

# Pictures to Pixels

Gordon McComb

You had to be there to know the thrill of viewing the first nationwide television broadcast or the excitement of watching *The Great Train Robbery* during its first run at the local nickelodeon. You can now get an inkling of what those experiences were like when you see a favorite drawing or the portrait of someone standing in front of you forming on the Macintosh screen. To bring you this new experience, some of the best minds that worked on the Mac have worked on software for a new genre of products—digitizers.

Digitizers permit you to transform artwork or anything else you can shoot with a video camera into a black-and-white digital image. You can view the image on a computer screen, save it on disk, and print it out.

Though the Mac makes it relatively easy to produce artwork, not everyone has the time or the skill to put on screen what they have in mind. If you want to draw a telephone on the Mac, the results may be disappointing unless you're a fairly skilled artist. Instead, you can attach a video camera to a digitizer and the Mac, point the camera at a real telephone or an illustration of a phone, and capture a digitized image. You can enhance digitized images with *MacPaint* and collect them for your own clip art library, sizing the art to your own specifications rather than those of the commercial clip art publishers.

### **How Digitizers Work**

Simply put, all digitizers convert visual information into digital information by breaking down an image into a mesh of fine dots and assigning a specific numerical value to the gray level found in each dot. Digitizing an image is akin to painting by numbers; like the dabbler who colors in a picture according to a



## *Digitizing an image is akin to painting by numbers.*

carefully coded outline, a digitizer fills each dot in an image with the degree of blackness or whiteness that, in combination with surrounding dots, best approximates the appropriate gray for that part of the picture.

Two kinds of digitizers are available for the Macintosh. Video digitizers use the standard video signal from a video camera or recorder to form digital information. The less common optical digitizers scan photos, illustrations, or other flat art with a tiny beam of light and base digital information on the beam's reflection.

When the signal that video digitizers use is sent to a video monitor or a television set, it is converted into a beam. The beam scans the screen, activating at different light intensities the small electroluminescent dots (called pixels) that form each video scan line. The beam travels from left to right and from top to bottom, completing a scan of the entire screen 30 times a second to produce the image you view.

A video digitizer turns the signal into a stream of binary numbers, reducing the light intensities represented by the video signal to a high-contrast black-and-white image, which the computer can represent digitally. The process of creating the digitized image on screen is called scanning; each of the digitizers I tested has its own scanning style. Some digitizers scan from left to right and others from top to bottom. Some digitizers show gray values in one scan, while others require several scans to show gray values.

With video digitizers you create original images with a video camera for the Mac as you would for replay on a television. You can use almost any color or black-and-white video camera, although I've found that the better the camera, the better the digitized image.

The video digitizers I tested also accept the composite video signal produced by other computers (such as the IBM Personal Computer or the Apple II), videocassette recorders, or videodisk players. You could, for example, play a videotape of the movie *Star Wars*, hold the image as Darth Vader cuts down Obi Wan Kenobi, and digitize the duel's climax.

Before you buy a video digitizer, make sure your video equipment can accept the digitizer's connectors. Two digitizers I tested use RCA phono connectors to connect to cameras, monitors, and other video devices. Most video cameras, however, give off a BNC signal, so you need a BNC to RCA adapter. One of the tested video digitizers accepts a direct BNC connection.

### **Four Digitizers**

Of the four digitizers I review in this article, three are video digitizers: the Koala MacVision, the New Image Magic, and the Servidyne Micro-Imager. The fourth digitizer, the Thunderware ThunderScan, is the only optical digitizer currently on the market. Each digitizer costs under \$400.

Regardless of how they convert an image into digital form, Macintosh digitizers use patterns to simulate gray scale—the range of shades from black to white—because the Mac can't recreate actual grays. The digitizer analyzes the high-contrast image it produces and, according to software instructions (which differ for each product), replaces groups of black and white dots with patterns. The patterns may or may not look good to you, since the software instructions that create them cannot always simulate the shades of gray you have in mind. Most digitizer software allows you to control the appearance of the digitized image and to edit the image by copying it into another application, such as *MacPaint*.

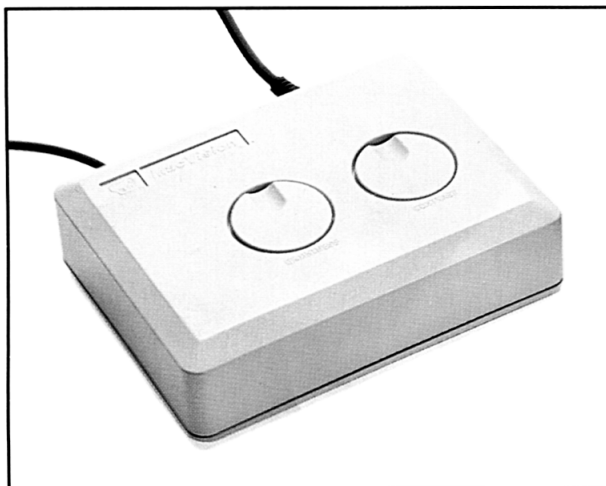
Mac digitizers aren't all created equal. They differ in the way they work, the complexity of the patterns they use to represent shading, and the amount of control they give you over the digitized image.

## **Koala MacVision**

Of the digitizers I tested, MacVision from Koala Technologies is the simplest to use but has the fewest special effects. MacVision is a video digitizer that includes a cream-colored box containing processing electronics and software on disk. Written by *MacPaint* author Bill Atkinson, the software captures the digitized image produced by the hardware. Once captured, the image can be copied to Macintosh documents or saved as a *MacPaint* document.

### Koala MacVision

This video digitizer has dials to control contrast and brightness. Like the other video digitizers, MacVision also comes with software for creating an image on the Mac's screen.



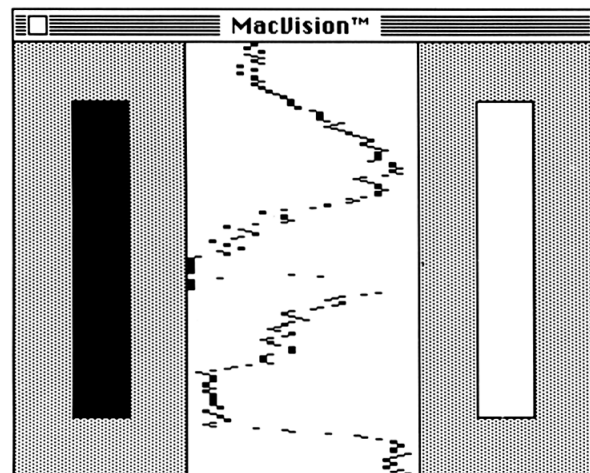
| MacVision       |
|-----------------|
| About MacVision |
| Adjust          |
| Scan Window     |
| Scan Screen     |
| Print Window    |
| Print Screen    |
| Save Screen     |
| ✓Modem Port     |
| Printer Port    |

**Figure 1**

When you open the MacVision desk accessory, the MacVision menu appears in the menu bar. The Adjust command lets you set contrast and brightness.

**Figure 2**

When you choose Adjust on the MacVision menu, a window appears that helps you fine-tune the hardware's contrast and brightness controls for the best possible balance. Turn the contrast and brightness dials until the wavy line is vertically centered and touches both sides of the window.



To set up the hardware, you attach a cable from MacVision to a Macintosh serial port. You then connect a video camera or another video source to MacVision. Since MacVision is powered through the Macintosh, you don't have to plug it in separately.

MacVision software is a desk accessory. Like other desk accessories, you can open and use MacVision from the Mac desktop or from within an application program. You install the MacVision desk accessory by copying the Install MacVision icon from the MacVision disk to another disk, such as a *MacPaint* disk, and opening the icon.

### Taking the Picture

To use MacVision, select MacVision from the Apple menu. A small window appears on screen, and the MacVision menu is on the menu bar. Point the camera at your subject and choose either the Scan Window or the Scan Screen command from the MacVision menu. With Scan Window the digitized image appears in a small Scrapbook-sized window, and with Scan Screen the image occupies the entire Mac screen. Either command causes the picture to appear on screen slowly from left to right. The scanning continues until you stop it by clicking the mouse button.

When you choose the Scan Window command, the image appears in a small 320- by 240-pixel MacVision window. When scanning is complete (in about 7 seconds), you can copy all or part of the window into the Clipboard from the Macintosh desktop or from within an application program. You can then paste it into the Scrapbook or an application program.

The scanning process takes 18 to 20 seconds with the Scan Screen command. Another disadvantage of this command is that by displaying the image on the full screen, you can't cut or copy a selected part of the picture. You have to save the entire image as a *MacPaint* document before you can select a part of it for editing.

Being a desk accessory, MacVision's best feature is that you can use it while you work with another application, although *MacPaint* is inactive as long as any desk accessory is open. Unfortunately, I found it nearly impossible to focus the image during scanning, since MacVision lacks a focusing aid. You have to use the camera's viewfinder or an external monitor to focus the image. MacVision's lack of a monitor jack aggravates the focusing problem because you have to unplug the camera cable from MacVision and connect it to a monitor.

You can overcome the lack of a monitor jack by purchasing an A-B switch from an electronics store. An A-B switch is designed to switch between two input devices such as a tape player and a turntable; it can help you switch more easily between MacVision and the video monitor. Plug the camera cable into the input jack of the A-B switch and connect the MacVision and monitor cables into the A and B output jacks.

You adjust dials on the hardware to control the brightness and contrast of the image MacVision sends to the Macintosh. The Adjust command on the MacVision menu gives you an indication of brightness and contrast before you begin the scanning process (see Figures 1 and 2). It's probably best not to rely on the Adjust command too much; I found that the eye is a better judge of contrast and brightness than the algorithms used by MacVision software. You can use the command to fine-tune the contrast and brightness as the digitized image appears on screen.

### Special Effects

Because of its simplicity, MacVision offers you little control over the digitized image. Unlike other video digitizers, for example, MacVision doesn't let you change the patterns that create the finished picture. Nevertheless, MacVision produces a few special effects. You can alter textures and patterns to some degree with the contrast and brightness controls. You can distort or multiply an image; by moving the camera during scanning you can stretch or squash an image. Humorous applications aside, you can use this method to control perspective, proportion, and size.

## New Image Magic

Of the digitizers I looked at, the New Image Magic is the hardest to use. However, Magic is packed with features. It is especially useful for fine-tuning the details of a digitized image.

You connect the hardware to one of the Macintosh's serial ports and to a video camera or other video source. If you don't already have a video camera, New Image's \$150 black-and-white camera is a good way to save money; the average cost of a color home video camera is about \$500. You complete the hardware connection by plugging the Magic digitizer into a wall outlet.

### Taking the Picture

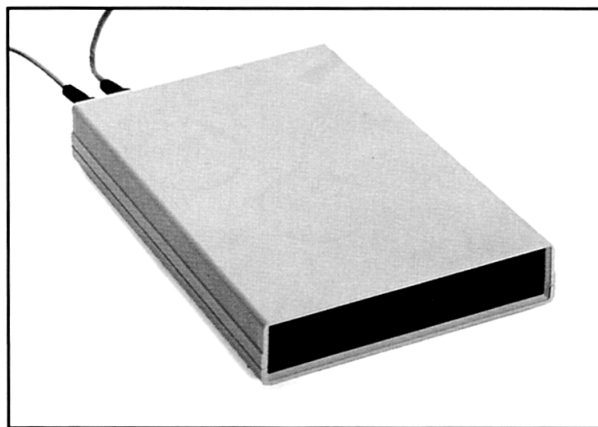
Insert the Magic software disk into the Macintosh and open the camera icon on the desktop. A complicated-looking control panel appears from which you take the picture, adjust brightness and contrast, edit patterns, and view previously digitized images. The picture window in the center of the panel is flanked on the left by a menu and on the right by a pan control window, a pattern palette, and a set of option boxes. Three horizontal bars stretch across the bottom of the screen (see Figure 3). I suggest that you get to know the control panel because the Magic system requires a thorough familiarity with its software.

Once you frame and focus your subject in the camera, you can set the control panel to produce a grayless black-and-white image by clicking the cut bar, which is the topmost of the horizontal bars below the picture window, or by clicking the pan control box in the upper-right corner of the screen. You can adjust the brightness of a grayless black-and-white image by moving the cut bar to the right.

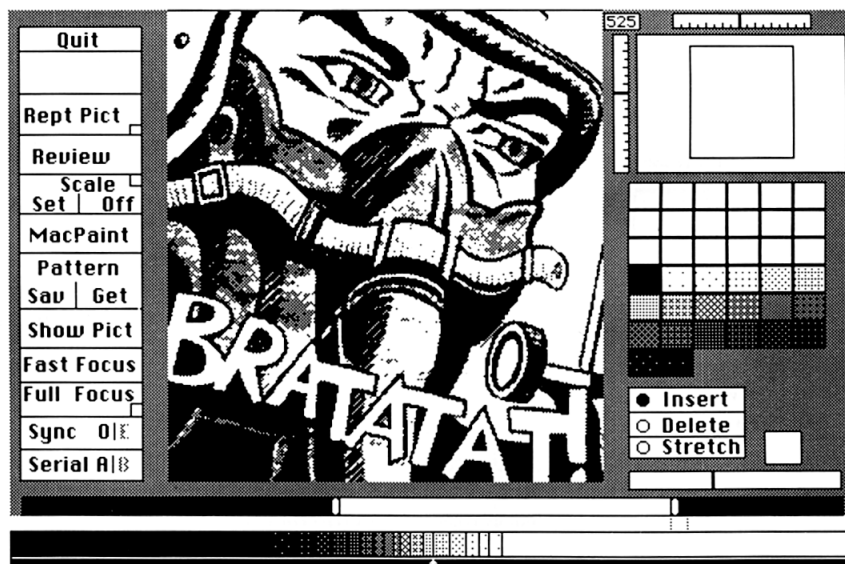
You can also get a black-and-white image with three patterns representing intermediate gray levels by clicking the picture window in the center of the control panel. One noteworthy feature of Magic is that if you don't like the patterns the digitizer uses initially, you can change them. As in *MacPaint*, you can choose from 38 editable patterns. You choose the patterns from the pattern palette on the right and drag them onto the pattern bar at the bottom of the screen.

The pattern bar represents the entire gray scale of the digitized image from black on the left to white on the right. You adjust the width of each pattern on the bar to control the portion of the gray scale represented by that pattern.

Although you can place all 38 patterns on the bar at once, using three or four is optimum; additional patterns slow down and unnecessarily complicate the scanning process. You adjust brightness by dragging the pattern bar to the left or right.



**New Image Magic**  
Magic's cream-colored box contains the processing electronics necessary to transform a video signal from a camera, a video recorder, or another source into a digital image that can be shown on the Mac.



**Figure 3**

The Magic control panel lets you review previously digitized images, focus the image, change and edit patterns, and adjust contrast and brightness. The box and rulers in the panel's upper-right corner are the pan control. You can select patterns from the palette and place them on the pattern bar; the thickest horizontal bar at the bottom of the screen.

Contrast is more difficult to adjust than brightness. First click the Stretch button located under the pattern palette. Then adjust the width of each pattern on the bar by clicking and dragging. As the individual patterns become narrower, the contrast increases.

### Special Effects

Magic is the only digitizer I tested that provides a precise way to measure the size of an image. Clicking the little square in the Scale box brings out rulers graduated in  $\frac{1}{8}$ -inch increments along the edges of the main window. You can resize the image by moving the camera or zooming the lens in or out.

Magic's scanning rate is fast enough to allow you to use the digitizer to focus the camera, but once again I found that focusing with the human eye is more accurate. When you click the Fast Focus option, a high-contrast image quickly appears in the main window. The Full Focus option lets you focus on a larger image, but scanning and editing are slower than when you use the Fast Focus button.

Because digitizers use patterns to represent shades of gray, an image can often look awkward; patterns sometimes appear overstated, and the

shadings of the patterns don't always match the gray shades of the original. To compensate, Magic software lets you blend patterns. A light blend tends to emphasize contours between shades of gray, while a heavy blend obscures the contours to give a more natural appearance. Too heavy a blend, however, can create a mess that's impossible to make out.

A unique feature of the Magic system is its pan control. A standard video signal produces an image roughly 768 pixels wide and 480 pixels high on a Macintosh. The Mac's screen displays only 512 by 342 pixels, or about 66 percent of the video image, losing the remaining 34 percent around the edges. Magic's pan control allows you to select the area of the video image that you want to digitize. This feature comes in handy when you digitize images from a videocassette recorder or videodisk player. However, when you work with a camera, you can always pan or tilt the camera to frame the image that you want to digitize.

## Servidyne Micro-Imager

Like the New Image Magic, the Servidyne Micro-Imager digitizes images either without gray levels or with selected patterns, which you can edit, to represent the gray scale. Micro-Imager accepts the standard video signal from cameras, videocassette recorders, and videodisk players and can be connected to a video monitor. After making those connections, you attach the hardware to one of the Macintosh's serial ports and plug it in. A switch on Micro-Imager permits you to set the digitizer for a color or black-and-white camera. When you set the switch for a color camera, Micro-Imager filters color information for maximum resolution in black and white.

### Taking the Picture

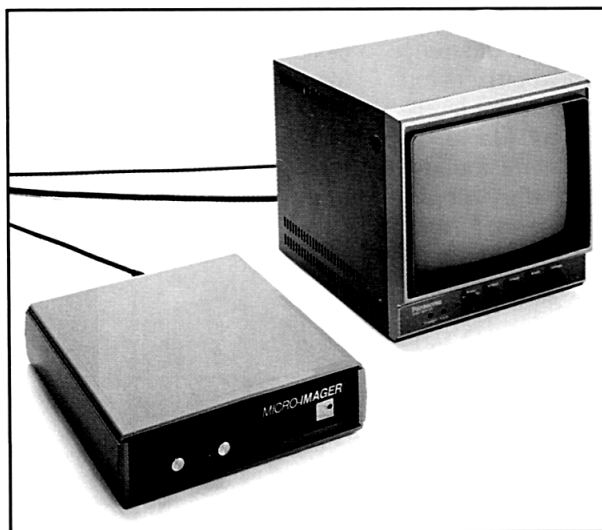
To digitize an image, open the Micro-Imager program and choose the Capture Image command on the Digitize menu. Within 5 seconds a high-contrast digitized image appears on screen. Like MacVision, Micro-Imager hardware has dials that let you adjust contrast and brightness.

Micro-Imager can produce a digitized image with six preset patterns representing the gray scale, but the scanning process takes twice as long as when it produces a grayless, high-contrast image. You create an image with patterns by choosing Multi-Shade-Pattern on the Options menu (see Figure 4).

You can select and save parts or all of the digitized image as a MacPaint document. After you drag the selection rectangle over the area you want to save, you can use Clear Outside Selection in the Edit menu to delete everything outside the rectangle. The Clear Inside Selection command, which deletes everything inside the selection rectangle, is next on the menu, so be careful (see Figure 5).

### Special Effects

If you don't like the way an image looks with Micro-Imager's preset patterns, choose Change Patterns on the Options menu (see Figure 4). A dialog box appears in which you can edit the patterns as you do in MacPaint; you click a pattern and then revise it as you see fit (see Figure 6). Experimenting with combinations of patterns can create stunning effects. For



### Servidyne Micro-Imager

Like the other video digitizers, Micro-Imager requires a video camera and proper lighting or uses the signal from another video source. Micro-Imager makes a direct video connection and doesn't need an RCA plug.

| Options               |
|-----------------------|
| ✓2 Shade              |
| Multi-Shade - Pattern |
| Multi-Shade - Random  |
| Change Patterns       |
| ✓Port A - Modem Port  |
| Port B - Printer Port |

**Figure 4**

The Options menu lets you change patterns and blend the shading of images you create with Magic. Choosing the Multi-Shade-Pattern option produces an image with regular patterns. If you want less regular patterns, choose the Multi-Shade-Random option to create blended patterns.

| Edit                    | Options | Digitize |
|-------------------------|---------|----------|
| Undo                    |         | ⌘Z       |
| Cut                     |         | ⌘H       |
| Copy                    |         | ⌘C       |
| Paste                   |         | ⌘U       |
| Clear Inside Selection  |         |          |
| Clear Outside Selection |         |          |

**Figure 5**

The Micro-Imager Edit menu lets you save selected portions of a digitized image. After selecting the portion you want to keep, you can choose the Clear Outside Selection command to save the area inside the selection rectangle. To save the area outside the rectangle, choose Clear Inside Selection from the menu.

## Digitizer Gallery

Although all four Macintosh digitizers reviewed in this issue are designed to generate computerized renditions of real-world images, there are subtle differences in the amount of detail and level of resolution among the images produced. The most significant difference is in the way the digitizers represent the intermediate levels between white and black, called the *gray scale*, found in the subject. Each digitizer employs unique software formulas to choose patterns that represent gray levels in the scale.

*Macworld* performed a test to demonstrate the differences among the four digitizers. Each product was used to create a digitized image of a black-and-white 8- by 10-inch glossy photograph of film star Jimmy Stewart. The video digitizers (MacVision, Micro-Imager, and Magic) were tested using the same lighting and video camera with a 35mm camera close-up lens. The photograph was fed through the Imagewriter for

the ThunderScan digitizer, which doesn't use a video camera.

You can see the differences in detail and in gray scale representation by examining a section of the image, such as the chin or the nose, and comparing the patterns used in each sample.



### **Koala MacVision**

*In the test, MacVision provided the smoothest transition from one gray value to another. Notice the variations of gray in the background. The digitizer doesn't give you control over the patterns with which it represents an image, but it is the easiest and fastest video digitizer to use.*



### **New Image Magic**

*The sample shows excellent modeling of gray values and good detail. Magic used 20 patterns to represent the gray levels in the test image. Magic's software is complex, and it is the most difficult digitizer to learn to operate; however, it offers the greatest control over pattern selection.*



#### **Servidyne Micro-Imager**

*The Micro-Imager represents an image using only six patterns, which results in abrupt transitions between gray values in an image with many levels of gray. You can see the effect in the test image along the chin line, which appears less realistic than in the images produced by the other digitizers.*



#### **Thunderware ThunderScan**

*ThunderScan has excellent resolution and produced the most detailed image in the test. Since it's the only digitizer that doesn't use a camera, ThunderScan takes longer to digitize an image. The time lost is often offset, however, by the time saved by not having to set up lights or a camera.*

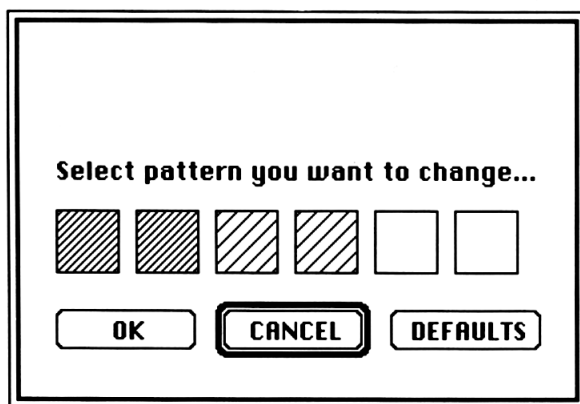


#### **The Original**

*This black-and-white glossy photograph of Jimmy Stewart is the basis of a test of four Macintosh digitizers.*

**Figure 6**

You can change Micro-Imager's six preset patterns by choosing the *Change Patterns* command on the *Options* menu (see Figure 4). You then edit patterns individually in the same manner as you do in MacPaint.



**Figure 7**

Micro-Imager gives movie stars Tony Curtis and Janet Leigh a digital look. You can experiment with patterns to create special effects. For example, the diagonal patterns selected in the *Change Patterns* dialog box shown in Figure 5 create an image with gray levels represented by diagonal lines only.

example, you can produce a digitized image that is composed entirely of diagonal lines (see Figure 7).

Patterns can be distracting if they're too obtrusive or too regular. The Micro-Imager system offers a random pattern mode that scrambles the dots so the patterns don't call attention to themselves. Random-pattern digitizing tends to increase contrast, but you can compensate by adjusting the image's brightness and contrast.

## Thunderware ThunderScan

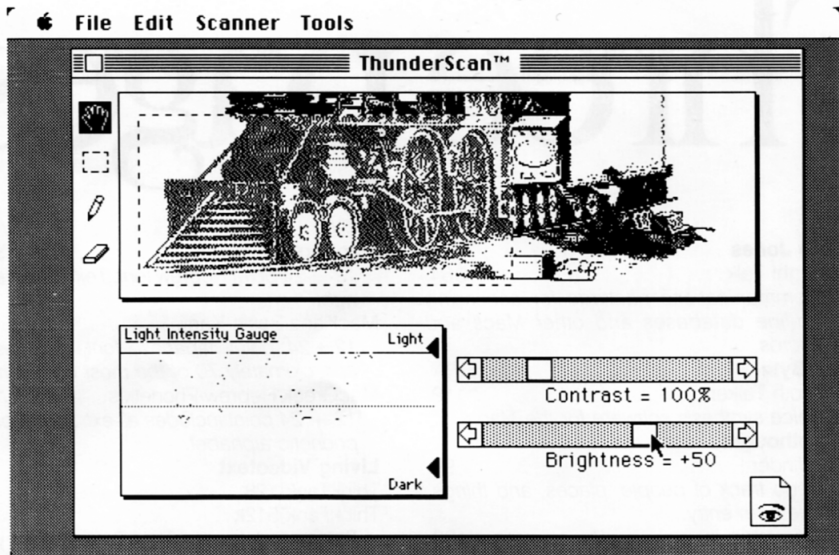
MacVision, Magic, and Micro-Imager represent the video approach to Macintosh digitizing. ThunderScan from Thunderware is an optical digitizer, which creates pictures without a video source. ThunderScan forms an image by scanning a photo, an illustration, or other flat art with a pinpoint stream of light. A light-sensitive detector senses the degree of lightness or darkness in each dot as the beam goes over it. To each dot, ThunderScan assigns a gray value of from 1 to 32 (from darkest black to lightest white). The gray values are encoded during scanning and stored in memory. When showing the digitized image on screen, ThunderScan software examines the gray values and determines which patterns to use to represent the gray scale.

The software was designed by Andy Hertzfeld, former Software Wizard at Apple Computer who wrote about a third of the Macintosh's system software, including the User Interface Toolbox. "I could draw circles and rectangles with *MacPaint*, but that's about the extent of my ability," Hertzfeld says, recounting how he became interested in ThunderScan. "When I first saw ThunderScan running on an Apple IIc, I realized that it could provide an inexpensive way for people like me to include drawings in their work."

The ThunderScan module contains the light emitter and detector and uses the Imagewriter printer as a scanning mechanism. The module fits onto the Imagewriter's ribbon bed, replacing the ribbon cartridge. During the digitizing process, the module sweeps back and forth across the original artwork as the Imagewriter feeds the paper through its platen a fraction of an inch at a time.

If you know how to put a ribbon into the Imagewriter, you can install the ThunderScan module. Take out the ribbon, pop the scanning module in its place, and patch ThunderScan's cable into the Mac. At the end of the cable is a small switch box that lets you select either scanning or printing mode. You replace the Imagewriter's carrier cover with a replacement included with ThunderScan.

One problem with ThunderScan is that you must replace the scanning module with a ribbon cartridge whenever you want to print with the Imagewriter. You'll probably want to print digitized images after a digitizing session. The ThunderScan system digitizes any image on paper that can fit into the Imagewriter, although the size of the image is limited not only by the Imagewriter but by the Macintosh's available mem-



**Figure 9**

Once ThunderScan digitizes an image, you can alter the contrast and brightness of all or part of the image. You select the marquee icon on the left side of the screen and create a selection rectangle with the mouse. After you select the area, you adjust the contrast and brightness with the controls that look like horizontal scroll bars until you get the effect you want. The new settings affect the selected area only.

## More Digitizers

Micron Technology offers its Micron Eye, which was the first Macintosh digitizer. For \$399 you get a camera and a scanner that produce simple digitized images. Unfortunately Micron Eye takes only thin slices of a picture at a time, producing only narrow images. It also suffers from lower overall resolution compared to the competition.

Other digitizers were in development at press time. I/O Video has announced a high-definition digitizer and camera package that will sell for around \$700.

As an alternative to digitizers that produce images primarily for you to store and edit, you might consider the Silicon Video digitizer from Epix. This \$3495 unit uses the Macintosh as a digitizing controller, producing extra-high-resolution images that are not designed to be edited with *MacPaint*. Instead, software that accompanies the Silicon Video system allows digitized images to be recorded on film or tape and transmitted via phone lines or satellite for teleconferencing.

If you decide to purchase a digitizer, the one you choose presents new possibilities for including visual images in your work. You may find it difficult to resist using pictures that you couldn't draw yourself. As you watch a picture become pixels on the Mac's screen, new technological vistas open up before you. □

▲▲▲▲▲▲▲▲▲▲ Gordon McComb is  
a Contributing Editor of Macworld.

**MacVision**  
Koala Technologies Corp.  
3100 Patrick Henry Dr.  
Santa Clara, CA 95052-8100  
408/986-8866  
List price: \$399

**Magic**  
New Image Technology, Inc.  
10300 Greenbelt Rd. #104  
Seabrook, MD 20706  
301/464-3100  
List price: \$399

**Micro-Imager**  
Servidyne Systems, Inc.  
1735 DeFoor Pl. NW  
Box 93846  
Atlanta, GA 30377  
404/352-2050  
List price: \$349

**Silicon Video**  
Epix  
7223 N. Hamilton Ave.  
Chicago, IL 60645  
312/764-9186  
List price: \$3495

**ThunderScan**  
Thunderware, Inc.  
21 Orinda Way  
Orinda, CA 94563  
415/254-6581  
List price: \$229

**I/O Video**  
222 Third St.  
Cambridge, MA 02142  
617/547-4141  
List price: under \$700