

## Introduction

### About *PiXELS*—*Character Animation Studio*

*PiXELS* is an integrated suite of professional tools for creating and animating 3D characters and visual effects. *PiXELS* gives you full control of every step in the production process:

- Easily build and edit organic models in real-time
- Create and apply textures and materials
- Position objects and lights within a scene
- Create realistic movements for all objects
- Produce broadcast quality renderings of your animations

We thank you for choosing *PiXELS* and look forward to providing you with powerful and efficient solutions for all of your creative needs. Should you require help, please contact our technical support desk at the number below. Your first year of technical support is included with the purchase of this software, extended contracts are available.

**Technical Support: 8 am–5 pm Monday–Friday (pst)**

**(619) 672-2634**

**E-Mail: [support@pixels.net](mailto:support@pixels.net)**

**URL: [www.pixels.net](http://www.pixels.net)**

### System Requirements

- PowerPC based computer running MacOS 8.0 or later
- 16 MByte available RAM (Complex scenes may require more memory)
- 30 MByte of hard disk space
- Color monitor capable of displaying at least 800 x 600 pixels (A large monitor is a definite advantage, since it helps distinguish details of the wireframe models for precision work.)

# Introduction

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## Legal Notice

The software described in this manual is furnished under license and may only be used or copied in accordance with the terms of that license.

## Installing *PiXELS*

1. Insert the *PiXELS* CD in your CD ROM drive.
2. Double click on the *PiXELS\_2.1\_Install* icon and follow the instructions.
3. There are optional files included on the *PiXELS* CD. If you have room on your hard drive, you should copy these files into your *PiXELS* folder.
  - *PiXELS* application program
  - *PiXELS* utility files
  - Shaders and texture maps
  - Sample *PiXELS* models
  - Optionally, a Read Me file for late-breaking information about *PiXELS*

To begin using *PiXELS*:

1. If you see a Read Me file, double click on the icon to open it. It describes last minute changes which may not be included in this guide.
2. Double click on the *PiXELS* application icon inside the *PiXELS* folder.

**Please Register Your Copy**

User Name :

Company Name :

Machine ID Code : 8388878-8391950

Software Key :

Call 619-672-2634 to register your software and obtain a software key. Be prepared to supply your machine ID code (shown above).  
If you prefer, you can also register online at:  
<http://www.pixels.net/registration.html>

**Register** **Not Yet**

3. The first time you use *PIXELS*, you will see a dialog box asking for your name, your company name, and a *Software Key*. The *Software Key* can be obtained by following the instructions shown in the dialog. After obtaining your *Software Key*, type in the requested information, and click **Register** to imbed it in your *PIXELS* file. The *User Name* and *Company Name* will appear on the splash screen each time you launch *PIXELS*.

4. If *PIXELS* is installed on a computer that does not have the proper system requirements (for example, insufficient memory or an unsupported processor), the application cannot be opened. If this happens, a dialog box will present an error message explaining the problem.

# Introduction

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## About this Manual

This manual explains everything you need to know to use *PiXELS*. If you are new to 3D, it is highly recommended that you read the chapter entitled *3D Basics* before beginning to learn the software.

In addition, we assume that you are familiar with the use of the mouse, as well as the Macintosh interface, icons and pull down menus. Basic skills common to all Macintosh applications like clicking, dragging, scrolling and opening files are not explained within these pages, but are covered in detail in the manuals that came with your computer.

The *Overview* section of this manual provides a summary of the *PiXELS* interface. Here you will learn the layout of the software and the locations of the tools and controls that you will use.

The *Exercises* and *Tutorials* sections contain a series of hands on projects that are specifically designed to teach you how to use the different tools, controls and features that make up *PiXELS*. If you want to get started quickly, this is the place for you.

The *Reference* section is broken into four chapters: *Views*, *Menus*, *Tools* and *Constraints*. Each chapter contains a list of all tools and features with step-by-step instructions for performing their related functions.

The chapter on *3D Basics* follows the *Reference* section. This chapter discusses general 3D topics and their implementation within *PiXELS*. Whether you're a first time user or just want to brush up on your knowledge of 3D, you can find the facts here.

A *Glossary* at the back of the manual provides definitions to terminology used in this guide.

Finally, there is an *Index* with a list of shortcut commands. This section will help you locate information contained within the manual.

## Understanding Commands

The following notations are used to describe how commands are entered into *PIXELS*:

### Menus and Menu Items

When instructed to access a menu item from a menu, the following notation is used: **Menu > Menu Item**.

For example, **File > New** means click on the “**File**” menu and select the “**New**” menu item.

When accessing a menu you may find that certain menu items have sub-menu items.

The related notation is **Menu > Menu Item > Sub-Menu Item**.

### Tools and Tool Groups

When instructed to access a tool from a tool group, the following notation is used: *Tool Group > Tool*.

For example, *Control > Move* means click on the *Control* tool group and then select the *Move* tool.

### Keyboard Commands

When instructed to hold down a key while performing an operation, the following notation is used: **Key - Operation**.

For example, **Shift - Click** means hold the shift key while clicking the mouse button.



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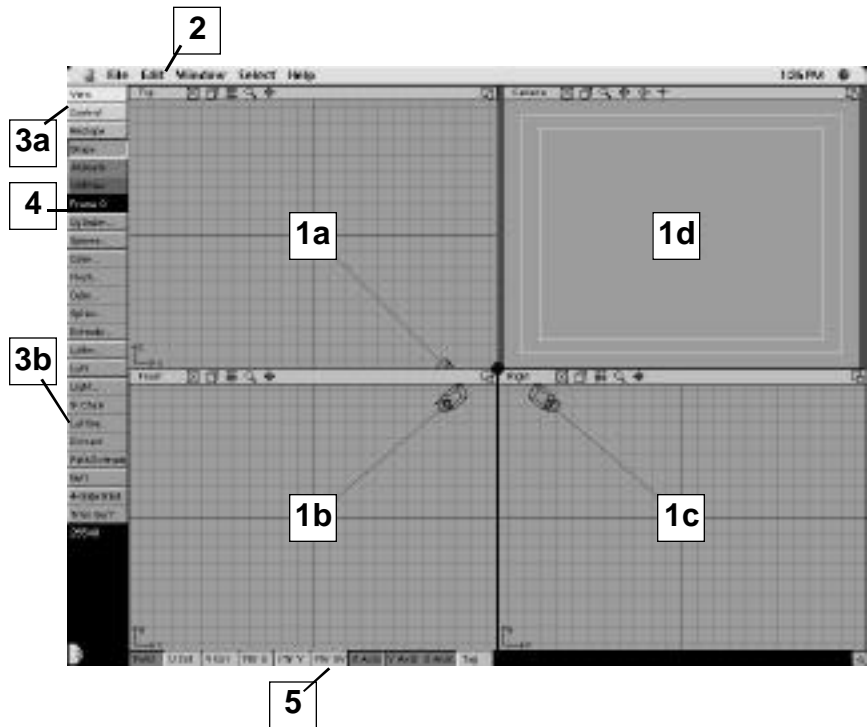
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## Overview

The *PiXELS* interface is the heart of *PiXELS—Character Animation Studio*. This display contains *four resizeable viewing panes* (1a–1d), a *menu bar* (2), a *tool palette* (3a, 3b), a *frame counter* (4) and a *constraints palette* (5). Let's look at each of these:



# PiXELS Overview

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## Viewing Panes

By default, the viewing area of the *PiXELS* display contains four viewing panes: *Top*, *Front*, *Right*, and *Camera* views. The *Top*, *Front* and *Right* views provide a 2D representation of the object(s) from the corresponding viewpoint. The *Camera* view is unique in that it represents the point of view of an object as it exists in *PiXELS*' 3D space. As you manipulate and edit an object, you can see the updates occur in each view.

## Menu Bar

At the top of the *PiXELS* interface is a menu bar which displays six menus: **File**, **Edit**, **Window**, **Select** and **Help**.

To select a menu, position the cursor over your selection and click and hold on it, a list of menu items will appear. Positioning the cursor over a menu item will highlight it, clicking on a highlighted item will activate it.

When instructed to access a menu item from a menu the following notation is used: **Menu Heading > Menu Item**.

For example, **File > New** means click on the **File** menu and select the **New** menu item.

When accessing a menu you may find that certain menu items have sub-menu items.

The related notation is **Menu > Menu Item > Sub-Menu Item**.

## Tools and Tool Groups

Along the left side of the interface screen are a column of buttons known as the *Tool Palette*. The tool palette is broken up into two distinct parts separated by a black box containing the *Frame Counter*. The buttons that are located above the frame counter are known as *Tool Groups*, the buttons below are the *Tools*.

Clicking on any of the top buttons will select the corresponding tool group. The bottom buttons will change, showing all the tools associated with the selected tool group. To select a tool, simply click on its button. The selected tool and tool group buttons will appear indented until another tool is selected. NOTE: Some tools will remain indented for only a second or two, giving you a visible feedback that the tool has done something.

When instructed to access a tool from a tool group the following notation is used: *Tool Group > Tool*. For example, *Control > Move* means click on the *Control* tool group and then select the *Move* tool.

Most tools also have keyboard shortcuts associated with them. To view these, make sure your cursor is not inside a floating palette then simply hit the space bar. The keyboard shortcuts will be displayed to the right of the tool it controls. These shortcuts can be modified by editing the “Preferences” file.

## Frame Counter

The frame counter is the black box located in the area between the tool groups and the tools. The frame counter displays the current frame number. The current frame can be changed in one of several ways:

- Click on the frame counter or hit the **Enter** key to open the **Go to Frame** dialog. Here you can enter the number of the frame that you want to go to.
- Select the *View > Time* tool (or hold down the **Control + Shift** keys) then click and drag in any view to move through time. Drag to the right to move forward in time, to the left to move back.

## Constraints

The constraint controls are located along the lower left portion of the interface screen. These controls allow you to specify how an object will be effected by any given command. To select a constraint, click on the desired button. More than one type of constraint can be applied at any given time.

## Floating Palettes

Though not a fixed element of the interface, floating palettes are available to provide valuable information about a scene. You can use floating palettes to change certain objects or scene parameters. Floating palettes can be positioned anywhere on the screen. To enter values numerically, the cursor must be within the palette while typing or hitting the **Enter** key to apply settings. If the cursor is not within the palette, the software will process your keystrokes as keyboard shortcuts.

# PiXELS Overview

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## Selecting an Object

To select an object for editing you can use *one* of the following methods:

1. Hold down the `Shift` key while clicking on any vertex on the object you want to select.
2. Hold down the `Shift` key, click, hold, and drag a rectangle around one or more vertices on the object you want to select. Release the mouse to finish the selection.
3. Use the **Select** menu.
4. Select the object from the pop-up menu located in the **Object Info** palette (**Window > Object Info**) or the **Point Info** palette (**Window > Point Info**).
5. Select the object in the **Timeline** palette (**Window > Timeline**).
6. Select the object from the schematic view. (See *Views*)

## Getting Started

If you want to learn how to use *PiXELS* through a hands on approach, then continue with the *Exercises and Tutorials* that follow this chapter. Otherwise, skip to the Reference Guide Sections: *Views*, *Menus*, *Tools* and *Constraints*, as they list all controls, tools and features with step-by-step instructions on how to use them. Either way, it is highly recommended that you eventually do all of the exercises & tutorials, as well as read the reference guide sections.

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## Exercises

The following exercises will introduce you to a variety of tools and features that make up *PiXELS—Character Animation Studio*. These exercises should be followed step-by-step in order to complete them successfully.

Exercise 1: General Introduction

Exercise 2: Organic Modeling

Exercise 3: Path Animation

Exercise 4: Inverse Kinematics

Exercise 5: Animating with the Timeline

Exercise 6: MorphMaker

Exercise 7: ShaderMaker



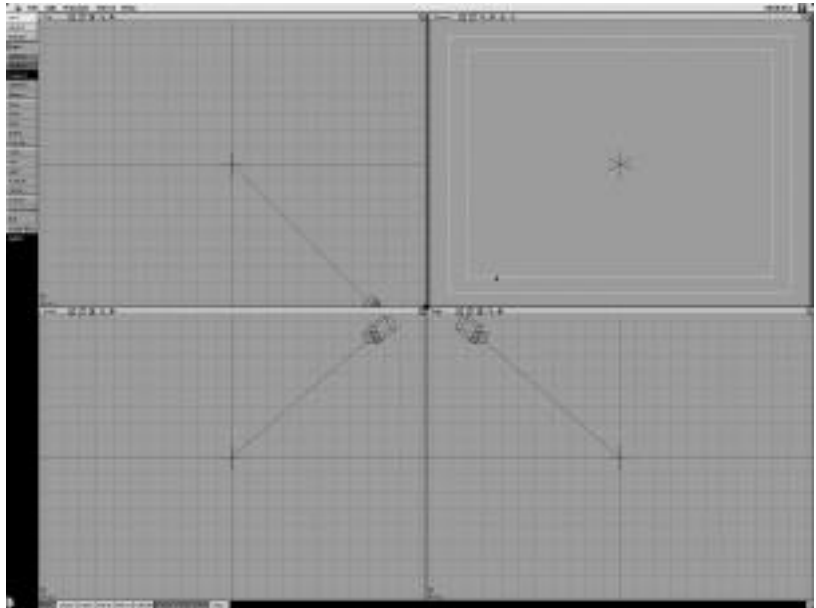


## Exercise 1

### General Introduction

#### Launch *PiXELS*

Double click on the *PiXELS* icon to launch the application. The *PiXELS* splash screen will open. After 3 seconds the *PiXELS* interface will appear.



#### Create a cube

Use the *Shape > Cube* tool to create a cube primitive. Leave all values at their defaults. Click the **OK** button to accept this cube.

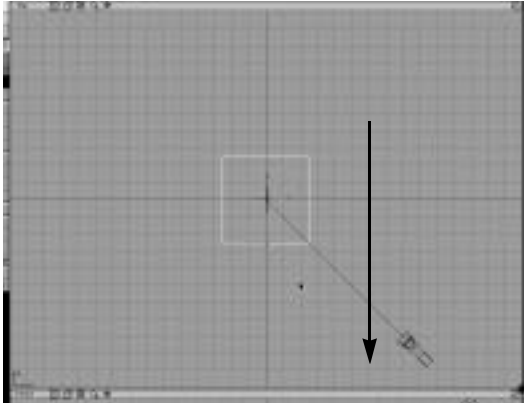


# PiXELS Exercises

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## Dolly out

Hold down the **option** key. This invokes the *View > Dolly* tool. Click in the Top view and drag the mouse down as shown. Notice how the view changes.

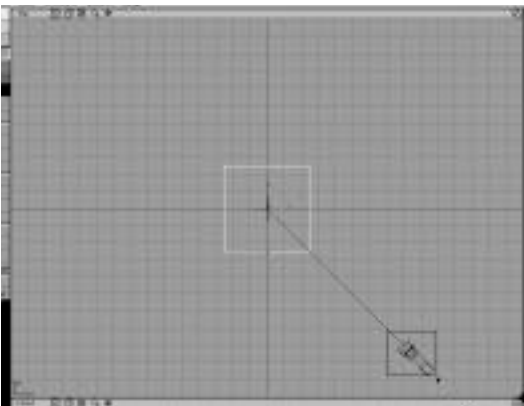


There are shortcuts for most of the view tools. They are as follows:

|       |                 |
|-------|-----------------|
| Pan   | shift           |
| Dolly | option          |
| Orbit | control         |
| Time  | control + shift |

## Select the Camera

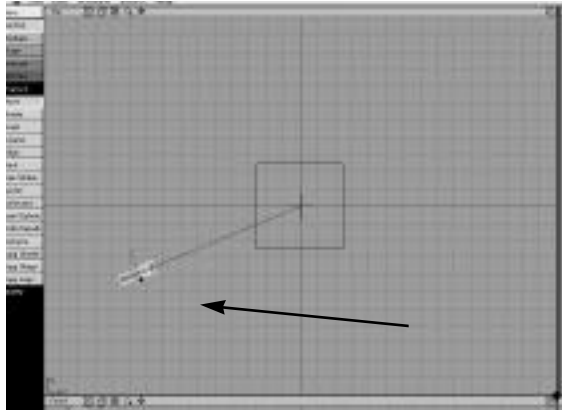
Hold down the **option** key. This invokes select mode. Click and drag a rectangle around the Camera as shown. As long as one corner of the Camera is located within this rectangle, the Camera will be selected.



NOTE: You must hold down the **Shift** key when selecting objects.

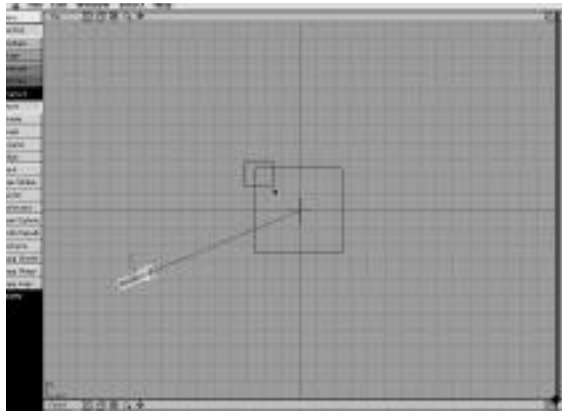
## Move the Camera

Select the *Control > Move* tool. Click and drag the mouse as shown to move the Camera. Notice how the Camera view updates.



## Select the cube

Hold down the **Shift** key. Click and drag a rectangle around one corner as shown.

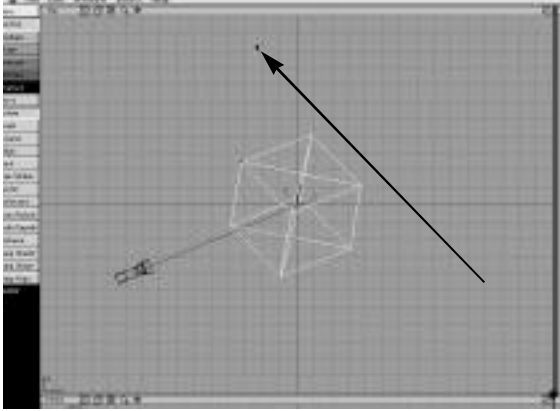


# PiXELS Exercises

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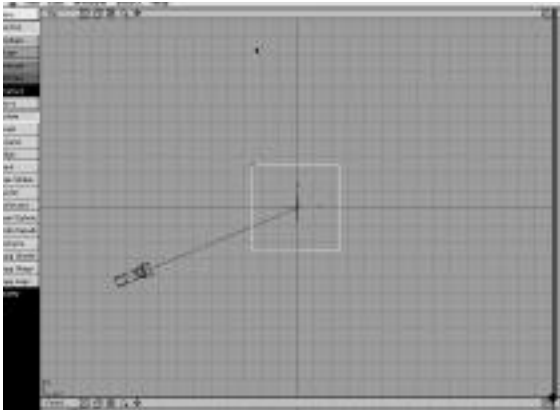
## Rotate the cube

Select the *Control > Rotate* tool. Click and drag as shown to rotate the cube. Notice how it rotates on all axes simultaneously and how difficult this is to control.



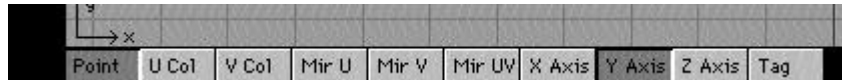
## Undo the last operation

Use the **Edit > Undo** ( **Z** ) menu item to reset the model back to the way it was before rotating.



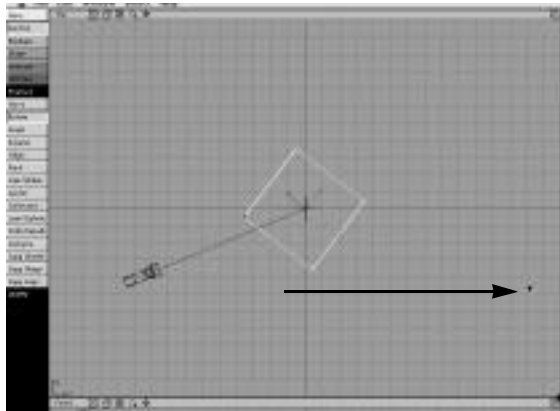
## Constrained rotation

Using the rotate tool was cumbersome and difficult to control. That's because we were trying to rotate in three dimensional space using a two dimensional pointing device (mouse). To make things more manageable, we can constrain movement to one or two axes. Click on the *X Axis* and *Z Axis* buttons at the bottom of the screen to disable them.



## Rotate the cube on its y axis

The last operation left only the y axis enabled so the *Rotate* tool should now work only on the y axis. Make sure the *Control > Rotate* tool is still the currently active tool. Click and drag as shown and notice how the cube rotates now.

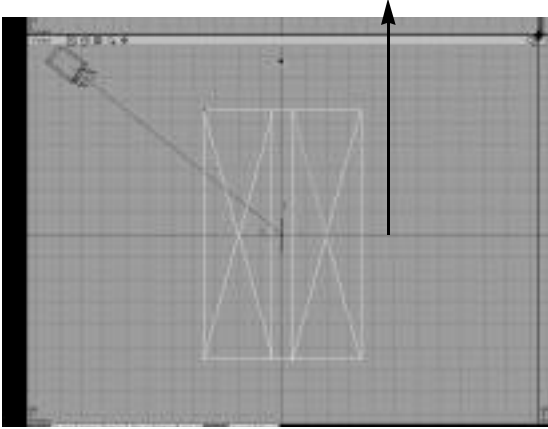


# PiXELS Exercises

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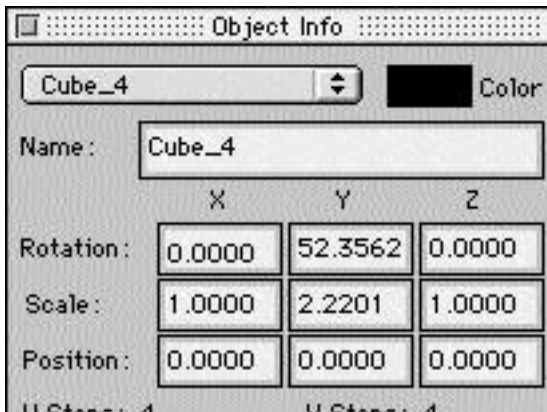
## Scale cube on its y axis

Select the *Control* > *Scale* tool. Click and drag in the Front view as shown to scale the cube. Notice how scaling also is constrained to the y axis.



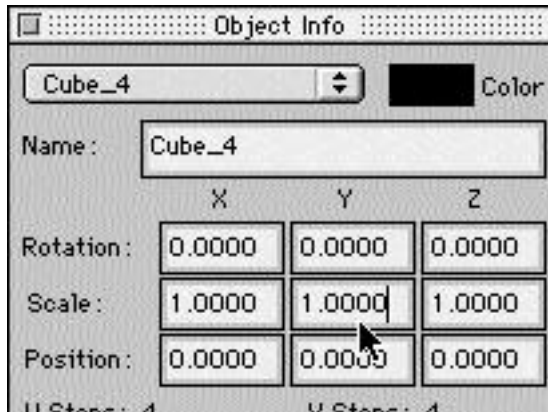
## Check Object Info dialog

Use the **Window** > **Object Info** ( **I** ) menu item to open the **Object Info** dialog. Notice the numbers in the **Rotation Y** and **Scale Y** edit fields. These are the numeric equivalents of the transformations (scale and rotation) you just manually applied to the cube. (Your numbers probably will not match those shown here.)



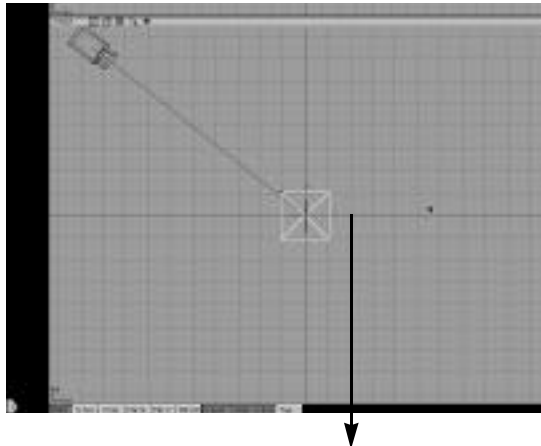
## Manually set transformation

To reset the cube back to its original size and orientation, simply change the **X, Y and Z values for the Rotation, Scale and Position** to match the settings in the diagram below. NOTE: you must keep the cursor inside this dialog while typing. If the cursor is outside this dialog, the software will think you are using keyboard shortcuts. To apply your new settings, keep the cursor inside the dialog and hit **return** or **enter**.



## Scale cube

Enable the x and z axis. Do this by clicking on the *X Axis* and *Z Axis* buttons at the bottom of the screen. Note that the *Y Axis* should still be enabled. Select the *Control > Scale* tool. To scale the cube down, click and drag in the Front view as shown.



# PiXELS Exercises

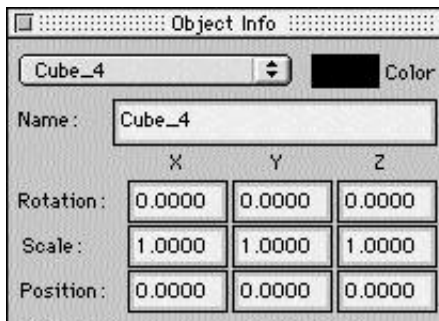
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## Park the cube

Use the *Control > Park* tool to park the cube. **Park Options** dialogue will open—click **OK** to accept defaults. Parking an object sets its scale, rotation and position values back to their defaults (1, 0, and 0 respectively) without changing the appearance of the object.

## Check the Object Info dialog

Use the menu item **Window > Object Info ( I )** to open the **Object Info** dialog. Notice that despite scaling the object down to about half its original size, the **Scale X**, **Scale Y**, and **Scale Z** values are all 1. This is the effect of parking the cube.

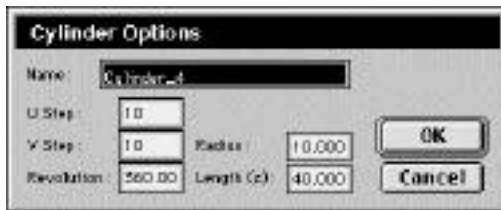


## Create a new scene

Use the **File > New ( N )** menu item to create a new scene. *PiXELS* will ask you if you want to save the current scene before closing (only one scene can be open at a time.) Click the **No** button to create a new scene without saving the current one.

## Create a cylinder

Use the *Shape > Cylinder* tool to create a cylinder. Click the **OK** button to accept the default cylinder.

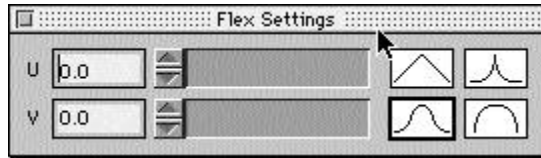




## Set the cylinder's flex values

Open the **Flex** dialog using the **Window > Flex** menu item ( **B**). Set the **U** and **V** sliders to 0.4. Sliders can be adjusted in one of three ways:

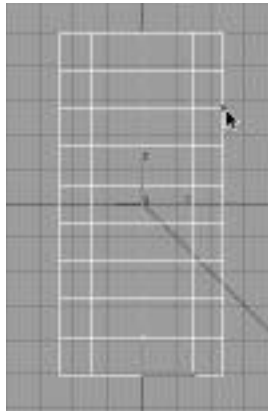
1. Click in either the up arrow or down arrow to move the slider up or down.
2. Click and drag in the slider itself.
3. Manually enter values into the fields (use tab to move through fields). To apply settings, hit the **return** or **enter** key. The cursor must be inside the dialog while typing.



## Select a Vertex

Select the *Reshape > Push/Pull* tool. Click on the vertex indicated.

NOTE: there is no need to hold down the **key**, it is only needed when selecting a new object, not a new vertex. Note also that not all tools allow you to select vertices. The *Move* tool (by default) does not affect the object at a vertex level, so while the *Move* tool is the current tool, the software doesn't select vertices.

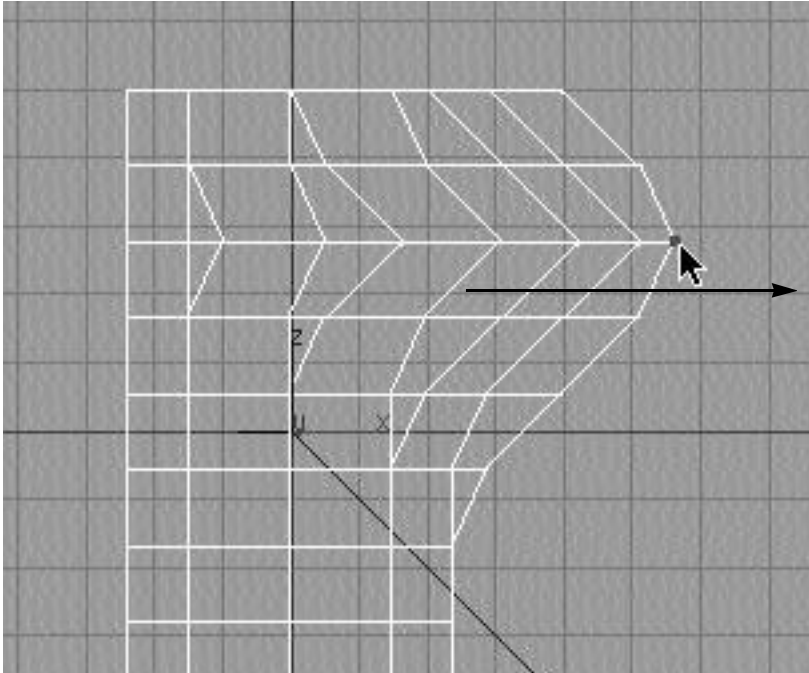


# PiXELS Exercises

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## Reshape the cylinder

Click and drag as shown. Notice how the surrounding points are affected by this tool. The number of points affected is set in the **Flex** dialog. The **U** and **V** values in the **Flex** dialog represent a percentage of the surface which will be affected. Try experimenting with different flex settings and interpolation modes (one of the four icons on the right side of the **Flex** dialogue) to see how they affect the surface you are reshaping.



## Exercise 2

### Organic Modeling

#### Launch *PiXELS*

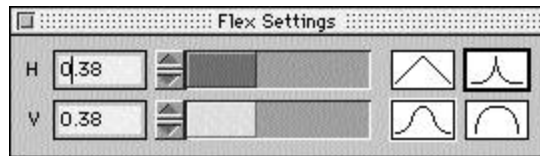
Double click on the *PiXELS* icon to launch the application. The *PiXELS* splash screen will open. After 3 seconds the *PiXELS* interface will appear.

#### Create a cylinder

Use the *Shape > Cylinder* tool to create a cylinder primitive. Click the **OK** button to accept the default cylinder.

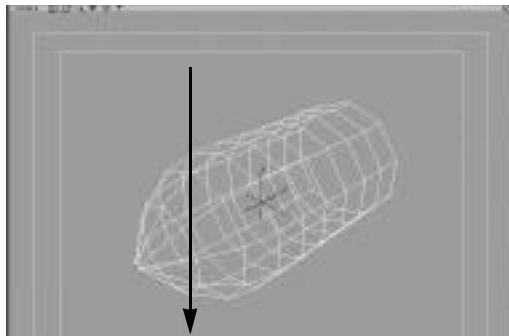
#### Set the cylinder's flex values

Use the **Window > Flex ( B )** menu item to open the **Flex** dialog. Set the **U** and **V** sliders to 0.38. Change the interpolation mode to *smooth weighted*. Type the **tab**, **return** or **enter** key to apply these settings. The cursor must be inside the dialog while typing.



#### Pinch the cylinder closed

Select the *Reshape > Pinch* tool. Click and drag in the Camera view as shown. Notice how the cylinder pinches shut. You may have to click and drag more than once to fully close the cylinder.

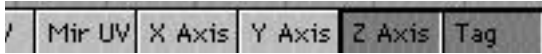


# PiXELS Exercises

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## Invoke vertex mode editing and disable the X and Y Axis buttons

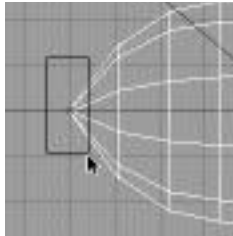
Select the *Control* > *Move* tool. Select the *Tag* constraint. Deselect the *X Axis* and *Y Axis* constraints



NOTE: The *Tag* constraint allows most of the *Control* tools to work at a vertex level, as opposed to their default object level. The *Tag* constraint does not work with *Reshape* tools because they are *always* in vertex mode.

## Tag some points

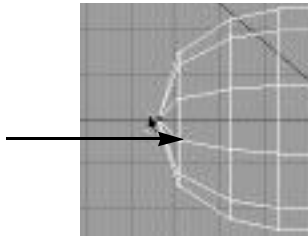
Hold down the **Alt** key. Click and drag a rectangle around the tip of the cylinder as shown.



NOTE: By default, only points on the currently selected object can be tagged. To tag points on all objects, hold down the **Alt** - **option** keys. To tag points on all objects other than the currently selected object, hold down the **Alt** - **control** keys.

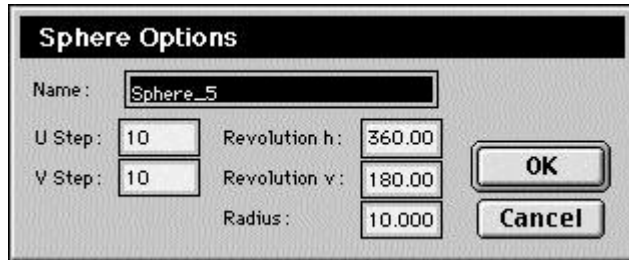
## Move the tagged points

Click and drag as shown to 'tuck-in' the nose of our cylinder. Notice how only the tagged points move.



## Create a sphere

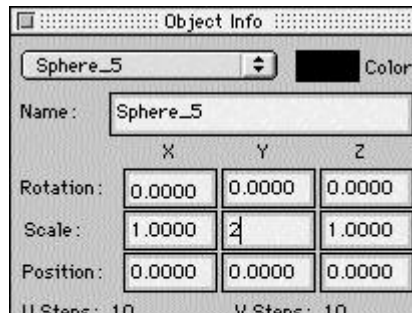
Use the *Shape > Sphere* tool to open the **Sphere Options** dialog. Click the **OK** button to accept the default settings.



## Numerically scale the sphere

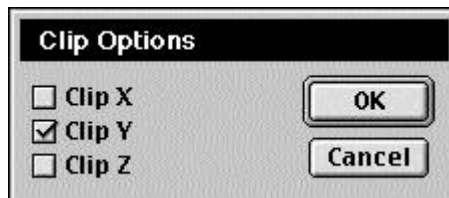
Use the menu item **Window > Object Info** ( **I** ) to open the **Object Info** dialog. Change **Scale Y** to 2.

To apply settings, hit the **return** or **enter** key. The cursor must be inside the dialog while typing.



## Clip the sphere

Use the *Reshape > Clip* tool to open the **Clip Options** dialog. Disable the **Clip X** option and enable the **Clip Y** option. Click the **OK** button to accept. This removes all points of a model that fall below Y=0.

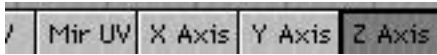


# PiXELS Exercises

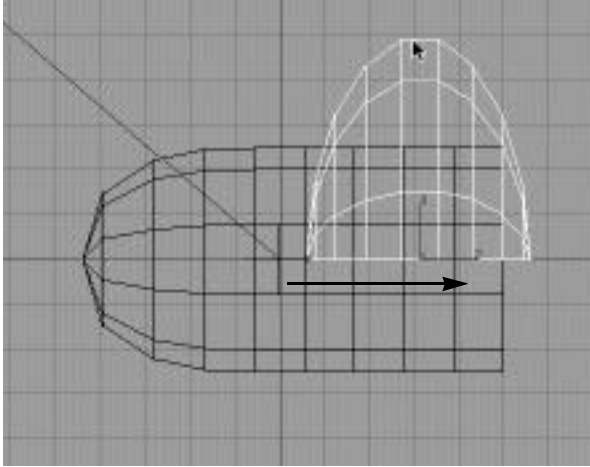
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## Move the sphere

The *Z Axis* should be the only axis constraint active.

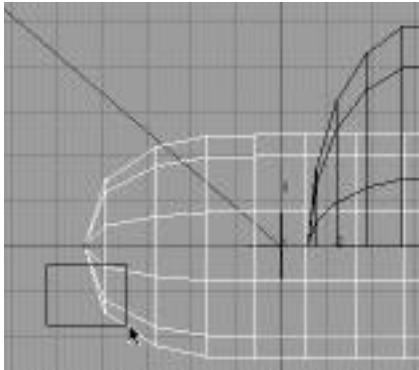


Use the *Control > Move* tool to position the sphere as shown.



## Collide sphere into cylinder - step 1

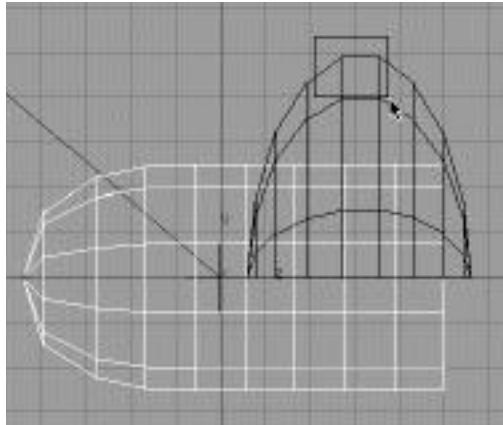
Enable *only* the *Y Axis* constraint. Select the *Reshape > Collide* tool. Hold down the *key* and click and drag a rectangle as shown to select the cylinder.



## Collide sphere into cylinder—step 2

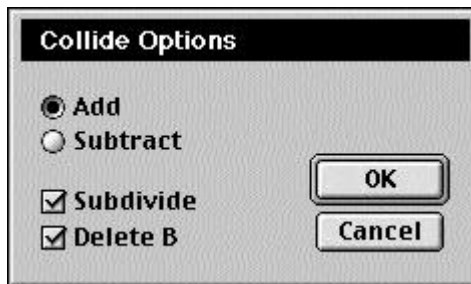
Without holding down the **Alt** key, click and drag a rectangle as shown to *pick* the sphere.

NOTE: *Picking* is different than *Selecting* an object. *Selecting* makes an object active, whereas *Picking* identifies an object so a specific operation may be applied to it. (i.e. *Pick* a sphere to collide with the cylinder, or *Pick* a path to extrude along) It is *not* necessary to hold down the **Alt** key when *Picking* objects.



## Collide sphere into cylinder—step 3

After you've picked the sphere, the **Collide Options** dialog will open. Enable the **Subdivide** and **Delete B** options and click the **OK** button to accept. Click **OK** in the **Subdivide** dialog that opens.



# PiXELS Exercises

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## Save the model

Use the menu item **File > Save As** to open the **Save As** dialog. Type DogHead into the **Save model as:** edit field and click the **Save** button to accept.



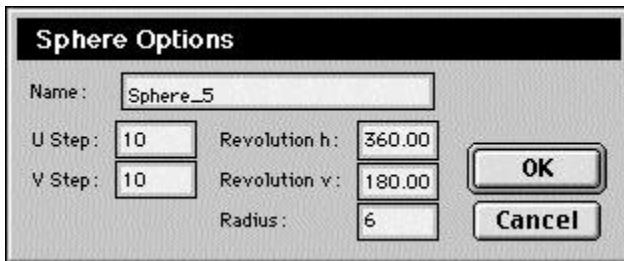
## Render the scene

Use the menu item **File > Quick Render ( R )** to render the scene into the Camera view. Click the mouse to exit render mode and return to model mode.

NOTE: this image will not be saved.

## Create a sphere

Use the *Shape > Sphere* tool to open the **Sphere Options** dialog. Set the **Radius** to 6. Click the **OK** button to accept.

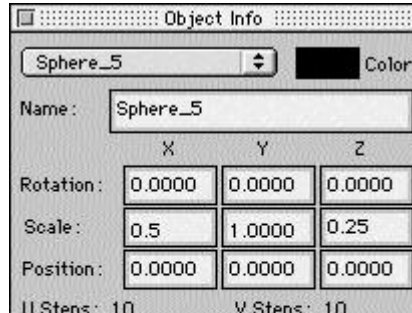




## Numerically scale the sphere

Use the menu item **Window > Object Info** ( **I** ) to open the **Object Info** dialog. Change the **Scale X** to 0.5 and the **Scale Z** to 0.25.

To apply settings, hit the **return** or **enter** key. The cursor must be inside the dialog while typing.



## Move the sphere

Enable all axis. Use the *Control > Move* tool to position the sphere. In the front view move it up and to the left. In the right view move it back.



## Duplicate sphere and position it

Use the menu item **Edit > Duplicate** to duplicate the sphere. The new sphere is placed directly on top of the old one. Use the menu item **Window > Object Info** to open the **Object Info** palette. Remove the *negative* sign from the **Position X** value.

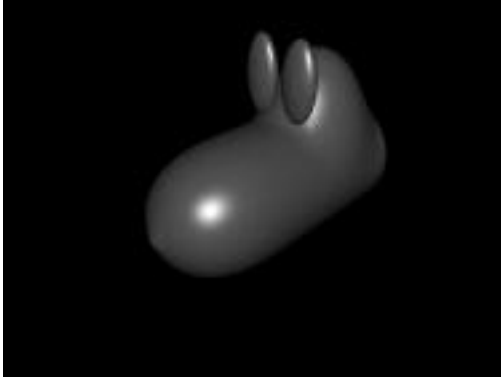
To apply settings, hit the **return** or **enter** key. The cursor must be inside the dialog while typing.

# PiXELS Exercises

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## Render the scene

Use the menu item **File > Quick Render ( R )** to render the scene into the Camera view. Click the mouse to exit render mode and return to model mode.

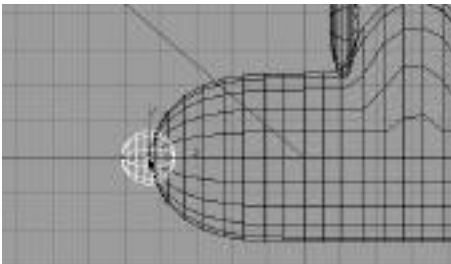


## Create a sphere

Use the *Shape > Sphere* tool to open the sphere dialog. Set the **Radius** to 3. Click the **OK** button to accept.

## Move the sphere

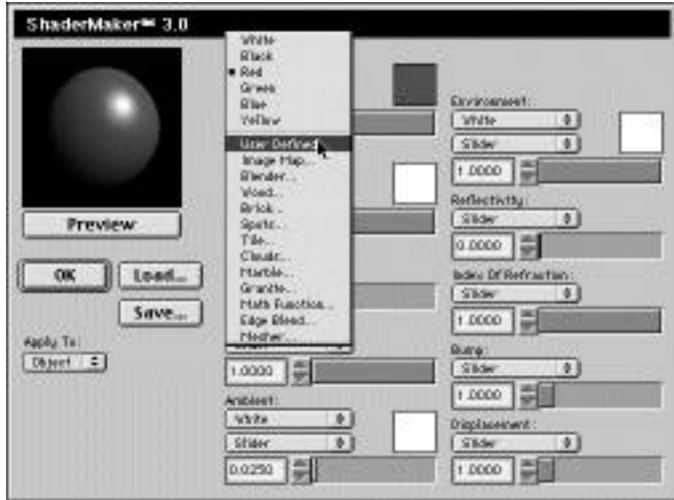
Disable all axis constraints except the *Z Axis*. Use the *Control > Move* tool to position the sphere as shown.



NOTE: the arrow keys can be used with almost any tool to *nudge* objects along. Each click of an arrow key is equal to clicking and dragging the mouse 1 pixel in the direction of the arrow key.

## Add color and texture to “nose”

Use the menu item **Window > ShaderMaker ( W )** to open the **ShaderMaker** dialog. From the first **Diffuse** pop up menu, select **User Defined**.

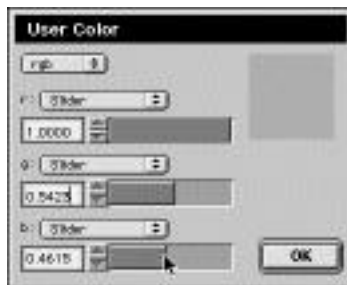


## Set nose color

The **User Color** dialog will appear. Change the sliders as follows:

r: 1.0  
g: 0.5423  
b: 0.4615

Click the **OK** button to accept. In the main **ShaderMaker** dialog, click the **OK** button to apply these settings to the currently selected model.



# PiXELS Exercises

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## Add color and texture to head and eyes

Repeat the last 2 steps for the eyes and head. Set both the eyes' user color to:

r: 0.9  
g: 0.9  
b: 0.95

Set the head's user color to:

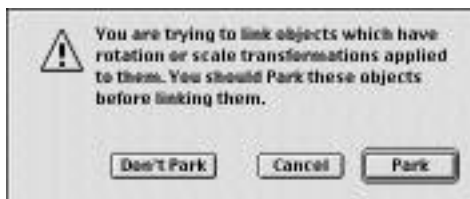
r: 0.5  
g: 0.2  
b: 0.0

## Link parts to head

Select the *Control > Link/Unlink* tool. Link the nose to the head by holding down the command key and selecting the nose. Then, without holding down the command key, pick the head. The **Link Options** dialog will appear. Click **OK** to accept the default options. A green line will appear showing this link.



Link the eyes to the head also. Because the eyes have been scaled, a dialog will appear asking if these objects should be parked before linking. Click **Park** to accept this option.



## Create and position a “null”

Use the *Shape > Null* tool to create a null object.

Use the *Control > Move* tool to position it as shown.



NOTE: a null object simply represents a position in space. It doesn't show up when rendered.

## Tell the head to look at the null

Select the *Control > Look/Unlook* tool. Tell the head to look at the null by holding down the **Alt** key and selecting the head. Then, without holding down the **Alt** key, pick the null object.



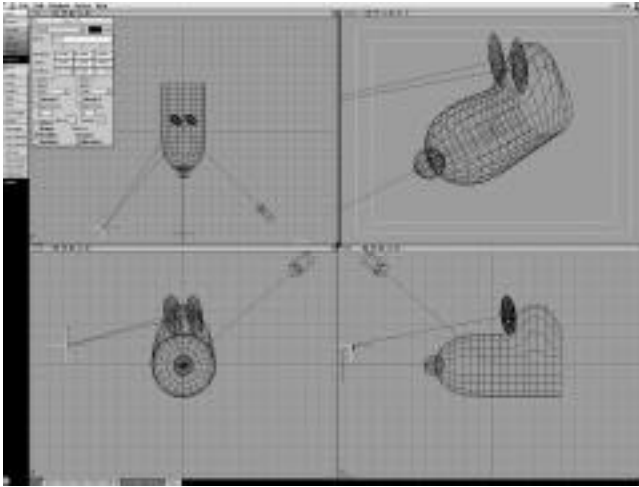
NOTE: a blue line will appear showing a link between the head and null.

# PiXELS Exercises

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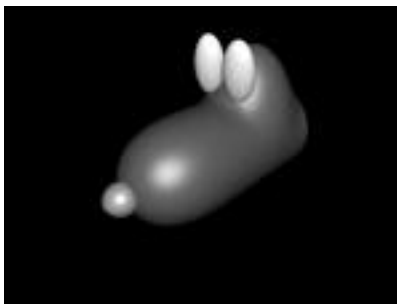
## Create and position another null

Enable all axes. Use the *Shape > Null* tool to create a null object. Use the *Control > Move* tool to position it as shown. Use the *Control > Look/Unlook* tool to tell the left eye to look at the null. Repeat for the right eye.



## Render the scene

Use the menu item **File > Quick Render** to render the scene into the Camera view. Click the mouse to exit render mode and return to model mode.



## Move the head's “look at” point

Select the first null. Use the *Control > Move* tool to move it around. Notice how the eyes still track their look at point (null #2.)

## Exercise 3

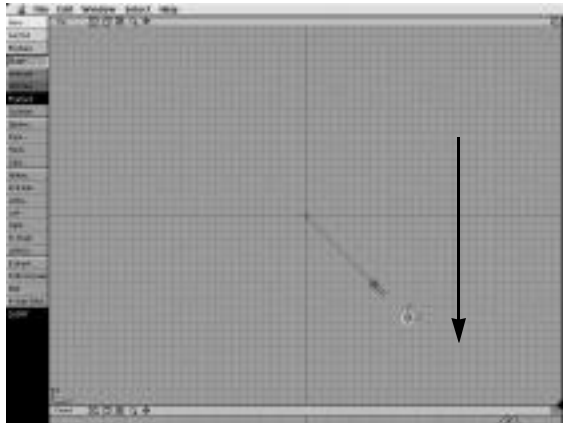
### Path Animation

#### Launch *PiXELS*

Double click on the *PiXELS* icon to launch the application. The *PiXELS* splash screen will open. After 3 seconds the *PiXELS* interface will appear.

#### Dolly out

Hold down the **option** key to invoke the *View > Dolly* tool. Click and drag as shown to dolly out in the Top view.



#### Draw a spline

Select the *Shape > Spline* tool. The **Spline Options** dialog appears. Select **NURBs** as the spline type and click **OK** to accept.

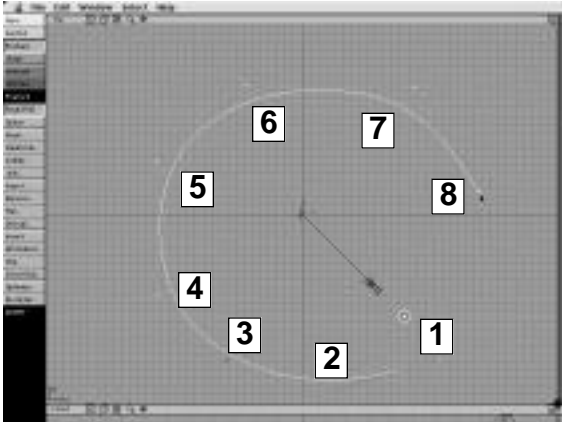


# PiXELS Exercises

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## Draw a spline

Click the mouse at position number 1. Release the mouse and move to position number 2. Notice how the *Spline* tool tracks the mouse. Click and release the mouse. Move to position 3 and click again. Repeat up to position 8. Double click on position 8. This ends *Spline* mode. If you forget to double click, hit the **esc** key.

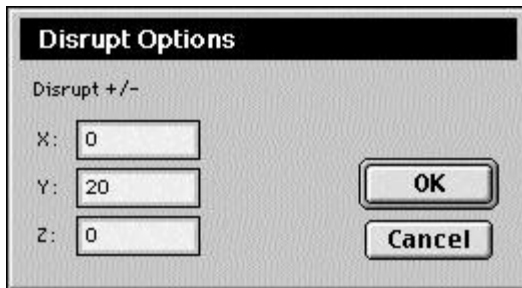


## Disrupt the path

Use the *Reshape > Disrupt* tool to open the **Disrupt Options** dialog. Set the parameters as follows:

X: 0  
Y: 20  
Z: 0

Click the **OK** button to accept.





## Set views

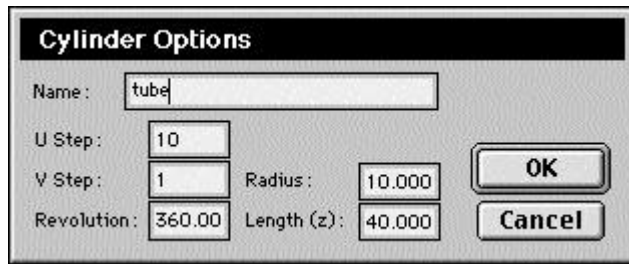
Use the *Dolly* (**option key**) and *Pan* (**shift key**) tools to size and position all four views so that the entire path can be seen in each.

## Create a circle

Use the *Shape > Cylinder* tool to open the **Cylinder Options** dialog. Set the parameters as follows:

Name: tube  
U Step: 10  
V Step: 1  
Revolution: 360  
Radius: 10  
Length (z): 40

Click the **OK** button to accept.



## Extrude the circle along the path

With the circle still selected, select the *Shape > Path Extrude* tool. Click and drag a rectangle around any vertex on the spline to *pick* it. The circle will be extruded along this spline. Use the **Edit > Hide Selected** menu item to hide the newly formed tube. Select the circle and hit the **delete** key.

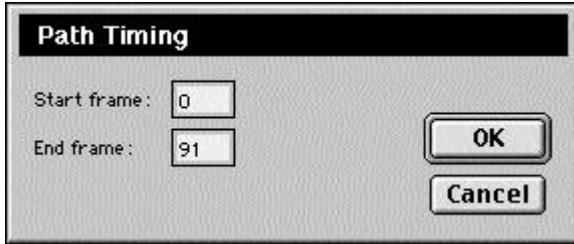
# PiXELS Exercises

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## Link the Camera to the path

+ click on the Camera to select it. Select the *Control > Path/Unpath* tool. Click and drag a rectangle around any vertex on the spline to pick it, designating this spline as the Camera's motion path. The **Path Timing** dialog will open. Set the parameters as follows:

Start frame: 0  
End frame: 91



Notice how the Camera aligns itself with the beginning of the path.

## Link the Interest to the path

+ click on the Interest to select it. The Interest is the null object that the Camera looks at. Wherever it goes, the Camera will track. If you have a hard time finding it, look for the blue line originating at the Camera. Follow this blue line to its end and you will find the Interest.

With the Interest selected, click on the *Control > Path/Unpath* tool. Click and drag a rectangle around any vertex on the spline to pick it, designating this spline as the Camera's motion path. The **Path Timing** dialog will open. Set the parameters as follows:

Start frame: -1  
End frame: 90

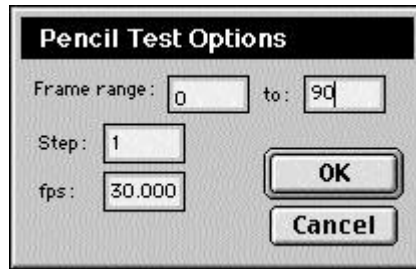
Save this model. In the **Save dialog** use the **New Folder** button to create a new folder inside the Projects folder located in your *PiXELS* folder. Name this new folder RollerCoaster. Name the file RollerCoaster\_scene.

## Render a pencil test

Use the *Animate > Pencil Test* tool to open the **Pencil Test Options** dialog. Set the values as follows:

Frame range: 0  
to: 90  
Step: 1  
fps: 30

Click the **OK** button to accept.



Click the mouse or type **- period** to stop. Click and drag the mouse left to right to shuttle.

## Return to frame 0

Click on the frame counter (the button separating the tool groups from the tools) to open the **Go to Frame** dialog. Type 0 <return>.

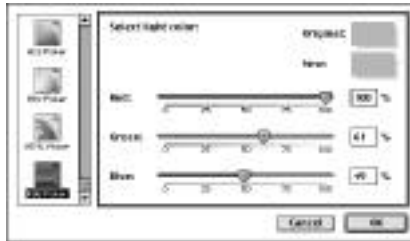
# PiXELS Exercises

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## Change the light color

Use the **Window > Object Info** menu item to open the **Object Info** palette. Select **Default Light** from the **Object Selector** pop-up menu. Click in the color box to the right of the **Object Selector** pop-up menu to open the **Color Picker** dialog. Set the **Red**, **Green** and **Blue** sliders as follows:

**Red** -        100  
**Green** -       61  
**Blue** -        49



Click **OK** to accept.

## Change the Light Type

Select **Sun** from the **Light Type** pop-up menu. Unlike a point light, a sun has no obvious source in the scene, only a direction from which the light is cast.

## Duplicate the light and change position and color

With the default light still selected, use the **Edit > Duplicate** command to make a copy of the light. Use the **Object Info** palette to change the **X**, **Y** and **Z Position** values to:

**X** - negative 50  
**Y** - negative 50  
**Z** - positive 50

Click in the color box to the right of the **Object Selector** pop-up menu to open the **Color Picker** dialog. Set the **Red**, **Green** and **Blue** sliders as follows:

**Red** -        51  
**Green** -       73  
**Blue** -        100

Click **OK** to accept.

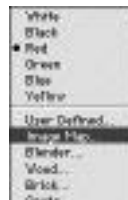
## Change the tube's settings

In the **Object Info** palette, select **tube** from the **Object Selector** pop-up menu. Change the following parameters:

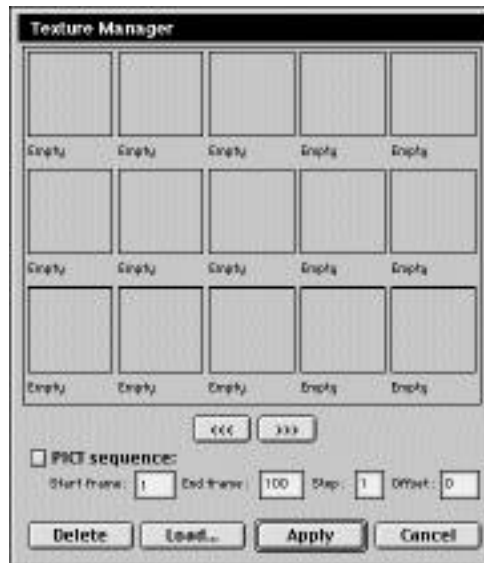
**U Subdivisions** - 4  
**V Subdivisions** - 8

## Apply a texture map to the tube

Use the **Window > ShaderMaker** ( **W**) menu item to open the **ShaderMaker** dialog. Select **Image Map** from the first **Diffuse** pop-up menu.



This will open the **Texture Manager** dialog:



Click in any empty tile or click the **Load...** button.

# PiXELS Exercises

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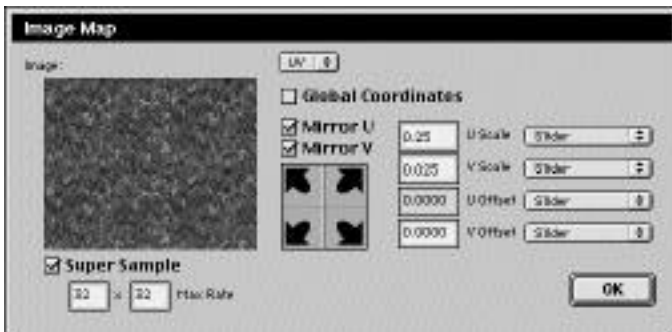
The **Open File** dialog will open. Navigate to the Textures folder located inside your *PiXELS* folder. Locate and select the texture named *bluestone.PICT*. Click **Open** to load this image. In the **Texture Manager** dialog, click **Apply**.



The **Image Map** dialog will open. Change the following parameters:

**Mirror U** - checked  
**Mirror V** - checked  
**U Scale** - 0.25  
**V Scale** - 0.025

Click **OK** to accept.



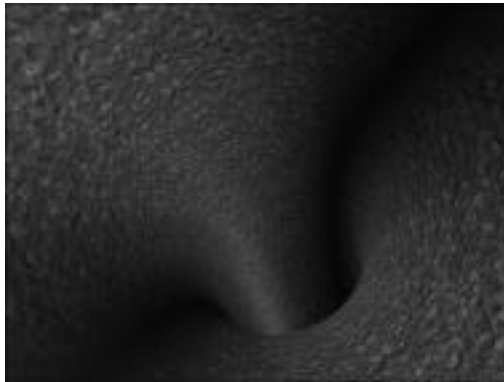
## Change the Specular settings

Change the **Specular** slider to 0.2 (you can type the value into the edit field to the left of the slider.) Change the **Roughness** slider to 0.5. Click **OK** to accept.



## Render a test frame

Use the **File > Quick Render** menu item to render a test frame into the Camera viewing pane. Click the mouse to return to model mode.



# PiXELS Exercises

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## Add a bump map

Use the **Window > ShaderMaker** ( **W**) menu item to open the **ShaderMaker** dialog. Select **Image Map** from the **Bump** pop-up menu. The **Texture Manager** dialog will open. Click on the *bluestone.PICT* tile. Click **Apply**. The **Image Map** dialog will open. Change the following parameters:

**Mirror U** - checked

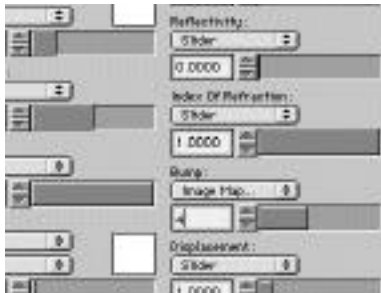
**Mirror V** - checked

**U Scale** - 0.25

**V Scale** - 0.025

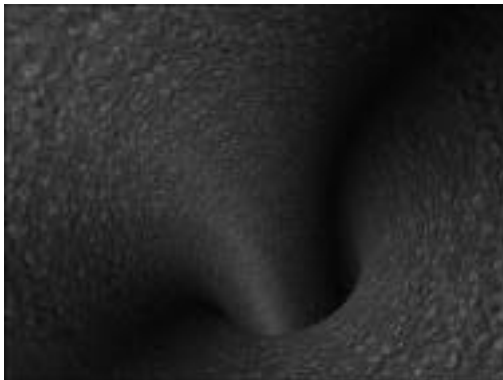
Click **OK** to accept.

In the **ShaderMaker** dialog, change the **Bump** slider to 4. Click **OK**.



## Render another test frame

Use the **File > Quick Render** menu item to render another test frame into the Camera viewing pane. Notice how the surface appears to be bumpy. This is what a bump map does. Click the mouse to return to model mode.



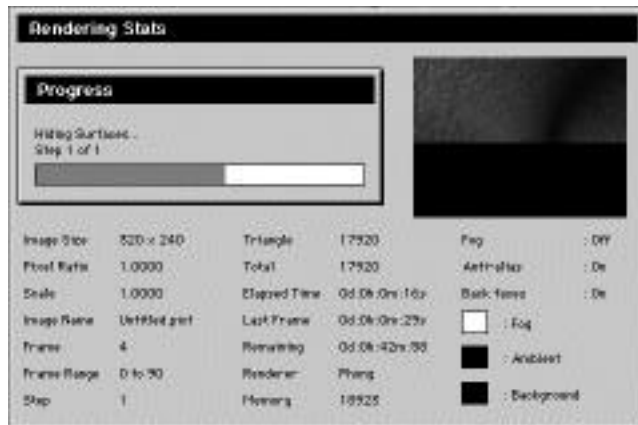


## Render your final animation

Use the **File > Render Setup ( U )** menu item to open the **Render Setup** dialog. Enable the **Range of Frames** option and click **OK**.



Use the **File > Final Render** menu item to render your animation to disk. In the **Save** dialog use the **New Folder** button to create a folder inside your RollerCoaster folder. Name it Frames. Set the file name to Frame and click **OK**. All of the frames for your animation will be rendered and saved with a numerical extension indicating the frame number of that image. After rendering, use the **Utilities > View PICTs** tool to playback your animation. Select the first frame and click **OK**.





## Exercise 4

### Inverse Kinematics

#### Launch *PiXELS*

Double click on the *PiXELS* icon to launch the application. The *PiXELS* splash screen will open. After 3 seconds the *PiXELS* interface will appear.

#### Create a cylinder

Use the *Shape > Cylinder* tool to open the **Cylinder** dialog. Change the following parameters:

|          |                      |
|----------|----------------------|
| Name -   | <u>Left Leg Skin</u> |
| Radius - | <u>2.5</u>           |

Click **OK** to accept.

#### Rotate 90°

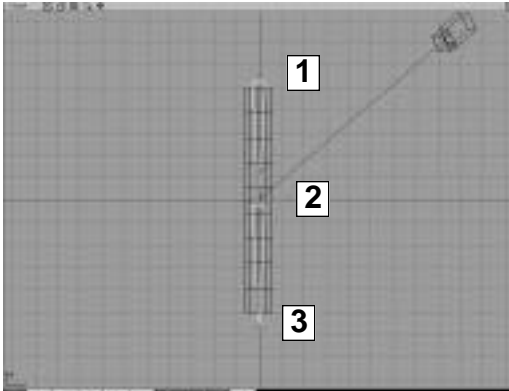
Use the **Object Info** palette to set the cylinder's **X Rotation** to 90°. Hit the **return** key to apply. Remember to keep the cursor inside the dialog while typing. Leave the **Object Info** palette open.

# PiXELS Exercises

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## Create an IK Chain

Creating an IK Chain is just like drawing a spline. You click the mouse one time at each joint, then double click on the last joint to end it (or hit the **esc** key.) Select the *Shape > IK Chain* tool. Click and release the mouse at position 1. Move the mouse to position 2 and click again. Finally, double click at position 3. If you forget to double click, hit the **esc** key.



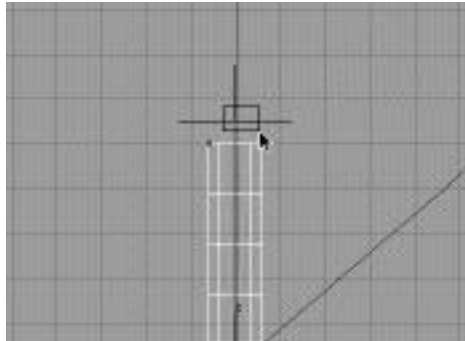
## Name the IK Chain

The **IK Chain Options** dialog will open. Set the **Name:** to Left Leg. Click the **OK** button to accept.

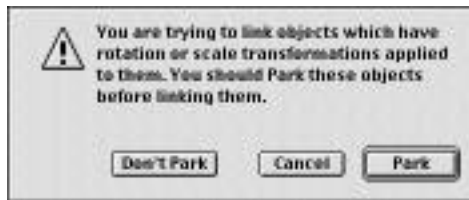


## Link the cylinder to the IK Chain

Select the *Control > Link/Unlink* tool. Select the cylinder by *pick*-clicking on it. In the Front view, click and drag a rectangle around the top portion of the IK chain as shown to *pick* it. (no *key*). This top portion is called the *root*. All initial links need to be applied to this part of the chain.



The following dialog will appear:



Click **Park**. Hierarchies are much more manageable if all objects within it share the same coordinate system. The **Link Options** dialog will now appear. Click **OK** to accept the default settings.

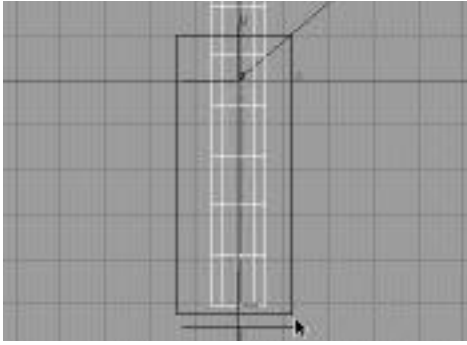


# PiXELS Exercises

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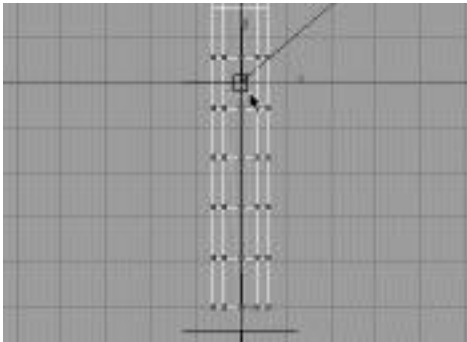
## Tag some points

Select the *Tag* constraint. While holding down the `Shift` key, click and drag a rectangle as shown. The `Q` key is used to invoke select mode.



## Link the tagged points to a different part of the IK Chain

Without holding down the `Shift` key, click and drag a rectangle as shown.

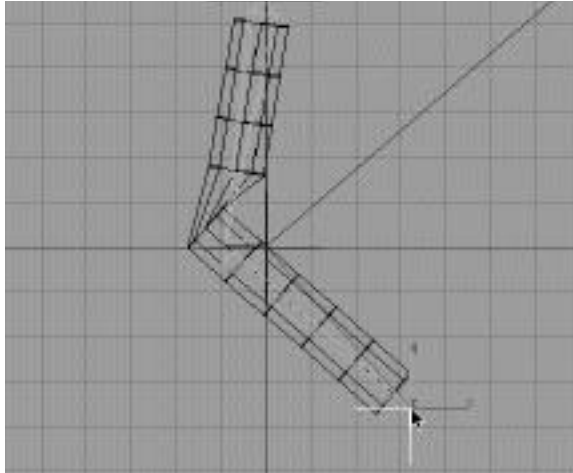


Deselect the *Tag* constraint.

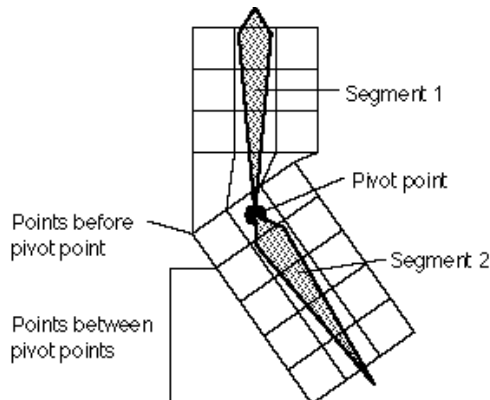


## Bend the IK Chain

First, select the last joint on the IK Chain. Next, use the *Control > Move* tool to move the last joint as shown. Notice how the cylinder is being affected by two different parts of the chain. Unfortunately the area around the joint looks awkward. The next steps will show you how to resolve this problem.



One common question is “How do I know which IK joint to link my tagged points to?” There are many factors which can affect how you decide to *link* and—as we will soon see—*weight* points to IK segments. A good place to start is to link the points just before the pivot point and all points up to the next pivot point (or in this case the end of the chain) to the segment which lies between those pivot points. This is the approach we are taking in this exercise.

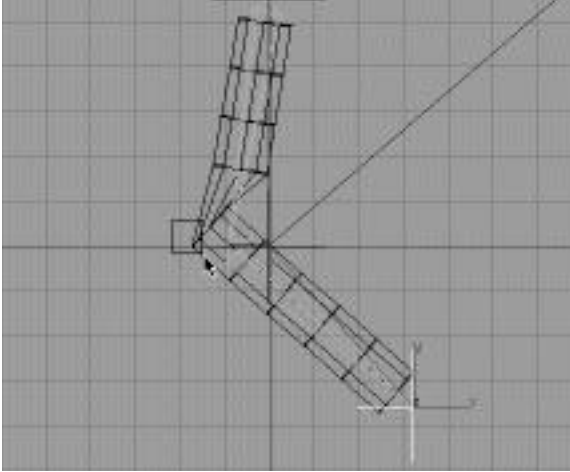


# PiXELS Exercises

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## Select the cylinder

Select the *V Col* constraint. This will allow for the adjusting of an entire ring of points at once. Hold down the **Shift** key and click and drag a rectangle as shown to select the cylinder and a row of points.



## Set IK Weight

Use the **Window > Point Info** menu item to open the **Point Info** dialog. Set the **IK Weight** slider to approximately 0.333. Hit the **return** key to apply. Remember to keep the cursor inside the dialog while typing. Notice how much smoother the transition from top to bottom is. The **IK Weight** parameter defines how much rotation to inherit from the segment the point is linked to. The remainder is inherited from the previous segment.

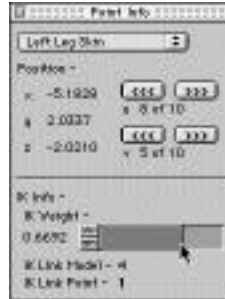


Leave this palette open.



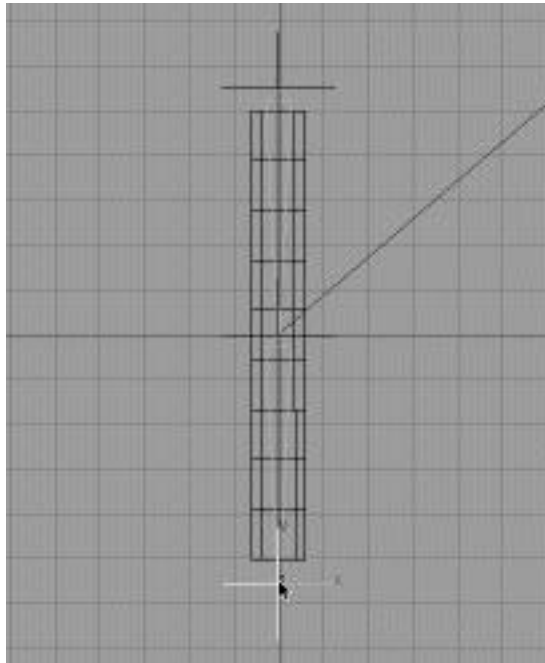
## Set IK Weight continued

Use the **v <<<** button to select the previous ring of points. Set the **IK Weight** slider to about 0.666. Hit the **return** key to apply. Remember to keep the cursor inside the dialog while typing.



## Straighten out the IK Chain

Select the last joint on the IK Chain. Use the *Control > Move* tool to move the last joint as shown.

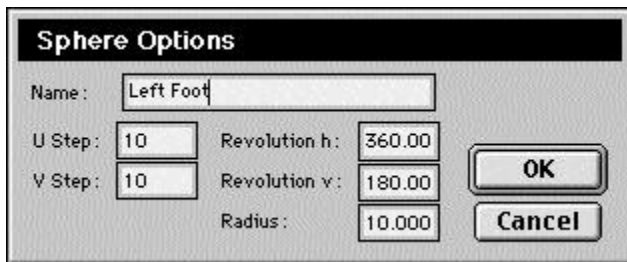


# PiXELS Exercises

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## Create a sphere

Use the *Shape > Sphere* tool to open the **Sphere Options** dialog. Change the **Name:** to Left Foot. Click the **OK** button to accept.



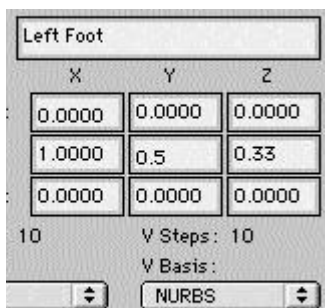
## Clip the sphere

Use the *Reshape > Clip* tool to open the **Clip Options** dialog. Disable the **Clip X** option and enable the **Clip Y** option. Click the **OK** button to accept.



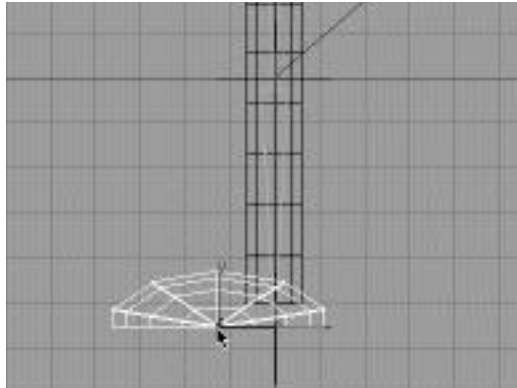
## Numerically scale the sphere

Use the **Object Info** palette to numerically scale the sphere. Set **Scale Y** to 0.5 and **Scale Z** to 0.33. Hit the **return** key to apply. Remember to keep the cursor inside the dialog while typing.



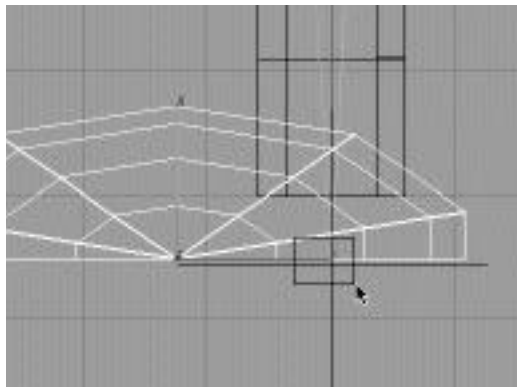
## Position the sphere

Use the *Control > Move* tool to position the sphere as shown.

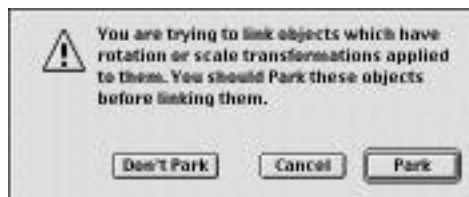


## Link the sphere to the IK Chain

In the front view, use the **Dolly** (**option** key) and **Pan** (**shift** key) tools to zoom in on the foot as shown. Select the *Control > Link/Unlink* tool. Without holding down the **key**, click and drag a rectangle as shown.



A dialog will appear asking if you want to park the cylinder. Click **Park**.



# PiXELS Exercises

The **Link Options** dialog will now appear. Click **OK** to accept the default settings.

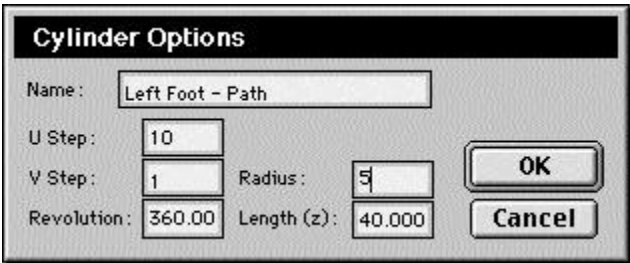


## Create a circle

Use the *Shape > Cylinder* tool to open the **Cylinder Options** dialog. Change the following parameters:

Name - Left Foot - Path  
V Step - 1  
Radius - 5

Click **OK** to accept.



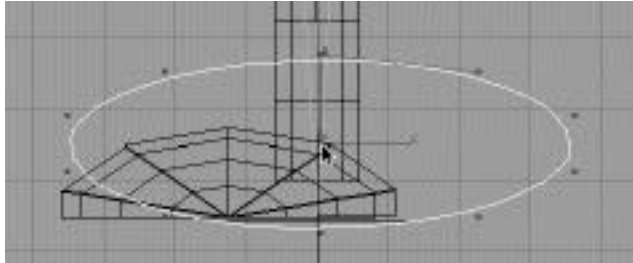
## Numerically scale the circle

Use the **Object Info** palette to numerically set the **X Scale** to 3. Hit the **return** key to apply.



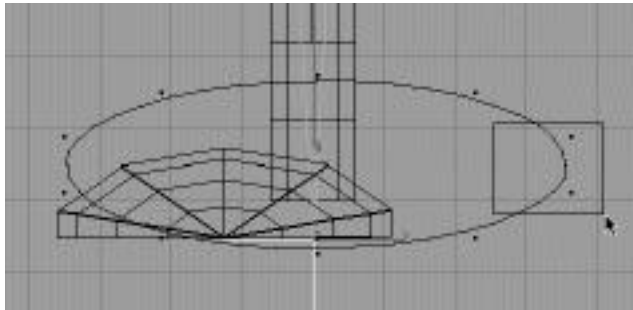
## Position the circle

Use the *Control > Move* tool to position the circle as shown. Take care to ensure that the bottom of the circle aligns with the bottom of the foot.

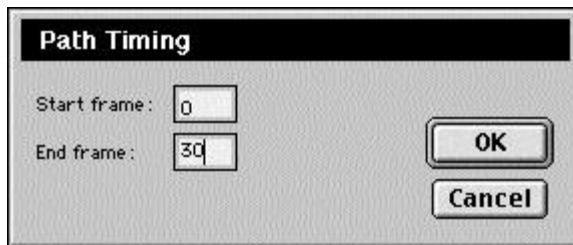


## Path link the last joint to the circle

From the **Object Info** palette, use the **Object** pop-up menu to select the **Left Leg\_jnt2** item. Select the *Control > Path/Unpath* tool. Click and drag a rectangle as shown to pick the circle as the path.



The **Path Timing** dialog will open. Set the **End Frame** parameter to 30 and click **OK**.

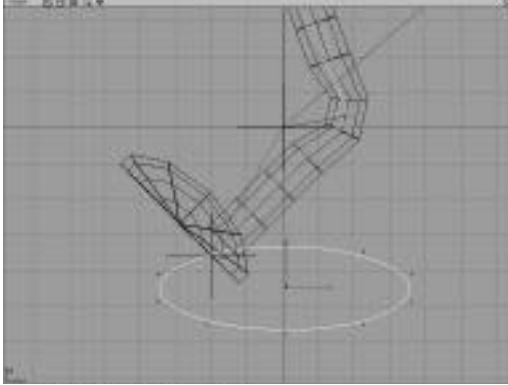


# PiXELS Exercises

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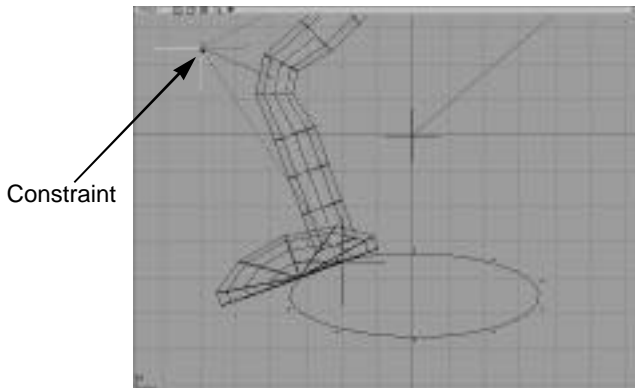
## Invert the path

From the **Object Info** palette, use the **Object** pop-up menu to select the **Left Foot - Path** item. Use the *Reshape > Invert* tool to reverse the direction of the path.



## Position knee constraint

Our leg is bending the wrong way! To correct this, select and position the knee constraint up and away from the knee as shown. Each joint in an IK Chain has a constraint associated with it. This constraint can be found by following the blue line which connects the joint being constrained with its null. (The null is actually the constraint.) This gives the computer hints as to how you want the IK Chain to behave.

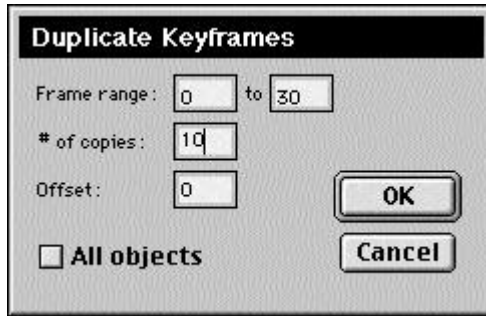


## Cycle the animation

Select the last joint in the IK Chain. Use the *Animate > Dup. Keys* tool to open the **Duplicate Keyframes** dialog. Change the following parameters:

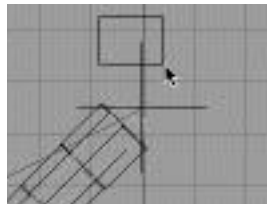
to - 30  
# of copies - 10

Click **OK** to accept.



## Link the motion path to the IK

Select the circular motion path. Select the *Control > Link/Unlink* tool. Click and drag a rectangle as shown to link the path to the root of the IK Chain.



A dialog will appear asking if you want to park the cylinder. Click **Park**. The **Link Options** dialog will appear. Deselect the **Rotation** option. Click **OK** to accept these settings.



# PiXELS Exercises

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## Position the left leg

Select the root of the IK Chain. In the **Object Info** palette, change the **Z Position** value to -8. Hit the **return** key to apply.

## Create, position and name the right leg

With the *Left Leg\_root* object still selected, use the **Edit > Duplicate Hierarchy** menu item to create a duplicate of the left leg. Use the **Object Info** palette to change the **Z Position** value to 8.

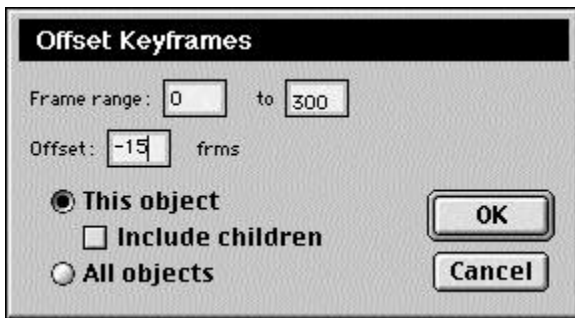
Now click and hold on the pop-up menu in the Object Info palette. You will notice that you now have duplicate “left foot”, “left leg root”, etc. Click on each of these names and you will be able to see what part of what leg is selected. When you see your “right leg” pieces selected, change the name of that piece to “right foot”, or “right leg root”, etc.

## Offset the right leg’s animation cycle

Select the last joint of the right leg. Use the *Animate > Offset Keys* tool to open the **Offset Keyframes** dialog. Change the following parameters:

to -            300  
Offset -       -15

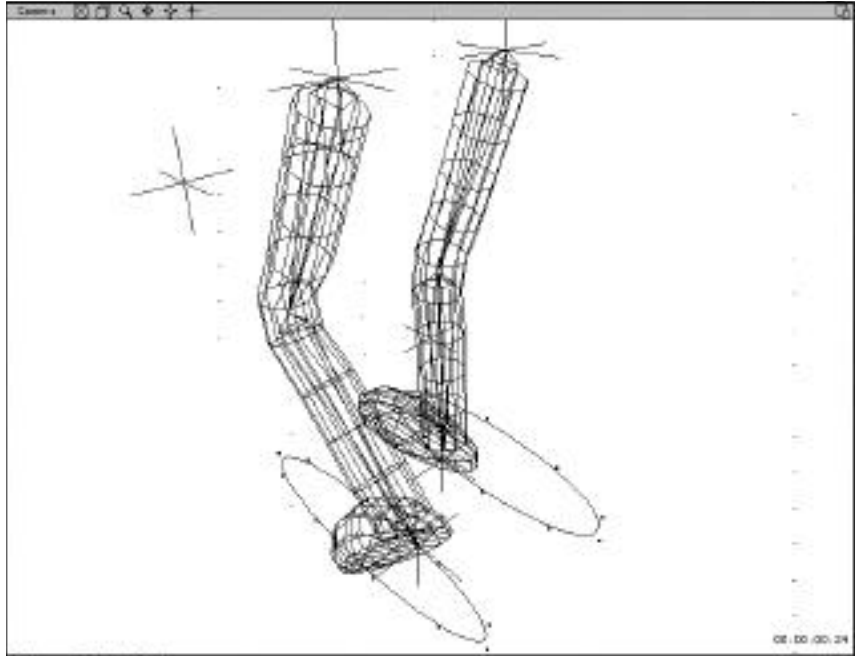
Click **OK** to accept.





## Render a pencil test

Use the *Animate > Pencil Test* tool to open the **Pencil Test Options** dialog. Set the **Frame range** to 0 to 30. Click **OK** to render and playback a pencil test of the animation.





## Exercise 5

### Animating with the Timeline


#### Launch PiXELS

Double click on the *PiXELS* icon to launch the application. The *PiXELS* splash screen will open. After 3 seconds the *PiXELS* interface will appear.

#### Create a cube

Use the *Shape > Cube* tool to open the **Cube Options** dialog. Click the **OK** button to accept the default settings and create a cube.

#### Open the Timeline palette

Use the **Window > Timeline** (  ) menu item to open the **Timeline** palette. In the **Timeline**, expand the **Cube\_4** group by clicking in the box to the left of the group's name as shown. All the animatable groups are now visible. If **Cube\_4** had any objects linked to it (children) they would show up here as well.



#### Expand the Position group

In the **Timeline**, expand **Cube\_4's Position** group by clicking in the box to the left of the **Position** group's name. All the animatable parameters (**X**, **Y** and **Z**) for the **Position** group are now visible.

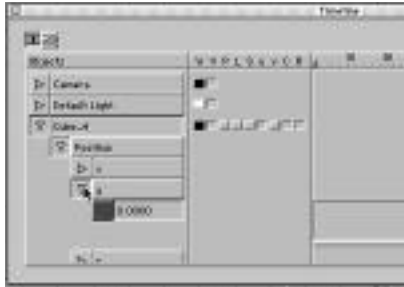


# PiXELS Exercises

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## Expand the Position Y parameter

In the **Timeline**, expand the **Position** group's **Y** parameter. This is as far down as we can go. We are now looking at the actual value for this parameter at this frame. More on that later. Note the green box to the left of the value. This box represents the function curve's color. Clicking on it will open the Apple color picker, allowing you to change the function curve's color.

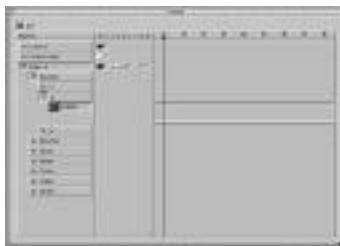


## Navigating the Timeline

Navigating the timeline is the same as in any other view. **Shift** - click and drag will pan. **Option** - click and drag will zoom. Pan the view a little to the right as shown.

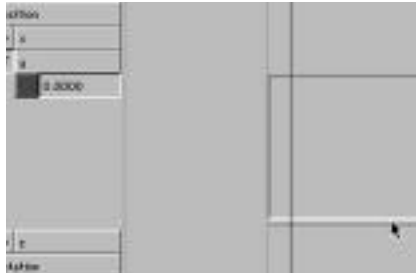


Click in the bottom right corner of the palette. Hold the mouse button down and drag to resize the window as shown.



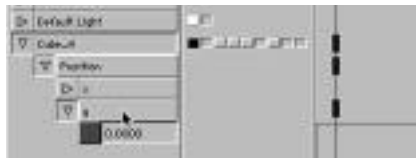
## Function curve viewing panes

To the right of the **Y** parameter is that parameter's function curve viewing pane. Since there are currently no keyframes, no function curve is visible. This viewing pane can be resized by clicking in the bar just below the viewing pane and dragging it down as shown.



## Adding keyframes

Keyframes can be added directly in the **Timeline**. **Option** - clicking on any group will add a keyframe to any value within that group. **Option** - clicking on the **Position** group will add keyframes for the **X**, **Y** and **Z** parameters. **Option** - clicking on the **Cube\_4** group would add keys to all **Position**, **Rotation**, **Scale**, etc... parameters. **Option** - click on the **Y** parameter to add a key.



## Go to frame 20

The current frame can be changed from within the **Timeline**. To change the current frame, click and drag the red box inside the *frame bar*. This red box is the *key insertion point*. Any new keyframes will be inserted at the frame indicated by this marker. Holding down the **option** key while dragging the current frame indicator will change the *add key insertion point* without changing the current frame.

Drag the key insertion point to frame 20 as shown.



# PiXELS Exercises

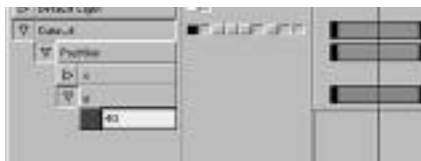
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## Add some more keyframes

**Option** - click on the **Y** parameter to add a new key at frame 20. Notice how the timeline changes. Drag the key insertion point to frame 40 and add another key for the **Y** parameter. Add keys at frames 60 and 80 as well.

## Numerically change the Y parameter

Drag the key insertion point to frame 10. Click on the value just below the **Y** parameter. Notice how it becomes highlighted. The value can now be edited. Type 40 followed by either the **enter** or **return** key to accept. The cube will move up, possibly out of view.



## Add even more keyframes

**Option**-click on the **Y** parameter to add a key at frame 10. Notice how the function curve updates.



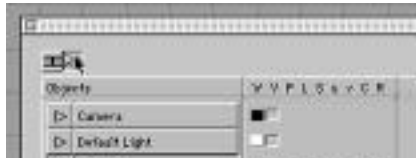
Drag the key insertion point to frame 30. Click on the value just below the **Y** parameter. Type 30 followed by either the **enter** or **return** key to accept. **Option**-click on the **Y** parameter to add a key at frame 30.

Drag the key insertion point to frame 50. Change the **Y** value to 20 and add a keyframe. Drag the key insertion point to frame 70. Change the **Y** value to 10 and keyframe this change also.



## Bar mode vs. curve mode

Data can be viewed in one of two ways. The default view (the one we have been working in) is *bar mode*. The alternate view is *curve mode*. Curve mode allows you to view and edit multiple curves simultaneously. Any parameter which has been fully expanded in the hierarchy will show up in this mode regardless of its position in the scrolling list. This allows you to edit curves from multiple objects simultaneously. To invoke curve mode, click on the **curve toggle button** in the upper left corner of the **Timeline** palette. To switch back to bar mode, click on the **bar toggle button**. Click on the **curve toggle button** now.



## Edit the function curve

Function curves are Adobe Illustrator® style bézier curves. As in Adobe Illustrator®, there are control handles associated with each control point (key). These handles can be edited to alter velocity from key to key. Hold down the **Shift** key and click and drag a rectangle as shown to select the first control point. Control handles are only visible for selected control points. NOTE: multiple control points *can* be selected.



# PiXELS Exercises

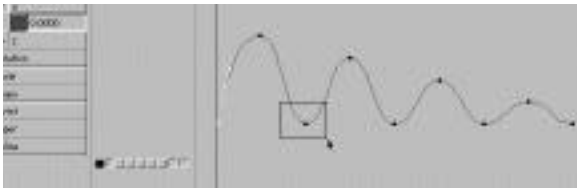
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Click on the box at the end of the control handle. While holding the mouse button down, drag the control handle as shown.



## Edit the remaining control handles

Hold down the **key** and click and drag a rectangle as shown to select the second control point. Notice how two control handles appear, one to the left of the control point and one to the right. Click and drag on the left control handle. Notice how the handle on the right mirrors your movements. This is called *maintaining continuity*. This maintained continuity results in smooth motion.

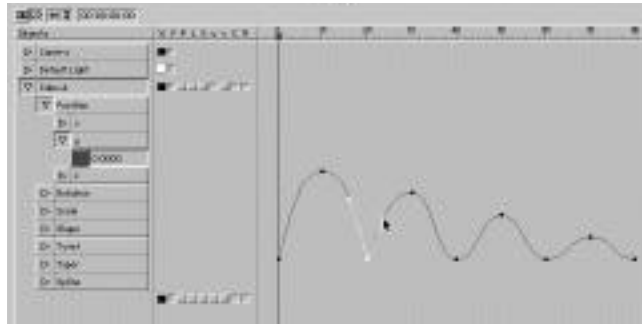


By default, control handles will always maintain continuity. Sometimes it is desirable to break continuity, allowing for abrupt changes in motion. To do this, hold down the **control** key when clicking on the control handle. The continuity will remain broken until you **control** - click on the control handle a second time. **Control** - click and drag the left control handle as shown.

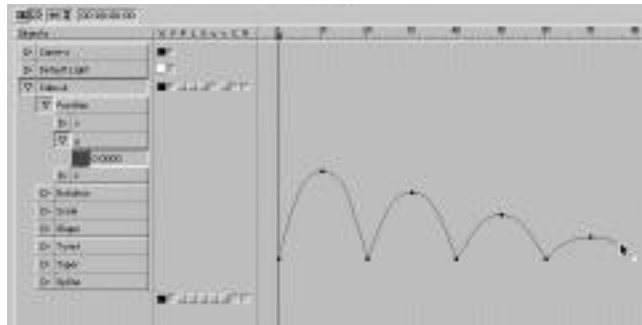




Without holding down the **control** key, click and drag the right control handle as shown.



Repeat this process for each of the remaining control handles, so that the function curve resembles the one shown below.

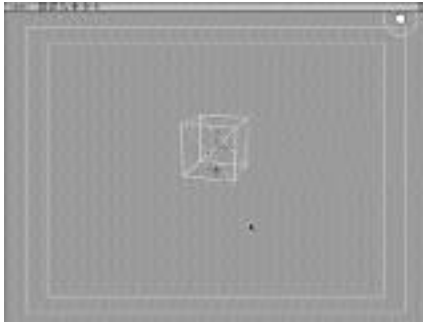


# PiXELS Exercises

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## Create a Pencil Test

Navigate the Camera view to match the one shown.



Use the *Animate > Pencil Test* tool to open the **Pencil Test Options** dialog. Set the **Frame range:** as shown. Click **OK** to accept.



## Exercise 6

### MorphMaker

#### Launch PiXELS

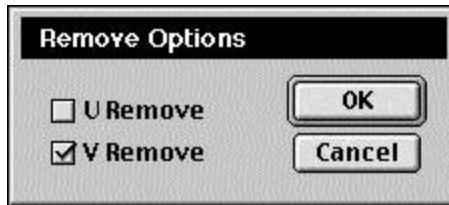
Double click on the *PiXELS* icon to launch the application. The *PiXELS* splash screen will open. After 3 seconds the *PiXELS* interface will appear.

#### Create a sphere

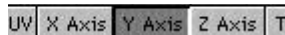
Use the *Shape > Sphere* tool to open the **Sphere Options** dialog. Click the **OK** button to accept the default settings and create a sphere.

#### Reshape the sphere

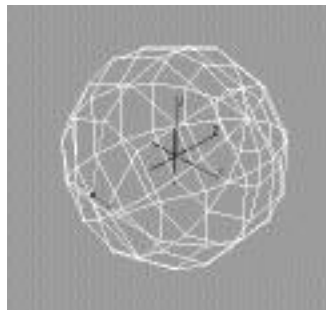
Use the *Reshape > Remove* tool to open the **Remove Options** dialog. Deselect **U Remove** and select **V Remove** as shown. Click **OK** to remove the current v-step.



Click on the **X Axis** and **Z Axis** constraints to deselect them.



Use the *Reshape > Pinch* tool to close the open end of the sphere as shown. This end of the sphere will be our character's mouth.



# PIXELS Exercises

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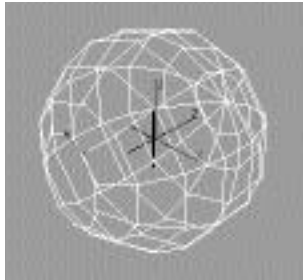
## Set our Reference pose

Use the **View > MorphMaker** menu item ( **M** ) to open the **MorphMaker** palette. Click the **Set Reference** button to designate the current shape as the reference pose.

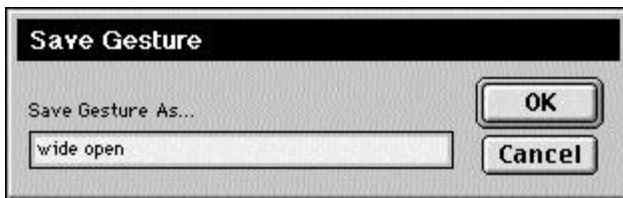


## Open the mouth

Use the *Reshape > Pinch* tool to open the character's mouth.



Click the **Save Gesture...** button. Name this gesture wide open and click **OK** to accept.



Keep the **MorphMaker** palette open.

## Make a smile

In the Front viewing pane's title bar, click on the word front to open the **View Options** dialog for this view. Select the **Clipping** option and click **OK** to apply.



In the **MorphMaker** dialog, click the **Zero Gestures** button to set the shape to it's reference state. Use the *Tag* constraint and the *Move* tool to select and position the points around the mouth as shown. The character should appear to be smiling.




Click on the **Save Gesture...** button. Name this gesture smiling and click **OK**. Move the slider back and forth. Notice how the mouth changes shape. This slider adjusts the influence that this gesture has on the final shape. Set the influence to about 0.6. Click on the **Keyframe Pose** button. This will add a keyframe at the *add key insertion point* for each gesture influencing our character's current shape.

# PiXELS Exercises

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## Animate the mouth

Open the **Timeline** palette (  T). Set the *add key insertion point* to frame 20. In the **MorphMaker** palette, select the **wide open** item from the **Gesture** menu. Adjust this gesture's influence. The mouth opens and closes as the slider is moved back and forth. Set the influence to about 0.5. Click on the **Keyframe Pose** button.

Set the *add key insertion point* to frame 40. Click on the **Zero Gestures** button to reset our shape. Click on the **Keyframe Pose** button.

NOTE: Shapes can have a negative influence as well. You can't set this with the slider, but you can in the timeline. A negative smile will give you a frown! Values greater than 1 can be used for exaggerated expressions.

## Render a pencil test

Use the *Animate > Pencil Test* tool to open the **Pencil Test Options** dialog. Set the **Frame range** to 0 to 40. Click **OK** to render and playback a pencil test of the animation.

## Exercise 7

### ShaderMaker

#### Launch *PiXELS*

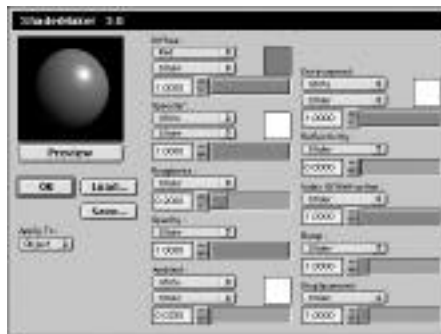
Double click on the *PiXELS* icon to launch the application. The *PiXELS* splash screen will open. After 3 seconds the *PiXELS* interface will appear.

#### Create a cylinder

Use the *Shape > Cylinder* tool to open the **Cylinder Options** dialog. Click the **OK** button to accept the default settings and create a cylinder.

#### Open ShaderMaker

Use the **Window > ShaderMaker** ( **W**) menu item to open the **ShaderMaker** dialog.



#### Background

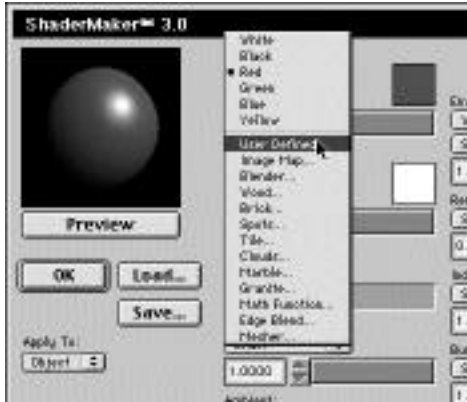
Shaders can be created from scratch or you can use the **Load** button to read a shader from disk. Once a shader has been read into ShaderMaker, it can be edited to create a new look.

# PiXELS Exercises

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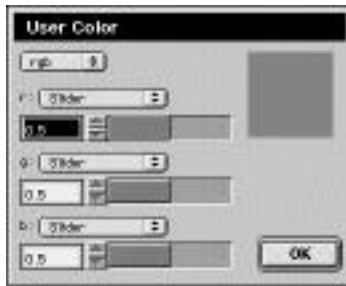
## Create a User Color node

Select **User Defined...** from the **Diffuse** color pop up menu (the first **Diffuse** menu).



## Change the color space

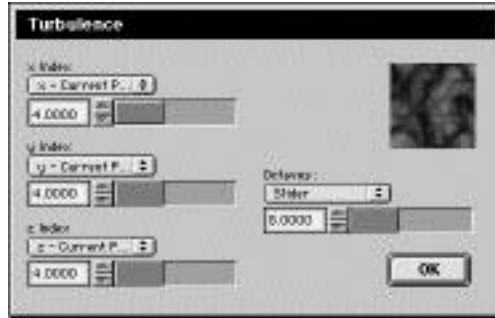
The **User Color** dialog will appear. It has three inputs – one for each component making up the color space you currently have selected. All three of the nodes are value nodes. These values are combined to make a color. The default color space is **rgb**. Change the color space from **rgb** to **hsv** by selecting **hsv** from the **color space** pop up menu located in the upper left corner of the dialog.





## Base hue on a procedural function

Notice how the three inputs change. Instead of saying r, g and b they now say h, s and v. These are short for hue, saturation and value. Select **Turbulence** from the hue pop up menu (the one labeled **h**:).



The **Turbulence** dialog will appear.

Click **OK** to accept this and return to the parent node—**User Color**. Click **OK** twice more to apply this shader to the current object.

Select the **File > Quick Render** menu item to see how your shader looks on the cylinder. You have just created your first shader. Congratulations!

## Review

To really get a feel for the power of ShaderMaker we encourage you to experiment. Go back to the **User Color** node and change some of the other sliders, or go one level deeper and play with the **Clouds** node. You'll be amazed at the effects you can attain with this simple shader. One important thing to note is that we didn't use the **Clouds** node to define the color of the object, as one might expect. Instead we used **Clouds** to perturb the hue of a **User Color** node. What would our shader look like if we used **Marble** or **Wood** to perturb the hue? Try it and see.

## What Next?

For more technical information on procedural shaders, read *Texturing And Modeling, A Procedural Approach* by David S. Ebert, et al. (AP Professional, 1994).



## Tutorials

The animation of digital actors is one of the most complex and demanding tasks an artist can undertake. Even the simplest of characters require the coordination of at least three different and distinct disciplines—modeling, articulation and animation.

On the following pages we will go through, in great detail, all the steps involved in creating a digital actor—from modeling and texturing the character, to illuminating the scene and, finally, bringing the character to life with *inverse kinematics*.



*Milton P. Penguin III*



## Tutorial 1: Starting From Scratch

### Launch *PiXELS*

If *PiXELS* is already running on your machine, choose the **File > Quit** (**Q**) menu item now.

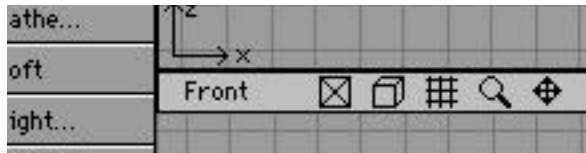
1. *Launch PiXELS.*

In the Finder, locate the *PiXELS* application icon. Double clicking on this icon will launch *PiXELS*.

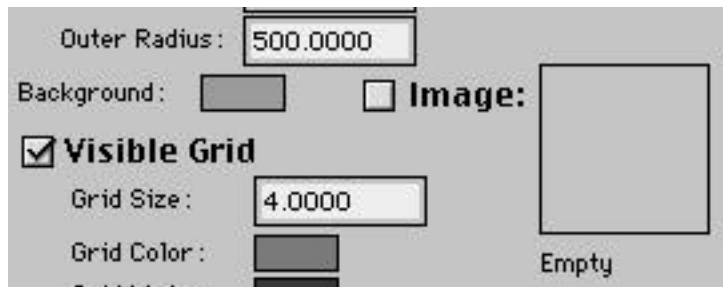
### Import Background Images

We will use pencil sketches as guides for the construction of our character. *PiXELS* has a feature which allows any view to display an image map, allowing the artist to trace over this template.

1. *Open the View Options dialog for the front view.*  
Click on the word *Front* in the title bar of the lower left viewing pane. This opens the **View Options** dialog.

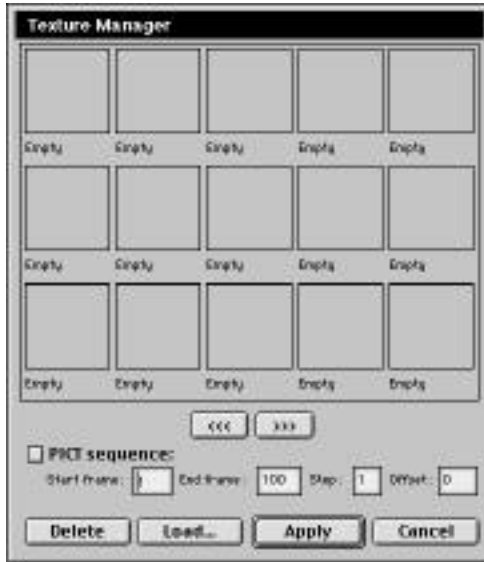


2. *Open the Texture Manager dialog.*  
Select the **Image** checkbox, then click on the empty box to the right of the **Image** checkbox to open the **Texture Manager** dialog.



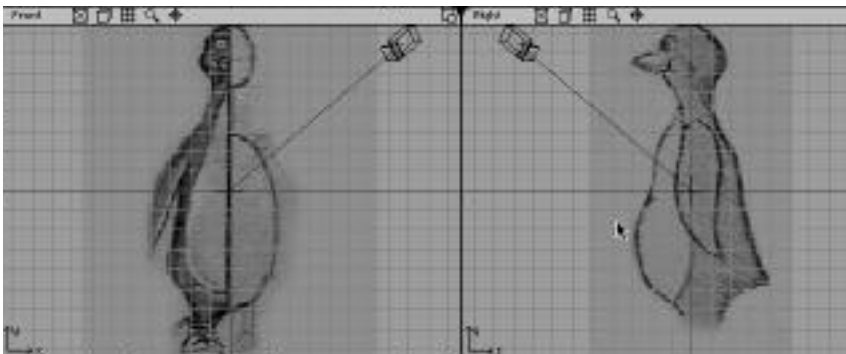
3. *Load a background image.*

Click on any empty box. The standard file dialog will open. Navigate to the *sketches* folder located inside the *tutorials* folder. Open the file inside titled *milty\_front*. Click the **OK** button to open this texture. Click the **Apply** button in the **Texture Manager** dialog to return to the **View Options** dialog. Click the **OK** button in the **View Options** dialog to return to *PiXELS*.



4. *Repeat for right view.*

Repeat steps 1 - 3 for the right view, this time loading the file titled *milty\_side*.

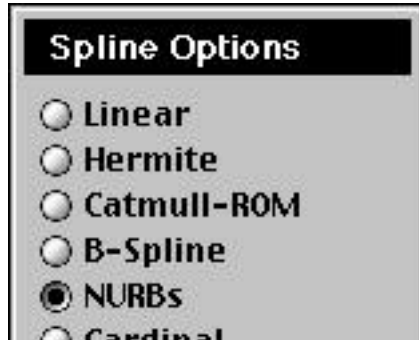


## Trace Templates

Now that we have our background images loaded, we can use them as templates to trace the contours of our character.

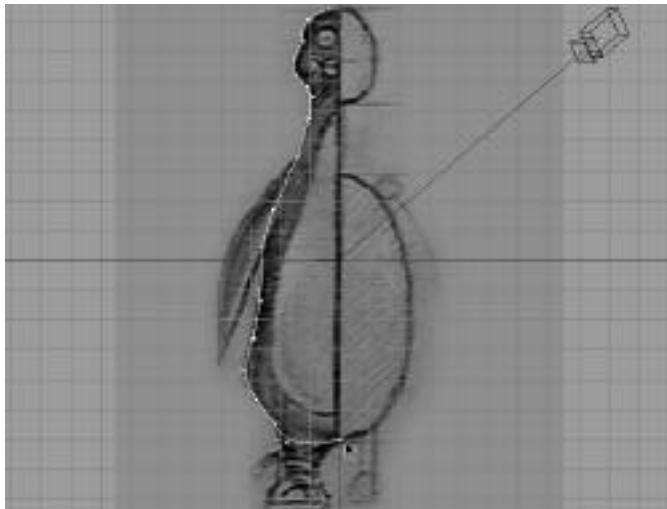
1. *Select the Shape > Spline tool.*

Click on the *Shape* tool group. Select the *Spline* tool. The **Spline Options** dialog will open. Select the **NURBs** option and click **OK**.



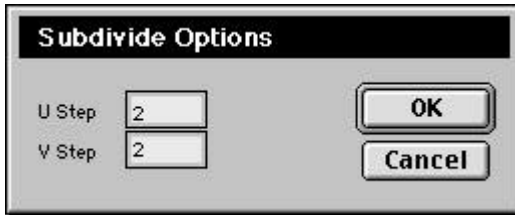
2. *Trace the template.*

In the front view, starting from the top of the head, going counter-clockwise, trace the character's left side profile. Double click to finish drawing the spline. If the double click doesn't take, hit the **esc** key.



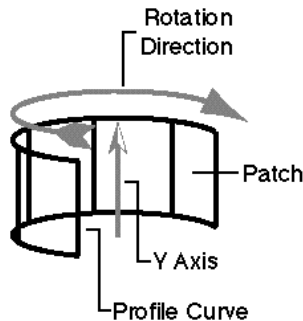
3. *Subdivide the spline.*

Click on the *Reshape* tool group. Select the *Subdivide* tool. The **Subdivide Options** dialog will open. Click **OK**.



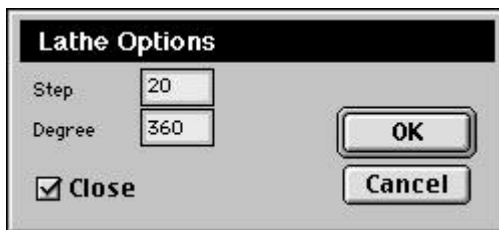
## Lathe the Spline to Create a *Patch*

Splines by themselves cannot be rendered. In order for our spline to be visible when rendered, we must construct a *patch* from it. There are many tools in *PiXELS* to create patches from splines. The *Lathe* tool forms a patch by rotating a profile curve around the y axis. Copies of the original curve are created at various stages of rotation. These copies are joined together to form a patch.



1. *Lathe the profile curve.*

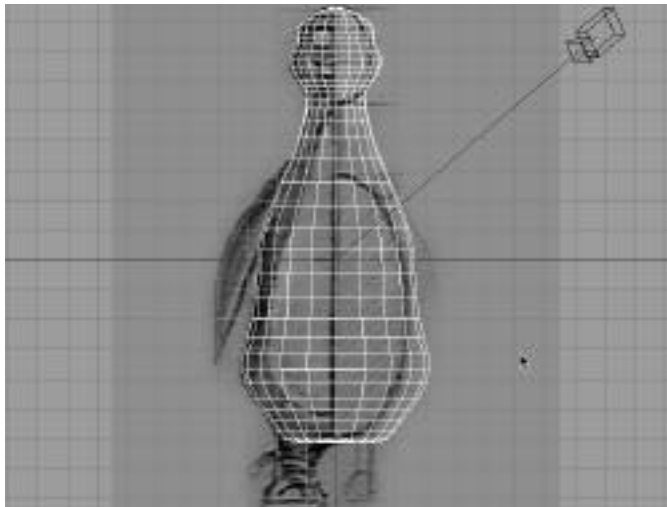
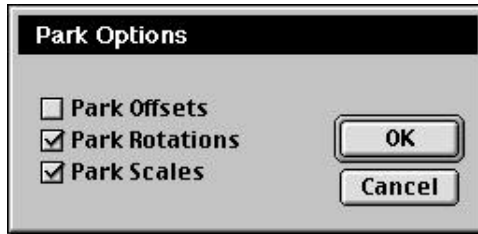
Click on the *Shape* tool group. Select the *Lathe* tool. The **Lathe Options** dialog will open. Set the **Step** option to 20 and click **OK**.





## 2. *Park the lathed surface.*

Click on the *Control* tool group. Select the *Park* tool. The **Park Options** dialog will open. Click **OK**.



## Edit Surface to Fit Sketch

In the front view, the newly created patch fits our sketch perfectly, but the right view shows some problems. We will need to manually edit the patch to fit our sketch.

### 1. *Set the constraints.*

Click on the *V Col* constraint to select it.

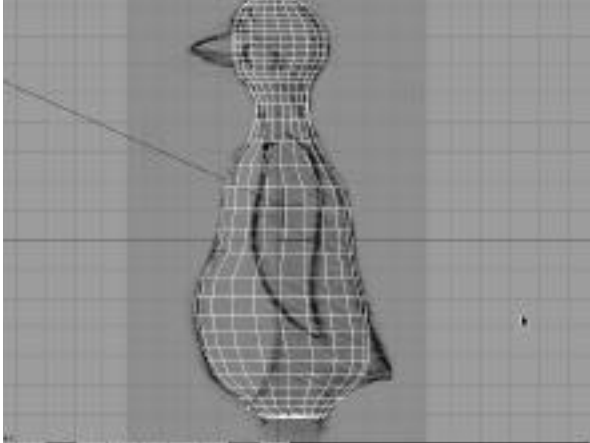
Click on the *X Axis* and *Y Axis* constraints to deselect them.

The *Z Axis* should be the only axis constraint left active.



2. *Reshape side view to match sketch.*

In the right view, use the *Reshape > Pinch* tool and the *Reshape > Push/Pull* tool to mold and position each cross section such that it matches our pencil sketch. The keyboard shortcut for *Push/Pull* is a and the keyboard shortcut for *Pinch* is d. By simply typing these letters, the corresponding tool is instantly selected. Type the space bar to see all the keyboard shortcuts available.

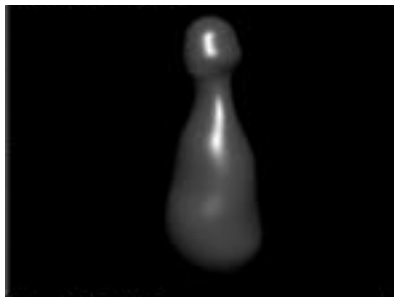


## Finish Up

Finally we will check our surface and save it to disk.

1. *Render the surface.*

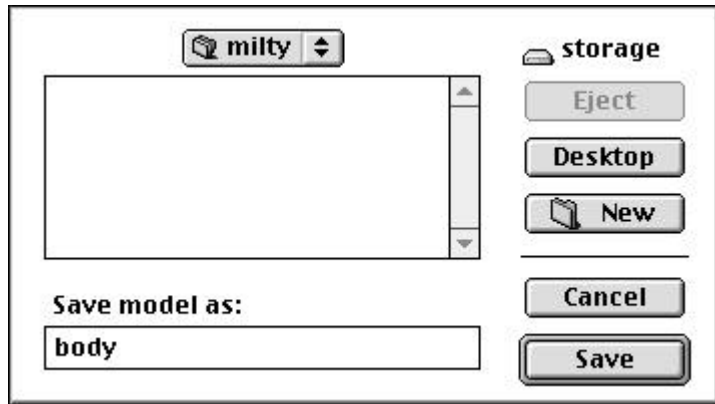
Choose the **File > Quick Render ( R )** menu item. After the rendering has finished, click the mouse button to return to *PiXELS*.



## 2. Save the model.

Choose the **File > Save** ( **S** ) menu item.

Save the model in the *milty* folder. Name the model body.



## 3. Quit PiXELS

Choose the **File > Quit** ( **Q** ) menu item.

In the next tutorial we will be creating a new project file. We could simply choose the **File > New** ( **N** ) menu item, but restarting *PiXELS* is preferred. Memory, like a hard disk, can become fragmented over time. Quitting *PiXELS* clears out all the memory used, allowing it to be reallocated upon launch.



## Tutorial 2: Primitives & ShaderMaker

### Launch *PiXELS*

If *PiXELS* is already running on your machine, choose the **File > Quit** ( **Q** ) menu item now.

1. *Launch PiXELS.*

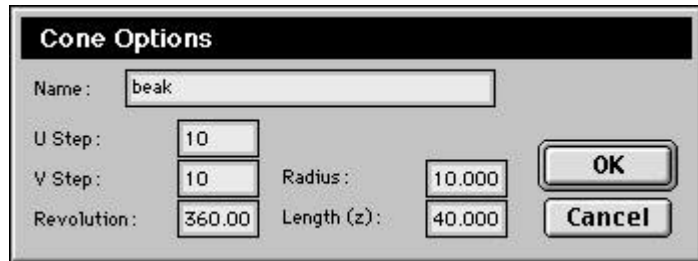
In the Finder, locate the *PiXELS* application icon. Double clicking on this icon will launch *PiXELS*.

### Create a Cone Primitive

Not all patches are constructed from manually drawn splines. *PiXELS* provides a wealth of basic building blocks, called *primitives*, from which you can construct many objects.

1. *Select the Shape > Cone tool.*

Click on the *Shape* tool group. Select the *Cone* tool. The **Cone Options** dialog will open.

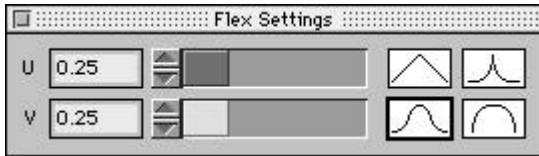


2. Change the name to beak and Click **OK**.

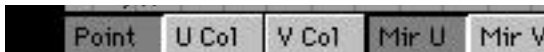
## Reshape the Primitive

Once a primitive has been created, it can be modified using any of the *Reshape* tools.

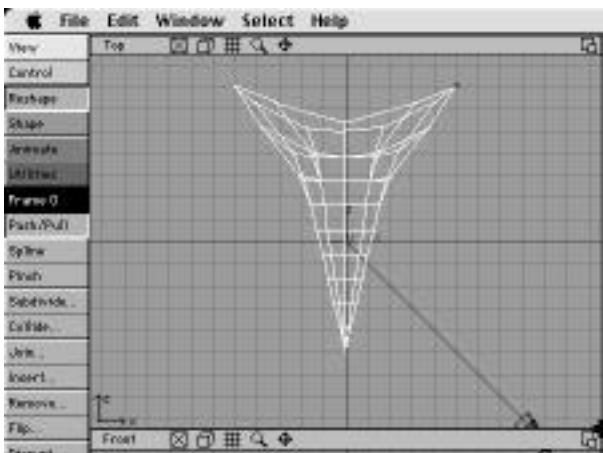
1. *Open the Flex dialog.*  
Click on the **Window** menu. Select the **Flex ( B )** menu item. The **Flex Settings** dialog will open.



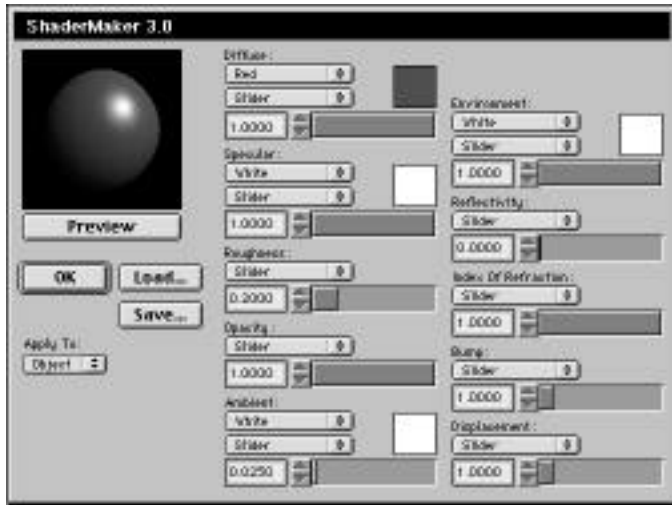
2. *Adjust the flex setting for the beak.*  
Set the **U** and **V** sliders as shown. Values can either be entered numerically or altered interactively using the sliders.
3. *Select the Mir U constraint.*  
Click on the *Mir U* constraint to select it. The constraints are located in the lower left corner of your screen.



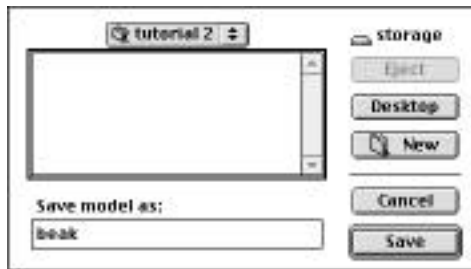
4. *Reshape the cone.*  
Select the *Reshape* tool group. Select the *Push/Pull* tool. In the top view, click on the cone's upper right control point. Click and drag as shown.



5. Use *ShaderMaker* to apply yellow color to beak.
- Click on the **Window** menu. Select the **ShaderMaker** ( W ) menu item. The **ShaderMaker** dialog will open. Select **Yellow** from the **Diffuse** color pop-up menu. Click **OK** to return to Pixels.



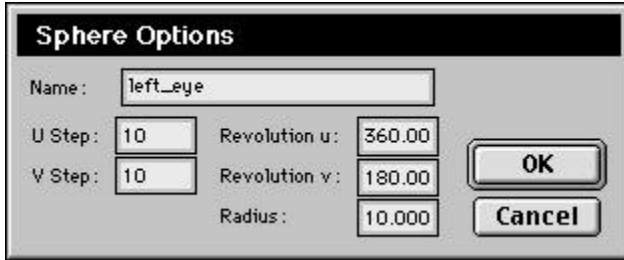
6. Save the model.
- Choose the **File > Save** ( S ) menu item.
- Save the model in the *milty* folder. Name the model beak.



7. Create a new scene.
- Choose the **File > New** ( N ) menu item. Since the last model we created was so simple, memory fragmentation is minimal. In this case, quitting and re-launching would be excessive.

## Create a Sphere Primitive

1. *Select the Shape > Sphere tool.*  
Click on the *Shape* tool group. Select the *Sphere* tool. The **Sphere Options** dialog will open.



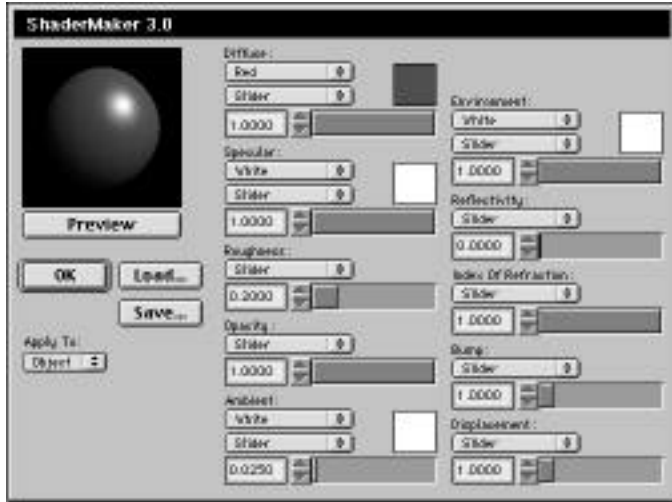
2. Change the name to left\_eye. Click **OK**.



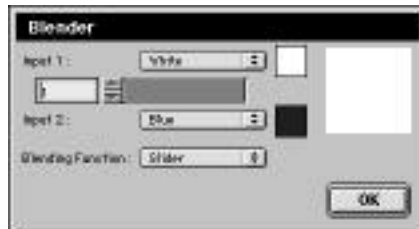
## Create an Eyeball Shader

OK, so we have a sphere. How are we going to make it look like an eyeball?

1. *Open the ShaderMaker dialog.*  
Click on the **Window** menu. Select the **ShaderMaker** ( **W**) menu item. The **ShaderMaker** dialog will open.

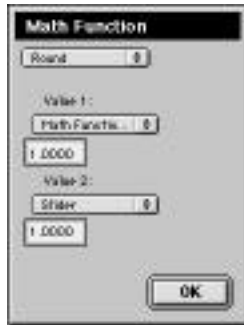


2. *Create a Blender node.*  
Select **Blender** from the first **Diffuse** pop-up menu. A **Blender** node will be created and a dialog will open allowing us to set initial parameters. Any parameter set now can always be edited later. Select **Black** from the **Input 1** pop-up menu. Select **White** from the **Input 2** pop-up menu. Set the slider to 1.



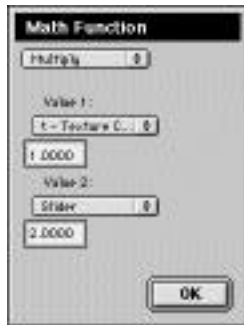
3. Create two **Math Function** nodes.

Select **Math Function** from the first **Blending Function** pop-up menu. A **Math Function** node will be created and a dialog will open. Select **Round** from the **Math Function** pop-up menu and **Math Function** from the **Value 1** pop-up menu. A second **Math Function** node will be created and another dialog will open.



4. Setup our **Math Function** parameters.

Select **Multiply** from the **Math Function** pop-up menu. Select **t - Texture Coordinate** from the **Value 2** pop-up menu. Set the scale factor for **Value 1** to 2. Click **OK** in all four dialogs.



5. *Render our eyeball.*

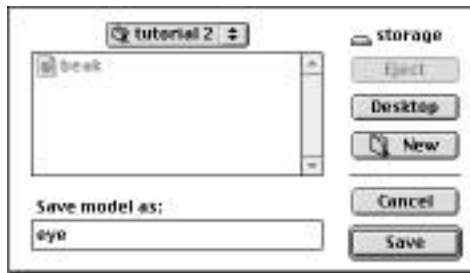
Use the **File > Quick Render ( R )** menu item to render our eyeball. Click the mouse to return to *PiXELS*.



6. *Save the model.*

Choose the **File > Save ( S )** menu item.

Save the model in the *milty* folder. Name the model eye.



## How'd We Do That?

Before we can understand how the eyeball shader works, we must first have a solid understanding of the sphere we are shading. Like all *PiXELS'* primitives, the sphere is made from a *patch*. All patches can be *unraveled* into a rectangular grid—even our sphere. This underlying grid is *parameterized* using a 2D coordinate system. To help differentiate between the standard 3D coordinate system,  $x$  and  $y$  are not used to label this coordinate system. Instead we use  $s$  and  $t$  as labels ( $u$ ,  $v$  and  $w$  are commonly used to label *yet another* coordinate system). Any point within this grid can be defined using  $s$  and  $t$  coordinates which range from 0 to 1. The exact center of the grid would be at  $\{0.5, 0.5\}$  in  $st$  space.

We can use this parameterized coordinate system to create some interesting shaders. Our eyeball shader is a good example of this. The blending between black and white is controlled by a rounded, scaled  $t$  coordinate. The exact function is  $\text{round}(t * 2.0)$ .

Let's examine this in depth.

The **Blender** node mixes **Input 1** with **Input 2** based on the value returned by the **Blending Function**. So, if **Input 1** was white, **Input 2** was black and the **Blending Function** returned a value of 0.5, the **Blender** node would return grey.

The round function returns the nearest whole number. So  $\text{round}(0.2)$  would return 0,  $\text{round}(0.6)$  would return 1 and  $\text{round}(0.5)$  would also return 1.

If  $t$  ranges from 0 to 1 and we use  $\text{round}(t)$  as a **Blending Function** from black to white, the **Blender** node will return white if  $t$  is greater than or equal 0.5. As such, we would get a shader that is half black and half white.

In the eyeball shader we are using black to represent the iris & pupil. This generally covers only about 25% of the eye, so we need to scale  $t$  so that it will round up to 1 after only 25% of the eye is filled with black. To do this, we multiply  $t$  by 2. Notice that  $t * 2$  will range from 0 to 2, instead of 0 to 1.

So, if  $2t$  ranges from 0 to 2 and we use  $\text{round}(2t)$  as a **Blending Function** from black to white, the **Blender** node will return white if  $2t$  is greater than or equal 0.5. As such, we would get a shader that is 25% black and 75% white.

Once we have this function, we simply convert it into a shader.

## Tutorial 3: Putting It All Together

### Launch *PiXELS*

If *PiXELS* is already running on your machine, choose the **File > Quit** ( **Q** ) menu item now.

1. *Launch PiXELS.*

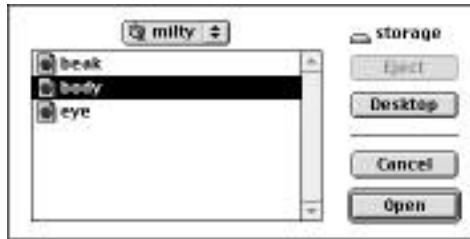
In the Finder, locate the *PiXELS* application icon. Double clicking on this icon will launch *PiXELS*.

### Import Body Parts

We now have 3 separate files. We will need to import them into one scene to create our finished character.

1. *Open the body model.*

Use the **File > Open** ( **O** ) menu item to load the body scene.



2. *Import the beak model.*

Use the **File > Import > PiXELS** menu item to import the beak model.

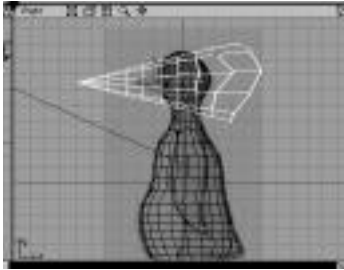


## Position and Scale the Beak

The beak is a little too big for the body. We will need to reposition and resize it to fit.

1. *Move the beak.*

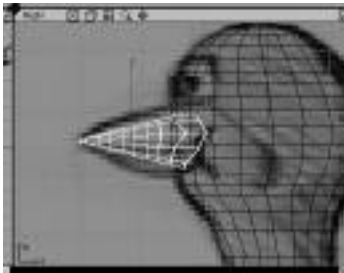
Use the *Control > Move* tool to position the beak as shown.



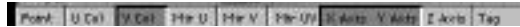
2. *Scale the beak.*

Use the *Pan* and *Zoom* tools to zoom in on the head as shown. Use the *Control > Scale* tool to resize the beak.

Don't worry about trying to match the height, just scale it so the width matches our sketch.



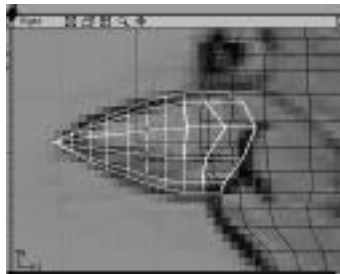
3. *Reshape the beak.*  
Disable the *Z Axis* constraint.



Use the **Window > Flex ( B )** menu item to open the **Flex Settings** palette. Set **U** and **V** to 0.



Use the *Reshape > Pinch* tool to constrict each beak cross section. The beak should now match our sketch.



## Import Body Parts

We now have 3 separate files. We will need to import them into one scene to create our finished character.

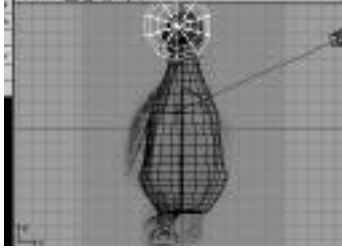
1. *Import the eye model.*  
Use the **File > Import > PiXELS** menu item to import the eye model.



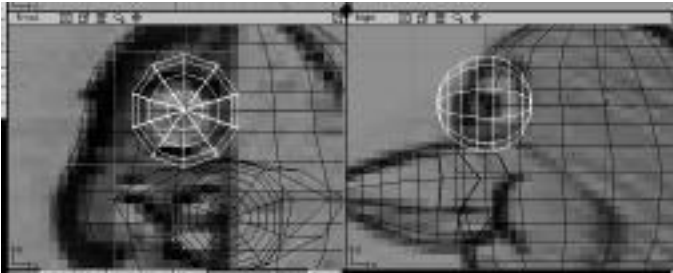
## Position and Scale the Eyes

Like the beak, the eye is a too big for the body. We will need to reposition and resize it to fit.

1. *Move the eye.*  
In the Front view, use the *Control > Move* tool to position the eye as shown.



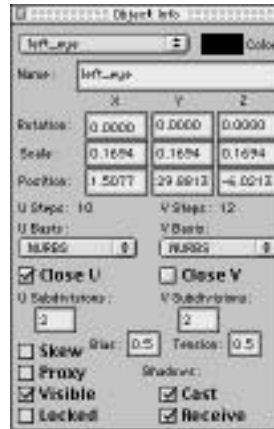
2. *Scale the eye.*  
Enable the *Z Axis* constraint. Use the *Pan* and *Zoom* tools to zoom in on the head as shown. Use the *Control > Scale* tool to resize the eye.





### 3. Move the eye.

Use the **Window > Object Info** ( **I** ) menu item to open the **Object Info** dialog. Remove the negative sign from the **X Position** parameter, moving the eye to the right of center in the Front view.



### 4. Create the right eye.

Use the **Edit > Duplicate** ( **D** ) menu item to create a duplicate of the eye. In the **Object Info** dialog, add a negative sign in front of the **X Position** parameter, moving the eye to the left of center in the Front view. Change this object's name to right\_eye.

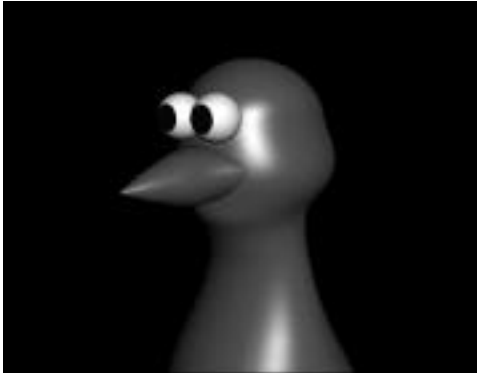


## Check Our Work And Save

Let's see what we've got and save our current state to disk.

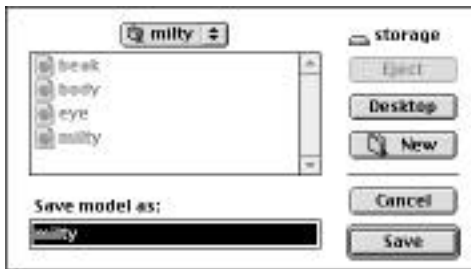
1. *Render Milty.*

Use the **File > Quick Render ( R )** menu item to render our character.



2. *Save.*

Use the **File > Save As...** menu item to save our composited character to disk. Name the file milty.



## Model The Legs

Now that we've got the head done, let's concentrate on his legs.

1. *Create a cylinder.*

Use the *Shape > Cylinder* tool to open the **Cylinder Options** dialog. Set the parameters as shown and click **OK**.



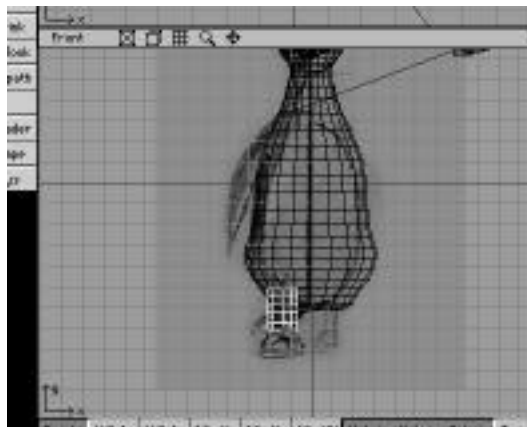
2. *Rotate the leg 90°.*

In the **Object Info** palette, set the **X Rotation** parameter to 90. Make sure the cursor is inside the palette and type the **return** key to apply.



3. *Position the leg.*

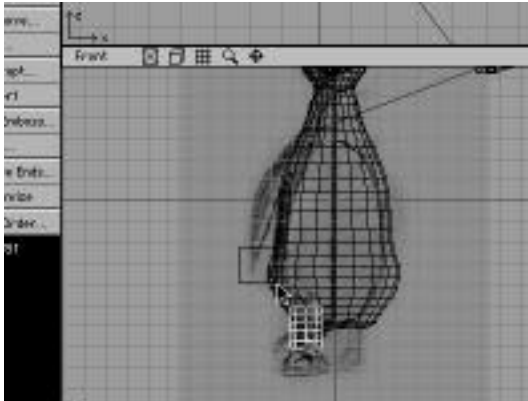
In the Front view, position the leg as shown.



4. *Set our constraints.*  
Set the axis constraints as shown.



5. *Merge the leg and body.*  
Select the *Reshape > Collide* tool. Click and drag a marquis as shown to pick the body.



The **Collide Options** dialog will open. Click **OK**.



6. *Make the left leg.*  
Select the *Reshape > Flip* tool. The **Flip Options** dialog will open. Set the parameters as shown and click **OK**.

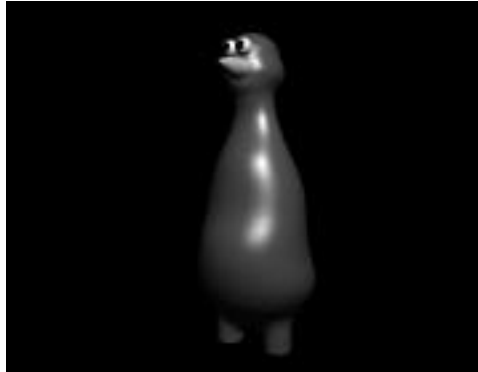


## Check Our Work And Save

Let's see what we've got and save our current state to disk.

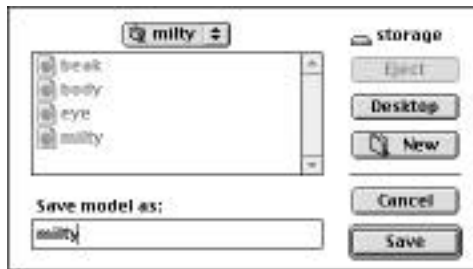
1. *Render Milty.*

Use the **File > Quick Render ( R )** menu item to render our character.



2. *Save.*

Use the **File > Save As...** menu item to save our composited character to disk. Name the file milty.





## Tutorial 4: Blend Surfaces

### Launch *PiXELS*

If *PiXELS* is already running on your machine, choose the **File > Quit** (**Q**) menu item now.

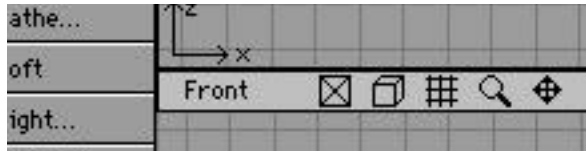
1. *Launch PiXELS.*

In the Finder, locate the *PiXELS* application icon. Double clicking on this icon will launch *PiXELS*.

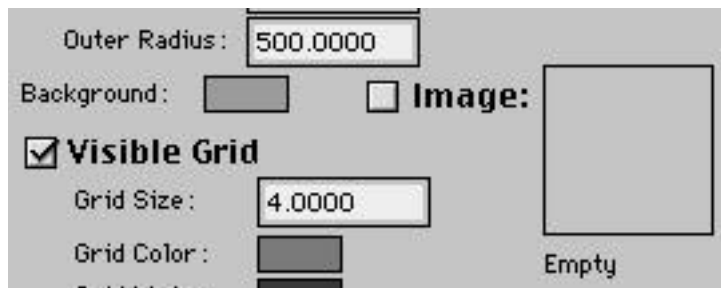
### Import Background Images

As in tutorial 1, we will use pencil sketches as guides.

1. *Open the View Options dialog for the front view.*  
Click on the word *Front* in the title bar of the lower left viewing pane. This opens the **View Options** dialog.

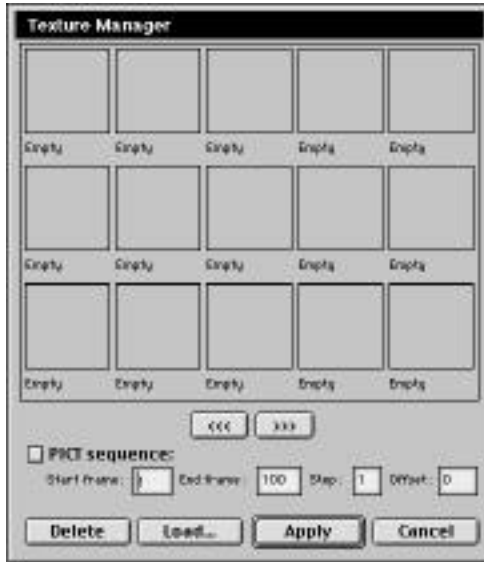


2. *Open the Texture Manager dialog.*  
Select the **Image** checkbox, then click on the empty box to the right of the **Image:** checkbox to open the **Texture Manager** dialog.



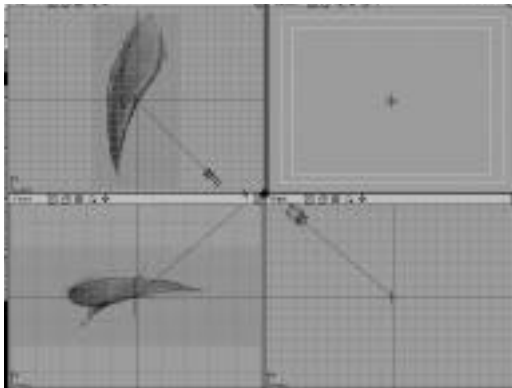
3. *Load a background image.*

Click on any empty box. The standard file dialog will open. Navigate to the *sketches* folder located inside the *tutorials* folder. Open the file inside titled *milty\_wing\_front*. Click the **OK** button to open this texture. Click the **Apply** button in the **Texture Manager** dialog to return to the **View Options** dialog. Click the **OK** button in the **View Options** dialog to return to *PiXELS*.



4. *Repeat for top view.*

Repeat steps 1 - 3 for the top view, this time loading the file titled *milty\_wing\_top*.



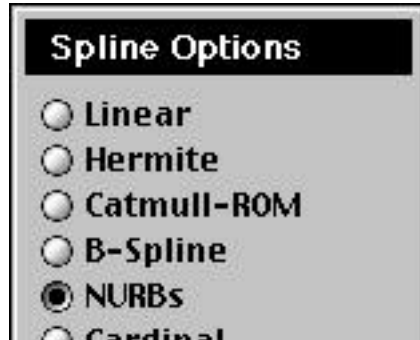


## Trace Templates

Now that we have our background images loaded, we can use them as templates to trace the wing.

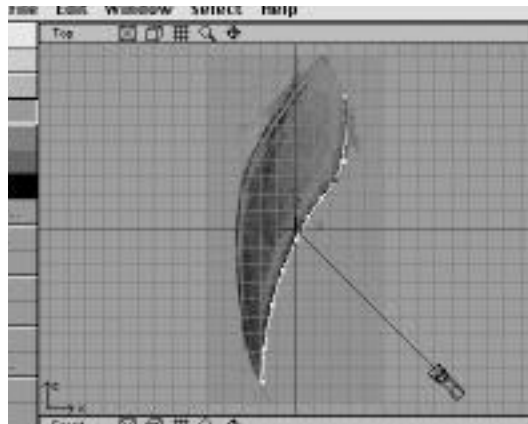
1. *Select the Shape > Spline tool.*

Click on the *Shape* tool group. Select the *Spline* tool. The **Spline Options** dialog will open. Select the **NURBs** option and click **OK**.



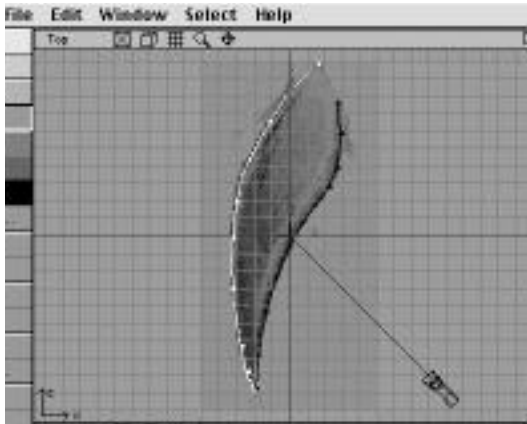
2. *Trace the top-right template.*

In the top view, working top to bottom, trace the right half of the wing only. Double click to finish drawing the spline. If the double click doesn't take, type the **esc** key. Using the **Object Info** palette, rename this spline wing\_right.



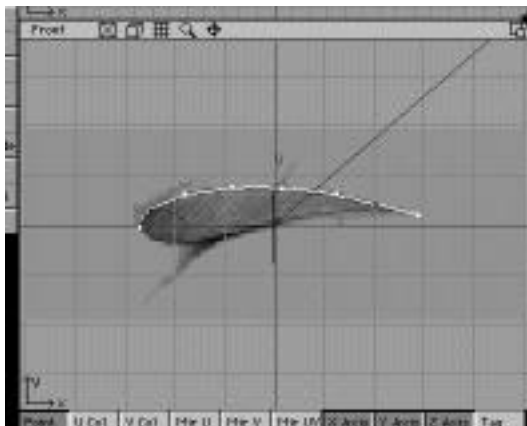
3. *Trace the top-left template.*

In the top view, working top to bottom, trace only the left half of the wing. Double click to finish drawing the spline. If the double click doesn't take, type the **esc** key. Using the **Object Info** palette, rename this spline wing\_left. We should have 2 separate splines outlining the top contours of the wing.



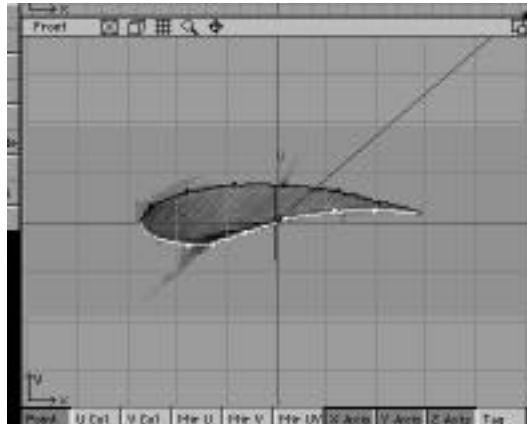
4. *Trace the front-top template.*

In the front view, working left to right, trace only the top half of the wing. Double click to finish drawing the spline. If the double click doesn't take, type the **esc** key. Using the **Object Info** palette, rename this spline wing\_top.



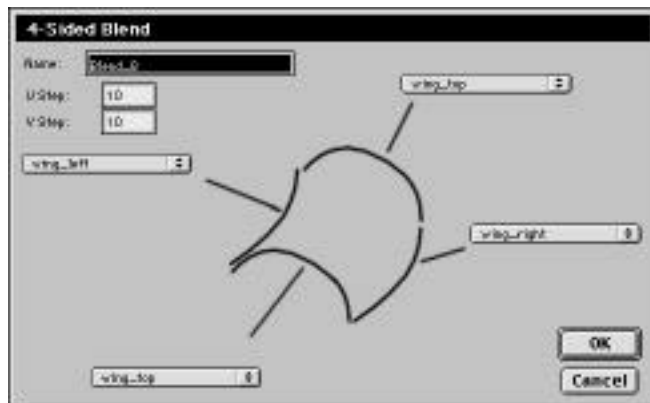
5. *Trace the front-bottom template.*

In the front view, working left to right, trace only the bottom half of the wing. Double click to finish drawing the spline. If the double click doesn't take, type the **esc** key. Using the **Object Info** palette, rename this spline wing\_bottom. We should have 2 separate splines outlining the front contours of the wing, for a total of 4 splines outlining the wing.



6. *Create the top of the wing.*

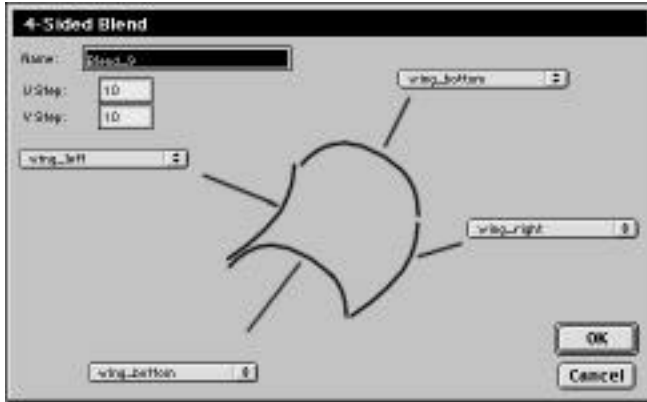
Select the **Shape > 4-Side Blend** tool. The **4-Sided Blend** dialog will open. Set the parameters as shown and click **OK**.



Note: We are not changing the name of the object. If you prefer, you could change the name to wing.

7. *Create the bottom of the wing.*

Select the *Shape > 4-Side Blend* tool. The **4-Sided Blend** dialog will open. Set the parameters as shown and click **OK**.



8. *Check the bottom wing's normals.*

Select the **Window > View > Normals** ( / ) menu item. The surface normals will appear. They show us which direction the selected patch is facing.



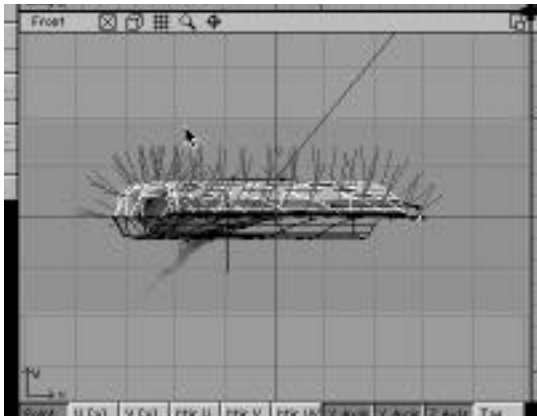
9. *Check the top wing's normals.*

Select the top half of the wing. Notice how the normals are facing inward, unlike the bottom half of the wing.



10. *Flip the top wing's normals.*

Use the *Reshape > Invert* tool to flip the surface normals for the selected object.



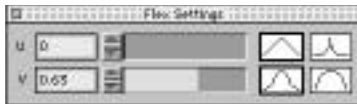
11. *Join the top and bottom halves.*

Select the *Reshape > Join* tool. Click any vertex on the bottom half of the wing to pick it. The **Join Options** dialog will open. Make sure the parameters are set as shown and click **OK**.

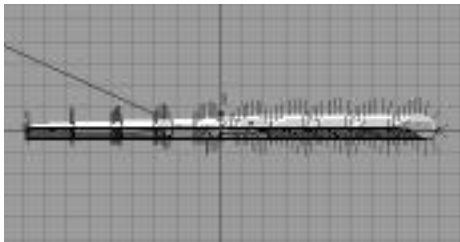


12. *Pinch the wing tip.*

Select the *X Axis* and *Z Axis* constraints to deactivate them. The *Y Axis* should be the only axis constraint active. Set the flex settings as shown.

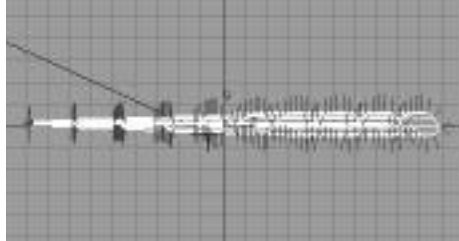


Use the *Reshape > Pinch* tool to pinch the wing tip closed on one end as shown.



13. *Delete everything else.*

Use the **Edit > Hide Selected** ( **3** ) menu item to hide the completed wing. Select and delete the bottom half of the wing and each of the boundary splines. Use the **Edit > Show All** ( **4** ) menu item to make the wing visible again.



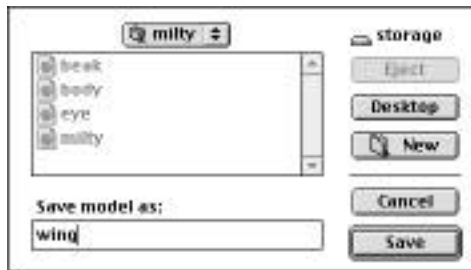
14. *Render the wing.*

Use the **File > Quick Render** ( **R** ) menu item to render the wing. Click the mouse button to return to PiXELS.



15. *Save the model.*

Choose the **File > Save** ( **S** ) menu item.  
Save the model in the *milty* folder. Name the model wing.  
Quit PiXELS.







## Tutorial 5: Articulation

### Launch *PiXELS*

If *PiXELS* is already running on your machine, choose the **File > Quit** ( **Q** ) menu item now.

1. *Launch PiXELS.*

In the Finder, locate the *PiXELS* application icon. Double clicking on this icon will launch *PiXELS*.

### Add The Wing To The Body.

1. *Open the milty model.*

Use the **File > Open** ( **O** ) menu item to load the milty scene.

2. *Import the wing model.*

Use the **File > Import > PiXELS** menu item to import the wing model.



### Size And Position The Wing.

The imported wing is too large, and is improperly oriented. We will need to rotate, scale and position the wing to fit the body.

1. *Rotate the wing.*

Use the **Object Info** ( **O** ) dialog to set the **X Rotation** and **Z Rotation** as shown..



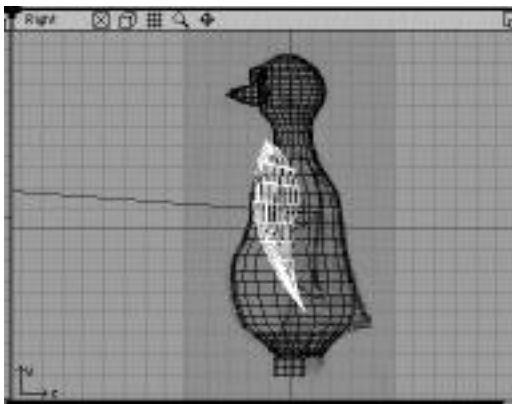
2. *Park the rotations.*

Use the *Control > Park* tool to realign the rotated wing with world space.



3. *Size the wing.*

Use the *Control > Scale* tool to size the wing as shown.



4. *Park the wing.*

Use the *Control > Park* tool to realign the scaled wing with world space.

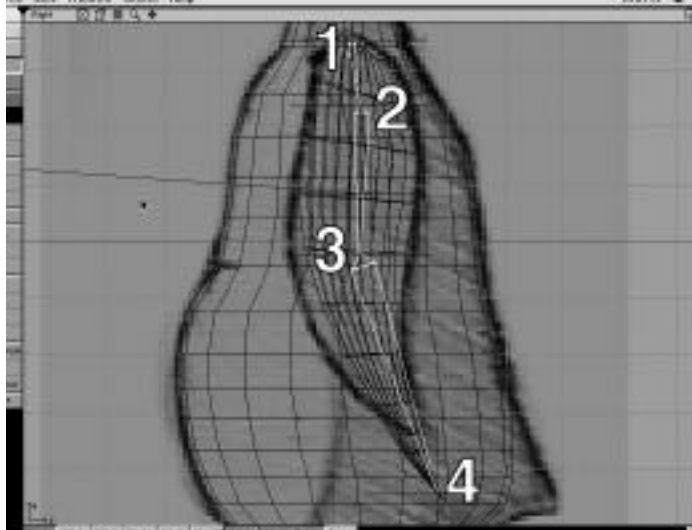


## Articulate The Wing.

If we want to animate the wing doing anything other than simple movements or rotations, we will need to *articulate* it. We do this by adding an *Inverse Kinematic (IK) Chain* to the wing.

1. *Create an IK chain.*

Use the *Shape > IK Chain* tool to draw an IK Chain as shown.



2. *Name the IK chain.*

The **IK Chain Options** dialog will open. Set the **Name** parameter to: wing\_ik.



3. Switch to Schematic view.

Open the **View Options** dialog for the Front view. Select **Schematic** from the **View** pop-up menu. Click the **OK** button.



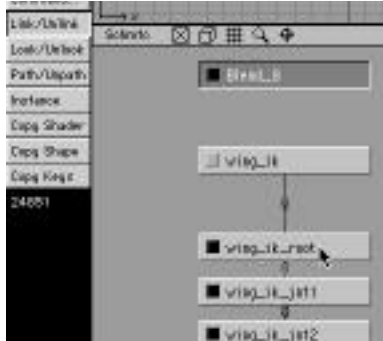
4. Select the wing.

Hold down the **key** and click on the *Blend\_8* (or *wing*) tile in the Schematic view to select it.



## 5. Link the wing to the IK Chain.

Select the **Control > Link/Unlink** tool. In the Schematic view, click on the *wing\_ik\_root* tile.



The **Link Options** dialog will open. Click the **OK** button.



Notice how the *Blend\_8* tile is now positioned under the *wing\_ik* tile. This indicates that *Blend\_8* is now a child of *wing\_ik*. The *Blend\_8* tile can be manually repositioned. In fact, any tile can be moved in the Schematic view without effecting the model it represents. Use the **Control > Move** tool to move a tile.



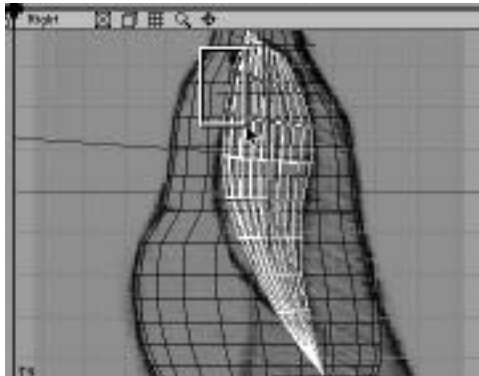
6. *Set up the constraints.*

Click on the *V Col* and *Tag* constraints to select them.



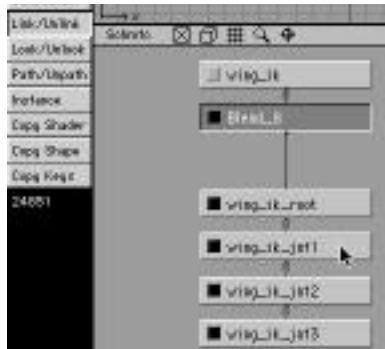
7. *Tag some points.*

In the right view, -click and drag a rectangle as shown to tag all the points on the 2nd and 3rd v step.



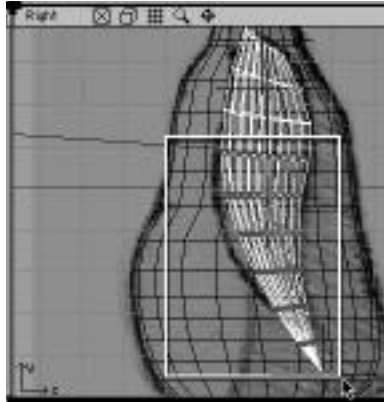
8. *Link these points to the 1st joint in the IK Chain.*

In the Schematic view, click on the *wing\_ik\_jnt1* tile to pick it. The tagged points will link to this joint.



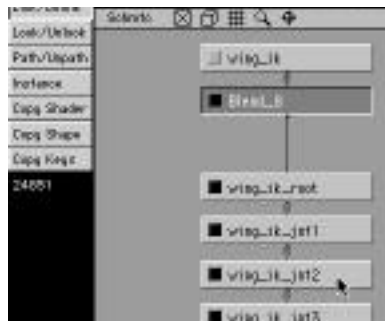
9. *Tag some more points.*

In the right view, -click and drag a rectangle as shown to tag all the points on from the 4th v step down.



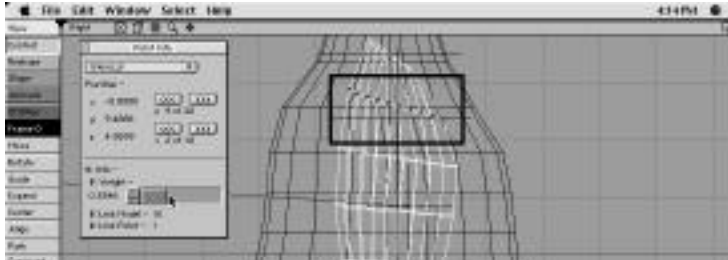
10. *Link these points to the 2nd joint in the IK Chain.*

In the Schematic view, click on the *wing\_ik\_jnt2* tile to pick it. The tagged points will link to this joint.

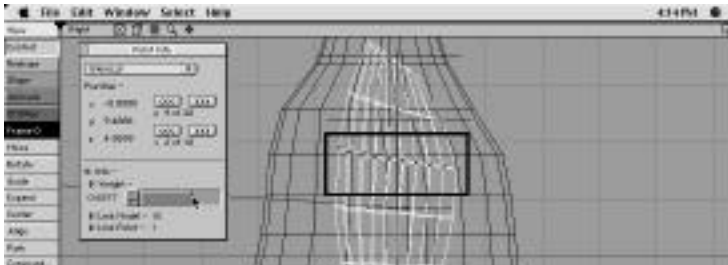


11. *Weight the v steps around the 1st joint.*

Open the **Point Info** ( **P** ) palette. -click and drag a rectangle, selecting all the points in the 2nd v step. Set the **IK Weight** slider to 0.33.



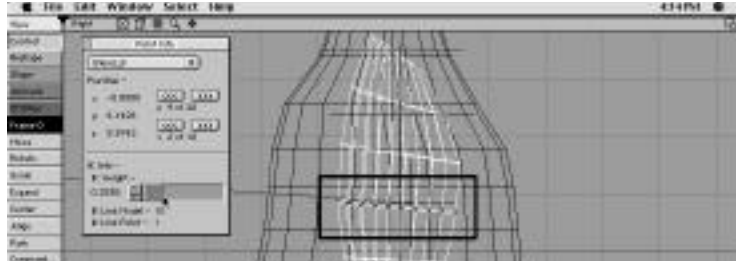
-click and drag a rectangle, selecting all the points in the 3rd v step. Set the **IK Weight** slider to 0.66.



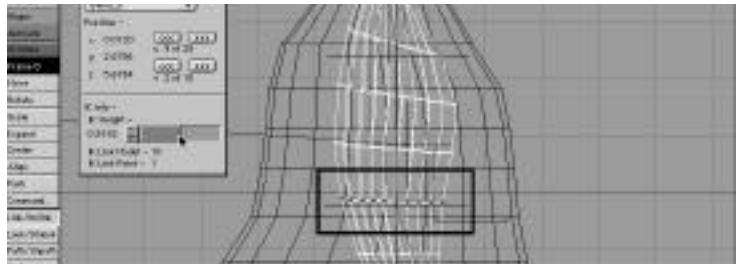


## 12. Weight the v steps around the 2nd joint.

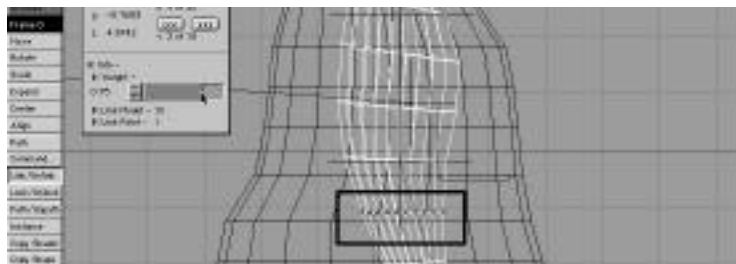
-click and drag a rectangle, selecting all the points in the 4th v step. Set the **IK Weight** slider to 0.25.



-click and drag a rectangle, selecting all the points in the 5th v step. Set the **IK Weight** slider to 0.5.

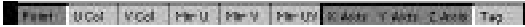


-click and drag a rectangle, selecting all the points in the 6th v step. Set the **IK Weight** slider to 0.75. Close the **Point Info** palette.



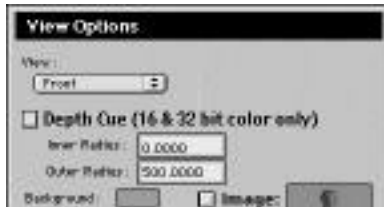
1. *Set up the constraints.*

Click on the *Point* constraint to select it. Click on the *Tag* constraint to deselect it.



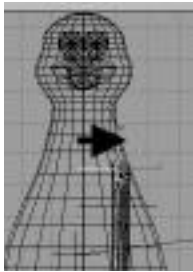
2. *Switch to Front view.*

Open the **View Options** dialog for the Schematic view. Select **Front** from the **View** pop-up menu. Click the **OK** button.

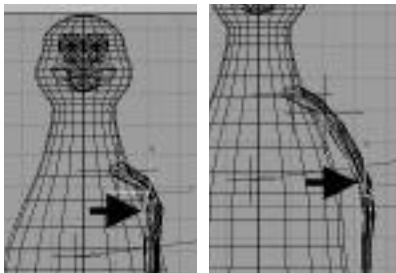


3. *Pose the wing.*

In the Front view, select and move *wing\_ik\_root* as shown.



Select and move *wing\_ik\_jnt1* and *wing\_ik\_jnt2* as shown.



## Create And Pose A Second Wing.

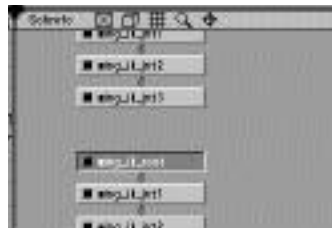
1. *Switch to Schematic view.*  
Open the **View Options** dialog for the Right view. Select **Schematic** from the **View** pop-up menu. Click the **OK** button.



2. *Select the parent of the wing hierarchy.*  
In the Schematic view, -click on the *wing\_ik\_root* tile. It will indent when selected.



3. *Duplicate the entire wing.*  
Use the **Edit > Duplicate Hierarchy** menu item to create a copy of the entire wing. -click on the new *wing\_ik\_root* tile. It will be below the original in the Schematic view.



## 4. *Position the new wing.*

Open the **Object Info** ( **I** ) palette. Type a minus sign in front of the **X Position** parameter. Rename to wing2\_ik\_root. Note: it may be helpful to organize the various wing components in the schematic view, placing the right wing to the right of center and the left wing to the left of center.

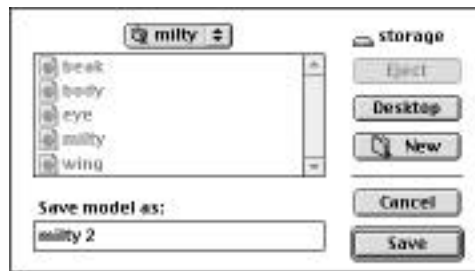


Repeat this for wing\_ik\_jnt1 and wing\_ik\_jnt2. Rename these to wing2\_ik\_jnt1 and wing2\_ik\_jnt2.



## 5. *Render and save.*

Use the **File > Quick Render** ( **R** ) menu item to check the appearance of Milty. Save the current scene as milty 2.

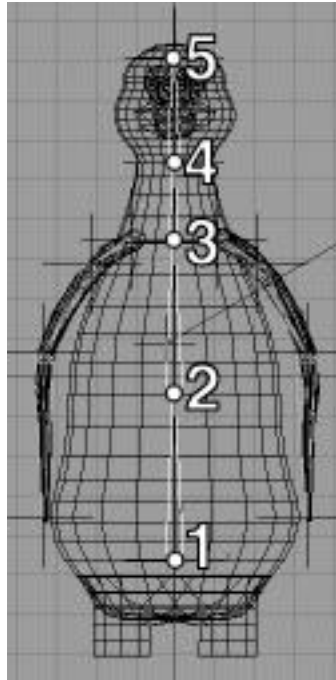


## Articulate The Body.

If we want to animate the body doing anything other than simple movements or rotations, we will need to *articulate* it. We do this by adding an IK Chain to the body.

1. *Create an IK chain.*

Use the *Shape > IK Chain* tool to draw an IK Chain as shown.



2. *Name the IK chain.*

The **IK Chain Options** dialog will open. Set the **Name** parameter to: backbone\_ik.



# PiXELS Tutorials

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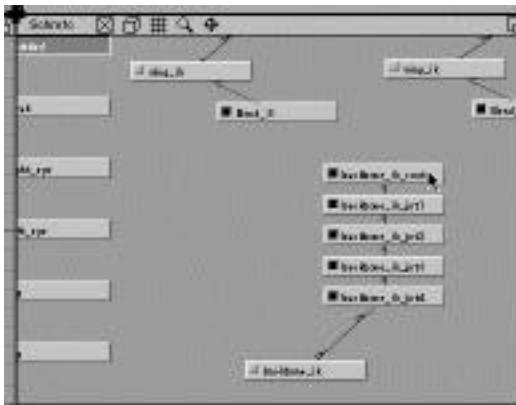
## 3. Rename the body.

-click on the body to select it. In the **Object Info** palette, change the name from Untitled to body.



## 4. Link the body to the IK Chain.

Select the **Control > Link/Unlink** tool. In the Schematic view, click on the *backbone\_ik\_root* tile.



The **Link Options** dialog will open. Click the **OK** button.



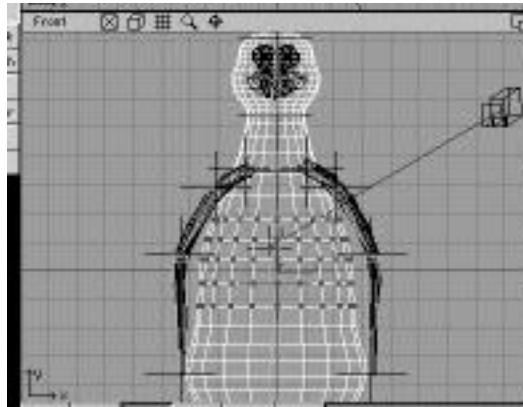
5. *Set up the constraints.*

Click on the *V Col* and *Tag* constraints to select them.



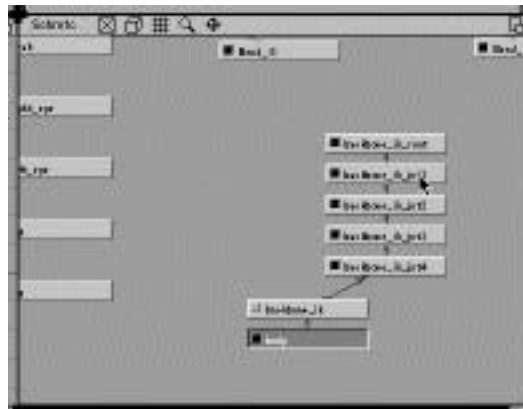
6. *Tag some points.*

In the Front view, -click and drag a rectangle to tag all the points shown.



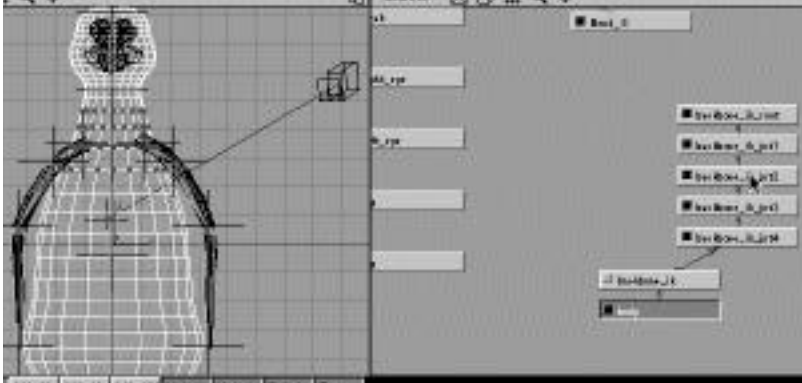
7. *Link these points to the 1st joint in the IK Chain.*

In the Schematic view, click on the *backbone\_ik\_jnt1* tile to pick it. The tagged points will link to this joint.



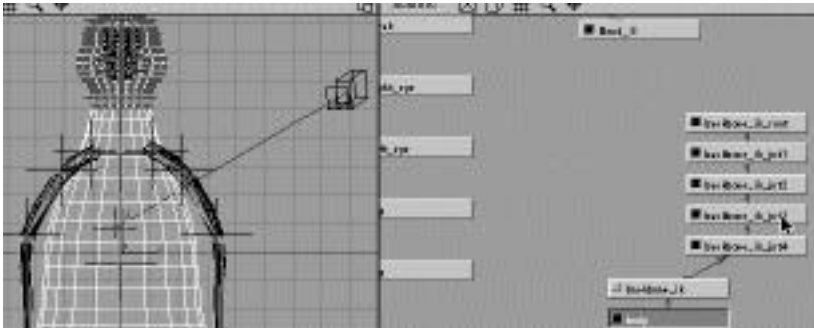
8. *Tag and Link points to the 2nd joint in the IK Chain.*

In the Front view, -click and drag a rectangle to tag all the points indicated. In the Schematic view, click on the *backbone\_ik\_jnt2* tile to pick it. The tagged points will link to this joint.



9. *Tag and Link points to the 3rd joint in the IK Chain.*

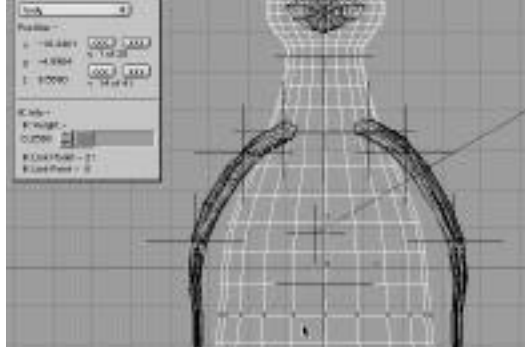
In the Front view, -click and drag a rectangle to tag all the points indicated. In the Schematic view, click on the *backbone\_ik\_jnt3* tile to pick it. The tagged points will link to this joint.



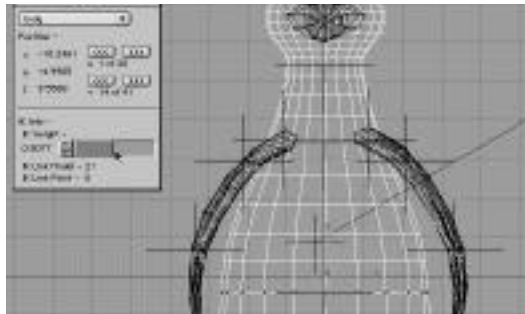


## 10. *Weight the v steps around the 1st joint.*

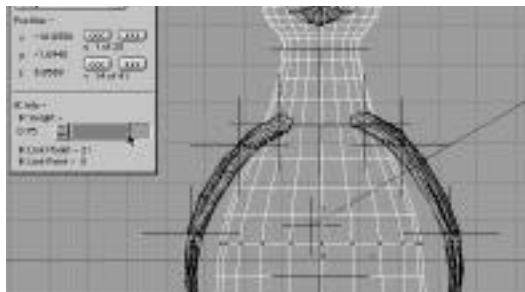
Open the **Point Info** ( **P** ) palette. -click and drag a rectangle, selecting all the points in the v step just below the 1st IK joint. Set the **IK Weight** slider to 0.25.



-click and drag a rectangle, selecting all the points in the v step directly over the 1st IK joint. Set the **IK Weight** slider to 0.5.

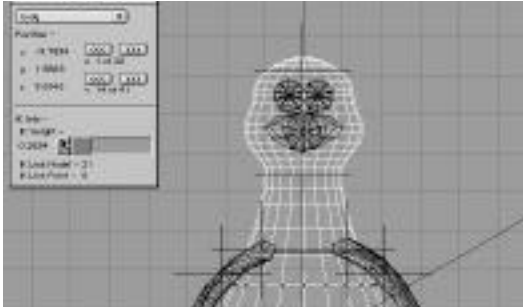


-click and drag a rectangle, selecting all the points in the v step just above the 1st IK joint. Set the **IK Weight** slider to 0.75.

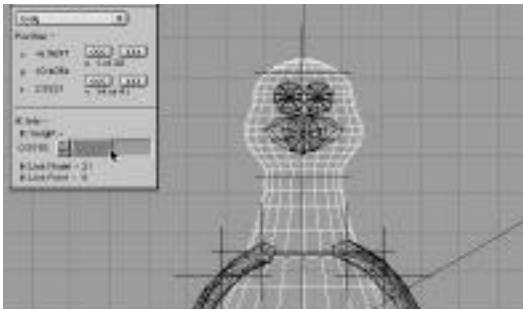


## 11. *Weight the v steps around the 2nd joint.*

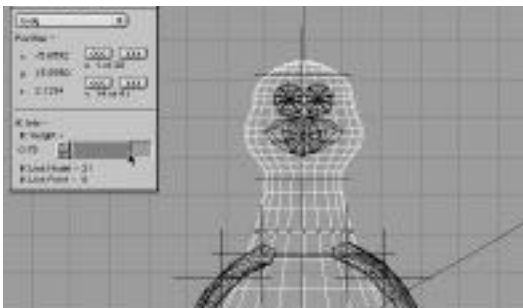
-click and drag a rectangle, selecting all the points in the v step just below the 2nd IK joint. Set the **IK Weight** slider to 0.25.



-click and drag a rectangle, selecting all the points in the v step directly over the 2nd IK joint. Set the **IK Weight** slider to 0.5.

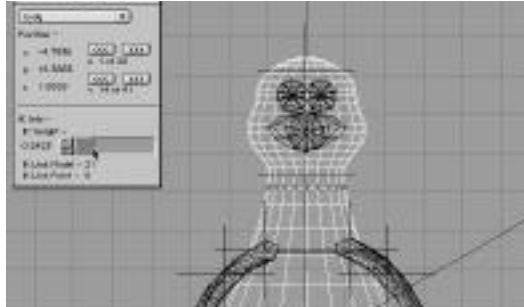


-click and drag a rectangle, selecting all the points in the v step just above the 2nd IK joint. Set the **IK Weight** slider to 0.75.

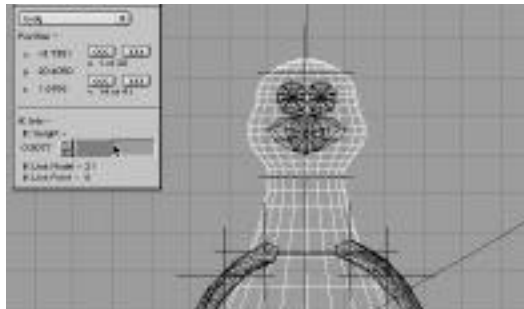


## 12. *Weight the v steps around the 3rd joint.*

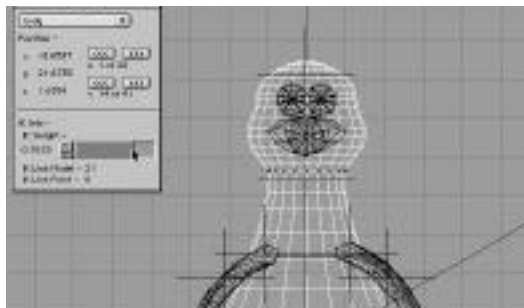
-click and drag a rectangle, selecting all the points in the v step just below the 3rd IK joint. Set the **IK Weight** slider to 0.25.



-click and drag a rectangle, selecting all the points in the v step directly over the 3rd IK joint. Set the **IK Weight** slider to 0.5.



-click and drag a rectangle, selecting all the points in the v step just above the 3rd IK joint. Set the **IK Weight** slider to 0.75.



## Link Parts To Body.

The wings and the body are now articulated, but if we move the body the wings will not remain attached. To correct this, we need to link the wing's IK chain to the body's IK chain.

1. *Setup constraints.*

Click on the *Tag* constraint to deselect it.



2. *Link the wing to the body.*

In the Schematic view, -click on the *wing\_ik\_root* tile.

Select the *Control > Link/Unlink* tool. In the Schematic view, click on the *backbone\_ik\_jnt1* tile.



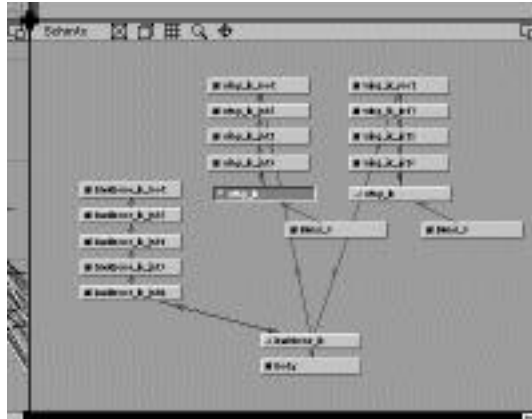
The **Link Options** dialog will open. Click **OK**.



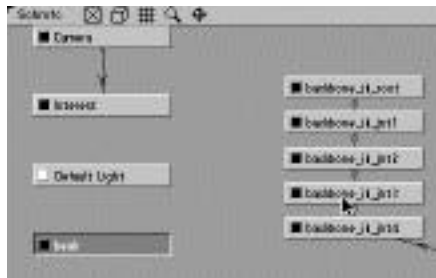
Repeat this for the duplicate *wing\_ik\_root*.

### 3. *Rearrange Schematic view.*

As objects are linked, the *Schematic* view will adjust to indicate changes in the hierarchical relationships between objects. It is often necessary to rearrange object tiles to accommodate your workflow. Arrange the tiles as shown.



4. In the Schematic view, -click on the *beak* tile. Select the Control > Link/Unlink tool. In the Schematic view, click on the *backbone\_ik\_jnt3* tile.

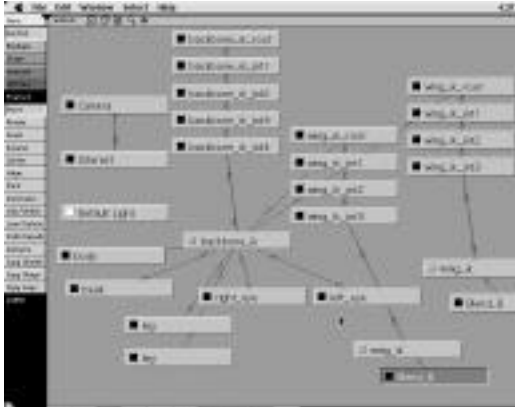


An alert dialog will open. Click the **Park** button. The **Link Options** dialog will open. Click the **OK** button.



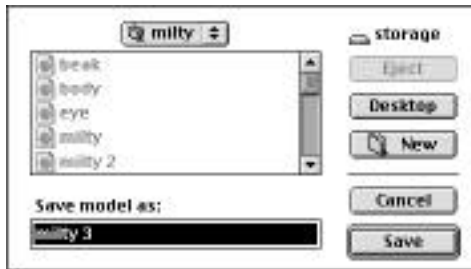
5. *Link the eyes and legs.*

Link both eyes to *backbone\_ik\_jnt3*. Link both legs to *backbone\_ik\_root*. Arrange the tiles as shown.



6. *Save.*

Save the scene as milty 3.



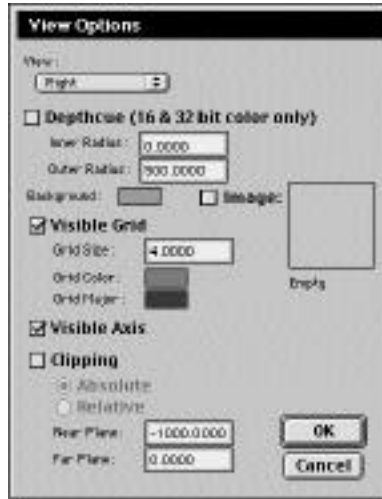
Do not quit the application.

## Tutorial 6: Texture

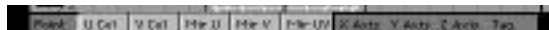
### Export A Tag Map Of The Body.

1. Switch to Right view.

Open the **View Options** dialog for the Schematic view. Select **Right** from the **View** pop-up menu. Click the **OK** button.

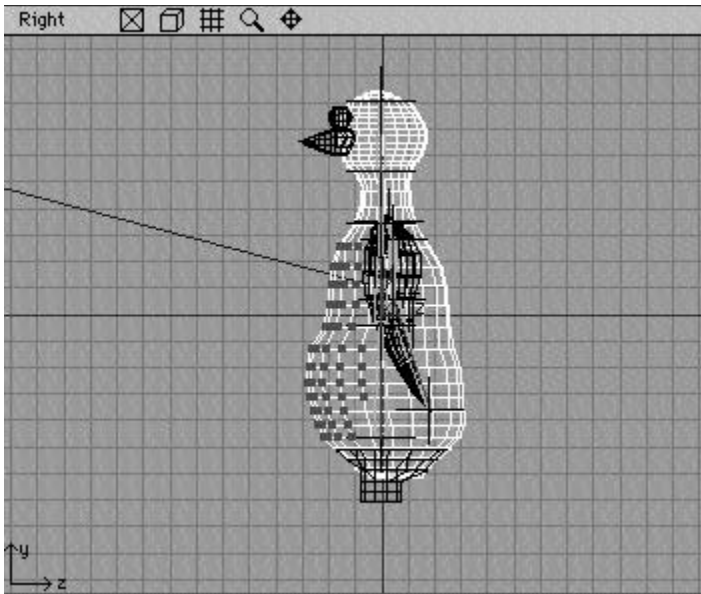


2. Set up the constraints.  
Click on the *Point* constraint to select it.



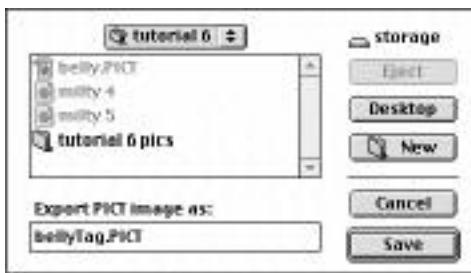
3. *Tag some points.*

In the Right view, -click and drag a rectangle to tag all the points shown.



4. *Export a tag map.*

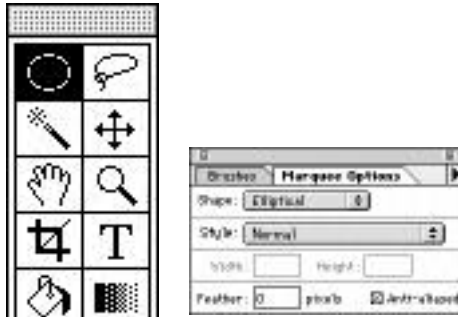
Use the **File > Export > Tag Map** menu item to export a PICT image depicting all the tagged points on the currently selected object. Name the image bellyTag.PICT.



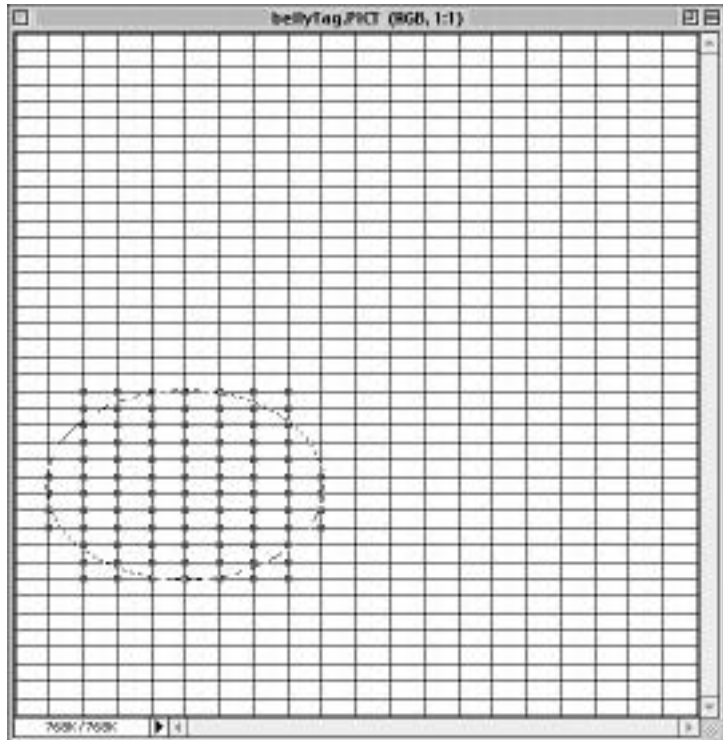



## Use The Tag Map To Create A Texture Map.

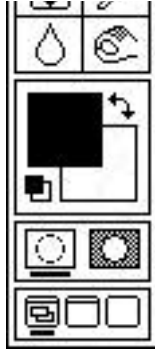
1. *Open the tag map in an Image editor.*  
Open *bellyTag.PICT* in your favorite image editor. For this tutorial we will use *PhotoShop™*. Select the marquee tool. Change the marquee shape to elliptical.



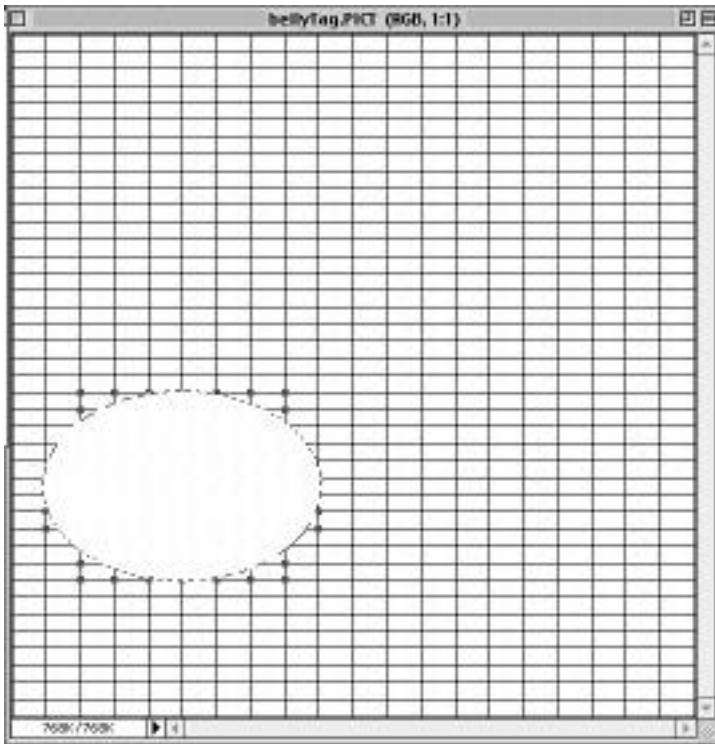
2. *Marquee the tagged points.*  
Use the marquee tool to select the tagged points as shown.



3. Set the foreground and background colors.  
Click on the  icon to set the foreground color to black and the background color to white.

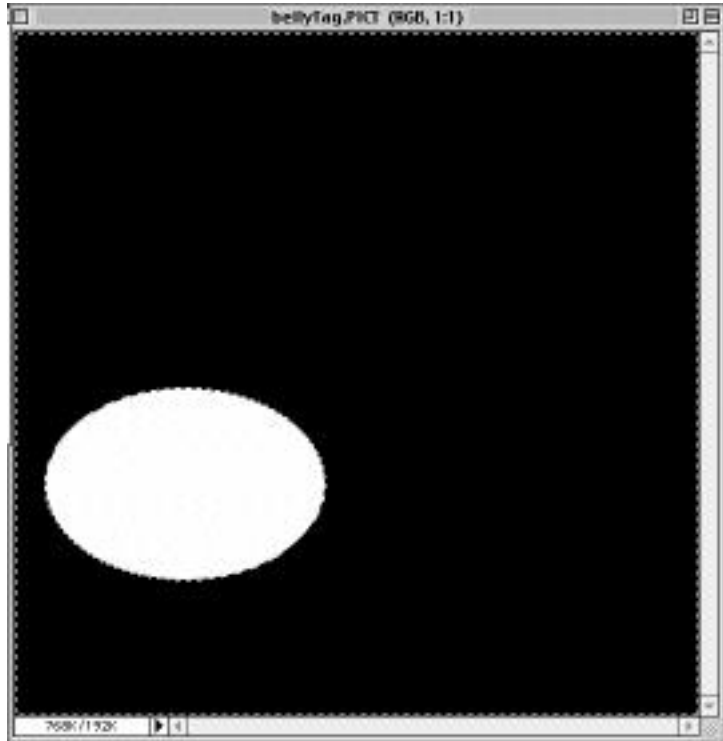


4. *Fill the selection.*  
Fill the selection with the background color.



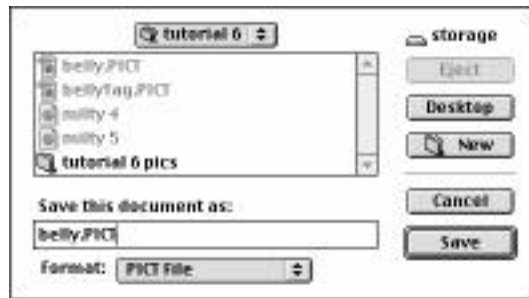
5. *Fill the inverse selection.*

Invert the selection. In *PhotoShop*™ use the **Select > Inverse** menu item. Fill the inverse selection with the foreground color.



6. *Save the image.*

Save the texture map as belly.PICT. Make sure the format is set to PICT.

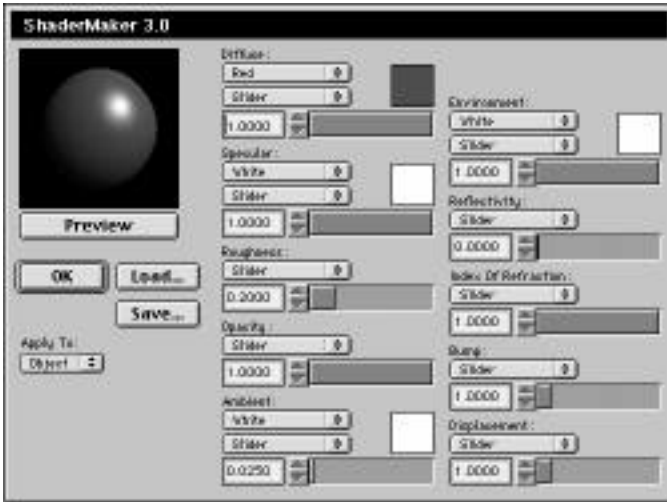


# PiXELS Tutorials

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## Apply The Texture Map.

1. *Open ShaderMaker.*  
Quit *PhotoShop™*. If *PiXELS* is not running, launch it now and load the *milty 3* scene. Select the body. Use the **Window > ShaderMaker** menu item to open the **ShaderMaker** dialog.



2. *Open the Texture Manager.*  
Select **Texture Map** from the first **Diffuse** pop-up menu. The **Texture Manager** dialog will open.

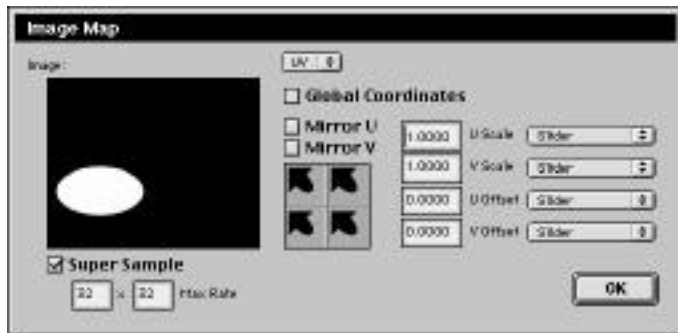


### 3. Open the texture map.

Click on any empty tile. The standard file dialog will open. Select the *belly.PICT* file and click **OK**. Click **Apply** in the **Texture Manager** dialog.



The **Image Map** dialog will open. Click **OK**. Click **OK** in the **ShaderMaker** dialog to return to *PiXELS*.



### 4. Shade the Wings.

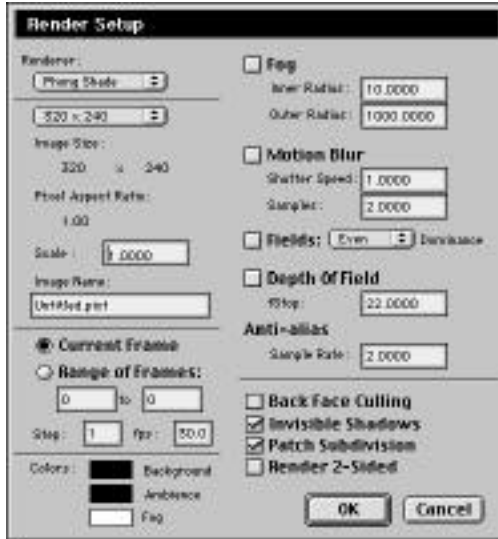
Set the diffuse color for both wings and both legs to black.



## Render And Save.

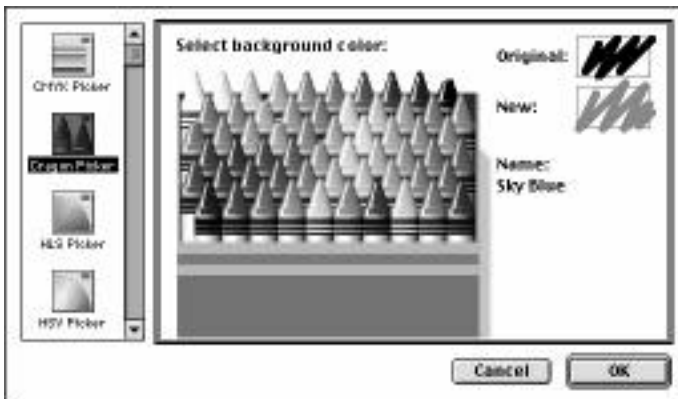
### 1. Set render options.

Use the **File > Render Setup ( R )** menu item to open the **Render Setup** dialog.



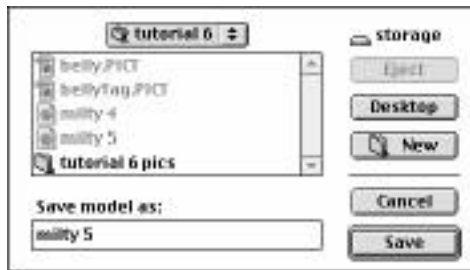
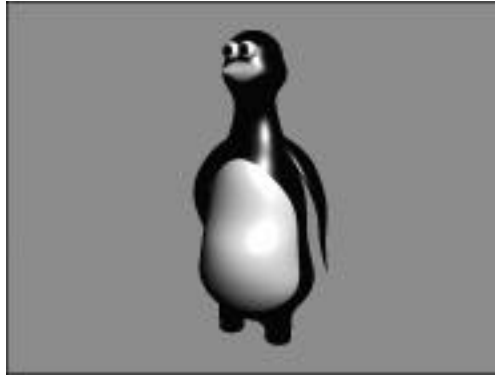
### 2. Change the background color.

Click in the **Background** color swatch. The Apple color picker will open. Select a light blue color. Click **OK** to accept.



3. *Render and save.*

Use the **File > Quick Render ( R )** menu item to check the appearance of Milty. Save the current scene as milty 5.







## Tutorial 7: More Modeling

### Launch *PiXELS*

If *PiXELS* is already running on your machine, choose the **File > Quit** ( **Q** ) menu item now.

1. *Launch PiXELS.*

In the Finder, locate the *PiXELS* application icon. Double clicking on this icon will launch *PiXELS*.

### Model Milty's Boots

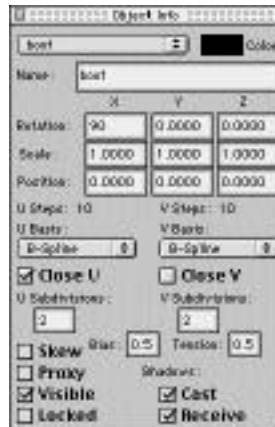
1. *Create a cylinder.*

Use the *Shape > Cylinder* tool to open the **Cylinder Options** dialog. Change the **Name** parameter to boot. Click **OK**.



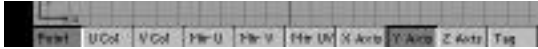
2. *Rotate the cylinder.*

Use the **Window > Object Info** menu item to open the **Object Info** palette. Change the **X Rotation** parameter to 90. Type **return** to apply.

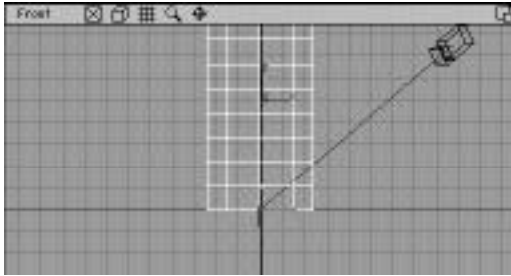


3. *Position the cylinder.*

Select the *Control > Move* tool. Deactivate the *X Axis* and *Z Axis* constraints, leaving the *Y Axis* active.



Position the cylinder as shown.



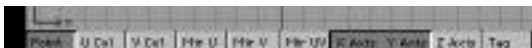
4. *Create a sphere.*

Use the *Shape > Sphere* tool to open the **Sphere Options** dialog. Click **OK**.

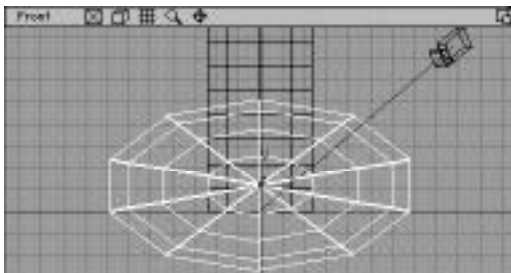


5. *Scale the sphere.*

Select the *Control > Scale* tool. Reactivate the *X Axis*, leaving the *Z Axis* inactive.



Scale the sphere as shown.



6. *Clip the sphere.*

Use the *Reshape > Clip* tool to open the **Clip Options** dialog. Select the **Clip X** and **Clip Y** options. Click **OK**.



7. *Collide the sphere and cylinder.*

Select the cylinder. Select the *Reshape > Collide* tool. Click on the sphere to pick it. The **Collide Options** dialog will open. Select the **Add**, **Subdivide** and **Delete B** options. Click **OK**.



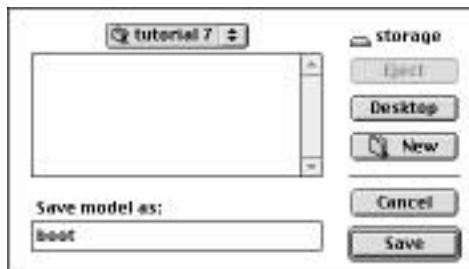
8. *Close the boot.*

Use the *Reshape > Close Ends* tool to open the **Close Ends Options** dialog. Select the **Sharp Edge** parameter. Click **OK**.



9. *Save.*

Save the scene as boot.





## Tutorial 8: Multiple Articulation

It is possible to articulate a single patch with multiple IK chains. In this tutorial we will examine this technique and use it to articulate Milty's legs and feet, as well as a small portion of his body.

### Launch PiXELS

If *PiXELS* is already running on your machine, choose the **File > Quit** ( **Q** ) menu item now.

1. *Launch PiXELS.*

In the Finder, locate the *PiXELS* application icon. Double clicking on this icon will launch *PiXELS*.

### Import Boot

1. *Open the body model.*

Use the **File > Open** ( **O** ) menu item to load *milty 5*.

2. *Import the boot model.*

Use the **File > Import > PiXELS** menu item to import the boot model.



## Position Boots

3. *Scale and rotate the boot.*

Use the **Window > Object Info ( I )** menu item to open the **Object Info** palette. Change **Y Rotation** to -90, **X Scale** to 0.5, **Y Scale** to 0.25, and **Z Scale** to 0.5.



4. *Switch to Right view.*

Open the **View Options** dialog for the Schematic view. Select **Right** from the **View** pop-up menu. Click the **OK** button.



5. *Position and rename the boot.*

Use the **Object Info** palette to change **X Position**, **Y Position** and **Name** as shown.



6. *Duplicate the boot.*

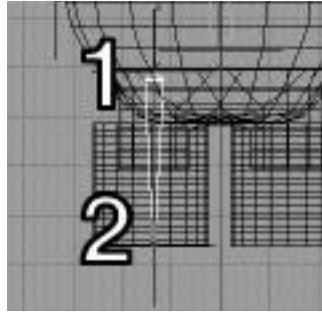
Use the **Edit > Duplicate ( D )** menu item to duplicate the boot. Change **X Position** and **Name** as shown.



## Articulate Boots

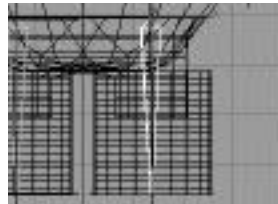
1. *Create an IK Chain.*

Use the *Shape > IK Chain* tool to draw an IK Chain as shown. Click **OK** in the **IK Chain Options** dialog to accept the default name.



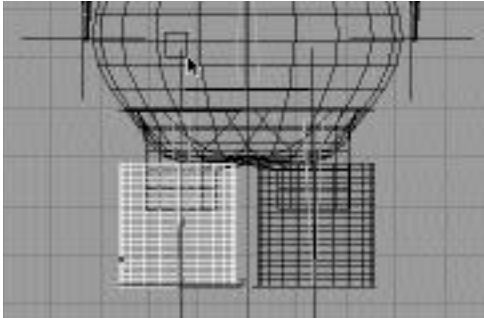
2. *Repeat for the other leg.*

Use the *Shape > IK Chain* tool to draw an IK Chain as shown. Click **OK** in the **IK Chain Options** dialog to accept the default name.



### 3. *Link boot to IK Chain.*

Select the first boot. Select the *Control > Link/Unlink* tool.  
Click and drag a rectangle as shown to pick the IK Chain.



The park alert will open. Click **Park**.



The **Link Options** dialog will open. Click **OK**.



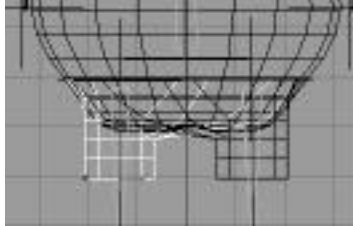
Repeat this for the second boot, linking it to the second IK Chain.



## Articulate Legs

1. *Hide both boots.*

Use the **Edit > Hide Selected** ( **3** ) menu item to both of the boots.



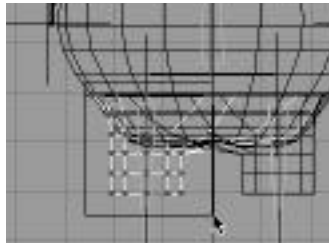
2. *Setup constraints.*

Setup the constraints as shown.



3. *Tag some points.*

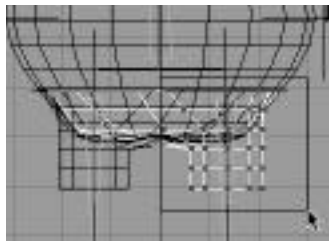
-click and drag a rectangle as shown.



Link these tagged points to the first leg IK Chain.

4. *Repeat on left leg.*

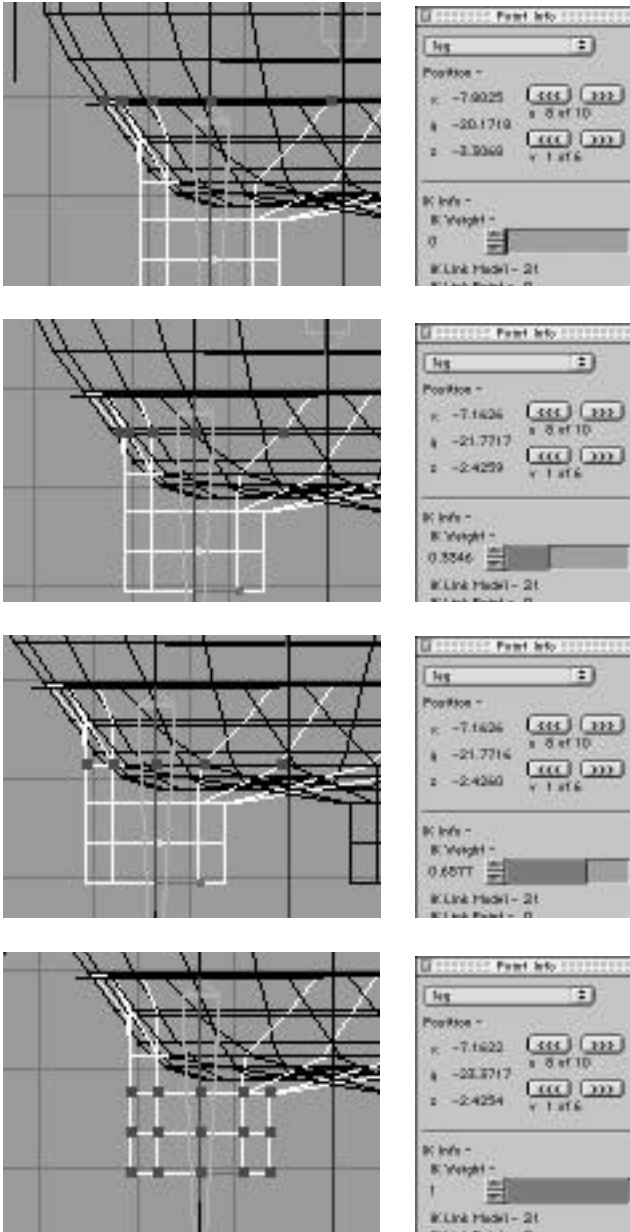
-click and drag a rectangle as shown.



Link these tagged points to the second leg IK Chain.

## 5. *Weight the leg's points.*

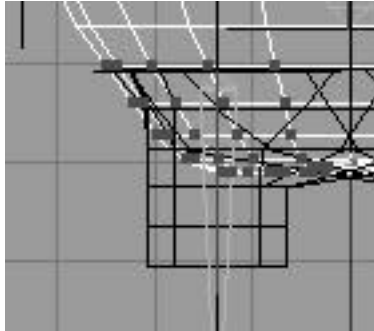
Tag and weight the right leg's control points as shown.



Repeat this procedure for the left leg.

## Articulate Body

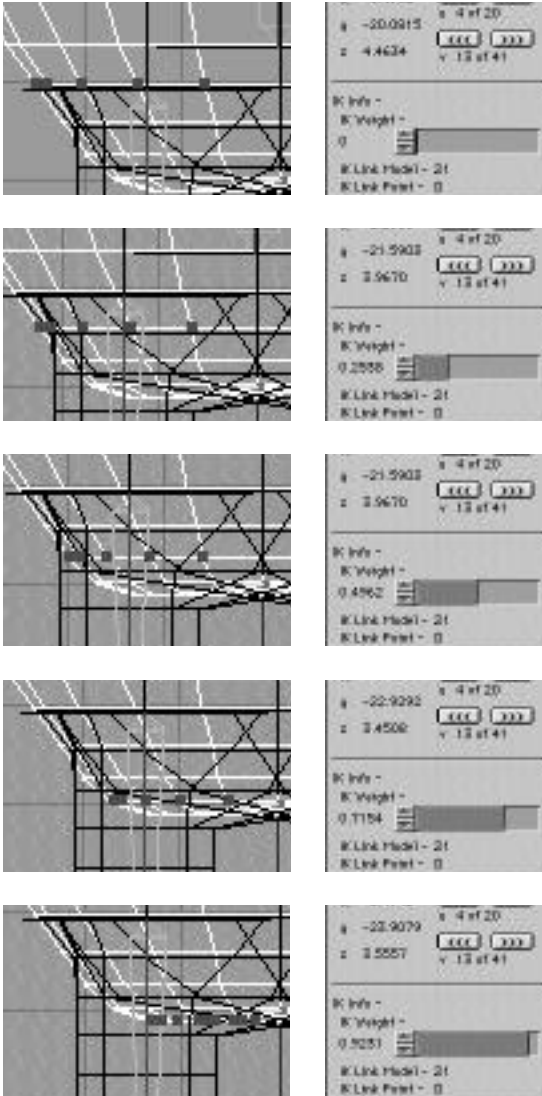
1. *Select the body.*  
Use the **Select > Previous** menu item until the body is selected (highlighted).
2. *Tag some points.*  
-click and drag a rectangle to select the points indicated.



Link these points to the right leg IK Chain.

### 3. *Weight the body's points.*

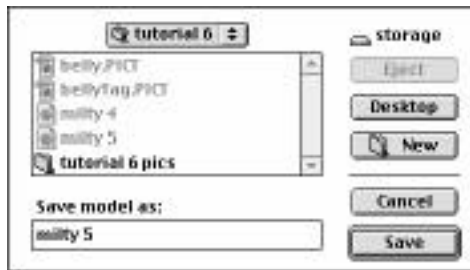
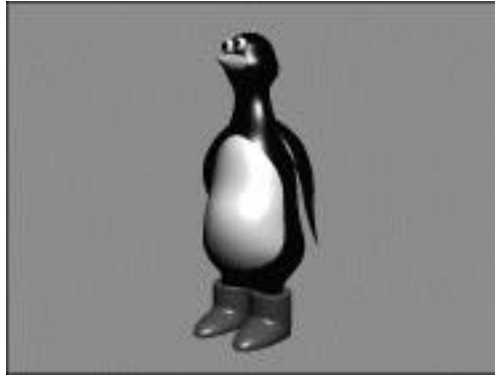
Tag and weight the right body's control points as shown.



Repeat this procedure for the left side of the body.

4. *Render and save.*

Use the **File > Quick Render ( R )** menu item to check the appearance of Milty. Save the current scene as milty 6.



# PiXELS Tutorials

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Congratulations!

You have just created a fully articulated digital actor. What you do from here is up to you and your imagination.

Additional training material will be periodically made available.

Check [www.pixels.net](http://www.pixels.net) or call (619) 672-2634 for more information.

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# PiXELS Views

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## Zoom Box



The *Zoom Box* can be found in the upper right hand corner of each view's title bar. It looks like two intersecting squares.

Clicking in this *Zoom Box* fills the viewing area with that view.

Any view can be set to fill the viewing area by clicking in its *Zoom Box*, including the *Camera* view. If you hold the *Option* key down while clicking in a *Zoom Box*, the view will zoom horizontally, but not vertically. This can be useful when working on wide objects or when using the *Twist & Taper* view.

## Deactivate



Any view can be deactivated by clicking on the first icon from the left in that view's title bar. The title bar will dim and that view will no longer refresh, speeding the refresh of all other views.

## Perspective



Perspective can be turned on or off by clicking on the second icon from the left in that view's title bar. When perspective is on, *PIXELS* will show objects “realistically” from that view's particular point of view. The edges of objects will converge on

a central vanishing point and objects closer to the viewer will appear larger than objects farther away. Any view can have perspective either on or off. When modeling, it is usually better to work without perspective in the top, front and right views.

## Grid



Click on this icon to show or hide a visible grid in the top, front or right views. The dimensions of the grid can be set in the **View Options** dialog, or by using the *gridsize* command in the **Command Line** window (which can be opened by selecting *Control > Command*).

## Zoom In/Out



Use this icon to zoom into or out of a view. To use, click on the icon and drag the mouse up to zoom out or down to zoom in. The distance from the original mouse click controls the speed of the zoom. In the *Camera* view, zoom moves the

Camera forward and back along the line of sight.

## Pan



Use this icon to pan around a view. To use, click on the icon and drag the mouse up, down, left or right. The view will move in relation to the mouse. The distance from the original mouse click controls the speed of the pan.

## Orbit (*Camera view only*)



Use this icon to orbit the Camera around the interest. To use, click on the icon and drag the mouse up, down, left or right. The Camera will orbit in relation to the mouse. The distance from the original mouse click controls the speed of the orbit.

## Surface (*Camera view only*)



Use this icon to toggle between hull and surface view. Surface view provides a more accurate representation of an object, but takes longer to draw.

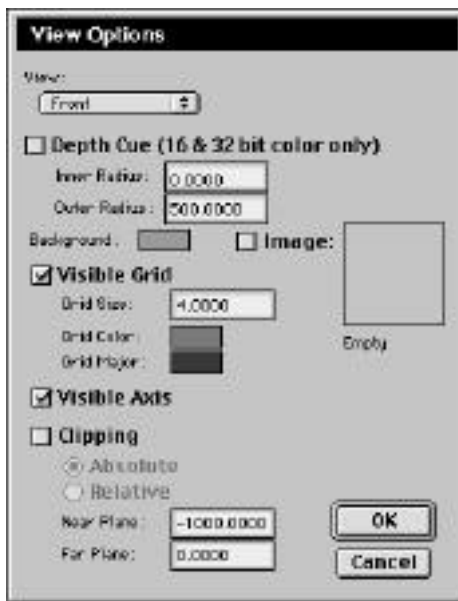
# PiXELS Views

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## View Options



Each of the four viewing panes have a number of different options that can be set. To access the **View Options** dialog box, click on the name of the viewing pane that you want to effect. The name can be found in the left corner of the bar at the top of each viewing pane. Any changes that you make to the **View Options** dialogue box are saved with the current scene and will be reinstated when that scene is loaded from disk.



Let's look at each of the options that can be set for the **View Options** dialogue box.

## View

When clicked on, this pop-up menu lists optional views that the selected viewing pane can display. Any view except the Camera view can be changed. You can select from the following view options:

Top View

Front View

Right View

Schematic View—discussed at the end of this chapter

ShaderMaker View—discussed at the end of this chapter

Twist & Taper View—discussed at the end of this chapter

## Depthcue

The Depthcue options draws wireframes which fade to the *Background* as the distance from the Camera approaches the *Outer Radius*.

## Inner Radius

Distance from the Camera where wireframes begin to fade.

## Outer Radius

Distance from the Camera where wireframes are 100% *Background*.

## Background

Every view has a background color. Clicking in the box to the right of the *Background* title will open the Apple color picker, allowing you to set the background color.

## Image

Any view can also have a PICT image as a background. This is helpful when modeling something from a scanned image (i.e. take photos of an object from the top, front and right) or for placing a computer model into a real scene. PICT sequences can also be used for rotoscoping. Click on the box to the right of the Image check box to open the Texture Manager dialog. See the ShaderMaker section for more details.

## Visible Grid

When checked, this option shows this viewing pane's grid. When unchecked, the grid will be hidden.

# PiXELS Views

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## Grid Size

Sets the size of the visible grid in *PiXELS* units. The **Visible Grid** option must be checked before the grid can be seen.

## Grid Color

Clicking on this box opens the Apple color picker, allowing you to set the color of the grid lines.

## Grid Major

Clicking on this box opens the Apple color picker, allowing you to set the color of the center or origin grid lines (the ones which intersect at 0,0).

## Visible Axis

When checked, this option shows the axis reference icon in the lower left corner of this viewing pane. When unchecked, the axis reference icon will be hidden.

## Clipping

When checked, portions of objects which are closer than *Near Plane* or farther than *Far Plane* are invisible or *clipped*. This makes working with complex scenes much easier, allowing you to focus on a single object or even a portion of that object.

## Absolute/Relative

When the **Absolute** option is selected, the clipping planes are considered to be absolute (world space) coordinates.

When the **Relative** option is selected, the clipping planes are considered relative to the Camera, so as you dolly in and out, different portions of the scene appear and disappear.

These options are a *Radio Group*, which means selecting one will automatically deselect the other. Both cannot be selected at one time.

## Near Plane

When **Relative** is selected, this value defines how close an object can be to the Camera before being clipped.

When **Absolute** is selected, this value defines the minimum position where, along the orthogonal (perpendicular) axis to this viewing plane, objects are visible.

## Far Plane

When **Relative** is selected, this value defines how far an object can be from the Camera before being clipped.

When **Absolute** is selected, this value defines the maximum position where, along the orthogonal (perpendicular) axis to this viewing plane, objects are visible.

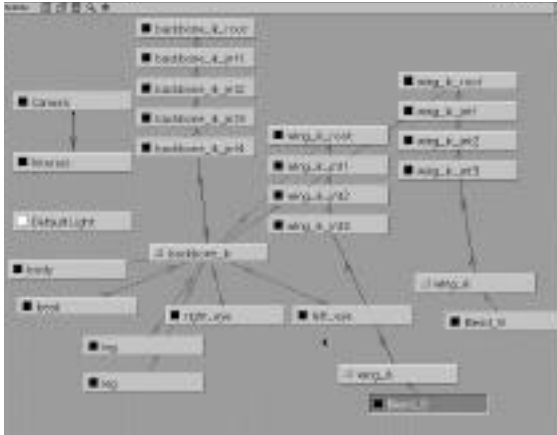
# PiXELS Views

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## Special Views

Each of the viewing panes for the top, front and right views can display one of the following special views: The Schematic View, The ShaderMaker View or The Twist & Taper View. Let's examine each of these.

### Schematic View

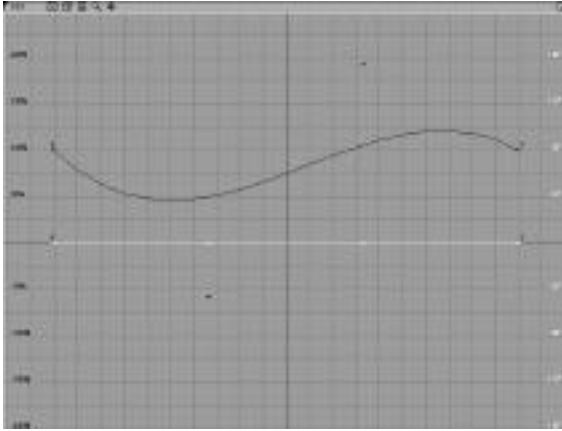


The Schematic View allows you to view the hierarchical structure of your scene. Each object is displayed as a small box, with its name printed inside the box. To the left of the name is the object's wireframe color. Objects can be selected from this view, making object selection much easier in complex scenes. The arrows that connect each object are color coded. Green arrows show objects that are linked together with a parent / child relationship, blue arrows show an object's point of interest, red arrows show a motion path that an object will follow, while magenta arrows point to a lattice that will deform an object.





## Twist & Taper View



The Twist & Taper view is a powerful feature for freeform reshaping of objects. It allows you to scale and rotate part of an object by moving four control points along the objects central spline.

The Twist & Taper View displays a blue (upper) curve that defines the object's scale at any given point from front (0) to back (1) and a red (lower) curve that defines the twist. Dragging any point on the upper curve will taper, flare and bulge the selected object, while dragging on the lower curve twists it.

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## File

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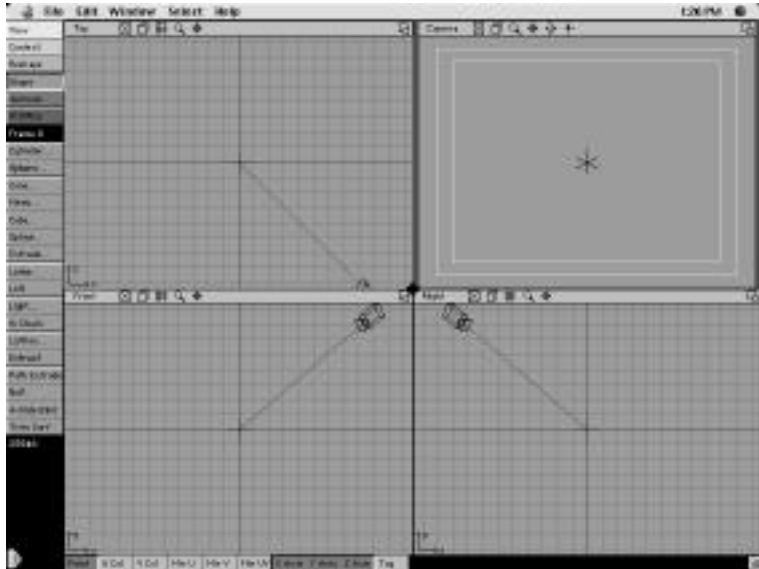
### *Render Setup (continued)*

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## New

Creates a new, unnamed *PiXELS* file using default settings to begin model creation.

1. Choose **New** from the **File** menu or type **N**.
2. An untitled window appears on the screen with the tool palette on the left, ready to begin. A typical session begins by choosing or importing a shape. (see *Tools > Shape* or *File > Import*.)

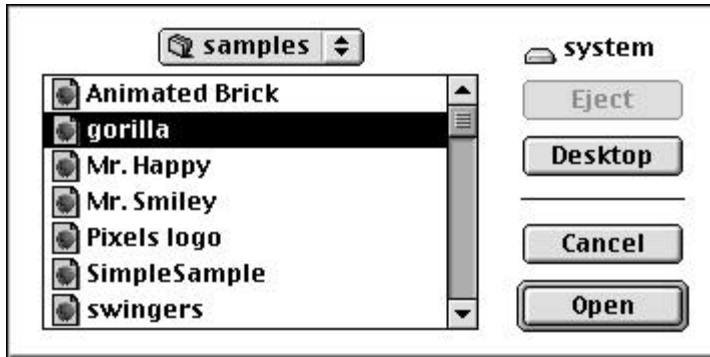


*A new, untitled scene.*

## Open

Opens an existing *PiXELS* file and displays it on the screen. Closes the file on the screen before opening another.

1. Choose **Open** from the **File** menu or type **O**.
2. A dialog box appears listing files in the selected folder that can be opened from *PiXELS*. Select a file name from the list and click **Open** or click **Cancel** to abort.
3. A *PiXELS* file can also be opened directly from the desktop by double clicking its icon.



*The standard Apple open dialog.*



## Import

Merges external model or motion data with the current *PiXELS* scene.

1. Choose **Import** from the **File** menu and drag the mouse to select and highlight the desired format.
2. Find the folder in which the file to be imported is located.
3. Highlight the desired file, and click **Open**. *PiXELS* opens the file and displays it on the screen.

## Illustrator Import Options



### Linearize Spline

When checked, converts Bézier splines to linear splines.

### Flatness

Sets the number of subdivisions used when converting Bézier splines to linear splines. The lower this value, the smoother your curves will appear. The value is a tolerance in degrees.

### Extrude Imported Art

When checked, all of the imported outlines will be extruded. Trim surface end caps are automatically created and placed. Compound objects are also detected, so holes in letters are created automatically. This is very useful for logos and text.

See the *Shape > Extrude* tool in the *Tools* section for more details about the various extrude options.

## Importing Dynamation Files

Dynamation is Wavefront's high-end particle animation system for Silicon Graphics workstations. Although some users won't have access to this system, the format which it exports provides a very straightforward way of describing generic particle data. The following information is provided for those of you who wish to write out Dynamation files.

A Dynamation file is simply an ASCII file containing the position and, optionally, directional vector information for any number of particles. Each file contains only one frame of information, so more often than not, multiple files will be needed. Each file has a numeric suffix to define its position in time. A typical file name might be something like "*SwarmOfBees.00001*" where 00001 would be the frame number.

### The Dynamation File Format

A simple Dynamation file may look something like this:

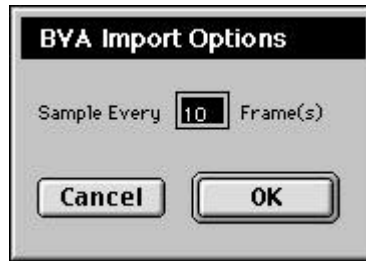
```
4 6 5 0 0 1
```

This is a particle definition. The first three numbers define a particle's position in space (x, y and z respectively.) The next three numbers represent a *directional vector*. This is simply a line which points in the direction the particle is heading. Because lines need at least two points to properly define them, in a direction vector it is assumed that the first point in the line is {0, 0, 0}. Currently the directional vector is assumed to be normalized. In other words the total length of the line is 1 unit. Future versions may use this directional vector to define where a particle was and where it is going. In this case, the vector would not be normalized.

For each particle in a scene there should be one particle definition like the one above. Each particle definition, except the last one, should be followed by a return character.

When *PiXELS* imports a Dynamation file, it duplicates the currently selected object or hierarchy and places it according to the x, y, z information contained in the Dynamation file. For each particle definition a new copy of the selected object is created. Once all the particle definitions are read, *PiXELS* goes to the next file in order. No more copies of the object are created. Instead the positional information is added to the object's fCurves. This process is repeated until the last file is read in or the maximum number of keyframes is reached.

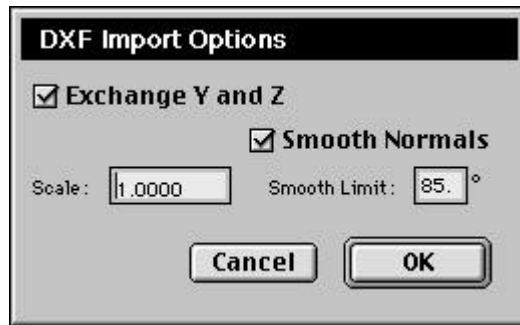
## BVA Import Options



### Sample Every $n$ Frame(s)

Imported motion data will be sampled every  $n$  frames. The function curve generated is smoothed using all the imported data, but control points are spaced out giving the animator some room to manipulate the imported data.

## DXF Import Options



### Exchange Y and Z

Some modeling systems use a coordinate system that differs from the one used by *PiXELS*. This option is used to correct for that.

### Smooth Normals

If checked, *PiXELS* will automatically smooth all normals for shared vertices.

### Scale

Sets the scaling factor for the imported model. (i.e. 0.5 = 50%)

# PiXELS Menus—*File*

---

## Smooth Limit

Defines the breaking point (in degrees) for smoothed polygons. If the angle between adjacent polygons is greater than this value, their normals will not be shared. If the angle is less than or equal to this value, the normals will be averaged and shared.

## OBJ Import Options



## Exchange Y and Z

Some modeling systems use a coordinate system that differs from the one used by *PiXELS*. This option is used to correct for that.

## Use Existing Normals

If present, use the normals defined within the file, otherwise recompute them.

## Scale

Sets the scaling factor for the imported model. (i.e. 0.5 = 50%)

## Smooth Limit

Defines the breaking point (in degrees) for smoothed polygons. If the angle between adjacent polygons is greater than this value, their normals will not be shared. If the angle is less than or equal to this value, the normals will be averaged and shared.

## Export

Saves a *PiXELS* document in DXF, RIB, 3DGF or 3DMF formats for use with other software applications. Optionally exports a PICT map of the surface to aid in the creation of texture maps.

1. Open or create a *PiXELS* file.
2. Choose **Export** from the **File** menu and drag the mouse to select and highlight the desired format.
3. In the dialog box, type in a name for the file to be exported.
4. Click **Save**, or click **Cancel** to return to the model without creating an export file.
5. Choose export options for DXF and 3DGF formats.

## DXF Export Options



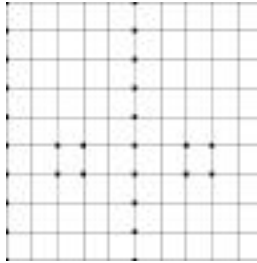
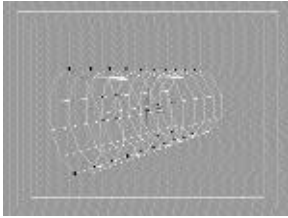
### Subdivide

Breaks the object down into finer polygons before exporting. The resolution is set in the **Object Info** palette, using the **U Step** and **V Step** edit fields. (See **Window Menu > Object Info > U Step** or **Window Menu > Object Info > V Step** for more info on this.)

### Scale

Sets the scaling factor for the exported model. (i.e. 0.5 = 50%)

## Tag Map Export



1. Using the tag tool, select key points on a model's surface. (i.e. eye sockets)
2. Select **File > Export > Tag Map** This creates a PICT file representing the surface of the model, with tagged points marked as red squares.
3. Import the PICT into your favorite paint package. Use the tagged points as a reference for painting. (i.e. Paint eyes where the eye sockets are.)

## 3DGF Export Options



### Splines

Retains spline information when exporting. Splines not supported by 3DGF are converted to the closest supported spline.

### Polygons

Converts splines to a linear basis when exporting. Some applications do not directly support splines, so this option can be used along with the **Subdivide** option to smooth models.

## **Subdivide**

Breaks the object down into finer polygons before exporting. The resolution is set in the **Object Info** palette, using the **U Step** and **V Step** edit fields. (See **Window Menu > Object Info > U Step** or **Window Menu > Object Info > V Step** for more info on this)

## **Scale**

Sets the scaling factor for the exported model. (i.e. 0.5 = 50%)

## Save

Saves changes made to the open model to a disk file. If no file has been created for the model, **Save** behaves just like **Save As**.

1. Choose **Save** from the **File** menu or type **S**.



## Save As



Saves a new *PiXELS* file or saves an existing one under a new name without overwriting the original version.

1. Choose **Save As** from the **File** menu.
2. A dialog box appears showing the default file name: *Untitled Model*. Type in a new file name.
3. Choose the folder and disk on which you want the document saved.
4. Click **Save**, or click **Cancel** to abort.

## Revert To Saved

Discard any changes you have made to your model since the last time it was saved.

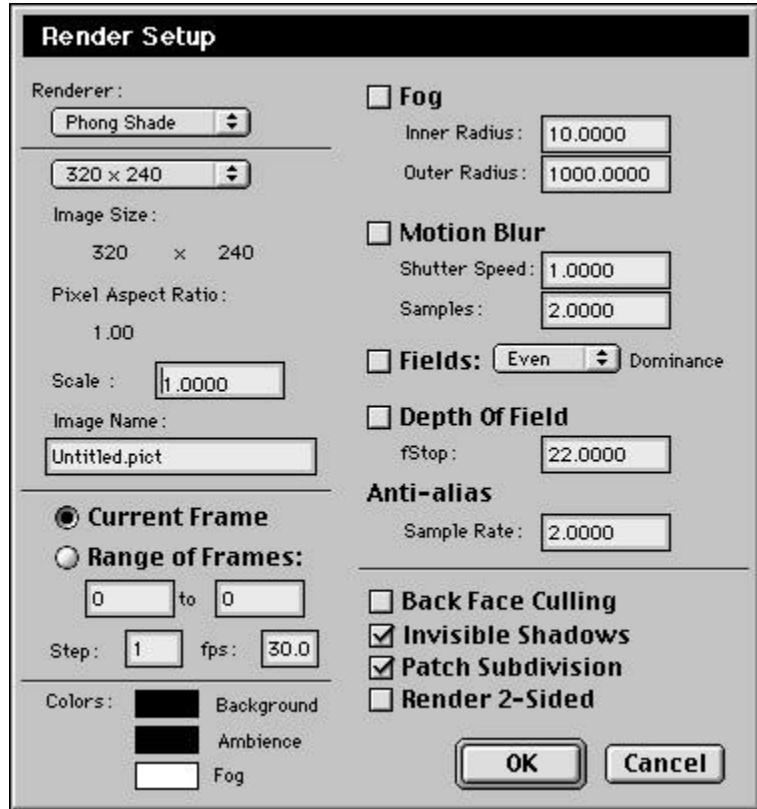
1. Choose **Revert To Saved** from the **File** menu.

## Render Setup

Sets the various rendering options.

1. Choose **Render Setup** from the **File** menu or type **U**.
2. Set the **Render Setup** parameters as desired.
3. Click the **OK** button to accept or the **Cancel** button to abort.

## Render Setup Options



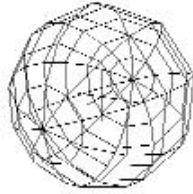
Let's look at each of the options that can be set for the **Render Setup Options** dialogue box.

# PiXELS Menu—*File*

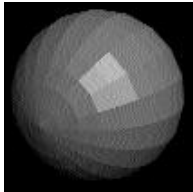
---

## Renderer

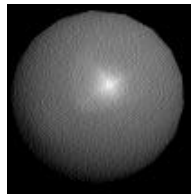
Use this pop-up menu to select the rendering method you wish to use. *PiXELS* has four rendering methods to choose from:



*Wireframe*: The simplest and fastest rendering technique, it shows only the transparent outline of forms.



*Flat Shade*: Gives the surface a faceted appearance to approximate the shape. Fast, but low quality renderings—good for previews.



*Gouraud Shade*: Renders a smooth, diffuse object by interpolating shading values between vertices. Not as fast, but higher quality to help see the details.



*Phong Shade*: Renders a smooth, specular object by interpolating normals between vertices. The highest quality renderings, takes longer but worth it! Use for final rendering to achieve broadcast quality images.

## Image Size

A pop-up menu which lists common image formats. You can select one of the predetermined image sizes or select the **Custom** menu item to manually enter any size.

## Pixel Aspect Ratio

Some devices use non-square *pixels* (such as NTSC television). This option ensures compatibility of images with these devices. The ratio is automatically determined for you based on the image size that you selected.

## Scale

A scaling factor to apply to the image when rendering. (i.e. 400x400 with a scale of 0.5 will render at 200x200)

## Image Name

The name to be applied to the final rendering when saved.

## Current Frame

Renders the current frame only (still image).

## Range of Frames

Renders a range of frames (animation). The frame range is set using the two edit fields immediately below this button. The first edit field is the start frame # and the second edit field is the end frame #.

## Step

Forces the renderer to render every *n*th frame.

## fps

Sets the number of frames needed to create one second of finished animation. (frames per second)

## Background, Ambience & Fog Colors

Uses the Apple color picker to define a background, ambience or fog color. The background color is merely placed behind rendered images. The ambient color is a 'global' illumination present in all rendered scenes. The fog color is used when calculating fog in a scene.

## **Fog**

Enables the fog option for the Flat, Gouraud and Phong renderers.

## **Inner Radius**

Sets a radius around the Camera inside which fog has no effect.

## **Outer Radius**

Sets a radius around the Camera outside which fog has a maximum effect. All points between the inner radius and outer radius will be effected by fog based on their distance from the viewer.

## **Motion Blur**

Enables the motion blur option for the internal renderer. Motion blur is caused by the exposure of a moving object over time.

## **Shutter Speed**

Defines a percentage of time between frames during which the aperture is open. A higher value causes greater motion blur. A value greater than one (1) can have unpredictable results and should not be used.

## **Samples**

Defines the number of samples used over time to render one pixel. Higher sampling rates will result in smoother motion blur, but will require longer rendering times.

## **Depth of Field**

Enables the depth of field option for the internal renderer. Depth of field causes objects over a certain range of depth to appear in focus, while objects outside that range appear blurred.

## **fStop**

Defines the size of the aperture opening on the Camera. A higher value results in a less pronounced depth of field, while values closer to zero produce a more exaggerated depth of field. Common values range from 1.2 to 22.

## **Anti-alias Sample Rate**

Sets the number of sub-pixel samples to average together when anti-aliasing. Higher values result in better anti-aliasing but require more RAM and time to render.

## **Backface Culling**

When selected, this feature accounts for all surfaces that can not be seen from the Camera's perspective and removes any related rendering calculations for them. This speeds up rendering time.

## **Invisible Shadows**

Enabling this feature allows shadows to be rendered from an object that is invisible, providing that the shadow casting feature for that object was turned on in the **Object Info** palette.

## **Patch Subdivision**

Divides the patches of all models in a scene into smaller pieces to create more detailed, smoother models. Each model's sub-division is based on settings placed in the **Object Info** palette.

## **Render 2 Sided**

When selected, this feature allows the insides of models that are exposed to the Camera to be rendered. However, use with caution as this may cause aliasing.

## Quick Render

Uses the options defined in **Render Setup** to render an image into the *Camera* view.

1. Choose **Quick Render** from the **File** menu or type **R**.
2. To cancel a rendering in progress type a **period**.
3. When you are finished looking at the rendering, click your mouse anywhere to return to *PiXELS*.



## Final Render

Uses the options defined in Render Setup to render a final image, or series of images to disk.

1. Choose **Final Render** from the **File** menu or type **F**.
2. To cancel a rendering in progress type a **period**.

## Quit

Exits *PiXELS*, returning you to the Macintosh desktop.

1. Choose **Quit** from the **File** menu or type **Q**.
2. If any unsaved changes have been made to the open file, *PiXELS* asks whether to save the changes before closing the file.
3. Click **Yes** to save changes, **No** to ignore changes, or **Cancel** to return to the current model without exiting *PiXELS*.

**Edit**

|                                  |              |
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| <b>Expand Hierarchy</b>          | <b>.6.40</b> |



### Undo

Reverses the most recent movement or repositioning applied to a model.

1. Choose **Undo** from the **Edit** menu or type **Z**.

## Cut

Deletes the selected model and stores it on the Clipboard.

1. Select the object to cut.
2. Choose **Cut** from the **Edit** menu, or hit **X**.

## Copy

Copies currently selected model into the Clipboard without changing the original model.

1. Select the object to be copied.
2. Choose **Copy** from the **Edit** menu or type **C**. The item will be stored in the Clipboard for later use.

## Paste

Places the model copied to the Clipboard into the scene.

1. Choose **Paste** from the **Edit** menu or type **V**.
2. The model will be pasted where it was when it was originally copied.



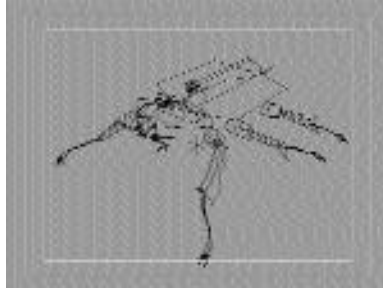
### Clear

Deletes a selected model from the scene, leaving remaining models unchanged. The clear command cannot be undone.

1. Select the object you wish to clear.
2. Choose **Clear** from the **Edit** menu or hit the **Delete** key.
3. A dialog box alerts you that this operation is irreversible.  
Click **OK** to confirm and delete, or click **Cancel** to abort.

## Proxy

Creates an approximation of the 3 D object to speed screen refresh.



## Proxy Options

### Proxy All

Proxies all models in a scene.

### Unproxy All

Unproxies all models in a scene.

### Proxy Selected

Proxies the currently selected model.

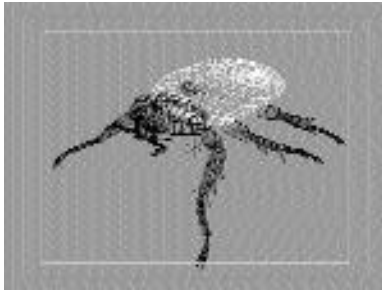
### Unproxy Selected

Unproxies the currently selected model.

## Hide Selected

Hides the currently selected model.

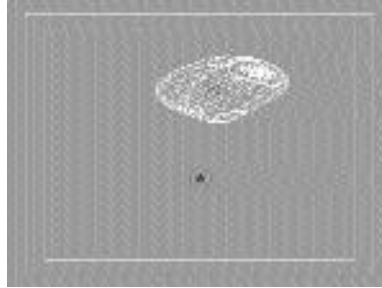
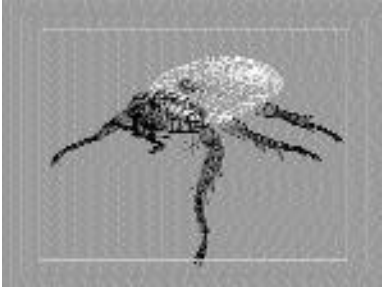
1. Select the object you wish to hide.
2. Choose **Hide Selected** from the **Edit** menu or type
- 3.



## Hide Unselected

Hides all models except the currently selected model.

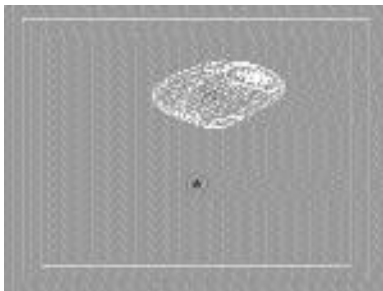
1. Select the object you wish to retain.
2. Choose **Hide Unselected** from the **Edit** menu or type **7**.



## Show All

Restore hidden parts of the model to the screen.

1. Choose **Show All** from the **Edit** menu, or type **4**.
2. Any hidden objects will be made visible.



## Duplicate

Makes a clone of the currently selected model. The duplicate is placed directly on top of its twin.

1. Select the object you wish to duplicate.
2. Choose **Duplicate** from the **Edit** menu or type **D**. A copy of the object will be pasted directly on top of the original.
3. The duplicate is the currently selected model, so you can now move, resize, reshape, etc... this object.

## Duplicate Hierarchy

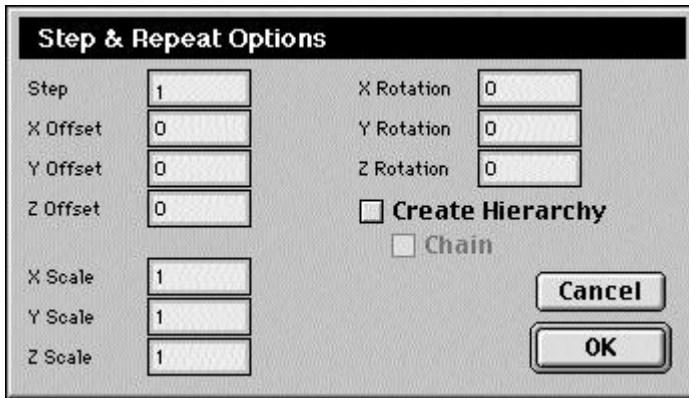
Makes a clone of the currently selected model and all its children. The duplicate is placed directly on top of its twin.

1. Select the parent of the hierarchy you wish to duplicate.
2. Choose **Duplicate Hierarchy** from the **Edit** menu. A copy of the hierarchy will be pasted directly on top of the original.
3. The duplicate is the currently selected model, so you can now move, resize, reshape, etc... this object.

## Step and Repeat

Copies an object and pastes it according to the offset instructions. The object may be pasted as many times as desired.

1. Select the object you want to affect.
2. Choose **Step and Repeat** from the **Edit** menu.



### Step and Repeat Options:

#### Step

The number of duplicates desired.

#### X, Y, Z Offset

Offset factor for x, y or z-axis.

#### X, Y, Z Scale

Scale factor for x, y or z-axis.

#### X, Y, Z Rotation

Rotation factor for x, y or z-axis.

#### Create Hierarchy

Links each duplicate to the first item in the chain.



### **Chain**

Links each duplicate to the previous item in the chain.

### **OK**

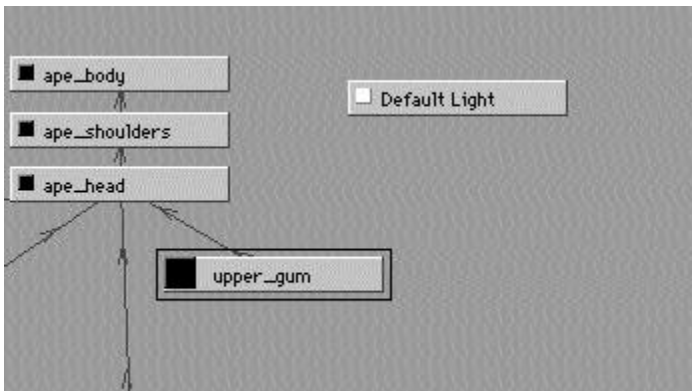
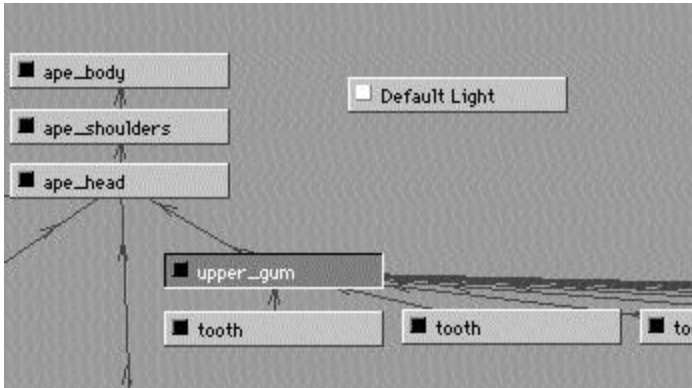
Accept and apply settings.

### **Cancel**

Exit dialog without applying settings.

## Expand Hierarchy

This command affects the appearance of objects in the Schematic view which can be selected in any of the view panes. When a parent object (an object that has children in the hierarchy) is collapsed, its children are not displayed in the Schematic view, but rather only the parent object is shown with a double outline to indicate that it has hidden children. When a parent object is selected, this command will expand a collapsed parent or collapse an expanded parent.



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### ***Brick (continued)***

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### ***Math Function (continued)***

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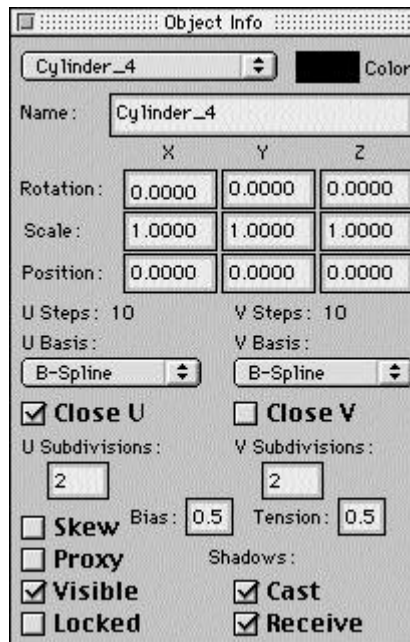
## Object Info

All objects, including lights and the Camera, have a number of different settings that can be assigned to them. The **Object Info** Palette displays all of these settings along with other relevant information about the currently selected model, light, or Camera. To view and edit these settings:

1. Select **Object Info** from the **Window** menu or press **I**.
2. The **Object Info** Palette will appear. Click on the Object pop-up menu at the top to select either a model, light or Camera.
3. Depending on your selection, different settings will appear. Settings are typed, toggled, or selected from pull down menus.

Let's examine the different settings that are available for models, lights and the Camera.

### Object Info Options for a selected *model*



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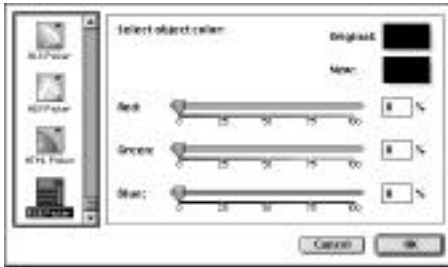
---

## Object

A pop-up menu which allows you to directly select a different object for editing.

## Color

Click this box to open the Apple color picker to select a color for this object's wireframe. It is useful on complex scenes, when you have multiple objects overlapping each other. By color coding them, they become easier to spot. Bright colors are usually preferred over muted tones. This color does not affect the color of the object when rendered.



## Name

The name of the model. Can be up to 32 characters.

## Rotation X

The rotation factor for the x-axis (pitch).

## Rotation Y

The rotation factor for the y-axis (yaw).

## Rotation Z

The rotation factor for the z-axis (roll).

## Scale X

The scaling factor for the x-axis (width).

## Scale Y

The scaling factor for the y-axis (height).

## **Scale Z**

The scaling factor for the z-axis (depth).

## **Position X**

The translation (offset) factor for the x-axis (left and right).

## **Position Y**

The translation (offset) factor for the y-axis (up and down).

## **Position Z**

The translation (offset) factor for the z-axis (in and out).

## **U/V Steps**

The number of subdivisions or steps this patch contains in each direction. These values cannot be changed directly.

## **U/V Basis**

The basis of the spline used to interpolate this surface when either rendering or subdividing.

## **Close U**

Closes the model along its u-steps.

## **Close V**

Closes the model along its v-steps.

## **U/V Subdivisions**

The number of intermediate points added to this object when rendering. For example, start with an object with a resolution of 10u x 10v. If U and V Subdivisions were both set to 2, the object would be subdivided to a resolution of 20u x 20v for rendering. If U and V Subdivisions were both set to 4, the object would be subdivided to a resolution of 40u x 40v for rendering.

## **Bias**

Controls the “lean” of the Tau and Beta splines.

# PiXELS Menu—*Window*

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## **Tension**

Controls the “rigidity” of the Cardinal, Tau, Tensed-B, and Beta splines.

## **Skew**

Forces patches with spline deformations to retain parallelism between v steps.

## **Proxy**

Sets the proxy feature for the selected object. (See **Edit Menu > Proxy**.)

## **Visible**

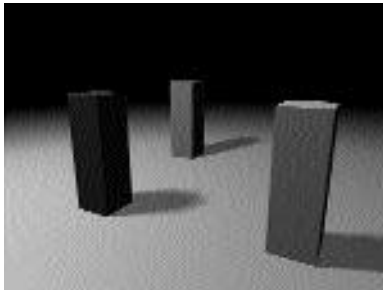
Sets the visibility for the selected object. (See **Edit Menu > Hide Selected**.)

## **Locked**

Objects with this set cannot be selected or altered and will appear dimmed in the modeling views. Locked objects will render normally.

## **Shadows: Cast**

Enables shadow casting for this object. At render time, only objects with this option enabled can cast shadows.



## **Shadows: Receive**

Enables shadow receiving for this object. At render time, only objects with this option enabled can receive shadows.

## Object Info Options for a selected *light*

If the selected object is a light, the **Light Info** dialog is displayed when the **Object Info** menu-item is chosen.

## Light Info Options

Light Info

Default Light Color

Name: Default Light

Light Type: Point

Position: X: 50.0000 Y: 50.0000 Z: -50.0000

Interest: nil nil nil

☐ **Glow**

Inner Core: 1.00 Outer Core: 3.00 Rate: 2.00

☐ **Falloff**

Inner Core: 20.0 Outer Core: 200. Rate: 8.00

☐ **Shadows**

Softness: 0.0 Density: 0.5 Cone Angle: 30.0 Delta Angle: 5.00

☒ **Visible**

## Color

Click this box to open the Apple color picker to select a color and intensity for this light.

## Light Type

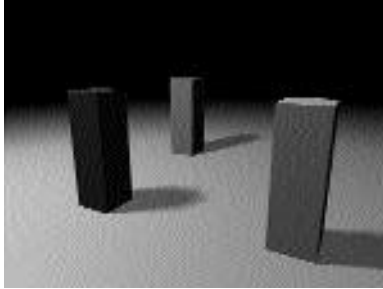
A pop-up menu from which you select the type of light you want. The types are:

*Null*: A light source which has no illumination, but can still glow.

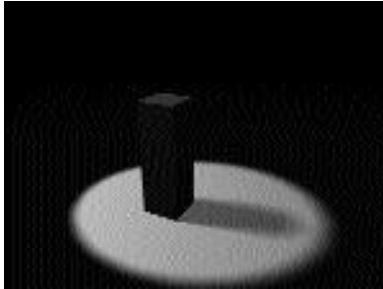
# PiXELS Menus—*Window*

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*Point:* An omnidirectional light. Light rays travel in all directions from the light.



*Spot:* A unidirectional light. Light rays travel in a cone from the position of the light toward the spotlight interest.



*Sun:* A light source that is infinitely far from the objects in the scene. The position of the light and interest are only used to define the direction the light is coming from.

## **Position**

Defines the position of the light in 3D space.

## **Interest**

Defines the position of the interest in 3D space. (i.e. the spot at which the light is pointing.)



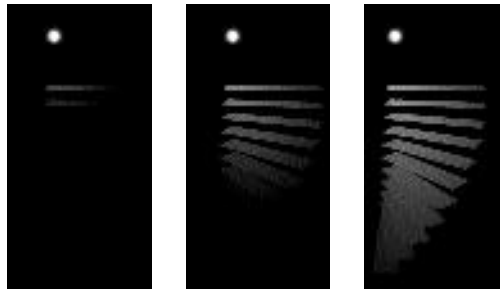
## Glow

When enabled, this light source will be visible at render time.



## Falloff

When enabled, the area of affect of the selected light source will be limited by the inner and outer core values. When disabled, this light source will have an infinite area of affect.

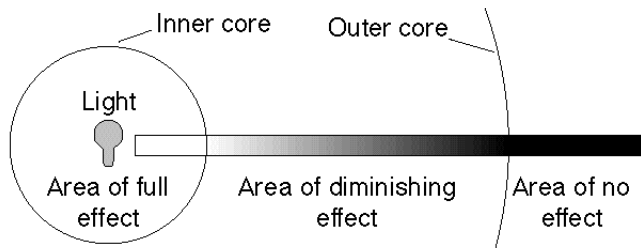


## Inner Core

Defines the area upon which the light will have full effect.

## Outer Core

Defines the area upon which the light will have diminishing effect.



# PIXELS Menu—*Window*

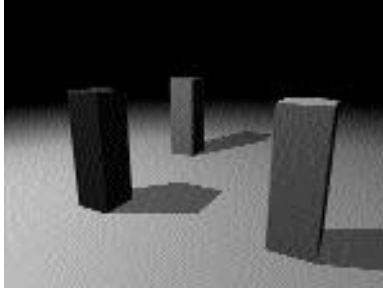
---

## Rate

Sets the softness or fuzziness of the outer core.

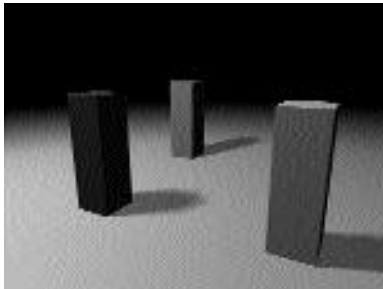
## Shadows

Enables shadow tracing for this light. Only objects with shadow casting enabled will be traced and only objects with shadow receiving enabled will render with shadows.



## Softness

Defines the size of the area light casting the shadows. If softness is set to zero, area lights are disabled and shadow rendering times will decrease.



## Density

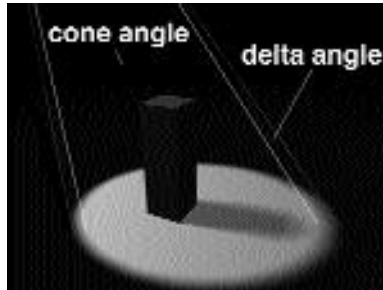
Defines the density of the shadow. Higher values create darker shadows.

## **Cone Angle**

Sets the angle at which light rays emanate from a spot light.

## **Delta Angle**

Sets the angle of decreasing light around the light cone.



## **Icon Visible**

Enables the visibility of the light icon in the modeling views. When disabled, the light will not be incorporated into the rendered image.

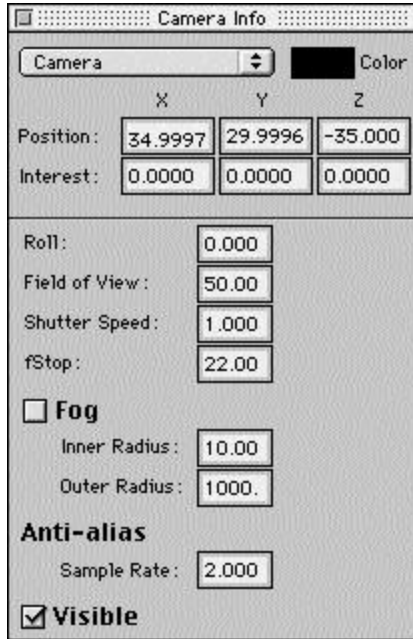
# PiXELS Menu—*Window*

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## Object Info Options for the *Camera*

If the selected object is the Camera, the **Camera Info** dialog is displayed when the **Object Info** menu-item is chosen.

### Camera Info Options



|           | X       | Y       | Z       |
|-----------|---------|---------|---------|
| Position: | 34.9997 | 29.9996 | -35.000 |
| Interest: | 0.0000  | 0.0000  | 0.0000  |

|                |       |
|----------------|-------|
| Roll:          | 0.000 |
| Field of View: | 50.00 |
| Shutter Speed: | 1.000 |
| fStop:         | 22.00 |

☐ **Fog**

|               |       |
|---------------|-------|
| Inner Radius: | 10.00 |
| Outer Radius: | 1000. |

**Anti-alias**

|              |       |
|--------------|-------|
| Sample Rate: | 2.000 |
|--------------|-------|

☒ **Visible**

### Color

Click this box to open the Apple color picker to select a color for the Camera's wireframe.

### Position

Defines the position of the Camera in 3D space.

### Interest

Defines the position of the Interest in 3D space.

### Roll

Sets the angle of lateral inclination for the Camera.

## **Field of View**

Sets the angle of view.

## **Shutter Speed**

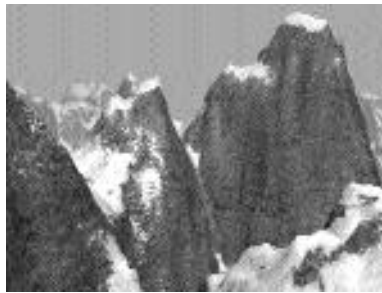
Defines a percentage of time between frames during which the aperture is open. A higher value causes greater motion blur. A value greater than one can have unpredictable results.

## **fStop**

Defines the size of the aperture opening on the Camera. A higher value results in a less pronounced depth of field, while values closer to zero produce a more exaggerated depth of field. Common values range from 1.2 to 22.

## **Fog**

Enables the fog option for the Flat, Gouraud and Phong renderers.



## **Anti-alias Sample Rate**

Sets the number of sub-pixel samples to average together when anti-aliasing. Higher values result in better anti-aliasing but require more RAM and time to render.

## **Visible**

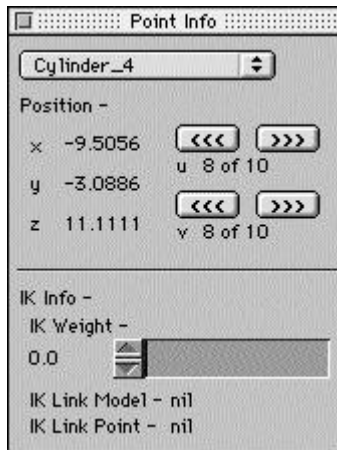
Enables the visibility of the Camera icon in the modeling views. Does not effect the rendered image.

## Point info

Used to precisely position points and set their weights for use with inverse kinematics.

1. Select a point (or a row of points.)
2. Select **Point Info** from the **Window** menu.
3. Enter coordinate information and IK information for the point(s)
4. Use the arrow buttons to edit neighboring points.
5. Click **OK** to accept settings or **Cancel** to abort.

## Point Info Options



## Object

A pop-up menu which allows you to directly select a different object for editing.

## Position

Displays the x, y, and z positions in global coordinates.

<<<   >>>

Use these to select different points for editing.

## **IK Link Model**

The IK Chain this point is linked to.

## **IK Link Point**

The joint on the IK Chain this point is linked to.

## **IK Weight**

Sets how much rotational information this point will inherit from the segment of the IK Chain it is linked to, versus the previous segment in the chain. (i.e. A value of 1 tells the point to inherit all rotational information from the IK Segment it is linked to. A value less than 1, and the point will inherit that percentage from the segment it is linked to and the remaining rotational information will be inherited from the previous segment in the chain.)

## ShaderMaker

ShaderMaker allows you to describe the material properties of your object's surface. ShaderMaker gives you full control over every aspect of shading a surface, from the color of the surface to complex light interactions such as reflection and refraction. All of this can be controlled using any one of ShaderMaker's *nodes*.

### Nodes

*Node* is the name given to the basic building blocks used within ShaderMaker. To see all the nodes available, choose **Window> ShaderMaker** and open the ShaderMaker dialog box then click on the first Diffuse pop-up menu. Take a moment to read the names of all the nodes. Every one of these nodes will produce a color, so we call these *color nodes*. Now click on the second Diffuse pop-up menu. Every one of these nodes will produce a numerical value, so we call these *value nodes*. Each node has a set of variables associated with it, called *input variables*. These variables describe the characteristics of a given node. Input variables require either a color or a value as input. Some common variables are scale, softness, grain and turbulence.

### Node Interaction

Within ShaderMaker, nodes can be linked to other nodes, making it possible to control a node's input variable with the output of another node. This interaction between nodes may at first seem complex, but it is, in fact, quite straight forward. It works somewhat like a patch bay, plugging values or colors from one node into another. There is no theoretical limit to how deep these interactions can go, however available memory and CPU speed will play a role in setting practical limits.

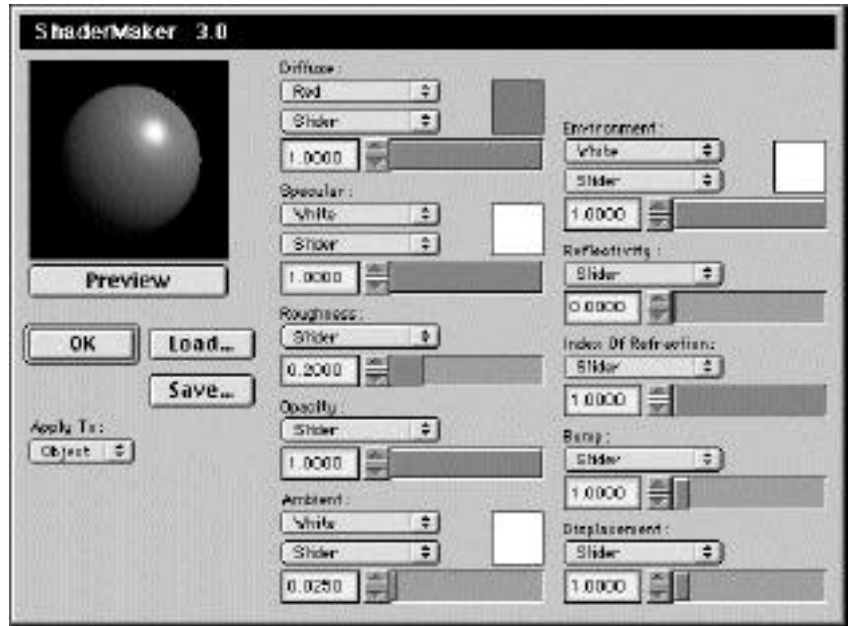
### Shaders

A shader is a combination of nodes which work together to create the final desired color, pattern, texture or look for your 3D object. Every shader is made up of 14 inputs controlling such variables as *Diffuse Color and Reflectivity*. Each of these inputs has a node associated with it which defines its value or color. Shaders can be created from scratch or you can use the **Load** button to read a Shader from disk. Once a Shader has been read into ShaderMaker, it can be edited to create a new look.



## ShaderMaker Options

After selecting the object you want to effect, open ShaderMaker by choosing the **Window > ShaderMaker** menu item.



From this dialog box you have access to a suite of tools designed to help you interactively create realistic looking textures without programming.

### Preview

Applies the current settings to a sphere and renders it into the **Preview Image** box.

### OK

Apply settings to selected model group and return to PiXELS.

### Load

Load a shader from disk.

### Save

Save the current shader to disk.

# PiXELS Menus—*Window*

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## **Apply To:**

Sets the model group you want this shader applied to. The options are:

*Object* - Applies the current settings to the currently selected model.

*Children* - Applies the current settings to all the children of the currently selected model.

*Group* - Applies the current settings to all objects associated with the current object.

*All* - Applies the current settings to all the models in a scene.

## **Diffuse**

Sets the surface illumination caused by scattering light.

## **Specular**

Sets the intensity of the highlight reflection.

## **Roughness**

Defines the spread of the specular decay over the object surface.

## **Opacity**

Density or transparency of the material.

## **Ambient**

Overall or internal illumination for a given object.

## **Environment**

Defines what is to be reflected or refracted.

## **Reflectivity**

How much of the environment is to be reflected.

## **Index of Refraction**

Defines the distortion of light rays as they pass through transparent or partially transparent objects.

## **Bump**

Simulates bumps in a surface by perturbing the normals.

## **Displacement**

Similar to bump, but rather than simulating, displacement actually alters the surface.

## **More About Nodes**

As discussed earlier, shaders are built of small components called *nodes*. There are two types of nodes; those that return *colors* and those that return *values*. Because of the flexibility inherent in ShaderMaker, the line between color nodes and value nodes is very grey. In fact color nodes can be used as value nodes. ShaderMaker simply converts the intensity of the color into a value and passes that to the parent node. Value nodes cannot directly return color values, but they are used to define the components of a user color—so you could quite easily create a shader that used a value node to create a color. A simple example would be a shader that used a *User Color* node to define *Diffuse Color*. The rgb components could be defined using the absolute value of the xyz components of the surface normal. Another example would be to use a *Function Curve* node to define the hue component of a *User Color* node. This allows you to change the hue of your color over time!

## Color Nodes

Color nodes are used to define a color attribute such as what gets reflected or what color the surface of the object is. The base nodes which require color node inputs are: Diffuse, Specular, Ambient and Environment.



### White, Black, Red, Green, Blue & Yellow

Predefined colors. These nodes contain no user definable parameters.

## User Defined

Allows the user to define a color in either the *rgb*, *hsv* or *hsl* color space. Optionally allows the user access to the Apple color picker.

## Color Model

A pop up menu used to define the preferred color space. Options include *rgb*, *hsv* and *hsl*.



## r/h Slider

Defines the function/scalar value used to determine the red component of the user color. When in *hsv* or *hsl* mode, this changes to the *h* slider, which controls the *hue* component.

## g/s Slider

Defines the function/scalar value used to determine the green component of the user color. When in *hsv* or *hsl* mode, this changes to the *s* slider, which controls the *saturation* component.

## b/l/v Slider

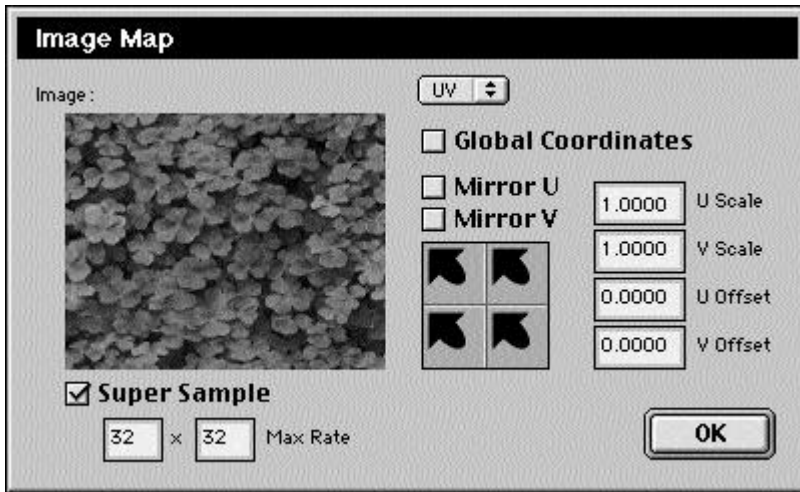
Defines the function/scalar value used to determine the blue component of the user color. When in *hsv* mode, this changes to the *v* slider, which controls the *value* component. When in *hsl* mode, this changes to the *l* slider, which controls the *lightness* component.

# PiXELS Menus—*Window*

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## Image Map

Uses a PICT image or series of images to define surface color.



## Image

The currently loaded PICT image. Click on the preview image to load a different image. PICT images can be stored in one of three places; inside the global Textures folder, inside the current project folder or inside the current project's Textures folder.

## Super Sample

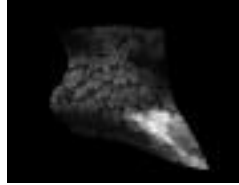
Enables the super sampling option. Super sampling smooths out the pixelization and aliasing that can occur when viewing textures from a distance or up close.

## Max Rate

Defines the maximum number of samples to use when super sampling. Higher values give smoother results but can take longer to render.

## Mapping Mode

A pop up menu used to define the mapping method to use.



*uv*, *vu* – These two options behave like magic rubber wallpaper that can be stretched over the object surface – the *pixels* of the PICT file are made to correspond with set positions on the object's surface. As a result, any distortion from stretching appears more natural. This is by far the most versatile mapping method. The two options are the same except that the image map is rotated 90 degrees.



*xy*, *xz*, *yz* – Works like a slide projector. The “screen” being projected onto is equal to one of the three viewing planes; *xy*, *xz* or *yz*. The size and position of the ‘screen’ is defined using the U Scale, V Scale, U Offset and V Offset parameters. Any surface not oriented with the selected viewing plane will distort the texture when rendering.

## Global Coordinates

Forces projected mappings to use global coordinates rather than local coordinates.

## Mirror U/V

When tiling texture maps, these options can help hide the seams between texture cells.

# PiXELS Menus—*Window*

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## **U/V Scale**

Sets the scale factor to apply to the texture map when using UV or VU mapping. When using one of the projection map methods, use these to define the size (in world space) of the texture map you are projecting on to the surface.

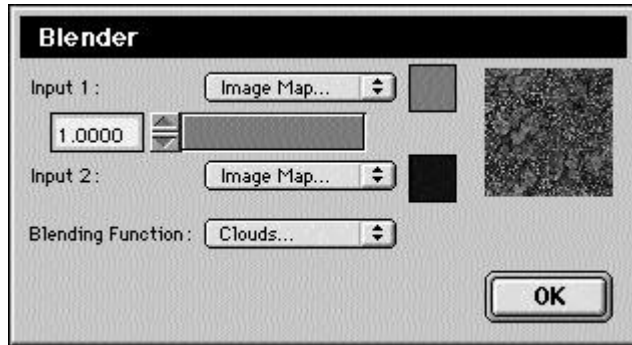
## **U/V Offset**

Defines the position of the first texture tile un UV space. When using one of the projection map methods, defines the position of the upper left corner of the projection 'screen' in *PiXELS* units.



## Blender

Merges two color nodes using a value node as an alpha mask.



### Input 1

Color node defining source channel 1.

### Slider

Sets the weight assignments between channel 1 and channel 2. A value of 0.0 will reveal 100% channel 1, 0.5 will show a 50/50 blend of channels 1 and 2, 1.0 will show 100% channel 2.

### Input 2

Color node defining source channel 2.

### Blending Function

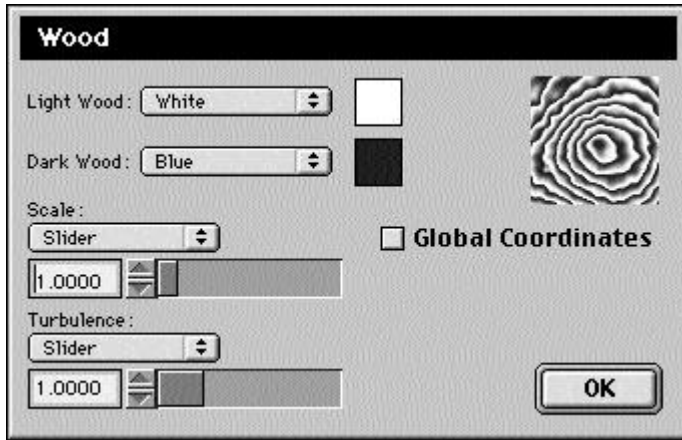
Value node used to define the blending mask. NOTE: the blending mask DOES NOT override the slider. If you want the blending function to fully control the output image, set the slider to 1.0.

# PiXELS Menus—*Window*

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## Wood

A 3D texture which simulates wood patterns.



## Light Wood

Color node used to define the base wood color.

## Dark Wood

Color node used to define the color of the concentric rings running through the texture.

## Scale

Slider/Value node used to define the size of the wood grain.

## Turbulence

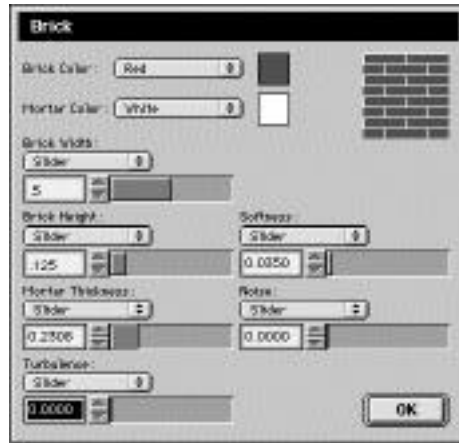
Slider/Value node used to define the randomness of the wood grain.

## Global Coordinates

When this item is checked, the texture is computed in world space rather than object space. If the object is moving in any way and this option is on, the texture will appear to 'slide' through the object when rendered.

## Brick

A 2D texture which simulates brick or stone wall patterns.



### Brick Color

Color node used to define the stone segments.

### Mortar Color

Color node used to define the area between stone segments.

### Brick Width

Slider/Value node used to define the horizontal scale of the bricks.

### Brick Height

Slider/Value node used to define the vertical scale of the bricks.

### Mortar Thickness

Slider/Value node used to define the spacing between bricks.

### Turbulence

Slider/Value node used to define the low frequency randomness of the brick pattern.

### Softness

Slider/Value node used to define the how softly brick blends into mortar.

# PiXELS Menus—*Window*

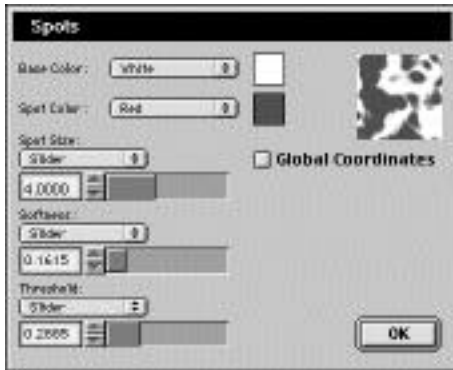
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## Noise

Slider/Value node used to define the high frequency randomness of the brick pattern.

## Spots

A 3D texture constructed of random spots.



## Base Color

Color node defining the area behind the spots.

## Spot Color

Color node defining spots.

## Spot Size

Slider/value node defining the size of the spots.

## Softness

Slider/value node defining the transition from spot to base colors.

## **Threshold**

Slider/value node defining the lean towards base or spot color. Values close to zero will favor the base color, while values closer to 1 will favor the spot color.

## **Global Coordinates**

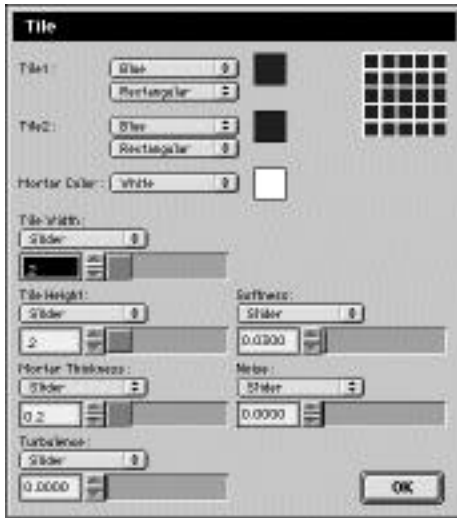
When this item is checked, the texture is computed in world space rather than object space. If the object is moving in any way and this option is on, the texture will appear to ‘slide’ through the object when rendered.

# PiXELS Menus—*Window*

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## Tile

A 2D texture which simulates tile patterns.



### Tile 1

Color node used to define the even tiles. The bottom menu is used to define the tile shape; either rectangular or elliptical.

### Tile 2

Color node used to define the odd tiles. The bottom menu is used to define the tile shape; either rectangular or elliptical.

### Mortar Color

Color node used to define the area between tiles.

### Tile Width

Slider/Value node used to define the horizontal scale of the tiles.

### Tile Height

Slider/Value node used to define the vertical scale of the tiles.

### Mortar Thickness

Slider/Value node used to define the spacing between tiles.

## **Turbulence**

Slider/Value node used to define the low frequency randomness of the tile pattern.

## **Softness**

Slider/Value node used to define the how softly tile blends into mortar.

## **Noise**

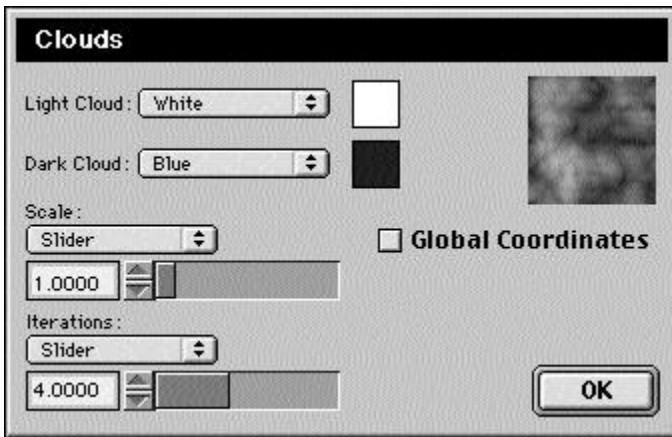
Slider/Value node used to define the high frequency randomness of the tile pattern.

# PiXELS Menu—*Window*

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## Clouds

A 3D fractal texture which simulates cloud patterns.



### Light Cloud

Color node defining the clouds.

### Dark Cloud

Color node defining the area behind the clouds.

### Scale

Slider/value node defining the size of the clouds.

### Iterations

Slider/value node defining the complexity of the cloud patterns.

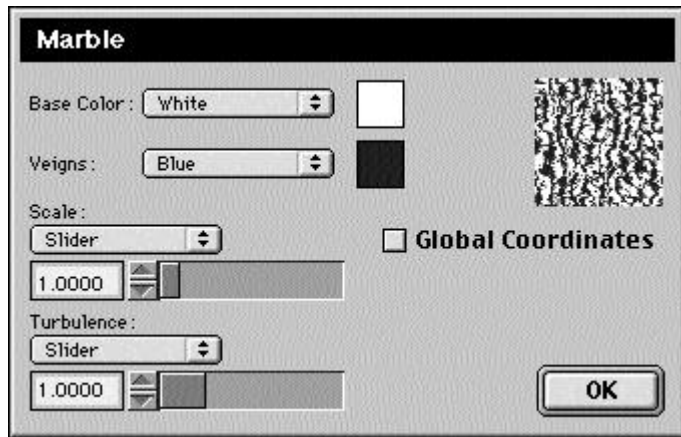
### Global Coordinates

When this item is checked, the texture is computed in world space rather than object space. If the object is moving in any way and this option is on, the texture will appear to 'slide' through the object when rendered.



## Marble

A 3D texture which simulates marble or stone patterns.



### Base Color

Color node defining the main portion of the texture.

### Veins

Color node defining the marble veins running through the texture.

### Scale

Slider/value node defining the size of the veins.

### Turbulence

Slider/Value node used to define the low frequency randomness of the marble veins.

### Global Coordinates

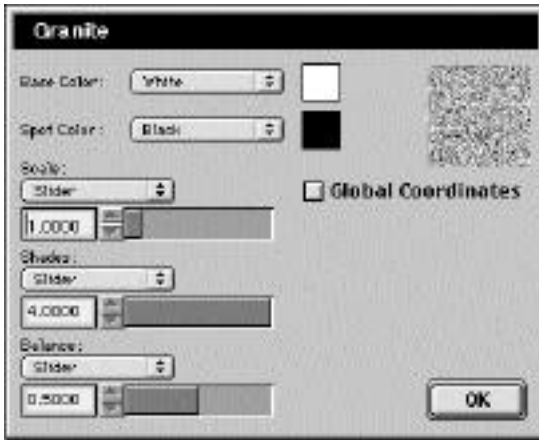
When this item is checked, the texture is computed in world space rather than object space. If the object is moving in any way and this option is on, the texture will appear to 'slide' through the object when rendered.

# PiXELS Menus—*Window*

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## Granite

A 3D texture which simulates speckled granite patterns.



### Base Color

Color node defining the main portion of the texture.

### Spot Color

Color node defining the speckles.

### Scale

Slider/Value node defining the size of the speckles.

### Shades

Slider/Value node used to define the number of varying shades visible inside the texture.

## **Balance**

Slider/value node defining the lean towards base or spot color. Values close to zero will favor the base color, while values closer to 1 will favor the spot color.

## **Global Coordinates**

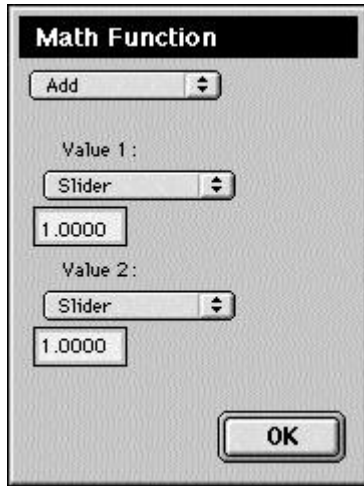
When this item is checked, the texture is computed in world space rather than object space. If the object is moving in any way and this option is on, the texture will appear to ‘slide’ through the object when rendered.

# PiXELS Menus—*Window*

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## Math Function

A utility node. Can be used to mathematically merge values, nodes and other parameters.



## Function

Pop up menu listing available math functions.

The available functions are:

**Add** - returns *Value 1* plus *Value 2*.

**Subtract** - returns *Value 1* minus *Value 2*.

**Multiply** - returns *Value 1* times *Value 2*.

**Divide** - returns *Value 1* divided by *Value 2*.

**Sin** - returns the sin of *Value 1*. *Value 2* is ignored.

**Cos** - returns the cosin of *Value 1*. *Value 2* is ignored.

**Tan** - returns the tangent of *Value 1*. *Value 2* is ignored.

**Sqrt** - returns the square root of *Value 1*. *Value 2* is ignored.

**Pow** - returns *Value 1* to the *Value 2* power.

**Log** - returns *Value 1* log *Value 2*.

**Mod** - returns the modulus (remainder) of *Value 1* divided by *Value 2*.

**Abs** - returns the absolute value of *Value 1*. *Value 2* is ignored.

**Sign** - returns -1 if *Value 1* is less than 0, returns 1 if *Value 1* is greater than 0 and returns 0 if *Value 1* is equal to 0. *Value 2* is ignored.

**Min** - returns *Value 1* if *Value 1* is less than *Value 2*, otherwise *Value 2* is returned.

**Max** - returns *Value 1* if *Value 1* is greater than *Value 2*, otherwise *Value 2* is returned.

**Clamp** - returns *Value 1* unless *Value 1* is less than 0 or greater than 1. If *Value 1* is less than 0, 0 is returned. If *Value 1* is greater than 1, 1 is returned. *Value 2* is ignored.

**Ceil** - returns *Value 1* rounded up to the next whole number. *Value 2* is ignored.

**Floor** - returns *Value 1* rounded down to the last whole number. *Value 2* is ignored.

**Round** - returns *Value 1* rounded to the closest whole number. *Value 2* is ignored.

**Step** - same as floor.

**Smoothstep** - returns *Value 1* bicubically smoothed. *Value 2* is ignored.

## **Value 1**

Slider/value node defining the first value in the math equation.

## **Value 2**

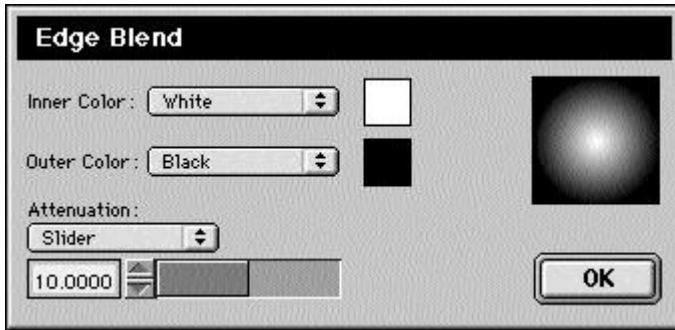
Slider/value node defining the second value in the math equation.

# PiXELS Menus—*Window*

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## Edge Blend

Blends color nodes based on surface and Camera angles.



### Inner Color

Color node defining surfaces facing toward the Camera.

### Outer Color

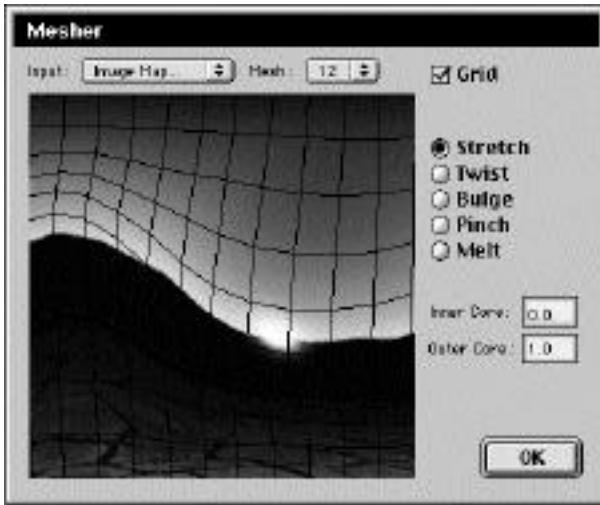
Color node defining surfaces facing away from the Camera.

### Attenuation

Slider/value node defining the power curve used for transition from inner to outer colors.

## Mesher

A color node used to apply mesh warps to other color nodes.



### Input

Color node defining base image used. This is what will appear in the preview window.

### Mesh

Pop up menu used to select the resolution of the underlying mesh.

### Grid

When enabled, the underlying mesh is visible.

### Stretch

Pushes and pulls the mesh around.

### Twist

Rotates the mesh.

### Bulge

Scales the mesh up.

# PiXELS Menus—*Window*

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## **Pinch**

Scales the mesh down.

## **Melt**

Randomly perturbs the mesh.

## **Inner Core**

Defines the portion of the mesh effected 100% by the current tool.

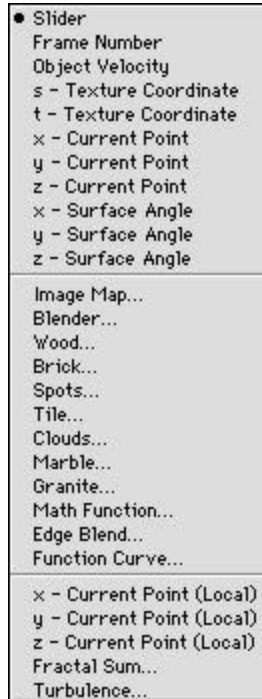
## **Outer Core**

Defines the total area of the mesh effected by the current tool. The area lying between the inner and outer core is the area of diminishing effect.



## Value Nodes

Value nodes define a value attribute such as bump height or reflectivity. Value nodes are almost always used in conjunction with a slider. The value returned by the node is multiplied by the slider value.



### Slider

Simply return the value of the slider.

### Frame Number

Returns the current frame number.

### Object Velocity

Returns the speed, in *PiXELS* units, at which the current object is moving.

# PiXELS Menus—*Window*

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## s/t - Texture Coordinate

Returns the location, in st space, of the current pixel being rendered.

## X/Y/Z - Current Point

Returns the location, in world space, of the current pixel being rendered.

## X/Y/Z - Surface Angle

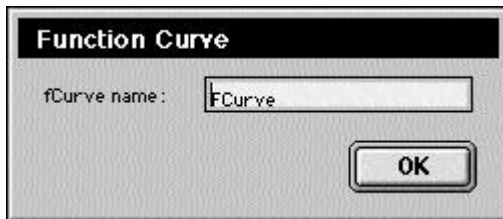
Returns the surface normal of the current pixel being rendered.

## Image Map, Blender, Wood, Brick, Spots, Tile, Clouds, Marble, Granite, Math Function & Edge Blend

See the Color Nodes section for more information

## Function Curve

Graphs values relative to time. Function curve points can be added, removed and edited from the **Timeline** palette, allowing for almost infinite control of values over time. To edit a function curve, exit **ShaderMaker** and open the **Timeline** palette. Expand the current object. Locate the **Shader** function curve group. Expand this item and you will find your newly created function curve.

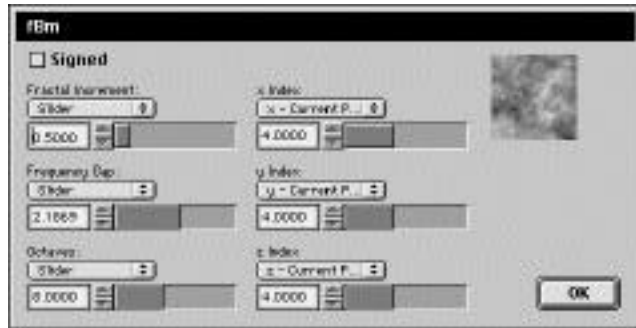


## X/Y/Z - Current Point (Local)

Returns the location, in local space, of the current pixel being rendered.

## fBm

A multi-fractal function. Very robust.



### Signed

When checked, values returned will be in the range of -1 to 1. If unchecked, values less than 0 will be returned unsigned. i.e. a value of -.25 will be returned as .25.

### Fractal Increment

Lower values will result in a smoother noise gradient.

### Frequency Gap

Higher values will produce larger fractals.

### Octaves

Defines the number of iterations for the fractal function. Higher values will produce more detailed fractals.

### x Index, y Index and z Index

Defines the position point from which to derive a noise sample.

# PiXELS Menus—*Window*

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## Turbulence

Another fractal function. Turbulence is always unsigned, returning values between 0 and 1.



### x Index, y Index and z Index

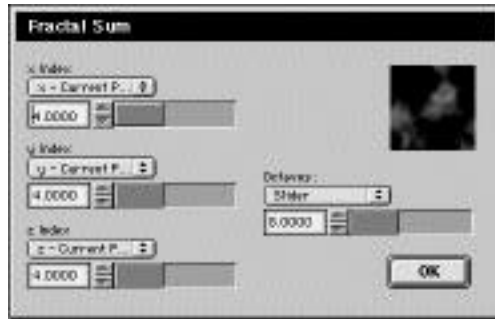
Defines the position point from which to derive a noise sample.

### Octaves

Defines the number of iterations for the fractal function. Higher values will produce more detailed fractals.

## Fractal Sum

Another fractal function. Fractal Sum returns values between -1 and 1.



### x Index, y Index and z Index

Defines the position point from which to derive a noise sample.

### Octaves

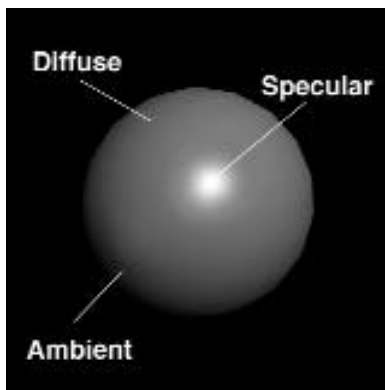
Defines the number of iterations for the fractal function. Higher values will produce more detailed fractals.

## Shading

At render time, patches are smoothed out and subdivided into triangles. How smooth a patch becomes is controlled using the **Object Info** palette's **U & V Subdivision** settings. The higher these values, the smoother the patch will appear at render time and the more memory it will require. Each triangle is a planar surface with its front oriented in one direction. The renderer calculates the relation between this orientation and the light sources in order to determine the shading of each triangle.

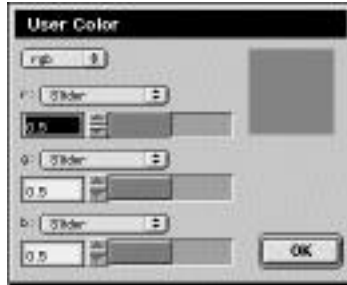
## Ambient, Diffuse, Specular Areas of Illumination

A surface rendered in *PiXELS* combines three different types of illumination to simulate the physical properties of light; ambient, diffuse and specular. Ambient shading represents the global 'scattered' light present in most scenes. A scene within a brightly lit white room would have high ambience. A scene in outer space would have no ambience. A shader with no diffuse or specular, but 100% ambient can be used on objects which require no shading, like backgrounds or glowing objects. Diffuse shading is the base illumination of any object, showing the subtle fluctuations in a surface through variations in highlight and shadow. Specular shading simulates the effect of light rays bouncing from the object to the observer's eyes, creating a highlight or hot spot. The size of this highlight can be controlled through the *Roughness* parameter to simulate a wide variety of materials, from plastic to metal.



## Defining Colors

There are many options for defining colors. The most common is to use the *User Color* node.



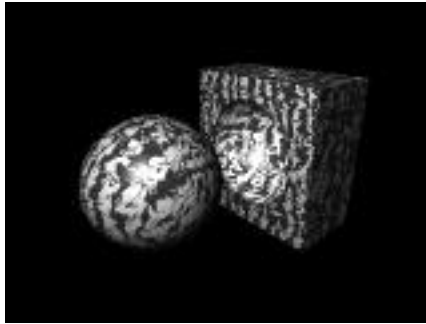
## Defining Values

Most values are defined using a combination of input node and slider value. The value returned by the node is multiplied by the slider value before being used. The *Slider* node always returns a value of 1.0, so the value set using the slider control is the value that will get passed into the renderer. If a color node is selected, its rgb value will be converted to hsv and the v component will be used.



## 2D vs. 3D Textures

There are two types of textures in ShaderMaker; 2D and 3D. The difference between them is the coordinate system upon which they are based. A 2D texture exists in a 2D world - with only 2 coordinates available. For each pair of coordinates there is a corresponding color. The simplest example is a PICT image. Given an xy pair we could easily find the corresponding pixel and its rgb color. 3D textures are a bit more complicated. These textures are like blocks of a material with the object enclosed. Each point within the block can have a different color.



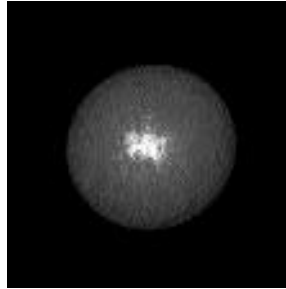
## Animating Textures

Any value parameter can be animated. From the pop up menu, select *Function Curve*. Using a *Function Curve* you can graph values relative to time. Another way to animate textures is to use an animated PICT sequence. To do this, you will need a series of sequentially numbered PICT files, with a five digit numeric extension like this: 'texturename.00000'. At render time, the Texture Manager will automatically load the file whose numeric extension matches the current frame number. If the current frame is greater than the last image, the system will cycle the frames, starting with the first frame again. If a frame is missing from the animated PICT sequence, a blank image will be used in its place.



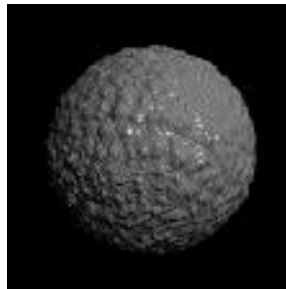
## Bump Mapping

Bump mapping, also known as normal perturbation, creates the illusion of surface roughness by altering the surface normals without actually modifying the surface itself. This illusion works well when viewed from the front, but when viewed from the side, it becomes obvious that the surface is actually flat. Height or depth of the bumps can be controlled using the **Bump** slider.



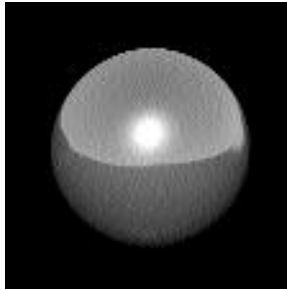
## Displacement Mapping

Displacement mapping takes bump mapping to the next level, altering the actual surface itself. Because of this, higher levels of subdivision are required. To change the subdivision level for an object with displacement, select the object and use the **Object Info** palette to change the **U/V Subdivision** parameters to a higher value like 8 or 12. The actual levels required will depend on the resolution of the rendered image, the object's proximity to the Camera and the detail inherent in the displacement map.



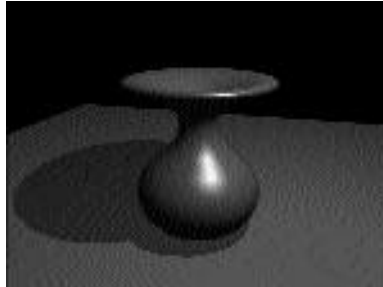
## Environment Mapping

Environment mapping can be used to simulate the effect of an image reflected onto the object's material—without using raytracing. Any color node can be used as an environment map, but it should be noted that all nodes used in this manner will be given a spherical parameterization as if it were a colored sphere that surrounds the object and reflects from the object's surface. Unlike other types of maps, a reflection map is not linked to the object, and will remain stationery when the object moves or rotates. The amount of environment reflected in an abject is controlled using the **Reflectivity** control.

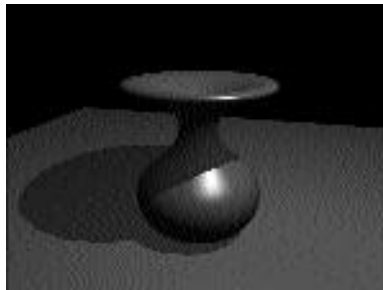


## Shadows

Any renderable object can receive and/or cast shadows. You can set these options using the **Object Info** palette. Objects that cast and receive shadows WILL NOT cast shadows onto themselves.



If an object needs to be self shadowing, an invisible shadow casting copy will need to be created. To do this, simply select the object, turn shadow casting for this object OFF and duplicate it. With the copy still selected, use the **Object Info** palette to turn shadow casting on and visibility off. This object will now cast shadows, but will not render.



## Optimizing Shadows

All shadow casting lights in *PiXELS* are raytraced, so the more triangles an object is made up of, the longer it takes to compute that object's shadow. A simple trick for speeding up shadow casting is to use a 'stand-in' object. This object is an invisible, lower detail version of the rendered object. The technique is very similar to the self shadowing trick described above. A copy of the object is made, it can be simplified and/or change the *U/V Subdivision* settings to 1—so no subdivision takes place at render time. Make the copy invisible, but turn on shadow casting. Make sure shadow casting is off for the original object, otherwise two shadows will be cast.

Other things to remember are:

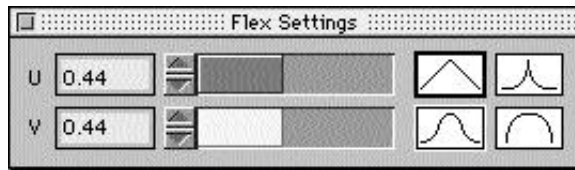
- Turn shadow casting off for objects whose shadows are not visible.
- Turn shadow receiving off for objects which do not receive any shadows.
- Area light sources take much longer to render. A light is considered an area light if its size is greater than zero.
- Suns cannot cast soft shadows, so setting their size to anything other than zero will have no visible effect, but may slow rendering.

## Flex

Sets the surface flexibility of the selected object.

1. Select a model
2. Choose **Flex** from the **Window** menu, or press **B**.
3. Use the sliders to set new values.
4. Select either linear or smooth interpolation.

## Flex Options



### U

Sets the area of effect for the u axis.

### V

Sets the area of effect for the v axis.



A linear interpolation will be used to remap surrounding points.



A smooth interpolation



A smooth interpolation weighted at the source.

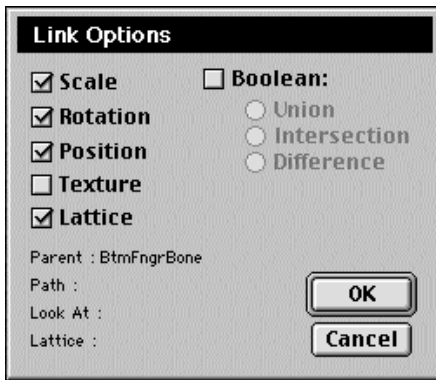


A smooth interpolation weighted at the edges.

## Link Options

Sets which attributes to inherit from the parent object and provides access to true Boolean modeling.

1. Select a model.
2. Choose **Link Options** from the **Window** menu or press **L**.
3. Select which attributes to inherit.
4. Click **OK** to apply link settings or **Cancel** to abort.



## Link Options Options

### Scale

Inherit scaling factors from parent.

### Rotation

Inherit rotational factors from parent.

### Position

Inherit x, y, and z offset from parent.

### Texture

Inherit all shader parameters from parent.

### Lattice

Inherit lattice deformations from parent. (If the parent is linked to a lattice).

## **Boolean**

Sets whether or not this object will affect its parent at rendering time.

## **Union**

Renders the parent and child objects as though they were one.

## **Intersection**

Renders only the overlapping portions of the parent and child.

## **Difference**

Carves out or subtracts the child from the parent when rendering.

## MorphMaker

MorphMaker is a tool that allows you to define a neutral reference pose for an object and any number of variations on that reference. These variations are called *gestures*. Any number of gestures can then be blended in any amount to form a *pose*. This feature can greatly simplify facial animation, among other things.

1. Select a model.
2. Choose **MorphMaker** from the **Window** menu or type **M**.



## MorphMaker Options

### Gesture Pop-up Menu

Allows you to select a gesture to edit with the **Gesture Slider**.

### Gesture Slider

Controls how much of the Gesture shown in the **Gesture** pop-up is added to the current pose.

### Set Reference

Saves the current shape of the selected object as the reference pose.

### Keyframe Pose

Saves the current pose in a new keyframe at the current frame number.

### Save Gesture...

Opens a dialog allowing you to name a gesture and then saves the current shape of the selected object under that name.

### Zero Gestures

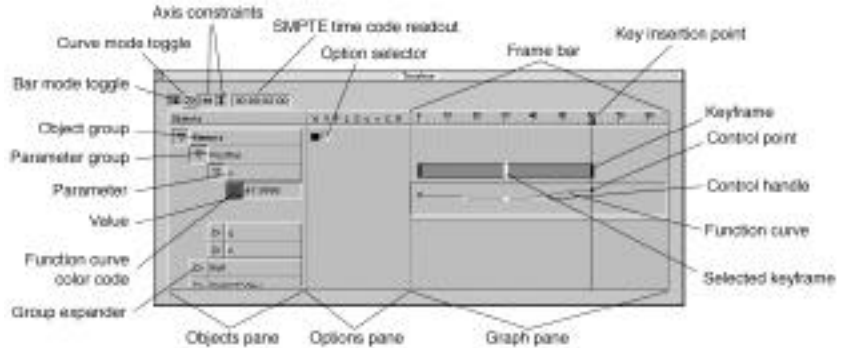
Sets the effect of each saved gesture to zero, effectively returning you to the reference pose.



## Timeline

Opens a floating window containing a graphical representation of animation timings for all objects in a scene. All animatable parameters of an object can be directly edited from within this window.

1. Select an object.
2. Click *Animate* in the main tool palette.
3. Click *Timeline* in the lower tool palette.



The Timeline window is divided into three main parts. From left to right they are the: *object pane*, *options pane* and *graph pane*. There is also a group of push-buttons in the upper left corner. The first button sets the graph pane to *Bar mode*. The second button changes it to *Curve mode*. The second pair of buttons can be used to constrain movement of function curve *control points*. The left button, if depressed, allows horizontal movement, i.e. you can change the *time* of a control point. The right button, if depressed, allows vertical movement, i.e. you can change the *value* of the parameter at that time. You can **pan** by **shift-dragging** in any pane. You can **zoom** by **option-dragging** in any pane. The window can be resized by dragging its bottom-right corner.

## Object Pane

You can select an object by clicking on its name in the object pane. The entry for the selected object will appear indented. The object pane is hierarchical, like an outline. You can click the *group expander* to the left of an object name to show or hide the parameter groups for that object. If the object has any objects linked to it (children) they will show up here as well. Clicking the group expander for a parameter group will reveal the animatable parameters for that group. Parameters can be expanded in this way as well. Expanded parameters reveal a color box and a value number. The color box shows the color that parameter's function curve will have in the graph pane. To change the color, click on the color box to open the Apple color picker dialog. The value number displays the value that that parameter has at the current frame. This value can be changed by clicking on the value number and typing in a new number. Type the **return** or **enter** key to apply the new value. To create a new keyframe, **option-click** any object group, parameter group or parameter. A black keyframe marker will appear in the graph pane.

## Options Pane

There are nine options available in the options pane: Wireframe color, Visible, Proxy, Lock, Skew, Close u, Close v, Cast shadows, and Recieve shadows. If you click and hold on an option selector for a few seconds, a description of what it does appears in the pane header. See **Window > Object Info** for a description these options. Not all objects have all nine options available. Lights and the Camera, for example, have wireframe color and visible options, but none of the others.

## Graph Pane

The current frame can be changed by dragging the key insertion point. If you hold down the **option** key while you drag, the key insertion point will change, but the current frame will not. This can be used to copy keyframes from one point in time to another.

The appearance and behavior of the graph pane will differ depending on whether *Bar mode* or *Curve mode* is selected. Bar mode shows the function curve for each fully expanded parameter in its own function curve pane. The function curve pane can be resized by dragging the bar just below the pane. To select bar mode, click on the **Bar** button (the left button in the upper left corner of the window). Curve mode allows you to view and edit multiple curves simultaneously. Any curve which has been fully expanded in the hierarchy will show up in this mode, so you can even edit curves from multiple objects. To select curve mode, click on the **Curve** button (the second one from the left in the upper left corner of the window).

Keyframes appear in the bar graph display as black rectangles. If the horizontal movement button is depressed, you can move a keyframe to a different time by dragging it. Multiple keyframes can be selected at one time. To select multiple keyframes, **-click** and drag a box around the keyframes you want selected. **-shift click** toggles selected keyframes. Selected keyframes can be moved or they can be deleted by typing the **delete** key. NOTE: the cursor must be inside the **Timeline** palette when typing.

Function curves are bézier curves. There is one control point for each key frame. **-click** on a control point to select it. The selected point will show a *control handle* that can be adjusted to alter velocity from keyframe to keyframe. By default, control handles will maintain continuity from one side of the control point to the other. If you want to break continuity (to have a sudden change of direction or velocity) at a control point, **control-click** and drag the handle. The continuity will remain broken until you **control-click** on the handle a second time.

# PiXELS Menus—*Window*

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## Full Screen

Sets the viewing window to either fill the screen (default) or fit into a resizeable, relocatable window.

1. Choose **Full Screen** from the **Window** menu, or type **F**.

## Snap To Grid

Provides for more precise positioning by aligning changes to an underlying grid. The grid size can be changed from the command line using the gridsizes command.

1. Choose **Snap To Grid** from the **Window** menu.

## View

A sub-menu which lists a number of viewing options.

1. Select **View** from the **Window** menu. A sub-menu will pop-up.
2. Drag the mouse to the desired option.

## View Sub-menu Items

### Grid

Toggles the visible grid for the top, front and right views.

### Normals

Shows the surface normals for the currently selected object.

### Links

Shows all parent/child connections. A green line will appear between a parent and all of its children to show a standard link. A blue line will appear to show a look-at link.

### Centers

Shows an object's x, y, and z orientation and center.

### Hull

Shows the connectivity between vertices by drawing a vector between them. This represents an approximation of the actual shape.

### Surface

Draws the actual spline curves that make up a shape. This is the most accurate vector representation of a shape, but can take a long time to draw.

### Bounding Box

Show only the bounding boxes (extents) of each object. The currently selected object will still draw normally. This provides the fastest screen redraw.

## **Fast Navigate**

Will use a proxy of the scene when using the View tools to navigate.  
This speeds screen refresh.

## **Motion Paths**

Will draw a blue line which represents the path a given object follows  
when animated.





## Select Contents

|                       |       |
|-----------------------|-------|
| Parent .....          | 6.113 |
| Interest .....        | 6.113 |
| Path .....            | 6.113 |
| Lattice .....         | 6.113 |
| Bone .....            | 6.113 |
| Skin .....            | 6.113 |
| Next Object .....     | 6.113 |
| Previous Object ..... | 6.113 |



## **Parent**

Selects the parent (if there is one) of the currently selected object.

## **Interest**

Selects the interest (if there is one) of the currently selected object.

## **Path**

Selects the path (if there is one) of the currently selected object.

## **Lattice**

Selects the lattice (if there is one) of the currently selected object.

## **Bone**

Selects the IK chain (if there is one) of the currently selected point.

## **Skin**

Selects the skin (if there is one) of the currently selected IK chain.

## **Next Object**

Selects the next object in the scene list. The order of objects in this list is determined by the order in which objects are created.

## **Previous Object**

Selects the previous object in the scene list. (see above)



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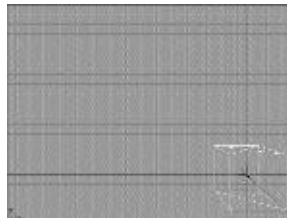
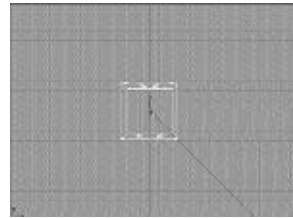
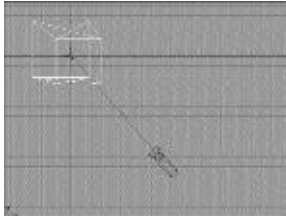
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## Pan

Moves the center of the current viewport. This tool does not effect the geometry of a model.

1. Click *View* from the main tool palette.
2. Click *Pan* in the lower tool palette.
3. Click in any window view and drag the mouse to move the center of that window.



# PiXELS View Tools

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## Zoom

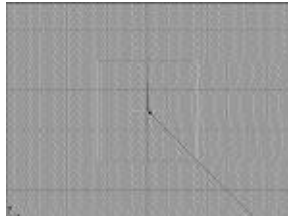
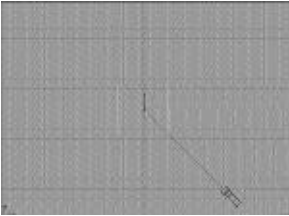
Scales the current view larger in 200% increments or smaller in 50% increments.

### To zoom in:

1. Click *View* in the main tool palette.
2. Click *Zoom* in the lower tool palette.
3. Click in any window view. Each click doubles the size of the image.

### To zoom out:

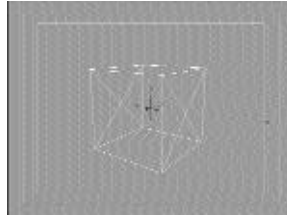
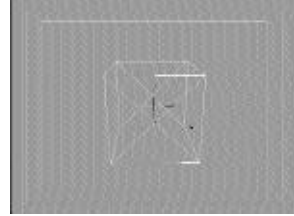
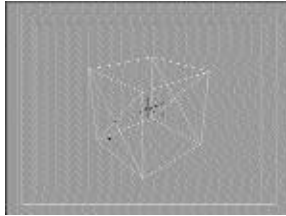
1. Click *View* in the main tool palette.
2. Click *Zoom* in the lower tool palette.
3. **-click** in any window view. Each click reduces the size of the image by half.



## Orbit

Rotates the Camera around the Interest.

1. Click *View* in the main tool palette.
2. Click *Orbit* in the lower tool palette.
3. Click in the *Camera* view and drag the mouse in any direction. The view turns as the mouse moves around.



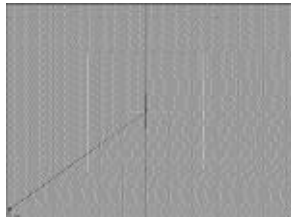
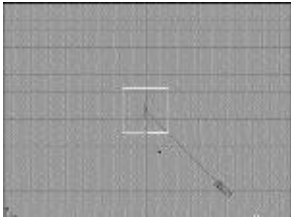
# PiXELS View Tools

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## Dolly

Interactively changes the user's view of the current view port in or out of a scene.

1. Click *View* in the main tool palette.
2. Click *Dolly* in the lower tool palette.
3. In any view window, click and drag the mouse. To bring the model closer (dolly in), move the mouse toward the bottom of the screen. To move the model further away (dolly out), move the mouse toward the top of the screen.





## Time

Moves the scene forward or backward in time. Can be used to preview animations, or navigate through an animation.

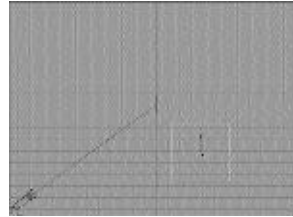
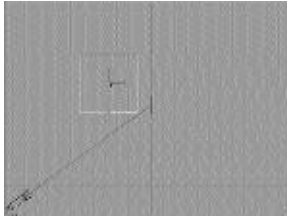
1. Click *View* in the main tool palette.
2. Click *Time* in the lower tool palette.
3. Click in any view and drag the mouse left to move backward or right to move forward in time. The view and frame counter change as the mouse moves.



## Move

Sets how far the model is offset from the center of the grid.

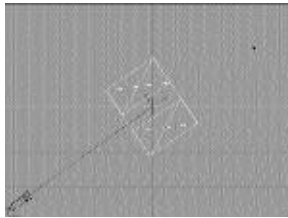
1. Click *Control* in the main tool palette.
2. Click *Move* in the lower tool palette.
3. Click and drag in any window to move the currently selected model.



## Rotate

Pivots the model, changing its orientation in 3 D space.

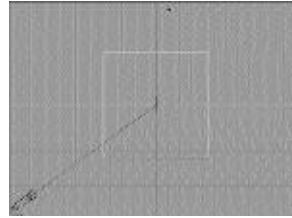
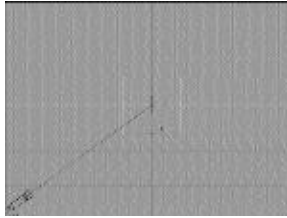
1. Click *Control* in the main tool palette.
2. Click *Rotate* in the lower tool palette.
3. Click in any view and drag the mouse in any direction to rotate the currently selected model.



## Scale

Resizes the currently selected object.

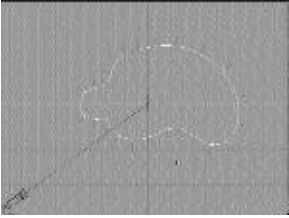
1. Click *Control* in the main tool palette.
2. Click *Scale* in the lower tool palette.
3. Drag the mouse up or down in any window to rescale the selected object. Moving the mouse up enlarges the object. Moving down reduces the selected object.



## Expand

Expands the currently selected object by ‘pushing’ each vertex out (or in) along its normal vector.

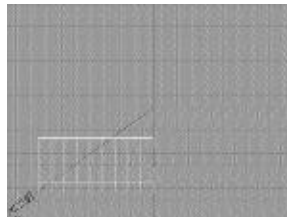
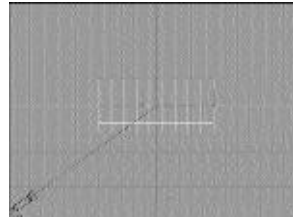
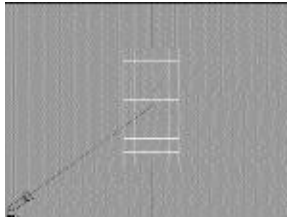
1. Click *Control* in the main tool palette.
2. Click *Expand* in the lower tool palette.
3. Drag the mouse up or down in any window to expand the selected object. Moving the mouse up expands the object. Moving down contracts the selected object.



## Center

Moves the x, y, z center of the selected object. Used most often to set an object's pivot point.

1. Select the object.
2. Click *Control* in the main tool palette.
3. Click *Center* in the lower tool palette.
4. Click and drag to move the center of the currently selected object.



## Align

Aligns the current object's center point with the center point of the next object selected.

1. Select the object which you want to align.
2. Click *Control* in the main tool palette.
3. Click *Align* in the lower tool palette.
4. Without holding down the **Shift** key, pick the object you want the currently selected object to align to.
5. Or hold down the **Shift** key and select a different object. Go to step 4.
6. Set any or all axis you want aligned.
7. Click **OK** to apply or click **Cancel** to abort.



### Align Options:

- X Center** - Sets the x-axis alignment factor.
- Y Center** - Sets the y-axis alignment factor.
- Z Center** - Sets the z-axis alignment factor.

Vertex level alignment is also possible. This allows you to align points on one object to points on another object.

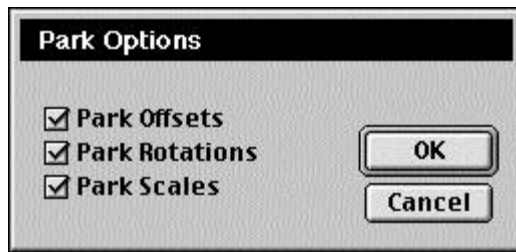
1. Select the object which you want to align points to.
2. Click *Control* in the main tool palette.
3. Click *Align* in the lower tool palette.
4. Click *Tag* in the *Selector* tool palette.
5. While holding down the **Shift** key, select the point(s) you want to align to.
6. Without holding down the **Shift** key, pick the point(s) on any other object you want to align to the previously selected point(s).



## Park

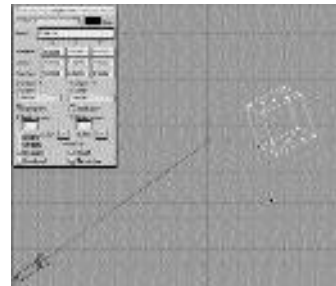
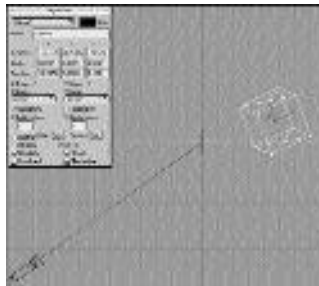
Applies all transformations and deformations and locks them into the object. The object center is reset to 0, its scaling is reset to 1 and its rotation is reset to 0. The model will still look the same, but may react differently.

1. Select the object which you want to park.
2. Click *Control* in the main tool palette.
3. Click *Park* in the lower tool palette.
4. The object is now parked, and all rotations, transformations and deformations have been applied.



### Park Options:

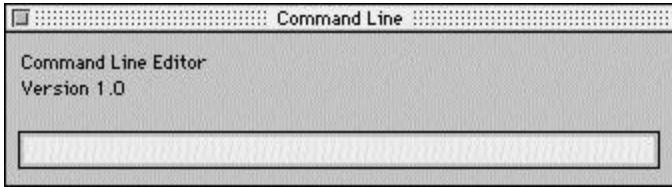
- Park Offsets** - Applies all position offsets to the objects' mesh and resets the object's positions to 0.0.
- Park Rotations** - Applies all rotations to the objects' mesh and resets the object's rotations to 0.0.
- Park Scales** - Applies all scaling factors to the objects' mesh and resets the object's scales to 1.0.



## Command

Provides access to a command line editor for typing in commands.

1. Click Control in the main tool palette.
2. Click Command in the lower tool palette.
3. Type in commands. (listed in the Glossary.) Hit either the enter or return key to see the effects of this command.



Commands:

The command line interface is case-sensitive, so type the commands exactly as they are shown here (replacing variables with the appropriate value.)

### **move point x y z**

Moves the current point on the current model by x, y, z units.

### **flexv n**

Sets the v Flex of the current model to n.

### **flexu n**

Sets the u Flex of the current model to n.

### **dolly WindowNumber x**

Sets the zoom factor of view WindowNumber to x.

The views are numbered as follows:

1. Top
2. Front
3. Right
4. Camera

### **pan WindowNumber x y**

Pans the view WindowNumber by x and y.

**normalheight n**

Sets the length of the normal vectors when the menu item “Show Normals” is implemented.

**gridsize n**

Sets the visible grid step to  $n \times n$  units.

**snapto n**

Sets the snap-to grid step to  $n \times n$  units.

**autodepth {on off}**

Sets the “Window->View->Auto Depth” menu item to on or off.

**keyhelp {on off}**

Sets the keyhelp feature to on or off. The keyhelp feature shows all the keyboard short-cuts next to the tool in the tool palette.

**showpath {on off}**

Sets the “Window->View->Motion Paths” menu item to on or off.

**showsurf {on off}**

Sets the “Window->View->Surfaces” menu item to on or off.

**showvertices {on off}**

Sets the “Window->View->Vertices” menu item to on or off.

**showhull {on off}**

Sets the “Window->View->Hull” menu item to on or off.

**showcenters {on off}**

Sets the “Window->View->Center” menu item to on or off.

**showlinks {on off}**

Sets the “Window->View->Links” menu item to on or off.

# PiXELS Control Tools

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## **shownormals {on off}**

Sets the “Window->View->Normals” menu item to on or off.

## **fastnavigate {on off}**

Sets the “Window->View->Fast Navigate” menu item to on or off.

## **grid {on off}**

Sets the “Window->View->Grid” menu item to on or off.

## **gridsnap {on off}**

Sets the “Window->Snap To Grid” menu item to on or off.

## **tran x y z**

Transforms ( moves ) the currently selected object by x, y and z units.

## **rot x y z**

Rotates the currently selected object  $x^\circ$ ,  $y^\circ$  and  $z^\circ$ .

## **scale x y z**

Scales the currently selected object  $x\%$ ,  $y\%$  and  $z\%$ .

## **point tran x y z**

Transforms ( moves ) the currently selected point by x, y and z units.

## **point rot x y z**

Rotates the currently selected point  $x^\circ$ ,  $y^\circ$  and  $z^\circ$ .

## **set tran x y z**

Sets the currently selected object's absolute x, y and z offsets.

## **set rot x y z**

Sets the currently selected object's absolute x, y and z rotation.

## **set scale x y z**

Sets the currently selected object's absolute x, y and z scale

**set renderloc x y**

Sets the center of the render window to x, y.

**set rendersize x y**

Sets the size of the default render window to x, y.

**select parent**

Selects the current object's parent and makes it the current object.

**select point h v**

Selects point h, v on the currently selected object.

**select n**

Selects the object numbered n and makes it the current object.

**select itemName**

Selects the object named itemName and makes it the current object.

**hide n1 n2**

Hides the objects numbered from n1 thru n2.

**hide h3ier**

Hides the currently selected object and all its children.

**hide down**

Hides the currently selected object and all objects numbered lower than it.

**hide up**

Hides the currently selected object and all objects numbered higher than it.

**hide all**

Hides all objects.

# PiXELS Control Tools

---

## **show n1 n2**

Shows the objects numbered from n1 thru n2.

## **show hier**

Shows the currently selected object and all its children.

## **show down**

Shows the currently selected object and all objects numbered lower than it.

## **show up**

Shows the currently selected object and all objects numbered higher than it.

## **show all**

Shows all objects.

## **name object itemName**

Renames the currently selected object to itemName.

## **update n**

Updates the view numbered n.

## **update current**

Updates the active view.

## **update {on off}**

Sets the auto-update feature to on or off.

## **cylinder**

Opens the Cylinder dialog, allowing you to create a new primitive.

## **sphere**

Opens the Sphere dialog, allowing you to create a new primitive.

**cone**

Opens the Cone dialog, allowing you to create a new primitive.

**mesh**

Opens the Mesh dialog, allowing you to create a new primitive.

**cube**

Opens the Cube dialog, allowing you to create a new primitive.

## Link/Unlink

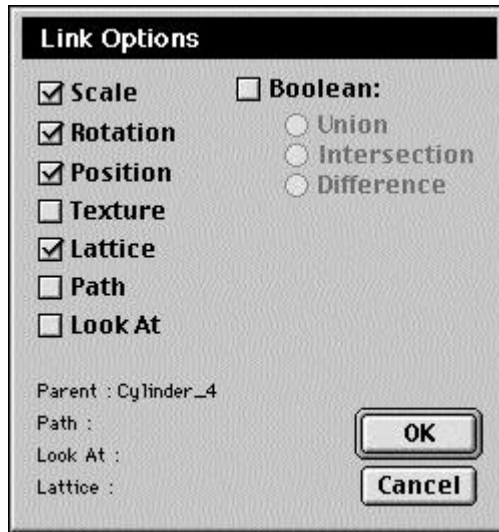
Applies a hierarchical (parent/child) grouping to objects so that they operate together but can retain their individual rotation and scale values. If a link has already been established, this tool breaks the hierarchical grouping of objects so that they operate independently once again.

1. Select the object which you want to link.
2. Click *Control* in the main tool palette.
3. Click *Link/Unlink* in the lower tool palette.
4. Without holding down the ☐ key, pick the object you want the currently selected object to link to.
5. Or hold down the ☐ key and select a different object, making it the currently selected object without establishing a link. Go to step 4.
6. The **Link Options** dialog will appear. Select the desired options and click **OK** to accept or **Cancel** to reject.

OR

1. Select the object which you want to unlink.
2. Click *Control* in the main tool palette.
3. Click *Link/Unlink* in the lower tool palette.
4. The system will beep to indicate that the link was broken successfully. If there is no beep, than no link was broken. Most probable cause: The selected object was not linked to anything.





## Link Options Options:

- |                       |   |
|-----------------------|---|
| <b>Scale -</b>        | Inherit scaling factors from parent.  |
| <b>Rotation -</b>     | Inherit rotational factors from parent.   |
| <b>Position -</b>     | Inherit x, y, and z offset from parent.   |
| <b>Texture -</b>      | Inherit all shader parameters from parent.  |
| <b>Lattice -</b>      | Inherit lattice deformations from parent. (If the parent is linked to a lattice). |
| <b>Boolean -</b>      | Sets whether or not this object will effect its parent at rendering time.         |
| <b>Union -</b>        | Renders the parent and child objects as though they were one.                     |
| <b>Intersection -</b> | Renders only the overlapping portions of the parent and child.                    |
| <b>Difference -</b>   | Carves out or subtracts the child from the parent when rendering.                 |

# PiXELS Control Tools

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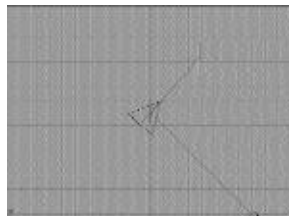
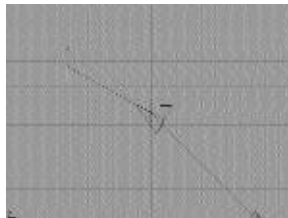
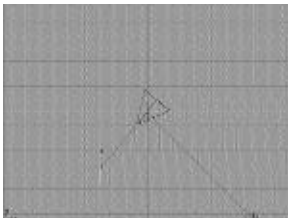
## Look/Unlook

Creates a hierarchy which forces one object to always face toward another object. If such a hierarchy has already been established, this tool breaks the hierarchical grouping of objects so that they operate independently once again.

1. Select the object you want to 'look at' another object.
2. Click *Control* in the main tool palette.
3. Click *Look/Unlook* in the lower tool palette.
4. Without holding down the **key**, pick the target object.
5. Or hold down the **key** and select a different object, making it the currently selected object without establishing a link. Go to step 4.

OR

1. Select the object which you want to 'unlook'.
2. Click *Control* in the main tool palette.
3. Click *Look/Unlook* in the lower tool palette.
4. The system will beep to indicate that the link was broken successfully. If there is no beep, than no link was broken. Most probable cause: The selected object was not linked to anything.



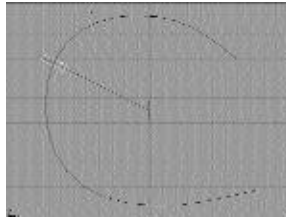
## Path/Unpath

Creates a hierarchy which links an object to a spline, using that spline as the object's motion path. If such a hierarchy has already been established, this tool breaks the hierarchical grouping of objects so that they operate independently once again.

1. Select the object which you want to 'path link'.
2. Click *Control* in the main tool palette.
3. Click *Path/Unpath* in the lower tool palette.
4. Without holding down the *key*, pick the path spline.
5. Or hold down the *key* and select a different object, making it the currently selected object without establishing a link. Go to step 4.

OR

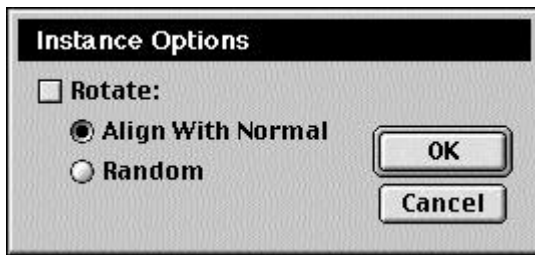
1. Select the object which you want to 'unpath'.
2. Click *Control* in the main tool palette.
3. Click *Path/Unpath* in the lower tool palette.
4. The system will beep to indicate that the link was broken successfully. If there is no beep, than no link was broken. Most probable cause: The selected object was not linked to anything.



## Instance

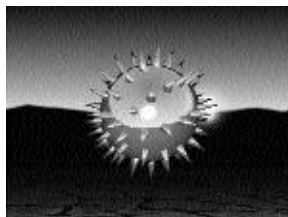
Duplicates a selected object across the surface of a target object. One copy is created for and aligned with each vertex on the target object.

1. Select the object to be duplicated.
2. Click *Control* in the main tool palette.
3. Click *Instance* in the lower tool palette.
4. Without holding down the **Alt** key, pick the target object.
5. Or hold down the **Alt** key and select a different object, making it the currently selected object without instancing. Go to step 4.
6. Set any desired options.
7. Click **OK** to apply or click **Cancel** to abort.



### Instance Options:

- Rotate -** When instancing, rotate each duplicate as described below.
- Align With Normal** - The duplicates are rotated so that their z-axis' are aligned with the target object's vertex normals.
- Random -** Using a fractal noise, each duplicate is randomly rotated. This is a good option for simulating natural elements such as leaves on trees.



*A cone instanced onto a sphere*

## Copy Shader

Copies the Shader definition from one object to another.

1. Select the source object (the one whose data you wish to copy.)
2. Click *Control* in the main tool palette.
3. Click *Copy Shader* in the lower tool palette.
4. Without holding down the `Ctrl` key, pick the target object.
5. Or hold down the `Ctrl` key and select a different object, making it the currently selected object without copying any data. Go to step 4.

## Copy Shape

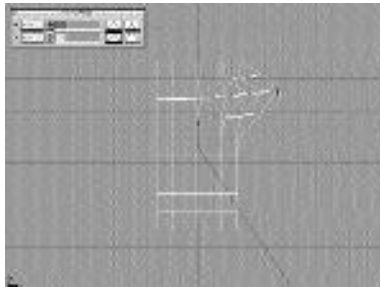
Copies the Shape geometry from one object to another.

1. Select the source object (the one whose data you wish to copy.)
2. Click *Control* in the main tool palette.
3. Click *Copy Shape* in the lower tool palette.
4. Without holding down the `key`, pick the target object.
5. Or hold down the `key` and select a different object, making it the currently selected object without copying any data. Go to step 4.

## Push/Pull

Use to grab any point or column on the mesh and drag it into a new shape.

1. Select the object you want to reshape.
2. If desired, adjust the flexibility or tension of the object (see **Flex** in the **Window** menu).
3. Click *Reshape* in the main tool palette.
4. Click *Push/Pull* in the lower tool palette.
5. Click on the vertex you want to move.
5. Drag with the mouse to push and pull that vertex into a new form.



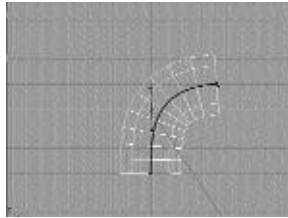
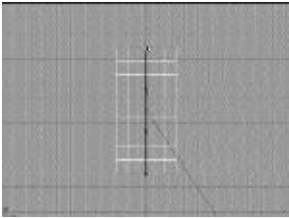
# PiXELS Reshape Tools

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## Spline

Uses the central Beziér curve present in every *PiXELS* object to bend and reshape that object.

1. Select an object to deform.
2. Click *Reshape* in the main tool palette.
3. Click *Spline* in the lower tool palette. With a color monitor, the spline of the selected object will appear in red.
3. Click on any of the spline's 4 control points and drag to bend and curve the object along its *backbone*.

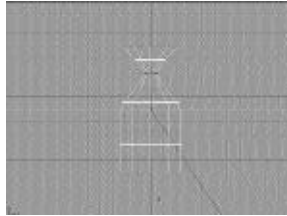




## Pinch

Constricts all the points in the current v step by pulling them toward their absolute center.

1. Select the object you want to pinch.
2. If desired, adjust the flexibility or tension of the object (see **Flex** in the **Window** menu).
2. Click *Reshape* in the main tool palette.
3. Click *Pinch* in the lower tool palette.
4. Click on any vertex in the v step you want to pinch. Use the *V Col* constraint to help you see which points will be pinched.
5. Drag the mouse up to bulge the points out, or drag down to pinch the points in.



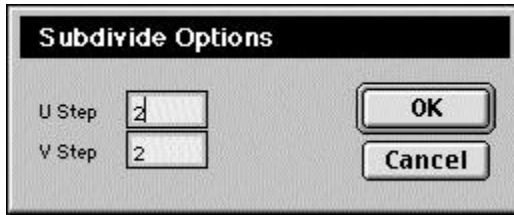
# PiXELS Reshape Tools

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## Subdivide

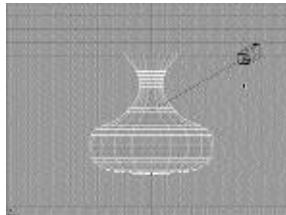
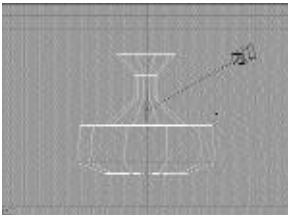
Divides a patch to create a more detailed, smoother, higher resolution object.

1. Select the object you want to subdivide.
2. Click *Reshape* in the main tool palette.
3. Click *Subdivide* in the lower tool palette.
4. Enter values for **U Step** and **V Step**.
5. Click **OK** to apply or **Cancel** to abort.



### Subdivide Options:

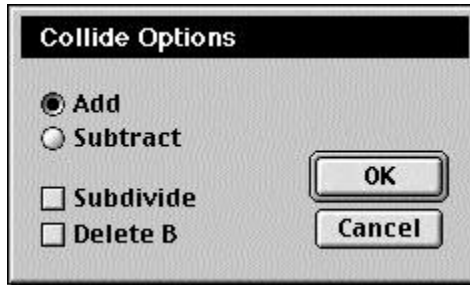
- U Step** - Sets the number of intermediate points to add between each u step.
- V Step** - Sets the number of intermediate points to add between each v step.



## Collide

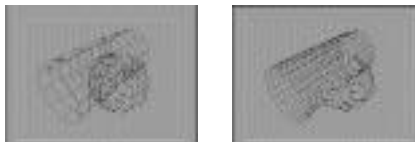
Provides the ability to *push* one object into or out of another to create dents and bumps.

1. Use the *Control* tools to line up the two objects to prepare for collision.
2. Select the object you want to dent or bump.
3. Click *Reshape* in the main tool palette.
4. Click *Collide* in the lower tool palette.
5. Without holding down the **key**, pick the object you want to collide into the currently selected object.
6. Make the desired changes to the **Collide Options** parameters.
7. Click **OK** to collide or **Cancel** to abort.



### Collide Options:

- |                    |  |
|--------------------|--|
| <b>Add -</b>       | Causes the collision to happen from the inside, pushing outward.   |
| <b>Subtract -</b>  | Causes the collision to happen from the outside, pushing in.   |
| <b>Subdivide -</b> | When selected, causes the object being collided with to subdivide before collision detection. This provides a more accurate representation of the colliding shape, but takes longer to calculate and returns a more complex model. |
| <b>Delete B -</b>  | Discards the colliding object (the object used to make the dent) upon return.  |



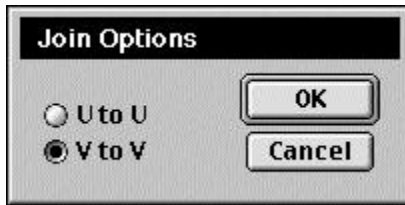
# PiXELS Reshape Tools

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## Join

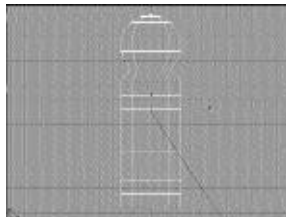
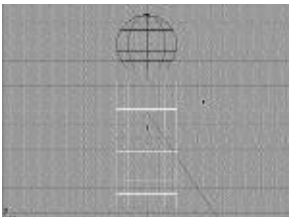
Bonds two objects together. Objects need the same number of points along the bonding axis to be joined.

1. Use the *Control* tools to line up the two objects to prepare for joining.
2. Select the first object you want to join. Select the object on the end you want joined.
3. Click *Reshape* in the main tool palette.
4. Click *Join* in the lower tool palette.
5. Without holding down the  $\square$  key, pick the object you want to join. Make sure you click on the end you want joined when selecting the second object.
6. Set the desired parameters.
7. Click **OK** to join or **Cancel** to abort.



### Join Options:

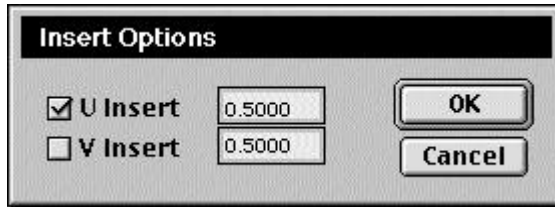
- U to U -** Joins the two selected objects while maintaining the step count of the v-axis.
- V to V -** Joins the two selected objects while maintaining the step count of the u-axis.



## Insert

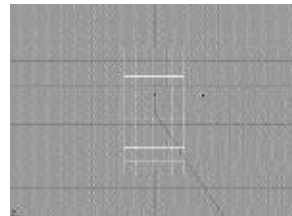
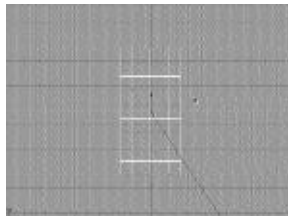
Adds a column of control points along the u and/or v-axis.

1. Select the object you want to insert points on.  
Inserted column of points will be between the currently selected point and the next point in line.
2. Click *Reshape* in the main tool palette.
3. Click *Insert* in the lower tool palette.
4. Set the desired parameters.
5. Click **OK** to insert or **Cancel** to abort.



### Insert Options:

- U Insert -** Adds a column of points along the object's u-axis. The number represents where the new column will lie between the current column and the next column in the patch.
- V Insert -** Adds a column of points along the object's v-axis. The number represents where the new column will lie between the current column and the next column in the patch.



# PiXELS Reshape Tools

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## Remove

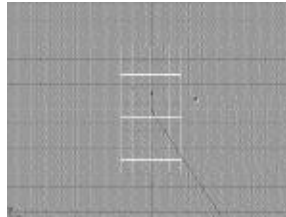
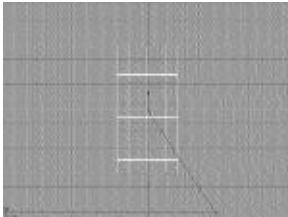
Removes a column of control points along the u and/or v-axis.

1. Select the object you want to effect.
2. Click on a point in the column you want removed.
3. Click *Reshape* in the main tool palette.
4. Click *Remove* in the lower tool palette.
5. Set the desired parameters.
6. Click **OK** to remove or **Cancel** to abort.



### Remove Options:

- U Remove** - Removes a column of points along the object's u-axis.
- V Remove** - Removes a column of points along the object's v-axis.



## Flip

Reverses the object across the x, y or z plane.

1. Select the object you want to flip.
2. Click **Reshape** in the main tool palette.
3. Click **Flip** in the lower tool palette.
4. Set the desired parameters.
5. Click **OK** to flip or **Cancel** to abort.



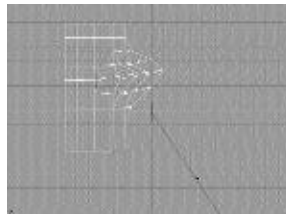
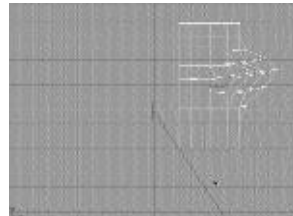
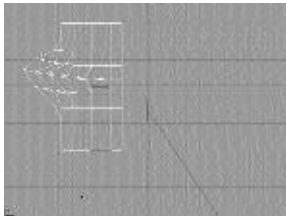
### Flip Options:

**Global Coordinates** - Flips the object's position values as well as the geometry.

**X Axis** - Flips the object on its x-axis.

**Y Axis** - Flips the object on its y-axis.

**Z Axis** - Flips the object on its z-axis.



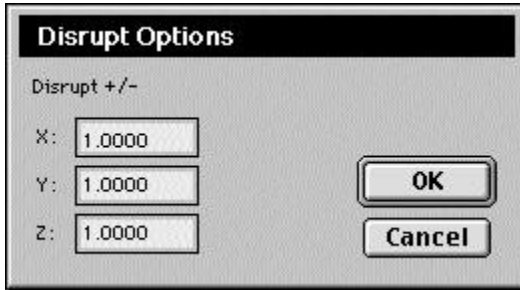
# PiXELS Reshape Tools

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## Disrupt

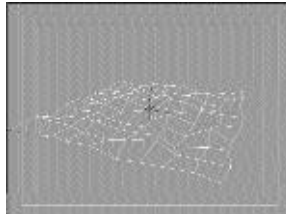
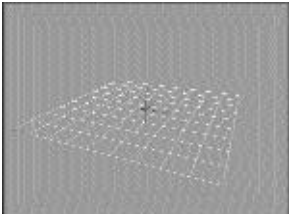
Randomly displaces every vertex on the selected patch.

1. Select the object you want to disrupt.
2. Click *Reshape* in the main tool palette.
3. Click *Disrupt* in the lower tool palette.
4. Set the **Disrupt Options** parameters.
5. Click **OK** to disrupt or **Cancel** to abort.



### Disrupt Options:


- X -** Sets the maximum displacement factor for X.
- Y -** Sets the maximum displacement factor for Y.
- Z -** Sets the maximum displacement factor for Z.

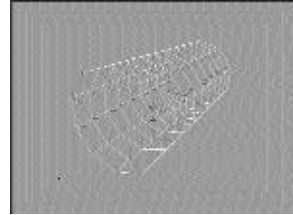
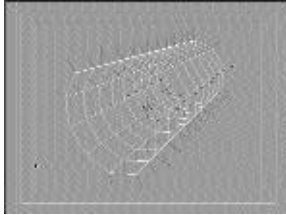




## Invert

Reverses the surface normals.

1. Select the object you want to invert.
2. Click **Reshape** in the main tool palette.
3. Click **Invert** in the lower tool palette.
4. The object's normals are now inverted. Use the **Window > View > Normals** (  ) menu item to view the normals.



# PiXELS Reshape Tools

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## 3 D Emboss

Uses the luminance values from any PICT image to displace the selected patch.

1. Select the object you want to emboss.
2. Click *Reshape* in the main tool palette.
3. Click *3 D Emboss* in the lower tool palette.
4. Set the **3 D Emboss Options** parameters.
5. Click **OK** to emboss or **Cancel** to abort.



### 3 D Emboss Options:

**Image Box** - Displays the current PICT image. If none is selected, this box will display a message stating so. Click on this box to load a PICT image.

**Displacement** - The offset factor. This number is multiplied by the luminance of the displacement map at any given pixel to factor how far to offset each vertex. The luminance values are read as decimals ranging from 0 for pure black to 1 for pure white.

**XY Mapping** - Maps the x to u and y to v.

**YZ Mapping** - Maps the y to u and x to v.

**Displace Normals** - Displacement will follow the surface normal.

**Displace XYZ** - Displacement will follow the selected axis.

**X** - Allows displacement along the x-axis.

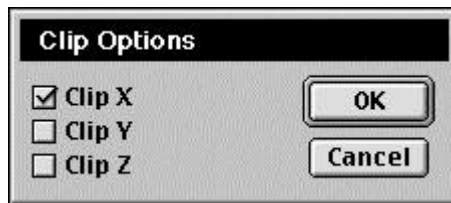
**Y** - Allows displacement along the y-axis.

**Z** - Allows displacement along the z-axis.

## Clip

Removes any portion of the selected object which lies in the negative coordinate area of any selected axis.

1. Select the object you want to clip.
2. If necessary, rotate or move the object so that the part of the object you want to trim off is positioned in the negative half of the coordinate axis you are going to use for clipping.
3. Click *Reshape* in the main tool palette.
4. Click *Clip* in the lower tool palette.
5. Set the axis you want to clip using the check boxes in the **Clip Options** dialog.
6. Click **OK** to clip or **Cancel** to abort.



### Clipping Options:

- Clip X -** Clips any portion of the selected model which lies below 0 along the x-axis.
- Clip Y -** Clips any portion of the selected model which lies below 0 along the y-axis.
- Clip Z -** Clips any portion of the selected model which lies below 0 along the z-axis.



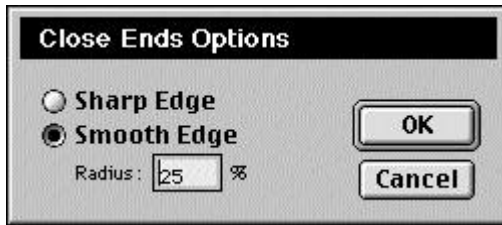
# PiXELS Reshape Tools

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## Close Ends

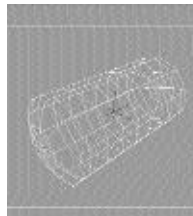
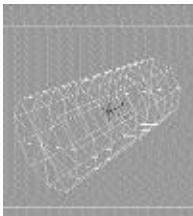
Adds flat or rounded end caps to the open sides of a selected object.

1. Select the object you want to close.
2. Click *Reshape* in the main tool palette.
3. Click *Close Ends* in the lower tool palette.
4. Set the **Close Ends Options** parameters.
5. Click **OK** to close or **Cancel** to abort.



### Close Ends Options:

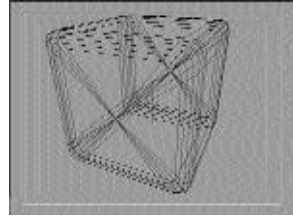
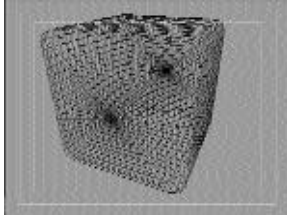
- Sharp Edge** - Sets the angle between the end cap and object at 90°. For B-Splines and NURBs this option also doubles-up the vertices at the corner to sharpen it.
- Smooth Edge** - Sets the angle between the end cap and object at 45°. Also takes into account the Radius parameter when factoring edge smoothness.
- Radius** - Sets the distance between the rounding vertices. The distance is equal to Radius multiplied by the distance to the end cap's center. Vertices closest to the end cap are moved in by this amount, all other rounding vertices are moved back by this amount.



## Optimize

Streamlines planar surfaces by removing redundant vertices that do not affect the object's geometry.

1. Select the object you want to optimize.
2. Click *Reshape* in the main tool palette.
3. Click *Optimize* in the lower tool palette.
4. The computer will display a progress bar to let you know it's working. When it's done, the model will be optimized.



# PiXELS Reshape Tools

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## Re-Order

Recreates the existing spline as closely as possible using the desired number of vertices.

1. Select the object you want to re-order.
2. Click *Reshape* in the main tool palette.
3. Click *Re-Order* in the lower tool palette.
4. Set the desired options and click **OK** to accept or **Cancel** to abort.

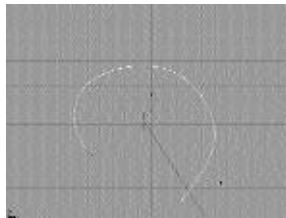
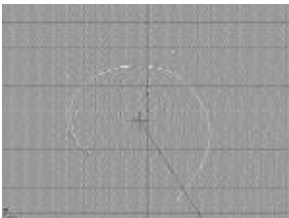


### Reorder Options

**Steps** - Sets the number of vertices the resulting spline will have.

**Uniform Spacing** - The resultant spline will have evenly spaced vertices.

**Random Spacing** - The resultant spline will have randomly spaced vertices.





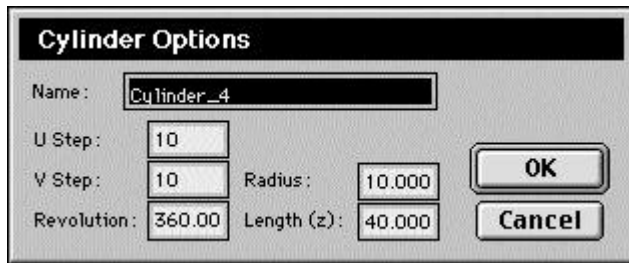




## Cylinder

A straight spline rotated 360° around an axis.

1. Click *Shape* in the main tool palette.
2. Click *Cylinder* in the lower tool palette.
3. Name the object. Naming objects makes them easier to select from the command line. This is nice when dealing with a large scene.
4. Set the **U Step**, **V Step**, **Revolution**, **Radius** and **Length (z)** parameters as desired.
5. Click **OK** to create the shape, or click **Cancel** to abort.



### Cylinder Options:

- |                     |  |
|---------------------|--|
| <b>U Step -</b>     | The number of vertices circling the cylinder. A higher value makes the cylinder rounder but may take longer to redraw and render. The minimum number is 3. |
| <b>V Step -</b>     | Represents the number of rings this cylinder will have. A value of 1 will create a circle.   |
| <b>Revolution -</b> | How far to spin the spline which will form the cylinder. 360° represents a full, closed cylinder.  |
| <b>Radius -</b>     | The width (x) and height (y) of the finished cylinder.   |
| <b>Length (z) -</b> | The depth (z) of the finished cylinder.  |

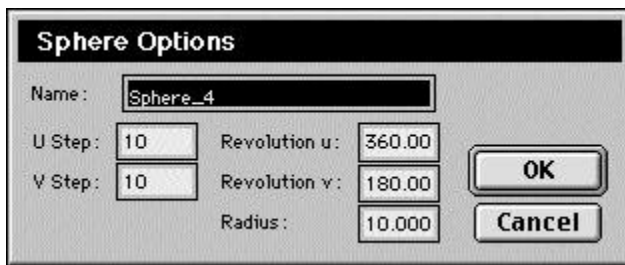
# PiXELS Shape Tools

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## Sphere

A semi-circular spline which has been rotated 360° around an axis.

1. Click *Shape* in the main tool palette.
2. Click *Sphere* in the lower tool palette.
3. Name the object. Naming objects now makes them easier to select from the command line. This is nice when dealing with a large scene.
4. Set the **U Step**, **V Step**, **Revolution U**, **Revolution V** and **Radius** parameters as desired.
5. Click **OK** to create the shape, or click **Cancel** to abort.



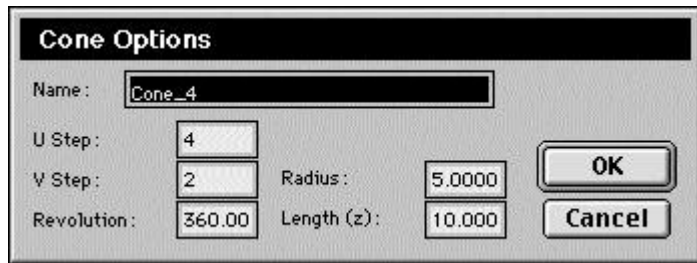
### Sphere Options:

- |                       |   |
|-----------------------|---|
| <b>U Step</b> -       | The number of vertices circling the sphere. A higher value makes the sphere smoother but may take longer to redraw and render. The minimum number is 3. |
| <b>V Step</b> -       | Represents the number of rings this sphere will have. The minimum number is 2.  |
| <b>Revolution U</b> - | 360 degrees forms a full sphere.  |
| <b>Revolution V</b> - | 180 degrees forms a full sphere from top to bottom.   |
| <b>Radius</b> -       | The width (x) and height (y) and depth (z) of the finished sphere.  |

## Cone

A cylinder with the x and y axis scaled down to a point at one end.

1. Click *Shape* in the main tool palette.
2. Click *Cone* in the lower tool palette.
3. Name the object. Naming objects now makes them easier to select from the command line. This is nice when dealing with a large scene.
4. Set the **U Step**, **V Step**, **Revolution**, **Radius** and **Length (z)** parameters as desired.
5. Click **OK** to create the shape, or click **Cancel** to abort.



### Cone Options:

- |                     |  |
|---------------------|--|
| <b>U Step</b> -     | The number of vertices circling the cone. A higher value makes the cone rounder but may take longer to redraw and render. The minimum number is 3. |
| <b>V Step</b> -     | Represents the number of rings this cone will have. The minimum number is 2.   |
| <b>Revolution</b> - | How far to spin the spline which will form the cone. 360° represents a full, closed cone.  |
| <b>Radius</b> -     | The width (x) and height (y) of the finished cone.   |
| <b>Length (z)</b> - | The depth (z) of the finished cone.  |

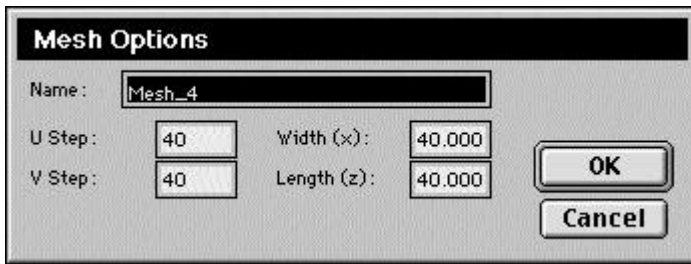
# PiXELS Shape Tools

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## Mesh

A flat plane which can be formed into a 3 D shape by pushing and pulling its points.

1. Click *Shape* in the main tool palette.
2. Click *Mesh* in the lower tool palette.
3. Name the object. Naming objects now makes them easier to select from the command line. This is nice when dealing with a large scene.
4. Set the **U Step**, **V Step**, **Width (x)** and **Length (z)** parameters as desired.
5. Click **OK** to create the shape, or click **Cancel** to abort.



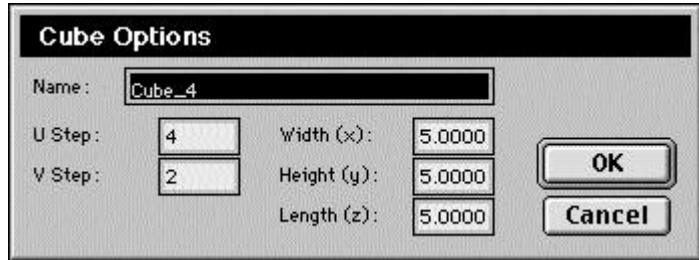
### Mesh Options:

- |                     |   |
|---------------------|---|
| <b>U Step</b> -     | The number of vertices along the u-axis The minimum number is 2.  |
| <b>V Step</b> -     | The number of vertices along the v-axis. The minimum number is 2. |
| <b>Width (x)</b> -  | The width (left to right) of the finished mesh.                   |
| <b>Length (z)</b> - | The depth (front to back) of the finished mesh.                   |

## Cube

A six sided solid block.

1. Click *Shape* in the main tool palette.
2. Click *Cube* in the lower tool palette.
3. Name the object. Naming objects now makes them easier to select from the command line. This is nice when dealing with a large scene.
4. Set the **U Step**, **V Step**, **Width (x)**, **Height (y)** and **Length (z)** parameters as desired.
5. Click **OK** to create the shape, or click **Cancel** to abort.



### Cube Options:

- |                     |   |
|---------------------|---|
| <b>U Step</b> -     | The number of vertices along the u-axis The minimum number is 4.  |
| <b>V Step</b> -     | The number of vertices along the v-axis. The minimum number is 1. |
| <b>Width (x)</b> -  | The width (left to right) of the finished cube.                   |
| <b>Height (y)</b> - | The height (top to bottom) of the finished cube.                  |
| <b>Length (z)</b> - | The depth (front to back) of the finished cube.                   |

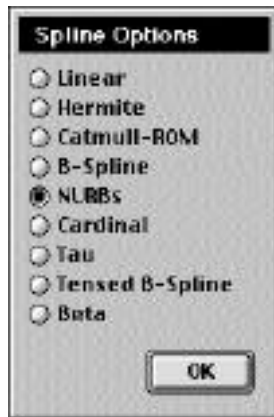
# PiXELS Shape Tools

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## Spline

The most basic primitive. This is the building block upon which all other shapes are based.

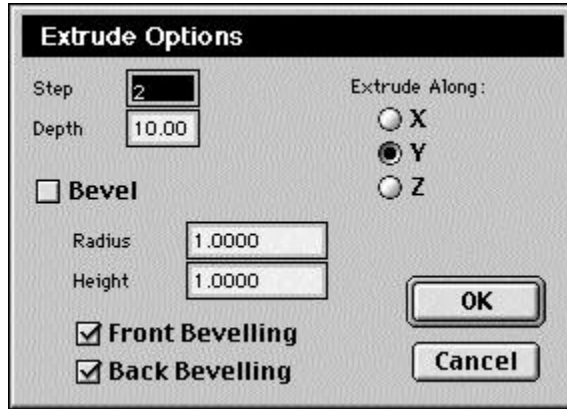
1. Click *Shape* in the main tool palette.
2. Click *Spline* in the lower tool palette.
3. Click in any window to enter drawing mode and start drawing. The first click defines the position of the first vertex. Each subsequent click will define the next vertex in line.
4. Double click to add the last vertex and exit drawing mode, or click on the first vertex to close the shape and exit drawing mode.
5. Use **Window > Object Info** to name the object. Naming objects now makes them easier to select from the command line. This is nice when dealing with a large scene.



## Extrude

Pulls a 2-D spline into 3 D space along a pre-defined axis.

1. Select the spline to be extruded.
2. Click *Shape* in the main tool palette.
3. Click *Extrude* in the lower tool palette.
4. Set the **Extrude Options** parameters as desired.
5. Click **OK** to create the shape, or click **Cancel** to abort.

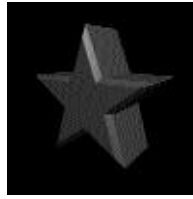
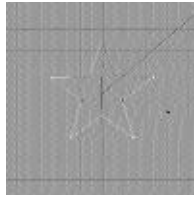
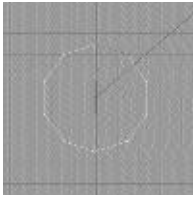


# PiXELS Shape Tools

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## Extrude Options:

- Step -** The number of vertices along the v-axis. The minimum number is 2.
- Depth -** The depth (front to back) of the finished object.
- Bevel -** Creates a 45° edge between both faces and the extruded object. This option will add v-steps to the finished object if needed.
- Radius -** How far the bevel pushes the surface out. A negative number will push the bevel inward.
- Height -** How far the bevel will extrude from the current face.
- Front Beveling-** Place a bevel on the front face of the extruded object.
- Back Beveling-** Place a bevel on the back face of the extruded object.

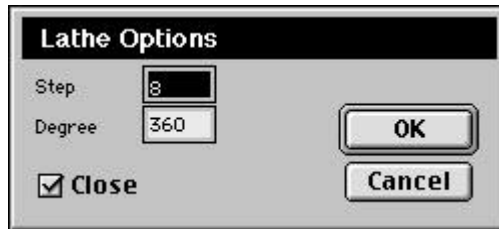




## Lathe

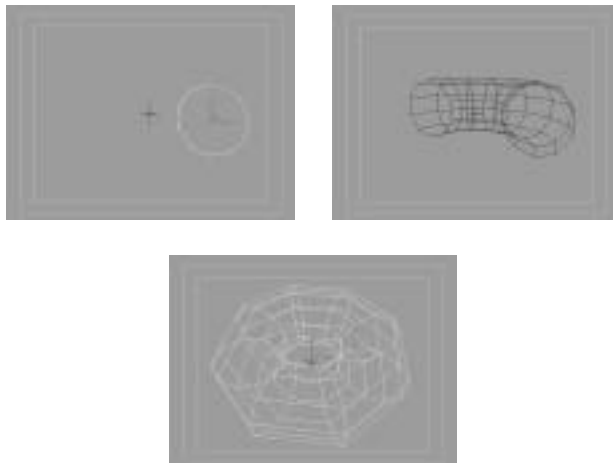
Spins a 2-D spline around the y-axis to create a new 3 D shape.

1. Select the spline to lathe. The spline must be drawn in the front or right window. The revolution is made around the y-axis.
2. Click *Shape* in the main tool palette.
3. Click *Lathe* in the lower tool palette.
4. Set the **Lathe Options** parameters as desired.
5. Click **OK** to create the shape, or click **Cancel** to abort.



### Lathe Options:

- Step -** The number of vertices along the u-axis The minimum number is 4. The higher this number, the *rounder* the final shape will appear.
- Degree -** The spline will revolve (counter clockwise) the number of degrees set around the y-axis.
- Close -** Closes the object ends.



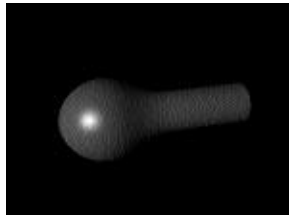
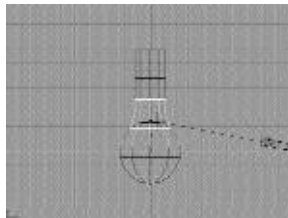
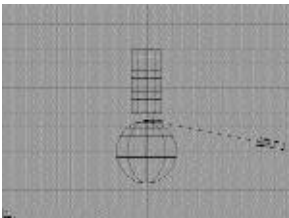
# PiXELS Shape Tools

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## Loft

Creates a 3 D object from a collection of splines defining “slices” of the object.

1. Draw or import a collection of splines representing different “slices” of the object.
2. Select the first slice of the object.
3. Click *Shape* in the main tool palette.
4. Click *Loft* in the lower tool palette.
5. Without holding down the   key, pick each consecutive slice. As these are selected, a 3 D object will form.



## Light

Places a light source in the scene and sets its intensity. Any number of lights may be placed in a scene, and each can be colored and moved.

1. Click *Shape* in the main tool palette.
2. Click *Light* in the lower tool palette.
3. Use the **Control** > **Move** tool to place the object anywhere in the scene.
4. Set the **Light Options** parameters as desired.
5. Click **OK** to create the light, or click **Cancel** to abort.

# PiXELS Shape Tools

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## IK chain

Allows you to draw kinematic chains. There is no limit to the number of joints allowed in a single chain.

1. Click *Shape* in the main tool palette.
2. Click *IK Chain* in the lower tool palette.
3. Click in any window to enter drawing mode and start drawing. The first click defines the position of the first joint. Each subsequent click will define the next joint in the chain.
4. Double click to add the last joint and exit drawing mode.



### IK Chain Options:

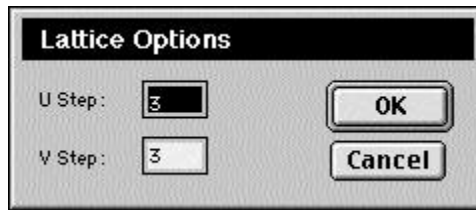
Inverse Forward Kinematics—creates a hierarchy in which each joint is linked to the previous joint in the IK chain.

Inverse Kinematics Only—Creates no hierarchy. Each joint is independent of the other joints in the IK chain.

## Lattice

A special primitive which resembles a cube. The lattice defines an area in 3 D space. This area can be deformed by reshaping the lattice. Any point on any object linked to this lattice, which falls within this lattice, will be remapped to the lattice's deformed 3 D space.

1. Select the object you want to create a lattice around.
2. Click *Shape* in the main tool palette.
3. Click *Lattice* in the lower tool palette.
4. Set the **Lattice Options** parameters as desired.
5. Click **OK** to create the lattice, or click **Cancel** to abort.



### Lattice Options:

- U Step** - The number of subdivisions this lattice will have left to right and top to bottom.
- V Step** - The number of subdivisions this lattice will have front to back.

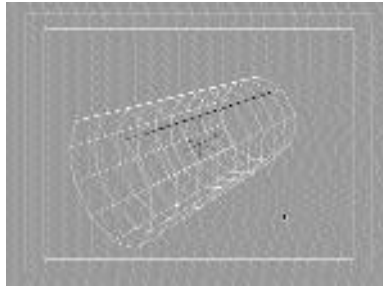
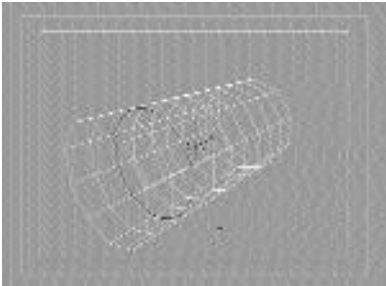
# PiXELS Shape Tools

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## Extract

Copies the currently selected u-col or v-col and pastes it into the scene, creating a new 2-D spline.

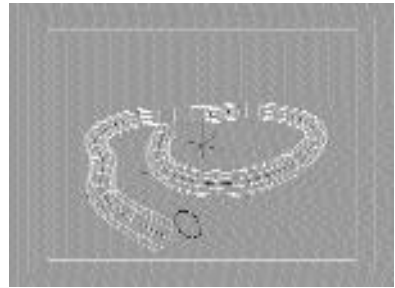
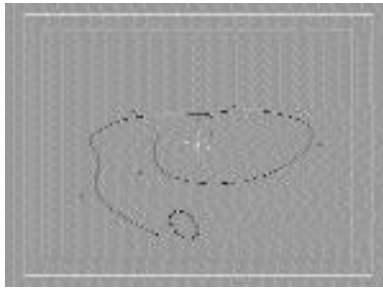
1. Select the object and *col* to extract.
2. Select either *U-Col* or *V-Col* constraint. If neither is selected *V-Col* is assumed.
3. Click *Shape* in the main tool palette.
4. Click *Extract* in the lower tool palette.
5. The selected u-col or v-col will be extracted and become the currently selected object.



## Path extrude

Creates a 3 D object by projecting one spline along another spline which is used as a path.

1. Select the object to extrude.
2. Click *Shape* in the main tool palette.
3. Click *Path Extrude* in the lower tool palette.
4. Without holding down the **Shift** key, pick the path to extrude along.



## Null

Creates a simple primitive which represents a position in space. A null does not show up when rendered.

1. Click *Shape* in the main tool palette.
2. Click *Null* in the lower tool palette.

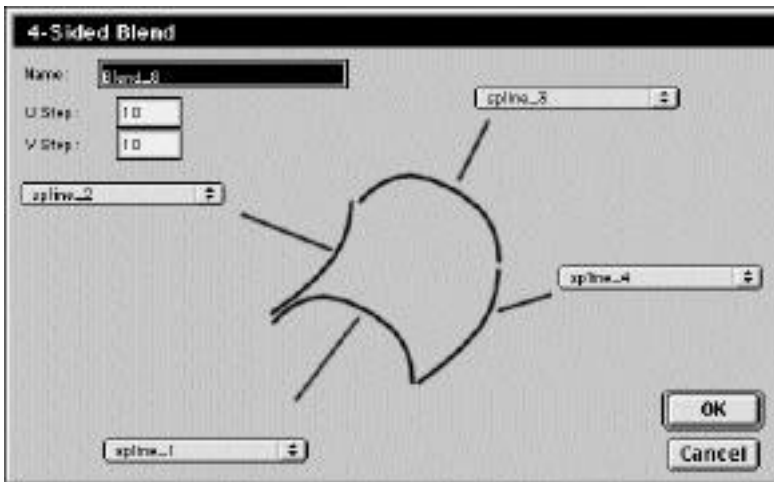
# PiXELS Shape Tools

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## 4 sided blend

Uses four user defined boundary curves to interpolate a patch.

1. Use the *Spline* tool to draw four boundary curves. The number of steps need not be the same in any of the splines, but the direction of the opposing curves (front/back and left/right) should be the same. If not, the resultant shape will have a twist.
2. Arrange the curves such that they define a boundary. The corners need not touch, but the closer they are the better.
3. If desired, name them front, back, left and right. This makes it easier to select in step 6.
4. Click *Shape* in the main tool palette.
5. Click *4-Side Blend* in the lower tool palette.
6. Use the four pop-up menus to select your boundary curves.
7. Set the number of steps for **u** and **v**.
8. Click **OK** to build your blended object or **Cancel** to abort.

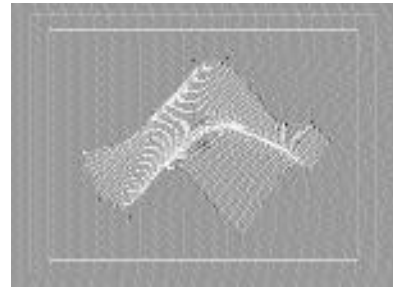
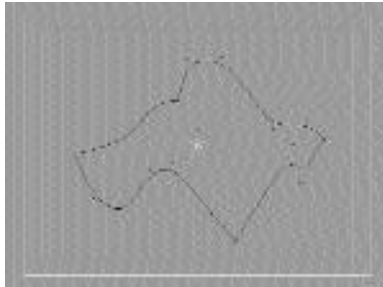


### 4 Sided Blend Options:

- U Step** - The number of subdivisions the resultant object will contain along the u-axis.
- V Step** - The number of subdivisions the resultant object will contain along the v-axis
- Spline 1** - The spline primitive defining the front boundary of the resultant object.



- Spline 2 -** The spline primitive defining the left boundary of the resultant object.
- Spline 3 -** The spline primitive defining the rear boundary of the resultant object.
- Spline 4 -** The spline primitive defining the right boundary of the resultant object.



## Trim Surface

Converts a 2D spline drawn in the front (xy) view into a renderable surface with the same shape as the original spline. If additional 2D splines are linked to the spline being trimmed, they will be incorporated into the trim surface as well.

1. In the front view, draw a spline. If you prefer, splines can be imported from Adobe Illustrator.
2. With the spline selected, click *Shape* in the main tool palette.
3. Click *Trim Surface* in the lower tool palette.

## Pencil Test

Renders a B&W wireframe of all the frames in an animation, then plays them back in real time.

1. Create an animation.
2. Click *Animate* in the main tool palette.
3. Click *Pencil Test* in the lower tool palette.
4. Set the **frame range** and **step rate** in the **Pencil Test Options** dialog. Click **OK**.
5. The computer will render each frame, one by one. When it is done, it will play them back at full speed.
6. To stop playback, click the mouse.
7. To scrub through frames, hold down the mouse and move left to rewind or right to fast forward.

### Pencil Test Options:

**From** - First frame in the Pencil Test Animation.

**to** - Last frame in the Pencil Test Animation.

**step** - Forces renderer to draw every *n*th frame.

## Offset Keys

Moves all keyframes for the current object or all objects in a scene.

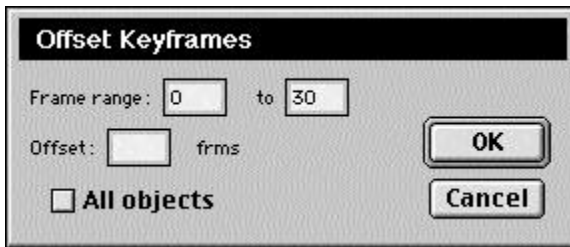
1. Select an object.
2. Click *Animate* in the main tool palette.
3. Click *Offset Keys* in the lower tool palette.
4. Enter an offset value and a frame range. To alter all objects in a scene, enable the All objects option. Click **OK** to accept or click **Cancel** to abort.
5. All keyframes for the current object, or all objects, between the inpoint and the outpoint will be offset by the value defined.

### Offset Keys Options:

**Frame range** - Defines a range of frames which this function will effect.

**Offset** - Defines an offset which the keyframes' position in time will be offset by.

**All objects** - When enabled, forces the function to effect all objects in a scene.



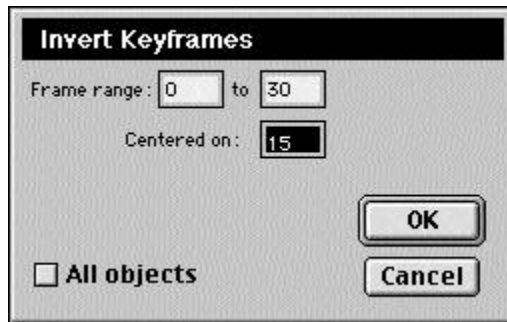
## Invert Keys

Flips all keyframes for the current object or all objects in a scene.

1. Select an object.
2. Click *Animate* in the main tool palette.
3. Click *Invert Keys* in the lower tool palette.
4. Enter a frame range. To alter all objects in a scene, enable the All objects option. Click **OK** to accept or click **Cancel** to abort.
5. All keyframes for the current object, or all objects, between the inpoint and the outpoint will be inverted.

### Invert Keys Options:

- Frame range** - Defines a range of frames which this function will effect.
- Centered on** - Defines a pivot point around which the keyframes will be flipped.
- All objects** - When enabled, forces the function to effect all objects in a scene.



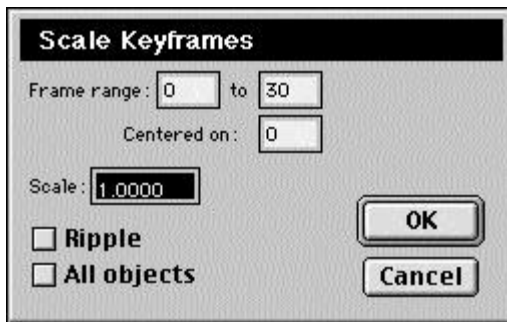
## Scale Keys

Scales all keyframes for the current object or all objects in a scene.

1. Select an object.
2. Click *Animate* in the main tool palette.
3. Click *Scale Keys* in the lower tool palette.
4. Enter a scale factor value and a frame range. To alter all objects in a scene, enable the All objects option. Click **OK** to accept or click **Cancel** to abort.
5. All keyframes for the current object, or all objects, between the inpoint and the outpoint will be scaled by the value defined.

### Scale Keys Options:

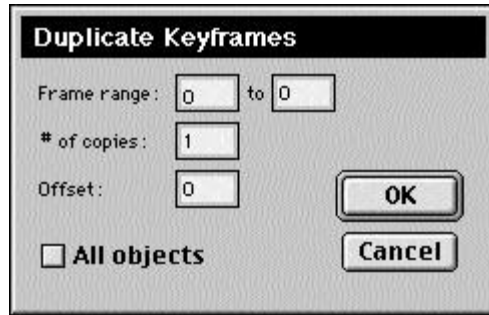
- Frame range** - Defines a range of frames which this function will effect.
- Centered on** - Defines a reference frame for scaling.
- Scale** - Defines a scaling factor which the keyframes' position in time will be scaled by. (i.e. a value of 0.5 = 50%)
- Ripple** All frames after the last frame scaled will be offset such that they remain sequenced with this last frame.
- All objects** - When enabled, forces the function to effect all objects in a scene.



## Dup. Keys...

Used to duplicate a set of keyframes for action that repeat in an animation.

### Duplicate Keys Options



**Frame range From To** - Specifies the range of frames from which keyframes are copied.

**# of copies** - How many copies to make.

**Offset** - If offset is zero, copies will be appended to the existing function curve. If some non-zero value is specified for Offset, each copy will be shifted forward that number of frames.

**All Objects** - Copy keyframes for all object or just the selected one.





## View PICT

A simple utility which allows you to quickly preview any PICT image.

1. Click *Utility* in the main tool palette.
2. Click *View PICT* in the lower tool palette.
3. Use the standard **Open** dialog which comes up to locate and select a PICT file.
4. Click the **Open** button to accept.
5. A window containing your selected image will appear centered on the main screen.
6. Click in the image window to return to normal operation.

## View TIFF

A simple utility which allows you to quickly preview any 24bit TIFF image.

1. Click *Utility* in the main tool palette.
2. Click *View TIFF* in the lower tool palette.
3. Use the standard **Open** dialog which comes up to locate and select a TIFF file.
4. Click the **Open** button to accept.
5. A window containing your selected image will appear centered on the main screen.
6. Click in the image window to return to normal operation.

## View PICTS

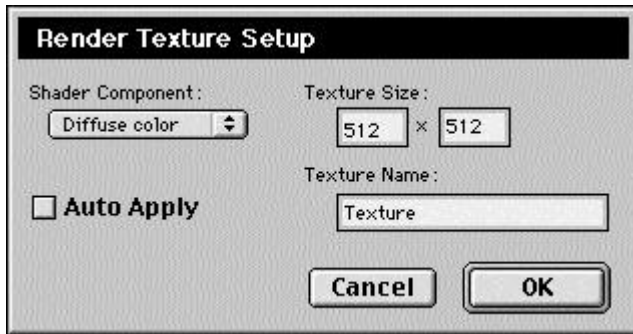
A simple utility which allows you to load and playback a series of PICT frames.

1. Click *Utility* in the main tool palette.
2. Click *View PICTs* in the lower tool palette.
3. Use the standard **Open** dialog which comes up to locate and select a the first frame of your animation. NOTE: the file name must match standard *PiXELS* file naming conventions for sequentially numbered PICTs - file name.#####.
4. Click the **Open** button to accept.
5. A window containing your selected image will appear centered on the main screen. Each frame in turn will be loaded and displayed. After all frames have been loaded into memory they will be played back at the speed set under **File > Render Setup**.
6. To stop playback, click the mouse.
7. To scrub through frames, hold down the mouse and move left to rewind or right to fast forward.

## Render Texture

Allows complex procedural Shaders to be rendered out to uv maps which can then be applied to the model.

1. Click *Utility* in the main tool palette.
2. Click *Render Tex* in the lower tool palette.
3. Set the desired options.
4. Click the **OK** to accept or **Cancel** to abort.



### Render Texture Setup Options:

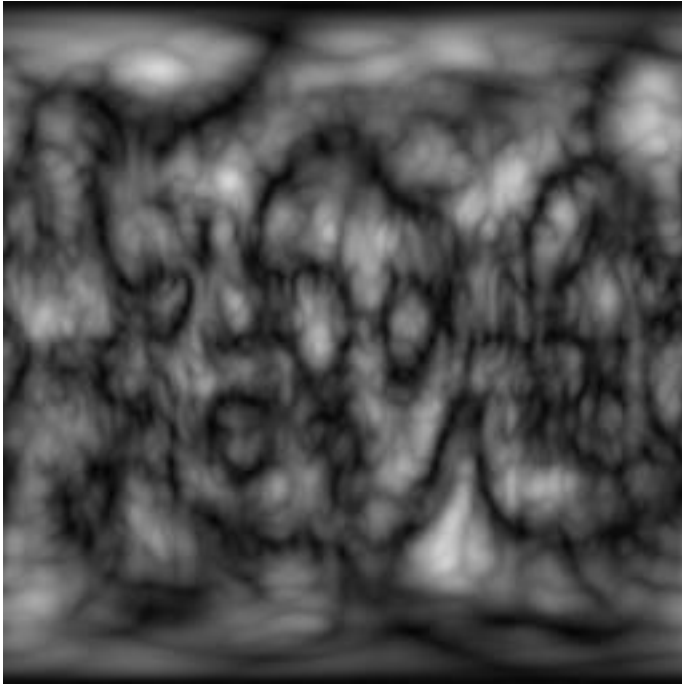
**Shader Component** - A pop up menu which lists all the base ShaderMaker nodes. Any one of these can be rendered out.

**Auto Apply** - After rendering, the uv map is loaded into memory and applied to the selected Shader component.  
Note: the procedural shader used to render this map will be overwritten. If you wish to keep this, the Shader must be saved first.

**Texture Size** - The size, in pixels, of the resultant texture map.

**Texture Name** - The file name given to the resultant texture map.

The Render Texture tool has many uses. When dealing with complex Shaders, this tool can be called upon to create a texture map which renders much faster than a procedural Shader. If a procedural Shader is being used on an object with an animated deformation, the Shader may appear to slide through the object. Rendering a uv map resolves this problem.



## Reset Schematic

If you have moved objects around in the Schematic view, this command restores them to their original positions.

## Constraints Contents

|        |       |      |
|--------|-------|------|
| Point  | ..... | .8.3 |
| U col  | ..... | .8.4 |
| V col  | ..... | .8.5 |
| Mir U  | ..... | .8.5 |
| Mir V  | ..... | .8.5 |
| Mir UV | ..... | .8.5 |
| X axis | ..... | .8.6 |
| Y axis | ..... | .8.6 |
| Z axis | ..... | .8.6 |
| Tag    | ..... | .8.7 |

# PiXELS Constraints

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## Point

Puts the *Push/Pull* tool into single point mode. The scene will reflect this by highlighting only the point currently selected.

1. Click *Point* in the Constraints palette.

# PiXELS Constraints

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## U col

Puts the *Push/Pull* tool into *U Col* mode. The scene will reflect this by highlighting the point currently selected and all points sharing that point's u-step. This tool can help orient you if you're having trouble seeing the difference between u and v.

1. Click *U Col* in the Constraints palette.

## V col

Puts the *Push/Pull* tool into *V Col* mode. The scene will reflect this by highlighting the point currently selected and all points sharing that point's v-step. This tool can help orient you if you're having trouble seeing the difference between u and v. It can also be useful in conjunction with the *Reshape > Pinch* tool to help you visualize which points will be pinched.

1. Click *V Col* in the Constraints palette.

## Mir U

Mirrors all *Push/Pull* deformations across the u-axis to help in the creation of symmetrical shapes. NOTE: If a shape has an uneven number of u-steps or if you have *inserted* u-steps on one side of a model and not the other, this tool will not work properly. The starting shape MUST be symmetrical to get predictable results.

1. Click *Mir U* in the Constraints palette.

## Mir V

Mirrors all *Push/Pull* deformations across the v-axis to help in the creation of symmetrical shapes. NOTE: If a shape has an uneven number of v-steps or you have *inserted* v-steps on one side of a model and not the other, this tool will not work properly. The starting shape MUST be symmetrical to get predictable results.

1. Click *Mir V* in the Constraints palette.

## Mir UV

Mirrors all *Push/Pull* deformations across an axis perpendicular to the u-axis to help in the creation of symmetrical shapes.

1. Click *Mir UV* in the Constraints palette.

# PiXELS Constraints

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## X axis

Turns the x-axis on or off. Objects can only be transformed along axes that are “on” (their buttons are pushed in). Works in conjunction with the control tools to constrain movement.

1. Click *X Axis* in the Constraints palette.

## Y axis

Turns the y-axis on or off. Objects can only be transformed along axes that are “on” (their buttons are pushed in). Works in conjunction with the control tools to constrain movement.

1. Click *Y Axis* in the Constraints palette.

## Z axis

Turns the z-axis on or off. Objects can only be transformed along axes that are “on” (their buttons are pushed in). Works in conjunction with the control tools to constrain movement.

1. Click *Z Axis* in the Constraints palette.

## Tag

Sets the transformation selection mode to *points* rather than object.

1. Click *Tag* in the Constraints palette.
2. Hold down the `⌘` key and click on any point to select it.  
OR hold down the `⌘` key and click and drag a rectangle around any points you want selected.  
OR hold down the `⌘` + shift keys and click on any point to toggle it. (If it's selected, it will become deselected. If it's deselected it will become selected.)  
OR hold down the `⌘` + shift and click and drag a rectangle around any points you want toggled.
3. Use any of the transformation tools to scale, move or rotate the selected points.

OR use the **File > Export > Tag Map**(PICT) tool to create a 2-D image of the surface for texture map creation. (See **File > Export > Tag Map** (PICT) for more info.)

The *Tag* tool will only work when the *Control* tool group is selected. To select points on objects other than the currently selected object, add the **option** key to any key combination listed above.

# PiXELS Constraints

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# 3D Basics

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## 3 D Basics

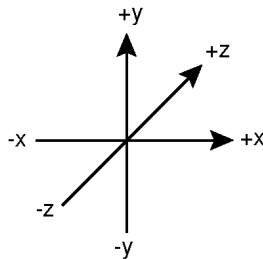
This section introduces basic 3D concepts and explains how they relate to PiXELS. If you are already familiar with the concepts and terminology common to 3 D computer graphics, you can safely skip this section.

### Cartesian Space

The hardest concept for a first time user of 3D computer software to understand, is the notion of working within a virtual three-dimensional space. This problem is augmented by the fact that your input device (a mouse) is limited to two-dimensional movement. That is, it cannot report how high off the table it is, it can only report left to right and top to bottom values. Furthermore, the computer screen is merely a two-dimensional interface to this virtual three-dimensional space.

*PiXELS* uses a mathematical representation of space known as the Cartesian coordinate system to represent your 3D scene and then project it onto your monitor's 2D screen. (The term "Cartesian" is used in honor of the French mathematician and philosopher Rene Descartes (1596 – 1650), who was one of the first to employ such coordinate systems.)

### X,Y,Z Axis



The Cartesian coordinate system uses three axis to represent position: x, y and z. The *positive x axis* points to the right, the *positive y axis* points up and the *positive z axis* points away from you. Where these three axis converge is called the *Origin*. The coordinates of the Origin are (x=0, y=0, z=0). This can be seen in any *PiXELS* view. With the grid turned on, look at the two darker lines—where these lines intersect is the *Origin*.

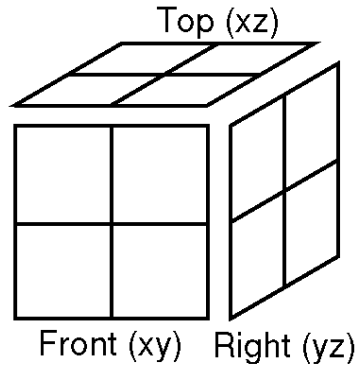
### XYZ Coordinates

The Cartesian coordinate system uses three coordinates to locate any point in space. These coordinates are labeled x, y and z. As a short hand they are sometimes written enclosed in braces and separated by commas. For example, the Origin can be written as {0,0,0}.

# 3D Basics

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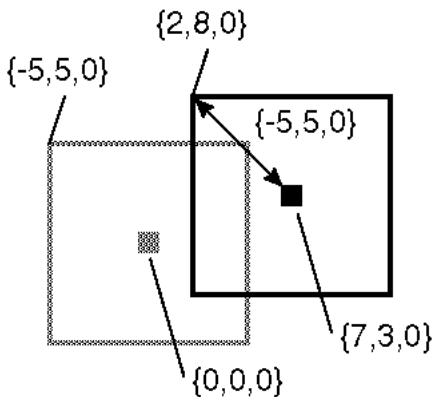
## XZ, XY, YZ Planes



Because of the limitations inherent in a two-dimensional screen, *PIXELS* uses three views aligned with coordinate planes to help you locate points in three-dimensional space. The Top, Front and Right views represent these three planes.

### Global and Local Coordinates

Each object in *PIXELS* has its own local coordinate system. When an object is created its center and orientation are the same as the world's. As you move and rotate the object, this changes. The world's center and orientation are still the same, but the object's center and orientation may have changed.



Take a simple square for example. Say the upper-left corner is located at  $\{-5,5,0\}$ . When the object is first created, that point is the same in local and global coordinates because the object's center is at  $\{0,0,0\}$ . If we move the object +7 along the x axis and +3 along the y axis, the upper-left corner would now be at  $\{2,8,0\}$  in global coordinates but would remain at  $\{-5,5,0\}$  in local coordinates—that is relative to

the center of the object. In other words, any point can be specified relative to its object's local coordinate system or relative to the global coordinate system shared by all objects.

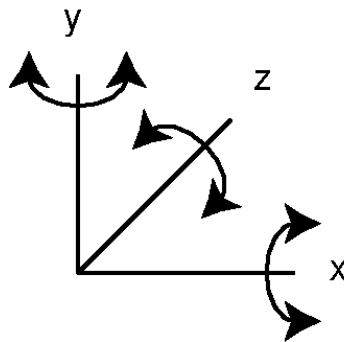
## Transformation

The size, location and orientation of an object in 3D space is known as its 'transformation'. When an object is first created, its transformation is set to align with the global coordinates. Its position is set to  $\{0, 0, 0\}$ , its size is set to  $\{1, 1, 1\}$  and its orientation is set to  $\{0, 0, 0\}$ . As you work with an object, these values can change.

## Translation

This refers to an object's position in space. There are three coordinates that define an object's position (x,y,z). These coordinates represent where the center of an object is located.

## Rotation

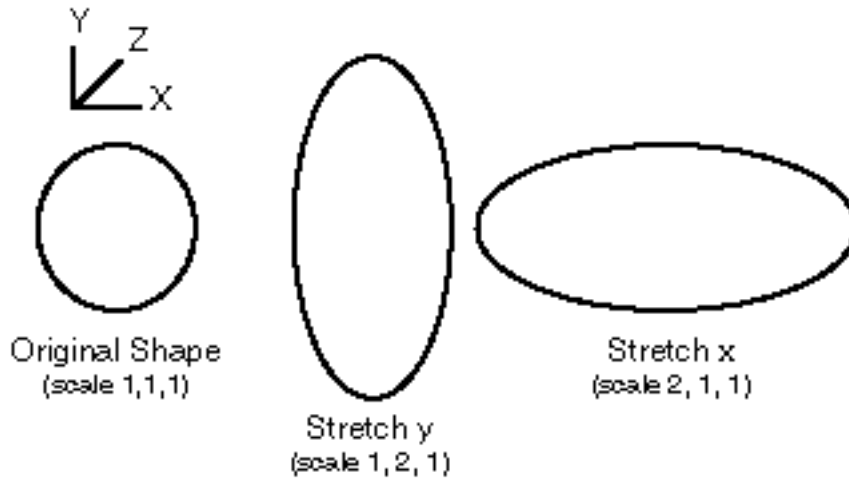


This refers to an object's orientation in space. An object will rotate around its center, so moving an object's center can change the way it rotates. There are three axis of rotation: x, y and z. To help you visualize this, imagine that each axis is a pole that your object is glued to. If you grip the pole between your forefinger and thumb and roll it back and forth, how will your object spin? This is the same rotation you can expect from PiXELS.

# 3D Basics

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## Scale



This refers to the size of the object. When an object is created or parked, its scale is set to 1 (or 100%) for each of the axis—x, y and z. These numbers represent scaling factors. To compute every point on a model, the x, y and z components are multiplied by the x, y and z scaling factors. With this in mind it becomes easy to see how different values can change the size of your object (i.e. a scale factor of 2 for each axis would double the object's size.) The three axis' scale factors can be set independently of each other for squashing and stretching effects—this is called differential scaling.

## Basic Elements

Points and splines, while not themselves visible in your final animation, are used to control the shape and movement of the objects you see.

### Points

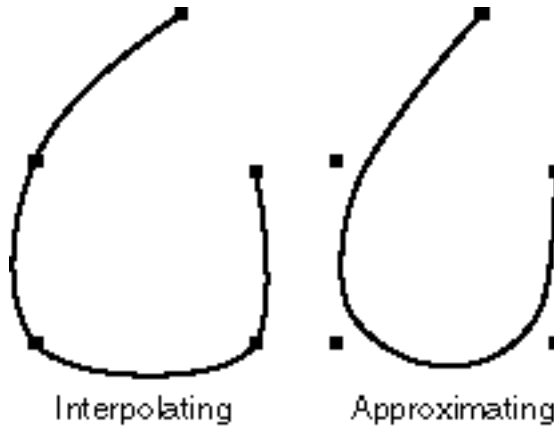
A point by itself is merely a location in Cartesian space, but by connecting multiple points we can start to build splines. Modeling objects is no more than entering a series of 3D points to define shapes.

### Splines

Splines are defined by multiple points, called *Control Points*. In its simplest form, a spline is little more than a set of control points connected together with straight lines. This is a *Linear* spline. To

introduce a curve to this set of control points you would only have to change the *Basis* by which the spline is computed. The *Basis* can be changed using the **Object Info** palette's **U Basis** and **V Basis** pop-up menus. There are a total of nine spline types, or bases, supported by *PiXELS*. Each basis is described in the following pages.

## Spline Types



Splines can be divided into two broad categories: *Interpolating* and *Approximating*. An interpolating spline's curve will always touch the points that define it. This gives them a more drastic, skin-like bend than approximating splines. Approximating splines have a very 'soft' curve because they don't necessarily touch the points that define them. Either type of spline requires three or more control points to show any curvature.

Some spline types have *Tension* and *Bias* parameters. The Tension parameter controls the relative amount of curvature near the control points of a spline. The Bias parameter controls how much the spline is skewed to one side or the other of a control point. A very biased spline will be flatter on one side a control point than the other.

*PiXELS* provides nine types of splines:

### Linear

The simplest spline that can be drawn—it is always the shortest distance between two points on screen. A linear spline never bends, and only needs two control points to be drawn.

# 3D Basics

---

## Hermite Spline

A simple interpolating spline.

## Catmull-ROM

A simple interpolating spline.

## B-Spline

Short for Basis-Spline. A simple approximating spline.

## NURBs

Stands for Non-Uniform Rational B-spline. NURBs have explicit weights and tensions that can be set for each control point, varying the effect of the line from point to point regardless of distance.

## Cardinal

An interpolating spline with a tension parameter added.

## Tau Spline

An interpolating spline with both tension and bias parameters added.

## Tensed B-Spline

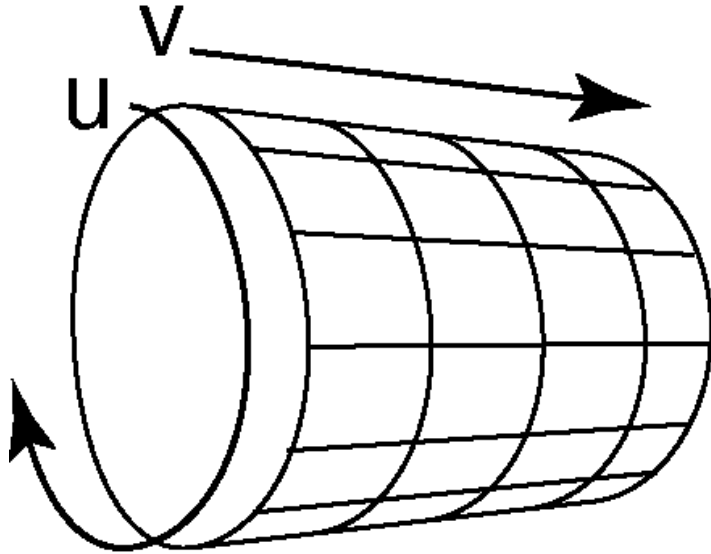
An approximating spline with a tension parameter added.

## Beta Spline

An approximating spline with both tension and bias parameters added.

## Mesh or Patch

A mesh is made up of two sets of splines that are perpendicular to each other, and which share the same control points. The resulting grid of splines defines a surface. In *PIXELS* the two sets of splines are referred to as *u* and *v*. Although the mesh's points can be moved around to change the shape (the geometry), the number of splines and how they are connected (the topology) stays the same. The resulting surface is like an infinitely stretchable quilt. You can create more places to 'tug' on a surface by adding a new set of control points to *u* or *v*.



### Basis

A single mesh can be constructed from two different types of splines, one for the  $u$  and one for the  $v$ . These are referred to as the  $u$  Basis and  $v$  Basis.

### Primitive Shapes

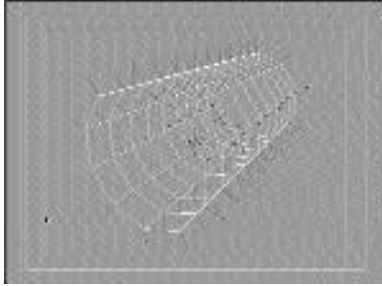
*PiXELS* provides you with a library of pre-made objects that are known as primitives. These can be used as-is, or as a starting point for modeling more detailed objects. They are the most commonly used shapes in their simplest forms - Sphere, Cube, Cylinder, Cone, Mesh and Spline.

Each of the primitive objects available from the *PiXELS* library is constructed from a single mesh. (i.e. The cylinder is simply a rolled up mesh, and the cone is a cylinder with one end tapered shut.) The unique power of meshes will allow you to achieve many effects when you are shaping these primitives. By deleting some of the splines from a mesh you can slice off sections of a sphere, or chop off levels of a cylinder until it is just a small ring. Keep in mind that when you deal with any shape in *PiXELS*, it can be rolled out to an oblong mesh.

# 3D Basics

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## Normals



The surface normal is a vector (line) which points perpendicular to (away from) the surface it originates from. Since models have more than one surface knowing which way the normals are facing can help you understand how a model will be effected by a particular function. This is important when rendering a model or for calculating complex operations such as collision.

If the normals of a model become inverted, certain routines may behave erratically or your model may render incorrectly. *PiXELS* provides controls that allow you to change the direction of the normals.

## Center Splines

Each primitive in *PiXELS* has an invisible central spline along which it is constructed. There are four control vertices that are positioned on the center spline. Each of these can be selected and moved independently in order to change the shape of the center spline. As the center spline is altered, the object's geometry will bend to follow this spline, thus creating a new shape. With this procedure, it is relatively simple to create complex bending and twisting for modeling or animation purposes.

## Camera

The Camera is a default object, that is to say it always exists (you can't delete it). Because the Camera is an object, it can be moved and animated. There are many settings that can be applied to the Camera such as its position, angle, field of view and shutter speed. All of the same rules of animation apply to the Camera as to any other object.



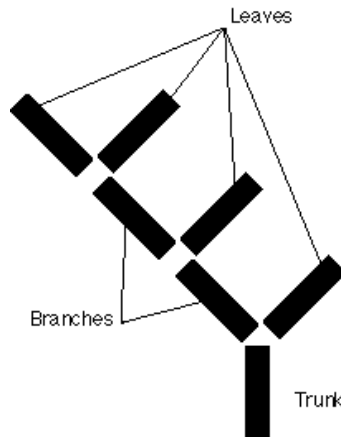
## Interest

The Interest represents a point in 3 D space which the Camera looks at. Anywhere the Interest goes, the Camera will track. The Interest can be linked to other objects, forcing the Camera to track that object. This is useful in “fly-by” animations, where the Camera is to follow a fast moving object. The Interest can also be linked to the Camera. This allows you to set the absolute rotation of the Camera. The Interest is, by default, located at {0,0,0}.

## Lights

A light source is a special kind of primitive. Upon startup there is a default light located at {50, 50, -50}. There are a number of different types of lights that can be added to a scene, including spot, point, sun and glow. Many settings such as color, intensity and position of a light can also be controlled and animated.

## Hierarchy



Objects may be grouped together in a hierarchy to facilitate manipulation or to share material. The original object is known as a parent and each object linked to it is known as a child.

The best way to understand the concept of hierarchy is to refer to a tree. First there is the trunk; then there are the branches; then there are the leaves. If you select the trunk of the tree and move it, all of the branches and the leaves will move along with it. If you select one branch and move it, its branching and the

leaves will move accordingly. If you select only one leaf, only that leaf will move. In PiXELS, hierarchies behave the same way but the combination of links that can be created is almost infinite.

# 3D Basics

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## Animation

In *PiXELS*, all objects including models, lights and the Camera can be animated. Each of these items have different settings (parameters) that can also be animated. For example, you can animate an object's scale, rotation, translation and shape. You can animate the color, position, shadow and Interest of a light. You can animate *any* component of an object's texture or shader. Plus, you can animate the position, Interest, roll, and focal distance of the Camera. Creating computer animation involves making changes to these parameters over time and assigning them to “key frames”.

## Key Framing

Animations are made up of individual images known as frames. An animation is created when a series of frames that have slight variations from one frame to the next are displayed one after another over time.

Key framing is at the core of computer animation and involves the following steps. First a starting frame is created on a timeline and all parameters for each object in a scene is assigned to it. Next, an ending frame is created later on the timeline and all changes to any parameters are assigned to it. The computer can compare the parameters assigned to the starting and ending frames and calculate all intermediate frames that would occur over time between them. This calculation is called interpolation.

For example, if you tell *PiXELS* that an object is large and red at Frame #1 and is then small and blue at Frame #10, these two frames are the keyframes. The computer will then calculate the intermediate values for all of the frames in between the keyframes. So as you move from Frame #1 to Frame #10 the large red ball will continue to get smaller and turn bluer at each frame until it reaches the values that were set for it at Frame #10. Thus, keyframing, combined with interpolation, allows you to create complex animations with a minimum amount of work.

## Animating the Position of an Object

The position of an object can be animated in one of two ways: path animation or keyframe animation.

Path animation allows you to create a path (spline) that an object will follow as it moves. Path animation creates only one function curve: the values for the keyframes range from 0 to 100 and represent a percentage of the path length.

Keyframe animation allows you to animate the position of an object, Camera or light by defining its original x,y and z coordinates at a starting keyframe and its final x,y and z coordinates at its ending keyframe. Three corresponding function curves are generated, one for each x,y and z coordinate.

*For a more complete discussion of general 3 D animation techniques, we suggest you read “3 D Computer Animation,” by John Vince (Addison-Wesley) or “Digital Character Animation,” by George Maestri (New Riders).*



## **Aliasing**

Also known as “The Jaggies.” Unwanted image artifacts that can result from sampling an image at too low a resolution. The effects, such as jagged edges, breakup of lines into dots and Moiré patterns, are most noticeable in high-contrast images with fine detail.

## **Bevel**

The detailing of small angles where edges meet to soften and appearance of the model. Bevels are also used to catch and reflect light.

## **Bezier spline**

Defines a curved surface by interpolating the first and last control points along with the inner two points governing the curve’s direction.

## **Bias**

The symmetry of the spline near a control point. A very biased curve will be flatter on one side than the other.

## **Clipboard**

A temporary storage area on the computer to hold the last item that was cut or copied from the model. The Clipboard is a standard feature on all Macintosh computers.

## **Interest**

A point in 3D space which the Camera looks at.

## **Color Space**

Any one of a number of methods for quantitatively describing colors, such that each color is associated with a unique point in space. Sometimes also called a Color Model.

## **Control points**

Points on the surface of the object that determine the underlying geometry of the object. The curve of a spline is determined by four or more control points.

## **Default**

Commonly preferred options set at program startup. Defaults may be manually changed.

# PiXELS Glossary

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## **Displacement Map**

The gray level information of any PICT image applied to an object to deform its geometry.

## **DXF**

Drawing Exchange Format, a file format widely-used for architectural drawings and other polygonal primitives.

## **Ease In**

A value that defines how abruptly an object at rest accelerates.

## **Ease Out**

The opposite of Ease In. A value that defines how abruptly an object in motion reaches a dead stop.

## **Export**

Saving files in a different format for use with other software applications.

## **Extrude**

The modeling process of pulling 2-D outlines or profiles into 3 D shapes.

## **Freeform**

Unique shapes that can be designed from drawn 2-D outlines.

## **Gouraud shading**

Rendering technique which varies brightness across each surface polygon to produce a smooth appearance.

## **Grid**

The horizontal and vertical lines in the background that help place the model in a perspective setting. The grid does not print.

## **Hidden line**

Built-in rendering of the surface mesh of an object with overlapped or obscured areas hidden.

## **Interpolation**

Calculation of intermediate points between specified control points to approximate and smooth the distance between the end points.

## **Keyboard shortcuts**

Keyboard equivalents that can be used as alternatives to pull down menus and the mouse.

## **Lathe**

The modeling process of creating a 3 D object by revolving an outline around an axis.

## **Loft**

Stretches a skin between 2-D shapes placed on a path to create a new 3 D shape.

## **Menu bar**

The row of pull down menu names at the top of the screen.

## **Mesh**

The two-dimensional undersurface grid applied to the model for shaping purposes.

## **NURBs**

Non-uniform rational B-splines which require an explicit specification of the parameters that trace out the surface.

## **Phong shading**

Rendering technique which produces shiny surfaces.

## **Photo realism**

A high level of realism accomplished by applying lights, shading, and textures to the 3 D model.

## **Picking**

(Not selecting)—Clicking directly on an object *without* holding down the key. This identifies the object so a specific operation may be applied to it.

## **PICT**

A graphics file format used by many computer applications. *PiXELS* can export rendered images into PICT formats.

## **Primitives**

Common geometrical forms which are used as 3 D building blocks to make more complex shapes.

# PiXELS Glossary

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## Proxy

An approximation of the skeletal structure of the model without all the wireframe details. *PiXELS* uses this feature to shorten redrawing time as changes are made to the model.

## Renderer

A computer program that can calculate a final image from the geometry, shading and lighting of a model stored in digital form.

## Rendering

The process of computing the final appearance of an image based on the geometry, shading and lighting of a model stored in digital form. Rendering translates bits in a computer into pictures we can see.

## Reshape

Modifications and alterations to a model that affect its geometry.

## RIB

RenderMan Interface Bytestream protocol. The format generated and required by MacRenderMan to render an image.

## Screen refresh

Redrawing the screen image after changes have been made.

## Selecting

(Not picking)— clicking on an object. It makes the object active.

## Shader

A computer program that calculates the appearance of any visible object based on such parameters as color, roughness, transparency, etc..

## Spline

A curve that is defined by four control points.

## Subdivision

The division of surface polygons into smaller polygons to create a smoother finished appearance of an object.



## **Surface Normal**

A vector perpendicular to the plane of every surface polygon used by the computer to calculate brightness, highlights, reflections, and distortions of the model.

## **Symmetry**

Changes to a model which affect the shape along the X and Y axis equally.

## **Texture mapping**

A two-dimensional pattern applied to or wrapped around the surface of a three-dimensional computer-generated model.

## **TIFF**

Tagged Image File Format. An industry standard graphics file format that represents an image as an array of pixels. The Tags are used to label the various kinds of information related to the image such as its size, resolution, type of compression, etc.

## **Toggle Command**

Operates like an on/off switch. Click on it to enable and click again to disable.

## **Tool Palette**

Modeling tools to shape, move and alter and manipulate 3 D forms.

## **U Step**

Coordinate space along the horizontal plane of the surface mesh.

## **V Step**

Coordinate space along the vertical plane of the surface mesh.

## **Vector**

A mathematical entity that indicates both direction and magnitude. Think of it as an arrow that can point in any direction and have any length.

## **Wireframe**

The undersurface skeletal structure of the model.

## **Z axis**

The coordinate used to determine the depth of a model.

# PiXELS Glossary

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## **3DGF**

3 D Geometry File format that supports spline-based objects but does not carry shading information.

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## Keyboard Shortcuts

|              |                      |
|--------------|----------------------|
| Select       | command key          |
| Pick         | no key needed        |
| Pan          | shift key            |
| Orbit        | control key          |
| Dolly        | option key           |
| Time         | control + shift keys |
| Move         | q                    |
| Rotate       | w                    |
| Scale        | e                    |
| Expand       | r                    |
| Center       | t                    |
| Align        | y                    |
| Park         | u                    |
| Command      | i                    |
| Link/Unlink  | o                    |
| Look/Unlook  | p                    |
| Path/Unpath  | Q                    |
| Instance     | W                    |
| Copy Shader  | E                    |
| Copy Shape   | R                    |
| Copy Keys    | T                    |
| Push/pull    | a                    |
| Spline       | s                    |
| Pinch        | d                    |
| Subdivide    | f                    |
| Collide      | g                    |
| Join         | h                    |
| Insert       | j                    |
| Remove       | k                    |
| Flip         | l                    |
| Disrupt      | A                    |
| Invert       | S                    |
| 3D Emboss... | D                    |
| Clip         | F                    |
| Close ends   | G                    |
| Optimize     | H                    |
| Re-order     | J                    |
| Point        | Z                    |
| U col        | X                    |
| V col        | C                    |
| Mir U        | V                    |

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|                |    |
|----------------|----|
| Mir V          | B  |
| Mir HV         | N  |
| X axis         | Z  |
| Y axis         | x  |
| Z axis         | c  |
| Tag            | v  |
| cylinder       | 1  |
| sphere...      | 2  |
| cone...        | 3  |
| mesh...        | 4  |
| cube...        | 5  |
| spline...      | 6  |
| extrude...     | 7  |
| lathe...       | 8  |
| loft...        | 9  |
| light          | 0  |
| IK chain       | !  |
| lattice...     | @  |
| extract        | \$ |
| path extrude   | %  |
| null           | &  |
| 4-side blend   | (  |
| pencil test    | ,  |
| offset keys    | +  |
| invert keys    | <  |
| scale keys     | -  |
| duplicate keys | >  |





















