The Threshold dialog box appears.

3. To specify the threshold level, position the pointer on the slider below the histogram.
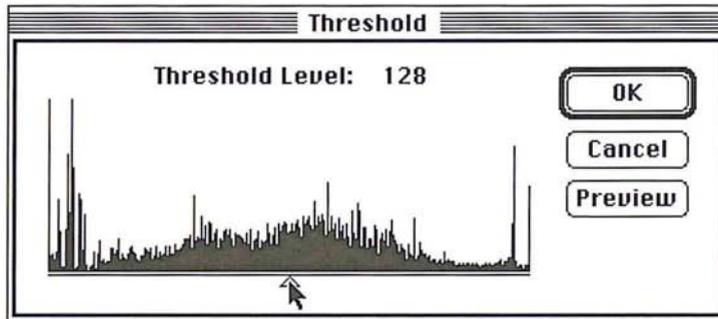

4. Holding down the mouse button, drag the slider until the threshold level you want appears at the top of the dialog box.

5. Click OK.

Before Threshold command

150 gray level

210 gray level

Threshold value: 175

gray level now 0

gray level now 255

16
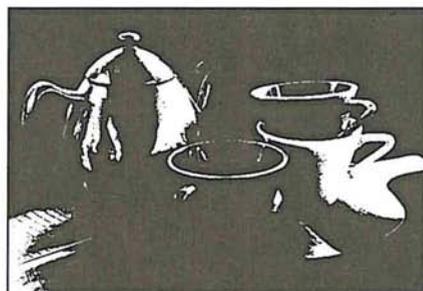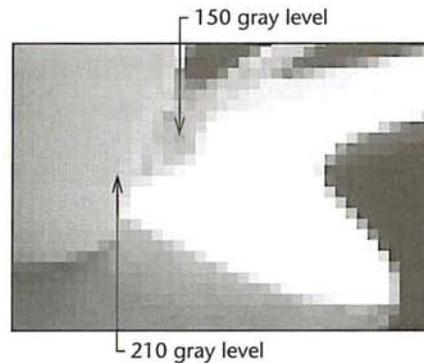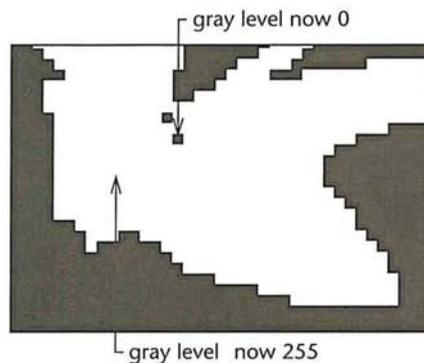
Creating a color curve

The arbitrary map feature allows you to correct the color in an image by remapping the color values of pixels with a high degree of accuracy. Remapping changes the current color values of pixels to different color values. You can define a color curve to create special effects. In conjunction with the separation setup parameters, the arbitrary map can also be used to create custom black-generation functions used to define the conversion from RGB to CMYK.

Each pixel in the image is mapped to a certain color level or levels from 0 (black) to 255 (white). The arbitrary map feature remaps the pixels' color values by defining a curve that specifies the different color values to which the pixels are to be mapped. The remapping is done through the Arbitrary Map dialog box, which is accessed through the Arbitrary command in the Map submenu.

The arbitrary map feature works on the active channel. If you open the Arbitrary Map dialog box while working on an indexed color image or the RGB channel of an RGB image, you have the option of remapping the color values for all three channels at once, or remapping the color values for individual channels separately. If you select the master channel, the changes you make are applied to all three channels. If you select the red, green, or blue channel, the changes are applied to the selected channel after the changes have been applied to the master channel's map.

You use the large square field in the Arbitrary Map dialog box to remap the color values of pixels in the image. You remap the color values by defining a curve in which the X and Y values for a given point on the curve are different. To define the curve used to remap the pixels' color values, you drag through the square field, which functions as a graph in which X and Y coordinates represent color values.

The X axis represents the original color values of the pixels, and the Y axis represents the new color values. Both axes range from 0 (black) to 255 (white). The X values increase from left to right, and the Y values increase from bottom to top. The diagonal line that appears by default in the field shows the current status of the pixels' color values, where the X values are equal to the Y values.

As you remap the pixels' color values, you can constrain the curve you draw to a line. After you have defined the curve, you can smooth it, or reset the curve to the diagonal line that appears when you first open the dialog box.

When the pointer is positioned at the extreme lower right corner of the field, the X value, the current color value, is 255, and the Y value, the new color value for the pixels, is 0. Markers appear on the sides of the field, and show the position of the pointer relative to the original and new color levels. Each tick mark on the side of the field represents approximately 13 steps in the 256-step scale.

In the illustration below, a straight line has been drawn from the lower right corner to the upper left corner, to create a negative of the current image, because the current color level of each pixel is remapped to its inverse value on the scale.
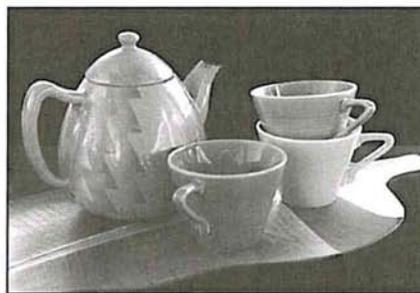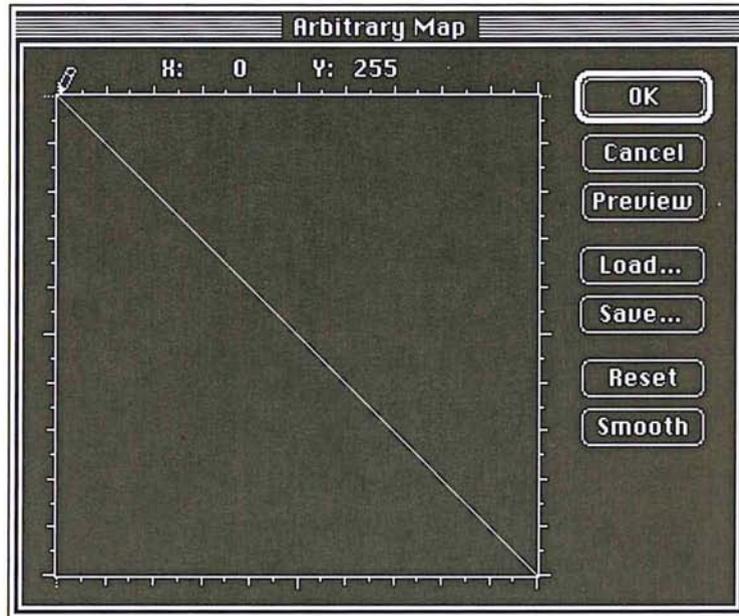
Gray scale image before remapping   After remapping

Petitioner Samsung Ex-1026, 0303
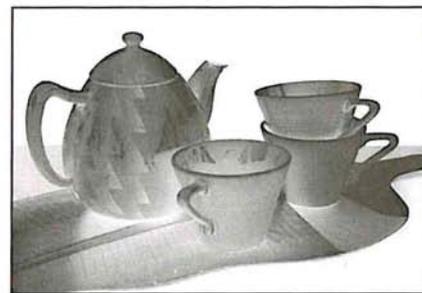
To access the Arbitrary Map dialog box:

1. Choose Map from the Image menu.

2. Choose Arbitrary from the Map submenu.

   The Arbitrary Map dialog box appears.
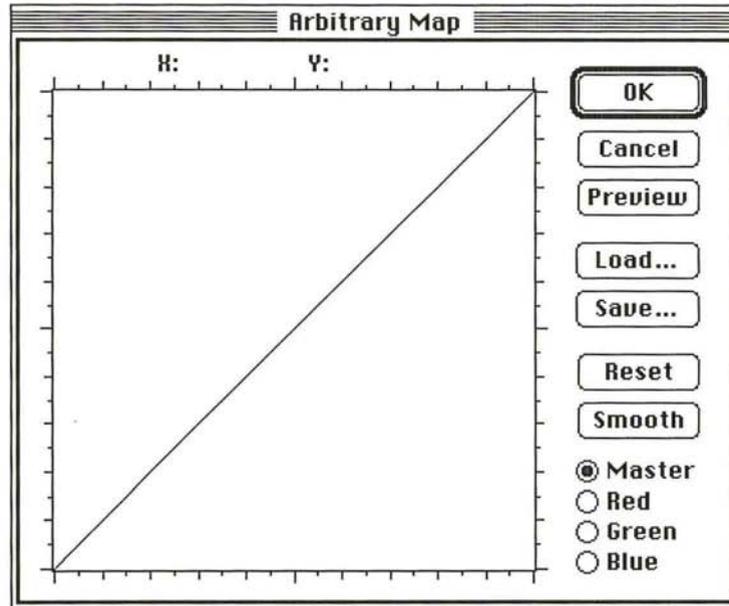
3. For RGB and indexed color images, click Master, Red, Green, or Blue to select the channel to which you want the changes applied.

To remap the current brightness levels of pixels to new levels:

1. Position the pencil pointer where you want to begin.

2. Holding down the mouse button, drag to define a curve that remaps the pixels to the brightness levels you want.

3. When you have finished defining your curve, release the mouse button.
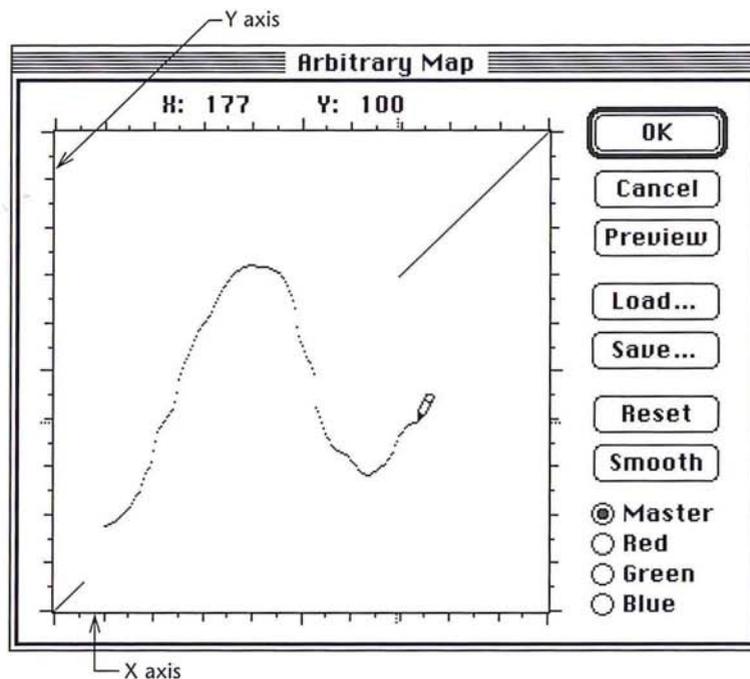
4. To smooth the curve you've drawn, click Smooth.

Arbitrary Map

H: Y:

| OK |
| Cancel |
| Preview |
| Load... |
| Save... |
| Reset |
| Smooth |

⦿ Master
○ Red
○ Green
○ Blue
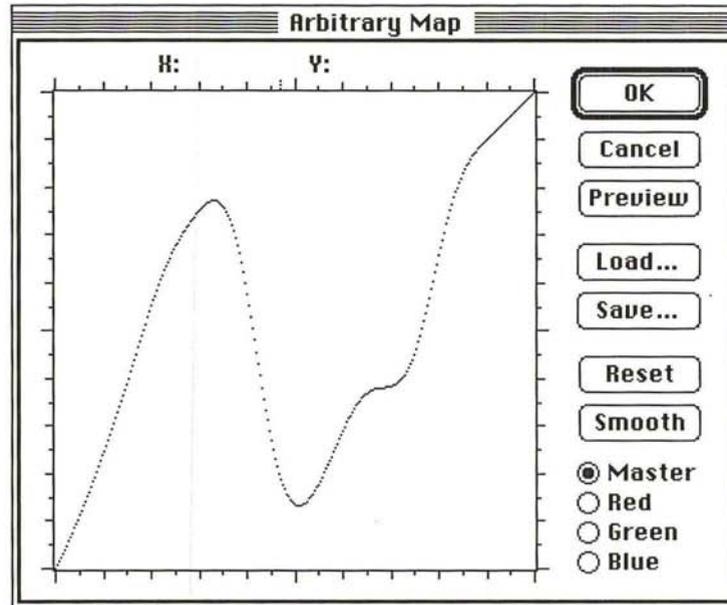
To constrain the pencil pointer to draw straight lines:

1. Click in the field where you want the line to begin.

2. Hold down the Shift key.

3. Click where you want the straight line to end.

4. Release the Shift key.

5. As an option, to reset the curve to the straight, diagonal line where X axis values equal Y axis values, click Reset.

6. To apply the arbitrary map to the image, click OK.

To save the current arbitrary map:

1. Click Save in the Arbitrary Map dialog box.

2. Type the file name in which you want to save the arbitrary map.

   If necessary, use the drive and directory buttons to access the folder in which you want to save the map.

3. Click Save.

   The arbitrary map is saved with the name and in the location you specified.

To load a previously saved map:

1. Click Load in the Arbitrary Map dialog box.

   The Open dialog box appears.

   If necessary, use the drive and directory buttons to open the folder that contains the map you want to load.

2. Click the map you want.

3. Click Open.

4. Click OK to apply the map to the image.

   The selected arbitrary map is loaded into the dialog box and is used to remap the brightness levels of the pixels in the document.
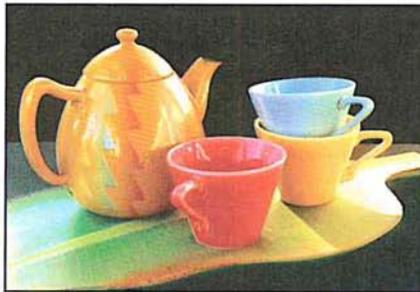
Before brightness curve

After brightness curve

Creating and using custom color correction maps

In a production environment, you may need to scan a large number of images and apply the same set of color corrections to all of them. You can do so two ways: through a keyboard enhancement program, or by creating a custom color correction map.

Keyboard enhancement programs, like Quickeys™, allow you to record the keystrokes for your first set of corrections, and play the keystrokes back for subsequent images. The playback is dependent on the sophistication of your keyboard enhancement program.

Custom color correction maps, once created, can be applied each time you need to scan and make color corrections to a batch of images.

The custom map files on the Calibration disk included in the Adobe Photoshop package can be used to adjust colors or gray values. The files, called Custom Map/RGB or Custom Map/B&W, for color or gray-scale images, respectively, contain the base color information needed to create custom, arbitrary maps.

Creating and using a custom color correction map is a two-step process. First, you adjust your image and record the adjustment values. You transfer those values to the Custom Map file, then save that file in the Raw format. Once saved, the file becomes an arbitrary map. To use the map to adjust color in a batch of images, load the new arbitrary map into the Arbitrary Map dialog box, and then apply the map to your image or series of images.

To create a color correction map:

1. Open the image to be used to create the custom map. This will be your calibration image.

2. Open the Custom Map/RGB or Custom Map/B&W file, depending on whether your calibration image is color or gray scale.

3. Click your calibration image to make it the active window.

4. In either the Map and Adjust submenu in the Image menu, choose any of the following color adjustment commands to run on the calibration image: Levels, Color Balance, Invert, Threshold, Posterize.

5. Record the order in which the adjustments are applied, and write down the numerical values of each adjustment. For example, if Levels adjustment is used and the Input Levels are changed to "5, 1.4, and 245," write those numbers down.

6. When you have finished making all adjustments to the calibration image, make the Custom Map file the active window.

7. Apply all of the changes you made to the calibration document to the Custom Map file, in the order in which they were made.

8. Choose Save As from the File menu, and select the Raw file format.

9. Type the document name you wish; it may be helpful to append "map" to the name. Enter 8BLT for the File Type, and 8BIM for the File Creator. Check the Non-interleaved radio button if you are saving an RGB ajustment. Click OK.

   You have now created and saved a custom color correction map.

To apply this map to other images:

1. Open the image in which you will correct the color.

2. Choose Map from the Image menu.

3. Choose Arbitrary Map from the Map submenu. The Arbitrary Map dialog box appears.

4. Click Load to locate and load the saved color correction map. You can now correct the color in your image.

5. To apply the map to your image, click OK .

Using the color adjustment commands

The commands used to make color corrections are in the Adjust submenu. You access the Adjust submenu via the Image menu. These commands allow you to adjust the brightness, contrast, and gamma, the balance or red, green, and blue values, and the hue and saturation in a selection.

To choose the color correction you want:

1. Choose Adjust from the Image menu.

   The Adjust submenu appears.

2. Holding down the mouse button, drag over to highlight the color adjustment command you want.

3. When you have selected the desired command, release the mouse button.

   The dialog box used to implement the command appears.

To move the color correction dialog box to a convenient location:

1. Position the pointer on the title bar at the top of the dialog box.

2. Holding down the mouse button, drag the dialog box to the desired location.

3. Release the mouse button.

### Adjusting the brightness and contrast

You can adjust the brightness and contrast of a selection or the entire image using the Brightness/Contrast command. You can increase the contrast in an image to improve a flat image, and adjust the brightness to lighten or darken an image.

> NOTE: Expert users will probably prefer to use the Levels command since it offers the greatest control.

To adjust the brightness in an image:

1. Choose Adjust from the Image menu.

2. Choose Brightness/Contrast from the Adjust submenu.

   The Brightness/Contrast dialog box appears.

```
═══════════ Brightness/Contrast ═══════════

    Brightness:    0              ┌──────────┐
                                  │    OK    │
    _____△_____        └──────────┘
                                  ┌──────────┐
    Contrast:      0              │  Cancel  │
                                  └──────────┘
    _____△_____        ┌──────────┐
                                  │ Preview  │
                                  └──────────┘
```
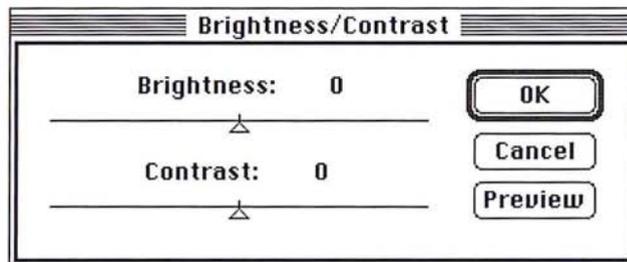
3. Position the pointer on the Brightness triangle.

4. Holding down the mouse button, drag to the right to increase the brightness; drag to the left to decrease the brightness.

   The value at the top of the dialog box displays the amount of brightness that is added to or subtracted from each pixel.

5. When the desired brightness adjustment is displayed, release the mouse button.

6. To preview the change to the selection, click Preview.

7. To apply the change to the image, click OK. To cancel the change, click Cancel.

Original image   Brightness: +30

To adjust the contrast in an image:

1. Choose Adjust from the Image menu.

2. Choose Brightness/Contrast from the Adjust submenu.

3. Position the pointer on the Contrast triangle.

4. Holding down the mouse button, drag to the right to increase the contrast; drag to the left to decrease the contrast.

5. When the desired contrast adjustment is displayed, release the mouse button.

   The Contrast value shows you how the increase or decrease in contrast in the image.

6. To preview the change to the selection, click Preview.

7. To apply the change to the image, click OK. To cancel the change or preview, click Cancel.

Original image   Contrast: +30

Adjusting the brightness, contrast, and gamma precisely

The Adjust Levels command is a powerful tool that allows you to change the brightness, contrast, and gamma of an image. Like the Brightness/Contrast command, the Adjust Levels command allows you to adjust the brightness and contrast in an image. In addition, the Adjust Levels command displays a histogram that lets you see precisely how the changes you make affect the color values of pixels in an image.

Like the other color correction commands, you can use the Adjust Levels command to adjust color values to visually satisfactory standards. You can also use the Adjust Levels command to make very precise changes based upon the color values of pixels in the image.

The ability to adjust the gamma in the image allows you to change the color values of the pixels with middle gray values without dramatically changing the shadows (very dark pixels) and highlights (very light pixels). You can increase or reduce the brightness and contrast in both the highlights and shadows of an image.

The Adjust Levels dialog box displays a histogram of the image. The histogram plots the color values versus the number of pixels at each level. You use the slider controls at the bottom of the Levels dialog box (Output Levels) to reduce the contrast in the image; you use the slider controls directly below the histogram (Input Levels) to increase the contrast in the image, and to adjust the brightness and gamma.

If you are working on an RGB or indexed color image, you can select the master channel to adjust the color values and apply the changes to the red, green, and blue channels simultaneously, or you can select a single channel and apply the changes to that specific channel.

You can move the dialog box to a convenient location to view the effects of your changes by dragging the dialog box by its title bar.

Reducing the contrast using Output Levels

You can use the slider controls on the bottom of the Adjust Levels dialog box (Output Levels) to reduce the contrast in the image. Reducing the contrast using the Output Levels control has the effect of lightening the image. The slider has two controls: the left, black triangle controls the shadows, and the right, white triangle controls the highlights. These slide bar controls allow you to remap the color values of pixels in order to narrow the tonal range of an image. The triangles' positions on the slide bar correspond to color values.

The values beside the title "Output Levels" display the range of color values in the image. The left value displays the lower end of the scale (the shadow areas) and right value displays the upper end (the highlight areas). You drag the black Output Levels slider to define the new lower limit of the scale (the 0 value); you drag the white Output Levels slider to define the new upper limit of the scale (the 255 value). The color values of pixels in the image are adjusted to the new upper and lower limits of the scale.

As an example, suppose your image contains colors that cover the entire 0 to 255 scale. If you drag the black Output Levels triangle to 64, a pixel with a color value of 0 is mapped to 64, and pixels with higher color values are raised to corresponding, lighter values. This lightens the image and decreases the contrast in the shadow areas. On the other hand, if you drag the white triangle to 128, a pixel with a color value of 255 is remapped to 128, and pixels with color values less than 255 are lowered to corresponding darker values. This darkens the image and decreases the contrast in the highlight areas.

If you open the Adjust Levels dialog box after decreasing the contrast, you will notice that the contrast changes are reflected in the histogram. For example, the movement of the black control to level 64 causes the histogram to show no pixels with color values between 0 and 63. This is due to the fact that the contrast change you made remapped pixels in this range to higher color values.

To decrease the contrast in the shadow areas and lighten the selection:

1. Choose Adjust from the Image menu.

2. Choose Levels from the Adjust submenu.

   The Levels dialog box appears.
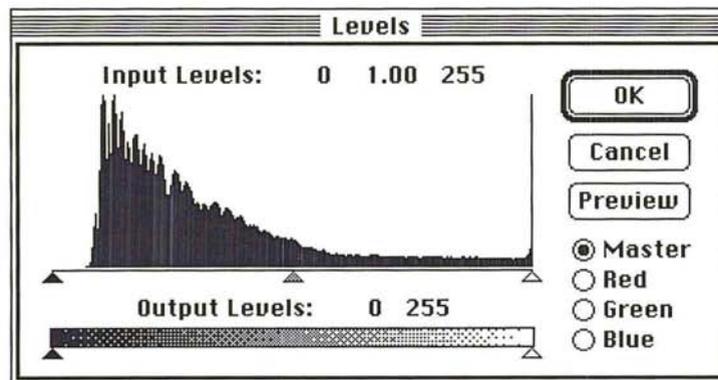
3. To work on an individual channel, click Red, Green, or Blue.

4. Position the pointer on the black triangle beneath the title "Output Levels."

5. Holding down the mouse button, drag the black Output Levels triangle to the right until the left value displays the color value you want to use as the lower limit on the scale.

6. Release the mouse button.

   The left value increases as you drag to the right.
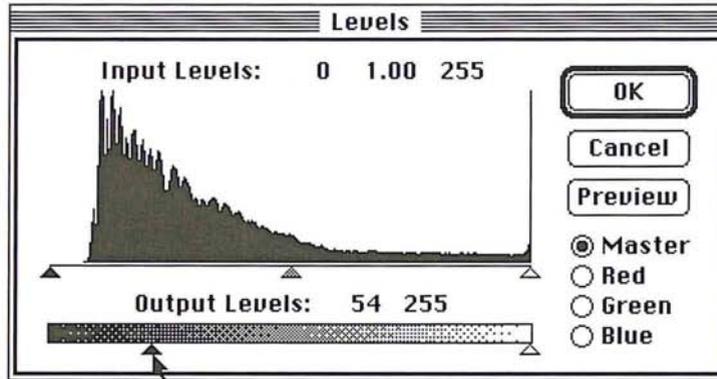
7. To preview the change to the selection, click Preview.

8. To apply the change to the image, click OK. To cancel the change or preview, click Cancel.

Original image

Contrast: output levels black triangle, 54

To decrease the contrast in the highlight areas, and at the same, decrease the brightness in the selection:

1. Choose Adjust from the Image menu.

2. Choose Levels from the Adjust submenu.

   The Levels dialog box appears.

3. To work on an individual channel, click Red, Green, or Blue.

4. Position the pointer on the white triangle beneath the title "Output Levels."

5. Holding down the mouse button, drag the white Output Levels triangle to the left until the right value displays the color value you want to use as the upper limit on the scale.

6. Release the mouse button.

The right value decreases as you drag to the left.
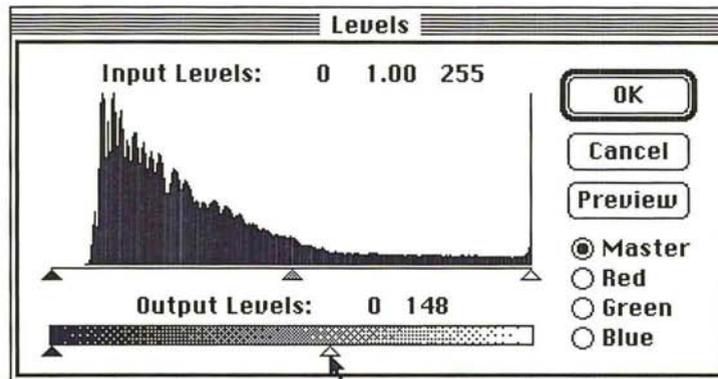
7. To preview the change to the selection, click Preview.

8. To apply the change to the image, click OK. To cancel the change or preview, click Cancel.

The image reflects the contrast change.


Original image   Contrast: output levels white triangle, 148

Increasing the contrast using Input Levels

The slider controls directly beneath the histogram in the Levels dialog box (Input Levels) allow you to increase the contrast in an image. Increasing the contrast in the shadows has the effect of decreasing the effect of darkening the image; increasing the contrast in the highlight areas lightens the image. This is useful when you are adjusting a scanned image, because scanned images often do not use the entire gray scale, and thus may have too little contrast.

You can drag the black Input Levels triangle to the right to darken the image and increase the contrast in the shadow areas. By dragging the black Input Levels triangle, you specify the level where solid black (level 0) starts. Pixels with color values below the specified level are mapped to 0 (solid black). Pixels with color values higher than the specified level are remapped to the appropriate, corresponding color values.

You can drag the white Input Levels triangle to the left to lighten the image and increase the contrast in the highlights. By dragging the white Input Levels triangle, you specify the level that you want mapped to solid white (color value 255). The pixels with color values above the specified level are mapped to white, the other pixels are remapped to the appropriate, corresponding color values on the scale. For example, suppose there are two pixels in the image with brightness values of 165 and 75, respectively.

┌ 75 color value
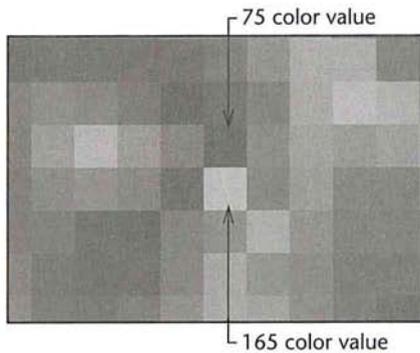
└ 165 color value

If you drag the white Input Levels triangle to 130, the pixel with the color value higher than 130 (the pixel with the 165 color value) is mapped to value 255 (white) and the pixel with the color value less than 130 (the pixel with the 75 color value) is mapped to the appropriate, corresponding color value, in this case, 154.

┌ this pixel is now mapped to a color value of 145

└ this pixel is now mapped to a color value of 255 (white)
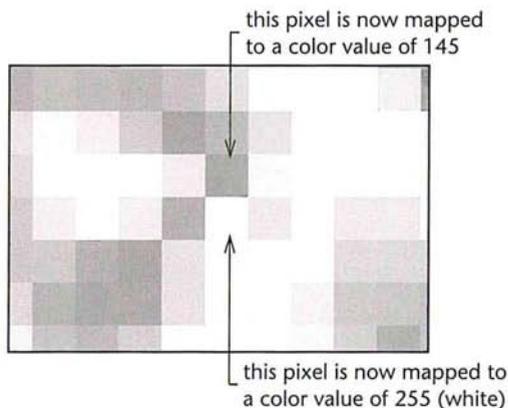
The values beside the title "Input Levels" display the values for the shadow color levels on the left, the gamma in the middle, and the highlight color levels on the right. The position of the Input Levels triangles is mapped to color values. As the position of the Input Levels triangles changes, the values above the slider controls change.

To increase the contrast in the shadow areas and darken the image:

1. Choose Adjust from the Image menu.

2. Choose Levels from the Adjust submenu.

   The Levels dialog box appears.

3. To work on an individual channel, click Red, Green, or Blue.

4. Position the pointer on the black Input Levels triangle beneath the histogram.

5. Holding down the mouse button, drag the black Input Levels triangle to the level at which you want to map the darkest color value (0). As you drag, the left value above the slide bar displays the current level.

6. When the contrast in the image is increased to the desired amount, release the mouse button.

7. To preview the change to the selection, click Preview.

8. To apply the change to the image, click OK. To cancel the change or preview, click Cancel.

Original image   Adjust levels: input levels black triangle, 30

To increase the contrast in the highlight areas and lighten the image:

1. Choose Adjust from the Image menu.

2. Choose Levels from the Adjust submenu.

   The Levels dialog box appears.

3. To work on an individual channel, click Red, Green, or Blue.

4. Position the pointer on the the white triangle directly beneath the histogram (Input Levels).

5. Holding down the mouse button, drag the white Input Levels triangle to the level at which you want to map the brightest value (255). As you drag, the right value above the slide bar displays the current level.

6. When the contrast in the image is increased to the desired amount, release the mouse button.

7. To preview the change to the selection, click Preview.

8. To apply the change to the image, click OK. To cancel the change or preview, click Cancel.

Original image

Input levels white triangle at 200

Adjusting the gamma

At times, you might want to lighten or darken an image without substantially changing the highlights and shadows. The gamma control allows you to do this. The gamma control is the gray, middle triangle in the Input Levels controls. The gamma control primarily affects the color values of the midtones (the middle color values in an image). The solid black-and-white areas are not affected.

To adjust the brightness levels of the midtones:

1. Choose Adjust from the Image menu.

2. Choose Levels from the Adjust submenu.

   The Levels dialog box appears.

3. To work on an individual channel, click Red, Green, or Blue.

4. Position the pointer on the gray middle triangle directly beneath the histogram (Input Levels).

5. Holding down the mouse button, drag the gray Input Levels triangle to the right to darken the image, or drag to the left to lighten the image.

6. When the midtones are adjusted to the level you want, release the mouse button.

7. To preview the change to the selection, click Preview.

8. To apply the change to the image, click OK. To cancel the change or preview, click Cancel.

Original image

Input Levels gray triangle at 1.67

Adjusting the color balance and color levels

The Color Balance command in the Adjust submenu of the Image menu allows you to change the mixture of colors in an RGB or indexed color image. The pixels in an RGB or indexed color image represent colors that are mixtures of the three primary colors: red, green, and blue. You can adjust or enhance one of the colors, such as the amount of red in an image of grapes and leaves, shown in the illustrations below. The Color Balance command operates only on RGB and indexed color images.

You can focus the color balance changes on the shadows, midtones, or highlights. The triangle controls in the Color Balance dialog box change their appearance to reflect your selection. When the Shadows option is selected, the triangles turn black; when the Midtones option is selected, the triangles turn gray; when the Highlights option is selected, the triangles turn white.

You can also enhance the level of a particular color by dragging a triangle control in the Color Balance dialog box toward that color. The values at the top of the Color Balance dialog box show the color changes for the red, green, and blue channels, in that order, from left to right. You enhance the green, for example, by dragging the triangle on the Green slider to the right (toward Green). Positive values show an increase in red, green, or blue; negative values show a decrease in these colors.

To adjust the levels of a particular color in an image:

1. Choose Adjust from the Image menu.

2. Choose Color Balance from the Adjust submenu.

The Color Balance dialog box appears.
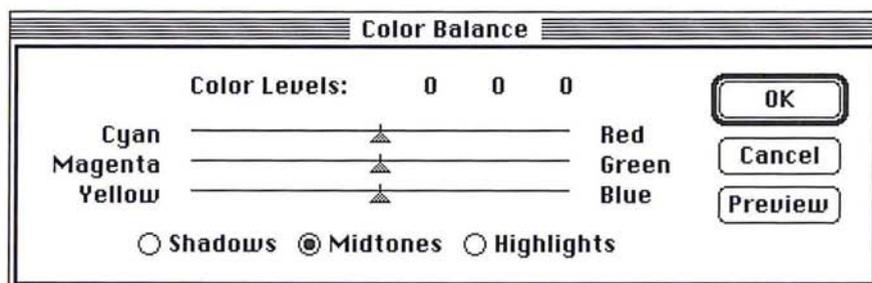
3. Click Shadows, Midtones, or Highlights to select the part of the selection on which you want to focus the changes.

4. Position the pointer on the triangle that controls the color you want to adjust.

5. Holding down the mouse button, drag toward the color if you want to make it more prominent in the image, or drag away from the color if you want to reduce the level of that color.

6. When the desired color adjustment is displayed, release the mouse button.

7. To preview the change to the selection, click Preview.

8. To apply the change to the image, click OK. To cancel the change or preview, click Cancel.

Color Balance: +45 cyan

Color Balance: -45 cyan

Adjusting the hue and saturation

The Hue/Saturation command in the Adjust submenu of the Image menu adjusts the hue and saturation of an image. Hue is color: red, yellow, cyan, and so on. Saturation is the purity of the color, and the amount of gray in a color. You use slider controls to adjust the hue and saturation. In addition, the Colorize option lets you adjust the hue and saturation to specific levels.

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By adjusting the hue, you can compensate for shifts in hue that occur in an NTSC image (a televsion or video image) that was acquired using a video frame grabber. You can use the Hue/Saturation command to push the hues into the correct positions on the hue color wheel. You can use the saturation slider to increase or decrease the saturation of the colors in the image.

NOTE: *If you adjust the hue and saturation while operating in 24-bit color mode, you cannot preview the hue changes you make unless you click Preview.*

Adjusting the hue

You use the slider controls beneath the title "Hue" in the Hue/Saturation dialog box to adjust the hue of the image. The Hue slider control remaps color levels in a unique way. When you drag the Hue triangle, the effect you achieve is analogous to rotating the colors around a hue color wheel, such as the color wheel in the Color Wheel dialog box. (The color wheel is displayed by Option-clicking the foreground or background color indicator.) The values displayed above the Hue slider reflect the number of degrees of rotation around the wheel the colors are to be rotated; the direction in which you drag the slider determines the direction of rotation around the color wheel.

If you drag to the right, you rotate the colors in a counterclockwise direction around the color wheel; if you drag to the left, you rotate the colors in the clockwise direction. For example, if pure blue pixels are included in the selection and you drag the triangle to the right until +90 is displayed and click OK, the blue color is changed to pink. Pink is the color located 90 degrees in the counterclockwise direction from blue on the color wheel.

90 degrees location
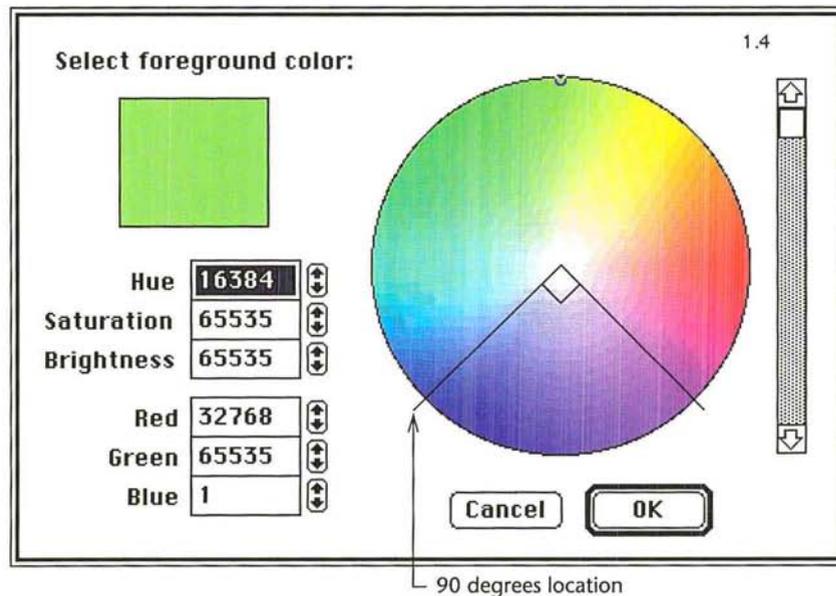
To adjust the hue of an image:

1. Choose Adjust from the Image menu.

2. Choose Hue/Saturation from the Adjust submenu.

   The Hue/Saturation dialog box appears.
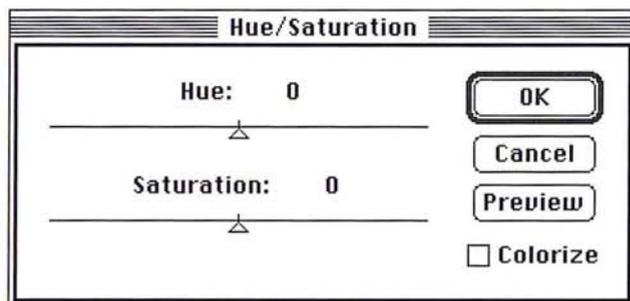
3. Position the pointer on the Hue triangle.

4. Holding down the mouse button, drag the triangle until the colors appear the way you want them.

5. Release the mouse button.

6. To preview the change to the selection, click Preview.

7. To apply the change to the image, click OK. To cancel the change or preview, click Cancel.
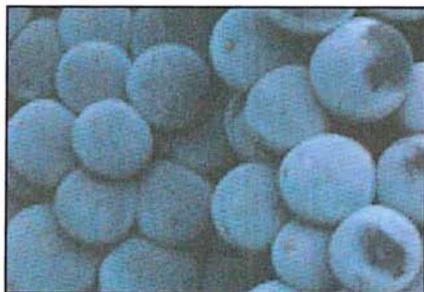
Original image
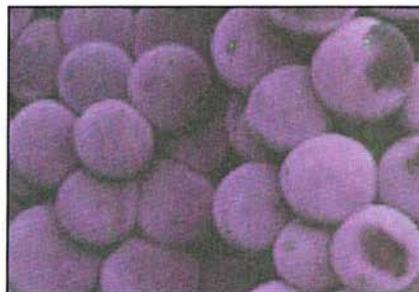
Hue: +90

Adjusting the saturation

You use the triangle control beneath the title "Saturation" in the Hue/Saturation dialog box to adjust the level of saturation in an image. This operation functions in a manner similar to that of the color wheel. The change in saturation using this control is analogous to clicking on the color wheel to adjust the saturation.

To adjust the saturation of an image:

1. Choose Adjust from the Image menu.

2. Choose Hue/Saturation from the Adjust submenu.

   The Hue/Saturation dialog box appears.

3. Position the pointer on the Saturation triangle.

4. Holding down the mouse button, drag to the right to increase the saturation, or drag to the left to decrease the saturation.

5. When the saturation adjustment you want is displayed, release the mouse button.

6. To preview the change to the selection, click Preview.

7. To apply the change to the image, click OK. To cancel the change or preview, click Cancel.
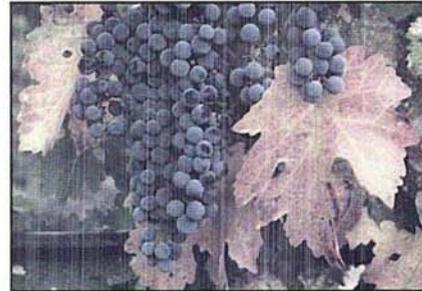
Saturation: +75   Saturation: -75

Using the Colorize option

The Colorize option in the Hue/Saturation dialog box allows you to remap the hue and saturation levels of pixels to specific values. When you change the hue while the Colorize option is active, all colors are remapped to a specific location on the color wheel; also, the lightness of the pixels is maintained. The Colorize option, when active, adjusts the saturation value of pixels by a specific percentage.

This differs from the standard operation in which the hue and saturation changes are based upon the existing values of the pixels. When you change the hue in the standard mode, the colors in each pixel rotate around the color wheel the specified number of degrees relative to their current positions on the wheel.

When the Colorize option is active, red is treated as the 0 degree point on the color wheel and the rotation value you specify using the Hue slider control is measured from that point of origin. For example, if you select the Colorize option and drag the Hue triangle until -90 is displayed, the image takes on a blue cast because blue is located 90 degrees in the clockwise direction from red.

Original image   Hue: -90

> NOTE: Because the Colorize option preserves the lightness value of each pixel, pure black and pure white are not colored, while the middle gray pixels are colored completely. If you want to color the black-and-white pixels, you must first use the Adjust Levels command to remap these pixels to middle gray.

To use the Colorize option:

1. Choose Adjust from the Image menu.

2. Choose Hue/Saturation from the Adjust submenu.

   The Hue/Saturation dialog box appears.

3. Click Colorize.

4. Use the Hue slider to select the hue to which you want the pixels remapped.

5. Use the Saturation slider to adjust the saturation of the pixels.

6. To preview the change to the selection, click Preview.

7. To apply the change to the image, click OK. To cancel the change or preview, click Cancel.

Chapter 17: *Using Filters to Modify Images*

The Adobe Photoshop program includes almost two dozen filters that allow you to soften or sharpen the focus, and apply special effects to images. With filters, you can soften, sharpen, fracture, or offset a selection. You can outline an image's edges, where abrupt color transitions occur. You can also customize your own filter to create special effects, and store the filter for reuse with other images. In addition, the Adobe Photoshop program also supports plug-in filters, designed by third-party software developers. Once installed, the filters are accessed by the Filter command in the Image menu.

The softening filters include the Blur, Blur More, Despeckle, Gaussian Blur and Motion Blur filters. The Diffuse filter makes a selection look less focused by moving pixels.

Sharpening filters include the Sharpen, Sharpen More, Sharpen Edges, and Unsharp Mask filters.

The High Pass filter retains the high frequency part of an image and suppresses the low frequency parts.

Outlining filters include the Trace Contour and Find Edges filters.

The Median, Minimum, and Maximum filters change the brightness of pixels. They evaluate the area around a pixel and replace the brightness value of the current pixel with the median, minimum, or maximum brightness value of the surrounding pixels.

Filters that can be used to create special effects include the Facet, Fragment, Mosaic, Offset, and Add Noise filters. The Facet, Fragment, Mosaic, and Offset filters all displace pixels to make a selection appear as if it has been broken up.

The Custom filter allows you to create your own filter by adding values to a grid that is used to perform a mathematical equation on pixels.

Many of the filters work by evaluating the brightness value of pixels in a selection, then changing the values. Changes are determined by making calculations that affect the pixels surrounding the current pixel. The current pixel is the pixel whose color value is currently being evaluated. The Adobe Photoshop program automatically evaluates each pixel in the selection individually, calculates its new brightness value, and then evaluates the next pixel in the selection. Other filters, like the Fragment filter, make several copies of a selection, then offset them.

All the filter commands operate on the active channel. If there is a selection in the image, the changes you make using the filters are applied to the selection; if there is no selection, the changes are applied to the entire channel. In this guide, the effects are described as being applied to the selection.

Once you choose a filter, that filter appears in the Image menu. You can use the same filter again by typing Command-F.

Filters that have dialog boxes associated with them appear with an ellipsis (...) after their name. When you type Command-F, the program uses the last value you entered in a filter dialog box to control the filter. To change the value in the dialog box that controls how a filter works, you can automatically display the dialog box. To display the dialog box for the most recently used filter, type Command-Option-F, or press down the Option key and choose the filter from the Image menu.

Using filters to soften an image

The Blur, Blur More, Motion Blur, Gaussian Blur, and Despeckle filters defocus and soften an image. Some of the filters have additional effects, or require specific values; these are described below.

All of the softening filters work in a similar manner.

To use a softening filter:

1. Select the part of the image to which you want to apply the filter.

2. Choose Filter from the Image menu.

   The Filter submenu appears.

   ```
   Add Noise...
   Blur
   Blur More
   Custom...
   Despeckle
   Diffuse...
   Facet
   Find Edges
   Fragment
   Gaussian Blur...
   High Pass...
   Maximum...
   Median...
   Minimum...
   Mosaic...
   Motion Blur...
   Offset...
   Sharpen
   Sharpen Edges
   Sharpen More
   Trace Contour...
   Unsharp Mask...
   ```

3. Holding down the mouse button, choose the softening filter.

4. Release the mouse button.

   The softening filter is applied to the current selection.

The Blur and Blur More filters

In addition to softening an image, the Blur and Blur More filters can be used to eliminate noise in the higher frequency parts of the image where abrupt color transition occur. Blur More produces a stronger blur effect (about three or four times stronger) than the Blur filter.
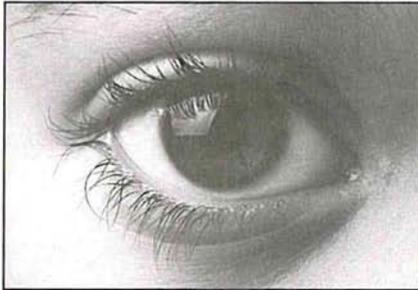

Original image
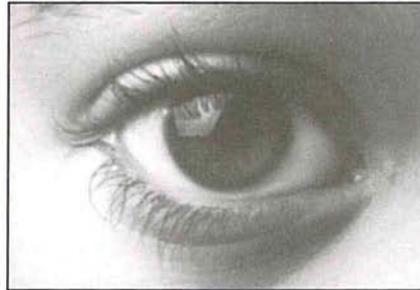
Blur More: applied four times

The Despeckle filter

The Despeckle filter detects the edges on an image, the areas where significant color changes occur, and blurs all of the current selection, except for the edges in the selection. Because the eye tends to notice the edges more than interior areas, the effect is a subtle blurring of the selection.
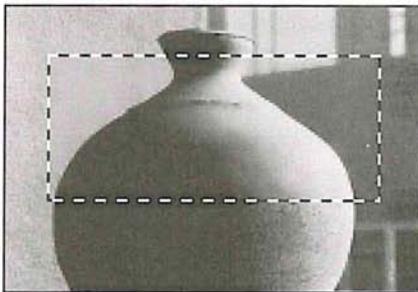
The Gaussian Blur filter

The Gaussian Blur filter quickly blurs a selection by a large amount; the effect is similar to choosing the Blur or Blur More filters several times. "Gaussian" refers to the shape of the curve of the color values of the pixels in the selection that results from implementing the filter. The resulting curve is a bell-shaped or Gaussian curve.

When you use the Gaussian Blur filter, you can specify a value that determines the degree of blurring that is to be applied to the selection. The value determines how much information from neighboring pixels is used in the blur calculations. The value you enter defines a radius (in pixels) around each pixel. The wider the radius, the more information is included in the blur calculations, and the stronger the blur effect. You can enter decimal values to specify the amount of blurring you want.

To use the Gaussian Blur filter:

1. Select the part of the image you want to blur.

2. Choose Filter from the Image menu.

3. Choose Gaussian Blur from the Filter submenu.

The Gaussian Blur dialog box appears.

```
Gaussian Blur...                         ┌──────────┐
                                         │    OK    │
Radius: [ 1.0   ]  (pixels)              └──────────┘
                                         ┌──────────┐
                                         │  Cancel  │
                                         └──────────┘
```
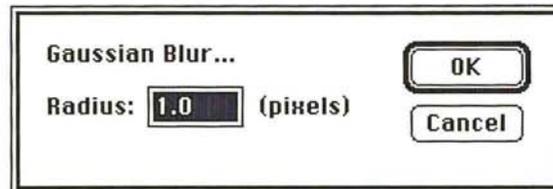
4. Enter a value from 0.1 to 100.0 to represent the amount of blurring you want.

5. Click OK.

The selection is blurred.
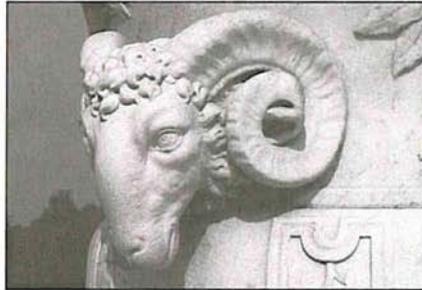
Original image

Gaussian Blur: 2
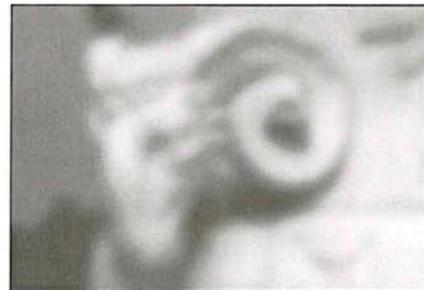
Gaussian Blur: 8.5

The Motion Blur filter

The Motion Blur filter produces a blur effect in a particular direction and of a specific intensity. The motion blur effect is analogous to taking a picture of a moving object with a fixed exposure time. You could use this filter to simulate the blurred image of a moving object.

You specify an angle and a distance with the Motion Blur filter. The Angle parameter allows you to specify the direction in which the object is moving, and the Distance parameter allows you to specify how far the object moves during the exposure. You specify an angle for the direction of the blur effect, where 0 degrees is located at 3 o'clock. The Distance parameter determines the severity of the blur effect. Enter a high value to produce a strong blur; enter a low value to produce a weak blur.

To use the Motion Blur filter:

1. Select the part of the image you want to blur.

2. Choose Filter from the Image menu.

3. Choose Motion Blur from the Filter submenu.

   The Motion Blur dialog box appears.
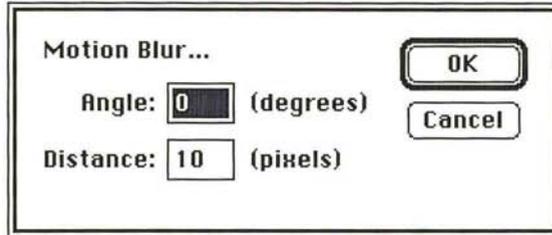
4. To specify the direction for the blur effect, enter a value from -90 to 90 in the Angle text box.

   To specify the value for the distance:

5. Press the Tab key, or click in the Distance text box.

6. Enter a value from 1 to 32 to specify the severity of the blur effect.

7. To apply the Motion Blur filter, click OK.

   After a few moments, the selection will display the motion blur effect.

Original image

Motion Blur, background only: direction, 45; distance, 30

Creating a diffused effect

The Diffuse filter shuffles pixels around in a selection to make the selection look less focused. There are three options associated with this filter: Normal, Darken Only, and Lighten Only. The Darken Only and Lighten Only options allow you to darken or lighten a selection, respectively, in addition to making it appear more diffused.

When the Normal mode is active, the pixels are moved around at random, regardless of their color values. When the Darken Only mode is active, the Adobe Photoshop program moves pixels around, but only replaces light pixels with darker pixels. This mode tends to accentuate the dark areas in the selection. When the Lighten Only mode is active, the Adobe Photoshop program replaces only dark pixels with lighter pixels when the pixels are shuffled around. This mode tends to accentuate the light areas in the selection.

**To use the Diffuse filter:**

1. Select the part of the image you want to diffuse.

2. Choose Filter from the Image menu.

3. Choose Diffuse from the Filter submenu.

   The Diffuse dialog box appears.

```
Diffuse...                    [    OK    ]
Mode:
   ⊙ Normal                   [ Cancel ]
   ○ Darken Only
   ○ Lighten Only
```
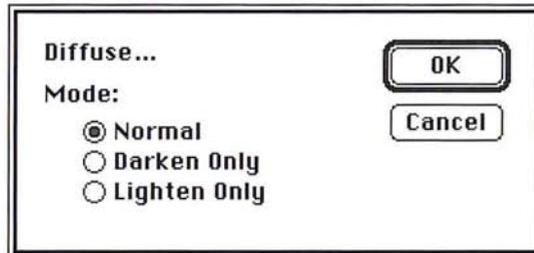
4. Click on the Diffusion mode you want.

5. Click OK.

   The Diffuse filter is applied to the selection.
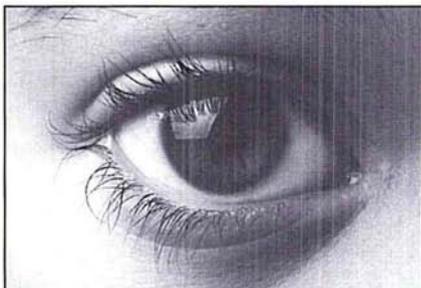
Original image
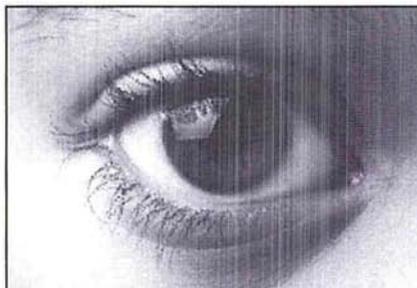
Diffuse: Normal, applied three times
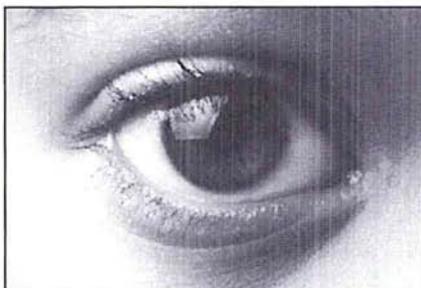
Diffuse: Lighten Only, applied three times

Diffuse: Darken Only, applied three times

Using filters to sharpen an image

The Sharpen, Sharpen More, Sharpen Edges, and Unsharp Mask filters bring a selection into focus and improve the clarity of an image by increasing the contrast in adjacent pixels in the selection. The Sharpen More filter applies a stronger sharpening effect than the Sharpen filter.

The Sharpen Edges filter only sharpens the parts of the image where significant color transitions appear. Because the eye notices changes around the edges of images more than in other areas, you can use the Sharpen Edges filter to focus an image without sharpening the entire image unnecessarily. The Unsharp Mask filter sharpens the high-frequency areas (the areas where abrupt color transitions occur) in a selection. The effects of these filters are shown below.

All of the sharpening filters work in a similar manner.

To use a sharpening filter:

1. Select the part of the image you want to sharpen.

2. Choose Filter from the Image menu.

3. Holding down the mouse button, choose the sharpening filter.

4. Release the mouse button.

The selection is sharpened.

Original image

Sharpen More applied

Original image

Sharpen Edges applied

The Unsharp Mask filter

The Unsharp Mask filter increases sharpness at the edges of density change in an image. The filter is commonly used in pre-press production to enhance details in the separations by producing exaggerated density at the borders of a color change.

The Unsharp Mask filter is useful for sharpening high-frequency areas in an image. The filter tends to have the greatest affect on high-frequency areas, where abrupt color transitions occur. The filter also will amplify a variable amount of lower frequency detail.

The Unsharp Mask filter sharpens pixels using a variable radius. You specify a radius (in pixels) around the current pixel, which is being evaluated. The Unsharp Mask filter then blurs a selection according to the specified radius. A fraction of this blurred result is then subtracted from the original data, resulting in a sharpening effect. The larger the radius, the more information is included in the filter's calculations. If you specify a high value for the radius, the lower frequencies will be amplified; if you specify a low value, only high-frequency areas will be amplified.

You can also specify the percentage of the filter's effect. The higher the percentage, the stronger the effect of the Unsharp filter mask on a selection. If you specify a low value, only a fraction of the effect is applied; if you specify a high value, most of the effect is applied.

To use the Unsharp Mask filter:

1. Select the part of the image to which you will apply the Unsharp Mask filter.

2. Choose Filter from the Image menu.

3. Choose Unsharp Mask from the Filter submenu. The Unsharp Mask dialog box appears.

```
┌─────────────────────────────────────────────┐
│  Unsharp Mask...              ┌──────────┐   │
│                               │    OK    │   │
│  Amount:  [50  ]  %           └──────────┘   │
│                               ┌──────────┐   │
│  Radius:  [1.0 ]  (pixels)    │  Cancel  │   │
│                               └──────────┘   │
└─────────────────────────────────────────────┘
```
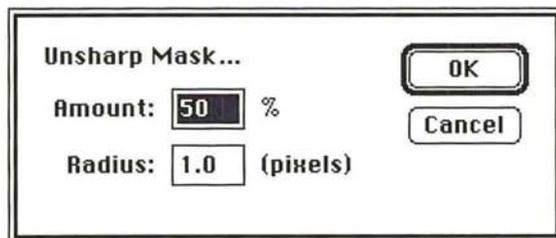
4. Enter the percentage amount of the unsharp effect you want to be applied, from 1 to 500.

5. Press the Tab key or click the Radius text box.

6. Enter a value from 0.1 to 99.9 for the radius of pixels surrounding the current pixel that will be included in the filter's calculation.

7. Click OK.

The Unsharp Mask filter is applied to the selection.

Original image

Unsharp Mask: radius 1.0/100%

Unsharp Mask: radius 5.0/100%

Using filters to outline areas of color transition

Both the Find Edges and Trace Contour filters outline areas of an image where abrupt color transitions occur.

Color transitions between pixels can be gradual or abrupt. Gradual transitions occur in areas of an image that share the same or similar colors. Abrupt transitions tend to occur at the edges of an image, where different parts of an image meet.

The Find Edges filter

The Find Edges filter automatically outlines the edges on an image. This filter is useful for creating a border around an image. The filter marks the edges on a color image by colored lines; it marks the edges on a gray-scale image by white lines.

To use the Find Edges filter, select part of your image, choose Filter from the Image menu, and drag to select Find Edges from the Filter submenu; the filter is applied to your selection.

Original image   Find Edges applied

> NOTE: This filter uses a standard edge-detection algorithm known as the "Sobel" operator.

The Trace Contour filter

The Trace Contour filter outlines the areas of a selection where a given transition between color values occurs. You specify a certain color value, then the Adobe Photoshop program outlines the areas in the selection where a transition from pixels with color values above or below that level occurs. You specify whether you want the contour outline to mark the areas where the color values fall above the specified level or where the values fall below the specified level.

As an example of how this filter works, suppose you are working on an image that contains two adjacent pixels with color values of 83 and 71, respectively. If you specify 74 as the value for the Trace Contour filter and select Upper as the position for the outline marker, the outline marker appears on the pixel with the 71 color value, because the pixel with the color value of 83 is the next pixel that has a color value above the specified level (74).

To use the Trace Contour filter:

1. Select the part of the image in which you want to trace the transitions in color levels.

2. Choose Filter from the Image menu.

3. Choose Trace Contour from the Filter submenu.

The Trace Contour dialog box appears.

```
Trace Contour...              ┌──────────┐
                              │    OK    │
Level:  128                   └──────────┘
                              ┌──────────┐
Edge:                         │  Cancel  │
   ◉ Lower                    └──────────┘
   ○ Upper
```

4. Enter a value from 0 to 255 to specify the threshold value that will be used to evaluate the color values.

5. Click Lower to outline the areas where the color values of pixels fall below the specified level, or click Upper to outline the areas where the color values of pixels are above the specified level.

6. Click OK.

brightness value: 85

brightness value: 47
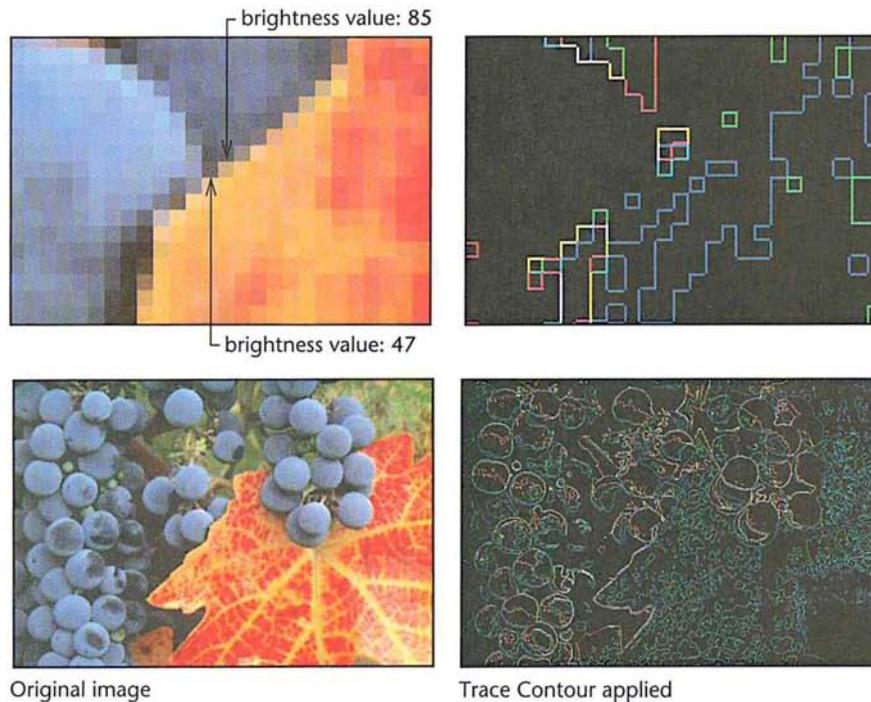
Original image

Trace Contour applied

Petitioner Samsung Ex-1026, 0337

Using filters to brighten an image

The Median, Maximum, and Minimum filters allow you to examine pixels in a given area of a selection, and adjust their brightness. Operating on one pixel at a time (the current pixel), these filters examine the brightness values of the surrounding pixels and replace the brightness value of the current pixel with either the maximum, minimum, or median brightness value encountered, depending on which filter you choose.

For all of these filters, you specify a radius that determines how far around the current pixel the filter looks at brightness values of surrounding pixels. The Maximum and Minimum filters use a value from 1 to 10 for the radius; the Median filter uses a value from 1 to 16 for the radius.

The Median, Maximum, and Minimum filters work in a similar manner.

To adjust the brightness values of pixels based on the values of pixels in the area:

1. Select the part of the image to which you want to apply the filter.

2. Choose Filter from the Image menu.

3. Choose either Maximum, Minimum, or Median from the Filter submenu.

   The dialog box for the filter you chose appears.

4. For the Maximum and Minimum filters, enter a value from 1 to 10. For the Median filter, enter a value from 1 to 16.

5. Click OK.

   The filter is applied to the selection.

The Median filter

The Median filter eliminates noise in an image. The Median filter normalizes the brightness levels of random noise pixels to the brightness levels of the surrounding pixels. Noise appears as pixels with random color values that are interspersed among the other pixels in an image.

```
Median...
Radius: [1] (pixels)        [ OK ]
                            [ Cancel ]
```
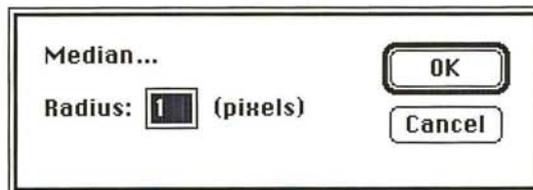
The Median filter eliminates large statistical variances in pixel brightness by replacing each pixel with the median value of its neighbors. Unlike a blur function, the Median filter eliminates noise rather than spreading it out over neighboring pixels. As a result, the Median filter can make an image appear blurred.

For each pixel in a selection, the filter determines the median brightness value of the pixels within a specified radius of the pixel and remaps the pixel to that brightness level. The larger the radius you specify, the more pronounced is the blur effect.
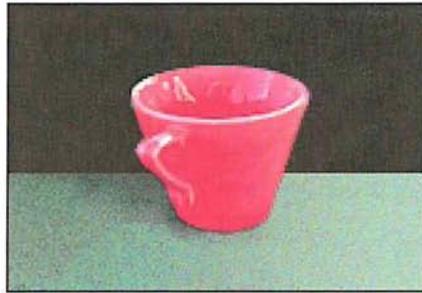

Original image
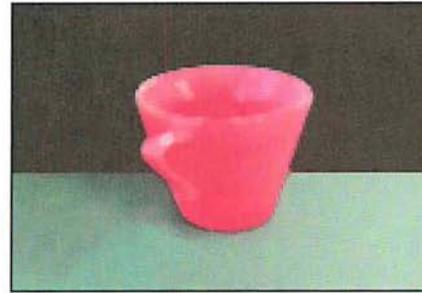
Median radius: 2 pixels

The Maximum filter

The Maximum filter expands the highlight areas in an image and shrinks the shadow areas.
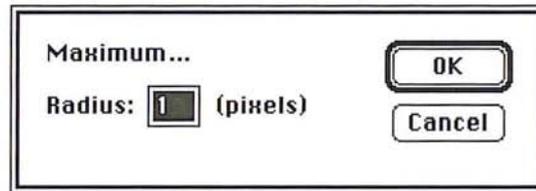
For each pixel in the selection, the Maximum filter evaluates the brightness values of the pixels within a certain area around the current pixel, and then applies the highest brightness value found within that area to the pixel. The area that is evaluated is determined using the following equation: $2n + 1$ by $2n + 1$, where n is the specified radius.

For example, suppose the specified radius is 5. The Adobe Photoshop program evaluates the brightness values of pixels within an 11-pixel square area around the current pixel. If the highest brightness value of a pixel within that area is 70, the program remaps the brightness value of the given pixel to 70.

In general, the larger the radius you specify, the larger the highlight areas become.


Original image   Maximum radius: 2 pixels

The Minimum filter

The Minimum filter expands the shadow areas in an image and shrinks the highlight areas. For each pixel in a selection, the filter evaluates the brightness levels of pixels within the specified radius around the pixel and remaps the pixel to the lowest brightness level found within the area.
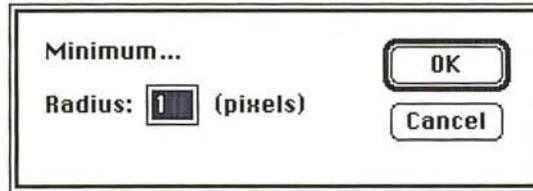
In general, the larger the radius you specify, the larger the shadow areas become.

Original image   Minimum radius: 2 pixels

Using special effect filters

Many of the Adobe Photoshop program filters allow you to produce special effects in an image. For example, you can use the Mosaic filter to make the selection look like it is made up of a series of large, rectangular blocks. Along with the Facet, Fragment, and Offset filters, the Mosaic filter displaces pixels to make a selection look more broken up. Other special effects filters include the Add Noise and Diffuse filters.

The steps for implementing the Facet and Fragment filters are identical.

To implement the Facet or Fragment filter:

1. Select the part of the image to which you want to apply the filter.

2. Choose Filter from the Image menu.

3. Choose the Facet or Fragment filter from the Filter submenu.

   The filter is applied to the selection.

The Facet filter

The Facet filter tends to clump pixels into blocks of pixels. You can use the Facet filter to create sharp definition in a selection.
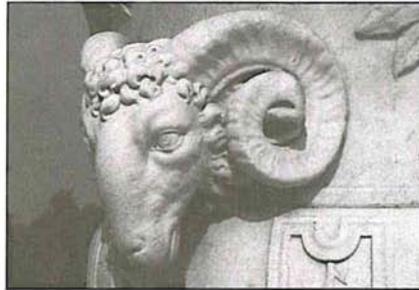
Original image

Facet: applied twice

The Fragment filter

This filter creates four copies of the pixels in the selection and offsets them from each other.

The Mosaic filter

The Mosaic filter clumps pixels in a selection into blocks of pixels of a specified size. You specify the size of the blocks using the Mosaic Filter dialog box. The pixels in a given block are all the same color, and the colors of the blocks represent the colors in the selection.

To use the Mosaic filter:

1. Select the part of the image to which you will apply the mosaic effect.

2. Choose Filter from the Image menu.

3. Choose Mosaic from the Filter submenu.

   The Mosaic dialog box appears.
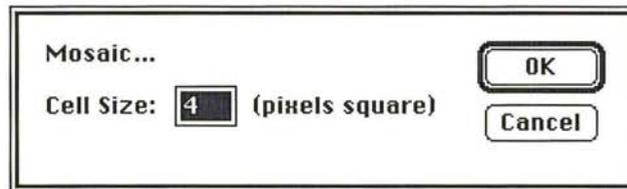
4. Enter a value (in pixels) from 2 to 64 to specify the size of the blocks that make up the mosaic.

5. Click OK.

   The Mosaic filter is applied to the selection.
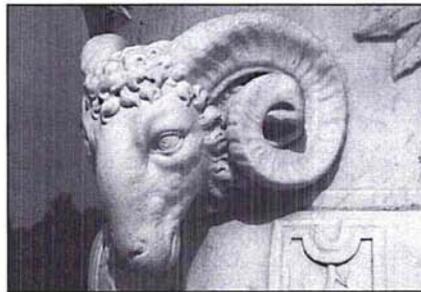
Original image

Mosaic: 6-pixel square
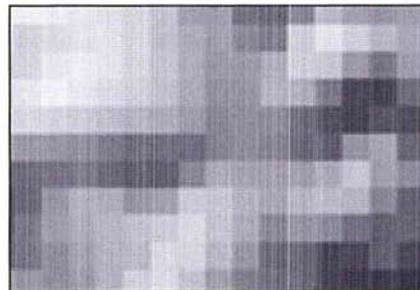
Mosaic: 6-pixel square, enlarged

The Offset filter

The Offset filter moves the pixels in a selection a specified distance in a specified direction. The area left empty by the move is replaced with an adjacent part of the image. If the selection is not located near the edge of the image, the effect of the filter is to create a duplicate of the image and place it directly beneath the original.

When you offset the selection, a "hole" the size of the selection is created in the top image, and the bottom image is moved over the specified distance in the specified direction while the top image remains in the same position. The bottom image shows through the hole left by the selection.

If the selection appears near the edge of an image, the area outside the image is undefined. You can specify what appears in the hole when the selection is offset. By default, the hole left by the selection is filled with the current background color.

You have three choices for what will appear in the space left behind the selection after it has been offset: Set to background, which fills the space with the current background color; Repeat edge pixels, which extends the colors of the pixels along the edge of the image through the space; and Wrap around, which causes the image to wrap to fill the space.

Original selection
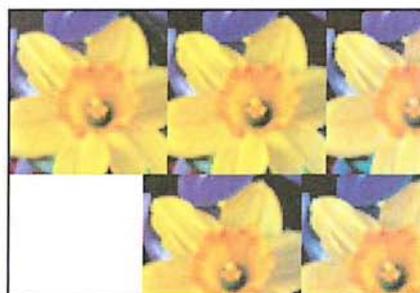
Set to background, horizontal value: 50; vertical value: 0

When the Repeat edge pixels option is active, the pixels along the edge of the image are repeated across the space in the direction the selection is offset. This can create a banding effect if the edge pixels are different colors.

Original selection
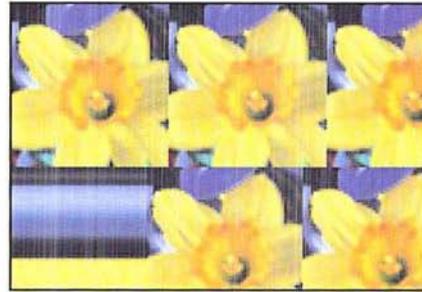
Repeat edge pixels, horizontal value: 50; vertical value: 0

The Wrap around option makes the image wrap around the part of the image opposite the selected area. You can use the Wrap around option to create a pattern that tiles correctly. Often when you create a pattern, the seams where the elements of the pattern join together are visible and detract from the pattern's appearance. You can use the Offset filter and the Wrap around option to expose the seam in a pattern, adjust the pattern to remove the seam, then define the pattern as your custom pattern using the Define Pattern command in the Edit menu.

When The Wrap around option is active, the Adobe Photoshop program wraps the image in the specified direction to fill the space left by the selection. Here is an example of how the Wrap around option works. If you select the lower right corner of an image and specify 0 for the horizontal offset and -100 for the vertical offset, the Adobe Photoshop program fills the space with the part of the image that appears 100 pixels down from the upper right corner of the image. If you select the same lower right corner of the image and enter 100 for the horizontal offset (to move the selection to the left) and -100 for the vertical offset, the program fills the space with the part of the image that appears 100 pixels to the right and 100 pixels down from the upper left corner of the image.


Original selection
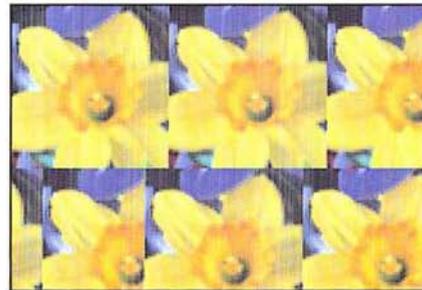
Wrap around, horizontal value: 50; vertical value: 0

To use the Offset filter:

1. Select the part of the image you want to offset.

2. Choose Filter from the Image menu.

3. Choose Offset from the Filter submenu.

   The Offset dialog box appears.
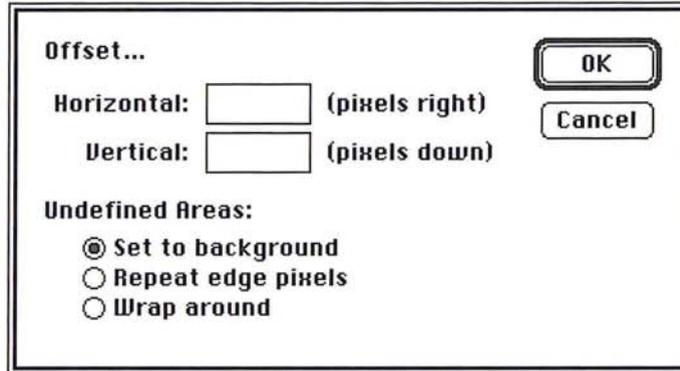
4. Enter the number of pixels you want the selection to be offset in the horizontal direction. Enter a positive value to move the selection to the right; enter a negative value to move the selection to the left.

5. Press the Tab key or click in the Vertical text box.

6. Enter the number of pixels you want the selection to be offset in the vertical direction. Enter a positive value to move the selection down; enter a negative value to move the selection up.
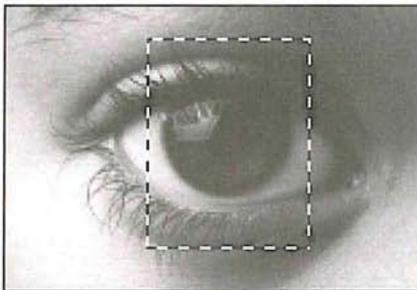
Original image with selection
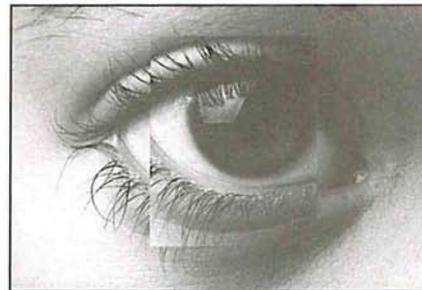
Horizontal Offset value: 30
Vertical Offset value: -20

7. If your selection appears near the edge of an image, specify how the undefined areas will be treated by clicking the Undefined areas option you want.

8. Click OK.

The Add Noise filter

Noise in an image is represented by pixels with randomly distributed color levels. The Add Noise filter can be used along with the painting tools on a gray-scale image. The painting tools apply paint that is free of noise. Therefore, if you apply paint to an area in an image that contains some noise, you might select the area you painted, and use the Add Noise filter to make the area blend in better with its surroundings.

When you use the Add Noise filter, you can select the method that determines how the color values of the noise pixels are distributed in the image. The two distribution options available to you are Uniform and Gaussian; you can experiment with these two options to achieve the effect you want.

When Uniform distribution is active, the value you specify for the amount of noise is the maximum value. The color values of the noise are determined by calculating random numbers between 0 and plus or minus the specified value.

When Gaussian distribution is active, the distribution of color values are distributed along a Gaussian (bell-shaped) curve. In this case, the value you specify for the amount of noise is used as the standard deviation of the color values of the noise. The standard deviation is a statistical calculation that represents how widely the values vary.

To add noise to a selection:

1. Select the part of the image to which you want to add noise.

2. Choose Filter from the Image menu.

3. Choose Add Noise from the Filter submenu.

   The Add Noise dialog box appears.

```
┌─────────────────────────────────────────┐
│                                          │
│   Add Noise...              ┌─────────┐  │
│                             │   OK    │  │
│   Amount: [32]              └─────────┘  │
│                             ┌─────────┐  │
│   Distribution:             │ Cancel  │  │
│       ◉ Uniform             └─────────┘  │
│       ○ Gaussian                         │
│                                          │
└─────────────────────────────────────────┘
```

4. Enter a value from 1 to 999 for the amount of noise you want to add.

5. Select either the Uniform or Gaussian option to distribute the noise in the selection.

6. To apply the Add Noise filter, click OK.

The Add Noise filter is applied to the selection.
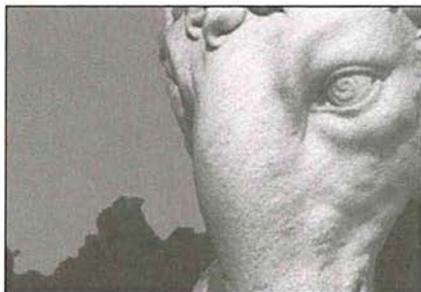
| Image with uniform sky | Add Noise: 30 |

Using the High Pass filter

The High Pass filter retains the high frequency part of the image and suppresses the low frequency parts of the image. High frequency areas coincide with sharp transitions that generally occur around the edges of distinct parts of an image, for example, where the ram's head shown in the following illustration meets the darker background. The low frequency areas occur where there are smooth, gradual transitions between the brightness levels of pixels, for example, on the surface of the ram's head.

To determine how much of the high frequency information to retain and how much of the low frequency information to suppress, you enter a value in the High Pass filter dialog box. The value you enter in the dialog box determines the amount of low frequency information that is suppressed. Enter a low value to suppress a large amount of low frequency information; enter a high value to suppress a small amount of low frequency information.

**To use the High Pass filter:**

1. Select the part of the image to which you will to apply the filter.

2. Choose Filter from the Image menu.

3. Choose High Pass from the Filter submenu.

The High Pass dialog box appears.

4. Enter a value from 0.1 to 100.0.

5. Click OK.

Petitioner Samsung Ex-1026, 0347
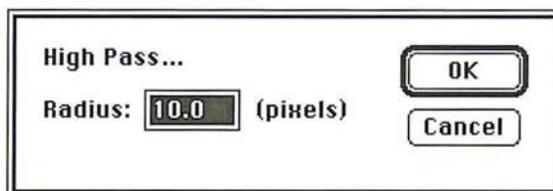
The High Pass filter is applied to the selection.
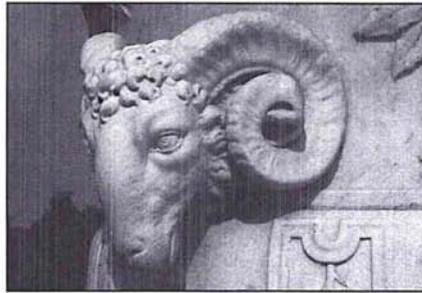
Original image
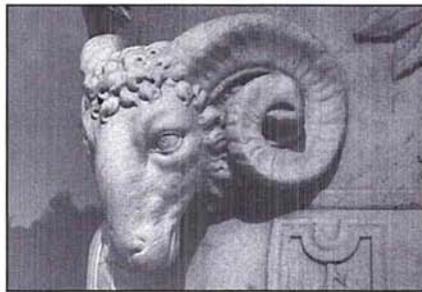
High Pass value: 80 pixels

High Pass value: 10 pixels

Using the Custom filter

The Custom filter allows you to create a special filter to suit your needs that can be saved and loaded into another document for use. Using the Custom filter, you can create special effects by changing the brightness values of pixels according to a mathematical convolution kernel that you specify. As an example, you can define a filter that shows off a selection in high relief or a filter that creates a motion blur effect.

The filter uses a grid consisting of text boxes. The grid acts as a template that is applied to each pixel, one at a time, in the image. The center text box in the grid represents the current pixel, the pixel whose new brightness value is currently being calculated; the text boxes around it represent the pixels surrounding that pixel. The values you enter in the text boxes apply a designated weight to the pixel represented by that text box. If you enter a high value, that pixel is heavily weighted and is more influential in the brightness calculations than pixels that are assigned lower values.

The Custom filter works as follows. You enter values into the grid text boxes and the Scale and Offset boxes. The values entered for Scale and Offset are applied to the value that results from the mathematical operations involving the values in the grid text boxes. The Adobe Photoshop program multiplies the brightness values of the center pixel and the surrounding pixels by the respective values in the grid text boxes.

As an example, if you enter "1" into the center text box, the program multiplies the current pixel's brightness value by 1. The program then adds the resulting brightness values of all of the pixels involved, divides that value by the Scale value, and finally adds the Offset value. The current pixel's brightness is changed to this final value.

Below are some examples of custom filters and their effects on an image.

Scale value: 1; Offset value: 128

Custom filter applied

Scale value:1; Offset value: 0
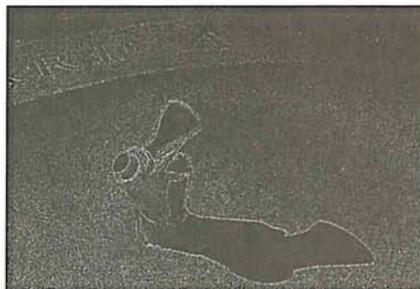
Custom filter applied

To create a custom filter:

1. Choose Filter from the Image menu.
2. Choose Custom from the Filter submenu.

   The Custom dialog box appears.

```
┌──────────────────────────────────────────────────────┐
│                                                        │
│  Custom...                              ┌────────────┐ │
│                                         │     OK     │ │
│  ┌────┐ ┌────┐ ┌────┐ ┌────┐ ┌────┐     └────────────┘ │
│  │    │ │    │ │    │ │    │ │    │      ┌───────────┐  │
│  └────┘ └────┘ └────┘ └────┘ └────┘      │  Cancel   │  │
│  ┌────┐ ┌────┐ ┌────┐ ┌────┐ ┌────┐      └───────────┘  │
│  │    │ │    │ │ -1 │ │    │ │    │                     │
│  └────┘ └────┘ └────┘ └────┘ └────┘      ┌───────────┐  │
│  ┌────┐ ┌────┐ ┌────┐ ┌────┐ ┌────┐      │  Load...  │  │
│  │    │ │ -1 │ │  5 │ │ -1 │ │    │      └───────────┘  │
│  └────┘ └────┘ └────┘ └────┘ └────┘      ┌───────────┐  │
│  ┌────┐ ┌────┐ ┌────┐ ┌────┐ ┌────┐      │  Save...  │  │
│  │    │ │    │ │ -1 │ │    │ │    │      └───────────┘  │
│  └────┘ └────┘ └────┘ └────┘ └────┘                     │
│  ┌────┐ ┌────┐ ┌────┐ ┌────┐ ┌────┐                     │
│  │    │ │    │ │    │ │    │ │    │                     │
│  └────┘ └────┘ └────┘ └────┘ └────┘                     │
│                                                        │
│           Scale:  ┌──────────┐                         │
│                   │ 1        │                         │
│                   └──────────┘                         │
│           Offset: ┌──────────┐                         │
│                   │          │                         │
│                   └──────────┘                         │
│                                                        │
└──────────────────────────────────────────────────────┘
```

3. Click a text box representing a pixel to which you want to assign a weighted value.
4. Enter the value by which you want the pixel in that position multiplied. The value can be an integer between -999 and 999. For example, if you want the brightness value of the pixel to the immediate right of the current pixel multiplied by 1, enter "1" into the text box to the immediate right of the center text box in the grid.
5. Repeat steps 3 and 4 for all of the pixels you want to be weighted.
6. Click the Scale text box.
7. Enter the value by which to divide the sum of the brightness values of the pixels in the calculation.
8. Click the Offset text box.
9. Enter the value to add to the result of the scale calculation.
10. Click OK.
11. The Custom filter you specified is applied to your selection.

To save the current custom filter:

1. Click Save in the Custom Filter dialog box.

   The Save As dialog box appears.

2. Type the file name in which you want to save the custom filter.

   If necessary, use the drive and directory buttons to access the folder in which you want to save the filter.

3. Click Save.

   To load a previously saved custom filter into the Custom dialog box:

1. Click Load in the Custom dialog box.

   The Open dialog box appears.

   If necessary, use the drive and directory buttons to open the folder that contains the filter you want to load.

2. Click the filter you want.

3. Click Open.

   The values used for the selected filter are automatically entered in the Custom dialog box.

Using plug-in filters

A plug-in filter is a filter that is developed by a third party for use in the Adobe Photoshop program. The effects vary according to the filter. Documentation for the plug-in filter is included with the third-party software disk in your Adobe Photoshop package.

Plug-in filters are easy to install; once installed, they appear in the Filter submenu, which is accessed via the Image menu, in the same way as the standard Adobe Photoshop program filters.

To install and use a plug-in filter:

1. Drag a copy of the filter from the third-party software disk to the folder that contains your preferences file (named "PS Prefs" by default).

2. Restart the Adobe Photoshop program. You do not have to reboot the Macintosh. The plug-in filter will appear in the Filter submenu of the Image menu.

3. Select the plug-in filter by choosing Filter from the Image menu and dragging to highlight the desired filter.

Starting with an image of plants in bottles, the artist applied the Find Edges filter to produce a hand-drawn effect. The color balance was adjusted to modify and subdue the colors; and the Diffuse filter was applied to roughen the transitions between colors. The leaf image was scanned on a flatbed scanner from an ink drawing. The background was created by scanning a small piece of tracing paper in a slide scanner. Both images were pasted onto the background using paste controls, allowing some of the background texture to show through the images.

Chapter 18: *A Printing Overview*

This chapter gives an overview of the basic concepts of printing, describes the general printing options, and explains how to print individual channels and print images on color printers.

The Adobe Photoshop program allows you to print images in a number of ways. You can create a halftone from a gray-scale image, as well as a color proof and color separations from color images using the four process colors. You can print halftones and color separations as negatives that an offset printer can use to print reproductions of your work.

The Adobe Photoshop program allows you to combine a variety of media—from photographs, scanned-in artwork like watercolors and old map fragments, pen-and-ink drawings, airbrushed illustrations—and produce them as camera-ready artwork. Producing high-quality results, whether a halftone or color separation, mandates good planning.

The key to producing a high-quality halftone or color separation is planning and testing the process first. Before producing camera-ready artwork, you should talk with everyone involved in the printing process, from the graphic designer and art director, to the print buyer, color separation house, and print shop, to take into account and compensate for any problems that may be encountered in printing the job. You should experiment with what will work by producing a proof or color key, compensating for factors such as paper surface and quality, then standardize your printing process.

This compensation or calibration is largely an iterative process in which you calibrate one aspect of the system, print out a test proof, compare the printed results to the display on-screen, then make an adjustment, and make another comparison. You may have to perform this process a number of times to achieve the results you want. When you have finished making calibrations to your system, it is a good idea to record the date of the calibration and the current settings in a printing log. This information helps you achieve predictable results.

Some of the problems that can be encountered in printing are poor registration and moirés; banding from dot gain; and the inability to produce or repeat predictable results due to imprecise calibrations of equipment.

Factors that can affect the quality of final printing include the quality of the film, ink, and paper that will be used in the printing; the concentration, amount, and use of the chemicals used in the film processor; and the experience and knowledge of the print shop. Other factors that affect printing include the calibration of the equipment, including the scanner, monitor, proofing system (such as a MatchPrint or Chromaline system), and the original image.

To achieve the best results, the output device you use, such as a PostScript imagesetter, should be set to the proper density limit and the processor should be properly calibrated. If these factors are inconsistent, you cannot achieve predictable results.

Because of the complexity of offset printing, a description of the process of color printing is beyond the scope of this section. If you are new to color printing or have never worked with a professional color-separation house before, it is suggested that you work closely with your local print shop.

Printing basics

To print any type of image, you first select any printing options, then specify settings for the particular image type. For halftones and color separations, you may have to calibrate the various plates to correct the color. Finally, you print the image as one or several plates.

You can print the three channels of an RGB image as a single, composite image; the three channels are printed as one on a single plate and appear black and white if you print them on a monochrome PostScript printer. You can also print the individual channels, one channel at a time on separate plates. By converting an RGB or indexed color image to a CMYK image, you can print a color separation of the image consisting of cyan, magenta, yellow, and black plates.

By default, when you print a gray-scale image on a 1-bit PostScript printer, the image is printed as a halftone, consisting of a series of dots. The size and density of the dots vary to create the optical illusion of variations of gray in the image.

For both a halftone and a color separation, you can specify the screen frequency and angle for each plate, just as if you were using a stat (photostat) camera. You can also specify the shape of the dot used in the screen and print a calibration bar to help you correct dot gain and color inconsistencies between the screen display and the printed image.

For all of the image types, you can print identifying information to help you crop and register (align) the image. The printing options appear in the Page Setup and Print dialog boxes under the File menu. The following sections describe the various options.

General printing options

For any type image you print, you can choose to print the document and channel name on each plate, along with crop marks, registration marks, and a caption. You can adjust the size of the printed image, print a negative of the image, and specify an emulsion side for your film processor. You can preview how these options will appear on the printed output by using the page preview box.

The page preview box is displayed in the lower left corner of the document window; it displays the size of the image in memory.

For more information about using the page preview feature, see the section, "Previewing the page size and layout" in Chapter 14, "Resizing Images."

The various printing options appear in the Page Setup dialog box under the File menu. To activate the option, you click the checkbox beside the option.

To display a page preview:

1. Position the pointer on the box in the lower left corner of the document window.

2. Press down the mouse button.

   The page preview appears.

3. Release the mouse button when you have finished previewing the page.

To activate a printing option:

1. Choose Page Setup from the File menu.

   The Page Setup dialog box appears.

```
┌─────────────────────────────────────────────────────────────────┐
│ LaserWriter Page Setup                              6.0   ┌────────┐│
│                                                           │   OK   ││
│ Paper: ⦿ US Letter  ○ A4 Letter                           └────────┘│
│        ○ US Legal   ○ B5 Letter  ○ ┌───────────┐          ┌────────┐│
│                                    │  Tabloid  │          │ Cancel ││
│        Reduce or ┌────┐            └───────────┘          └────────┘│
│        Enlarge:  │100 │%  Printer Effects:                ┌────────┐│
│                  └────┘   ⊠ Font Substitution?            │Options ││
│        Orientation        ⊠ Text Smoothing?               └────────┘│
│        ┌──┐┌──┐           ⊠ Graphics Smoothing?           ┌────────┐│
│        │  ││  │           ⊠ Faster Bitmap Printing?       │  Help  ││
│        └──┘└──┘                                           └────────┘│
│ ................................................................... │
│   ┌───────────┐  ┌──────────┐  □ Labels        □ Negative          │
│   │ Screens...│  │ Border...│  □ Crop Marks     □ Emulsion Down     │
│   └───────────┘  └──────────┘  □ Calibration Bars                  │
│   ┌───────────┐  ┌──────────┐  □ Registration Marks                │
│   │ Transfer..│  │ Caption..│                                       │
│   └───────────┘  └──────────┘                                       │
│   ┌─────────────┐                                                   │
│   │ Size/Rulers.│                                                   │
│   └─────────────┘                                                   │
└─────────────────────────────────────────────────────────────────┘
```
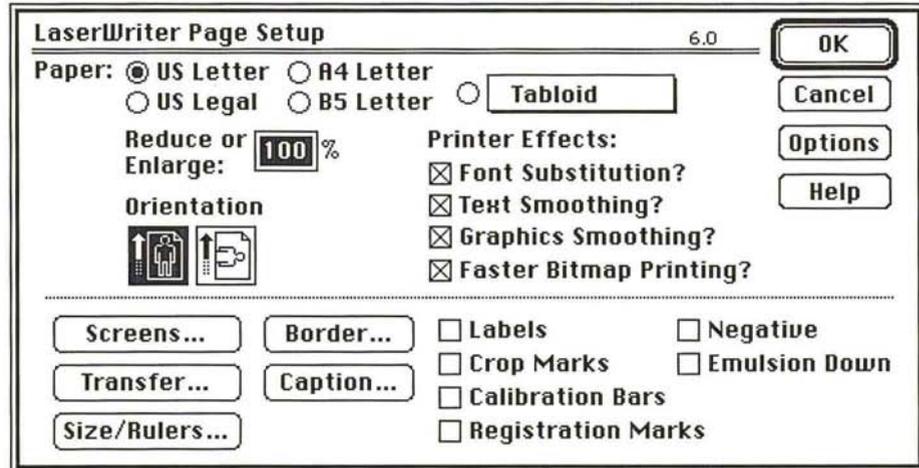
2. Click the checkbox next to the appropriate option to select it.

Printing crop marks

When the Crop Marks option is checked, crop marks are printed near the edges of the image. The crop marks indicate where the image is to be trimmed.

Printing labels

When the Labels option is checked, the document name and the channel name are printed on the image.

Printing registration marks

The Registration Marks option prints registration marks on the image, including bull's-eyes and star targets, to help you register the various plates that are printed. These marks are used primarily for aligning CMYK color separations.

Printing calibration bars

The Calibration Bars option prints an 11-step gray-scale. The steps represent a transition in density from 0 percent to 100 percent in 10-percent increments.

When you print a CMYK color separation, this step wedge appears only on the black plate. However, the cyan, magenta, and yellow plates display screen tints of the channel you are printing. The illustration below shows a sample black plate. The illustration on the following page shows the full-color image with the screen tints, called progressive color bars, on both sides of the image.

progressive color bars (can be used to calibrate monitors)
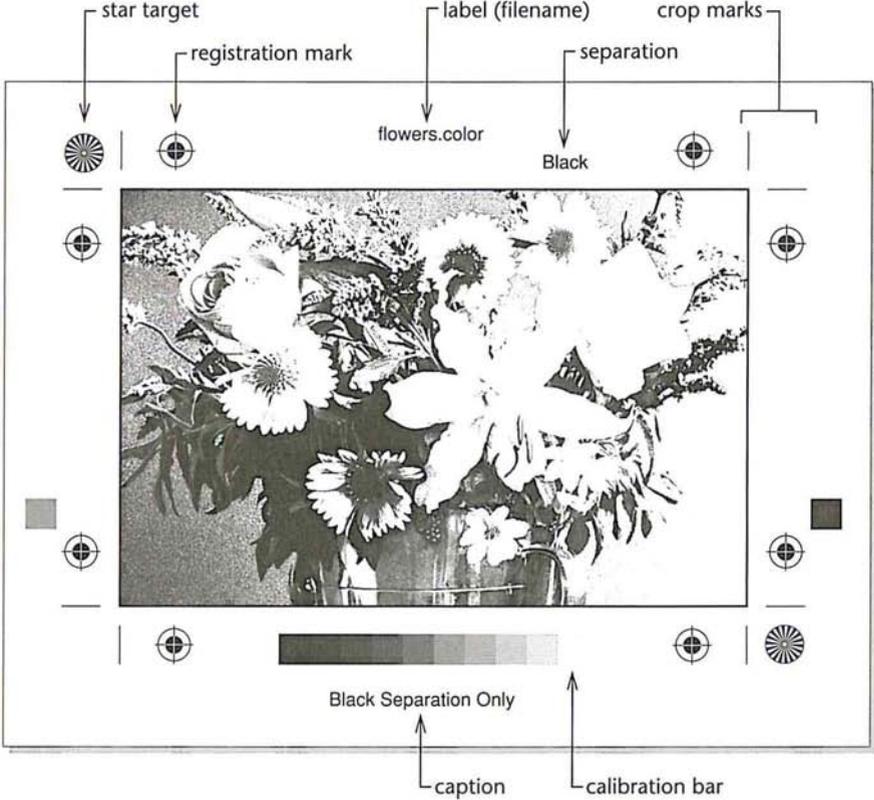
Printing a negative

The Negative option prints an inverted version of the image. Only the output (not the image on-screen) is converted to a negative when you use this option. If you are printing separations directly to film, you will probably want a negative, although in many countries it is common to print film positives. You should also check with your print shop about whether it prefers a film positive or negative of your image. If you are printing to paper, you will want a positive. It is recommended that you print on film to achieve the best results.

Specifying an emulsion side

Emulsion refers to the photosensitive layer on a piece of film or paper. The Emulsion Up option (right-reading) means that any type in the image is readable when the photosensitive layer is facing you. The Emulsion Down option (right-reading) means that the type is readable when the photosensitive layer is facing away from you. Normally, images to be printed on paper should be printed emulsion up, whereas images to be printed on film should be printed emulsion down.

To tell whether you are looking at the emulsion up (emulsion side) or the emulsion down (base), examine the film after it has been developed under bright light. One side will appear shinier than the other. The dull side is the emulsion up side; the shiny side is the emulsion down side (base).

You should check with your print shop to see whether it prefers film as a positive emulsion up, negative emulsion up, or negative emulsion down.

Simulation of a printed page with Negative and Emulsion Down options active

Printing a border

You can specify the width of a border you want to appear around an image using the Border dialog box. The dialog box appears when you click the Border option in the Page Setup dialog box. The border is printed in black. The unit of measure is points, inches, or millimeters.

You can select the units of measure you want from the pop-up menu beside the Width text box.

To specify the width of a border:

1. Choose Page Setup from the File menu.

2. Click the Border option.

   The Border dialog box appears.

```
┌─────────────────────────────────────────────────┐
│                                                  │
│   Border...                        ┌──────────┐  │
│                                    │    OK    │  │
│   Width:    ┌──────┐  ┌─────────┐  └──────────┘  │
│             │      │  │(points) │  ┌──────────┐  │
│             └──────┘  └─────────┘  │  Cancel  │  │
│                                    └──────────┘  │
│                                                  │
└─────────────────────────────────────────────────┘
```
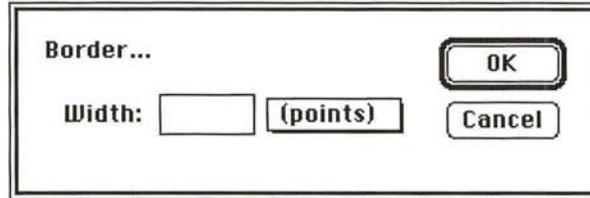
3. Choose the units of measure you want from the pop-up menu beside the Width text box.

4. Enter the width you want the border to be; you can specify decimal values.

5. Click OK.

Printing a caption

You can enter text that will appear below an image using the Caption dialog box. The dialog box appears when you click the Caption button in the Page Setup dialog box.

You use the standard Macintosh text editing techniques to edit the text in the dialog box. You can print up to six lines of text as a caption; additional text will not appear on the image. The text is printed as 9-point Helvetica type.

To define a caption:

1. Choose Page Setup from the File menu.

2. Click the Caption option.

   The Caption dialog box appears.

```
┌──────────────────────────────────────────────────────┐
│                                                        │
│   Caption...                          ┌──────────┐    │
│   ┌────────────────────────────────┐  │    OK    │    │
│   │                                │  └──────────┘    │
│   │                                │  ┌──────────┐    │
│   │                                │  │  Cancel  │    │
│   │                                │  └──────────┘    │
│   │                                │                  │
│   │                                │                  │
│   └────────────────────────────────┘                  │
│                                                        │
└──────────────────────────────────────────────────────┘
```
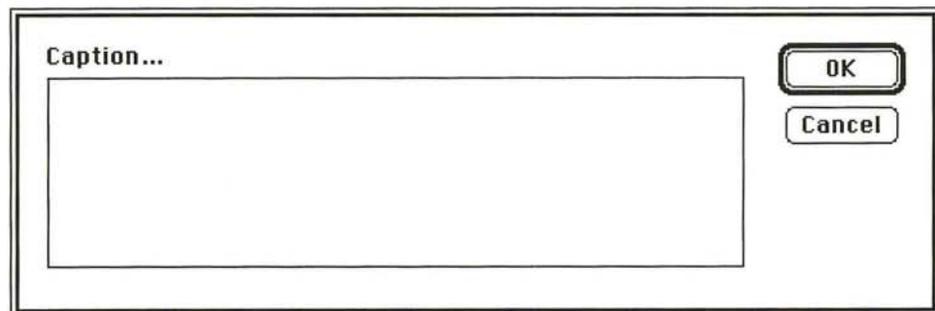
3. Type in the text box the text you want to appear as the caption.

4. Click OK.

Miscellaneous printing options

Other printing options allow you to print only the selected area on an image, or to transfer the image data to the output device in ASCII format. The options that control how an image is printed appear in the lower left corner of the Print dialog box. The options that are not currently available are dimmed. The options and their effects on the printed image are described below.

```
LaserWriter                                          6.0      [  OK  ]

Copies: [1]          Pages: ⦿ All  ○ From: [    ] To: [    ]   [ Cancel ]

Cover Page:   ⦿ No ○ First Page ○ Last Page               [  Help  ]

Paper Source: ⦿ Paper Cassette  ○ Manual Feed

Print:        ⦿ Color/Grayscale ○ Black & White
.................................................................
☐ Print Selected Area Only        Encoding:
☐ Print Selected Channel Only        ○ ASCII
☐ Print Using Color PostScript       ⦿ Binary
☐ Correct for Printing Colors
```

Printing a selected area only

You can print just part of an image that was previously selected with the rectangular marquee.

To print a selected part of an image:

1. Select the part of an image you want to print using the rectangular marquee tool.

2. Choose Print from the File menu. The Print Selected Area Only option is automatically checked.

3. Click OK.

Only the selected area is printed.

Printing with print spoolers and across networks

By default, the Adobe Photoshop program transfers binary information to printers. However, some print spooler programs and computer networks don't support files that are binary-encoded. In these situations, you can choose to transfer the document in an ASCII format. Files that are encoded in the ASCII format require about twice as much time to transfer as binary files, because they contain about twice as many characters.

To select the ASCII encoding option:

1. Choose Print from the File menu.
2. Click ASCII.
3. Click OK.

The image information is sent to the printer in ASCII format.

Composite and color image printing options

If you are printing a color image, you can choose to print only the active channel. You can also compensate for the differences between the RGB colors of the monitor and the CMYK printing ink colors, and send color PostScript language information to the printer if you are printing on a color PostScript printer.

Printing individual channels

You can choose to print one channel at a time. The Print Selected Channel Only option is automatically selected when you print an RGB, HSL, HSB, or multi-channel image. This option is available when you print a CMYK image, but you must select it manually. To use this option with an RGB image, the red, green, or blue channel must be active. The Print Selected Channel Only option is not available when the RGB display option is active.

To print a single, specific channel of an image:

1. Choose Channel from the Mode menu.

2. Choose the channel you want to print from the Channel submenu.

```
  Bitmap
  Gray Scale
  Indexed Color
  RGB Color
✓ CMYK Color
  HSL Color
  HSB Color
  Multichannel
  ─────────────────
  Color Table          ▶
  ─────────────────
  Channel              ▶ ✓ Cyan        ⌘1
  ─────────────────      Magenta ↖ ⌘2
  New Channel            Yellow      ⌘3
  Delete Channel         Black       ⌘4
  ─────────────────
  Split Channels
  Merge Channels...
```

3. Choose Print from the File menu.

4. Click the Print Selected Channel Only option, if it is not already checked.

5. Click OK.

    The active channel is printed.

Printing a color composite and a color corrected image

Normally, if you intend to print large quantities of an image on a conventional, four-color press, you convert an RGB or indexed color image to a CMYK image and then print a color separation that consists of four plates, one plate for each of the four process colors. However, if you have a color output device, you can print a composite image using the Use Color PostScript option. If you select the Use Color PostScript option and print an image on a color PostScript printer while the RGB display mode is active, an RGB composite image will be printed.

When you print a color composite, you should use the Correct for Printing Colors option in the Print dialog box to compensate for differences between the RGB colors and the CMYK printing ink colors. This option causes the Adobe Photoshop program instead of the printer to make the conversion to CMYK colors, which usually produces better results.

When you select the Use Color PostScript and Correct for Printing Colors options and print on a color PostScript printer, the Adobe Photoshop program prints the composite image on one page. The program performs an internal RGB to CMYK conversion before sending the data to the printer. The image type of the image displayed on-screen remains the same; the image is not converted to a CMYK image.

If the Correct for Printing Color option is selected before printing to a color QuickDraw printer, the Adobe Photoshop program performs an internal RGB to CMYK conversion before sending the data to the printer.

To print a composite color image:

1. Open the indexed color or RGB image you want to print; if you are printing an RGB image, choose Channel from the Mode menu and select the RGB Channel command.

2. Choose Print from the File menu.

3. If you are printing to a color PostScript printer, click the Use Color PostScript option.

4. To print a color corrected version of the image, click the Correct for Printing Colors option in the Print dialog box.

5. To print the image, click OK.

   Your composite color image is printed.

Chapter 19: *Printing Halftones*

This chapter describes how to print a halftone from a gray-scale image. It also covers how to adjust for the gamma of your monitor and compensate for dot gain on press.

A halftone is an image composed of a series of dots of varying sizes. When you produce a halftone of a gray-scale image, the variations in size and spacing between the dots simulate the changes in gray levels that occur in a continuous-tone image. (When you print a CMYK image, the dots determine the various tint densities that occur in each of the four process colors.)

Conventional graphics uses a stat camera to produce a halftone by placing a halftone screen between a piece of film and the image, and exposing the film. The image is converted to a series of dots. A computer and imagesetter follow a similar principle in producing a halftone.

Before printing a halftone, you can calibrate your monitor to correct any discrepancy in gray-levels, brightness, or contrast between your screen display and the printed image. The process of printing a halftone begins with a gray-scale image. Using the image, you set up your halftone screen including its frequency, angle, and dot shape. You select general printing options, including printing calibration bars and other identification such as crop or registration marks with the image. Then you print the halftone and check the results. If the halftone needs adjustment, you repeat the process.

Several factors affect the quality of the halftone, including attributes of the screen. The screen attributes include the screen frequency, screen angle, and dot shape. With gray-scale images, the Adobe Photoshop program uses only one screen to produce the halftone.

19

The screen frequency controls the density of dots on-screen. The dots are arranged in lines on-screen, and the frequency is commonly measured in lines per inch (lpi). The screen frequency used is largely dependent on the type of paper stock and the quality of the press to be used to print the image. The higher the screen frequency, the finer the image produced. Magazines, which normally are printed on coated paper stock on high-quality presses, tend to use fine screens of 133 lpi and up. Newspapers, which are normally printed on lower-quality paper stock, tend to use lower screen frequencies, such as 85 lpi screens.

Screen frequency: 100 lines per inch

Screen frequency: 50 lines per inch

The screen angle used to create halftones of gray-scale images is usually 45-degrees.

The dot shape also affects the printed image. The shape of the screen dot determines the shape of the dots that comprise the halftone. Elliptical-shaped dots are commonly used; however, the Adobe Photoshop program also supports round, line, square, and cross-shaped dots.
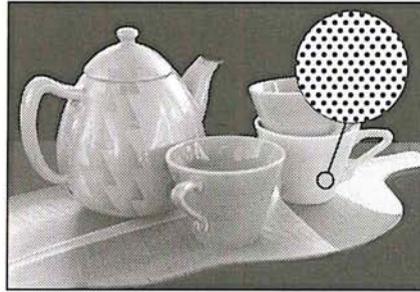
Round
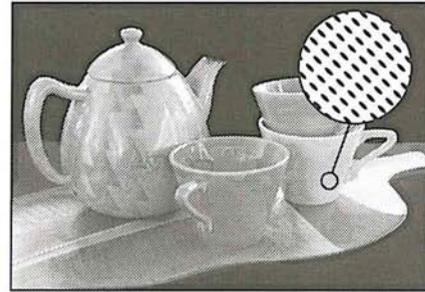
Ellipse
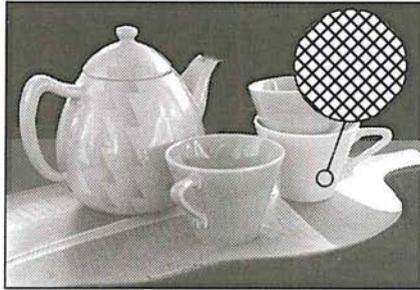
Cross
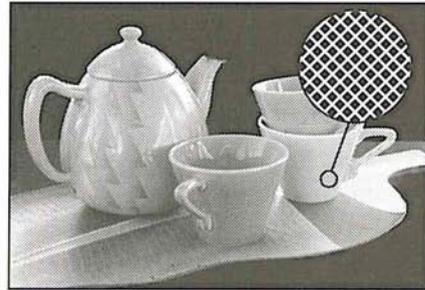
Square

Line

In general, you perform seven major steps to produce a halftone. The following sections describe the steps in detail. They are:

1. Convert the image to a gray-scale image.

2. Select the screen attributes, including the screen angle and frequency, and the dot shape.

3. Load the transfer function file appropriate for the paper stock on which you will print the image.

4. Calibrate the monitor gamma using the Levels dialog box under the Adjust command in the Image menu, and the Gamma Gray Ramp file included on the Calibration disk.

5. Select the printing options you want, including the Calibration Bar option, which is necessary to perform the density calibrations.

6. Print a proof of the image.

7. Calibrate the density of the output of the gray-scale image. This step includes a number of different operations, including:

   ■ Using a densitometer to measure density levels on the printed calibration bar.

   ■ Converting the densitometer readings to percentage values (if necessary).

   ■ Entering values in the Transfer Function dialog box, which is accessed through the Transfer option in the Page Setup dialog box, to adjust the density levels.

Preparing to print a gray-scale image

Printing a halftone of a gray-scale image is a process that involves a series of steps. The first step in printing a halftone of a continuous-tone black and white image is to make sure that you are working on a gray-scale image. You can do this by opening the Mode menu and checking to make sure that the Gray Scale menu item is checked. Then you set your screen settings including the screen frequency, angle, and dot shape. Next, you select the general printing options you want to use, such as crop and registration marks.

For halftone images, you can also choose encoding options and whether to print a selected area only. You should check your monitor gamma and, if necessary, adjust the monitor correction setting. The monitor gamma affects the appearance of the image displayed on-screen and the density of the output.

Before you print an image, you should select the transfer function file appropriate for the type of paper stock you plan to use. The transfer function file compensates for dot gain on press. You can adjust the transfer function information to achieve density levels suitable for the press.

Finally, you are ready to print your image. If the results are not as you expected, you should adjust the density of the output using the Transfer option.

Step 1: Converting to a gray-scale image

The first thing you should do in preparing to print a halftone image is convert the image to a gray-scale image if it is not already a gray-scale image.

To convert an image to a gray-scale image:

1. Select the image to be converted.

2. Choose Gray Scale from the Mode menu.

The image is converted to a gray-scale image.

Step 2: Selecting screen attributes

The screen attributes you can specify include the screen frequency, screen angle, and dot shape. Screen frequency can be measured either in lines per inch or lines per centimeter. For gray-scale images, the screen angle typically is at 45 degrees. In most cases, you should use the default setting for the screen angle. Dot shapes include round, elliptical, line, square, and cross. You set up the screen attributes in the Page Setup dialog box, which is under the Page Setup command in the File menu. You may want to save these screen settings as defaults to use with future halftones.

If you save the screen settings as the default settings, the screen settings will appear in all new Adobe Photoshop documents of the same image type you create. For example, if you specify 120 as the default screen frequency for a gray-scale image, the 120 screen-frequency value will be used for all new gray-scale images you create. If you specify 133 as the default screen frequency for a color image, the 133 screen frequency will be used in all new color images you create.

To define the screen attributes for a gray-scale halftone image:

1. Choose Page Setup from the File menu.

The Page Setup dialog box appears.

```
LaserWriter Page Setup                          6.0        OK

Paper: ⊙ US Letter  ○ A4 Letter                           Cancel
       ○ US Legal   ○ B5 Letter   ○ [ Tabloid ]
                                                          Options
       Reduce or [100]%    Printer Effects:
       Enlarge:            ⊠ Font Substitution?           Help
       Orientation         ⊠ Text Smoothing?
                           ⊠ Graphics Smoothing?
       [👤] [👤→]          ⊠ Faster Bitmap Printing?

       [ Screen... ]  [ Border... ]   ☐ Labels          ☐ Negative
                                       ☐ Crop Marks       ☐ Emulsion Down
       [ Transfer... ] [ Caption... ]  ☐ Calibration Bars
       [ Size/Rulers... ]              ☐ Registration Marks
```
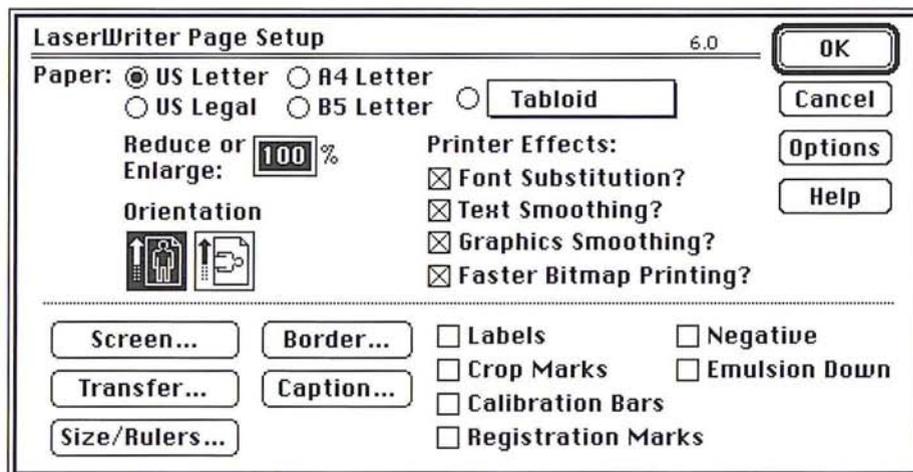
2. Click Screen.

The Halftone Screen dialog box appears.

```
┌─────────────────────────────────────────────────────┐
│                                                       │
│  Halftone Screen...                    ┌──────────┐   │
│                                        │    OK    │   │
│  Frequency:  [133   ]  [(lines/inch)]  └──────────┘   │
│                                        ┌──────────┐   │
│      Angle:  [45    ]  (degrees)       │  Cancel  │   │
│                                        └──────────┘   │
│  Shape:                                ┌──────────┐   │
│                                        │  Load... │   │
│        ◉ Round                         └──────────┘   │
│        ○ Elliptical                    ┌──────────┐   │
│        ○ Line                          │  Save... │   │
│        ○ Square                        └──────────┘   │
│        ○ Cross                                        │
│                                                       │
└─────────────────────────────────────────────────────┘
```
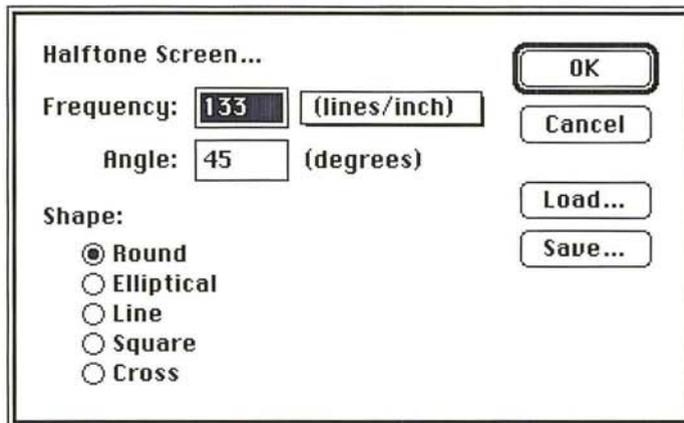
3. Use the pop-up menu next to the Frequency text box to specify lines per inch (line/inch) or lines per centimeter (lines/cm) as the units of measurement.

4. To specify the screen frequency, double-click in the Frequency text box, and enter a value from 1.0 to 999.0.

5. To specify the screen angle, press the Tab key or double-click in the Angle text box, and enter a value from -180.0 to 180.0.

6. To select the dot shape, click the dot shape you want.

   To save the current halftone screen settings:

1. Click Save in the Halftone Screen dialog box.

   The Save As dialog box appears.

2. Enter the file name in which you want to save the screen settings.

   If necessary, use the drive and directory buttons to access the folder in which you want to save the settings.

3. Click Save.

   The settings are saved in the file and location you specified.

   To load previously saved screen settings into the active document:

1. Click Load in the Halftone Screen dialog box.

   The Open dialog box appears.

   If necessary, use the drive and directory buttons to open the folder that contains the settings you want to load.

2. Select the document you want, and click Open.

   The selected settings are loaded into the Halftone Screen dialog box.

To save the settings as the new defaults:

1. Press down the Option key.

2. Click –> Default.

```
┌─────────────────────────────────────────────────────┐
│                                                       │
│  Halftone Screen...                  ┌─────────────┐  │
│                                      │     OK      │  │
│  Frequency: ▓185▓   (lines/inch)     └─────────────┘  │
│                                      ┌─────────────┐  │
│     Angle:  │ 45 │  (degrees)        │   Cancel    │  │
│                                      └─────────────┘  │
│  Shape:                                               │
│                                      ┌─────────────┐  │
│      ○ Round                         │  <-Default  │  │
│      ◉ Elliptical                    └─────────────┘  │
│      ○ Line                          ┌─────────────┐  │
│      ○ Square                        │  ->Default  │  │
│      ○ Cross                         └─────────────┘  │
│                                                       │
└─────────────────────────────────────────────────────┘
```
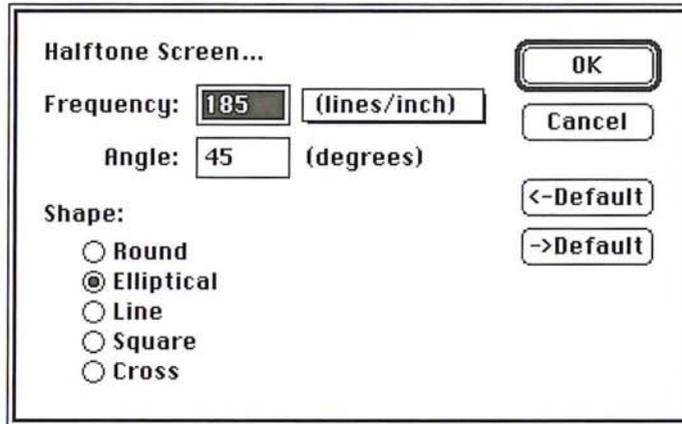
To revert to the original default settings before closing the dialog box:

1. Press down the Option key.

2. Click <– Default.

   When you have finished defining the screen information, click OK.

Step 3: Loading a transfer function file

The Transfer Function dialog box lets you specify the density settings for your halftone image, and save the settings as files. The files allow you to compensate for dot gain based upon the ink retention of the paper stock you are going to use. The density, or transfer function, settings allow you to compensate for dot gain in an image. Dot gain is an increase in density, and is measured as the density of light reflected off an image.

The transfer function files contain the different density settings for an image. The density settings are classified as highlights, 1/4 tones, midtones, 3/4 tones, and shadows.

You should consult with your print shop or print buyer to determine the type of paper stock to be used, then choose the appropriate transfer function file for that paper stock.

There is a different transfer function file for newsprint, coated matte stock, (which has a fine layer of material that allows it to retain ink without smearing), coated glossy stock, and uncoated stock.

To select a transfer function file to use with your paper stock:

1. Insert the Calibration disk included in the Adobe Photoshop package.

2. Choose Page Setup from the File menu.

3. Click Transfer.

   The Transfer Function dialog box appears.

```
┌─────────────────────────────────────────────┐
│                                              │
│  Transfer Function...          ┌─────────┐   │
│                                │   OK    │   │
│  Highlights: [0   ] %          └─────────┘   │
│                                ┌─────────┐   │
│  1/4 Tones:  [20  ] %          │ Cancel  │   │
│                                └─────────┘   │
│  Midtones:   [42  ] %          ┌─────────┐   │
│                                │ Load... │   │
│  3/4 Tones:  [65  ] %          └─────────┘   │
│                                ┌─────────┐   │
│  Shadows:    [100 ] %          │ Save... │   │
│                                └─────────┘   │
│  Monitor Gamma: [1.40 ]                      │
│                                              │
└─────────────────────────────────────────────┘
```
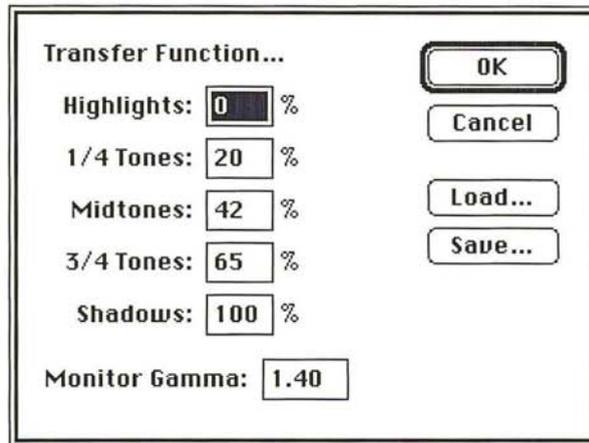
4. Click Load in the Transfer Function dialog box.

   The Open dialog box appears.

   If necessary, use the drive and directory buttons to open the Transfer Function folder on the Calibration disk.

5. Select the transfer function file appropriate for the paper stock you will use, and click Open.

   The selected settings are loaded into the Transfer Function dialog box.

6. Click OK.

7. Click OK again.

Step 4: Calibrating the gamma of your monitor

If you are using a gray-scale or color monitor, you will want the appearance of documents on your monitor to match the printed output as closely as possible. Because of differences in monitors, factory settings, and other factors, no two monitors are exactly alike. A consistent display is especially important if you are correcting your gray-scale images on-screen.

A discrepancy may occur between the electrical input to your monitor and how the monitor displays color or gray tones. You can correct such a discrepancy using the monitor gamma value, as well as standardize your display and compensate for changes over time by calibrating your monitor using the monitor gamma value.

The monitor gamma value varies between manufacturers and even between monitors from the same manufacturer. The default monitor gamma value is 1.4, which is the normal gamma correction value for the Apple® Hi-Res, 13-inch RGB monitor. You can purchase self-calibrating monitors that maintain a consistent monitor gamma, or you can adjust the monitor gamma to a consistent level using monitor calibration hardware and software.

If you are using a self-calibrating monitor or monitor calibration device, simply adjust your monitor to a known gamma value, and use this same gamma value in the Transfer Function dialog box. Otherwise, you must estimate your monitor's gamma value.

The Adobe Photoshop program provides you with a way to estimate the correct gamma correction value for your monitor. This process involves using the Levels dialog box under the Adjust command in the Image menu, and the Gamma Gray Ramp file; the Gamma Gray Ramp file is located on the Calibration disk. The Gamma Gray Ramp file displays dithered gray ramps interleaved with true gray ramps. By using the gamma slider in the Levels dialog box to make the true gray ramps match the dithered gray ramps, you can estimate your monitor gamma.

Do not undertake the following procedure until your monitor has been on for at least 20 minutes. Before you do anything else, follow the instructions for adjusting the monitor display in the manual provided with the monitor.

To estimate your monitor gamma:

1. Insert the Calibration disk included in the Adobe Photoshop package.

2. Open the Gamma Gray Ramp file.

   The Gamma Gray Ramp file appears.

3. Choose Adjust from the Image menu.

4. Choose Levels from the Adjust submenu.

   The Levels dialog box appears.

5. Position the pointer on the gray (middle) Input Levels triangle beneath the histogram.

6. Holding down the mouse button, drag the slider to the left or right until the center portion of the true gray ramp matches the center portion of the dithered gray ramp as closely as possible.

7. Note the center value at the top of the Levels dialog box; this is the value you will enter for your monitor gamma.

8. Click Cancel.

9. Close the document without saving changes (so you can use this document again to estimate the gamma on other monitors).

To enter the correct monitor gamma value:

1. Choose Page Setup from the File menu.

   The Page Setup dialog box appears.

2. Click Transfer.

   The Transfer Function dialog box appears.

3. Double-click the Monitor Gamma text box in the Transfer Function dialog box.

4. Enter the value you recorded from the Levels dialog box above.

5. When you have finished entering the monitor gamma value, click OK.

6. Click OK again.

Step 5: Selecting printing options and printing the image

The next step in printing a halftone is to choose the printing options you want from the Page Setup dialog box. In most cases, you should print film negatives to give to the printer. The image quality of negatives is better than positives. (For one thing, there is less dot gain on negatives.) You should consult with your print shop to determine the correct media to use.

To print negatives of an image, you should select the Calibration Bars, Negative, and Emulsion Down options in the Page Setup dialog box before printing. To print positives, make sure that Emulsion Down and the Negative option are not checked.

When you open the Print dialog box to print a gray-scale image, you can also choose the Print Selected Area Only option and the Encoding options. These options are described in Chapter 18, "A Printing Overview."

To select printing options:

1. Choose Page Setup from the File menu.

   The Page Setup dialog box appears.

```
┌─────────────────────────────────────────────────────────────────────┐
│ LaserWriter Page Setup                              6.0    ┌────────┐ │
│                                                            │   OK   │ │
│ Paper: ◉ US Letter  ○ A4 Letter                            └────────┘ │
│        ○ US Legal   ○ B5 Letter  ○ ┌─────────┐  ┌────────┐ │
│                                    │ Tabloid │  │ Cancel │ │
│        Reduce or  ┌───┐            └─────────┘  └────────┘ │
│        Enlarge:   │100│ %   Printer Effects:    ┌─────────┐│
│                   └───┘     ☒ Font Substitution? │ Options │ │
│        Orientation          ☒ Text Smoothing?   └─────────┘│
│                             ☒ Graphics Smoothing? ┌──────┐ │
│         ▢▢              ☒ Faster Bitmap Printing? │ Help │ │
│                                                  └──────┘ │
│ ┌───────────┐  ┌──────────┐  ☐ Labels        ☒ Negative   │
│ │ Screen... │  │ Border...│  ☐ Crop Marks     ☒ Emulsion Down │
│ └───────────┘  └──────────┘  ☒ Calibration Bars│
│ ┌───────────┐  ┌──────────┐  ☐ Registration Marks│
│ │ Transfer..│  │ Caption..│                     │
│ └───────────┘  └──────────┘                     │
│ ┌────────────┐                                   │
│ │ Size/Rulers..│                                 │
│ └────────────┘                                   │
└─────────────────────────────────────────────────────────────────────┘
```
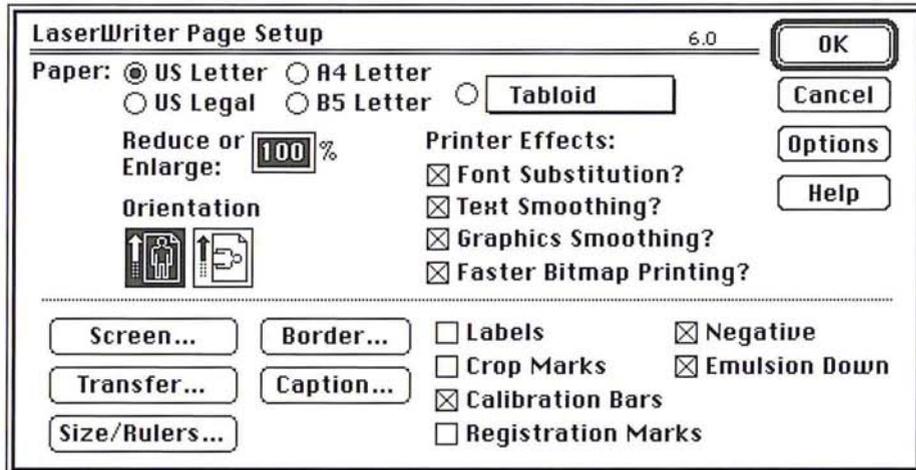
2. Select the Calibration Bars, Negative and Emulsion Down options by clicking the appropriate boxes.

Step 6: Printing the image

The next step in producing a halftone is to print a proof of your image.

To print your image:

1. Choose Print from the File menu.

   The Print dialog box appears.

```
┌─────────────────────────────────────────────────────────────────────┐
│ LaserWriter                                         6.0    ┌────────┐ │
│                                                            │   OK   │ │
│ Copies: ┌─┐      Pages: ◉ All ○ From: ┌──┐ To: ┌──┐ └────────┘ │
│         │1│                           └──┘     └──┘ ┌────────┐ │
│         └─┘                                         │ Cancel │ │
│ Cover Page:    ◉ No ○ First Page ○ Last Page       └────────┘ │
│ Paper Source: ◉ Paper Cassette ○ Manual Feed        ┌──────┐ │
│ Print:        ◉ Color/Grayscale ○ Black & White     │ Help │ │
│                                                     └──────┘ │
│ ☒ Print Selected Area Only        Encoding:         │
│ ☐ Print Selected Channel Only     ○ ASCII           │
│ ☐ Print Using Color PostScript    ◉ Binary          │
│ ☐ Correct for Printing Colors                       │
└─────────────────────────────────────────────────────────────────────┘
```
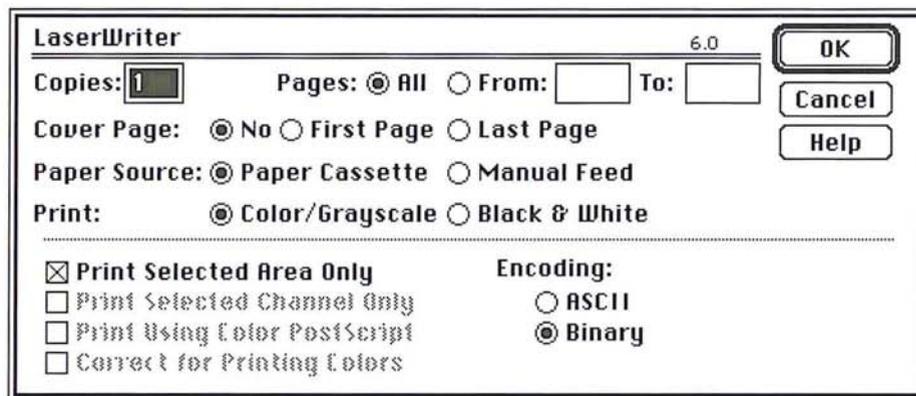
2. Click OK.

The gray-scale image is printed as a halftone. If the halftone produced is satisfactory, you are finished.

However, in some cases you may have to adjust the output to compensate for factors like dot gain and the density range supported by the printing press you intend to use. The following section covers how to calibrate the output.

Step 7: Calibrating the output for gray-scale images

The quality of output can vary quite a bit, depending on your image-setting equipment, the strength and mixture of your chemicals, the batch of film you are using, and the press you use. The Transfer option allows you to calibrate and adjust the screen process, to ensure more consistent densities. The Transfer option is controlled through the Transfer Function dialog box, which is accessed from the Page Setup dialog box under the File menu.

The Transfer option operates as a lookup table. Here is a simplified example of how it works. When you print an image, the Adobe Photoshop program evaluates the density of each pixel in an image and classifies it according to five levels. The levels are highlights, 1/4 tones, midtones, 3/4 tones, and shadows. The classification is based on the color values (or gray-scale values, in the case of a gray-scale image) of the pixel, which are evaluated on a 256-step scale. The white pixels in an image have a value of 255 and are classified as highlights; the black pixels in an image have a color value of 0 and are classified as shadows. The pixels with intermediate color values are classified as 1/4 tones, midtones, or 3/4 tones, depending on their values.

When you print an image, the Adobe Photoshop program looks up the density specified for each level in the Transfer Function dialog box and outputs the pixels with that level at the specified density. For example, if you specify a value of 10 for the Highlights in the Transfer Function dialog box and print an image that contains highlight pixels, these pixels will print out at a density of 10 percent.

You may need to adjust the density settings that control the middle densities in an image. This adjustment is based on a visual examination of the printed image. You may also need to adjust the overall density range based on the density range the press supports. This adjustment involves the highlight and shadow areas on an image.

Based on visual examination, you can adjust the values for the 1/4 tones, midtones, and 3/4 tones. If the image is too dark, you should lower the values in these areas; if the image is too light you should increase the values.

To adjust the overall density range of the printed image, you should first consult with your printer to find out the density range of the press you will use. The density range is the range from the smallest highlight dot the press can print to the largest shadow dot it can print. On a given printing press, a very small highlight dot might be too small to hold ink, and beyond a certain density level, the shadow dots might fill into solid black, thereby removing all of the detail in the shadow areas. Therefore, you need to ask your printer about the effective density range of the printing press to be used for your job.

For example, if the smallest highlight dot the press can hold is a 10-percent dot, you should aim to produce a 10-percent highlight dot; if the largest shadow dot the press can hold is a 90-percent dot, you should aim to produce a 90-percent dot in the areas where you want shadow detail to appear.

When you select the Calibration Bars option in the Page Setup dialog box, the Adobe Photoshop program prints an 11-step gray-scale wedge below the image. You use the calibration bar to adjust the output to compensate for dot gain. The illustration below shows the calibration bar printed below the gray-scale image.

calibration bar
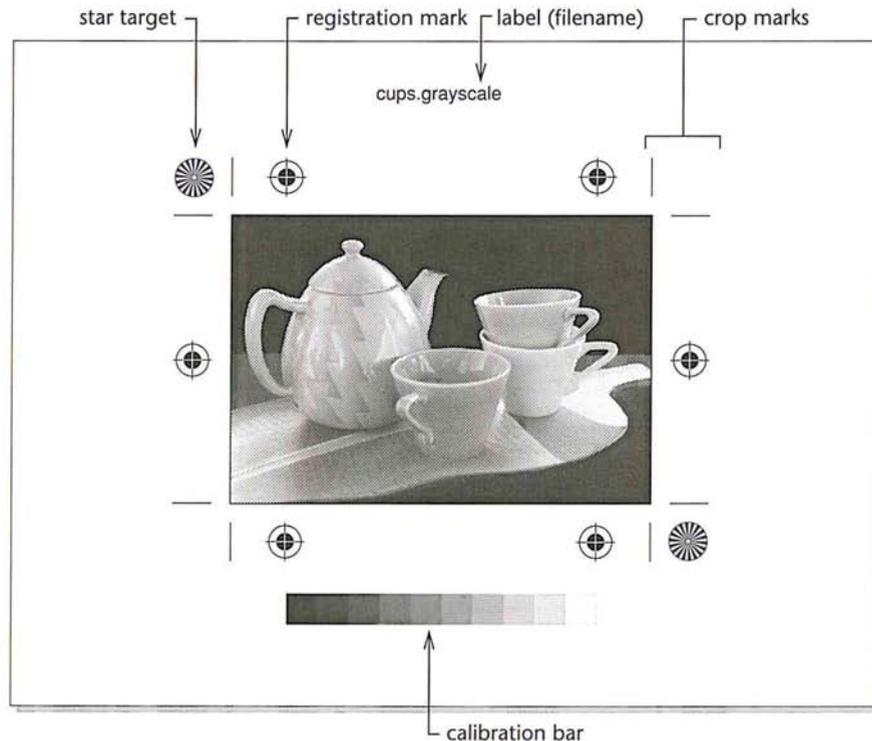
You can have the Adobe Photoshop program automatically adjust the printed output to compensate for any dot gain (increase in dot size) that results from printing. To do so, you use a densitometer to record the density values at the appropriate steps in the calibration bar, calculate the required adjustment, and enter the appropriate values in the Transfer Function dialog box under the Page Setup command in the File menu. You can measure either the density values of the calibration bar that is printed on a press proof or the values on a color proof, such as a MatchPrint or color key.

Because your objective is to obtain the best results on the final printed piece, you should ask your print shop to create a press proof of the image so you can measure the density levels that result.

However, printing press proofs requires time and money. If time is short and budget a consideration, you can take measurements on the proof you printed. To measure the density on a press proof, you use a photodensitometer, which measures reflective density on an opaque surface. Make sure that the densitometer is properly calibrated and in good working order before you use it.

You may need to convert the recorded density readings to percentage values to make the correct adjustments in the Transfer Function dialog box. Some densitometers make this conversion for you.

The Transfer Function dialog box contains default density settings that are already adjusted to compensate for dot gain. The settings vary, depending on the paper stock Transfer option you chose. As an example, a 42-percent value for the midtones has an 8-percent dot gain compensation built-in. In other words, the Adobe Photoshop program prints a midtone dot, which normally should have a density of 50 percent, at a 42-percent density, and assumes that the dot will grow 8 percent on the press.

If you record a density value of 48 percent on the middle step in the calibration bar, and you want the midtone dot to print at a 50-percent density, you would raise the value of the midtone dot by 2 percent to 44 percent. In other words, the 42-percent setting produced a 48-percent midtone dot, so to increase the density of the dot to 50 percent, you enter 44 percent in the Midtones text box in the Transfer Function dialog box.

NOTE: The 1/4 tone, midtone, and 3/4 tone values are optional. If you leave these blank, the Adobe Photoshop program will interpolate their values.

You can save the transfer function settings in a document, and load them into another Adobe Photoshop software document to use the same settings. You can also save these settings as the default settings for all Adobe Photoshop software documents.

To calibrate the output to compensate for dot gain:

1. Choose Print from the File menu.

2. Click OK.

   The image is printed as a halftone.

3. Use a densitometer to measure the density values on the printed calibration bar and to convert the readings to percentage values.

   To adjust the density settings in the Transfer Function dialog box:

1. Choose Page Setup from the File menu.

2. Click Transfer.

   The Transfer Function dialog box appears.

```
┌──────────────────────────────────────────────────┐
│  Transfer Function...                             │
│                                    ┌───────────┐  │
│  Highlights:  [0  ] %              │    OK     │  │
│                                    └───────────┘  │
│  1/4 Tones:  [ 20  ] %             ┌───────────┐  │
│                                    │  Cancel   │  │
│  Midtones:   [ 42  ] %             └───────────┘  │
│                                                   │
│  3/4 Tones:  [ 65  ] %             ┌───────────┐  │
│                                    │  Load...   │  │
│  Shadows:    [ 100 ] %             └───────────┘  │
│                                    ┌───────────┐  │
│                                    │  Save...   │  │
│  Monitor Gamma:  [1.40]            └───────────┘  │
│                                                   │
└──────────────────────────────────────────────────┘
```
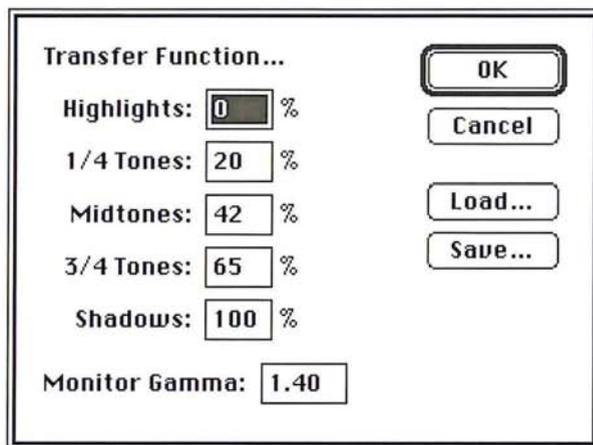
3. Click the text box for the tone you want to adjust, and enter a value to adjust the density to the desired level.

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To save the current transfer function settings in a document:

1. Click Save in the Transfer Function dialog box.

   The Save As dialog box appears.

2. Enter the file name in which you want to save the screen settings.

   If necessary, use the drive and directory buttons to access the folder in which you want to save the settings.

3. Click Save.

To save the current transfer function settings as the new defaults:

1. Choose Page Setup from the File menu.

2. Click Transfer.

   The Transfer Function dialog box appears.

3. While pressing down the Option key, click –> Defaults in the Transfer Function dialog box.

4. Click OK.

   To revert to the default settings before closing the Transfer Function dialog box, while pressing down the Option key, click <– Defaults.

   When you have finished defining the transfer function information, click OK.

   If you have successfully printed a halftone and are satisfied with the results, you are finished. If you are dissatisfied with your results, you may want to adjust your system, image, or print settings by repeating the seven steps in this chapter.

Chapter 20: *Producing a Color Separation*

The Adobe Photoshop program creates a color separation by converting the red, green, and blue colors of an image into CMYK colors. This chapter describes the steps you follow to calibrate and produce color separations. A color separation is an image that has been separated into CMYK colors, then is printed on four separate plates, each plate representing one of the four process colors. The calibration instructions discussed in this chapter explain how to calibrate the density of the output, the colors on your monitor, and the color separation process itself.

This chapter also covers the steps for selecting the screen attributes of the halftone screens used in the color separation, how to control the amount of black generated on the black plate, and how to create traps. Traps prevent gaps from appearing along edges in an image due to slight misalignment or movement of the printing plates on press.

With the Adobe Photoshop program you produce the four pieces of camera-ready film ("plates") by printing each color plate of the CMYK image using a specified screen frequency and angle. Normally, you print each plate on film, and each of the four plates appears as a halftone image on the film. The halftone dots on the film contain the tint density information that your print shop uses to create the printing plate for that particular color.

The screen angle and frequency are different for each plate. The screen angles used are very important because if the screen angles are incorrect, moiré patterns will appear in the image when the four colors are printed on the press.

Another important part of the color separation process is the ability to achieve consistent and predictable results for all your work. A true color separation system requires a completely controlled environment to produce consistent results. Lighting must be constant. The monitor must be calibrated so that the monitor display and the printed output appear the same. Any calibrations made to the system must be fed back through the system in a single-loop system—from the scanner that input the image through the display monitor, to the color proofing system, and back to the original image—so that compensation can be made for any changes. (Note that the program does not perform scanner calibration, however.)

While such a controlled environment and single-loop feedback system are ideal, they are beyond the scope of this user guide. Also, in most instances, the default settings in the Adobe Photoshop program will produce excellent results. However, calibrations can be made that will help you produce the highest quality output possible on your equipment.

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To produce the best possible results, you print a color proof, then perform a series of calibrations to correct color in your separations. You should perform some of these calibrations each time you print a color separation to achieve the best results. For example, you should calibrate the output to adjust for dot gain each time you print on a different imagesetter or on an imagesetter that hasn't been properly calibrated. You should adjust the color swatches in the Separation Setup dialog box, which is accessed through the Preferences dialog box, each time you change to a different printing press that uses different inks. The color swatches are CMYK tint samples that affect the color separation process.

Other calibrations need to be made rarely or only once. You might never need to adjust the black generation settings, and you should only have to specify the monitor gamma correction once, then change it only if the monitor gamma changes over time or if you install the Adobe Photoshop program on another machine.

In general, you should perform the necessary calibrations before you generate a color separation you want to be printed. To perform the calibration, you correct the monitor gamma, create a color separation of an image using the default separation settings, print the color separation, and then use the resulting four pieces of film for the density calibration process. The steps discussed below assume you are generating film negatives to be sent to the printer.

In most cases, you perform nine major steps, including two optional steps, to produce a color separation. The following sections describe the steps.

The steps to produce a color separation include:

1. Select the screen attributes, including the screen angle and frequency, and the dot shape.

2. Calibrate the monitor gamma using the Levels dialog box, under the Adjust command in the Image menu, and the Gamma Gray Ramp file included on the Calibration disk.

3. Load the transfer function file appropriate for the paper stock on which you will print the image.

4. Calibrate the density of the output. This step includes a number of different procedures; they include:

   ■ Converting an RGB image to a CMYK image.

   ■ Selecting the printing options you want, including the Calibration Bar option, which is necessary to perform the density calibrations.

   ■ Printing the image.

   ■ Creating a color proof.

   ■ Using a densitometer to measure density levels on the calibration bar printed on the black plate.

   ■ Entering values in the Transfer Function dialog box, which is accessed through the Transfer option in the Page Setup dialog box, to adjust the density levels.

5. Adjust the color swatches.

This step includes additional operations; they include:

■ Examining the color swatches printed in the Appendix or printing the Photoshop Color Swatches file included on the Calibration disk. The file and the Appendix both contain the same color swatches displayed in the Separation Setup dialog box that you use to calibrate your monitor colors. You may want to create a color proof of the Color Swatches file to match against your monitor display.

■ Adjusting the color swatches in the Separation Setup dialog box to match the printed color swatches.

6. An optional calibration step allows you to fine-tune the color swatches.

The procedures for implementing this step are:

■ Converting an RGB image to a CMYK image.

■ Printing the color separation.

■ Creating a color proof from the four pieces of film.

■ Converting the CMYK image back to an RGB image.

■ Visually comparing the RGB display to the printed CMYK version, and noting ways to change the CMYK color swatches to make the RGB image more closely match the CMYK image.

■ Returning to the CMYK mode.

■ Adjusting the color swatches in the Separation Setup dialog box to make the RGB image appear closer to the CMYK printed image.

■ Converting back to the RGB mode to view the effect of the changes on the RGB image; and if necessary, repeating the procedure until the RGB image closely matches the printed CMYK image.

7. An optional color separation step includes adjusting the black generation, which controls the amount of black generated on the black plate of a color separation. This step involves:

■ Choosing the black generation option you want from the Separation Setup dialog box while in the RGB mode.

■ Converting the image to the CMYK mode.

8. Create color traps.

9. Print final, camera-ready film.

Step 1: Selecting screen attributes

You can specify the screen frequency, screen angle, and dot shape to be used in your image. To make sure that you can correct color in your image and register the four plates correctly, you should print labels, calibration bars, and registration marks, and select the Negative and Emulsion Down options.

The version of the Halftone Screens dialog box that appears in a color document is different from the dialog box that appears when you set up the screen attributes for a gray-scale halftone. The instructions below concentrate on the areas that are unique to the setup for color separations. The section, "Step 7: Calibrating the output for gray-scale images" in Chapter 19, "Printing Halftones," contains detailed instructions on editing the screen attributes. See that section for details about defining the screen attributes.

You should use the Auto function to specify the resolution of the output device and the screen frequency you intend to use. Once you have entered that information, the Adobe Photoshop program automatically determines the appropriate frequencies and angles for the four halftone screens. The Adobe Photoshop program uses the Adobe Minimum Moiré calculations to determine the screen frequencies and angles that produce the best results. You should not adjust these frequencies and angles. If you do, moiré patterns may appear on the image.

```
Halftone Screens...                                    [ OK ]

                                                      [ Cancel ]
Frequency   ┌─ Auto Screens... ──────────────────┐
            │                          [ OK ]     │
      Angle │   Printer: [1270]  (dots/inch)      │  [ Auto... ]
            │                          [ Cancel ] │
Shape:      │   Screen:  [150]   (lines/inch)     │
            │                                     │  [ Load... ]
   ● Rou    └─────────────────────────────────────┘  [ Save... ]
   ○ Elliptical
   ○ Line
   ○ Square
   ○ Cross
```
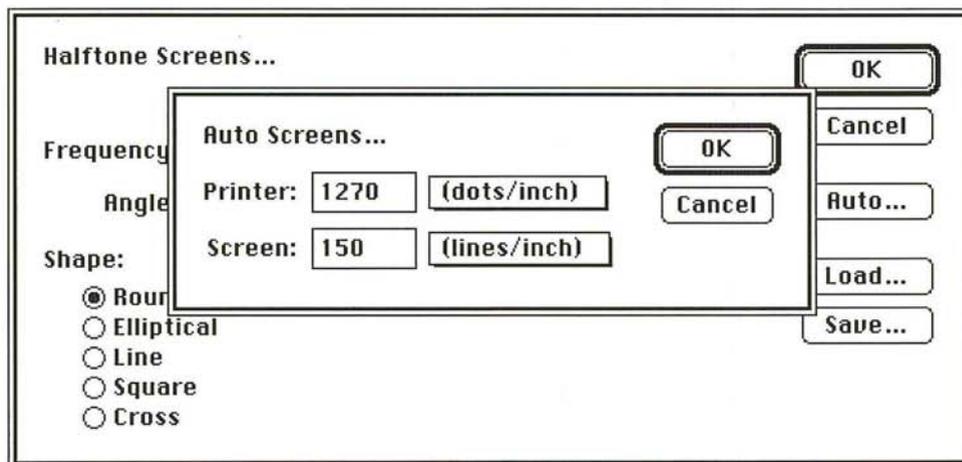
To specify the screen attributes:

1. Choose Page Setup from the File menu.

   The Page Setup dialog box appears.

2. Click Screens.

   The Halftone Screens dialog box appears.

```
┌─────────────────────────────────────────────────────────────┐
│ Halftone Screens...                              ╭────────╮  │
│            C:      M:      Y:      K:             │   OK   │  │
│                                                  ╰────────╯  │
│ Frequency: │47.4│ │47.4│ │50│ │53│ │(lines/inch)│           │
│                                                  ╭────────╮  │
│    Angle: │108.4│ │161.6│ │90│ │45│ (degrees)    │ Cancel │  │
│                                                  ╰────────╯  │
│ Shape:                                           ╭────────╮  │
│   ◉ Round                                        │ Auto...│  │
│   ○ Elliptical                                   ╰────────╯  │
│   ○ Line                                         ╭────────╮  │
│   ○ Square                                       │ Load...│  │
│   ○ Cross                                        ╰────────╯  │
│                                                  ╭────────╮  │
│                                                  │ Save...│  │
│                                                  ╰────────╯  │
└─────────────────────────────────────────────────────────────┘
```

3. Click Auto to define the desired screen attributes using the Auto Screens dialog box.

   When you have defined the screen attributes, click OK; click OK again.

Step 2: Calibrating the gamma of your color monitor

Calibrations you may need to make to your image to produce the best quality output include calibrating your monitor to determine the monitor gamma, calibrating your output to adjust for dot gain, and adjusting the color swatches each time you print on a different printing press.

You can standardize your display and compensate for changes over time by calibrating your monitor. You can calibrate your monitor by adjusting the monitor gamma value.

The monitor gamma value varies between manufacturers and even between monitors from the same manufacturer. The default monitor gamma value is 1.4, which is the normal gamma correction value for the Apple Hi-Res, 13-inch RGB monitor. However, there is considerable variation in monitor gamma even among monitors made by the same manufacturer.

You can adjust the color display visually or using a calibration system such as that available from Radius for the Apple 8-bit monitor, which reads calibration information back to the display to adjust it automatically.

The Adobe Photoshop program provides you with a way to estimate the proper gamma correction value for your monitor.

Calibrate the monitor gamma using the Levels dialog box, under the Adjust command in the Image menu, and the Gamma Gray Ramp file included on the Calibration disk in the Adobe Photoshop package.

This process involves using the Levels dialog box under the Adjust command in the Image menu, and the Gamma Gray Ramp file included on the Calibration disk in the Adobe Photoshop package. The Gamma Gray Ramp file displays dithered gray ramps interleaved with true gray ramps. By using the gamma slider in the Levels dialog box to make the true gray ramps match the dithered gray ramps, you can estimate your monitor gamma.

Do not undertake the following procedure until your monitor has been on for at least 20 minutes. Before you do anything else, follow the instructions for adjusting the monitor display in the manual provided with the monitor.

To estimate your monitor gamma:

1. Insert the Calibration disk.

2. Open the Gamma Gray Ramp file.

   The Gamma Gray Ramp file appears.

3. Choose Adjust from the Image menu.

4. Choose Levels from the Adjust submenu.

   The Levels dialog box appears.

5. Position the pointer on the gray (middle) Input Levels triangle beneath the histogram.

6. Holding down the mouse button, drag the slider to the left or right until the center portion of the true gray ramp matches the center portion of the dithered gray ramp as closely as possible.

7. Note the center value at the top of the Levels dialog box; you will enter this value for your monitor gamma.

8. Click Cancel.

9. Close the document without saving changes (so you can use this document again to estimate the gamma on other monitors).

To specify the appropriate amount of gamma correction for your monitor:

1. Choose Preferences from the Edit menu.

   The Preferences dialog box appears.

2. Click Separation Setup.

   The Separation Setup dialog box appears.

3. Double-click the Monitor Gamma text box.

4. Enter the gamma value you recorded from the Levels dialog box.

5. Click OK, and click OK again.

Step 3: Loading a transfer function file

The next step is to load the transfer function file appropriate for the paper stock you intend to use. For instructions on how to do this, see the section, "Step 3: Loading a transfer function file" in Chapter 19, "Printing Halftones."

Step 4: Calibrating for dot gain on color separations

You should now convert an RGB or indexed color image to a CMYK image, print it out, then use the calibration bar printed on the black plate to calibrate for dot gain. Dot gain increases the density in parts of an image.

To convert an RGB or indexed color image to a CMYK image, choose CMYK color from the Mode menu. The image is separated into cyan, magenta, yellow, and black channels. Because each pixel in the image has to be converted separately, this might take a few minutes.

The next steps are to select the options in the Page Setup dialog box under the Page Setup command in the File menu to perform the calibration, and calibrate the output to compensate for dot gain.

Calibrating for dot gain is described in detail in the section, "Step 7: Calibrating the ouput for gray-scale images" in Chapter 19, "Printing Halftones." The sections that follow primarily address the areas unique to the color separation process. For more information about the calibration process, see that section in chapter 19.

When you selected the Calibration Bars option, an 11-step gray-scale wedge (called a "calibration bar") was printed below the image on the black plate. You use the four pieces of film to create a press proof or a color composite, such as a MatchPrint, then use a photodensitometer to measure and record the density levels of certain steps in the calibration bar.

You need to convert the recorded density readings to percentage values to make the correct adjustments in the Transfer Function dialog box.

Information about determining the proper adjustments to make to the density values in the Transfer Function dialog box is contained in the section, "Step 7: Calibrating the output for gray-scale images" in Chapter 19, "Printing Halftones." In the case of a color separation, you need to adjust the density values for four colors. To do this, make the same density adjustments to all four colors based on the measurements of the calibration bar on the black plate. For example, if the measurements on the calibration bar indicate that you need to increase the Midtones value to 44 percent, enter 44 in the Midtones text boxes for the cyan, magenta, yellow, and black colors.

Dot Gain Calibration

1 RGB
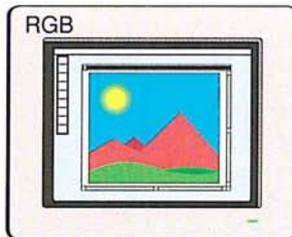
Convert the RGB image on your screen to the CMYK mode.

2

Cyan
Magenta
Yellow
Black
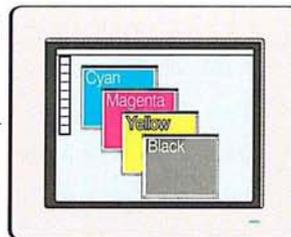
Print a press proof of your image on the same type of paper on which your final project will be printed.

3 Transfer Functions...

	C:	M:	Y:	K:	
Highlights:	0	0	0	0	%
1/4 Tones:	20	20	20	20	%
Midtones:	42	42	42	42	%
3/4 Tones:	65	65	65	65	%
Shadows:	100	100	100	100	%

OK
Cancel
Load...
Save...
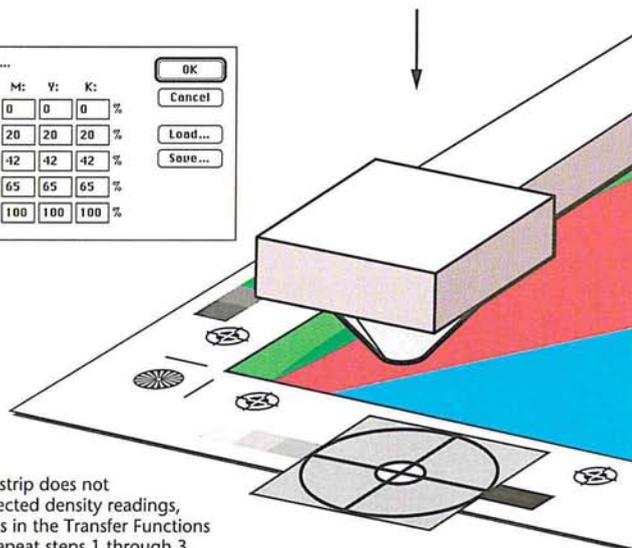
If the calibration strip does not produce the expected density readings, change the values in the Transfer Functions dialog box and repeat steps 1 through 3.

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To select the Page Setup options to perform the calibration:

1. Choose Page Setup from the File menu.

   The Page Setup dialog box appears.

2. Make sure that the Labels, Calibration Bars, Registration Marks, Negative, and Emulsion Down options are checked. If they aren't checked already, click them.

3. Click OK to close the Page Setup dialog box.

4. Choose Print from the File menu.

   The Print dialog box appears.

5. Click OK.

   The four plates are printed.

To calibrate the output to adjust for dot gain:

1. Create a press proof using the four pieces of film you just printed.

2. Use a photodensitometer to measure the density of the lightest, darkest, and middle steps in the calibration bar, and record the values for use in step 7.

3. Convert the density values to percentage values (if necessary).

4. Choose Page Setup from the File menu.

5. Click Transfer.

   The Transfer Function dialog box appears.

6. Double-click the text box for the level and the color you want to adjust.

7. Enter a value to adjust the density to the desired level.

8. Click OK.

Step 5: Calibrating the monitor colors

After you have calibrated the output for dot gain, and adjusted the monitor gamma (if necessary), you can calibrate the printed colors to match the colors displayed on your monitor. You perform this calibration by adjusting the color swatches displayed on-screen to make them match the same color swatches when printed.

NOTE: This color matching process is fundamentally different from that used by the Adobe Illustrator 88 program. Illustrator's native color space is CMYK; adjusting its color swatches is used to make its screen preview match the printed results. The native color space of the Adobe Photoshop program is RGB; adjusting its color swatches is used to make the printed results match the screen display.

You can use either the sample color swatches provided in the Appendix, or you can print the Photoshop Color Swatches file included on the Calibration disk. You should only print the color swatches file after you have calibrated your system for dot gain.

The color swatches are used to generate parameters that help convert an RGB image to CMYK. It is very important that they be calibrated accurately. The quality of your separation will be strongly influenced by the color swatch calibration.

NOTE: When the Calibration Bars option is selected, and a color image is printed, small color swatches are printed at the sides of the image. On the left are the 80% screened colors and the 50% CMY swatch. On the right are the 100% screened colors. These swatches, called screen tints, can be used to adjust the monitor's color swatches if you prefer.

Once you have generated a screen tint sheet, the next step is to match the color swatches in the Separation Setup dialog box, which you open by choosing the Preferences command from the Edit menu. The Separation Setup dialog box displays the same color swatches that appear in the Appendix and in the Photoshop Color Swatches file. The color swatches, from upper left to right, are as follows: 80 percent cyan, 80 percent magenta, 100 percent yellow, 100 percent magenta and yellow, 80 percent cyan and yellow, 100 percent cyan and magenta, and 50 percent cyan, magenta, and yellow.

The default percentage values that appear below the color swatches are CMYK color tint levels that can be displayed accurately on an RGB monitor. For example, pure, 100-percent cyan cannot be accurately displayed on-screen, so an 80-percent tint is used.

20

You can change the tint values to other percentage values. You can enter a value between 70 and 100 percent for all the swatches except the CMY swatch. You can enter a value between 30 and 70 for that swatch. The default settings correspond to the tint densities of the colors that appear in the printed color swatches. In general, you should use the default values for color calibration.

Color Swatch Calibration

1 Print a press proof of the Photoshop Color Swatches file on the same type of paper on which your final project will be printed.

2 Separation settings

Compare the printed sample to your monitor display, and adjust the Separation settings until you achieve a color match. Save these settings in a file.

Offset printed sample
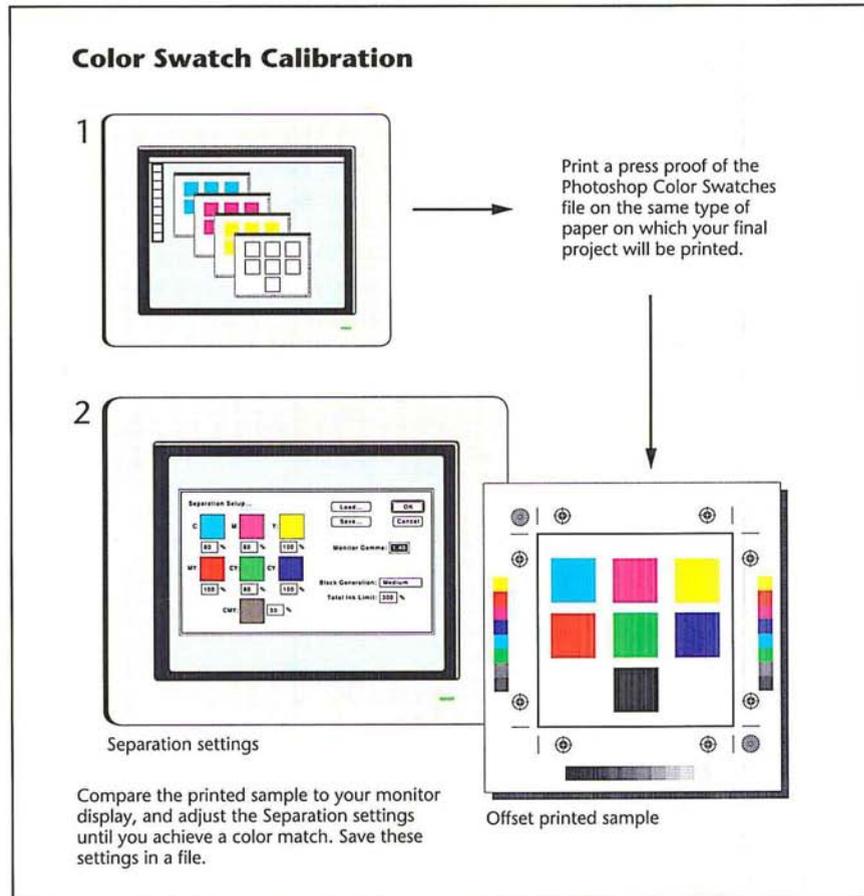
To generate your own printed color swatches:

1. Insert the Calibration disk.

2. Open the Photoshop Color Swatches file.

3. Choose Print from the File menu.

4. Click OK.

5. Use a color proofing system to create a color proof of the color swatches, or ask your print shop to produce a press proof using the color swatches.

   Follow the instructions below to use the printed color swatches to calibrate the colors displayed on your monitor.

To adjust the color swatches:

1. Choose Preferences from the Edit menu.

2. Click Separation Setup.

   The Separation Setup dialog box appears.
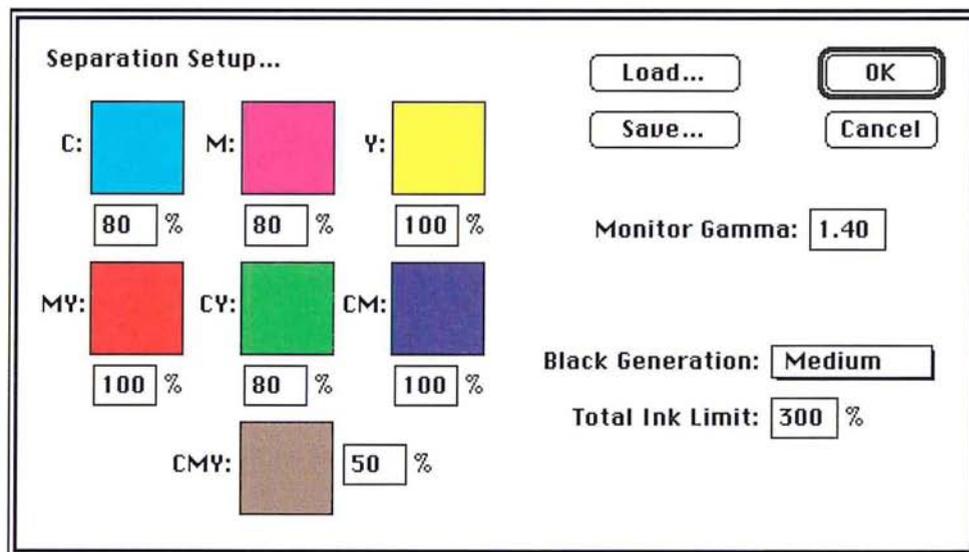
3. As an option, to change the percentage values for the tint samples, double-click in the text box beneath the swatch you want; enter the tint value you want (as a percentage).

4. Click the color swatch you want to adjust.

   The Color Wheel dialog box appears.
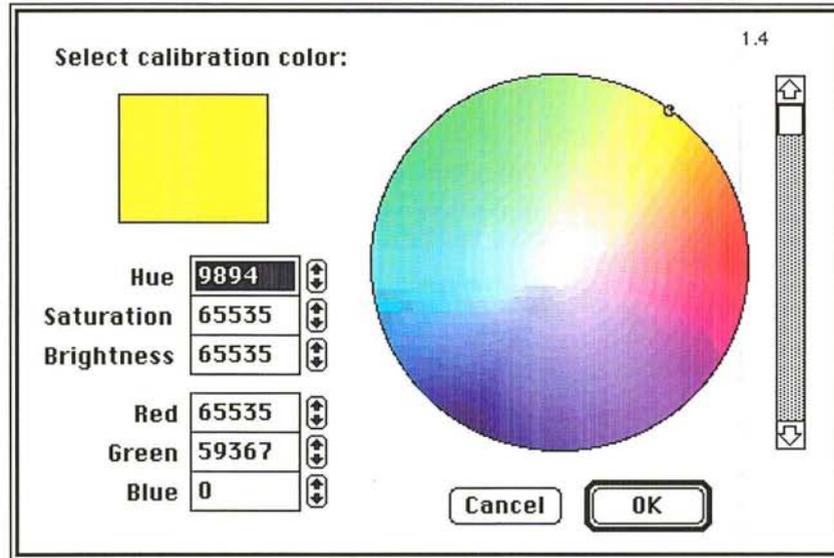
5. Use the controls in the Color Wheel dialog box to define a color that closely matches the appropriate color on the printed color swatches.

   For instructions on using the color wheel to select colors, see the section, "Using the color wheel" in Chapter 11, "Selecting Colors."

6. Click OK.

7. Repeat steps 4 through 6 for all the color swatches that need adjusting.

8. Click OK, and click OK again.

   The changes you make to the colors are saved in your preferences file.

Steps 6 and 7: Color separation options

This section describes how you can fine-tune the color swatches, automatically create color traps, and control the amount of black generation.

Step 6: Fine-tuning the color swatches

Because it is difficult to match color visually, sometimes the color swatch values selected in the previous section are not exactly right. This section describes how you can fine-tune the color swatch values by matching the colors in an entire image. This technique is possible because the Adobe Photoshop program, in addition to being able to perform a normal RGB to CMYK color separation, is also able to perform a CMYK to RGB color preview.

To perform this calibration, you should open an RGB or indexed color document, choose CMYK Color from the Image menu to produce a color separation, and print that separation. Be sure to save the CMYK file before quitting the program.

You then have two choices for producing the proof for the calibration. You can use a color proofing system, like the MatchPrint system, to create a composite, four-color proof of the image. The four-color proof process is similar to the actual printing press process that ultimately will be used to print the image. A color proof made from four pieces of film more closely matches the printed result than a color composite printed on paper. As an alternative, you can send the four pieces of film to a print shop to produce a press proof using the ink and paper you will use to print the final piece. This option can be expensive, but it produces the closest approximation to the final printed piece.

If the composite color or press proof matches the image displayed on the monitor, there is no need to perform any additional color calibration. However, if the color proof does not match the display, you need to adjust the color swatches to calibrate the color separation process.

After you produce a color proof, you convert the CMYK image back to an RGB image and compare the RGB image on-screen to the printed CMYK image. You should note the variations in color between the two images and consider ways to adjust the CMYK colors swatches to make the RGB image on-screen match the printed CMYK image.

You may have to repeat this process a few times to make the display match the printed output. However, once you have calibrated the CMYK colors on-screen, the color separation process will be more accurate with other images.

> WARNING: After you convert back to the RGB mode, do not make any adjustment to the RGB image. You want only to view the effects of the changes to the CMYK color swatches on the RGB image. If you alter the RGB image, you may not be able to undo the conversion and return to the CMYK mode.

Color Swatch Fine-Tuning

1 RGB

Mode
Bitmap
Gray Scale
Indexed Color ...
RGB Color
✓ CMYK Color
HSL Color
HSB Color
Multichannel

Cyan
Magenta
Yellow
Black

Print Press Proof

2

RGB

Mode
Bitmap
Gray Scale
Indexed Color ...
RGB Color
✓ CMYK Color
HSL Color
HSB Color
Multichannel

Cyan
Magenta
Yellow
Black

Compare colors
of screen and
press proof. (The sky
is an incorrect color.)

Edit
Undo Mode Change ⌘Z

3

**Fine tune
color swatches**

Mode
Bitmap
Gray Scale
Indexed Color ...
RGB Color
✓ CMYK Color
HSL Color
HSB Color
Multichannel

Cyan
Magenta
Yellow
Black

Compare colors. (The blue
sky has shifted on the
monitor display.)

To create a press proof for a calibration:

1. Open a document that contains an RGB or indexed color image.
2. Choose CMYK Color from the Mode menu.

   The image is converted to a CMYK image.
3. Choose Print from the File menu.
4. Click OK.
5. Save the CMYK file.
6. Take the resulting four pieces of film, and create a press proof or use a color proofing system to create a four-color proof.

To compare the RGB image on-screen to the printed CMYK image:

1. Open the CMYK image that you just printed.
2. Choose RGB Color from the Mode menu.
3. Compare the RGB image to the printed CMYK image. Note any variations in color between the two images, and consider how to adjust the CMYK color swatches if necessary. Do not adjust the RGB image.
4. Choose Undo Mode Change from the Edit menu.

   The CMYK version of the image is restored without any alterations.

To adjust the color swatches:

1. Choose Preferences from the Edit menu.
2. Click Separation Setup.
3. Click the color swatch you want to adjust.

   The Color Wheel dialog box appears.
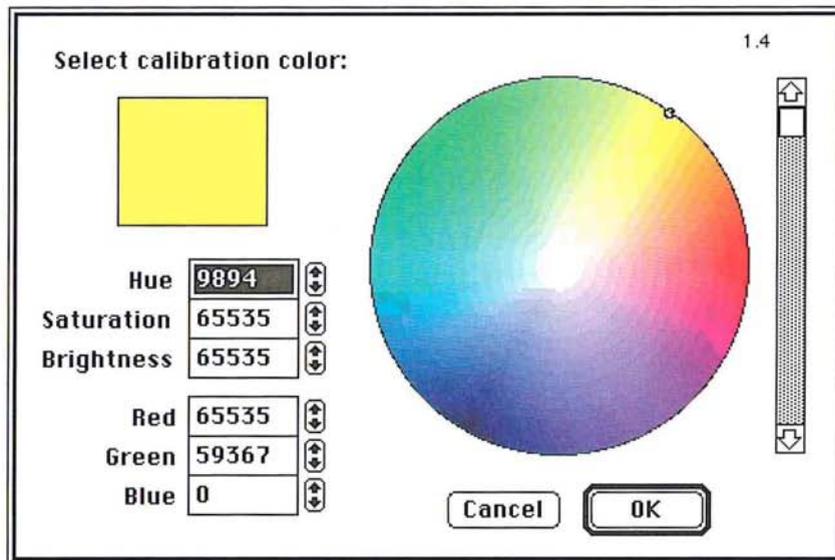
4. Use the controls in the Color Wheel dialog box to adjust the color so that the RGB display of the image matches the printed CMYK image.

   For instructions on using the color wheel to select colors, see the section, "Using the color wheel" in Chapter 11, "Selecting Colors."

5. Click OK.

6. Repeat steps 3 through 5 for any color swatches that need adjusting.

7. When you have finished adjusting the color swatches, click OK, and click OK again.

   Repeat the preceding steps to view the effects of the changes on the RGB display of the image, return to the CMYK mode, and adjust the color swatches in the Separation Setup dialog box to make the RGB image match the color proof.

Step 7: Adjusting the black generation

The black generation option for color separations allows you to replace the combination of cyan, magenta, and yellow colors of your image with black. Black generation involves a process called undercolor removal, which is an adjustment color separators use to make precise adjustments for the printed image.

The undercolor removal process removes a portion of cyan, magenta, and yellow in the areas where these three colors overlap, and replace some percentage of those colors with black. Often when cyan, magenta, and yellow appear in high densities in dark areas of an image, a muddy, brownish color results, and the shadow detail in the image is lost. Undercolor removal is designed to eliminate these problems.

You make your choices for black generation before you convert an image to the CMYK format.

Part of the black generation process involves specifying the maximum density of ink that the printing press you intend to use can support. If an area of the image exceeds that amount, the option automatically removes ink from that area.

The upper end of the density limit is 400 percent, which means that a 100-percent tint of each of the four process colors is applied to the image. However, most presses cannot support this much ink on the page without degrading the quality of the image. You should ask your printer what the density limit on the press is. The value specified for the total ink limit ensures that no more than the specified amount of ink will be printed on any area of the image; in fact, the amount of ink printed may be less than the specified amount. The default maximum density is 300 percent.

You can control how much black is substituted for the cyan, magenta, and yellow colors in an image using the black generation options. The amount of black that is substituted is reflected on the black plate of acolor separation. If no black is substituted, no black appears on the black plate; if the maximum amount of black is substituted, the black plate will contain a large amount of black.

Black generation options

The black generation options are None, Light, Medium, Heavy, Maximum, and Custom. The name of the option reflects the amount of black generated on the black plate—that is, the Light option generates a light amount of black. Medium is the default option and should produce satisfactory results in most cases. You can use the Maximum option with images that contain a large amount of solid black color against light backgrounds, such as images showing screen shots of dialog boxes and windows taken from a Macintosh computer.

The Custom option allows you to precisely control the amount of black generation during a color separation. The steps for using the Custom option differ from those for the other options, and are described in the section that follows this.

Black generation set to medium

Black plate

Black generation set to heavy
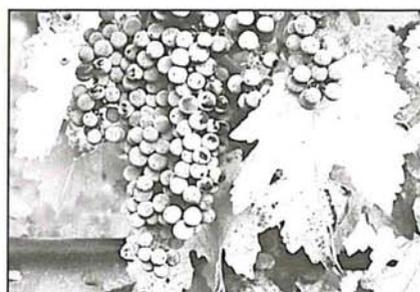
Black plate

To specify the total ink density supported by a press and the desired amount of black generation:

1. Ask your print shop what the maximum density of ink is that the press can support.

2. Choose Preferences from the Edit menu.

   The Preferences dialog box appears.

3. Click Separation Setup in the Preferences dialog box.

   The Separation Setup dialog box appears.

4. Click the Total Ink Limit text box.

5. Enter the total ink limit recommended by your printer as a percentage value from 200 to 400.

   > *NOTE: This limit is applied before the Transfer option, which, by default, lightens the printed result to compensate for dot gain. Thus, you may be able to enter a slightly higher limit that your print shop specified.*

6. Position the pointer on the box beside the title, "Black Generation."

7. Press down the mouse button.

   The Black Generation pop-up menu appears.

8. Holding down the mouse button, choose the black generation option you want.

   The option appears in the box.

9. Click OK, and click OK again.

   When you create a color separation, the amount of black that appears on the black plate will be determined by the option you chose.

The Custom black generation option

The Custom option allows you to accurately control the amount of black generated during a color separation. The Custom option allows you to use the Arbitrary Map dialog box, which is accessed from the Map submenu in the Image menu, to adjust the areas where black appears in the image. You may not want black to appear in certain areas in an image. As an example, in a photograph of a person, you might not want black to appear in the areas where there is a transition between dark areas, such as dark hair and the flesh tones of the face. If black appeared in these areas, the transition might be exaggerated, and the printed result might be unsatisfactory.

The Custom option allows you to use the controls in the Arbitrary Map dialog box to remap the black pixels that appear in these areas to white, thereby ensuring that cyan, magenta, and yellow will be used in these areas instead of black. The steps for using the Custom option are described as follows.

To use the Custom option for black generation:

1. Choose Save from the File menu to save any changes made to the document.

2. Choose Preferences from the Edit menu.

   The Preferences dialog box appears.

3. Click Separation Setup in the Preferences dialog box.

4. Position the pointer on the box beside the title, "Black Generation."

5. Press down the mouse button.

   The Black Generation pop-up menu appears.

6. Holding down the mouse button, choose Maximum.

7. Click OK, and click OK again.

8. Choose CMYK color from the Mode menu to create a color separation.

   The black plate appears as the active channel.

To adjust black in an image using an arbitrary map:

1. Choose Map from the Image menu.

2. Choose Arbitrary from the Map submenu.

   The Arbitrary Map dialog box appears.

3. As an option, you can load one of the the black generation curves provided on the Calibration disk to see how an arbitrary map controls the black generation. The maps for light, medium, heavy, and maximum black generation are provided.

To load an arbitrary map on the Calibration disk:

1. Click Load in the Arbitrary Map dialog box.

   The Open dialog box appears.

   Use the directory and drive buttons to locate the folder on the Calibration disk that contains the maps.

2. Click the map you want.

3. Click Open.

   The curve for the selected map is loaded into the Arbitrary Map dialog box.

4. Use the controls in the Arbitrary Map dialog box to adjust the areas where black appears in the image.

5. Save the arbitrary map in a file by clicking Save and specifying a file name and location.

   For instructions on using the Arbitrary Map dialog box to remap the color values of pixels, and saving the map in a file, see the section, "Creating a color curve" in Chapter 16, "Making Color Corrections."

6. Choose Revert from the File menu to return to the RGB image.

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7. Click OK in the alert dialog box to revert without saving changes.

   To use the custom arbitrary map to control the amount of black generation:

1. Choose Preferences from the Edit menu.

2. Click Separation Setup in the Preferences dialog box.

3. Choose Custom from the Black Generation pop-up menu.

   The Open dialog box appears.

   Use the drive and directory buttons, if necessary, to select the arbitrary map file you created.

4. Click Open.

5. Click OK, and click OK again.

6. Choose CMYK color from the Mode menu to create a color separation.

   The information in the arbitrary map file is used to control the amount of black generated in the color separation.

Step 8: Creating traps

Trap is the overlap needed to ensure that a slight misalignment or movement of the separations will not affect the final appearance of the print job. If any distinctly different colors in your image touch, you may need to overprint them slightly to prevent tiny gaps from appearing when the document is printed. This technique is known as adding traps.

Even the best presses experience slight shifts in the position of the plates. To ensure proper trapping, print shops use techniques called choking and spreading, in which traps are created by overexposing the film to produce the necessary overlap. Because you are printing the Adobe Photoshop files directly to film, shrinking and spreading cannot be used, but traps can be produced using the program's Trap command. The Trap command in the Image menu is only active in CMYK images.

Consult with your print shop for the amount of misregistration you can expect to experience on press. The value can be in pixels, points, or millimeters. The Adobe Photoshop program uses this value to determine automatically where color transitions occur, and where the colors in those areas should be spread outward. So if the plates shift on press, ink still will be printed continuously throughout the image.

To spread the colors in areas (create trap) where color transitions take place:

1. Choose CMYK Color from the Mode menu to convert the image to the CMYK format.

   The image is converted to an image consisting of four channels. The channels, cyan, magenta, yellow, and black, are used to print the four plates you send to the printer.

2. Choose Trap from the Image menu.

   The Trap dialog box appears.

Trap...		OK
Width: 1	✓ (pixels) (points) (mm)	Cancel
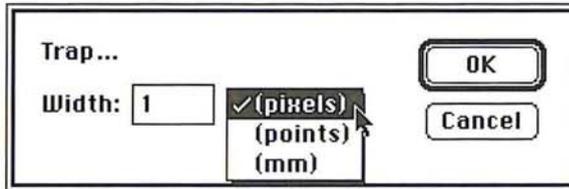
3. Use the pop-up menu beside the text box to choose the units of measure you want; you can choose pixels, points, or millimeters.

4. Enter the amount of anticipated misregistration you will experience on the press.

5. Click OK.

   When you have finished calibrating and setting up your color separation, you can print the final film.

Step 9: Printing final, camera-ready film

You are ready to print your separated image as four pieces of camera-ready film.

To print the the final, camera-ready film:

1. Choose Page Setup from the File menu.
2. Check Labels, Registration Marks, Negative, and Emulsion Down.
3. Click OK.
4. Choose Print from the File menu.
5. Click OK.
6. The image is printed as final, camera-ready film.

If you are satisfied with your results, you have successfully printed the final, camera-ready film to be used to create plates for a press. If you are dissatisfied with your results, you may want to go back and adjust your system, monitor, image, or other print settings in this chapter's previous eight steps.

Chapter 21: *Tips and Troubleshooting*

This chapter contains tips for using the Adobe Photoshop program most efficiently, and solutions to problems you may encounter when using the program. Many of the tips and solutions address situations you may encounter when making color corrections and printing images. In addition, the chapter includes techniques for using the Adobe Photoshop program with the Adobe Illustrator 88™ program.

Working efficiently with color

Following are techniques for working most efficiently with color images. This section explains how to select CMYK colors precisely and achieve the desired results, save color documents for video applications, view color changes dynamically on 24- and 32-bit systems, and save color documents for video applications.

CMYK colors appear different than those specified

Problem: The CMYK values specified didn't yield the same values when the image was separated. As an example, you specified a color of 10% cyan, 55% magenta, 100% yellow, and 10% black, but the actual separated values of this color differed.

Cause: The CMYK values you choose must be consistent with the black generation curve that dictates how RGB colors are translated to CMYK colors. (The black generation curve is specified in the Separation Setup dialog box under the Preferences command in the Edit menu.) Otherwise, your CMYK values will appear differently than what you specified. The black generation curve defines a unique mapping for each RGB value. That is, for a given black generation curve, every RGB color has an equivalent CMYK color. If you change your black generation curve, then your RGB colors will translate to different CMYK colors.

Solution: To determine the actual CMYK values that will result from the separation, click the cursor once on the CMYK pop-up menu in the color palette. The sliders will adjust to display the CMYK values that the color will have when it is separated.

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Color changes do not preview dynamically on 24- and 32-bit systems

Problem: In 24-bit mode, the screen displays odd colors, or a system error results as you move the sliders in the color adjustment dialog boxes which are accessed via the commands in the Adjust submenu in the Image menu.

Cause: If you have a 24- or 32-bit monitor and are in 24-bit mode, you can view millions of colors at a time and preview color changes dynamically. A feature called color table animation causes the screen to change interactively as you adjust color by moving the sliders in the Levels, Color Balance and Brightness/ Contrast dialog boxes. The Adobe Photoshop program implements color table animation in 24-bit mode using a 32-bit QuickDraw command called Direct-SetEntries.

However, some early releases of 24- and 32-bit video cards by several video board manufacturers have bugs in their implementations of the DirectSetEntries command. These bugs may prevent previewing color changes or may result in a system error.

Solution: In the Preferences dialog box under the Edit menu, uncheck the box labeled "Use DirectSetEntries." Disabling the DirectSetEntries option will prevent a system error, but it will also disable the ability to preview changes interactively as you move the color adjustment sliders. However, you can preview the changes by clicking the Preview button in the Levels, Color Balance and Brightness/Contrast dialog boxes. To solve the problem, contact your video board manufacturer for a replacement to the ROMs in the video card.

Undesirable dithering patterns appear in 16-bit PICT images

Problem: Noticeable and undesired patterns occur in a 16-bit PICT image that has been saved from a 24- or 32-bit image format.

Cause: Some applications, such as video, don't require the image resolution and information contained in 24- and 32-bit images; converting the image to a smaller format reduces the amount of color information and disk space required by the image. When saving a 24-bit image as a 16-bit PICT file for video or other applications, the Adobe Photoshop program normally dithers the image to simulate the colors in the 24-bit image that cannot be included in the 16-bit file. A 16-bit image can display only 32,768 different colors (compared to more than 16 million for a 24-bit image), but this display is usually adequate for video purposes. However, dithering can result in a noticeable and undesired pattern throughout the image.

Solution: Dithering can be disabled by ensuring that the 24-bit image contains 32,768 or fewer unique colors before it is saved. Decreasing the number of colors in an image to 32,768 or less effectively converts a 24-bit image to a 16-bit file before it is saved.

To change a 24-bit image to 16 bits for video applications, you use the Posterize command in the Map submenu in the Image menu to decrease the number of colors in each channel to 32 levels. This will result in an image that now has no more than 32,768 individual colors. When you save the image as a 16-bit PICT file, the image will be saved without dithering.

Tips and techniques for printing efficiently

Following are techniques for printing images most efficiently, as well as solutions to some problems you may encounter when printing an image.

Problem: The printer is taking an usually long time to print.

Cause: The resolution of your image may be too high for the resolution of your printer.

Solution: Make sure that you have properly sampled down your image to comply with the resolution at which you are printing. Before printing your image, you should save your file. Then use the automatic resampling feature in the Resample dialog box under the Resample command in the Image menu to adjust the resolution of your image.

To do so, choose Resample from the Image menu, and in the Resample dialog box, click Auto. Enter the resolution for the printer, and click OK to have the Adobe Photoshop program automatically resample the file. When you have finished printing, revert the illustration to the version you saved before the resampling, using the Revert command in the File menu. It is important to revert your image, to retain all of the information in the image. You should not resample down below the resolution at which you will print the final image because when you resample down, you delete image information that cannot be recovered.

High-resolution images print enlarged and at a low resolution

Problem: Images that were scanned at high resolution print much larger than the original size and at much lower resolution than scanned.

Cause: The Adobe Photoshop program opens documents in some formats at 72- dpi resolution, regardless of the resolution of the original document. This may cause a document to appear enlarged when it prints, if the resolution of the original image is greater than 72 dpi. Because the image still contains all of its information, the image will be sized many times larger than the original and will thus print too large and at low resolution.

Solution: To correct this, change the size of the document using the Size/Rulers option in the Page Setup dialog box under the File menu. Notice as you make the size smaller, the resolution will increase and become closer to the original scanning resolution. The option will cause the image to print at its accurate size, but will not affect how the image appears on-screen.

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Using computer and system memory efficiently

Following are techniques for using computer and system memory most efficiently.

Space on hard disk appears lost

Problem: Help! A system error occurred, and now it appears that a large segment of the hard disk is missing. All of the space occupied by the files doesn't add up to the storage capacity of the disk.

Cause: When a system error occurs, the directory entries used to locate files on your hard disk can be damaged. If a system error occurs while you are running the Adobe Photoshop program, it is possible that the space occupied by the PS.temp file could become lost to the Macintosh system. It may appear as though a large segment of your hard disk is actually missing.

The PS.temp file is a special file created by the Adobe Photoshop program to implement the program's virtual memory scheme. Virtual memory allows you to work on images of nearly any size, by using a hard disk instead of RAM (random-access memory) to hold information. The PS.temp file contains the program's virtual memory information. The file is normally deleted when you quit the program.

Solution: To restore the lost space on your hard disk easily and quickly, run the Disk First Aid program, a utility supplied with Apple's system software. For more information, see your Macintosh documentation.

Third-party virtual memory program doesn't speed processing

Problem: The Connectix Virtual program is installed to speed up processing, but it doesn't seem to have an effect on the Adobe Photoshop program. If anything, it seems to slow down the program.

Cause: The Adobe Photoshop program's implementation of virtual memory is highly optimized for its particular architecture. No additional virtual memory program is required for optimal system performance when using the Adobe Photoshop program.

Virtual memory uses the hard disk to hold information when there is not enough RAM in your computer. Because the access speed of a hard disk is much less than that of memory chips, large images that must be swapped to and from disk will slow processing noticeably.

For both color and black-and-white images, the Adobe Photoshop program requires between three and five times the file size in combined RAM and hard disk space. Thus, to work on a 10-megabyte color image, you will need nearly 30 megabytes of free disk space.

Solution: If a virtual memory program is used, the Adobe Photoshop program's Multifinder memory allocation should be set to some value smaller than the amount of actual RAM installed in the Macintosh.

You will get the best performance if you use an empty hard drive (or drive partition) as the Adobe Photoshop program's virtual memory disk. An empty drive contains contiguous disk space, allowing the PS.temp file to be stored in one large piece, rather than in fragments throughout the hard drive. The PS.temp file contains the program's virtual memory information, and is automatically located in the same folder as the preferences file.

Message states disk is full

Problem: The message continually displays that operations can't be performed because the disk is full.

Cause: Your preferences file may be on a disk that doesn't have enough free disk space for your image.

Solution: Make sure that your Adobe Photoshop preferences file is on a volume or hard disk that has enough free disk space to equal about three times the size of the file. The file size is displayed in the lower left corner of the document window.

Installed plug-in modules don't appear in the program

Problem: After additional plug-in modules have been installed in the same folder as the Adobe Photoshop program, the additional features still are not accessible in the program.

Cause: Plug-in modules must be placed in the same folder as the Adobe Photoshop preferences file to be accessible.

Solution: Move the plug-in modules to the same folder as the preferences file, and restart the Adobe Photoshop program. Some of the plug-in modules may appear as filters in the Filter menu. Other plug-in modules may appear as import and export modules in the Acquire and Export submenus in the File menu.

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Painting tools don't work

Problem: Painting tools don't apply any paint on the image.

Cause: Painting tools only work inside areas that are part of the current selection or when no part of the image is selected.

Solution: Check to make sure that you are not painting outside a selected area. If you are painting outside a selected area, choose either None or Inverse from the Select menu.

Using the Adobe Photoshop program with Adobe Illustrator 88

This section includes tips and techniques for using Adobe Illustrator 88 in tandem with the Adobe Photoshop program, and solutions to problems you may encounter when doing so. The section assumes you are using version 1.9.3 or later of Adobe Illustrator 88 software.

Imported Adobe Illustrator 88 files have jagged edges

Problem: Files imported to the Adobe Photoshop program from the Adobe Illustrator 88 program have jagged edges.

Cause: Like other image types, Adobe Illustrator 88 files are imported into the Adobe Photoshop program in a low-resolution, 72-dpi format. The low resolution can result in images with fairly jagged edges.

The Adobe Photoshop program can import files in a variety of formats, including the EPS file format created by Adobe Illustrator 88, but sometimes the files to be imported require special consideration.

Only part of the information in an EPS file is useable by the Adobe Photoshop program. An EPS format can contain both vector (mathematically described line art) and pixel-based (scanned) graphics. An EPS file may also include a low-resolution PICT file (either color or black-and-white) that can be used to preview the images on screen when imported into other applications.

Although the Adobe Photoshop program can import EPS files, the program works only with pixel-based images, and so can only read and write the pixel-based portion and the PICT images of an EPS file. In contrast, Adobe Illustrator 88 is primarily a vector-based program, and therefore its files are saved in a vector format.

Adobe Illustrator 88 files intended to be exported to the Adobe Photoshop program should be saved with the Macintosh preview option selected. This option saves the file as a 72-dpi PICT image, suitable for importing into the Adobe Photoshop program. However, once imported into the Adobe Photoshop program, the 72-dpi images have fairly jagged edges.

Solution: To smooth out the edges, you can use the same trick that Adobe Photoshop software uses to create anti-aliased (or smoothed) text.

While still in the Adobe Illustrator 88 program, simply resize the image by about 2-1/2 times. To do so, select your image to be scaled. Click the scale tool to select it, and hold the Option key and click; a transformation dialog box appears. Enter a value of 250% and click OK.

Save the file using the Save As command; be sure to check the Color Macintosh preview option. Then import the image again into the Adobe Photoshop program. In the Adobe Photoshop program, convert the image from indexed color to RGB using the Mode menu. Choose Resize from the Image menu, and shrink the image to 40 percent of the original size.

If your file is too large, the Adobe Illustrator 88 program may not save it. In that case, you should copy portions of the image onto the Clipboard and paste them into the Adobe Photoshop program. To save portions of an image, select a part of the image; hold the Option key and choose the Copy command from the Edit menu. This will place a color PICT image on the Clipboard.

File cannot be imported into the Adobe Photoshop program

Problem: Adobe Illustrator 88 files containing Adobe Photoshop images can't be opened or used on the Macintosh you are using.

Cause: Often, the most efficient way to print documents containing both separated color images and Adobe Illustrator 88 artwork is by exporting the files to the Adobe Illustrator 88 program. Once placed in the Adobe Illustrator 88 program, the file must be saved in a specific way, depending on how you plan to use it later.

As long as you plan to use the file on the same Macintosh, you will have no difficulty using the EPS file. However, if you plan to use the file on another Macintosh, or take the file to a service bureau for processing, you must take care in how you save the EPS file. The Adobe Illustrator 88 program, by default, does not save placed Encapsulated PostScript (EPS) files within its images because the files can be large and require a large amount of disk space. Instead, the Adobe Illustrator 88 program uses a pointer to point to an EPS file's location on the hard disk.

Solution: You have two options for saving and exporting the EPS file with the Adobe Photoshop and Adobe Illustrator 88 programs. You can save the file as an ASCII file or as an EPS file.

To save the artwork as an ASCII file, use the Save As dialog box to check the EPS option to Include copy of Placed Encapuslated PostScript files for other applications. The file now can be used on another Macintosh.

If you want to save the artwork as a binary file, you will have to first copy the file to a floppy disk for use on another Macintosh or by a service bureau. To save the artwork as a binary file, use the Save As dialog box to check the binary option. Do not check the EPS option; using this option will generate an error message when you try to reopen the file in the Adobe Illustrator 88 program. Once you have copied the file to a floppy disk and saved it without checking the EPS option, you can then take copies of the placed Adobe Photoshop files, as well as the Adobe Illustrator 88 files, to another Macintosh or to a service bureau.

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Adobe Photoshop files can't be exported

Problem: Adobe Photoshop images can't be imported into the Adobe Illustrator 88 program.

Cause: To be imported into the Adobe Illustrator 88 program, Adobe Photoshop images must be saved in the EPS file format. The Adobe Illustrator 88 program only accepts the EPS file format.

Solution: To import an Adobe Photoshop image into the Adobe Illustrator 88 program, you open an Adobe Illustrator 88 document and use the Place command in the File menu of the Adobe Illustrator 88 program.

If you want to import a color Adobe Photoshop image, and you plan to separate the final result using Adobe Separator, you will want to separate it first. To do so, first convert the Adobe Photoshop document to CMYK before saving it, using the CMYK Color command in the Mode menu. This creates separate images for each color plate that will be saved as one EPS file. Then choose the Save As command from the File menu, and choose the EPS option from the File Format pop-up menu; the EPS Options dialog box displays options for preview resolutions and encoding. For placement into the Adobe Illustrator 88 program, the files must be saved using the 1 bit/pixel Preview PICT option, in either binary or ASCII encoding format.

It's important to note that if you choose the binary option in the Adobe Photoshop program, and plan to use the EPS option in the Adobe Illustrator 88 program's Save As dialog box, you will not be able to reopen the files in Adobe Illustrator 88, and an error message will be generated. Either choose the ASCII encoding option if you want to also use the EPS option; or use the binary encoding option, but do not select the EPS option in the Adobe Illustrator 88 program.

Imported EPS files don't appear in the artwork

Problem: The placed EPS file imported from the Adobe Photoshop program doesn't appear in my artwork.

Cause: By default, placed EPS files do not display in the Adobe Illustrator 88 artwork mode, but they will display in the preview mode.

Solution: Change the default in the Preferences dialog box in the Edit menu. To display placed EPS images, check the Show placed images option. Once the option is checked, placed EPS images will display in both the artwork and preview mode.

Imported PICT files can't be opened

Problem: An error message results when you try to open PICT files imported from the Adobe Illustrator 88 program in the Adobe Photoshop program. The Adobe Photoshop program can't open the PICT file.

Cause: If a file is too large, the Adobe Illustrator 88 program may not save a PICT preview, and you will be unable to open the file.

Solution: You may be able to select portions of your illustration, and then copy and paste them into the Adobe Photoshop program. To copy a color PICT image to the Clipboard, select a portion of the image to be copied; hold down the Option key and choose Copy from the File menu to transfer the image to the Clipboard.

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Section 6: *Reference Material*

The designer combined two separate slides of houses and clouds to create this image. Using two copies of the clouds image at two different magnifications, she filled the entire background area with the first selection, and reduced the second selection in size and pasted it behind the houses in the foreground area.

The designer selected a section of the houses and road from the original scan, and, omitting the original sky in the background, placed them on top of the new clouds. Using a filter, she sharpened both areas to create a crystalized effect. She then selected the upper and left sides of the image and copied them to a separate file where she converted them to gray scale to remove the original color information. The designer then converted the image back to RGB mode where she colorized it using the hue/saturation controls. She then copied the selection and positioned it in the composite image.

Appendix: *Photoshop Color Swatches*

The Photoshop Color Swatches printed on this page, as well as the electronic file on the Calibration disk, should be used with the instructions on calibrating your monitor colors, in Chapter 20, "Producing a Color Separation." The Photoshop Color Swatches allow you to match the colors displayed on your monitor to the actual printed output. As a result, you can adjust what you see on-screen to what you get on your printed output.

To calibrate your monitor using the printed swatches, hold the page next to your monitor and compare each swatch to the corresponding swatch in the Separation Setup dialog box under the Edit menu, adjusting the monitor colors as necessary. To calibrate your monitor using a press proof of the electronic file on the Calibration disk, follow the same procedure.

For more information, see Chapter 20, "Producing a Color Separation."

C: 80 %   M: 80 %   Y: 100 %

MY: 100 %   CY: 80 %   CM: 100 %

CMY: 50 %
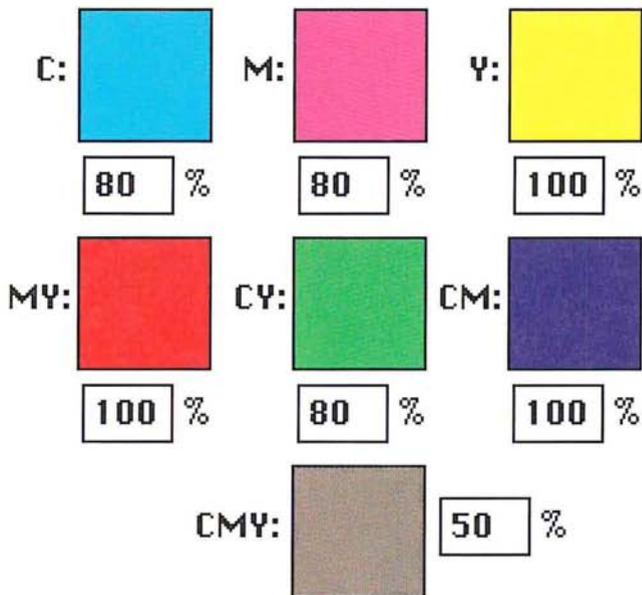
Glossary

additive primary colors   Red, green, and blue, which are the three colors used to create all other colors when direct, or transmitted, light is used (for example, on a computer monitor). They are called additive primaries because when pure red, green, and blue are superimposed on one another, they create white.

alpha channel   An 8-bit, gray-scale representation of an image, often used for creating masks that isolate part of an image.

anti-aliasing   Smoothing edges created with painting, selection, or type tools.

arbitrary map   An option that helps control the amount of black in a color separation by remapping black pixels in certain areas of an image to white, thereby ensuring that cyan, magenta, and yellow will be used in those areas instead of black.

ASCII   Acronym for American Standard Code for Information Interchange. A standard that assigns a unique binary number to each text character and control character.

aspect ratio   The height-to-width ratio of a marquee selection.

bitmap-type image   A single-channel image with 1 bit of color information per pixel, also known as a bitmapped image. The only colors displayed in a bitmap-type image are black and white.

black generation   The amount of black generated on the black plate of a color separation.

brightness   One of the three dimensions of color; the other two are hue and saturation. The term is used to describe differences in the intensity of light reflected from or transmitted through an image independent of its hue and saturation.

bull's-eyes (registration marks)   Marks that appear on a printed image, generally for CMYK color separations, to help you align the various printed plates.

calibration bars   The printed 11-step gray-scale wedge that appears on printed output. When you print a CMYK color separation, this step wedge appears only on the black plate. On a color image, this refers to the color swatches printed at the sides of the image.

caption   Text that appears below a printed image.

channel   Analogous to a plate in the printing process, a channel is the foundation of an image. Some image types have only one channel, while other types have several channels. An image can have up to 16 channels.

CMYK   Cyan, magenta, yellow, and black, the four process colors.

CMYK image   A four-channel image containing a cyan, magenta, yellow, and black channel. A CMYK image is generally used to print a color separation.

color correction   The changing of the colors of pixels in an image, including adjusting brightness, contrast, mid-level grays, hue, and saturation to achieve optimum printed results.

color separation   An image that has been separated into the four process colors of cyan, magenta, yellow, and black (CMYK), and is then printed on four separate plates, each plate representing one of the four process colors.

constrain   To restrict the movement of a selection.

continuous-tone image   An image containing gradient tones from black to white.

contrast   The tonal gradation between the highlights, midtones, and shadows in an image.

crop   To select part of an image and discard the unselected areas.

crop marks   The marks that are printed near the edges of an image to indicate where the image is to be trimmed.

densitometer   An instrument used to measure the density of printed halftones. A densitometer is used to measure the density levels on the printed calibration bars.

density   The ability of an object to stop or absorb light. The less the light is reflected or transmitted by an object, the higher its density.

density range   The range from the smallest highlight dot the press can print to the largest shadow dot it can print.

dithering   The technique of making adjacent pixels different colors to give the illusion of a third color. Dithering can give the effect of shades of gray on a black-and-white display, or more colors on an 8-bit color display.

dot gain   A defect in printing that causes dots to print larger than they should, causing darker tones or colors. Dot gain is reflected in an increase in the density of light reflected by an image.

dpi   Dots per inch; a measure of resolution.

emulsion   The photosensitive layer on a piece of film or paper.

fade-out rate   The rate at which the paint brush and airbrush tools fade out as you paint with them to simulate an actual brush stroke.

feather edge   The area along the border of a selection that is partially affected by changes you make to the selection.

fill To paint a selected area with a gray shade, a color, or a pattern.

floating selection A selection that has been moved or pasted on an image. It floats above the pixels in the underlying image until it is deselected.

fringe The pixels along the edge of a selection. The fringe pixels contain a mixture of the colors in the selection and the background color(s) around the selection.

fuzziness A parameter that controls how much anti-aliasing is applied to the edges of a selection.

gamma A measure of contrast that affects the mid-level grays (midtones) of an image.

gradient fill A fill that displays a gradual transition from the foreground to the background color. Gradient fills are made with the blend tool.

gray-scale image A single-channel image consisting of up to 256 levels of gray, with 8 bits of color information per pixel.

gray-component replacement (GCR) The removal of a mixture of cyan, magenta, and yellow, and replacement of them with black.

halftone The reproduction of a continuous-tone image, made by using a screen that breaks the image into various size dots.

highlight The lightest part of an image, represented in a halftone by the smallest dots, or the absence of dots.

histogram A graphic representation of the number of pixels with given color values. A histogram shows the breakdown of colors in an image.

HSB image An RGB image that is displayed in three channels: hue, saturation, and brightness. Only one channel is displayed at a time.

HSL image An RGB image that is displayed in three channels: hue, saturation, and luminance. Only one channel is displayed at a time.

hue Color; the main attribute of a color that distinguishes it from other colors.

indexed color image A single-channel image, with 8 bits of color information per pixel. The index is a color lookup table containing up to 256 colors.

kern To adjust the character spacing in type.

labels A printing option that prints the document and channel name on the image.

leading The line spacing for type, measured from baseline to baseline of the lines of text.

linear fill   A fill that is projected from one point to another, in a straight line.

lpi   Lines per inch; a measure of resolution.

luminance   Lightness; the highest of the individual RGB values plus the lowest of the individual RGB values, divided by two; a component of an HSL image.

luminosity   A color parameter that measures the brightness of color. Luminosity is expressed as a value computed as the weighted average of the pixel's individual RGB values, expressed as a percentage (.30 x red + .59 x green + .11 x blue).

midtone   Tonal value of dot, located approximately halfway between the highlight value and the shadow value.

moiré pattern   An undesirable pattern in color printing, resulting from incorrect screen angles of overprinting halftones. Moiré patterns can be minimized with the use of proper screen angles.

multichannel image   Any image that has more than one channel.

noise   In an image, pixels with randomly distributed color values.

pattern   A selection that repeats in tiles to form a regular design.

pixel   A single dot on a computer display or in a digital image.

plug-in module   Software developed by a third-party vendor in conjunction with Adobe Systems that lets you use a function that is not available in the standard Adobe Photoshop application.

process color   The four color pigments, cyan, magenta, yellow, and black, used in color printing.

1/4 tone   Tonal value of dot, located approximately halfway between highlight and midtone.

radial fill   A fill that is projected from a center point outward in all directions.

random access memory (RAM)   The part of the computer's memory that stores information temporarily while you're working on it.

registration marks (bull's-eyes)   Marks that appear on a printed image, generally for CMYK color separations, to help you align the various printed plates.

repeat rate   The rate at which paint is deposited on an image by the painting and editing tools when the mouse is stationary.

resample   To change the resolution of an image. Resampling down discards pixel information in an image; resampling up adds pixel information through interpolation.

resize   To change an image's size while maintaining its resolution.

resolution   The number of pixels per inch in an image, or the number of dots per inch used by an output device. Resolution can also refer to the number of bits per pixel.

RGB image   A three-channel image containing a red, green, and blue channel.

saturation   The amount of gray in a color. More gray in a color means lower saturation; less gray in a color means higher saturation.

scanned image   The image that results when a photograph, slide, paper image, or other two- or three-dimensional image is converted into a digital image.

scanner   An electronic device that digitizes and converts photographs, slides, paper images, or other two-dimensional images into bitmapped images. A video camera is a scanner that converts three-dimensional objects into digital, bit-mapped images.

screen angles   The angles at which the halftone screens are placed in relation to one another.

screen frequency   The density of dots on the halftone screen, commonly measured in lines per inch.

shadow   The darkest part of an image, represented in a halftone by the largest dots.

spacing   The distance between the pixels that are affected by each painting and editing tool.

star targets   The printed pinwheels, used primarily in printing color separations, to align the different plates, and measure dot doubling, grain, and slurring during printing.

3/4 tone   Tonal value of dot, located approximately halfway between midtone and shadow.

tolerance   A parameter of the magic wand and paint bucket tools that specifies the color range of the pixels to be selected.

toolbox   The set of tools, normally displayed to the left of an image. The toolbox is a floating palette that you can move or hide.

trap   An overlap that prevents gaps from appearing along the edges of an object in a separated image, due to slight misalignment or movement of the separations on-press.

undercolor removal (UCR)   The technique of reducing the cyan, magenta, and yellow inks from the darkest neutral shadow areas in an image, and replacing them with black.

virtual memory   The memory space that is separate from the main memory (physical random access memory), such as hard disk space. Virtual memory allows you to work on large documents without requiring you to have large amounts of RAM.

zoom   To magnify or reduce your view of the current document.

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