 is maximum specular

Bump Array

This 3D shader creates an array of dimples. Could be used for the surface of a golf ball or for metal floor plating. It is also useful for creating a pattern of round holes in an object, like the lid of the original Star Trek communicator. Apply the shader to the Transparency Channel with a Density of 10.0 and the Bump Color set to black.

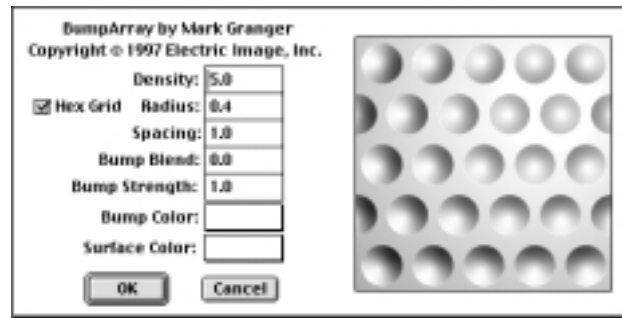


Figure 114 — Bump Array Shader

Will affect the channel in which it is applied and the Bump/Diffuse Channel.

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in.

Hex Grid

Realigns the bumps in a hexagonal pattern. It defaults to on.

Procedural Shaders — Bumpy Noise

Radius

Controls the radius of the bumps.

Spacing

Controls the distance between each bump. This number can be set small to cause the bumps to overlap.

Bump Blend

Distance over which the bumps blend together. Smooths over transitions when the bumps overlap.

Bump Strength

Controls the magnitude of the bump, how deep or high it is. Can be positive or negative.

Bump Color

The RGB color of the bumped area.

Surface Color

Sets the RGB value of the surface. You can set the alpha to 0.0 to let the object's diffuse color, or the next texture map in the diffuse list, come through instead.

Bumpy Noise

This 3D shader creates a bumpy, noisy pattern. Could be used for alien flesh.
Will affect the Base and Bump Channels.

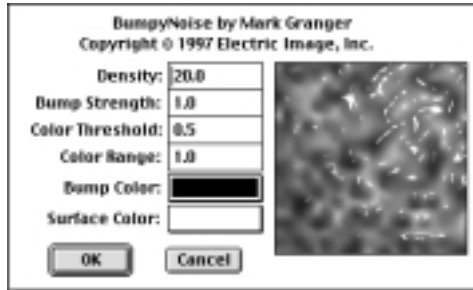


Figure 115 — Bump Noise Shader

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in.

Bump Strength

Controls the magnitude of the bumps on the surface. Useful range is -5.0 to 5.0

Color Threshold

Changes where the color blend begins between Bump Color and Surface Color. 0.5 is right in the middle of the bump, 1.0 is right at the top of bump.

Color Range

Controls the variation in color between the lowest and highest points on the surface. Useful range is between 0 and 10.

Bump Color

The RGB color of the bumped area.

Surface Color

Sets the RGB value of the surface. You can set the alpha to 0.0 to let the object's diffuse color, or the next texture map in the diffuse list, come through instead.

Cammo

This is a camouflage 3D shader and is loosely patterned after the standard US “Woodland” pattern.



Figure 116 — Cammo Shader

Will affect only the channel in which it is applied.

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in.

Surface Color

Sets the RGB value of the underlying surface. The three Cammo regions are applied on top of this surface. You can set the alpha to 0.0 to let the object’s diffuse color, or the next texture map in the diffuse list, come through instead. There are three different regions added on top of the surface color. They each have the following controls.

Scale

Controls the size of the pieces that make up the region.

Level

Controls how much of the Surface color shows through the region. 0.0 allows all of the surface color to show through. 1.0 allows none at all.

Color

RGB color of the region.

Cell Look

This shader is neither a 2D or 3D shader, but rather an illumination shader which gives a cartoon-like appearance to the groups it is applied to. The defaults have been picked to work well. You may wish to try it, as is, before changing any of the values in the interface. The shader will automatically pick up the diffuse color of the object. Therefore, you don't have to change the color values in the shader for each object you use it with.

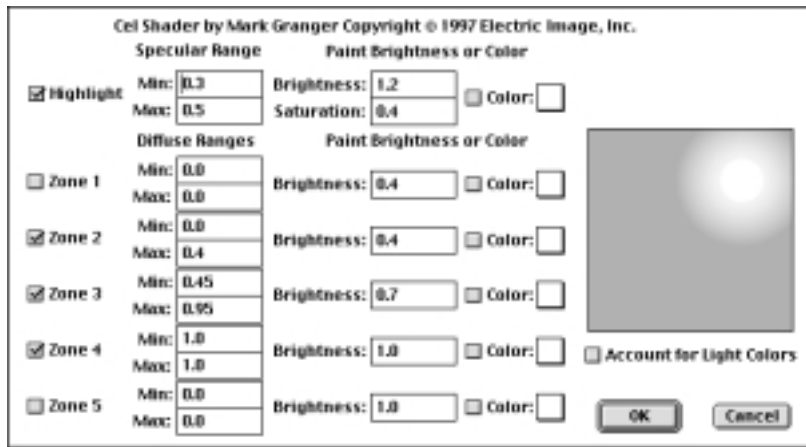


Figure 117 — Cartoon Cel Shader

Apply to the Diffuse Channel, will affect Diffuse and Specular.

Highlight

If this option is on, the highlight (specular) is operated on by the shader.

Specular Range Min/Max

Specular is always in the range of 0 to 1. 0 is no specular, 1 is 100% specular. As the object is shaded, pixels with a specular value below the Min get no specular highlight at all. Pixels greater than the Max get the color in the specular channel of the group after being processed by the Brightness and Saturation values. Between the Min and Max, the color is ramped.

Brightness

Varies the brightness of the computed highlight.

Saturation

Varies the saturation of the computed highlight.

Color

When on, the color chosen using the swatch is used instead of the group's specular color.

Zones

Sets the number of different colors that will be used to shade the group.

Diffuse Range Min/Max

If the brightness of the pixel being shaded falls into this range, the objects diffuse color is multiplied by the Brightness value and applied. If the brightness falls in between ranges (as in the case of 0.42, using the numbers in the illustration), the color is ramped.

Brightness

The factor by which the diffuse color is multiplied to yield the final pixel color.

Color

If the brightness of the pixel being shaded falls into Min/Max range for this Zone, the object's diffuse color is replaced by this color.

Account for Light Colors

If this option is on, the highlight and the diffuse colors of the shader are effected by scene lighting, otherwise the colors of the group will match the swatches in the shader.

Checker Board

This shader can be either 2D or 3D, and places a checkerboard pattern on the surface of the group. Will affect only the channel in which it is applied.



Figure 118 — Checker Board Shader

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in.

Color1&2

RGB color of the alternating squares.

3D Checker

Makes the procedural act as a solid shader. The checkerboard pattern will repeat throughout the group.

Clouds

This 3D shader creates a cloud-like fractal pattern. Will affect only the channel it is applied to.



Figure 119 — Clouds Shader

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in.

Cloud Threshold

Controls how many cloud puffs are present. Useful range is 2.0 to 0.0.

Cloud Range

Controls the density of the clouds. Useful range is 10.0 to 0.0

Cloud Color

RGB color of the clouds.

Sky Color

RGB color of the area not covered by clouds.

Color Noise

This 3D shader creates a psychedelic color pattern, similar to tie-dye.

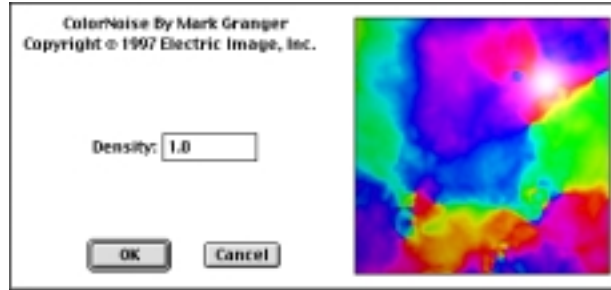


Figure 120 — Color Noise Shader

Will affect only the channel that it is applied to.

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in.

Crumple

This 3D shader creates a bumpy pattern on an object very similar to crumpled aluminum foil. *This shader is not anti-aliased, so use additional group sampling as needed.*



Figure 121 — Crumple Shader

Will affect the channel in which it is applied and Bump channels.

Noise Level

Controls how many iterations of noise are computed for the shader. Each successive iteration is half the size of the previous one. More Levels require more rendering time.

Noise Scale

Sets the height at which the High Color is drawn.

Noise Factor

Each successive level of noise gets smaller by this amount.

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in.

Bump Scale

Sets the magnitude of the bump. Can be negated to invert the crumple effect.

Bump Factor

At each successive level of noise is computed the bumps get smaller by this amount.

Animation

Animates the noise pattern over time. A value of 1.0 moves the noise 1 unit of the preview square per second. This can be used to create animated water effects. Try doing this by animating the Z value for the shader applied to a flat plane.

High Color

Sets the RGB value of the surface at the top of the bumps. You can set the alpha to 0.0 to let the object's diffuse color, or the next texture map in the diffuse list, come through instead.

Low Color

Sets the RGB value of the surface at the bottom of the bumps. You can set the alpha to 0.0 to let the object's diffuse color, or the next texture map in the diffuse list, come through instead.

Crust

This 3D shader creates a series of high, flat ledges.

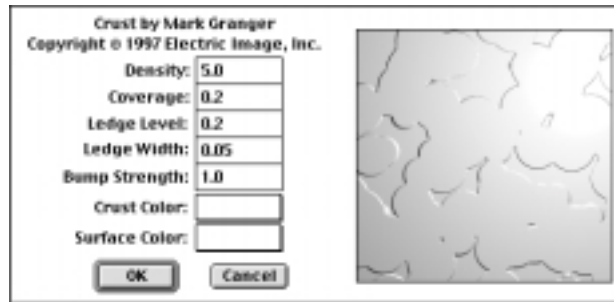


Figure 122 — Crust Shader

Will affect the channel in which it is applied and Bump channels.

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in.

Coverage

Controls the region that the Crust Color covers. 0.0 yields no Crust Color. 1.0 will cause the Crust Color to cover the entire procedural.

Ledge Level

Controls how far the ledges spread out across the surface of the crust.

Ledge Width

Sets the widths of the ledges.

Bump Strength

Sets the magnitude of the bump for the ledges. Values can be either positive or negative.

Crust Color

Sets the RGB value of the ledges.

Surface Color

Sets the RGB value of the surface. You can set the alpha to 0.0 to let the object's diffuse color, or the next texture map in the diffuse list, come through instead.

Cyclone

This 3D shader creates a vortex pattern. The effect is quite startling when applied to the Transparency Channel.

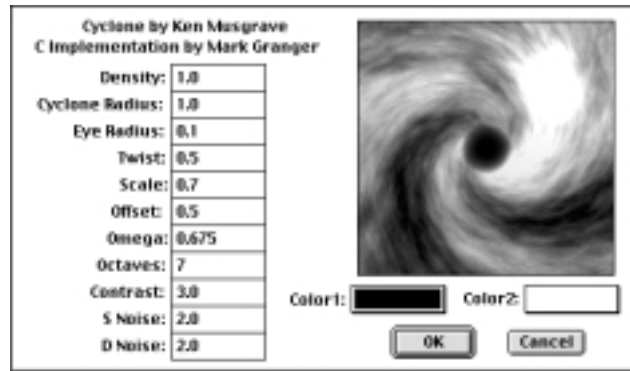


Figure 123 — Cyclone Shader

Will only affect the channel in which it is applied.

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in.

Cyclone Radius

The radius of the main body of the swirling vortex. This value manages the apparent “strength” of the vortex. The default value of is 1.0, giving a decent looking vortex. Smaller numbers will impart less energy to the vortex, effectively weakening it. A value of 0.0 will look like smoke, rather than a cyclone. Likewise, values of over 5.0 will have a similar effect.

Eye Radius

The radius of the eye at the center of the vortex. 0.5 corresponds to the width of the preview window.

Twist

Sets the number of revolutions the vortex makes within the width of the preview window

Scale

Sets the magnitude of the amount of clouds created in the vortex. Small changes in this value can vary the look of the effect significantly.

Offset

Can be used to make the overall effect more misty.

Omega

Increases the choppyness of the clouds. Useful range is between 0.0 to 1.0, with 1.0 being more choppy than 0.0.

Octaves

Controls the complexity of the noise function. Useful range is 1 to 8

Contrast

Lower numbers decrease the contrast between Color1 and Color2.

S Noise

A noise seed. Can be used to vary the look of the cyclone.

D Noise

A noise seed. Can be used to vary the look of the cyclone.

Color1

Sets the RGB value of the region not part of the swirling vortex.

Color2

Sets the RGB value of the cluds in the vortex.

Dots

This 3D shader makes a grid of dots on the surface of the object.

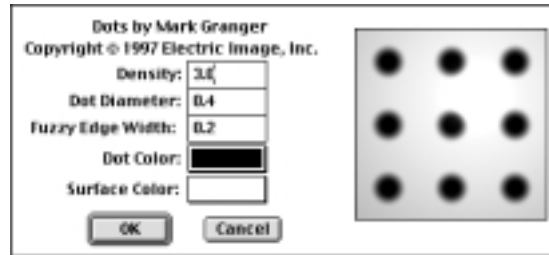


Figure 124 — Dots Shader

Will only affect the channel in which it is applied.

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, adding more dots, smaller to zooming in, removing dots. The default is 1.0.

Dot Diameter

Diameter of the dots. A diameter of 1.0 fills the preview window at a density of 1.0.

Fuzzy Edge Width

Sets a region around the dot to blur slightly. Makes a nicer transition from the surface to the dots.

Dot Color

The RGB color of the dots.

Surface Color

Sets the RGB value of the surface. You can set the alpha to 0.0 to let the object's diffuse color, or the next texture map in the diffuse list, come through instead.

Eroded

This 3D shader puts dents and holes in the surface of an object. (The shader uses a black and white checker pattern in the preview area to denote actual holes that will be visible through the material — the pattern does not render.)



Figure 125 — Eroded Shader

Will affect the channel in which it is applied and Bump channels.

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in.

Bump Strength

The magnitude of the bump applied to the dented portions of the surface. Can be a negative number.

Erode Holes

When on, holes are actually cut through the surface. When off, areas that represent holes are shaded with the Hole Color.

Hole Min

The surface of the object is represented by a value of 0 to 1. Where 0 is the bottom of the deepest hole. Hole min sets the range over which holes occur on the object. In the default case, holes appear between 0.3 and 0.4

Hole Max

The surface of the object is represented by a value of 0 to 1. Where 1 is the top of the surface. Hole max sets the range over which holes occur on the object. In the default case, holes won't appear between 0.4 and 1.0. Between 0.3 and 0.4 there is a ramp wherein the surface transitions nicely into the hole.

Hole Color

RGB value of the color applied to the holes when the Erode Holes flag is off.

Surface Color

Sets the RGB value of the surface. You can set the alpha to 0.0 to let the object's diffuse color, or the next texture map in the diffuse list, come through instead.

Flame

This 3D shader creates a fire-like color pattern. You may want to re-align the cubic projection icon to bottom or top, as the preview shader is presenting the flames to you in that orientation. (This shader does not aminate the flame effect.)

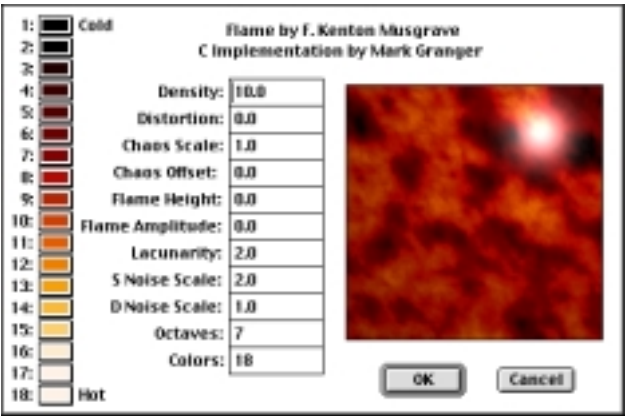


Figure 126 — Flame Shader

Will only affect the channel in which it is applied.

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in.

Distortion

Scales the combination of all noise functions. Larger numbers will yield many smaller regions of flame. Useful values are in the range of 0 to 1.

Chaos Scale

Scales the color temperature of the shader. Larger numbers are hotter.

Chaos Offset

Increases the color temperature of the shader (default is 0.0.) Larger numbers are hotter. Numbers over 1.5 tend to “burn out” the shader and are not very useful.

Flame Height

If set to 0.0 (the default), this shader behaves as a 2D shader. If a height is provided, the colors will vary as the height of the object changes. Apply to the top of a cube and enter in a height value. When you render the side of the cube, you will see the colors creeping up.

Flame Amplitude

Scales the flame temperature based on the height.

Lacunarity

Sets the gaps (dark areas) between the regions of flame in the preview window. By setting the colors of the coolest regions to Alpha 0.0 in the color picker, you can see the group’s diffuse color through the gaps.

S Noise Scale

Acts as a noise seed to vary the look of the flame.

D Noise Scale

Acts as a noise seed to vary the look of the flame.

Octaves

Sets the fractal complexity of the shader. Useful values range between 1 and 7.

Colors

Sets the number of colors, from the list of colors on the left, to use when creating the procedural effect.

Fractal Noise

This 3D shader creates a fractal-based noise pattern.



Figure 127 — Fractal Noise Shader

Will affect the channel in which it is applied and the Bump channels.

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in.

Noise Level

Controls the complexity of the noise. Useful range is 0 to 8

Noise Factor

Higher numbers produce a rougher surface, smaller number a smoother surface.

Bump Strength

Sets the magnitude of the bump. Can be negated.

Bump Factor

With each successive noise level calculation, bumps get smaller by this factor.

Sharpen Bumps

Takes the highest point and makes it rougher, takes the lowest point and makes it softer. Good for making the bumps nice and craggy.

Color Factor

Sets the point where the shader switches from the High Color to the Low Color. Higher numbers will completely eliminate the Low Color.

Sharpness

Larger numbers increase the contrast between the High and Low Colors

High Color

Sets the RGB value of the surface at the top of the bumps. You can set the alpha to 0.0 to let the object's diffuse color, or the next texture map in the diffuse list, come through instead.

Low Color

Sets the RGB value of the surface at the bottom of the bumps. You can set the alpha to 0.0 to let the object's diffuse color, or the next texture map in the diffuse list, come through instead.

Granite

This 3D shader creates a granite rock appearance.

Apply only to the Diffuse Channel. Will affect the Diffuse and Specular Channels.

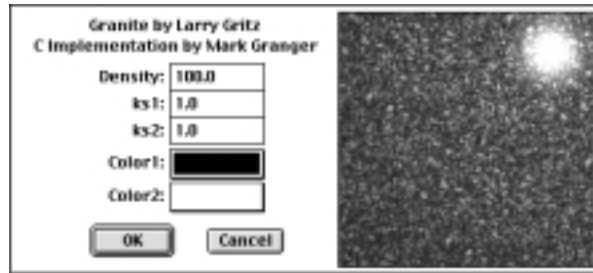


Figure 128 — Granite Shader

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in.

ks1

The Specular value for the region colored by Color1. 1.0 is max, 0.0 is no specular

ks2

The Specular value for the region colored by Color2. 1.0 is max, 0.0 is no specular

Color1

The RGB value for the underlying color of the granite rock.

Color2

The RGB value for the colored pieces that mix in with the granite rock.

Grid

This shader creates a 2D or 3D grid of lines.

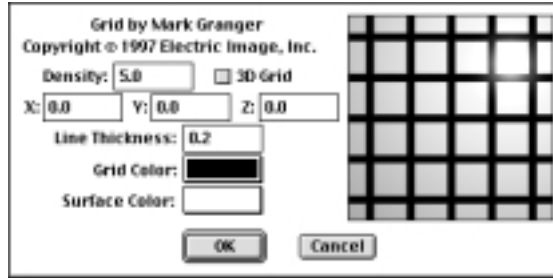


Figure 129 — Grid Shader

Will only affect the channel to which it is applied.

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out (seeing more of the grid), smaller to zooming in (seeing less of the grid). The default is 1.0.

3D Grid

Makes the shader work in 3D space. Apply to the top of a cube, then render the side of the cube. You will see the grid coming up the sides of the cube.

X,Y,Z

Offsets the grid pattern in the direction specified. Very useful when the 3D Grid checkbox is on as you might find the Z position of the grid leaves you right in the middle of a line.

Line Thickness

Sets the thickness of the grid lines. The default is .2. Smaller numbers produce thinner lines.

Grid Color

Sets the RGB color of the lines.

Surface Color

Sets the RGB value of the underlying surface. You can set the alpha to 0.0 to let the object's diffuse color, or the next texture map in the diffuse list, come through instead.

Hex Tile

This 2D shader creates a hexagonal pattern of terra cotta tiles. Perfect for your patio or mud room.



Figure 130 — Hex Tile Shader

Will only affect the channel in which it is applied.

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in.

Tile Radius

Sets the size of the tiles. 1.0 represents one full tile in the preview window.

Mortar Width

Sets the width of the mortar between the tiles. Useful range is 0.0 to 0.3

Tile Vary

Allows subtle variations in the color of the tiles. Useful range is 0.0 to 1.0

Scuffing

Sets the darkness of the scuff marks on the surface of the tiles. Useful range is 0.0 to 5.0

Stains

Creates separate stained areas using the Scuff color. Useful range is 0.0 to 5.0

Stain Frequency

Controls the size of the stained areas. Larger numbers create smaller stains.

Scuff Frequency

Controls the size of the scuff marks. Larger numbers create smaller marks.

Tile Color

Sets the RGB value of the tiles

Mortar Color

Sets the RGB value of the mortar between the tiles.

Scuff Color

Sets the RGB value of the scuff marks on top of the tile.

Marble

This 3D shader creates a marble-line surface for rocks, pillars, temples, etc.

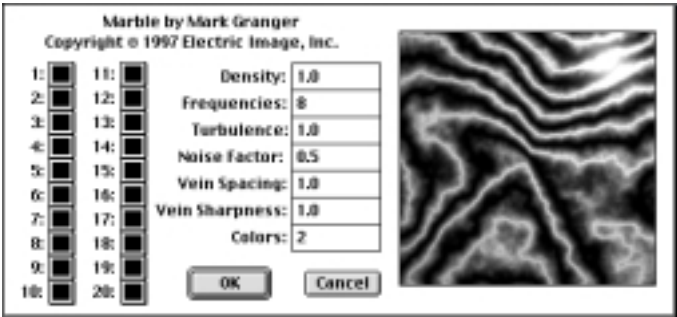


Figure 131 — Marble Shader

Will only affect the channel in which it is applied.

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in.

Frequencies

Controls the number of separate veins that appear in the marble. The default is 8 and you can see 8 distinct black veins running through the marble in the preview window.

Turbulence

Sets the waviness of the veins. Larger numbers yield more waviness.

Noise Factor

Affects the variation of the veins along their length. Useful values are in the range of 0.0 to 1.0

Vein Spacing

Controls the distance from one vein to the next.

Vein Sharpness

Controls the sharpness and apparent width of the veins.

Colors

Controls how many of the colors on the left side of the interface are used to shade the marble. (*Color number 1 defaults to alpha 0.0, allowing the diffuse color of the group to show through.*)

Plank

This 3D shader creates a nice parquet-style wood pattern. Can be used to great effect on the floors of entry halls or on dance floors. Biases the specular highlight with the parquet pattern as well. Can also be used to simulate hardwood flooring.

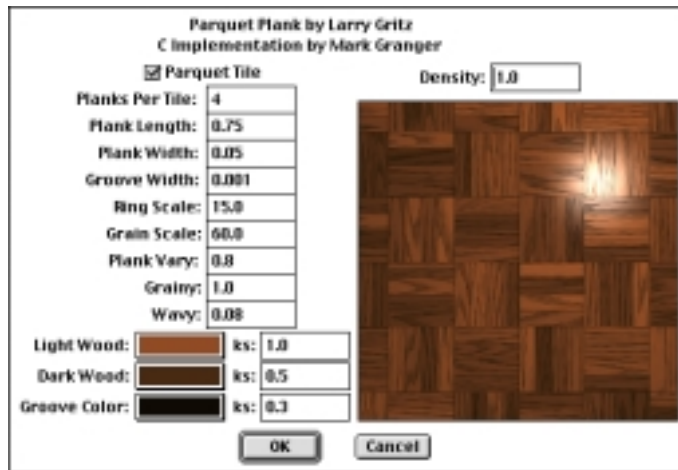


Figure 132 — Plank Shader

Apply only to the Diffuse Channel. Will affect the Diffuse, Bump, and Specular channels.

Procedural Shaders — Plank

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in.

Parquet Tile

Creates the parquet pattern of tiled wood. If off, long planks are created instead; perfect for hardwood floors.

Planks Per Tile

Number of individual wood slats that make up each tile.

Plank Length

Sets the length of the planks when the Parquet Tile flag is turned off.

Plank Width

Sets the width of the tiles when the Parquet Tile flag is on. If the flag is off, it sets the width of the individual planks.

Groove Width

Sets the width of the grooves that separate the tiles from one another and the grooves that separate the planks within the tiles from one another.

Ring Scale

Larger number create more, tighter grain patterns in the planks.

Grain Scale

Larger number cause the grain patterns to be thicker.

Plank Vary

Cause color variation in the individual planks. Useful range of values is 0.0 to 2.0.

Grainy

Sets the amount of grain in each plank. Larger numbers give you smaller grain.

Wavy

Larger numbers make the grain more wavy.

Light Wood

Sets The RGB color of the lightly colored planks.

Dark Wood

Sets The RGB color of the darkly colored planks.

Groove Color

Sets The RGB color of the grooves between the planks and tiles.

ks

Sets the specular for each of the areas. 0.0 is no specular. 1.0 is maximum specular.

Random Dots

This 3D shader creates a pattern of randomly colored dots. Perfect for that summer dress.

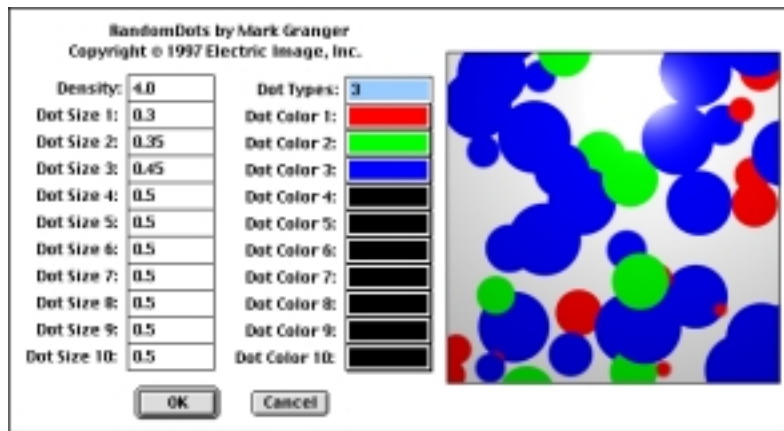


Figure 133 — Random Dots

Procedural Shaders — Rust

Will only affect the channel in which it is applied.

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in. Defaults to 1.0.

Dot Types

This value controls which of the 10 different dots are supported will be used by the shader, from top to bottom of the list as presented in the window.

Dot Color

Sets the color of each dot

Dot Size

Sets the maximum size of each dot. There is random variation in the size from the maximum down.

Rust

This 3D shader creates a rusted surface pattern. The surface appears thick with areas eroded down to holes.

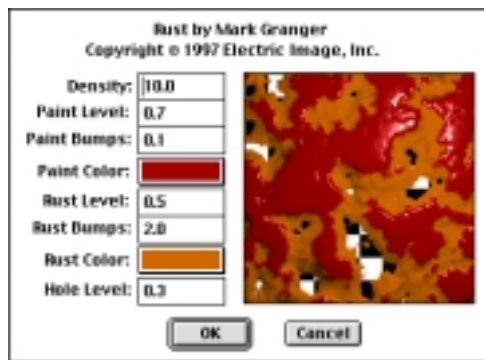


Figure 134 — Rust Shader

Apply only to the Diffuse Channel. Will affect the Diffuse and Bump channels.

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in.

Paint Level

Controls how deep into the surface the paint reaches.

Paint Bump

Sets the magnitude of the bumps on the painted surface.

Paint Color

Sets the RGB value of the surface. You can set the alpha to 0.0 to let the object's diffuse color, or the next texture map in the diffuse list, come through instead.

Rust Level

Sets the amount of the surface affected by the rust. 1.0 is all rusty, 0.0 is no rust at all.

Rust Bumps

Sets the magnitude of the bumps on the rusty surface.

Rust Color

Sets the RGB value of the rusted area.

Hole Level

Sets the amount of the surface that becomes holes. 1.0 is all hole, 0.0 is no holes.

Stucco

This 3D shader creates a stucco pattern using bumps. Great for adding a slight variation to interior and exterior walls.

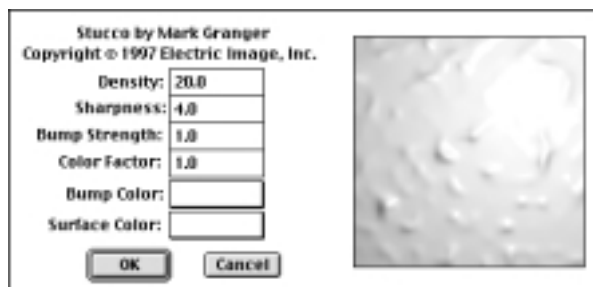


Figure 135 — Stucco Shader

Will affect the channel in which it is applied and Bump channels.

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in.

Sharpness

Controls the smoothness of the bumps. Smaller numbers are smoother, larger numbers sharper. Useful range is 0 to 10.0

Bump Strength

Sets the magnitude of the Bump. Can be positive or negative.

Color Factor

Controls the blend, and therefore the spread, of the Bump Color into the Surface Color. Larger numbers correspond to a larger spread.

Bump Color

Sets the RGB value of the bumps.

Surface Color

Sets the RGB value of the surface. You can set the alpha to 0.0 to let the object's diffuse color, or the next texture map in the diffuse list, come through instead.

Veins

This 3D shader creates a series of polygonal shapes separated by grooves. Could be used for alien skin or even the surface of a cobblestone walkway.

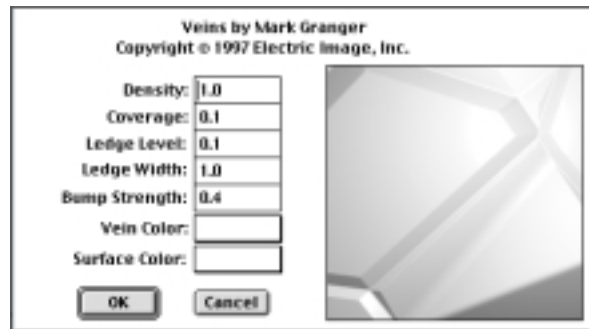


Figure 136 — Veins

Will affect the Channel in which it is applied and Bump channels.

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in.

Procedural Shaders — Veins

Coverage

Controls the region that the Vein colors covers. 0.0 yields no Vein Color. 1.0 will cause the Vein Color to cover the entire procedural.

Ledge Level

Controls the height that the shapes rise above the veins

Ledge Width

Controls the width of the shapes

Bump Strength

The magnitude of the bump. Can be negative to cause the veins to rise above the shapes.

Vein Color

Sets the RGB value of the veins.

Surface Color

Sets the RGB value of the surface You can set the alpha to 0.0 to let the object's diffuse color, or the next texture map in the diffuse list, come through instead.

Waves

This 2D shader creates a sinusoidal pattern. Can be used to simulate ripple effects as drop-lets fall into water. This shader causes the waves to animate, flowing outward at a rate controlled by the Wave Frequency.

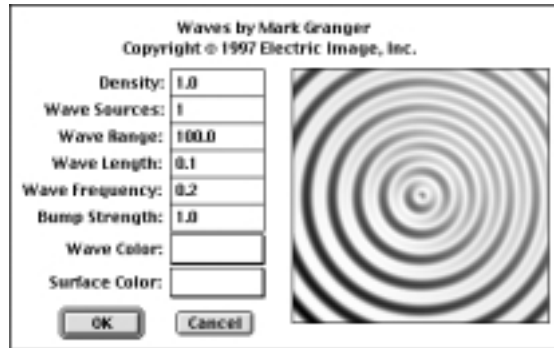


Figure 137 — Waves Shader

Will affect the channel in which it is applied and Bump channels.

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in.

Wave Source

Sets the number of sources that generate the waves. More sources give rise to complex interference patterns

Wave Range

Sets the distance between Wave Sources.

Wave Length

Distance between the wave crests.

Procedural Shaders — Wisp

Wave Frequency

Number of units the rings move outward per second.

Bump Strength

The magnitude of the bump. Can be negative invert the wave.

Wave color

Sets the RGB value of the wave crests.

Surface Color

Sets the RGB value of the surface You can set the alpha to 0.0 to let the object's diffuse color, or the next texture map in the diffuse list, come through instead.

Wisp

This 3D shader creates a series of lightly drawn lines, as if a calligraphy pen had been used to draw on the surface.

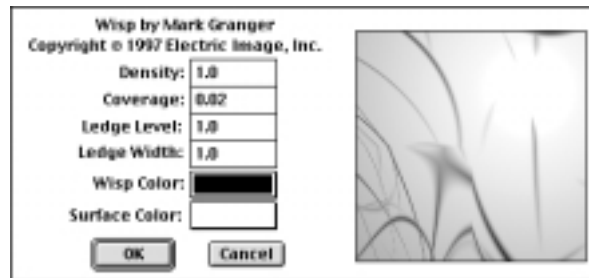


Figure 138 — Wisp Shader

Will only affect the channel in which it is applied.

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in.

Coverage

Sets the region that the Wisp Color covers. 0.0 yields no Wisp Color. 1.0 will cause the Wisp Color to cover the entire procedural.

Ledge Level

Larger numbers increase the number of lines that are drawn

Ledge Width

Smaller numbers increase the thickness of each line.

Wave Color

Sets the RGB value of the lines.

Surface Color

Sets the RGB value of the surface You can set the alpha to 0.0 to let the object's diffuse color, or the next texture map in the diffuse list, come through instead.

Wood

This 3D shader creates a basic wood-like appearance.



Figure 139 — Wood Shader

Will only affect the channel in which it is applied.

Density

Sets the Scale of the shader on the group. Larger numbers are equivalent to zooming out, smaller to zooming in.

Frequencies

Controls the number of separate grains that appear in the wood.

Turbulence

Sets the waviness of the grain. Larger numbers yield more waviness.

Noise Factor

Affects the variation of the grain along their length. Useful values are in the range of 0.0 to 1.0

Vein Spacing

Controls the distance from one vein to the next.

Vein Min

Controls the minimum width of the veins.

Vein Max

Controls the maximum width of the veins.

Colors

Controls how many of the colors on the left side of the interface are used to shade the wood.

The Project Window

Introduction

The Project Window has always been the heart of animation in ElectricImage. It is this single window into your scene that offers the most control, to virtually every parameter. ElectricImage 2.8 includes a few “under the hood” improvements in the Project Window, as noted below:

- The Animation Box
- The Velocity Enable Check Box
- New object selection methods
- Object Parking

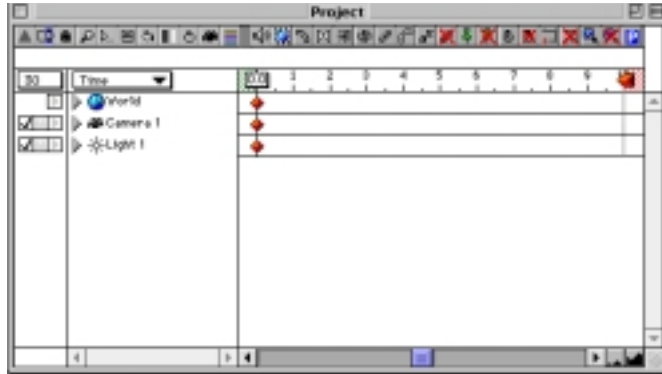


Figure 140 — Project Window

The Animation Box

As an animator, you will find that while you may have hundreds of objects in a given scene, you may only be animating ten or twenty of them. Like a director on a movie set, you expect your props to stay put, while requiring your actors to move and express themselves. When animating with a computer, all of these objects have to be tracked, maintained, and otherwise dealt with in some fashion. Not all of them need to be animated, however.



Figure 141 — Typical Animation Box

That's where the animation box comes in. A third column has been added to the left side of the project window, next to the Visibility check box and the Lock check box. The Animation box is a little green arrow that enables animation for each group and each animation channel within that group. The animation box next to the group name acts as a master switch. If the master isn't on, the channels below won't animate regardless of the settings of their animation boxes. A new preference under the *Edit > Preferences Keyframe tab* menu controls whether or not groups default with their master animation boxes on or off.



Figure 142 — Animation Preference

By activating animation channels only when necessary, you will conserve memory and improve interface performance within ElectricImage. You can specify on a channel by channel basis which attributes will animate, and which will not.

The Velocity Enable Box



Figure 143 — Velocity Enable Check boxes

A velocity enable box has also been added next to each animation channel capable of a velocity calculation. You can disable the velocity calculation for any channel you choose by turning off this box.

Object Selection Methods

The 2.8 Project Window also adds greater ease of changing common characteristics of multiple objects by adding some new object selection methods. The following steps will explain the procedure for changing the Visibility, Lock, or Animation settings for multiple objects, and objects with children.

Selecting and changing attributes for Multiple objects:

- Select the objects in the Project Window.



Figure 144 — Multiple Objects Selected

- Click the desired box on one of the selected objects.



Figure 145 — Selected Objects with Animation Turned Off

The selection changes for only the selected objects.

Selecting and Changing Objects with Children

- Use Option and Command (⌘) keys and click on the parent object
- Change the animation value



Figure 146 — Parent and Children Animation Records deactivated

The animation records for the parent group and its children have now been changed.

This technique also works if you have an object with hidden children. Just follow the procedures above. These features, in combination with selection sets, will make the management of large projects substantially easier.

Object Parking

As mentioned in the Introduction chapter, object parking allows you to reset all of the transformation values of a group to zero (0.0). Often times models are imported in a variety of scales and from a variety of modeling programs in order to compose a complete scene. This can necessitate the use of scale operations to equalize the relative size of the models, and translation operations to fix the relative distances for the composition. Experienced users will note that these preparations can make animation somewhat complex.

This is especially true when these objects with multiple scales and transforms are then made part of the same hierarchy. While transforms to align relative positions of groups are straightforward, scale operations (especially non-uniform scale operations) can cause problems from time to time, if classic transforms are selected in the group linkage win-

dow. It would be far easier to position and scale groups relative to each other, and then “zero them out” making everything about then equal (from a transform point of view.) This is what object parking is all about.

Object parking can be used for all object types within ElectricImage: Cameras; Lights; model groups; and effectors such as bones. *Remember to use parking before you begin to animate!*

There are three locations for the parking icon:

- Tools Menu
- *Windows>Tools Palette*
- Project Window Tool Bar



Figure 147 — Parking Icon

To use object parking:

- Select the object(s) to park
- Click on the Park icon in the project window

The objects have now had their transforms reset to 0.0.

Function Curve Editor

Introduction

One of the most exciting new features of ElectricImage 2.8 is the Function Curve Editor. The Function Curve Editor is a powerful feature which lets you graphically create, edit and apply animation information to virtually any parameter in a scene. Function curve editors have formed the basis of some of the most powerful character animation software anywhere.

What is a Function Curve Editor?

The Function Curve Editor is a new window which allows animators to graphically control animation data in the form of a curve which represents changes in time and data values. The editing methods in the Function Curve Editor provide far more control over how the values change, not just when the values change as with the older velocity graphs in previous versions of ElectricImage. All animation channels can be edited with a function curve, with the exception of color.

The Benefits of Using the Curve Editor

The art of animation involves many subtleties. Good animators know that to add those subtleties can be an exercise in tedium. The function curve editor is intended to make that task easier. By being able to edit the curve as it enters and exits a keyframe, the animator has more control over each keyframe, leading to more control to the overall animation and the realism of the shot. At the very least, using the Function Curve Editor will assist the animator in creating complex motion using fewer keyframes, saving time in the process.

Implicit and Explicit Translation

As you may have already noticed, all vectorized quantities in ElectricImage (position, reference, center, etc.) now have an extra pulldown menu in their info windows. This pulldown controls whether the quantity is Implicitly or Explicitly translated. Implicit translation is what you have been using in past versions of ElectricImage. Explicit translation allows separate control for each of the three translation components (X,Y,Z).

Implicit Translation Example

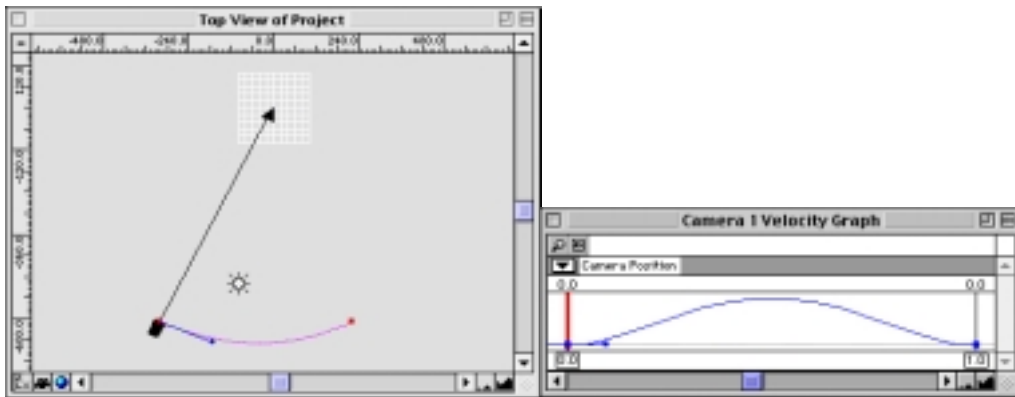


Figure 148 — Top View and Velocity Curve Example

The figure above shows us the top view of a basic motion path, as you were used to seeing in prior versions of ElectricImage. Next to it is the graph of the camera motion velocity.

The Camera's motion path is really a composite of the Z and X channels of the Camera motion path transform. When you drag the Camera in the top view, the Z and X values change but Y does not. Velocity is computed on the composite vector (the vectors of X and Y). There is no curve available to individually adjust any of the three components by itself.

Explicit Translation Example

By making the Camera's transformation Explicit, velocity calculations are removed and you are free to independently manipulate the three component vectors of the motion (X,Y,Z).

To make an group's Translation explicit:

- Open the Group Info window for a given object. Make sure that the X-Form window is in the foreground.

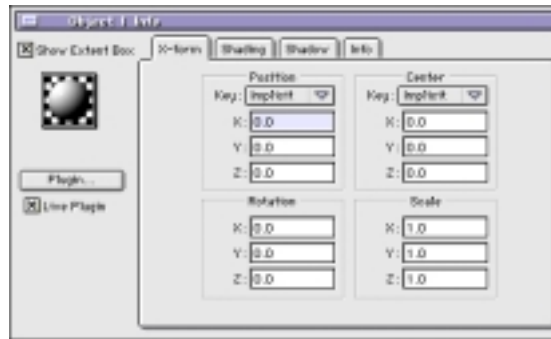


Figure 149 — Group Info Window

- Change the translation of the particular Transformation characteristic from Implicit to Explicit. The illustration below shows the Position translation being changed.

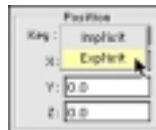


Figure 150 — Key Menu

The translation value for the object's position is now explicit.

One of the first things you will notice is the change in the way the motion path for the object is now drawn in the world view windows. The path is no longer the familiar bezier spline, but rather a curve with no real controls. You can create new keyframes as before, by changing the time and dragging the group to a new position, but you cannot edit the shape of the curve in the world view windows.

Accessing the Curve Editor

There are two ways to open the Function Curve Editor:

- Choose Windows>Function Curve Editor
- Type **⌘ - `** (Command - `).

The Function Curve Editor opens.

The Function Curve Editor Window

The Function Curve Editor is divided into three sections:

- Graph Window
- Channel List
- Tool Bar

Graph Window

The graph window contains the function curves that graph the actual channel data, the timeline, and the data scale. The timeline is displayed at the top of the window area. It is the same timeline in the project window, and functions indentially. The data scale displays data values which change depending upon the window magnification. The combination of the time scale and data scale is used to plot the channel curves.

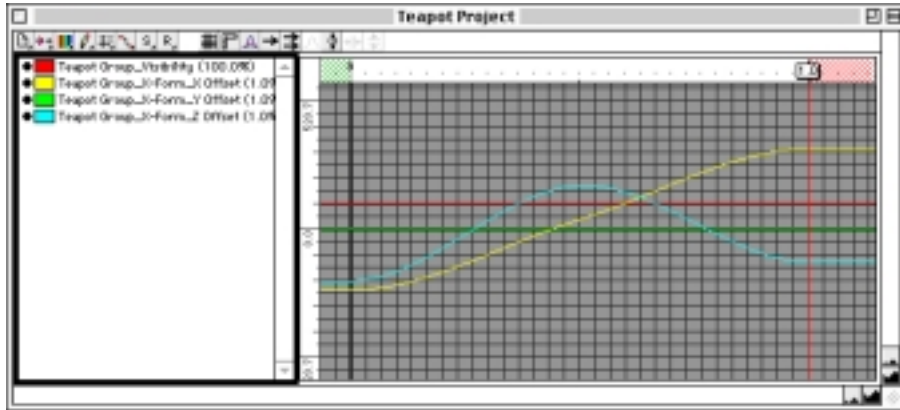


Figure 151 — Function Curve Editor (with channel data)

Channel List

To the left of the graph window is the channel list. The channel list is where all of the loaded channels are displayed. Each channel is represented by individual curves. The channel list is covered in detail on

Tool Bar

Above the channel list and the graph window is the tool bar. The tool bar contains icons which are used to control the display of the function curve editor, the display of elements within the editor, and the loading and saving of channel envelopes. The Tool bar is covered in detail on page 254.

Initially, there won't be any channels loaded into the Editor. Channels are loaded by two methods:

- From the project window, by double-clicking on the animation channel names in the particular object that you want to work with.
- Using the Key Channel Loader described in the Toolbar section of this document.

You can load in as many channels as you like from as many different groups as you like. Virtually any animatable channel, except RGB color, can be loaded into the editor.

The Graph Window

The graph window is used as an interactive display to modify the effects between two or more keyframes. Through the use of the graph window, keyframes may be added and deleted, as well as modified. Acceleration/Deceleration and Velocity are optionally plotted as well, depending upon toggles set in the tool bar. *See “The Toolbar” on page 254 for more information.*

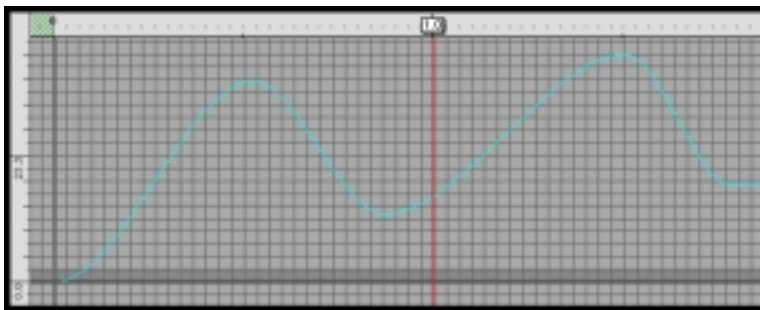


Figure 152 — Graph Window

The active channel curve is drawn in white. All other curves are drawn in the color next to the channel name. (*See “To set the curve color:” on page 254.*)

Time and data ranges can be selected by dragging in the areas to the right and bottom of the graph window. These ranges are indicated by darker gray regions in the graph window background. The display of these regions can be toggled by clicking on the time and data range icons in the tool bar. *See “Time Range” on page 260 and “Data Range” on page 260.*

There are a variety of commands and shortcuts available in the Graph Window.

The Tab Key

Can be used to restrict the axial movement of the keyframes. Tab once to restrict in X, tab again to restrict to Y, tab again to restrict diagonally, tab again to restore free movement.

Option Clicking

Option-clicking (or option-clicking and dragging) will add a new key to the point on the curve on which you clicked.



Figure 153 — Option Click adds new keyframe

Command Clicking

Command clicking on a key will break or mend the control handles.



Figure 154 — Command Click adjusts slope of handles

Shift Clicking

Shift clicking or marquee selecting a group of keys will allow the keys to be dragged together.



Figure 155 — Shift Click selects multiple keys

Control-Drag

Holding down the control key as you drag a key will interactively scale the curve (requires that a time range be selected first).

Keypath Drag

Drag the curve between to keys to drag both keys. This allows you to drag a section of the curve.

Dragging the Window

Hold the space bar down to drag the entire Graph Window.

Toggle Linear

Command-Control clicking on a key will toggle the linear buttons in the Key Channel Dialog box for that key.

Cut and Paste

Cutting and pasting sections of the curve requires that a time range be selected first.

Channel List

The channel list contains all of the loaded channels in the function curve editor. Each curve in the graph window corresponds to one item in the channel list. All channels added to the list are added to the bottom. The list cannot be reordered. The black circle to the left of each channel name controls the display of the curve for that channel. Clicking on the curve will change the visibility of the curve (the circle will turn transparent when the curve is not drawn.)

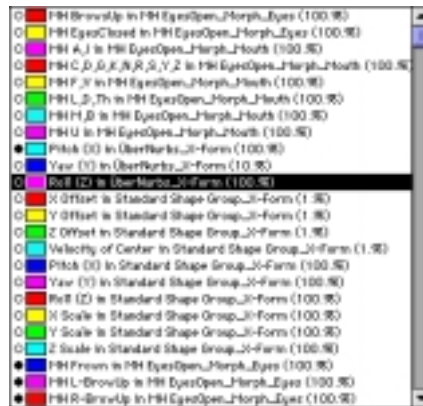


Figure 156 – Channel List

The channel list display area can be resized by dragging the right edge next to the scroll bar left or right (the cursor will change as indicated below.)



Figure 157 – Resize Window Pane Icon

Each channel in the list has a separate color to plot its curve in the graph window. The color swatch next to the name of the channel is used to set the curve color.

To set the curve color:

- Click on the color swatch for the desired channel.
- Choose a new color from the color picker.
- Click the OK button to accept the new color.

The new curve color will now be set.

The selected channel will always draw its curve, regardless of the channel's visibility setting in the channel list.

Double clicking the channel name in the list will bring the Key Channel Window for that item forward. *See the “Key Channel Window” on page 260 for more information.*

The loading and saving of channel envelope information is controlled by icons in the tool bar. *For more information on tool bar functions, see “The Toolbar” on page 254.*

The Toolbar

To effectively edit motion and time data, some special tools are required. The Function Curve Editor comes with its own set of tools which are used to edit data splines, load motion data, and various other tools to manipulate the motion data. The following sections will detail the function of each Tool icon and its menu items.

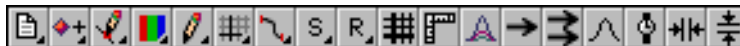


Figure 158 — Function Curve Toolbar



Envelope Load

Envelope Load allows you to load values into and save data out from curves described in the Graph Editor (See the Graph Editor section below.) These curve files are called “enve-

lopes.” Envelopes may be loaded or saved across the entire time range or across a selected range of time.

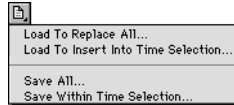


Figure 159 — Envelope Load Menu

One of the benefits of using a computer is that it can do the repetitive work for you. In ElectricImage 2.8, you can easily load motion data from motion capture device data files, other groups or function curves from another EI project. By saving and loading envelopes from other channels, you can reuse existing motion data and customize it for your current animation project. This works very well when doing repetitive motion, such as animating a set of humming bird wings, a trail of ants taking over a picnic, or matching blinking light patterns.

Clicking on the Load icon brings up a drop down menu with four choices:

- Load to Replace All...
- Load to Insert Into Time Selection
- Save All...
- Save Within Time Selection.

These tools allow you to load and save motion envelopes.

Load To Replace All

This menu choice will replace all of the keys with a previously saved channel envelope. Selecting this menu choice will present the standard Macintosh file open dialog from which you can select an envelope file. Envelope files can be saved from other channels or motion capture data files.

Load to Insert Into Time Selection

Using this option will replace the selected time frame with the saved data envelope. If the inserted envelope is larger than the selection area, keys outside the selection area are scaled to allow for the inserted envelope. Inserting an envelope works as if a slice of time is being inserted at the selection area. If the selection area is the same size in time as the envelope, keys outside the selection are unaffected. If the envelope is smaller than the selection area, keys following the selection area are shifted to an earlier time in the timeline.

Save All

Use the Save All function to save all keys in the selected function curve. This effectively saves an entire channel as an envelope which can be loaded at a later time

Save Within Time Selection

Using this option, you can save all keys located within a selected range to an envelope file.



Key Channel Loader

As its name suggests, the Key Channel Loader is used to add key channels into the Curve Editor. Select the object(s) in the Project Window, then use this tool load in all of or a selected group of animation channels. Once loaded, the channels are displayed in the channel list. The circles to the left of the channel names may be used to turn off the display of the channel in the graph window. Channel may be removed from the editor by selecting them in the channel list and hitting the delete key or by using the clear under the edit menu.

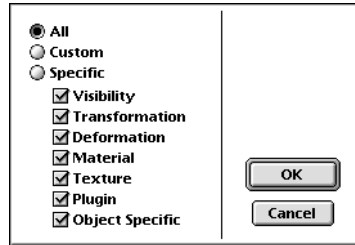


Figure 160 — Key Loader Dialog

All

Using the All option, all channels for the selected object(s) are added to the key path editor. Depending on whether the selected object is a camera, light, or geometry there may be as few as 7 or as many as 30 or more channels added to the editor via this option.

Custom

Loads the channel selected using the Custom... view option in the project window.

Specific

Using the Specific option, you can import channels of selected types only. This option works well when you only need to edit a single attribute on many objects, such as the visibility property. Since some attributes have interrelated channels, those too will be loaded. For example, loading the Material type will load as many as 22 channels, while the Transform type will load 9 and the visibility type only one.



Color Preferences

Use to set the default color for curves displayed in the graph window of the Curve Editor. Clicking on this option invokes a dialog box with editor attributes accompanied by a color bar for customizing the color used for each attribute. You may use any color combination

which is comfortable for you, although selecting non-contrasting colors may make it difficult to distinguish between editor attributes.



Figure 161 — Color Preferences Dialog



Graph Display Element Control

This pulldown changes the on/off settings of the last nine controls represented in the toolbar. Since, these nine controls can be turned off or on by clicking on them, this particular tool is redundant and will likely be removed.

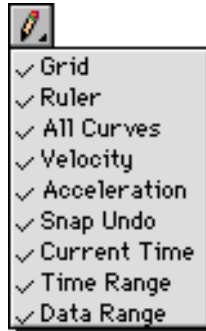


Figure 162 — F Curve Graph Display Element Control Menu

Grid

Displays a horizontal and vertical grid.

Ruler

Toggles the visibility of the time and range scales.

All Curves

Toggles whether the selected channel or all channels are displayed.

Velocity

Displays the velocity graph.

Acceleration

Displays the acceleration path.

Snap Undo

Displays the Snap Undo path.

Current Time

Displays the current time marker.

Time Range

Displays the time ruler.

Data Range

Displays the data ruler.



Grid Options

This menu controls the grid. Both the spacing of the visual grid and the snapping grid are controlled here. To activate snapping, make sure that the caps lock key is set.



Key Channel Window

The Key Channel window is used to set the curve type for each channel, and the beginning. You can also manage individual keyframes through the key list. Get to know this window well, as it will offer you the ability to fine tune your function curves, and get the most out of your animation efforts.



Figure 163 — Key Channel Window

The Motion Type Menu

The motion type menu determines the type of spline curve used to calculate the interpolation of the data in the channel. There are four different curve types:

- Linear
- Natural Cubic
- Hermite
- F-Curve

Linear

Straight line between the keys, no interpolation.

Natural Cubic

B-Spline interpolation, no controls. Use where you want automatic smoothing.

Hermite

More versatile than Natural Cubic. The whole curve won't change when one key is adjusted.

F-Curve

Contains control handles for fine adjustment. This will give the best control and is similar to Bezier curves.

The Left & Right Extension Menus

The beginning and ends of function curves can have a variety of behaviors. This allows you to create repetitive motions quickly and easily, and has the added value of transmitting any changes to the carried over curve sections, if desired.

Hold

The hold option maintains the value of the starting or ending point of the curve.

Repeat

This option will cause the entire curve to repeat itself in a cycle.

Oscillate

The Oscillate option will make the curve repeat itself in a mirror-image fashion.

The Key List Subsection

Individual channel keys are displayed in the keylist to the lower left of the Key Channel window. Keyframe attributes are displayed when a particular keyframe is selected in the list. There are several attributes that are controllable on a keyframe by keyframe basis:

- Time
- Value
- Spline-specific controls

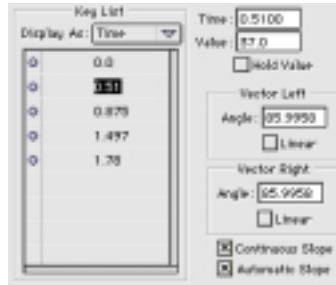


Figure 164 — Keyframe List

Time and Value Edit Boxes

You can change the time or value of the selected keyframe. Enabling the Hold Value check box will force the value of the slope between the selected keyframe and the next keyframe be maintained until the next keyframe: no interpolation will occur. This will appear as a flat line until just before the next keyframe in the Function Curve Editor.

Spline Specific Fields

This section displays different controls depending upon the spline selected in the Motion Type popup menu:

- Linear
- Natural Cubic
- Hermite
- F-Curve

Linear

There are no additional controls for the Linear Motion Type.

Natural Cubic

There are no additional controls for the Natural Cubic Motion Type.

Hermite

There are controls for the Tension, Bias, Continuity attributes of the acceleration and velocity of the curve. You can type the values in directly, or hold down the T, B, or C keys (lower case is fine) and dragging. You will see the acceleration and velocity curves change as you adjust the value. You will also clearly see changes in the actual motion path drawn in the world view windows. You can linearize the values by checking the Linear button.

F Curve

Controls for the keyframe vectors will appear if the Motion Type is set to F-Curve. The keyframe vectors are the little “teeter bars” that appear at each keyframe. There are separate vectors for the left and right side of the keyframe. You can set the vector angles by clicking and dragging on the vectors, or by typing values directly into the edit boxes. In addition, you can linearize the spline segment by enabling the Linear button. When the beginning or ending keyframes are selected, on the left or right vector will be displayed.

There are also two check boxes for slope control, which affect the shape of the curve, and how the curve is interpolated through its control points:

Continuous Slope

Causes the curve to be smoothed along both sides of the control point equally.

Automatic Slope

Causes the curve's adjoining slopes to be adjusted for smoothness.

Editor Display Scale

The Editor Display Scale box allows you to scale individual curves so that they can be displayed together in the Editor. For example, let's say you have a X motion curve that runs from 0.0 to 4444 over 4 seconds and you also have a roll channel that goes from 0.0 to 5 degrees over the same 4 seconds. Using the Editor Display Scale you can set the scale of the X motion to 1.0 and the roll to 889. In this way, both curves will be visible in the Curve

Editor and the same time. The Editor Display value for each channel is listed as a percentage after the channel name in the channel list.

Snap

When a data or time range is edited within the Function Curve Editor, the original path becomes the Snap value. The Snap command stores the present position of a curve in memory. This allows you to display the original path while you make changes to it. You can make adjustments to a function curve and revert back by clicking the Unsnap option or saving the new curve as the snap value (or new original) by clicking the Snap option.

Range

Ranges are highlighted sections of the Graph Window. The tools in this menu allow you to select a time or data range and to operate on sections of a curve within the range. The range itself is created by dragging in the white band just below (time range) or just to the right (data range) of the curve editor. The Time Range and Enable Range buttons must be on for the range to be displayed (see below).

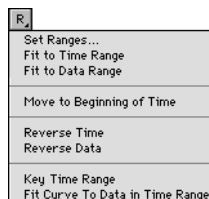


Figure 165 — Range Menu

Set Ranges...

Brings up a dialog box that allows you to type in values to create the range instead of dragging the range at the right or bottom of the Graph Window.

Fit to Range

Scales the curve to fit within the selected time range.

Fit to Data Range

Scales the curve to fit within the selected data range.

Move to Beginning

Move an entire channel's keyframes to start at time 0

Reverse Time

Reverses the order of keyframes reversing the animation.

Reverse Data

Reverse keyframes to reverse data values

Key Time Range

Deletes keyframes outside of the selected time range.

Fit Curve To Data in Time Range

This option fits a curve to custom keyframe data with a tolerance setting. The original custom data is deleted. You can use this setting to turn motion capture data into motion curves.



Grid Enable

This button toggles the display of the grid in the graph window.

**Time Scale Enable**

This button toggles the display of the time scale, the value scale, and the time thumb control. The time thumb display mode (seconds, timecode, frames) can be changed by option-clicking on the control.

**All Paths**

When this button is off, only the channel highlighted in the channel list is displayed in the graph window.

**Velocity Display**

Toggles the display of the velocity curve. The velocity curve is updated as you make changes to the channel curve.

**Acceleration Enable**

Toggles the display of the acceleration curve. The acceleration curve is updated as you change the channel curve.

**Current Time**

Toggles the vertical time line that crosses through the editing field.



Time Range

Toggles the display of the selected time range. The Time Range is chosen by dragging in the white region just below the Graph Window. Copying and pasting takes place inside the chosen Time Range.



Data Range

Toggles the display of the selected data range. The Data Range is chosen by dragging in the white region just to the right of the Graph Window.

Character Animation Section

Introduction

ElectricImage 2.8 introduces state-of-the-art character animation features, including advanced inverse kinematics, facial expression morphing and the ability to use hierarchical Bones to deform a single skin object. As character animation is such a complex and varied topic, we have decided cover the topic in several sections, spread over multiple chapters.

The first section will address inverse kinematics. The first three chapters in this section will cover Effectors, Hierarchies and Constraints, and the Group Linkage Window. The last two chapters will cover Deformations and Facial Animation.

Bones are partially covered in the Effectors chapter and the Deformations chapter, as a bone can serve double duty as both an effector and a deformation.

Using Effectors

Introduction

Effectors are invisible null objects that models, cameras, and lights in a scene can be linked to. Any transformation, rotation, scale, or deformation applied to the effector will be passed on to the groups that are linked to it. Using effectors allows you to control complex animation's by layering motion characteristics into separate control objects. The following chapter will explain the use of effectors of all kinds, and describe the layout of the new effector window.

Effectors can be used at any level in a heirarchy chain, and can be esecially useful in an inverse kinematics chain, to create a “broken hierarchy,” as explained in the chapter “Hierarchies and Constraints.”

Adding Effectors to a Scene

1. Choose **File > Add > Type > Effector**. Or choose the effector icon from the Object Palette.



Figure 166 — The Add Effector button from the Object Palette

2. The cursor will change to an arrow with a cube next to it.



Figure 167 — The Add Effector cursor

3. Click in any view window to set the effector in the scene.

The Effector Info Window



Figure 168 — The Effector Info window with the X-form tab displayed

An effector's characteristics are controlled by the settings in the Effector Info Window. This window is very similar to the Group Info window for model geometry. It is divided into two specific sections, each marked by a folder tab.

- X-Form
- Special

X-Form (Transformation) Tab

The X-form tab in the effector info window is similar to the x-form tab for other objects in a scene. There are four rows of data cells that allow the input of values:

- Position
- Center
- Rotation
- Scale

Position

This row of data cells allows the input of X, Y, and Z position values for the effector. The "Key" pull-down menu offers a choice of "Implicit" or "Explicit" keyframe recording.



Figure 169 — The Implicit/Explicit menu

Implicit

will create a velocity curve for the keyframes.

Explicit

will create f-curves for the keyframes.

(For an explanation of Implicit and Explicit translation, please refer to “Using and Animating Groups” chapter.)

Center

This row of data cells allows the input of X, Y, and Z position values for an effectors center of rotation. Changing these values will move the physical center of the effector.

Rotation

This row of data cells allows the input of X, Y, and Z rotation values for the effector.

Scale

This row of data cells allows the input of X, Y, and Z scale values for the effector.

Special Tab

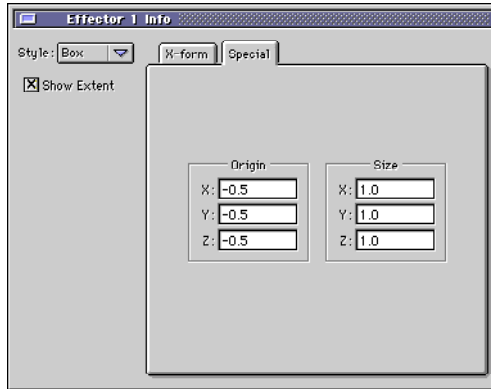


Figure 170 — The Effector Info window with the Special tab displayed

The Special tab contains editable fields that affect how different types of effectors display in a scene. This tab is used for **Box Effectors**, **Joints**, and **Bones** only.

The Style pull down menu in the effector info window offers a choice of how you want to display an effector. The standard effector display styles are **Cross** and **Box**. There are also a special class of effectors called **Joints** and **Bones** that create pre-built hierarchies. (See the Skeleton Effectors and Bones section later in this chapter.) Whichever display method is chosen, keep in mind that an effector represents a single point in space, and is transformed in relation to that point.

The Effector Style Menu



Figure 171 — Style pull down menu

Box

Choosing Box from the style drop down menu will display a cube in the scene. An extra checkbox called **Show Extent** will become available right below the Style drop down menu.



Figure 172 — The ShowExtent checkbox

Extents are essentially the lines that join to create the cube. They display the outer limits of the space occupied by the effector. Unchecking this box will disable the display of the cube, leaving only its center of rotation visible in the scene.



Figure 173 — A box effector showing extents

The defining characteristic of a box effector is that it can be resized. This makes the box effector display perfect for scaling and deformations, as well as surrounding groups of linked objects.

Special Tab Options

Selecting Box from the style pull down in the Effector Info window will cause the Special tab to display two new options:

- Origin
- Size



Figure 174 — The Origin and Size value boxes

These options only affect the way the effector displays.

Origin

The Origin defines the point in space that the boxes extents are drawn from. The origin displays as a small cross. In the picture below, the Origin is represented by the black circle and the black crossed lines at the center of the effector.



Figure 175 — A Box effector with the Origin point in the center

Size

The Size defines the size of the box effectors extents in world units. Don't confuse size with scale (found in the X-Form tab). If you scale a box effector, you will scale all objects attached to it. Changing extent size affects only the box display. You can, for instance, change these values to make a box effector larger in order to surround the groups that are linked to it.

The size and origin boxes work together to control the overall size and positioning of the effector in space. When a change is made to the size values, the boxes extents will change in relation to the origin point. To keep the origin exactly in the center of the box the values in the origin fields need to be a negative half of the value in the size fields.

For instance, if you change a boxes size from 1.0 on x, y, and z to 100 you would need to change the origin to -50 on x, y, and z to keep the point from which the box is drawn even with the boxes center point.

Cross

Choosing Cross from the style menu will display a small target shaped circle.



Figure 176 — A cross effector

The defining characteristic of the cross effector display type is that it can't be resized. This makes the cross effector ideal for large scenes that require constant zooming in and out. Regardless of how far in or out you zoom, the cross effector will remain the same size, and thus be easy to select and manipulate.

Special Tab Options

There are no editable attributes displayed in the special menu for a cross effector.

Joint



Figure 177 — Style pull down menu

Choosing **Joint** from the style drop down menu will display a Skeleton Effector Joint Vector in the scene.



Figure 178 — Joint (Skeleton) effector

A joint displays as a long, toothpick shaped object, that is pointy on one end and round on the other. The center of a joint effector is displayed where the horizontal and vertical vector lines cross. Joint effectors are used to create skeletal hierarchies. To create a linked chain of joint effectors use the **File > Add > Type > Skeleton** command.

Special Tab Options

Selecting the joint display method enables a row of size data cells in the special tab.



Figure 179 — The Size boxes

These values can be modified to change the length of the Joints vector. Because skeleton joints always orient with the Z-axis running the length of the vector, the only value that needs to be changed is the Z data field. (See *Drawing Skeletons and Bones* for more information.)

Bone



Figure 180 — Style pull down menu

Choosing Bone from the style drop down menu will display a Bone Effector Joint Vector in the scene.



Figure 181 — A Bone Effector

A bone displays as a long, toothpick shaped object, that is pointy on one end and pyramid shaped on the other. The center of a bone effector is displayed where the horizontal and vertical vector lines cross. Bone effectors are used to deform object meshes. To create a bone effector chain use the **file > add > type > bones** command.

When a bone display style is chosen, several new items become available in the effector info window.



Figure 182 — New options in the window when Bone is selected

Bone Color

The bone color displays the color the bone will appear in when it is deselected. This color can be changed by clicking on the color tab and choosing a new color from the color picker.

Bone Highlight

The bone highlight color displays the color the bone will appear in when it is selected. This color can be changed by clicking on the color tab and choosing a new color from the color picker.

Set Rest

Rotating a bone into the desired position and pressing the "Set Rest" button will tell the bone what position to stay in when it is at rest. Please refer to Chapter X, Deformations, for more information.

Set Bias

Resets the current rotation values of the bone to 0,0,0. Bones have a default Z orientation, which can interfere with imported data, such as motion capture data. This feature lets you position the bone, and then “zero it out.” This is similar to indexing a servo motor or motion control axis on a robotic camera system.

Special Tab Options

Selecting the joint display method enables several new options in the special palette. These options, with the exception of bone length, are specific to how a bone deforms a mesh. *(See the Deformations chapter for more information.)*



Figure 183 — The Special Menu options for Bone

Why use an Effector?

Often times an animation requires "layering" of motion. You may need to translate or rotate an object in several different ways to achieve the desired animated results. The only problem is that an object has only one set of data channels. Once the rotation channels are filled, for instance, they can't be changed without erasing the previous values. You can, however, link to a second object to create a second set of rotations that will happen on top of the rotations that have already occurred in the local data channels. Effectors allow you to gain control of your animation by separating transformations into easily addressable layers.

One classic example of this is a moon orbiting a planet. You want the moon to rotate about its local center point, but you also want it to orbit around the planet's center point. You create a rotation of the moon on the Y-axis so it spins. But now you have to give the moon a second Y-axis rotation characteristic that orbits it around the planet. The only way to do this is to link the moon to an effector that is positioned over the center of the planet. By rotating the effector on Y you can create two y-rotations for the moon!

Another example would be creating a swarm of bees. You would want to individually animate each bee so it flies in a slightly different manner, but you would also want all the bees in the swarm moving forward at a similar rate. You could animate each bee's forward motion individually. Each time you change one bee in the swarm's forward accelerations, however, you would have to re-animate the rest of the swarm to follow. A better way to control the swarm would be to link each bee in the swarm to an effector that pulls them forward as a group. This would allow you individual control over each bee (as long as the link type is set to free), but move them all forward at the same rate.

If you're working on a complex animation task and having difficulty achieving the desired results, ask yourself "Could an effector help me here?"

Skeleton Effectors and Bones

Skeleton Effectors and Bones are a special class of effector that can be used to create pre-linked hierarchies. Skeleton Effectors and Bones both display similarly as sharp "tooth-pick" like vectors.



Figure 184 — Joint (Skeleton) effector and Bone Effector

Skeleton Effector chains can be used to create complex hierarchies that geometry can be linked to. By allowing an underlying hierarchy of skeleton effectors to control a complex model, you gain the freedom to manipulate, or replace geometry without the necessity of re-defining all of your joint parameters.

Bone Effectors are used to create chains that can deform an objects mesh. They can be used to create smooth skeletal deformations in situations where you can't work with a jointed model.

Adding Bones and Skeleton Effectors

Choose **File > Add > Type** and pick **Skeleton** or **Bone**. Skeleton Joints and Bones can also be added by choosing the skeleton or bone effector icon from the Object palette.



Figure 185 — The Skeleton and Bone effector icons

Click in any window to set the root of the chain (double click to set the root for a bone), click a second time to set the length of the vector. Continue clicking in this fashion to create a linked chain of any length.

To end the creation of a chain type **⌘-**. (Command-Period)

Skeleton Effector and Bone Orientation

The Z-Axis of a skeleton Effector or a bone is always oriented parallel to the length bone vector. This has the potential to cause confusion if you don't look for it.

For instance if you draw a skeleton effector in the front view window, starting at the top and moving to the bottom, you would expect the z-rotation tool to rotate the effector like the hand on a clock. However, you will find this isn't the case because the z-axis is aligned with the world's Y-axis.

Hierarchies and Constraints

Introduction

Inverse kinematics depends upon hierarchies to function. A hierarchy is defined as a collection of groups attached in a relationship with each other in some fashion, like the links in a chain (hierarchies are often referred to as chains.) Any time you link two objects together you are creating a hierarchy. A hierarchical relationship allows the transformations of a parent object to be passed along to child objects. A hierarchy can be as simple as two linked objects, or as complex as a thousand linked objects.

Constraints limit the scope or motion of a joint within the hierarchy. By establishing constraints for each joint, a variety of specialized motion can be easily achieved. Also, inverse kinematics chains are far more predictable if constraints are applied to each joint. The solution process of inverse kinematics can be made more efficient by imposing constraints as well. Constraints and hierarchies work hand in hand together. This chapter will have direct impact upon your success in working with inverse kinematics. *See also chapter 2 of the ElectricImage Version 2.5 Supplement, “Inverse Kinematics” for additional information.*

Hierarchies

There are two types of hierarchies:

- Static
- Articulate

Static Hierarchy

A static hierarchy consists of a group of linked objects that don't change relationships to each other. A chair is an example of a static hierarchy. The legs, back and seat are all linked together in a “locked” relationship that never changes.

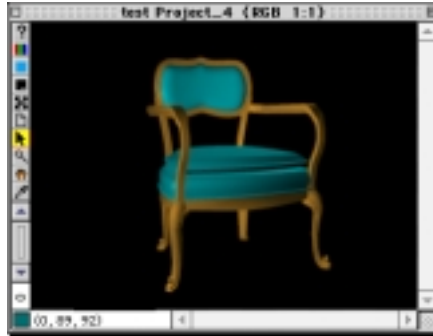


Figure 186 — A Static Hierarchy

Articulate Hierarchy

An articulate hierarchy consists of a group of linked objects that move in a pre-defined relationship to each other, and their parent object. A robotic manufacturing arm would be an example of an articulate hierarchy. The claw, upper arm, and lower arm are all linked to the base, but each item is free to move around its own pivot point. Articulate hierarchies require an extra degree of thought and set-up prior to animating.

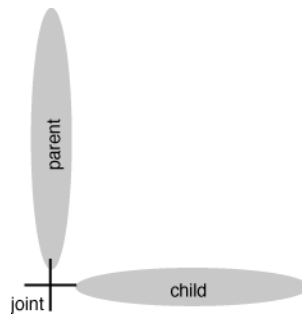


Figure 187 — An Articulate Hierarchy

That's where constraints come in. A **constraint** is a way to limit, or control an objects motion. In ElectricImage a constraint can be accomplished in several ways: By parenting one model to another; By setting joint position and rotation limits; or by creating an auto-Ik constraint.

Joints and Chains

When you link one object to another, you create a joint. The joint is simply the point where the two objects connect.



The position of the joint is determined by the objects center point, which in turn controls how linked objects move in relationship to each other.

A **chain**, or **joint chain**, is a series of one or more joints that have been linked together. To use the human body as an example, the shoulder is a ball and socket joint, the elbow is a hinge joint, and the wrist is similar to a universal joint. The upper arm (shoulder), the lower arm(elbow), and the hand (wrist) form a joint chain.

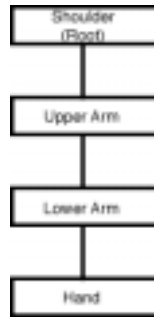


Figure 188 — Typical Hierarchy Chain

Every chain has a **root** that defines the parent object holding the chain in place.

Understanding How Joints Rotate

Objects in ElectricImage rotate around their center of rotation. You can recognize the centerpoint when you're in wire frame mode as a small black dot on selected objects.

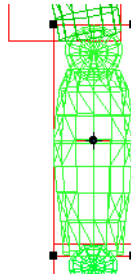


Figure 189 — Arm With Rotation in Center

When you're creating joint chains you need to make sure that the center of rotation is aligned with the area you want the object to rotate around.

If you were to create an arm chain, you would probably want the lower arm to rotate around the end that's attached to the upper arm. When you import the model, you will need to check and see where the center of rotation is. If it's in the middle of the lower arm, the rotation tools would cause it to spin like a propeller.

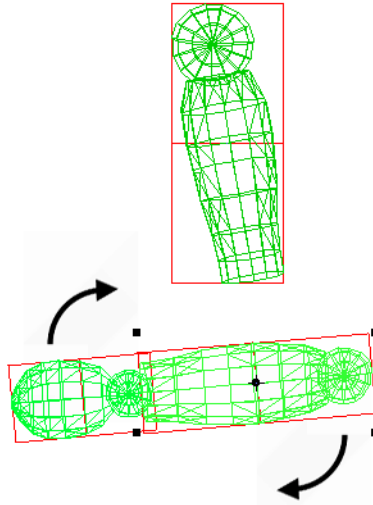


Figure 190 — Result of Center Rotation on Arm

If, on the other hand, you move it down to coincide with the point it joins the upper arm, you will get a believable rotation.

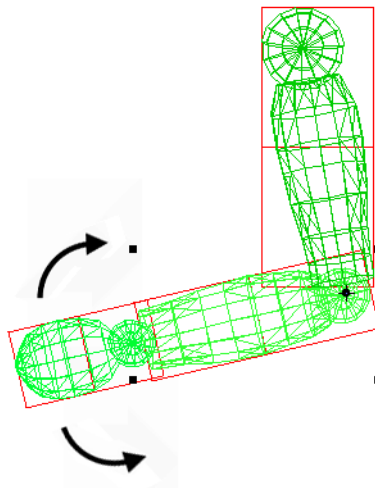


Figure 191 — Result of Proper Rotation Point for Arm

To move the center of rotation you have to move the local origin, which appears as a small cross on selected objects.

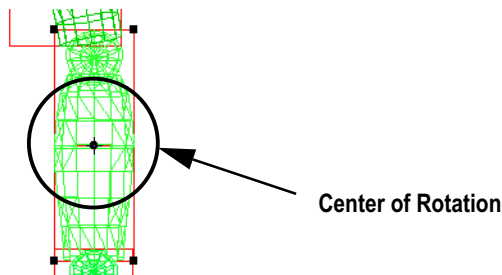


Figure 192 — Center of Rotation

It's important to note that the local origin and the center of rotation are controlled in different dialogues. The center of rotation is controlled in the group info window for an

object with the “center” data channels. The Local origin is controlled in the group linkage window.

In a normal hierarchy you would want to keep the local origin and the centerpoint equal to each other. This is to make sure that wherever you drag the local origin to, will also be the point around which and object rotates. When the “center” values in the group info windows are at 0,0,0 the center of rotation will align exactly with the local origin. The center of rotation is the point that actually defines the geometric center of an object. The local origin, on the other hand, simply defines where an object joins to its parent. This is why control for the two resides in different dialogues. The center of rotation is defined as an offset of the local origin. So when you move the local origin, the center of rotation will move a proportional amount. The only time you can get into difficulty here is if you manually enter an offset in the “center” channels. This may cause your object to rotate out of synch with the position of the local origin.

Animating Joint Chains

When you have you're joints properly configured to rotate in relationship to each other, the next logical thing to do is animate them. There are two ways to animate joint chains in ElectricImage: *Forward Kinematics*, and *Inverse Kinematics*. With either method your goal is to move part of a chain toward a target object.

Animating with forward kinematics requires that you control your hierarchy from the top down. You move the parent, then the child. Any movement you give to the parent is passed on to the child, but the movement you give to the child is NOT passed on to the parent. This is the default positional animation method in ElectricImage.

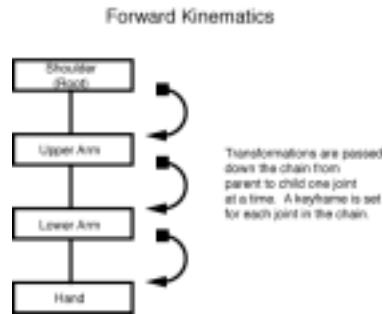


Figure 193 — Forward Kinematics Flow Chart

Let's say we want to create an animation of an arm chain as it reaches out for a glass of water.

Using forward kinematics we would first rotate the upper arm toward the glass, then the lower arm, and finally the hand. This method of animating gives you the greatest control over your joints by forcing you to set keyframes for each one of them. It isn't the most intuitive way to reach the target though. You have to guess how far to move the upper arm, then the lower arm, in order to get the hand closer to the glass.

Illustrations “Chain at Rest”, “Shoulder is Moved First”, and “Rotated Elbow brings Hand to Glass” demonstrate this process.

Forward Kinematics Example

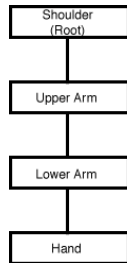


Figure 194 — Chain at Rest

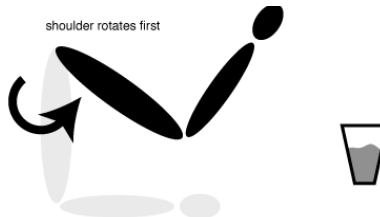
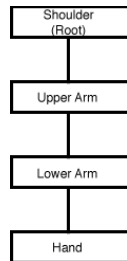


Figure 195 — Shoulder is Moved First

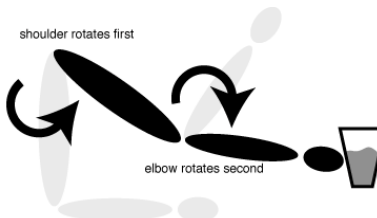
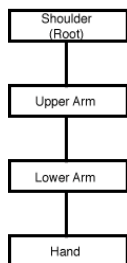


Figure 196 — Rotated Elbow brings Hand to Glass

Hierarchies and Constraints — Animating Joint Chains

Wouldn't it be much easier if we could just pull the hand toward the glass and have the rest of the joints follow?

Animating with Inverse Kinematics will allow us to do just that. As its name implies Inverse Kinematics lets you animate from the bottom up. You pass information FROM the child TO the parent. Any movement you give to a child object is passed up the hierarchy to its parents. Unlike forward kinematics then, parents are aware of what their children are doing.

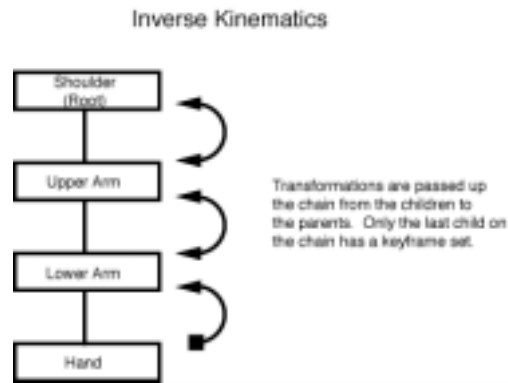


Figure 197 — Inverse Kinematics Flow Chart

To animate our arm with Inverse Kinematics we select the Lower Arm, the Upper Arm, and the hand (in any order), and pull on the hand with the IK tool. In one simple step you have animated all the joints in the arm chain and reached the glass of water!



Figure 198 — Inverse Kinematics Version of Glass Example

With an inverse kinematics method you've gained control over reaching the target, but you've lost control over your joints. Instead of having fixed keyframe values for each joint in the chain, you have only one keyframe (the one for the child) controlling them all.

One thing you must keep in mind about Inverse Kinematics is that the parent/child relationship in your hierarchy hasn't been turned off. It's just temporarily reversed when you use the IK tool. It is possible to create a conflict by using an inverse kinematics method and a forward kinematics method on the same chain.

In our example of a hand reaching for a glass of water we set a keyframe, using IK, for the hand which controls the lower arm and the upper arm. If, we decide to use the move tool to translate the upper arm forward, a forward kinematics solution, we will move the hand past the glass.

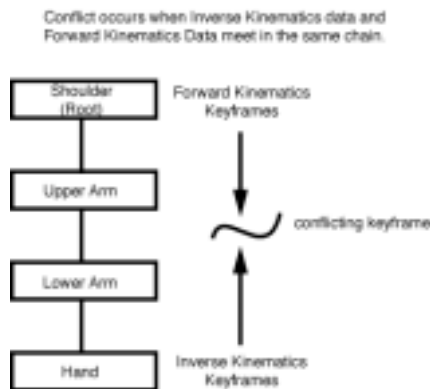


Figure 199 — Conflicts between Forward and Inverse Kinematics

Because the forward kinematics solution forces the child to follow the parent again, the IK keyframes are actually dragged out of position!

It's a case of the “Push Me Pull You.” When you're using the IK tool, the parents are aware of where the children have been keyframed and react accordingly. Using the Forward Kinematics tools (move tool, x,y,z rotate tools) makes the parents ignore the child keyframes.

Using the IK tool

Because IK works on a hierarchy, you must select all the objects you wish to translate first.

Select all the objects in the chain(s) you wish to translate with the IK tool. Holding the shift key down while selecting will let you make multiple objects active.

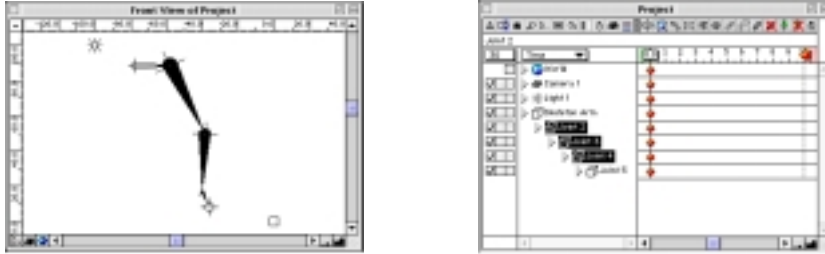


Figure 200 — Multiple selected joints in the Front View and Project Windows

With the IK tool select the child on the chain(s) you wish to manipulate



Figure 201 — The bottom child on the chain is selected

Pull in any view window. The chains will all move at once within any limits and constraints that have been set for them.



Figure 202 — The IK Chain in motion

It's important to keep in mind that the IK tool actually translates AND rotates all the selected joints in a chain at the same time. So if all the joints in your chain are set to free (giving them the freedom to rotate and translate) using the IK tool to move the chain will actually cause it to break apart.

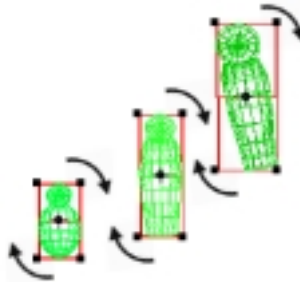


Figure 203 — The IK Chain breaking apart

IK Preferences

The kinematics preferences box can be opened by choosing **Edit > Preferences...Kinematics Tab**. The options in this box control the way in which ElectricImage solves Inverse Kinematics solutions.



Figure 204 — The Kinematics Preferences Tab

There are six sections in the Kinematics Preferences Tab:

- IK Dragging Options Section
- IK Deselected Joint Options Section
- IK Interactive Solutions Section
- IK Automatic Solution Section
- Constraint Multipliers Section
- Global Gravity Section

IK Dragging Options Section

This section contains controls which govern the behavior of inverse kinematics chains as you drag them. There are three options:

- Use Phantom Joint
- Use Global Gravity
- Keep World Orientation

Use Phantom Joint

When this box is checked, phantom (ghost) joints for a chain will be displayed as it is manipulated with the IK tools. This option defaults to on.

Use Global Gravity

This option activates global gravity for the chain, using the values in the global gravity section. This option defaults to off.

Keep World Orientation

This option locks the rotation of the groups in the chain in global space. This option defaults to off.

IK Deselected Joint Options Section

This section contains the controls which govern the behavior of the deselected joints in the inverse kinematics chain. There are two items in this section:

- Lock Rotation
- Lock Position

Lock Rotation

This checkbox, when enabled, will prevent deselected joints in a chain from rotating. This option defaults to on.

Lock Position

This checkbox, when enabled, will prevent deselected joints in a chain from moving. This option defaults to off.

IK Interactive Solutions Section

This section contains controls which lets you fine tune the behavior of the interactive IK solution process.

Find Exact Solution

This checkbox, when enabled, will force ElectricImage to find the exact IK solution for a joint chain when it is manipulated. Enabling this option can add significantly to the time it takes to redraw the position of a chain.

Solution Time

This data field allows the entry of a time, in seconds, for the IK chain to update once its been manipulated. This time only applies if the Find Exact Solution box has been checked.

Automatic Solution Options

This option controls the behavior of the Automatic Inverse Kinematics feature.

Solution time

This data field allows the entry of a time, in seconds, that can be used before the chain is automatically redrawn.

Constraint Multipliers Section

These edit boxes contain values that establish the relative importance of Position, Orientation, Stiffness, Viscosity and Gravity when applying inverse kinematics. These values can be set between 1 and 0. The higher the number in each field the higher the priority that channel will take in when the IK solution is calculated.

Global Gravity Section

These data fields allow the entry of a global gravity constraint that will be applied to all joints in a chain when using the IK tool. The default setting is X= 0, Y= -1.0, and Z= 0. Normal Earth gravity would be zero for the X and Z axes, and a negative value for the Y axis.

Gravity only effects how the group moves while the model is being dragged in IK mode.

Creating a Workable Hierarchy

When you create a joint chain, you are creating a series of dependencies. Each joint in a chain will move and rotate in relationship to its parents movements. If you give each joint in that chain the freedom to rotate on all axes, you could end up with a joint chain that is spinning out of control.

The price you must pay for the ease of animating with IK is properly setting up joint rotation and position limits for each joint in your chain. By doing this you're telling the IK tool where and how to bend your joints.

Broken Hierarchies

When you join multiple joint chains into a single hierarchy, you have to pay close attention to how these chains will interact with each other when you animate them. In any hierarchy there can only be one parent. Every time you make a change to the parent you will be sending a cascade of changes down all of the joint chains that are connected to that parent. This could lead to a hierarchy that bends and twists in unexpected ways.

To prevent the animation of one joint chain in a hierarchy from contaminating others in the same hierarchy it's sometimes necessary to break the hierarchy into separate pieces that all lie on the same level.

The best case for breaking a hierarchy is the human body.

As a joint chain structure the human body has two arm chains, two leg chains, a back chain, a head chain, and hips. In the natural world the hips tend to be the point where everything finally connects. When the hips move forward, so do the arm chains, the head chain, and the legs.

It's easy to animate the arm and leg chains in this configuration. Any IK animation you give these chains will stop being passed at their roots. But when you try and move the entire hierarchy forward (to take a step) the hips will send their movement data back down into the leg and arm chains. This will cause the IK solution you've applied to these chains to be overridden. The end result will be a hierarchy that isn't working properly. Each time you rotate a chain in this hierarchy you run the risk of sending the translation and rotation information into another, seemingly unrelated, chain.

This can be prevented by breaking the hierarchy up into smaller, related sections. By connecting the arm and leg chains to an effector, you create a sort of animation “washer” that helps prevent the keyframes used to move the entire hierarchy forward from interfering with the local IK keyframes you give to your chain.

Animating a broken hierarchy also requires a “broken” animation technique. You must devise an animation strategy that allows you to animate the movement of the individual chains with rotation keyframes, but also allows you to pull the same chains around with effectors that act as roots of the individual hierarchies.

Auto-IK

While it's not advisable to use the IK tool and the forward kinematics tools on the same chain, it is possible to achieve the same effect on the chain using an auto-ik constraint. This type of constraint allows you to manipulate objects with the move and rotate tools, but applies an Inverse Kinematics solution to the chain.

Auto-IK allows you to force your chain to follow an object that lies outside of its hierarchy. When you move the object that your chain has been auto-IK constrained to, an IK solution will be passed up the chain, controlling all of the joints, until it reaches the termination point. (This is also known as “goal animation.”)

At the same time you will be able to translate the root of the chain in a different direction. When you do this, the joint chain as a whole will try and orient itself so that it stays aligned with the position of the root, and the auto-ik constraint object. This is why it's called a constraint. When the chain is in motion, it will be constrained to a position between the root, and the auto-IK constraint object.

Because an auto-IK constraint object is not part of the joint hierarchy itself, the IK solution doesn't know where to stop applying itself within the chain. In order to keep the auto-IK constraint from affecting all of the joints, you will need to set a termination point. The termination point simply tells the auto-IK solution where to stop applying itself.

Setting up an Auto-IK Constraint

Using an auto-IK constraint requires a jointed chain and a constraint object that is not part of the chains hierarchy.

Select the part of the chain that you want to follow the constraint object.

Choose the Constrain to object tool from the Project Window or the Tool Palette.



Figure 205 — The Constrain to Object tool

Click on the constraint object. Two keyframes will immediately be set. One at the current position of the time thumb, and one at the end of the animation. These are custom keyframes that will be recalculated every time you move the constraint object.

Select the part of the chain you are constraining and switch your project to keyframe mode. Spin down the data channel arrow for the object.

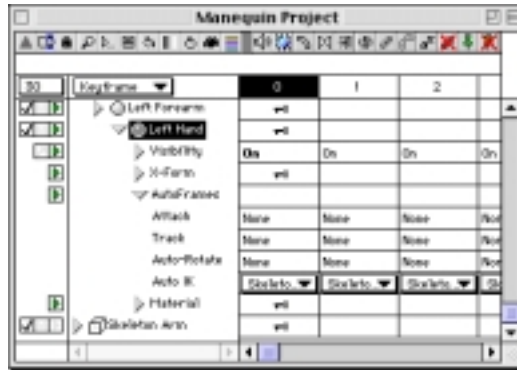


Figure 206 — Auto Frames Channel opened

Spin down the AutoFrames arrow for the object and pick a termination point from the Auto IK dropdown menu.

Once the termination point is set you can animate the constraint object, and the chain will follow along. Each time you preview your animation the auto-keyframes will be recalculated.

To disable an auto-IK constrain select the object in the chain that's being constrained and click on the Remove Constraint Tool.



Figure 207 — The Remove Constraint tool

Because Auto-IK constraints create custom keyframe data for the objects they're constraining, it's a good idea to use the **Keyframe > Clear All Keyframes** command on the object the constraint has been removed from.

The Group Linkage Window

Introduction

Through the Group Linkage Window, you determine transformation behavior, rotation order, link type, rotation orientation, movement constraints, inherited transform behavior, and joint attributes. It is wise to take the time to work with these attributes to get the most from bones deformations and inverse kinematics.

A pivot point is the location on the group in which rotations occur. It is also the point of origin for scaling operations, and translation (movement). A pivot point is visible for each group in all of the world windows, and is presented as a black cross, as illustrated below:



Figure 208 — Pivot Point Indicator

The pivot point and the group center are almost always located in the same position. The group center can be offset from the pivot point by typing in a new value in the Group Info Window. Doing so is ill advised, and can cause some unwieldy animation behavior. The combination of the group center indicator (a black dot) and the pivot point appears below:



Figure 209 — Pivot Point and Center Indicator

The pivot point defaults to the center of the group. You can use the Group Linkage Window to place the pivot point at some other location. You can even set the pivot point to be well outside of the group's extents, if need be.



Figure 210 — The Linkage Icon

There are four ways to access the group linkage window:

- Select a group and choose the Linkage Icon from the Tools palette
- Select a group and choose the Linkage Icon from the *Tools* menu
- Select a group and choose the Linkage Icon from the Project Window
- Hold down the Command & Option keys and double click on a group

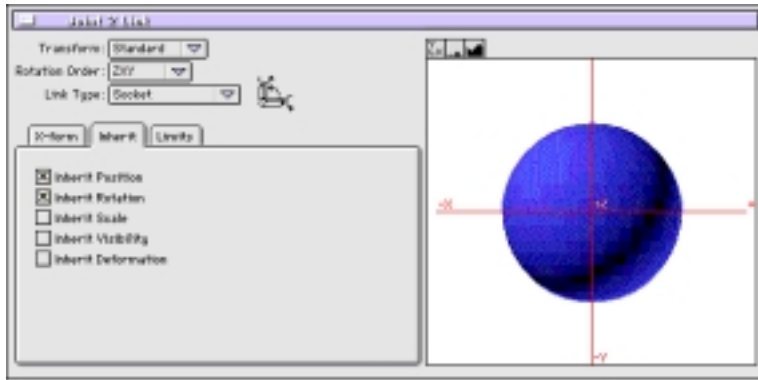


Figure 211 — The Group Linkage Window

The Group Linkage Window can be positioned to your preference. It can also be resized by clicking on the lower right hand corner and dragging. It is context sensitive — the contents of the window will change to reflect the currently selected group. It can display the linkage information for one group at a time. The window is divided into three sections:

- Group Preview Pane
- Pop Up Menu Section
- Tab Section

Group Preview Pane

The group preview pane allows the pivot point for an object to be interactively positioned by clicking and dragging. Unlike the world windows, the pivot point representation in the Group Linkage Window is that of a large red cross hair, called a gnome. The gnome displays the X, Y, and Z coordinate position and orientation for the joint. Where these vectors meet represents the center of the pivot point.

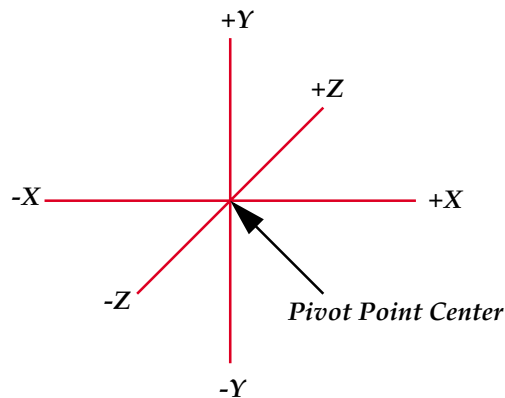


Figure 212 — Pivot Point Gnome

The detail to which an object is drawn in the group preview window is controlled by the settings in the Drawing Preferences Box, under *Edit > Preferences Drawing Tab*. Also, the shader ball icon can be set to control drawing, by holding down the option key and clicking on the icon, then choosing the desired drawing level from the pop up menu list.

The group preview window view can be manipulated in the same way world view windows are. Clicking on the zoom in, zoom out buttons will bring an object closer or farther from the view window. Option-clicking on the zoom icons will fit the group into the view. Clicking on the view pop-up will change the angle from which the object is viewed.

The gnome can be positioned by clicking and dragging on it in any orthographic view. The gnome cannot be interactively dragged when the view is set to skew, but it can be interactively rotated.

Pop Up Menu Section

The pop up menu section at the top of the group linkage window contain settings that will affect joints the same way regardless of what information is entered in the tabs. There are three menus:

- Transform Menu
- Rotation Order Menu
- Link Type Menu

Transform Menu

Rotations are susceptible to a distortion known as “shearing” when non-uniform scaling is applied to groups within a hierarchy. The transform menu lets you choose how the phenomenon will be addressed, on a group by group basis (each group can have a separate setting). The transform menu offers two options:

- Classic
- Standard

Standard

To avoid the shearing phenomenon, this option allows ElectricImage to compensate by processing scaling operations so that the shearing phenomenon does not occur. This is the default method.

Classic

This method bypasses any compensation for the shearing effect. You can use this option if you are not applying non-uniform scaling to any groups in the hierarchy without any ill

effects. If you do notice shearing, switch to the Standard method. This option is called classic because other programs on the market use this method (even though it is less sophisticated.)

Rotation Order Menu

Object rotation order determines how rotations will be processed. Each rotation axis is processed one at a time. Ultimately, one of the three axes will nullify one of the other axes. For example, a rotation applied to Y and Z may produce the same result, even though they are clearly different axes. This is called “gimbal lock.” Choosing a different rotation order can alleviate the problem.



Figure 213 — The Rotation Order Pulldown

The default is ZXY. This means that Z rotations will be calculated first, followed by X, and finally by Y axis rotation calculations. For many animation situations the default settings will work just fine.

A good rule of thumb for assigning rotation order is to calculate the axes in a descending order of stability. Think about how your object is moving, and decide which axis is most important to creating the desired motion. Which axis is second most important, and which is the least important.

The last six choices in the Rotation Order pull-down have a fourth coordinate inside parentheses. This coordinate controls the last rotation in the order. For instance, XYZ(z)

The Group Linkage Window — Introduction

indicates an X rotation, then a Y rotation, and a second X rotation that is controlled by the Z coordinate channel.

An alternative method for dealing with gimbal lock is to assign separate effectors for each axis of rotation, and parenting the group to these effectors. Set up each effector so that it can only rotate on a single axis, which prevents gimbal lock altogether.

Link Type Menu

The Link Type pull-down menu contains pre-configured link types that can be applied to an objects pivot point. Use this pull-down menu to set a basic set of position and rotation limits for a joint. The link type chosen will create global rotation and position limits that will override specific values entered in the limits sub-palette, by locking specific X, Y, and Z channels.



Figure 214 — The Link Type Menu

There are eleven menu options in the Link Type Menu:

- Custom...
- Free
- Ball Planar
- Cylinder Planar
- Planar
- Socket
- Cylinder
- Universal

- Slide
- Pin
- Lock

Custom

The custom option opens a dialogue box that allows specific rotation and position parameters to be locked or unlocked for a group. Parameters with check marks next to them are completely disabled. For instance, a check mark next to Lock Y Position will disable an objects ability to move on the Y-axis.

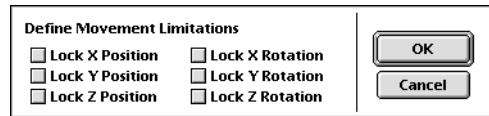


Figure 215 — The Custom Link Window

The Custom link type can be used to see what kind of position and rotation limits are created by the other pre-defined link types. Just pick one of the link types, like socket, and then choose Custom. The Custom Joint dialogue will pop-up with the limits that a socket link uses already checked off.

Free

This link type allows an object total freedom to move and rotate on all axes. Free is the default link type for root objects in any chain. Because this joint type is free to move and rotate on all axis, the values in the limits sub-palette will override it.

Ball Planar

This link type locks the Y position channel only.

The Group Linkage Window — Introduction

Cylinder Planar

This link type locks the Y position channel and the X rotation channel.

Planar

This link type locks the Y position channel and the X and Z rotation channels.

Socket

This link type locks the X, Y, and Z position channels.

Cylinder

This link type locks the X and Y position channels and the X and Y Rotation Channels.

Universal

This link type locks the X, Y, and Z position channels and the X rotation channel.

Slide

This link type locks the X and Y position channels and the X, Y, and Z rotation channels.

Pin

This link type locks the X, Y, and Z position channels, and the X and Y rotation channels.

Lock

This link type locks all position and rotation channels.

Folder Tab Section

All of the specific local controls for an group's pivot point can be set in the folder tabs of the Group Linkage window. There are three folder tabs in this section:

- X-form (Transformation)
- Inherit
- Limits

The X-Form Tab

The X-form tab controls the position and orientation of the gnome, and thus the pivot point for an object. Values entered in these fields will cause the gnome to be re-positioned in the group preview pane.

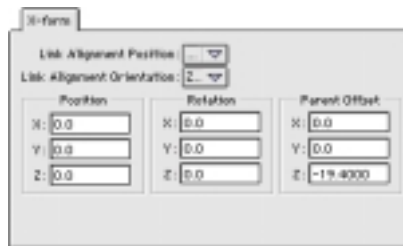


Figure 216 — The Transformation window

Link Alignment Position

This pull-down controls the position of the groups pivot point in relation to its geometric bounds. The different choices will place the gnome in that position relative to the group.



Figure 217 — The Link Alignment Menu

There are a total of seven items in this menu:

- Middle
- Front
- Back
- Top
- Bottom
- Left
- Right

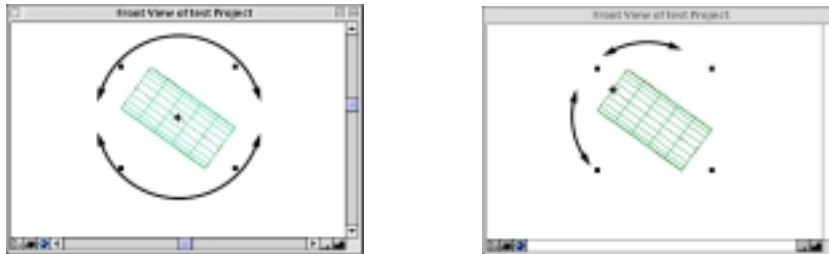


Figure 218 — Changing the Pivot Point

Middle

The default for all objects, positions the pivot point exactly in the center of the object.

Front

This option positions the pivot point with the groups front.

Back

This option positions the pivot point with the groups back.

Top

This option positions the pivot point with the groups top.

Bottom

This option positions the pivot point with the groups bottom.

Left

This option positions the pivot point with the groups left side.

Right

This option positions the pivot point with the groups right side.

Link Alignment Orientation

This pull-down controls the orientation of the groups pivot point. Changing the link alignment orientation changes the orientation of the X, Y, and Z axes of the pivot point. Changing the **Link Alignment Orientation** will change the direction that the object rotates.



Figure 219 — The Link Alignment Menu

The results of changing the Link Alignment Orientation can be seen in the group preview pane by watching the changes in the gnome orientation as different options are chosen.

The Group Linkage Window — Link X-Form Tab

There are three choices in the Link Alignment Menu:

- Z is Z
- Z is X
- Z is Y

Z is Z

The default option maintains the objects initial link coordinates.

Z is X

This option will swap the group's Z and X coordinates so that the Z coordinate becomes the X coordinate.

Z is Y

This option swaps the group's Z and Y coordinates so that the Z coordinate becomes the Y coordinate.

Position Section

This area contains data cells for the X, Y, and Z position of the pivot point. Entering values in this field will update the position of the gnome in the group preview window.

Rotation Section

This area contains the data cells for the X, Y, and Z rotation of the pivot point. Entering values in this field will update the orientation of the gnome in the group preview window.

Parental Offset Section

This area contains data cells for the X, Y, and Z parental offset values of the pivot point. The parental offset is the distance between the pivot point of the parent object, and the pivot point of the child object. Changing the values in the Parental Offset data cells changes the distance between the pivot point of the child and the pivot point of the par-

ent, it does not change the position of the pivot point in relation to the object. Changing the parental offset value will cause an object to move closer too, or farther away from its parent.

The Inherit Tab

The inherit tab controls which transformations performed on the parent will be passed on to the child in a hierarchy. To enable an attribute check its box, to disable an attribute uncheck its box.

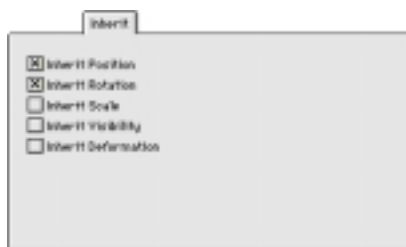


Figure 220 — The Inherit Tab

By default rotation and position information are passed from the parent to the child. When a parent object is transformed or rotated, its child will be transformed or rotated accordingly. If the position and rotation checkboxes were unchecked, the child would not react at all to the parents movements.

The default preferences for the inherit options can be changed by opening the Import... options under the Edit menu. The Import Preferences dialog contains an identical set of attributes to the inherit palette. Checking attributes in the Import Preferences dialogue will make those settings the default for all newly created hierarchies.

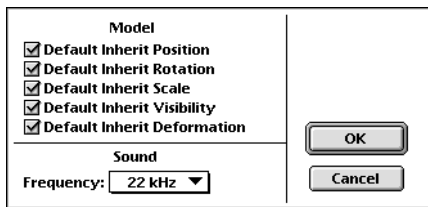


Figure 221 — The Import Options dialog

Inherit Position

This checkbox option, when enabled, links the position of the child group to the position of its parent group. When the parent is moved in X, Y, or Z space, the child will be moved with it.

Inherit Rotation

This checkbox option, when enabled, links the rotation of the child group to the rotation of its parent group. When the parent is rotated in X, Y, or Z space, the child will be rotated with it.

Inherit Scale

This checkbox option, when enabled, links the scale of the child group to the scale of its parent group. When the parent is scaled in X, Y, or Z space, the child will be scaled with it.

Inherit Visibility

This checkbox option, when enabled, links the visibility of the child to the visibility of the its parent. When the parent's visibility is off, the child's visibility will be off.

Inherit Deformation

This checkbox option, when enabled, will include the child with a deformation applied to the parent. The deformation region for the parent must be adjusted to include the child

object within the deformation region for this option to be effective. This is a very powerful feature that will allow you to deform an entire hierarchy as if it were one object.

The (Joint) Limits Tab

Joint limits allow you to set up your hierarchy chains to behave in a realistic manner, using a variety of natural forces and limited ranges of freedom. You can also create joint libraries to make the creation of complex hierarchy chains easier.



Figure 222 — The Limits Tab

The limits tab consists of the following items:

- Load Joint Pop Up Menu
- Rotation Tab
- Stiffness Tab
- Viscosity Tab
- Position Tab
- Gravity Tab

Load Joint Pop Up Menu

This pull-down menu allows you to use, or remove, joints from a pre-defined joint library. Unlike the pre-defined choices in the Link Type menu, these joints can have pre-defined rotation and position limits in degrees of freedom.



Figure 223 — The Load Joint menu with the New submenu exposed

This pull-down menu allows you to use, or remove, joints from a pre-defined joint library. Unlike the pre-defined choices in the Link Type menu, these joints can have pre-defined rotation and position limits in degrees of freedom.

Use

Loads a choice of pre-defined joint types in the currently open joint library. To create a new library choose **Use > New**.

Remove

Removes a pre-defined joint from a group.

Modify

Allows a pre-defined joint type to be replaced.

The Rotation Sub-Tab

The rotation sub tab allows joint rotation limits to be set for X, Y, and Z rotation. There are four items in the tab:

- Enable Limits Check box
- Minimum Section
- Center Section
- Maximum Section



Figure 224 — The Rotation sub-tab

Minimum Section

This row of data cells contains values, in degrees, for the minimum angle a joint can rotate.

Center Section

This row of data cells contains the values, in degrees, for the angles at which the joint wants to be naturally positioned at rest. This value is used to help smooth the transition between the minimum and maximum rotation limits. Instead of rotating between the maximum and minimum, the joint motion curve will arc through the center limit first.

Maximum Section

This row of data cells contains values, in degrees, for the maximum amount a joint can rotate.

Use Current Value Arrows

Each data cell in the rotation limits sub-palette has a small arrow that, when clicked on, will bring up a Use current value box. Selecting this option will update the current rotation value of the joint into the data cell. This allows rotation limits to be set interactively by rotating a joint with the rotate tools, and transferring the value of the rotation into a limits data cell. The group linkage window is non-modal, so you can easily jump back and forth between world view windows and the limits palette to make use of this feature.



Figure 225 — The Use Current Value popup

ElectricImage is very smart when it comes to updating the maximum and minimum cells with current limits. It knows to put the highest value in the maximum box, and the smallest value in the minimum box. This means you can click on the Maximum or Minimum use current value arrow and the proper values will be inserted where they belong. For instance, if you try to put a negative X value in the Maximum box, and a positive X value in the minimum box, ElectricImage will automatically “flip-flop” the two values so the positive value is in the Maximum box and the negative value is in the Minimum box.



Figure 226 — The Use Center of Limits popup

There is an additional current value choice in the drop-down menu for the center data cells called Use center of limits. Selecting this option will divide between the minimum and maximum limits and enter the result in the data cell. Note that in some cases the center of limits may not be where you want the joint to be when it is at rest. In those cases manually rotate the joint into the resting position and select the “use current values” option.

The Stiffness Sub-Tab

The stiffness sub-tab can be used to control the amount of pull required to move a joint through its X, Y, and Z rotation. The higher the values in these fields the harder the pull required to move the joint. The end result is that joints with a smaller stiffness setting will move farther, faster, than joints with a high stiffness setting.



Figure 227 — The Stiffness Sub-Tab

An example would be a human leg. The thigh bone should move slower than the shin bone. Setting a higher stiffness for the thigh would mimic this motion.

The Enable checkbox, when checked, makes the stiffness settings active.

The Viscosity Sub-Tab

The viscosity sub-tab can be used to control the viscosity, or apparent friction, of a joints X, Y, and Z rotation. The higher the values in these fields, the more friction the joint will appear to experience as it rotates. Very high values will make the joint appear to catch and release as it rotates. Click the Enable box to activate viscosity.



Figure 228 — The Viscosity Sub-Tab

An example would be a rusty door hinge. The rust would cause more friction, and thus cause the joint to move in an un-smooth fashion. To recreate this you would apply a high amount of viscosity to the hinge joint.

The Position Sub-Tab

The position sub-palette allows joint position limits to be set for the X, Y, and Z axes. These limits control how close, or far, a group can move from its parent. The enable limits checkbox, when checked, makes the position limits active.



Figure 229 — The Position Sub-Tab

There are two sections in the Position Sub-Tab:

- Minimum
- Maximum

Minimum

This row of data cells contains the minimum X, Y, and Z position values for the groups joint.

Maximum

This row of data cells contains the maximum X, Y, and Z position values for the groups joint.

Each data cell has a drop-down menu arrow that, when selected, will input the current position of the joint into the field.

The Gravity Sub-Tab

The gravity sub-tab contains values for X, Y, and Z gravity settings for the joint. The settings in these fields apply only to the joint they're set for, not the entire hierarchy. Local and Global gravity settings only affect how a group moves while the model is being translated in IK mode, it is not a physics simulation. Checking the Local box overrides global gravity settings for the joint. Normal gravity settings would be X=0, Z=0, and a - Y setting.

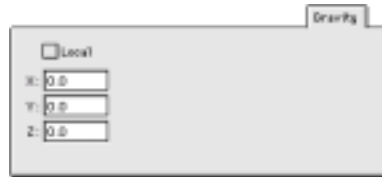


Figure 230 — The Gravity Sub-Tab

Working in the Group Linkage Window

Because the group linkage window offers a wide variety of tabs and input fields, it's helpful to develop a standard procedure when creating joints. Like any complex task, it's best to start with the basics and work your way to the specifics. A basic procedure might go something like this:

- Choose a pre-defined link type from the Link Type global pull-down menu.
- Select the X-Form Palette and choose a link alignment position for the pivot point. (If one applies)
- Interactively drag the gnome into position in the group preview window. Tweak the values in the X-form palette if needed.
- Set Joint rotation and position limits in the Rotation and Position sub-palettes.
- Test your joint to make sure it's working properly.
- Set Stiffness, Viscosity, and Gravity settings only if they're needed.

Deformations

Introduction

Deformations allow you to bend, twist and otherwise distort groups in a variety of different ways. A basic tool for 3D character animation, deformations will enable you to impart “life” into a character, “bend steel with your bare hands” (apologies to the Superguy!), and so on. ElectricImage 2.8 introduces two new types of deformations: a multi-point bezier deformation, and hierarchical (skeletal) bones deformations, which you can use with inverse kinematics. When used in conjunction with morphing, all of these deformation tools provide everything you need to create fantastic character animation.

In this chapter we'll discover just what a deformation is, how to use it, the differences between each deformation type offered in ElectricImage and some tips on their use.

What is a Deformation?

A deformation region allows you to squash, stretch, twist, bend, shear or wobble wobble any group (including its children) in any manner you see fit. You can have one deformation action on a group, or you can have many. Any deformation is animatable, which means you can make that can of tomato soup do the macarena if your heart desires. When you combine different animated deformations into one object, often times the flexibility offered is amazing.

Deformations in ElectricImage

In ElectricImage, deformations are applied to groups through the use of regions. A deformation region is similar to a group's cubic extent at first, but you can adjust the area of a

region to suit your needs. You can assign as many deformation regions as you like to a group. The reasons for doing so are up to you, and are typically done for either more precise control or data management (too many deformations in a single region can sometimes get a little complex to follow.)

Actual deformations are assign to a specific region. You can have as many deformations as you like in a region, and they can be of any supported type. The effect that a deformation will have on a group is dependent upon both the order of the deformations in the region's deformation list, and the order of the actual regions in the region list. In both cases, the lists are processed top to bottom. You can think of this as a simple hierarchy.

For a complete technical discussion on deformations in ElectricImage, please refer to the ElectricImage Series 2 Reference Manual, chapter 16, "The Group Deformation Window."

Using Deformations

In order to supplement the previous documentation on deformations, we have provided a sample ElectricImage project file, which you can find on the 2.8 CD ROM.

Find and open the file, called HotDogD4M.Project. You'll immediately notice a hot dog wearing a set of Groucho glasses. We're going to explore the use of deformations by making this hot dog do things that no ordinary hot dog would stand for.



Figure 231 — the Hot Dog object

To Apply a Deformation

1. Select the group, by either clicking on it in the world views or selecting its name in the Project window.

2. Open the Group Deformation Window. There are three ways you can do this:

- Select it from the Tools menu
- Click the small Deformations icon in the top row of the Project window.
- Click the Deformations icon in the Tool bar.

The Group Deformation window opens:

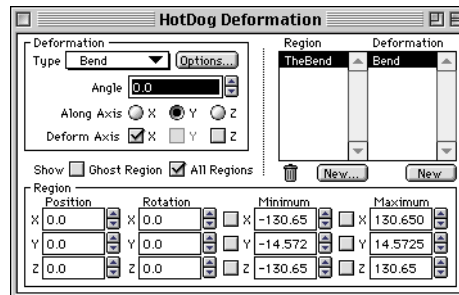


Figure 232 — Deformation window for the Hot Dog group

Now we will take a look at this dialog and break down its individual parts:

- Deformation Section
- Region/Deformation Section
- Region Section
- Show Region Buttons

Deformation Section

The deformation section consists of the type menu, the options button, the Angle/Amount/Strength edit box, Along Axis and Deform Axis check boxes. This section is where you choose and control the deformation.



Figure 233 — Deformation section of the Deformation Window

Type

This pop-up menu contains all the different types of deformations available to you. This is where you select what kind of deformation you'd like to use. We'll discuss the different kinds of deformations later in the chapter.

Options

Clicking this button brings up options specific to the type of deformation selected. Each deformation type has different options available to it, so depending on what type of deformation you've chosen with the Type pop-up, you will get a different dialog each time you select the Options button. We'll discuss the options for each type of deformation individually when we discuss each later in the chapter.

Strength% (or Scale or Angle)

This is where you enter the amount of deformation to be applied to the group. To animate a deformation, you simply change the value in this box over time, by either directly entering a number or by adjusting it via the rocker buttons to the right of the window. Another way to change this value is by directly manipulating the deformation region in the World views by clicking and dragging on the selected group. You will see the group update in

the world view windows as you drag. Just about any deformation available may be interactively set this way.

One thing to note about this box is that its label will change, depending upon which type of deformation you chose. For Twist, Shear and Bend, it will change to Angle; for Scale, Taper or Bulge deformations, it will read Percentage; and for Stretch and Bezier deformations it will read Strength.

Along Axis

These three radial buttons determine what axis or axes the deformation is calculated along. Let's use a bend deformation as an example.

Deform Axis

These check boxes determine what direction the deformation will occur towards. These check boxes are dependent upon what axis you chose to deform along in the Along Axis setting. If an axis is not available to a particular deformation type, the check box associated with that axis will be grayed out.

Using a bend deformation on the Hot Dog as an example, let's look at how these two settings work together.

Deformation Axis Examples

Deform X along Y

If you choose to bend the hot dog along its Y axis (Along Axis setting is Y), note that the Y Deform Axis box is grayed out. That's because you're calculating along the Y axis and can't deform in the Y direction.

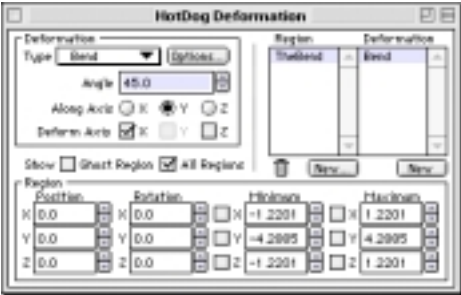


Figure 234 — Y axis deformation along the X axis

Keeping the axis along which the deformation takes place set to Y, a deform along the X axis will make the object bend to the left or to the right, depending on the value assigned to Angle. Looking at the front view window, positive X is to the right, and negative X is to the left. Because we have a bend angle of 45 degrees (positive,) the object bends to the right.



Figure 235 — 45° X Axis Bend Along Y

Deform Z along Y

If you choose to deform only the Z axis, you'll see that when you bend your hot dog it will bow forward or arc its back.



Figure 236 — Y axis deformation along the Z axis

This is because the deformation is moving the polygons toward either the positive or negative Z along the Z axis. Because we have a negative value for our Angle, the Hot Dog will bend towards negative Z, which is to the left when looking at the side view window.

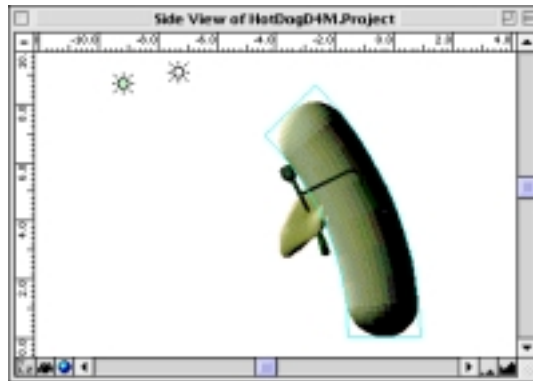


Figure 237 — -45° Z Axis Bend Along Y

Deform X and Z along Y

If you choose to deform in both X and Z axes (both check boxes selected,) then the hot dog will appear to bend in all directions, like forward to the right, backward to the left, etc.



Figure 238 — Y axis deformation along the X and Z axes

The illustration entitled “-45° X and Z Axis Bend Along Y” show the Hot Dog bending to the forward left. This is because our X deformation is causing it to bend to the left along the positive X axis, and our Z deformation is causing it to bend forward along the negative Z axis.

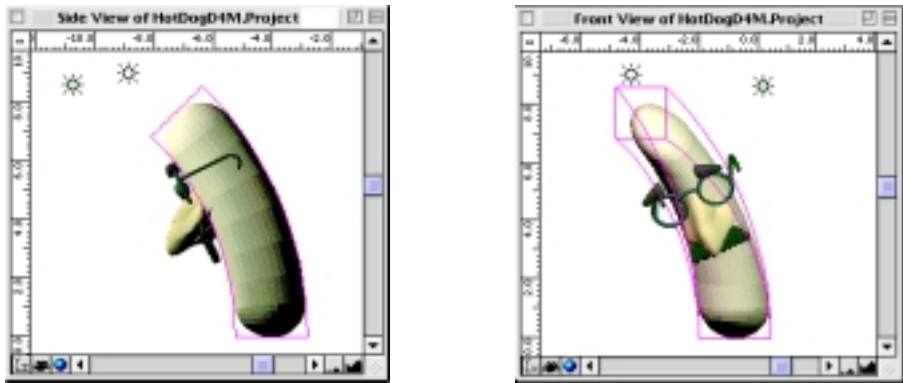


Figure 239 — -45° X and Z Axis Bend Along Y

Show Regions

As mentioned previously, regions are the extents within which actual deformations are applied to the group. There are two types of region display options, Ghost Region and All Regions.



Figure 240 — The Show Regions check boxes

These two check boxes determine how the deformation region is displayed in the world view windows.

Ghost Region creates a faded purple box delineating the original extents of the deformation region. No matter how much you deform an object, the Ghost Region will always retain the original shape of the deformation region to show you the original position of the region.

By checking the All Regions box you can show every region not currently selected in the Region list (located in the upper right of the Group Deformation Window) as a cyan colored line. The difference with this cyan line vs. the faded purple line of the Ghost Region is that the cyan line of All Regions actually deforms the extent box of the region to show just how much that region has deformed.

Comparing the Ghost region to All Regions gives you an idea of how complex things are, and is a good way of finding problems and solving them. If you have 3 or 4 deformations and want to know how deformed any of the other regions are, simply check the All Regions box and every deformation region will show up as a cyan line, with any deformation effects applied to the cyan extents box. This is also extremely helpful when you have different regions in different parts of a group and don't want your regions to overlap. By checking All Regions you can be sure that your new regions don't overlap and accidentally interfere with any previously placed regions.

Region/Deformation Section

This section contains tools and lists for creating and managing regions and deformations. As mentioned previously, deformations are contained within a region that is assigned to a group. You can have as many regions as you like, and as many deformations within a region as you like.



Figure 241 — The Region/Deformation lists of the Deformation Window

This section covers the following items:

- Region List
- Deformation List
- The Trash Can
- The New buttons

The Region List

This is the area in which all your deformation regions are listed. They are order dependent, processing from top to bottom. You may drag any region up or down in this list to change the sequence in which a deformation is applied. It is sometimes necessary to adjust the order of regions (and/or their deformations) for very complex multi-deformation effects.

The Deformation List

This section lists all the different deformation types associated with a particular Region. You may change this setting via the Type pop-up menu. The currently selected deformation type for TheBend is Bend.

To Change the Deformation Type

1. Click on the Type pop-up window and change the deformation type for TheBend to a Scale deformation.



Figure 242 — The Deformation Type popup menu

Notice that the Deformation list has updated to show that you have changed the deformation type to Scale. You'll also note that the Angle box has changed its name to Scale%, which is the animatable value for a scale deformation.



Figure 243 — The Deformation window with TheBend region set to Scale

2.Change the deformation type back to Bend.

The Trash Can

You can delete a region or deformation by dragging it's name to the Trash Can icon. Once something is deleted in this fashion, the information applied to the disposed region is lost. Immediately invoking the Undo command (or typing **⌘-Z**) will restore the region and its information.

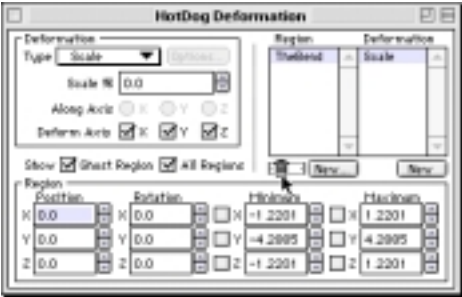


Figure 244 — The scale deformation dragged to the trash

The New Buttons

Under both the Region list and the Deformation list you will see a button labelled New. Clicking this button will creates a new region or deform, depending on which button is clicked. All new regions are created with Bend deformations by default.

To Rename a Region or Deformation

Regions or Deformations can be easily renamed. Both are renamed in exactly the same manner. To illustrate this we will now rename TheBend to something else.

1. Double-click on TheBend region.

A dialog box appears.



Figure 245 — The change region name dialog box

2. Type in "Hot Dog Bend" as a new name for TheBend.

The Deform Region is now renamed.



Figure 246 — TheBend is renamed Hot Dog Bend

4. Change Hot Dog Bend back to TheBend.

To Add a Region or Deformation

1. Click the New button under the Region list and name the new region Twister.

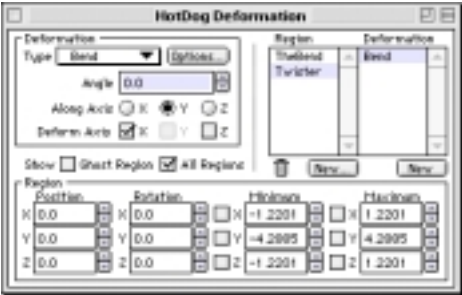


Figure 247 — The Twister group is created

Note that the default deformation type for the new Region is Bend. Since we already have a Bend, let's make this a Twist deformation.

2. Make sure that the Twister region is highlighted in the Region list. Change the deformation region to Twist

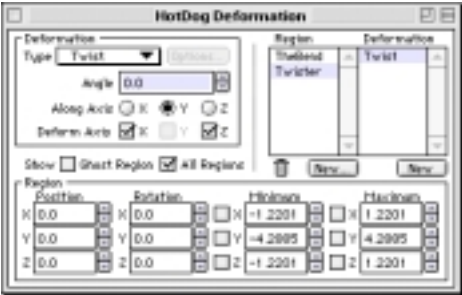


Figure 248 — The Twister region deform is changed to Twist

The Region Section

This section gives you precise numerical control over regions, and the space that they occupy. You can use the edit boxes to adjust the area of the region, or to limit the effectiveness of a region.



Figure 249 — The Region section of the Deformation window

The Region Section contains four separate items, each containing a space for X, Y, and Z values:

- Position
- Rotation
- Minimum
- Maximum

Position

These edit boxes allow you to set the position of the deformation region relative to the group it is applied to. This setting may be adjusted by any of three methods:

- Direct entering of numeric values
- Direct manipulation in the world view windows
- By the up and down buttons located to the right of each value.



Figure 250 — The Position boxes

This setting is animatable over time. Each of the three coordinates is available, so the deformation region may be anywhere in world space. The default 0,0,0 positions the deformation region at the center point of the group it is applied to. All measurements are in ElectricImage world units, and are measured from the center point of the group being deformed.

Animating the Position of a Deformation Region

The ability to animate the position of the region is useful if you need a deformation to shift from one part of the group to another. Lets make our hot dog pass through a “distortion field.”

1. In the Region list, select the Twister region. In the Y Position box, type in a value of -10.

The Twist deformation has now shifted directly below the Hot Dog group.

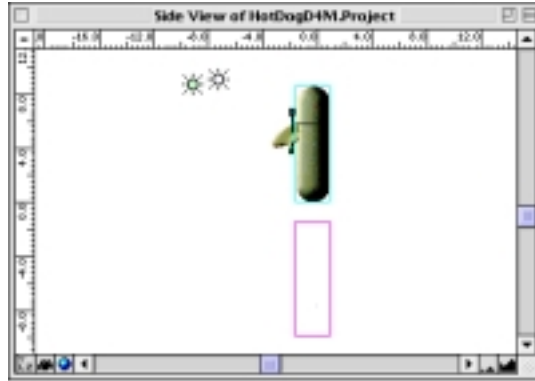


Figure 251 — The Twister region directly below the Hot Dog

2. Now we will create our “Distortion Field. Give the Twist deformation an angle of 90° along the Y axis. This will give the Twister region a 90° twist along the Y axis.

Keep an eye on the Hot Dog as you make your change. While there is no change in the shape of the Hot Dog itself, notice that it has turned to its left.



Figure 252 — The Twister region at 90° , with the Hot Dog turned to the left

3. In the areas titled Minimum and Maximum, click and activate the check boxes next to the Y value. The Hot Dog group is now oriented correctly. (Why this worked will be explained in detail later in the chapter.)



Figure 253 — The Region section with the Y values checked

Your Side View window should look like the following:

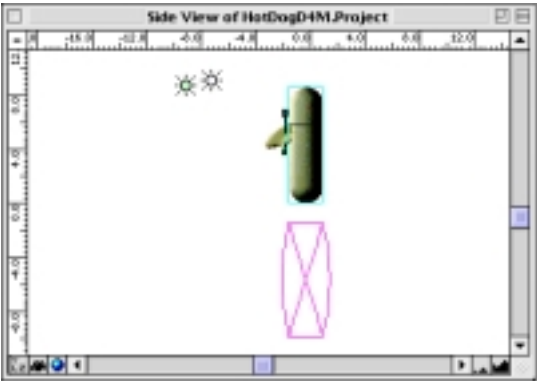


Figure 254 — The correct Side view window

4. Open your Project window, and move the time thumb to 1 second.
5. In the Deformation window, enter a value of 10 into the Y Position field for the Twister region. A keyframe is created in the Project window for the Hot Dog group.

The region is now directly above the Hot Dog group.

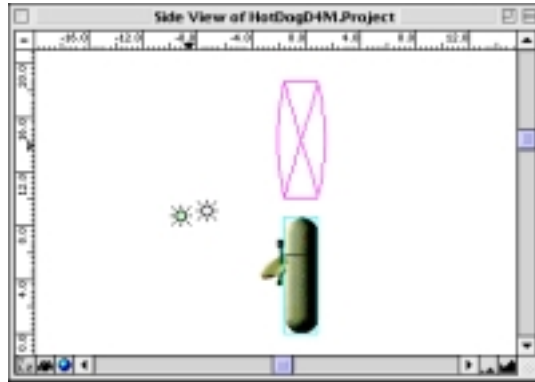


Figure 255 — The deform region above the Hot Dog Group

6. Again, it looks like nothing has happened to the Hot Dog. To see the effect of the steps we just performed, click the little camera icon in the bottom left of the Camera View window to preview the animation.

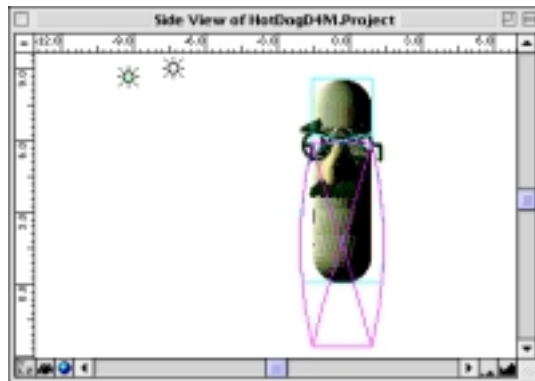


Figure 256 — The group is deformed as the region passes through it

As the deformation region changes its position up the Y axis it applies its deformation to the Hot Dog group.

Rotation



Figure 257 — The Rotation boxes

The Rotation section enables you to set the rotation value of a deformation region relative to the group to which it is applied to. This setting may be adjusted by any of three methods:

- Direct entering of numeric values
- Direct manipulation in the world view windows
- By the up and down buttons located next to each value.

Like Position, this setting is animatable over time. Each of the three rotation axes is available, so the deformation region may be rotated at any angle. All rotations are measured in degrees. Rotating the group to which a deformation region is applied does not affect these rotation values; they are only affected by direct rotation of the region itself.

Rotating a Region with the Trackball

You can rotate a region for alignment or effect.

Let's clear the previous work:

- Move the time thumb back to 0.

- Make sure that the Deformation window is open
- Drag the Twister Region to the trash to delete it

Your project should look like the illustration below:



Figure 258 — The Front View window

To rotate the region:

- Select TheBend from the Deformation list
- Press the Control key.
- A Green wireframe sphere will appear. Click and drag within the sphere to rotate

The circle, referred to as a trackball, will rotate, rotating the deformation region in turn.

Note that the Trackball only rotates upon whatever two axes are visible in the particular world view window. In the illustration “Region Trackball” below, the Front View window allows rotation to take place only upon the X and Y axes, as the Z axis is not directly visible. Also, as you rotate the Trackball, notice the X and Y values in the Rotation section update in real time.

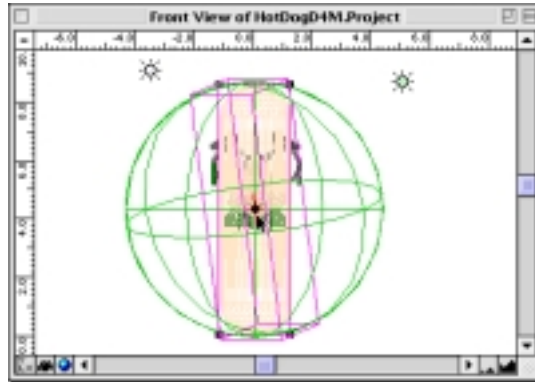


Figure 259 — Region Trackball

Animating a Region's Rotation

The following exercise will show you how to animate the rotation values of a deformation region:

- Clear Rotation Values to 0.0
- Deform the X axis of TheBend along the Y axis using a value of 45°
- Move the time thumb in the Project Window to 1 second
- In the Deformation Window, and enter the value 360 in the Y Rotation field.
- Preview your animation

Watch the Bend deformation rotate over time to produce a twirling effect, making our Hot Dog look like he's doing stretching exercises.



Figure 260 — The Hot Dog is animated

Rotation of regions also comes in handy when you want to bend an object in one direction, but when you apply the deformation it's bending from the other direction.

Let's say you wanted to bend our hot dog so that his bottom end moved instead of his top end, making him look like he's kicking instead of bowing. The following steps will demonstrate this technique to you:

- Clear Rotation Values to 0.0
- Rotate TheBend deformation region 180 degrees on the Z or X axis at time 0 (essentially flipping it upside-down)
- Deform the X axis of TheBend along the Y axis using a value of 45° (as before)
- Preview your animation

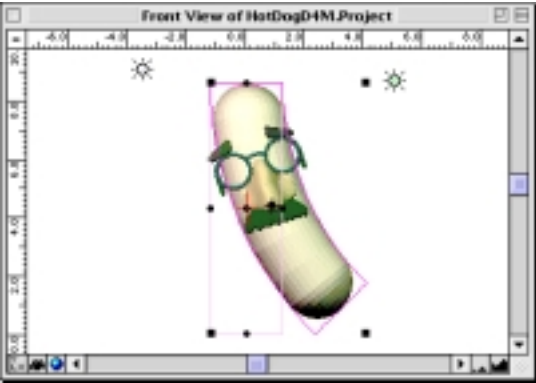


Figure 261 — The deformation region rotated 180° on the X axis

The deformation is now applied to the opposite end of the group. The bottom of the Hot Dog now flips around in a circle, like it's dancing.

Minimum & Maximum

Each region can have a limited range of effectiveness. The edit boxes in this section (along with their associated check boxes) will enable this control.



Figure 262 — The Minimum and Maximum boxes

The Minimum and Maximum boxes are for setting the size of the deformation region relative to the group they are applied to. The numbers that initially appear in these fields represent the extents size of the group the region is applied to. These setting may be adjusted by any of following methods:

- Direct entering of numeric values
- By the up and down buttons located next to each value.
- Direct manipulation of the Boundary Knobs of the deformation region in the world view windows.

Boundary Knobs

The Boundary Knobs are the little black dots (circles) in the middle of each side of the deform region. In order to see them in the World View windows, Show Ghost Region must be checked and a Deformation Region must be selected in the Deformation window.



Figure 263 — The Boundary Knobs displayed

Notice the little black dots on the left, right, top, and bottom of the Deformation Region. These are the boundary knobs.

Using the Boundary Knobs

To adjust the size of the deformation region using the Boundary Knobs, click and drag their dots interactively in one of the World View windows. This will adjust the size of the deformation region and will determine exactly where the region will deform the group.

By checking the check boxes next to these fields, you can limit the effect a deformation region has to only the polygons contained within the region.

If you like, refer back to the exercise on Animating the Position of a Deformation Region. Remember when we put the 90° rotation on the deform region and the Hot Dog group rotated 90° to the left, even though it wasn't actually within the deform region? When we enabled the checkboxes next to the Y Minimum and Y Maximum fields, we limited the effect that the Deformation Region had on the geometry to the values contained in the checkboxes. In this instance, these values represented the Y extents of the Hot Dog group. As such, the deformation did not take place until the deform region actually entered the space occupied by the extents of the group.

Adjusting the Minimum and Maximum

The following exercise will demonstrate further the use of the Minimum and Maximum values.

- Activate the ghost region
- Set all region position and rotation values to 0.0
- Deform TheBend with an X axis Angle value of 0°, along Y.
- Enter the value -1.4 in all the Minimum boxes and 1.9 in all the Maximum boxes

The region box changes size to reflect the new values entered.

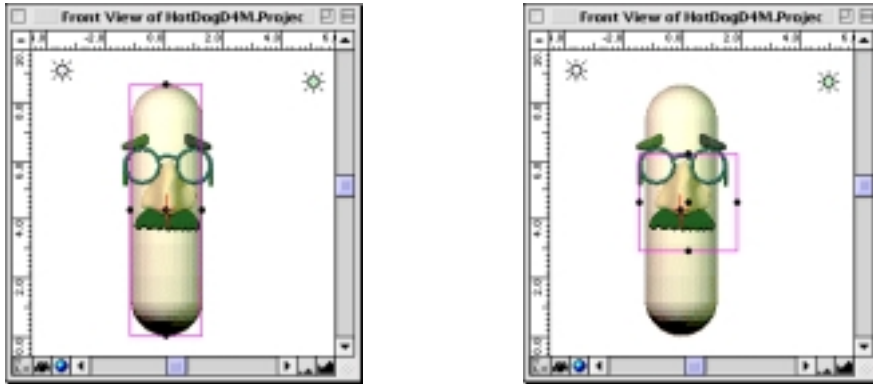


Figure 264 — Before and After the Minimum and Maximum values are applied

Bend the group to see the effects of limiting the effective range of the region:

- Select Bend in The Bend Region
- Enter an Angle value of 90°

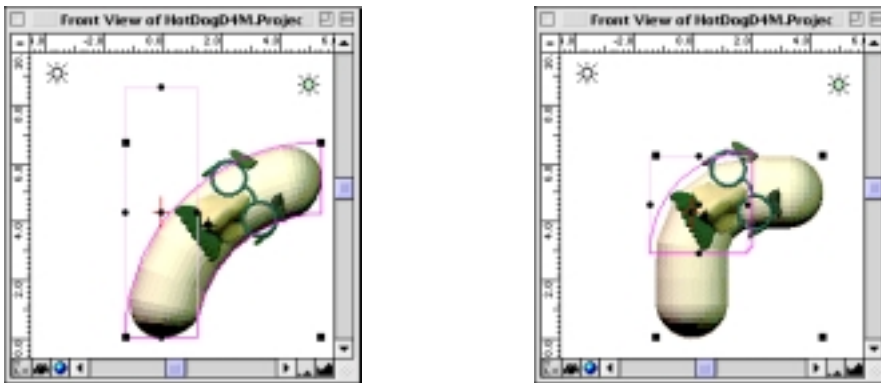


Figure 265 — The 90° bend with the full region and the newly defined region

See how the Hot Dog now has a tighter bend with a smaller arc? Before we were calculating the bend along the whole length of the hot dog; now the bend only occurs within the area defined by the region.

Deformations — Using Deformations

Let's change the height of the Region along the Y axis:

- Select the top knob of the region
- Drag it upwards

The arc of the bend will change as you drag it. The deformation itself is still 90, but the range of the bend is expanding along the Y axis as the region itself expands along the Y axis.



Figure 266 — The 90° bend expands as the Y deform area increases

Let's see what happens when we reset the limits on the region:

- Set your Y Maximum back to 1.9
- Enable the check boxes next to Y Minimum and Y Maximum.



Figure 267 — The 90° bend with Y Minimum and Maximum off and on

The hot dog is standing straight up except that the area directly within the bend region is all bent out of shape. What the check boxes did was tell the program not to include any polygons outside of the box to receive the effects of the bend. While this doesn't look so great in this example, you can easily see the difference that the Minimum and Maximum checkboxes make.

This feature is very useful if you need to have something deform in only in one part of a group while not affecting anything else in the group. This is extremely helpful for keeping different deformation regions from interfering with each other.

Types of Deformations

There are 12 different types of deformations in ElectricImage. They are:

- Scale
- Shear
- Twist

- Taper
- Bend
- Bulge
- Linear Wave
- Circular Wave
- Stretch
- Bezier
- Bezier II
- Bones

Below you will find a description of each type of deformation and an example illustrating its use. To duplicate these examples make your Deform Window settings the same as those provided in the example, creating and deleting Deformation Regions as necessary.

Scale

This type of deformation affects the scale of the group. The amount of scaling applied is measure in percentage. You do not need to determine what axis the deform is along in the Along Axis area since Scale affects all axes selected in the Deform Axis check boxes. To designate the axis or axes along which the Scale will occur, click the appropriate check box in the Deform Axis area.

There are no options available for the Scale deformation type.

Below is an example of a scale deformation applied to the X and Z axes of the hot dog and limited with the Minimum and Maximum settings.

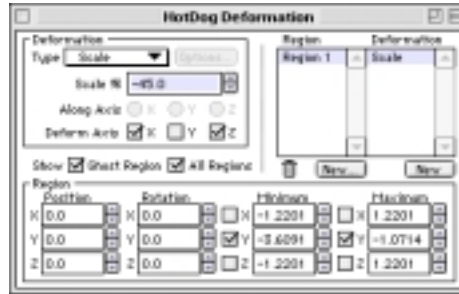


Figure 268 — The Scale deformation

Shear

This deformation will Shear (or offset) a group along an the axis defined in the Deform Axis check boxes. You may choose to shear a group along any axis by selecting that axis in the Along Axis area.

Shearing can best be described as slanting an object in a particular direction. This slanting is more defined and uniform than the Bend deformation, resulting in a harsher effect than bending gives.

There are no options for the Shear deformation that can be accessed via the Options button.

Here is an example of a Shear deformation applied to the Hot Dog.



Figure 269 — The Shear deformation set to 30°

Twist

The Twist deformation allows, as its name would suggest, for the twisting of a group. Twisting can best be defined as rotation along a defined axis where one end of the deformation region rotates clockwise and the opposite end rotates counterclockwise. The amount of deformation is determined by the degree value in the Angle box.

There are no option available for twist deformations.

Twists are generally set up to affect both axes that are not used to calculate the deformation. For example, if you calculate a twist along the Y axis, it can be used to deform either the X, the Z or both the X & Z axes. Experiment with setting Deform Axis to either one or the other remaining axes of a deformation to see the varying possible results.

Note: Since our Hot Dog group is essentially a long, skinny, Y-oriented object, we will use another object to better illustrate the Twist deformation. Simply turn off visibility for the Hot Dog group and enable visibility for the Box group.

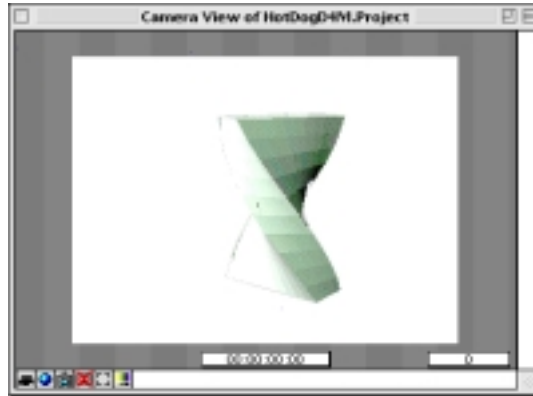


Figure 270 — The Twist deformation

Taper

The Taper deformation allows a group to be tapered. Tapering can be described as reducing or increasing the dimensions of an object on one end of the deformation region. This dimension change can occur along one or two axes. The amount of tapering is determined by the value in the Percentage field.

If the value in the Percentage field is -100%, the group will Taper to a flat edge along whichever Deform Axis is not selected. The group will taper to a point if the Deform Axis check boxes indicate that two axes are selected.

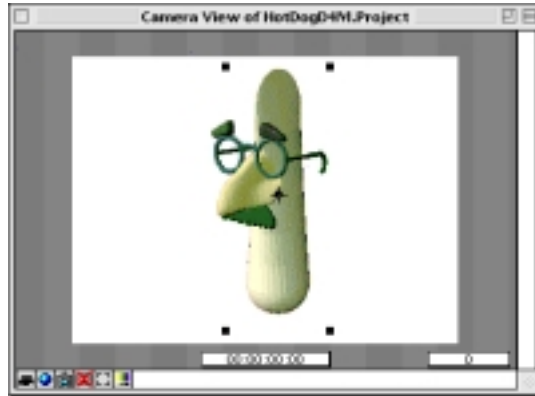


Figure 271 — -100% X axis Taper deformation



Figure 272 — -100% X and Y axis Taper deformation

If the value in the Percentage field is 100%, the group will double in size on the end of the deformation region effected.



Figure 273 — 100% X and Y axis Taper deformation

Taper Options

The Taper deformation has a Fillet Taper option, which is accessible through the Options button in the Group Deformation window. The Fillet Taper option may be applied to either the beginning, the end or both ends of the region.



Figure 274 — The Taper options window

Filleting a taper causes a smooth transition between the taper deformation and the unaffected polygons. This can be seen if the deformation region is reduced to be smaller than the size of the group as a whole. Without Fillet Taper enabled, the edges of the deformation region (where the deformation begins to effect the group,) will appear to have hard, clean edge. With Fillet Taper enabled this edge is rounded and has a softer transition from the area not deformed into the area being deformed.



Figure 275 — Front view of a Taper with no Fillet options selected

Note the hard edges at the boundaries of the taper region. If this is objectionable, activating the “At Beginning” option can remedy this.



Figure 276 — Front view of a Taper with beginning Fillet options selected

At Beginning causes the deformation to be blended into the surrounding polygons, changing the shape dramatically.



Figure 277 — Front view of a Taper with beginning and ending Fillet options selected

With both the At Beginning and At End options selected, we see a smooth transition into the deformation at both ends.

Bend

The bend deformation is used to bend a group. The bend occurs along the axis set in the Along Axis check boxes and deforms in the direction as determined in the Deform Axis check boxes. The deformation amount corresponds with the value in the Angle field.

The bend deformation has a Bend from Center option available via the Options button.



Figure 278 — The Bend Options dialog

Deformations — Bend

Selecting this option changes the center radii of the bend arc from the edge of the deformation group and places it at the midpoint of the deformation region.

If you apply the Bend from Center option to a Y axis bend deformation, both ends of the hot dog will bend away from center, rather than having one end “locked down” while the other bends away.

Front View of a 90 degree Bend deformation with Bend from Center disabled.

Note how only one end bends away from the group’s center line...

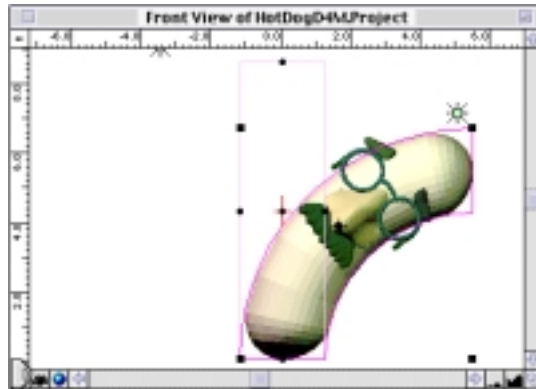


Figure 279 — Bend from Center Disabled (default setting)

Front View of a 90 degree Bend deformation with Bend from Center enabled. Note how both ends bend away from the group’s center line...



Figure 280 — Bend from Center Enabled

If a Bend deformation is used in tandem with other types of deformations, and these different deformation regions overlap, it is best to place the bend deformation region last in the Region list, so as to apply the Bend deformation to the other deformations in the list. this will help to avoid some unwanted or unpredictable results that may occur if vertices that are to be deformed by another region if they are bent first.

Bulge

The bulge deformation allows a group to have it's dimensions increased or decreased on two axes from the center of the Bulge deformation region. The amount of dimension deformation is correspondent to the Bulge% value. A positive Bulge% value will expand the groups dimensions away from the center of the bulge region, whereas a negative Bulge% value will draw the dimensions of the group inward toward the center of the bulge region.

If you set the Bulge% value to 75, our hot dog will look like a fat knockwurst. If you set the Bulge% value to -75, the hot dog will look more like a smoothly rounded hourglass. Bulge

Deformations — Bulge

deformation with a Bulge% value of 75. Notice how the vertices are “pushed out” from the center of the region.

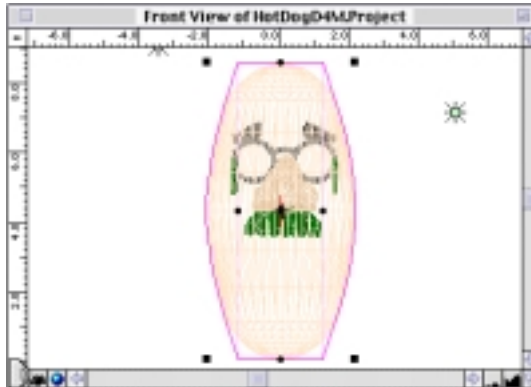


Figure 281 — Bulge Out 75%

Bulge deformation with a Bulge% value of -75. See how the vertices are “pulled in” toward the center of the region.

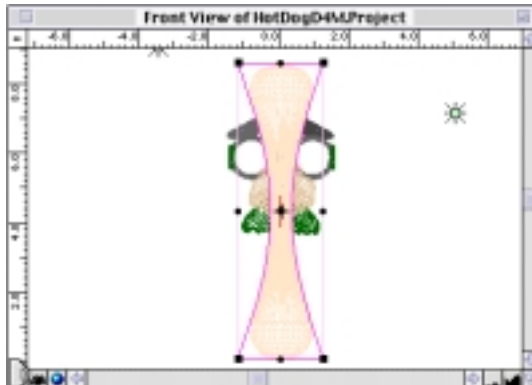


Figure 282 — Bulge in, -75%

The bulge deformation has a Filleted Bulge option available via the Options button. Similar to the Fillet Taper, the Filleted Bulge allows the edges of the deformation region to be made rounded, rather than the default hard edge when this option is disabled. Unlike the Fillet Taper, however, the Filleted Bulge has no setting for filleting the beginning or end of the region. this is because the Bulge deformation has no beginning nor end, but effects the group from the center of the region.

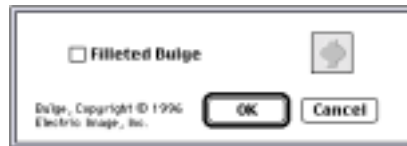


Figure 283 — Bulge Option Dialog

A Bulge region with Filleted Bulge option enabled. Note how the deformation eases in and is rounded.

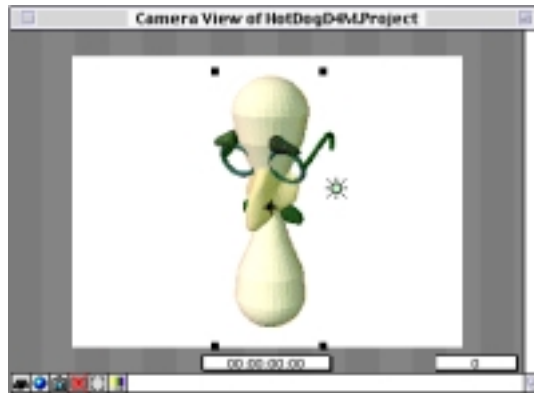


Figure 284 — Filleted Bulge Option Enabled

Linear Wave

The Linear Wave deformation deforms the vertices of the group along a sine wave that passes along the axis delineated in the Along Axis radial button settings. The crest and trough of the Linear Wave are deformed in the direction delineated in the Deform Axis check boxes. The degree of deformation corresponds to the setting in the Amplitude field. The higher the Amplitude, the more “wavy” the deformation. The lower the Amplitude, the less “wavy” the deformation. The Amplitude is a measurement of Electric Image units. If the Amplitude value is set to 1, then the linear wave crest deformation will offset the centerline of the Along Axis by 1 Electric Image unit in the direction of the Deform Axis setting. The example below is of a Linear Wave deformation calculated along the Y axis and deforming the X axis, to an amplitude value of 1. Note how the center point of the along axis (in this case, the Y axis) is offset by 1 Electric Image unit, as shown in the ruler ticks.

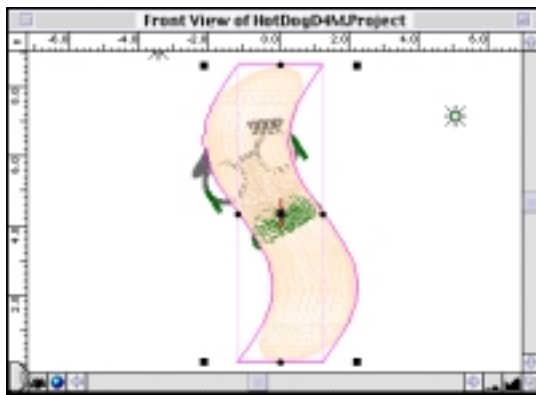


Figure 285 — Linear Wave Deformation

If you’re having difficulty understanding the Linear Wave, think of an ocean. The waves of an ocean are traveling along an axis. If the ocean is like any other body of water, the waves travel in a horizontal direction. This would mean they are Along the X axis (the horizontal axis). Now, the high part of an ocean wave is called it’s crest. The low part of a

wave is called it's trough. The waves of an ocean go up and down as they travel horizontally. This would mean that the ocean waves are deforming the water's Y axis (hence the up and down of the wave). If the waves of an ocean traveled horizontally (along the X axis) but deformed side to side (deforming the Z axis instead of the Y axis,) then the waves of the ocean would wiggle like a snake instead of going up and down. If you want higher wave crests and lower wave troughs, you need to increase the Amplitude.

The Linear Wave deformation has a Phase and a sin curve selector option available via the Options button. To choose a simple sine wave, select the radial button next to Sin. This is the default. To select a Cosine wave, select the radial button next to the 1- Cos. A cosine wave will have two crests to the sine wave's one.

The Phase option allows you to choose where along the sine wave you wish the deformation to start. Every sine wave has a phase value. The default value for the beginning of a wave is 0. As you travel along the length of the wave, the phase value increases or decreases, depending on the direction you travel. If you travel along a sine wave to the right, the phase value increases. If you travel along a sine wave to the left, the phase value decreases. Phase is the measurement of where you are along the length of the wave. If you need your Linear Wave deformation to begin it's deformation at some point other than the 0 point of the wave, you can change the value in the Phase field of the Options dialog. The line drawing of the curve will update to reflect the value you have entered. Look at the examples below to see the differences that can be achieved via a change in the Phase value. Note the curve feedback in the Options dialog, and how that variance affects the group deformation. This area is one where exploration and experimentation is best tried.

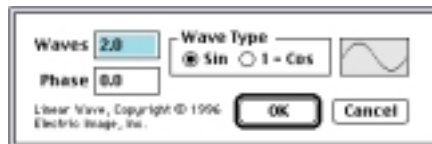


Figure 286 — Linear Wave Option Dialog

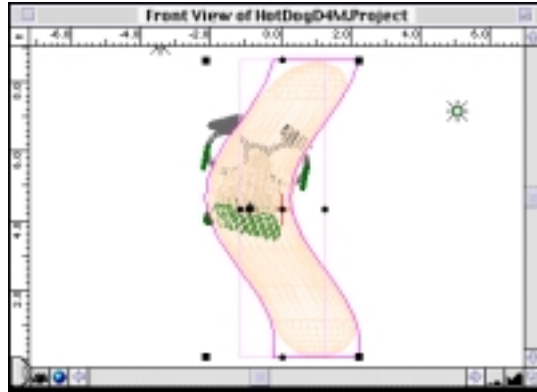


Figure 287 — Phase set to 75

By animating the Phase value over time you can achieve interesting results, and with some work can animate convincing seaweed flowing in ocean currents, by adjusting nothing more than the Phase value over time.

If you want more than the 2 waves given by the sin or cosine wave, you can adjust the Waves field value in the Options dialog to suit your tastes.

Circular Wave

This deformation type allows you to create waves or ripples similar to those found when a stone is thrown into a pond. The waves move outward from the center of the region in a circular pattern. The amplitude (e.g.: crest and trough) of the wave move along the Deform Axis, as set in the Deform Axis check boxes. The height of the wave, or intensity of amplitude, are determined by the actual height of the circular wave deformation region in the axis determined as the Along Axis. Below is an example of how the region height affects the wave height...

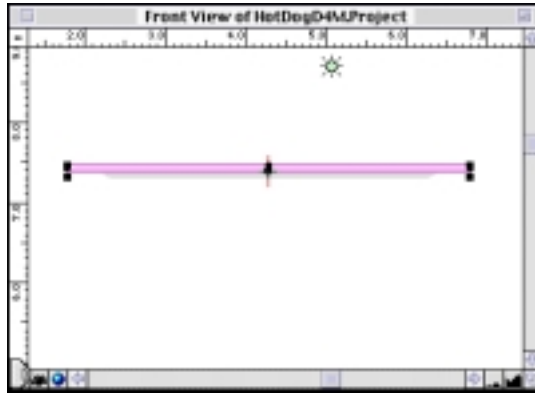


Figure 288 — Wave Height is Dependent upon Height of Deformation Region

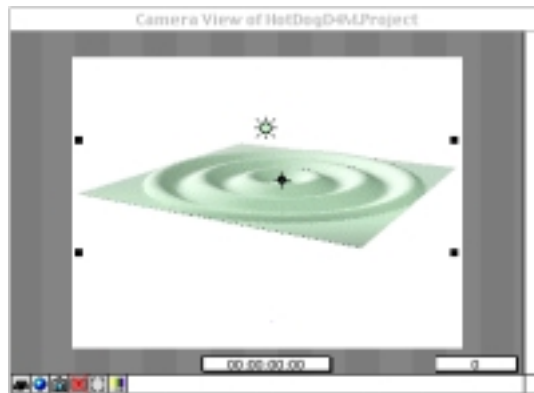


Figure 289 — Camera View with same settings as previous figure

In other words, if your Deform Axis is X, the waves will move outward horizontally. If the Deform Axis is set to Z, the same will occur, since these waves are circular and move in all directions on these two axes. If your Along Axis is Y, the waves will act like ocean waves/pond ripples and will have the appearance of having height. To adjust this height, adjust the actual height of the deformation region. To do this, show Ghost Region, grab the

boundary Knob on the top of the region and drag it either up or down to suit your desire for wave height. Here is a close up of the deformation region and the Knobs you'll need to adjust. Note the relation between wave height and the height of the deformation region....

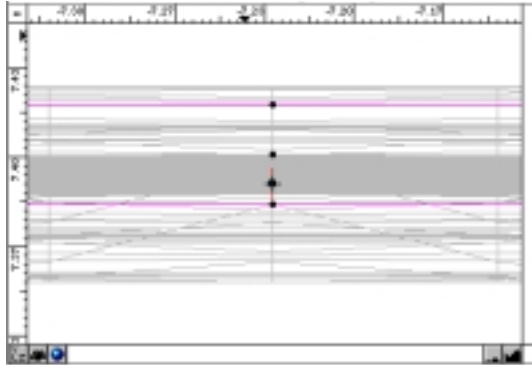


Figure 290 — Close-up of Circular Wave Region

To determine how much of the group is influenced by the circular wave's deformation region, you may change the value in the Outer Radius field. The Outer Radius is a measurement of percentage of coverage. A setting of 100 will allow 100% of the region to influence the group. A setting of 50 will only allow half of the region to influence the groups deformation. This setting may be animatable over time to produce a rippling effect. An object may start with an Outer Radius of 0, which will not allow any of the region to deform the group. By setting the Outer Radius to 100 at a later time, the impression of a stone being thrown into a still pond may be achieved, with expanding concentric waves resulting.

The circular wave deformation has a number of Rings option available via the Options button. To increase the number of waves, simply change the value in this dialog. This value may be animated over time to produce expanding rings effects.



Figure 291 — Circular Wave Options Dialog

You may also combine several Circular Wave deformation regions to achieve even more interesting wave effects. For the random wave pattern found in a pool on a breezy day, you may add a number of regions of varying size, outer diameter and wave height settings. Also, rain drops falling onto a puddle may be achieved by adding many smaller regions to the puddle group, and animating the regions outer diameter, as well as it's wave height to give the impression of small, short rippling effects common to rain drops. Combined with proper water material properties, this effect can be stunning. Here is an example of how combining several Circular Wave deformation groups can be applied...

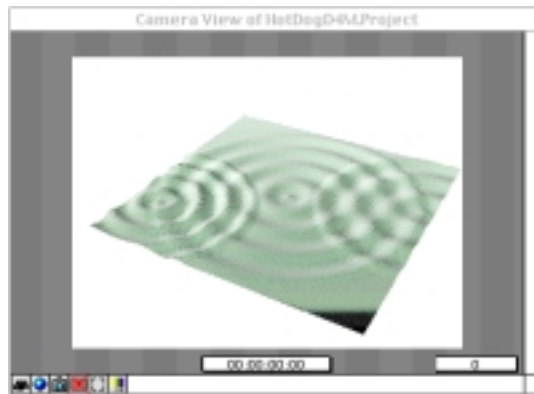


Figure 292 — Multiple Circular Wave Deforms

Stretch

The stretch deformation allows you to grab a region of vertices and pull, move, rotate or scale them in any direction while remaining attached to the remaining unselected vertices of the group outside of the stretch region. The Stretch deformation is best used when the deformation region is smaller than the entire group. If the entire group lies within the region of the Stretch deformation, nothing will appear to happen when the Stretch region is moved, rotated, etc. except that the whole group moves. To grab this section of vertices, you must “capture” them. To capture the vertices for deformation, you must access the Capture Vertexes button via the Options button. When your region of desired deformation is set, you must click the Capture Vertexes button to enable deforming the object.

Think of your group as a piece of taffy. Now, holding this taffy in your hand, grab one end of it with your fingers. Now, pull that section away from the rest of the taffy glob. It remains attached, but deformed. It is stretched. This is basically how the stretch deformation works. You define how much “taffy” (e.g.: vertices) you grab by the size of the deformation region. You close your fingers around the taffy you wish to pull by capturing the vertices (e.g.: Capture Vertexes) and you pull by moving the deformation region with your mouse, or by entering values in the position or rotation fields.

The best way to understand the Stretch deformation is to see it in action. Follow this example:

- Add a new region to the list
- Choose the Stretch Deformation type
- Activate the Ghost Region
- Use the boundary knobs to the bottom of the group only
- Choose the Options button
- Select the Capture Vertexes button (this tells the computer that you were ready to start pulling this group into or out of shape.)
- Grab the region with your mouse and pull it as you see fit.

You may also rotate the region via the Rotation values for the region as found in the Group Deformation window

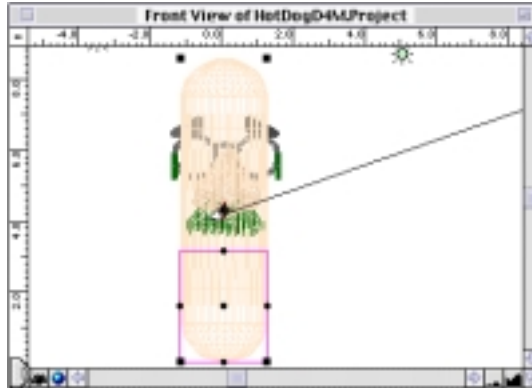


Figure 293 — Stretch Deformation

If the stretching seems too harsh or edgy, you may adjust the Blend Factor in the Options dialog. Increasing the Blend Factor reduces the harshness of the stretching. A higher Blend Factor will allow the stretch region to affect a wider area of vertices outside of the actual stretch deformation region.



Stretch with Blend Factor at 5

You may limit the stretching to affect only vertices along the X, Y or Z axes. This means that if you only enable the X axis, that no matter how hard you try to move the region on the Y axis, the region will not be allowed to move in that direction until you enable the Y axis in the Deform Axis check boxes. You'll also note that the Along Axis radial buttons are disabled. This is because the Stretch deformation doesn't calculate along an axis, but is determined by the size of the region of captured vertices, as well as the Blend Factor, regardless of axis. You may also pre-define your stretch region's position and animate it's Strength% over time to slowly deform your group without having to set keyframes for the position or rotation of the stretch region. Only adjust the Strength% over time. The result is similar to that of a magnet pulling the vertices out of shape over time.

Bezier

One of the most powerful tools for character animation within Electric Image is the Bezier deformation. A Bezier deformation allows for a very fluid deformation of the group by it's Along Axis and in the direction as determined by the Deform Axis check boxes. The main controls for the bezier deformation are its control arms and anchor points. The control arms behave in a manner very similar to bones, but have some pronounced differences from bones. Think of the control arms as puppeteering rods built inside of the group. By moving the puppeteering rods, you change the shape of the group. The control arms appear as indigo colored lines that run along the length of the Bezier region as defined in the Along Axis radial buttons. The control arms may be animated to produce the effect of bending, twisting, stretching, squashing and arcing the group as influenced by the control arm. The deformation occurs along the axis that the control arms are parallel to. To define which axis the control arms are parallel to, set this axis in the Along Axis radial buttons.

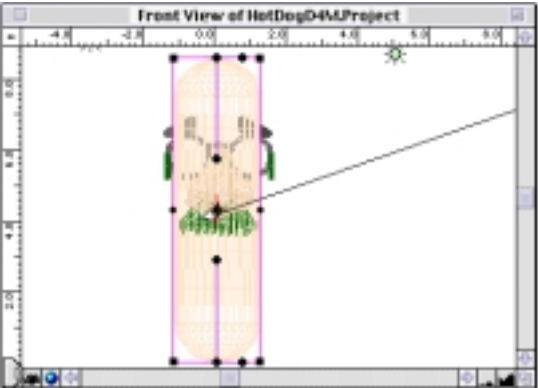


Figure 294 — Along Axis set to Y

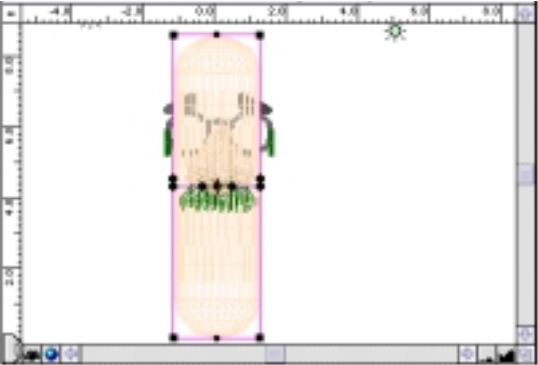


Figure 295 — Along Axis set to the X

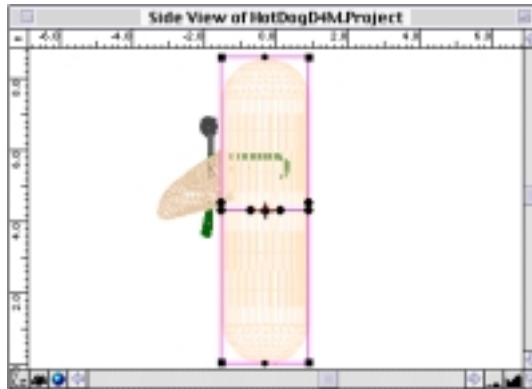


Figure 296 — Along Axis set to the Z

You will note that the boundary knobs of the Bezier region are concealed where the Control points of the control arms rest on the regions boundaries. To get at these boundary knobs, switch the Along Axis setting to a different axis to reveal the Knobs. Adjust them to your liking and then reset the Along Axis to the axis you desire to deform along.

Each control arm has three controlling points on it. The Anchor point, the Control point and the Spin point. All three points may be animated separately by grabbing them and moving them with the mouse, or they may be moved as a group by grabbing the control arm itself and moving it. Grabbing the control arm itself and moving the Anchor, Control and Spin points all at once produces a result similar to that of the Stretch deformation.

The Anchor point is the black dot at the base of a control arm that is closest to the center of the deformation region. This is the center of rotation for the entire control arm. When the control arm is moved, it seems to pivot and rotate around this point.

The Control point is the black dot at the very end of the control arm and is located at the boundary of the Bezier region. To move the control arm but not affect the Anchor point, grab and move the Control point. This will deform the vertices as influenced within the region.

The Spin point is the point attached to a small spur control arm that emerges from the Control point and is perpendicular to the Control arm. The Spin point allows you to spin the top of the Bezier region for twisting the group. The center of rotation for the Spin point is the Control point, where the center of rotation for the Control point is the Anchor point. The Anchor point has no center of rotation and cannot be rotated. The Anchor point may be moved. Moving the Anchor point effects the rest of the control arm's effects of deformation.

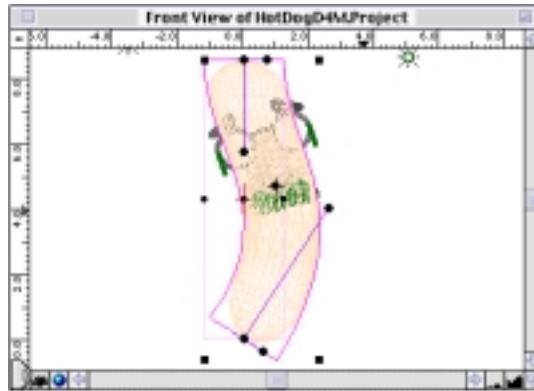


Figure 297 — Moving the Control Point

Moving the Control point only causes the group to deform along the curve produced between the two points. (Note that the curve is not actually drawn.) You can drag the control point to any position, as with any bezier spline.

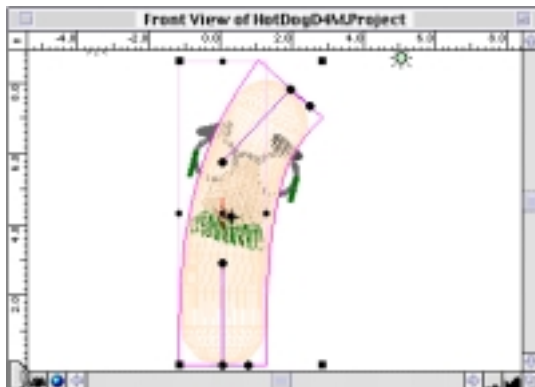


Figure 298 — Moving the Anchor Point

Moving the Anchor point is equivalent to changing the endpoints of the bezier spline. This is useful for making a character lead or “telegraph” the intended direction of travel (or perhaps for making a great Axl Rose impersonation!)

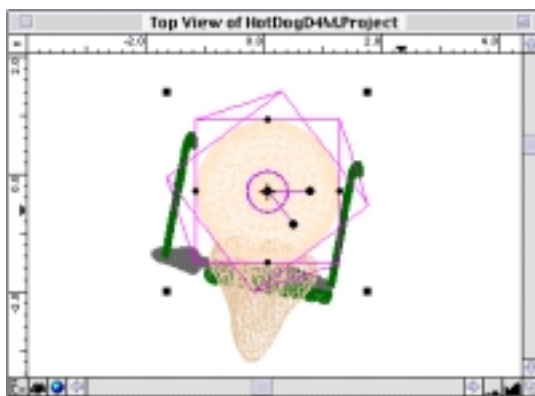


Figure 299 — Moving the Spin Point

Moving the spin point will twist the group along the spline direction, with the majority of the twist occurring at the location of the spin point.

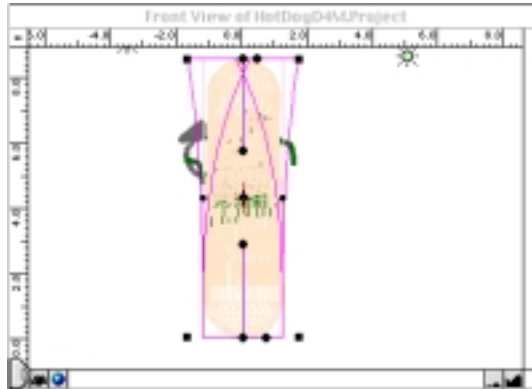


Figure 300 — Spin Rotation from the Side

The figure above shows the spin from another direction. Again, notice how the twist effect is more pronounced around the spin control point.

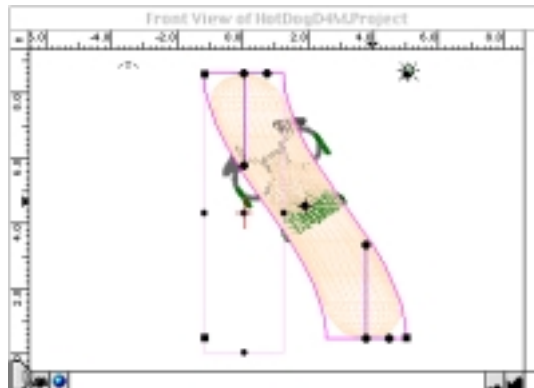


Figure 301 — Dragging the Control Arm

You can also just drag the entire control arm, which will offset the endpoint, keeping the trajectory of the control arm intact. In the example above, the shape is starting to deform back to it's original orientation.

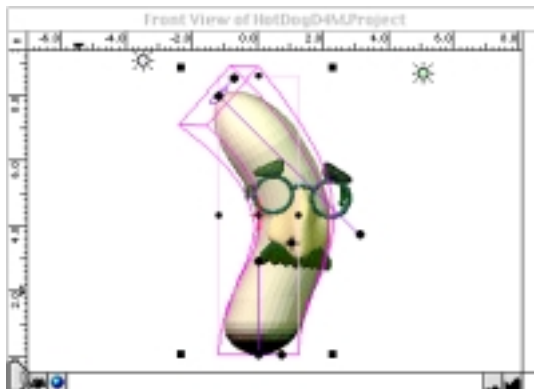


Figure 302 — Bending and Twisting a Bezier

Bezier deformations, used in tandem with each other, can produce powerfully flexible deformations. One can animate the fingers of a hand with a combination of Bezier deformation regions. One important tip to keep in mind when combining more than one Bezier region on a group is to limit the influence of the region's deformation. This is done via the check boxes next to the Maximum and Minimum fields in the lower right of the Group Deformation window.



Figure 303 — Limited Bezier Region and its effects

Like any deformation, you can have multiple bezier deformations on a group. When doing so, it is best to assign a new region, so you can change the focus area of the bezier effect, as shown in the illustration, “Limited Bezier Region and it’s effects” on page 384.

The hot dog has two bezier regions on it. You’ll note that when the lowermost Control point of the upper region is moved, it moves the whole bottom of the group. This may or may not be desirable.

You can limit the influence of that region by checking it’s Y Minimum limit box, and thus limit the influence of this region to only those vertices with a Y position value greater than the Minimum Y as set in the field.

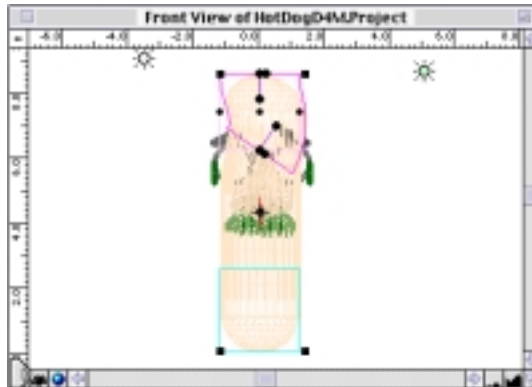


Figure 304 — Limited Region Bezier Deformations

Now the lower bezier region’s upper Control point is moved. Note the very unpleasant deformation results (illustration on page 386). This looks pretty ugly. That’s because the upper deformation region has already had it’s deforming effects applied. By deforming the lower region, we magnify, or multiply in combination that effect, so that what we see is the result of the two regions affecting the same vertices twice.



Figure 305 — Problem associated with limiting Y Minimum

This can be corrected by limiting this region's Y Maximum influence. Do this by checking the check box next to the Y Maximum field in the Group Deformation window.

Observe how the deformations Maximum Y influence is constrained to those vertices within the actual Bezier region itself in the following illustration. The undesirable kink can be removed by insuring the regions are close but not overlapping.



Figure 306 — Not Perfect, but Getting There (Min and Max limited)

If you need to have greater control over the location of your Anchor, Control or Spin points, you may obtain their location, relative to the group's object space, by clicking the Options button. In the dialog you will see fields for entering numeric values to adjust the positions of these points. This dialog is especially helpful for duplicating point positions. If you need to return an Anchor, Control or Spin point to a previously keyframed position, you can obtain that location information in this Options window for later reference. Also in the Options dialog you will note a Reset Points button. Clicking this button will reset all the Anchor, Control and Spin points to their default position relative to the deformation region. This is helpful if your deformation gets out of hand or you need to return to the default position after animating a deformation.

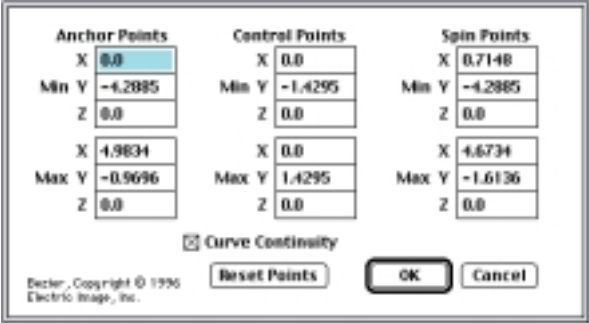


Figure 307 — Bezier Options Dialog

Also within the Options dialog you will see a check box marked Curve Continuity. This is useful for overriding the default results of the Bezier deformation. By default, when a group is deformed using a Bezier deformation, pinching is minimized. However, you may have undesired results because the continuity, or the continuing, of the curve of the group's vertices as they cross the bezier region boundaries may not be smooth. The illustration "Bezier example without continuity applied" is an indication that the Curve Continuity option for a Bezier region is necessary.

Deformations — Bezier II

The hot dog is not maintaining its volume as it deforms, violating one of the primary laws of squash and stretch, a common cartoon technique. To remedy this, activate the Curve Continuity option in the dialog.

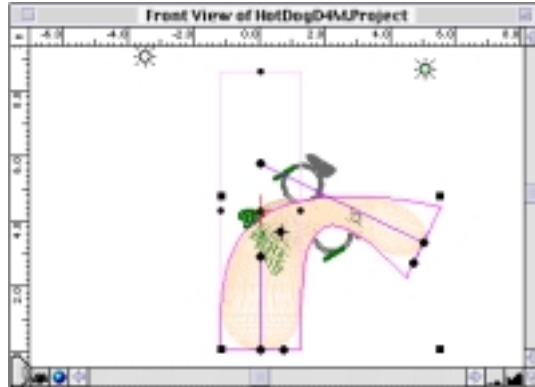


Figure 308 — Bezier example without continuity applied

Similar to the Stretch deformation, you may preset the amount of bezier deformation and simply animate its Strength% over time to give a very complex magnet effect.

Bezier II

Bezier II is a new deformation type added to Electric Image for version 2.8. This deformation type behaves in every way similar to the Bezier deformation, but allows greater flexibility in the ability to add extra control arms on the interior of the deformation region. Up to four control arms may be had with a Bezier II deformation type. The Bezier II deformation deforms exactly the way a Bezier deformation does relative to the Deform Axis and Along Axis settings.

In the following illustration, note how the control arms are arranged within the boundaries of the Bezier II region.

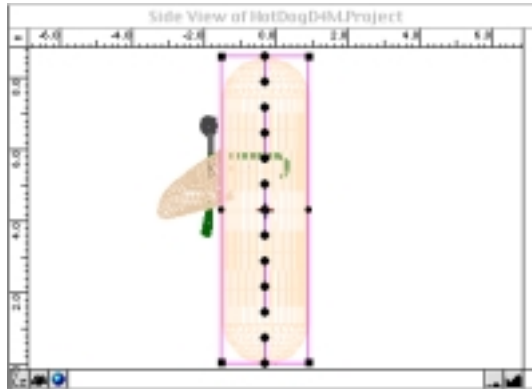


Figure 309 — Bezier II default condition

To determine the number of control arms a Bezier II deformation may have, you must access the control arm dialog via the Options button. You may also turn off the visibility of the Anchor, Control and Spin points of each of the control arms. In the Options dialog you may also select what type of curve you wish to use. By clicking the left curve type, it is similar to selecting a non-continuous curve. By selecting the right curve type it is similar to selecting a Continuous curve in bezier deformations. The text below the curve types will update to give information about the choice of curve you have made. Also, the Bezier II Options dialog has a Reset Curve button. This behaves in a similar way to the Reset Points button in the Bezier deformation options dialog. This will set all the Anchor, Control & Spin points for all control arms to their default position.



Figure 310 — Bezier II Options Dialog

Like the Bezier deformation you may move any or all of the Anchor, Control or Spin points of each control arm. Again, either by individually selecting and moving each point or by grabbing the control arm as a whole. Since we covered how the end control arms work within the section discussing the Bezier deformation, let us take a closer look at the interior control arms of the Bezier II deformation.

The interior control arms acts more as “rockers”, while the end most control arms behave like puppeteering rods similar to the way they behave in the Bezier deformation type. The interior control arms each have two Control points to their one Anchor point. This allows them to “rock” back and forth, with their center of rotation being the center Anchor point of the control arm.

Note in this illustration how this combination of “rocking” the interior control arms can produce a complex “wavy effect.”

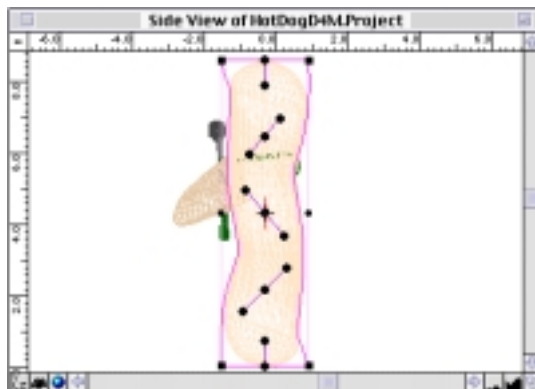


Figure 311 — Tilted Control Arms

In the following illustration, observe how you can move the Anchor and Control points for each interior control arm by dragging the Anchor points. The relation of the Control and Anchor points to one another remains the same, however the relation of the interior control arms to the group changes. This technique is very powerful for complex muscle movements and internal shape distortions commonly found in character animation.

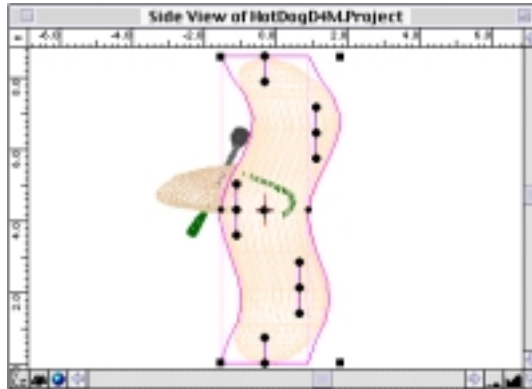


Figure 312 — Offset Control Arms

By combining moving the Anchor points and adjusting the Control points for each interior control arm, you can achieve very complex deformation effects.

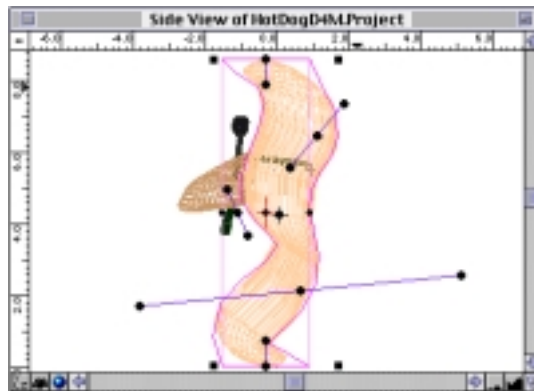


Figure 313 — Hoo, Baby, I Like it Like That!

Again, as with regular Bezier deformations, you may use a series of Bezier II deformations in tandem on a single group to achieve even more complex deformations. Remember to

Deformations — Bones

use the limit influence check boxes next to the Minimum and Maximum fields to keep these multiple regions under control. However, there comes a point of diminishing control with multiple Bezier II deformation regions.

Example of a multiple Bezier II deformation region combo. The more you add, the more difficult it becomes to get predictable results using Bezier II deformations.

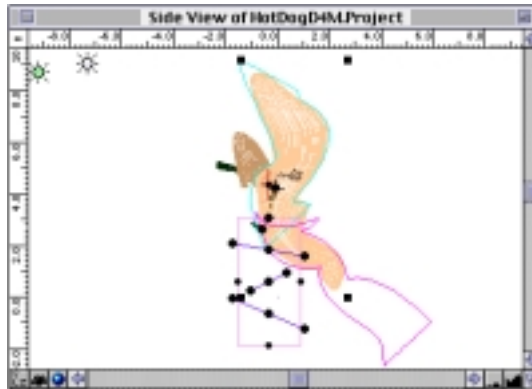


Figure 314 — Now things are getting a little out of hand

Bones

Bones are used to perform “free-form” deformations, with fewer limitations than the other deformation types. Bones can be linked together to form a deformation chain, imparting an incredible amount of control over a group. With bones, you can deform “single skin” objects such as characters or animals as if there were being moved by their own skeletal system (in fact, they are!) You can even use bones to create “morph targets” for facial expression morphing. In all, bones are quite handy.

Bones can also be a bit picky. Bones act like little magnets, pushing and pulling on groups, sometimes destroying them if used with wild abandon. Deforming a group with bones

almost always means there will be more than one bone parented to a group. That means that they will compete with each other, unless you limit their ranges of influence.

Prepping the Model

Like any other deformation, bones require a model that is properly meshed in order to provide the best results. You can use the Dicer plug-in to mesh the model if necessary.

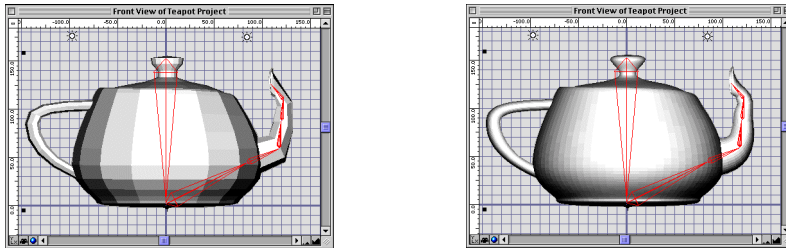


Figure 315 — Low Resolution and high Resolution Models with Bones

The Dicer plug-in will regenerate the model quite often. Since it is unlikely that you will want to change the resolution of the model over time (the reason why Dicer regenerates) it is best to save the model as a new file once you have the proper resolution.

You can use low resolution proxies to speed up the interaction process when working with bones. Just make sure that the low resolution model is volumetrically similar to the final target model. You can parent both models to a null effector, with the same cubic extent as the models, and then make the working model or final model visible.

Adding Bones

There are two ways to add bones to your project:

- From the File Menu (File>Add>Type>Bones)
- From the Object Palette (Bones Icon)

Bones are added as a chain until you stop the process by choosing *command-period*. The length of the bone is dictated by the distance between each mouse click. In effect, you can actually draw the skeleton on top of the desired model in the world views.

A typical skeleton is comprised of several link chains. The main chain would be the body, including the spine and neck. The extremities would each be a separate chain. When reproducing a bones chain, it is best to create each extremity as a separate chain, and then create the final hierarchy with the parenting tools available in the Project Window. This will enable you to maximize bone usage with inverse kinematics.

Associating Bones to a Group

In order for bones to affect the shape of a group, three steps must first be undertaken. Like other types of deformations in this chapter, bones must be attached to a deformation region. See the section “Creating Deformation Regions.” It is a good idea to create a unique deformation region for bones, to separate them from other deformations. This is necessary because bones can exist in only one region per group, and that region needs to cover the entire extent of the group in a default position.

Remember that regions are order sensitive, and you might want to have the Region containing the bones deformation be at the top of the list. Either before or after you create a deformation region for the bones chain

Before you parent a bones chain to a group, you must first set up the chain so that the linkages of each bone provide the appropriate type of constrained motion. (*See the chapter entitled “Group Linkage Window” for more information on configuring and constraining joints.*)

To associate bones with a group:

- Make sure that the previous recommendations have been followed
- Select the first bone in the chain from the project window
- Click on the Parent tool icon in the project window
- Select the group name in the project window that you want to deform with bones

Assuming that all of the steps have been followed, the bone chain is now attached to the desired group.

Moving the Bones Around

Now that you have created a bones chain, deformation region, set up the joint constraints, and parented the bones to a group, you are ready to test your work. You can use either forward or inverse kinematics to move a bone chain. Each produces a different result. (*For more information on Forward and Inverse Kinematics, see the chapter entitled, “Using Effectors.”*)

As you move the bones chain and interact with it, you will likely decide to adjust the values and parameters of the bones for the effect that you want to achieve. To do this, you must configure each bone separately through the Bone Info Window.

To access the Bone Info Window:

- Select the bone
- Double click or choose **File>Get Info...**

The Bone Info Window will appear.

Bone Info Window

The Bone Info Window contains a series of buttons and tabs for configuring the bone, and animating it. As a bone is an effector in ElectricImage, in addition to a deformation type, we will only cover the controls which are related to bones deformations in this chapter.

For an explanation of the other controls, see the chapter “Using Effectors.”

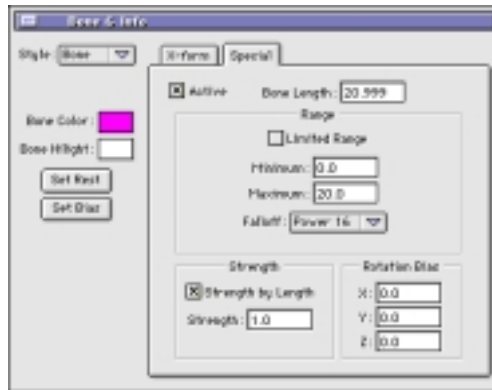


Figure 316 — Bone Info Window

This chapter will cover the controls in the two tabbed sections:

- Bones X-Form Tab
- Bones Special Tab

Bones X-Form Tab

This tab contains the transformation information for a bone. The information in this tab is equivalent for the other effector types, and is covered in detail in the Using Effector chapter.

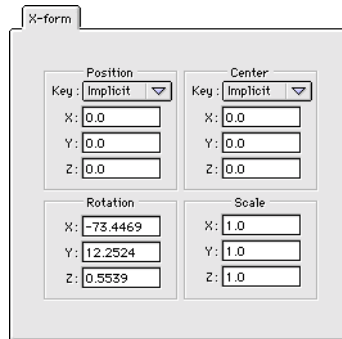


Figure 317 — Bones X-Form Tab

Bones Special Tab

This tab contains controls for adjusting and setting bones characteristics.



Figure 318 — Bones Special Tab

The tab is divided into four sections:

- General Section
- Range Section
- Rotation Bias Section
- Strength Section

General Section

This section contains the active check box, which determines whether or not the bones effects will be applied to the group, and the bone length edit box. Bone length is set at the time that you create the bone, but you are free to edit the length of the bone at any time with this control. Bone length is a factor in the strength of the bone.

Range Section

The range section contains four items which control the effective range of the bone, and how its energy will be applied to the group through the bone:

- Limited Range Check Box
- Minimum Range Edit Box
- Maximum Range Edit Box
- Fall Off Popup Menu

Limited Range Check Box

This check box activates the bone's ability to limit its influence. The numbers in the Minimum and Maximum range edit boxes are used when this feature is active. If this feature is not active, the bone's effective influence will apply throughout the deformation region for the bone, on the group to which the bone is attached.

When this option is active, the actual range of the bone will be drawn in the world view windows around the bone itself. The minimum value will not be drawn if it's value is 0.0, otherwise it will be drawn in dashed lines. The maximum value will be drawn (if it's value is not 0.0) in unbroken lines.

Minimum Range Edit Box

This edit box specifies the minimum area of effectiveness for the bone. A value of 0.0 (the default value) will begin to dissipate the energy of the bone immediately, until the maximum range value is encountered, using the method specified in the Falloff menu.

Minimum values can be greater than zero. In this instance, the strength of the effect is applied from the center of the bone until it encounters this boundary, at which point the energy will begin to fall off as specified in the Falloff menu.

If you encounter a severe amount of distortion on your model, try setting the minimum value to be larger than 0.0. Combined with the Maximum range value, you can get very precise control over the deformation area.

Maximum Range Edit Box

The edit box specifies the maximum are of influence for the bone. Any part of the group which falls outside of this area will not be directly effected by the bone. This option is valid only when the limited strength check box for the bone is active.

Falloff Menu

The falloff menu determines the energy transition from the Minimum to the Maximum range of the bone. The following methods are available:

- Ease
- Linear
- Power (of) 2
- Power (of) 4
- Power (of) 8
- Power (of) 16

Each of these methods affect the visual quality of the transition. Ease is typically the best method, and the default. You may wish to experiment with the other methods as well to suit your taste.

Rotation Bias Section

Bones have a default direction of influence, which can cause problems for certain types of data, such as motion capture data. This type of data is typically not “indexed” with any accuracy. That is to say, there is no rational frame of reference to begin mapping the

motion capture data, as it is typically stored as a series of offset values. This section enables you to “reconfigure” the bone to more closely match the first frame of data in the capture file.

The edit boxes are used to “zero out” the bone. Position the bone to the desired beginning position and click the Set Bias button to do so.

Strength Section

Bones have the strongest effect on points closest to them, or those within the bones limited range (assuming that option is active.) You may wish to add bones which counteract the effect of other bones for more precise mesh control. Typically, these bones would not be independently animated, as their intended function would be to suppress unwanted distortions from becoming pronounced.

Overlapping areas of bone influence can produce points which are under the control of more than one bone. When that occurs, the strength of each bone will have an effect as well. Sometimes this will be of use to you, such as the case mentioned in the paragraph above. At other times, it might be a hindrance. This can be avoided to a degree by limiting the bones area of influence.

As bones can be set to different strengths, the bone with the higher strength value will exert more influence over points than bones with lower values. All of the bones affecting the points will exert some influence, however. Bones with equal strengths will tend to cancel each other out if pulling in opposing directions.

The Strength by Length check box will use the length of the bone to calculate its influence over the group. The strength edit box is used to set a direct amount of strength for the bone, taking all of the bones contained within the chain into consideration for the overall effect on a group. Bones with strengths that are greater than their neighbors will exert more influence, however the neighbors will still have some “pull,” so to speak.

Tips On Using Deformations

Performance is affect by the Amount of Colors Displayed

It is a good idea to keep the bit depth settings of your monitor at 256 colors when working within ElectricImage, as it is optimized for this monitors setting.

Use Deformation Scale only if Deforming a Group

Do not scale the group or it's children via the Group Info window. Scaling groups before applying deformations is just asking for trouble, especially if your are deforming a group and it's linked children. The greater the variance from the default scale of the parent (e.g.: x1.0, y1.0, z1.0), the greater the distortion of deformed linked children. If you need to scale a parent and children group before adding a deformation, then use a Scale deformation. Make sure the Scale deformation is the first region listed in the Region list in the Group Deformation window. This will allow Electric Image to apply the Scale deformation first to the group and it's children, followed by any other deformations. One drawback to this is that if you need to Scale deform your group and children by a large amount, it becomes difficult to see the actual Scale region in the world views. The Scale region remains the size of the group before it was scaled, while as the group is scaled, it becomes larger or smaller. Note in the example below how the Ghost Region of the Scale deformation stays the same size, while the group itself, scaled by 100%, grows larger. In this example, this is fine, but try scaling a group by 1000% and you can see why you may not want this.

Turn Off inherit Deformation or Child Groups will Deform too

If you want to deform an object, but simply want it's linked children to move along with the faces, not actually be distorted themselves, then make sure the linked children have Inherit Deformation disabled in their Group Link window. This is the best setting for having hands follow a body, or in the case of our hot dog, having the glasses follow the deforming hot dog without getting all twisted up themselves.

On the Other Hand, That May Be What You Want

If you desire the children of a group to deform in a similar manner as its parent, then make sure the Inherit Deformations option is enabled in the children's Group Link window. This is most useful for eyelids that deform along the eye as they blink, or for clothes that you wish to squash and stretch with a character as they bend or move. This way the children objects will not intersect with the parent as it deforms.

Make Sure Your Models Are Meshed

Groups that don't seem to deform very well may need to have their mesh density increased. Deformations will only move polygons as a whole. Deformations cannot bend a polygon itself. So if your deformation seems "choppy" or doesn't seem to bend smoothly, try increasing the polygon density of the deforming group. You can either do this by adjusting this in the modeler, or by parenting the group to be deformed to a Dicer! object. The best way to handle parenting to a Dicer! is to add the Dicer! object (File>Add>Socket>Dicer!), to the project, then link the group to it. Then export the Dicer! object with the group linked to it as a fact. Re-import the Dicer! object into the project. Discard the linked group and rename the Dicer! in the Project window to the name of the group. What this does is forces Electric Image to recognize the Dicer! group as having more polygons. This is helpful when it comes time to render because at render time all Dicer! objects need to be recalculated for each frame. But a high density mesh is just read like any other model.

Rotations Can Get Tricky

If you need a group to rotate, but don't want the deformation to rotate with it, then counter rotate the deformation. Look at the SewerSnake.Project on the Electric Image CD-ROM. Note how the bend deformation region doesn't go twirling around at the bottom of the sewer snake as it rotates? This is because the rotation of the sewer snake is offset by a similar counter rotation of the deformation region. This gives the appearance of the deformation region not moving, when in fact it is actually rotating -1 degree for every degree of rotation of the group it deforms.

Camera View of SewerSnake.Project illustrating counter rotation of deformation regions. The head of the sewer snake rotates along with the other parts of the sewer snake as it rotates on its Y axis.



Figure 319 — Counter Rotation of Regions will Compensate Strange Results

Multiple Groups can give More Control

You can use a combination of groups to achieve even more complex animated deformation effects by applying the deformation of one group to another as it passes through the first group. Look at the SewerSnake-2.Project on the Electric Image CD-ROM. The parent Standard Shape, a cylinder, has a 90 degree Bend deformation applied to it. The child, the sewer snake, has Inherit Deformation enabled in its Group Link window. As the sewer snake is animated to intersect with the parent cylinder, it inherits the 90 degree bend that its parent has. This technique is very useful for showing complex organic mechanisms in action.

Camera View of SewerSnake-2.Project illustrating inherited deformations to achieve complex animated deformation effects.

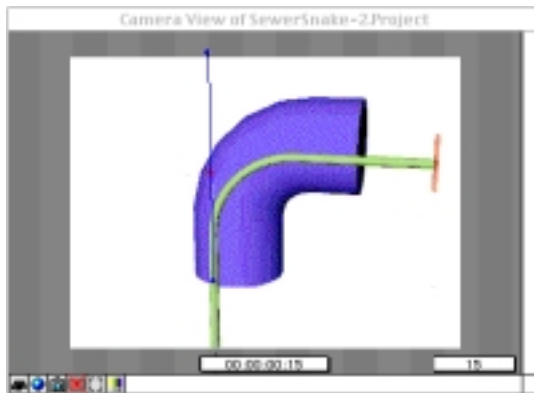


Figure 320 — Child Group Passes through Parent Region

Facial Animation

Introduction to the Morph Window

One of the most powerful features for character animation is morphing. There are effectively two types of morphing techniques — simple target morphing and weighted target morphing. ElectricImage 2.8 offers the weighted target method, as it is superior for facial animation. *For simple target morphing, try the shareware Keymorph plug-in.* This chapter will concentrate on using the Morph Window for Facial Animation.

Morphing creates in-between models from a source model and one or more target models. The source model is typically a “neutral” version of the model, and the target models are versions of the model in various poses or expressions. In simple target morphing, the models may not even need to depict the same object. A plate could morph into an apple, for example.

Morphing requires that models contain the same number of points and polygons, and that they are stored in the same order. For example, the polygons which make up a nose for the source model must directly map to the polygons which make up the nose in the target model. If these polygons do not correspond, very strange results will occur.

The Morph Window is just one part of the character animation equation. In addition, bones, effectors, and inverse kinematics round out the tools that are typically used to create great character animation.

Creating Models for Morphing

It is best to start with the source model, and use it to create your target poses. There are a variety of ways to create both the source and target models, depending upon the model-

ing software that you choose to use. You can even use the bones feature in ElectricImage to create target models from your source model.

To create the new poses or expressions that you need, you drag the points of the polygons to create the new shape. This can be a tedious and laborious process, but when done well, the results are worth every second. 3D author George Maestri has written a very thorough treatise on character animation, which includes a variety of illustrations that are typically used for facial morphing. Published by New Riders, it's called, "Digital Character Animation," and it's ISBN number is 1-56205-559-3. It retails for approximately \$55.00 — not cheap, but it will save you an incredible amount of time and effort!

Using the Morph Window in ElectricImage

Once you have created the necessary target models, its then time to load the models into ElectricImage so that they can be morphed. Morph model targets are not added into an ElectricImage project as other models are. Instead, they are added through the Morph tool. All models in the project, whether or not they are used for morphing, are listed in the project window, above the group list (in the default project window display). Let's load a model and have a look around the Morph Window.

To add a morph source model into ElectricImage:

- Add the source or anchor model to the project as a normal object file .
- Be sure that the animate checkbox (see the Project Window chapter) is on for both the model and the group.
- Select the source model.
- Click on the Morph button in the Project Window.

The following window will appear.



Figure 321 — Morph Window with targets

The name of the source model will appear in the Morph Anchor section, to the top left. The model that will be morphed is drawn in the view area to the right of the window. The Morph Window is divided into sections:

- Morph Anchor
- Target Match Popup Menu
- Reload Target Data Button
- Morph Group
- Morph Target
- Keyframe/Timeline Slider
- Viewing Area

Morph Anchor Section

The morph anchor is the base or source model. The morphing engine will actually use this model to create all of the poses and expressions specified by you in the Morph Window. The name of the anchor file is listed here.

Target Match Popup Menu

The target match popup menu tells the morph engine how to treat the morph target groups. There are five menu options to choose from, depending upon the desired treatment of the targets.

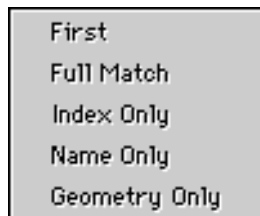


Figure 322 — Target Match Popup Menu

First

This option will use the first group in the target model as the morphing target. If you only have single groups in your morph models, use this option.

Full Match

This is the default option. Group names, number of coordinates and group index order must all match in order for this option to have expected results. Properly constructed morph targets should conform to this recommendation.

Index Only

Group order must match in order for the morphing to work properly with this option selected. In other words, given a group named “foo” in both the source and target models, each occurrence of group “foo” in the target models must match the order in which group “foo” occurs in the source (anchor) model. No other restrictions are active with this option selected.

Name Only

This option morph only across group names contained within the source (anchor) model. All other groups will be ignored.

Geometry Only

This option ignores group names, or group order, and addresses each polygon vertex in the order in which it is stored within the model file. In this case, each vertex in the source model must be in the same order in the target models. This should be the case in any event.

Reload Target Data Button

This button will allow you to replace morph targets while retaining the animation channel data for the target. This is useful for fine tuning poses, or substituting higher resolution morph targets.

Morph Group Section

Morph target models are placed within Morph groups. You can have as many morph groups as necessary. Morph groups are used to organize your morph targets into logical collections. As you can imagine, some morphing projects can get pretty complex. The morph groups will help to better manage the complexity.

For example, if you have many different models which describe mouth movement, you may wish to place all of those targets into a morph group called “mouth.”

To add a Morph Group:

- Click the Add Morph Group button.
- A dialog will appear, asking you to name the group.
- Click OK to clear the dialog.

The morph group is created, and added to the Current Morph Group popup menu. Any morph targets that you add will always be added to the morph group indicated by the Current Morph Group menu.

Morph Target Section

As mentioned previously, the morph target models are effectively the extremes of the variety of poses or expressions that you will be using in the morphing process. Morph targets are contained within morph groups for easier management of model and morph data. Morph targets are added to the current selection displayed in the Current Morph Group Menu.

To Add Morph Targets:

- In the Morph Target section, click the Add button.
- A file dialog will appear, listed model files.
- Select and add the desired target files.
- When complete, press the done button in the dialog.

The target files are now displayed in the morph target area. Along with the actual file names, slider bars, edit and check boxes are also displayed in the Morph Target Section. The default state of a target slider is the center of the slider. A morph can actually operate in the positive or negative. The checkbox to the right of the target name enables or disables the target from being used in the morph process.

In addition to the actual Morph targets, there are three buttons and one menu in the Morph Target Section:

- Add
- Del(ete)
- Add Blend To Curve Editor
- Default Morph Blend Menu

Add (Morph Targets)

This button allows you to add morph targets to the selected Morph Group.

Del(ete Morph Targets)

This button allows you to remove the selected morph target from the morph target list.

Add Blend to Curve Editor

This button will manual force an update to the animation of the selected morph target to the function curve editor for fine tuning. In addition to the manual button presented here, at the bottom of the Morph Target section is a checkbox that will automatically send data to the function curve editor, if activated.

Default Morph Blend Menu

This menu allows you to choose the interpolation method for the morph targets. The interpolation method will appear in the function curve editor as the appropriate spline type. There are four options:

- Linear (Default)
- Natural Cubic
- Hermite
- F-Curve

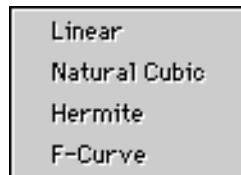


Figure 323 — Default Morph Blend Menu

Linear (Default)

This option directly blends one morph target to another. This option produces rather mechanical results.

Natural Cubic

This option uses a natural spline to interpolate one morph target to another. Splines tend to produce a more realistic result than linear interpolation. This curve type offers no modification options in the function curve editor.

Hermite

This option uses hermite splines to interpolate one morph target to another. Hermite splines offer additional Tension, Bias, and Continuity control over the spline curve interpolation. These attributes can be adjusted in the function curve editor by selecting either the T, B, or C keys and dragging the mouse with the keyframe selected in the editor.

F-Curve

This option uses function curves to interpolate one morph target to another. Function curves offer a very realistic result, and additional control in the function curve editor.

Keyframe/Timeline Slider

This slider sets the project time, so that the morphing action desired occurs at the time you specify. You can either drag the slider to the desired frame number, or manually enter the frame number in the edit section.



Figure 324 — Keyframe/Timeline Slider with Playback Controls

To the left of the frame display field are the playback controls. These controls are illustrated in the following diagram:

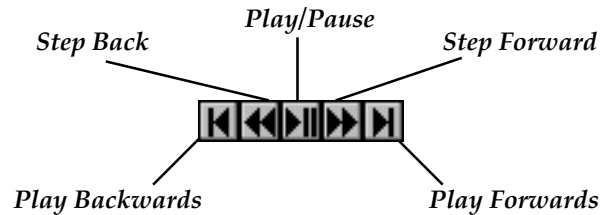


Figure 325 — Playback Controls

Play/Pause

Starts playback of the morph animation. All of the other playback controls require that Play be on in order to work.

Step Forward

Will cause the animation to step forward one frame.

Step Backward

Will cause the animation to step backward one frame.

Play Forward

Will cause the animation to play forward.

Play Backward

Will cause the animation to play backward.

View Area Section

This is where you can view the results of your morphing choreography. The default display is wireframe for speed, however, you can also display this window as phong shaded, by option clicking on the blue ball icon in the upper section of the window.

Making Morphs

We have covered the Morph Window, and the process of adding a morph source model and its targets in the previous sections in this chapter. Now we are going to concentrate on creating actual morph animations.

The Morph Window is best used as a facial morphing system (although you can animate anything you care to morph with it). Each morph target has a slider that lets you blend the target with the source. The range of each slider is negative target to positive target, with the center, 0, being null (the source would be the result if all of the sliders set to zero. Typically, your morph target poses (the models that you create for the pose positions) will be the positive end of the scroll bar (value 1.0). The negative values (value -1.0) are the opposite of the positive poses, and are derived by determining the change of the target model from the source model, and then negating that value. This gives you the benefit of not having to create minimum and maximum ranges.

All of the morph targets are weighted and averaged together to form the final object for that frame. You can change the interpolation method for the best results. See the section entitled “Default Morph Blend Menu” on page 411.

The mechanics of the morphing process requires that you do two basic things:

- Set the current frame
- Move the sliders for the desired look for that frame

The aesthetics of morphing requires far more, of course. It's one thing to set poses for sync sound dialog and the like. It's quite another to do it with style, and breathe character into your creation. George Maestri's previously cited book, “Digital Character Animation,” goes a long way in describing how to achieve character.

For our part, we offer the following: regular people tend to act pretty straight forward, and are usually not overly dramatic. Animators learned long ago that presenting such real world people makes a rather mundane performance. They learned that by exaggerating the performance somewhat, the performance becomes much more interesting. The typical purpose of character animation is to entertain, or sell by entertaining. A few extra movements, some obvious thought implied to the character perhaps, can go a long way. It can also go overboard as well, and earn the curse of being “over animated,” especially if true to life subjects are being presented.

Two of the greatest tools that you can use to your success are timing and characterization. Timing let’s you present the character effectively, making the most by doing the least. Simply stated, but not simply achieved. Some of the world’s best comedians are also the best at timing (knowing when and when not to tell a joke, give a look, and so on.) Timing for an animation is a learned art, and it takes *time* to get it right (sorry!)

Characterization is effectively the soul of the character that you are endeavoring to create. Since the characters you are animating aren’t real, it is your job to impose a sense of reality to them. In this way they can seem real, or at least real enough, so that the audience can accept them, and enjoy the performance.

Typically, this involves imparting a sense of thought to the character, giving its actions a sense of deliberateness. Making the character appear to think and ponder, as well as react and emote, are all ways of imparting a soul to it. Some performances might be pantomime, others might use heavy dialog. Some might be theatrical, others might be subtle.

In addition to the Maestri book, there is another must have reference has been written by two of the “nine old men” from Disney’s golden age: “The Illusion of Life,” By Frank Thomas and Ollie Johnston. It is available through Amazon.com, and retails for about \$60.00 (Amazon has it for \$42.00 at the time of this printing.) This book presents a remarkable history of Disney’s best animation, and is an excellent treatise on animating characters.

Timing

Typically, animation is keyframed every 8th frame. Cycles tend to happen in eight frames, gross mouth positions for dialogs on eight frames, and so on. Essentially derived at for film speeds of 24 frames per second, eight frames evenly divides a second into three even chunks. Video animation is 29.997 frames per second, but you might find that ten frames can be just a tad too long (its up to you.)

ElectricImage user Alain Duranceau, a great character animator, animates everything at 24 fps, and then uses Adobe® After Effects® to “drop frame” the movie up to video timings. This produces a very film like result (and renders even faster!)

You should put a keyframe where ever you think necessary (some animators have keyframes on almost every frame!) but the 8 frame technique is a good rule of thumb.

To set keyframes in the Morph Window:

- Move the keyframe slider into position
- adjust the morph target slider bars for the proper expression

The view area will update to the new pose. Keep adding new keyframes every 8 or so frames as needed.

To playback the animation:

- Click the Play / Pause button
- Click the button again to stop

Working with Sync Sound

One of the most powerful character animation tools is sound. The great thing about sync sound and dialog is that the timing is built in. All an animator has to do is match up lip positions (and add some emotion, of course — acting!)

Since version 2.0, ElectricImage has provided support for sync sound, via AIFF files and Quicktime files. For more information on importing sound files, please consult the ElectricImage Reference Manual.

To animate with sync sound in the Morph Window, you use the sync sound display in the Project Window. The Keyframe slider in the Morph Window will stay in sync with the overall project time slider. By positioning the Project and Morph Windows relative to each other so that you can see the full Morph Window, and the sync sound track in the Project Window, sync sound is very straight forward to accomplish. To check your animation, create a preview in ElectricImage in Quicktime format. When the quicktime file plays back, you will be able to immediately see the in sync results of your work.

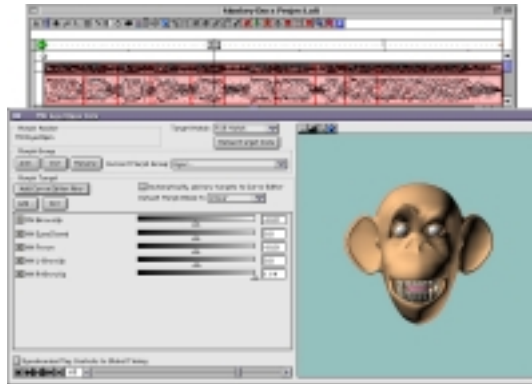


Figure 326 — Typical Sync Sound Window Setup

Sync dialog is actually fairly easy to animate to, and with a little practice the waveforms become very easy to read. As an assistant, you can use the Cue feature to break up the waveforms and annotate them from the Sound Info Window. A few minutes of work here will make sync dialog a snap. Typically, creating a separate cue for every spoken word should be enough. You can then use the cue playback feature to get a feel for the mouth positions required to sync. Then, all you do is match the mouth positions to the sound. The previous illustration shows how to organize your windows so that you can see the waveform and morph window at the same time.



Figure 327 — Sound Info Window Cue List

It's a good idea to concentrate on matching the mouth movements in one pass through, and then layer in the emotional content in additional pass throughs. If you try to animate every aspect of the performance at once, things can get real confusing. Animating in passes is actually faster in the long run, and tends to yield better work.

Working with Morph Curves in the Function Curve Editor

The Morph Window is great for creating the expressions and emotions that you want to put into your character. The function curve editor is the better tool for tweaking timings of those expressions and emotions. Why? The Function Curve Editor presents morphing as curves, showing how the inter-relationships of the morph targets are working. Subtle changes can be made in the editor that would be rather tedious to try in the Morph Window. With a little practice you might even prefer to animate your morphs in the Function

Curve Editor. It is also easy to match non-morph animation in your project with morph animation in the function curve editor.

You can also adjust timings in the project window, by dragging the keyframe diamonds to new desired locations.

To copy a morph “blend” into the function curve editor, select the morph targets that you would like to edit, and click on the Add Blend to Function Curve Editor button. The blend will now be presented as a linear curve in the editor.

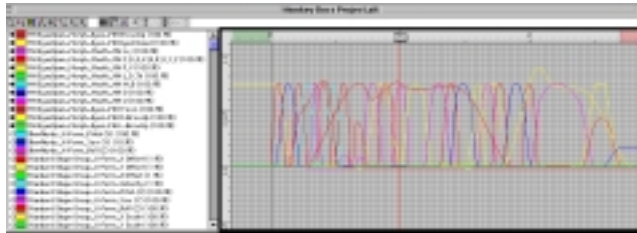


Figure 328 — Function Curve Editor with Morph Blend Curves

The morph target channel is presented to the left of the window. Select the channel, and the curve changes to white in the editor. Double click on the channel, and you can change the curve to any supported type. You can use all of the tools available in the function curve editor to tweak or enhance your animation.

For more information, see the Function Curve Editor chapter.

Morphs and Materials

When rendering morph models, only the material settings in the anchor model will be used. Material morphing is not currently supported. Therefore, you need to assign all shading attributes to the anchor model. The groups listed in the project window when

you select by model are the groups for the anchor model — the groups for the target models are not presented in the list.

You can still animate the materials used in the anchor model as expected. If you do not want to animate your materials, disable the animation flag on the material and texture channels in the project window, under the appropriate group name. This will prevent unwanted artifacts from occurring.

Colophon

Many people, both ElectricImage customers and staff, worked long and hard contributing to this supplement and the tutorial files on the ElectricImage 2.8 Installation CD. Some of their work has been edited for content and space restrictions, and some material originally scheduled for the printed supplement has instead been placed on the CD (and vice-versa.) We are grateful for all of the submissions received, as they have made this supplement a far better product than it would otherwise have been. We would also like to recognize those who helped proof the supplement, and offered constructive commentary on its content, as well as production assistance.

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Matt Ashton, Troy Benesch, Terée Carter, Lee Croft, Zax Dow, Eric Fernandes, J.J. Gifford, Dan Gregoire, James David Hattin, Andrew Heimbald, Jason Hill, Matt Hoffman, Beverly Houwing, Erich Ippen, Mike Jackson, Kory Jones, Keith Lango, Fred Lewis, Alex Lindsay, Peter Lish, Julian Love, Craig Lyn, Sang Mah, Chris Mills, Jay Roth, Todd Ruiz, Chris Sage, Joey Suing, Vince Tourangeau, Frank Vitale, Steven Walker, Scott Wells, Chris Weyers, everyone who beta tested the product (there are simply too many to mention) and the rest of the Electric Image staff.

We have endeavored to make sure that this list is accurate, however, mistakes do happen, and we deeply regret any omissions.

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