What to Look for in Scanning Software

Correcting at the Scan Stage

By Andrew Rodney

There must be hundreds of scanners on the market, ranging in price from less than $100 to tens of thousands of dollars. One attribute common to all these scanners is the need for driver software. No matter how great the scanning hardware, without software, it is nothing more than an expensive doorstop. Potential buyers often concentrate solely on hardware specifications, completely ignoring the scanning software. But as buyers become more discriminating in the scanner market, perhaps manufacturers will try to capture sales based on the quality of both their hardware *and* software.

Why is scanning software so important? Why not simply make a quick-and-dirty scan, then fix all the problems in Photoshop? Thanks to the new 48-bit tools in Photoshop 5.0, this is a valid consideration. Performing global corrections in a 24-bit file will cause some data loss (and thus quality), but performing the same corrections in Photoshop on files with more than 24 bits of color (high-bit data) eliminates this problem. Of course, 48-bit files are twice as large as 24-bit files, so processing time will suffer.

On the other hand, producing corrections at the scan stage will

not incur any loss of speed. Scanning an image with corrections usually takes no more time than scanning a raw file. In many cases, making corrections at the scan stage on high-bit data produces image quality identical to making the same corrections in Photoshop. In some cases, the quality of an image corrected in the scan stage will be superior to even Photoshop's 48-bit capabilities.

What to Look For

Ideally, when we place an image on the scanner, we want to either match the scan to the original or produce a superior image. While some scanners I've worked with can do an amazing job of perceptually matching the original, in many cases, decisions about producing the best possible file require human intervention. Scanners that use good auto-correction algorithms (and there aren't many) can at least get us to a starting point. From there, the image usually needs tonal or color corrections. Then some selective color corrections may be necessary, providing the scanning software supports this kind of work. Few scanners support selective color corrections; i.e., the ability to alter just one color without altering the others.

When I evaluate a scanning interface, I consider the scanning software's ability to sharpen an image at the scan stage. Virtually every scan requires some degree of sharpening to overcome the natural softening that occurs in the

Figure 1. The main interface for Imacon's ColorFlex software has a large preview and clean interface. Notice the enlarged view in the lower left corner, showing the individual pixels the cursor covers (taken from the subject's eye).

scanning process. Unfortunately, few scanning interfaces provide the controls necessary to perform this important task, so often you will have to do the sharpening in Photoshop.

Another consideration is the size of the preview. It's amazing how many software packages on the market provide tiny preview windows for the prescan. After all, we have to make all of our scanning decisions from this preview. Unlike working with a file in an image editing package, we usually cannot zoom in or increase the size of this preview (which itself is simply a low-resolution file). The better scanning interfaces allow users to drag the preview window as large as they like. On a 21-inch monitor, this usually provides a good starting point.

Figure 1 illustrates the scanning interface for the Imacon FlexTight software (ColorFlex). Notice how the prescan nearly fills the screen. It also enables you to zoom into or out of the preview scan for a closer look. Zooming into a low-resolution preview causes the image quality to suffer, but this is still a handy feature for using the controls discussed below.

Some scanning interfaces, such as Agfa FotoLook 3.0, allow the user to make a selection on the prescan. The scanner will then produce a secondary prescan of that area alone, providing a larger image that can be seen more clearly. This is a great feature that more software packages should incorporate; however, the secondary prescan does take time to produce. Another feature that is quite useful is a small magnification window that shows the prescan at a pixel level, which both ColorFlex and FotoLook provide (see Figure 1). As the user moves the cursor over the prescan, a highly magnified view is updated in this small

preview window. As you will soon see, the ability to target an exact sampling of pixels is very useful. The unique and powerful interface design found in Color Quartet also provides this magnified view, and much more.
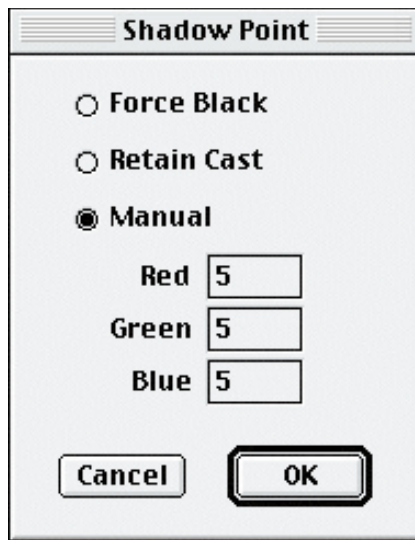

Figure 2. Double-clicking on the Eyedropper tool in the SprintScan Plus software allows the user to set the "clipping" value for the Shadow Eyedropper. In this case, Rodney set the default at 0/0/0 to 5/5/5 to ensure just a bit of data in the darkest values of the scan.

Eyedropper Tools

Now that we have software that provides a decent view of the prescan, let's examine some necessary tools for setting the tonal range of the resulting scan. It's a good idea to set the range first, then worry about correcting the color; in many cases, setting the tonal range will fix many color problems. I first try to set both ends of the tonal scale. In other words, I need to correctly assign the shadow and highlight values of the prescan. One of the easiest ways to accomplish this is to use the black and white Eyedropper tools. The Eyedropper tools allow the user to click on a pixel or a sampling of pixels and assign them a certain RGB value. For example, the blackest black in a digital image has a value of 0 red, 0 green, and 0 blue. The whitest

highlight would have a value of 255 red, 255 green, and 255 blue. If I have a white Eyedropper set to 255/255/255, whatever pixel I click on will be reassigned that exact value. If I had a specular highlight with a value of 240/245/250, and I clicked on that pixel with the white Eyedropper tool, then all the values in the image with those values or higher would be reassigned a value of 255/255/255. This would set a highlight value and ensure that the highlight is neutral.

The problem is, often we don't want our highlights to be pure white or our shadows to be pure black. Many output devices need just a bit of data on either end to produce a good print. Ideally, we would be able to set the highlight Eyedropper to a value close to 250/250/250, which would allow our highlights to have a minute amount of data. This is why Eyedroppers that can be set numerically are so important, and why Eyedropper tools that can't are problematic (See Figure 2).

Not all scanning interfaces provide these tools, and of those that do, even fewer allow the user to set the exact values for each eyedropper. In any case, it is critical to click on the right pixels with the Eyedropper tools, which is another reason why it is so important to have a large preview window, or better still, a magnifying palette. Just like the Eyedroppers in Adobe Photoshop's Levels or Curves, if you pick the wrong pixels, you could easily ruin the file.

Having a neutral Eyedropper tool, which is found only in the best scanning interfaces, is also quite important. Clicking on a pixel assigns equal red, green, and blue values, thus producing a neutral tone. This tool is very useful for removing color casts that remain in the prescan after setting the highlights and shadows. The trick is finding
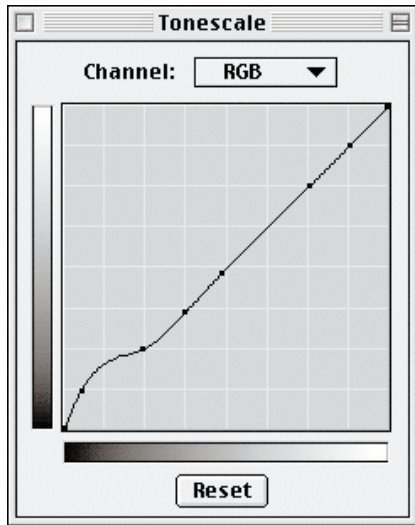
Figure 3. This curve was adjusted to manipulate just the shadow area of the prescan.

an area in the prescan that you know should be neutral and precisely clicking on only those pixels. Using all three Eyedropper tools, the tonal range of the prescan and the color casts can usually be set correctly.

Fine Tuning with Curves

Another tool found in many scanning interfaces, and one which is quite useful for setting tonal range and color, is the Curves control. In most scanning software packages, Curves work the same way as they do in Adobe Photoshop. Many new users find Curves confusing and move to a simpler—and far more destructive—tool, such as Contrast and Brightness. Avoid using Brightness and Contrast at all costs, because while the interface seems simple, the controls are very crude. Brightness and Contrast are linear corrections, while Curves is not. This means that as you move the Brightness and Contrast sliders, *all* the tones in the image shift in one direction or the other. You may increase the lightness in the shadows, but you are also lightening all the other tones in the image, including the midtones and highlights. Curves, on the other hand, allows a specific area in the tonal range to be adjusted and leaves other areas untouched.
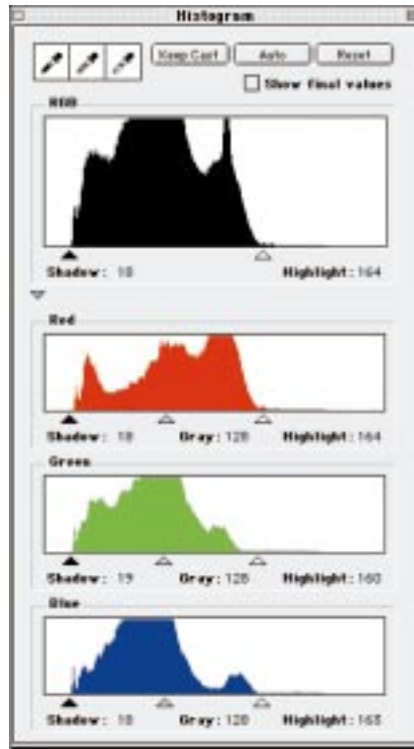

Figure 4. The Histogram feature in ColorFlex software allows the manipulation of all colors (top) for changing tonal values, or individual colors for changing the color balance. Notice the Eyedropper tools and a button that allows the user to retain a color cast if desired.

Notice the Curves in the Polaroid Sprintscan Plus scanning interface (Figure 3). They are similar to Photoshop's Curves. The grids on the Curves allow the user to precisely lock down some areas so that no manipulations will be carried over into other areas.

In Figure 3, I pulled a curve in the lower left portion of the dialog, which affected the shadows in the prescan. By moving the curve upward, I retargeted all the dark tones to make them lighter, but in a smooth fashion (by virtue of the gradual curve itself). Notice that I locked down the rest of the tonal range of the image by placing a point on the entire curve directly on the straight line. This gives me the ability to manipulate just the lower end of the tonal curve, near the shadows, while leaving the rest of the curve unaltered. This same approach can be used with Photoshop Curves

and provides the user with almost unlimited control over areas of the tonal range. By manipulating a curve on just one color channel rather than all three (Red/Green/Blue), the user can precisely alter just the color of the prescan in specific areas of the tonal range.

To remove a color cast from the shadows (cyan for instance), simply click on the red channel in the pull-down channel menu and start pulling on a point in the lower regions of the curve, while locking down the rest of the curve. Curves is such a powerful correction tool in both scanning and imaging software that I would have to reject any scanning interface that lacked this important tool.

Another useful tool for dealing with tone and color corrections is the standard histogram (though it is implemented in few scanning packages). While curves may provide more control than a histogram, the graphical feedback in a histogram can be very advantageous. For example, you can see exactly where the data to be captured is laid out, and you can move the sliders on either side to precisely pick which end of the tonal range you want to capture. In Figure 4 (the ColorFlex scanning interface), I moved the sliders on either end of the histogram until they both butt into some real data. This is much like using the black and white Eyedropper tools to set either end of the tonal scale, except here I set the range not by clicking on the prescan, but by simply moving the sliders into position.

Selective Color

Better scanning packages provide the user with selective control tools that allow fine tuning of color and sometimes density. However, it's impossible to make selections for prescan corrections the same way you use the Lasso tool in image

manipulation packages. This means that, by and large, all tonal or color corrections must be applied to the image globally. For example, if you scan a landscape image in which all the color and density settings are to your liking, except for a cyan cast in the blue sky, you can use the selective color control to introduce more red into a specific range of blue that includes the sky. However, if the blue lake also falls within that range, and it doesn't have a cyan cast, you will be unable to remove the cyan cast in the sky without affecting the lake as well. This is where you need an image editing application after the scan.

Most of the scanning interfaces that provide selective color require you to pick the color you wish to alter (sometimes enabling you to increase or decrease the range of colors affected), and provide you with an interface that allows those colors to be remapped to a different color or density value. This is one of three different selective controls found in LinoColor (see Figure 5).

All the colors of the spectrum are divided into a pie with six slices. You pick the slice that contains the colors in the image you wish to alter and simply move the center control point to any of the other color slices. This remaps all the colors in the first slice to the new values. In Figure 6, I've gone overboard to illustrate how only some colors can be affected using this feature. Of all the controls I've seen in various scanning interfaces, selective controls seem to differ the most from package to package.

Sharpening a Scan

Many scanner software packages allow you to sharpen the files being scanned. Virtually every file needs some sharpening, so you would expect this feature to be consistent and easy to use. Unfortunately, few
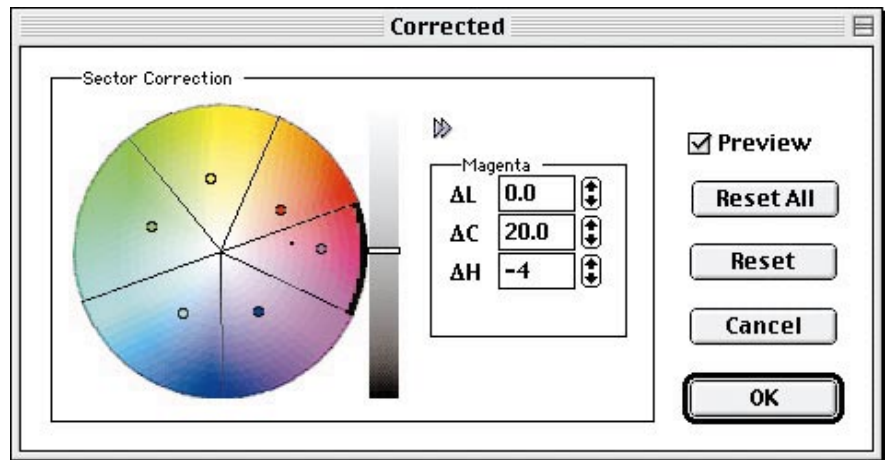

Figure 5. LinoColor's Selective Color interface allows the user to change the color cast in one color without affecting other colors of the image.

Figure 6. This illustrates the effect of using selective color manipulation to an extreme. The sky in the background is normally blue, but Rodney instructed the Selective Color feature to add magenta to just the blues in the image.
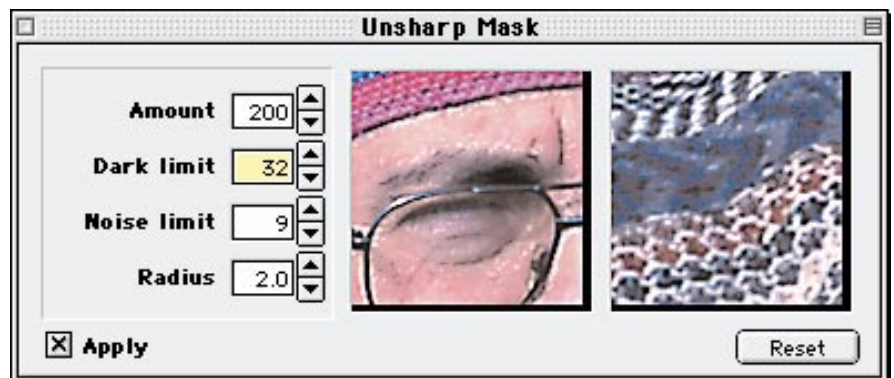

Figure 7. This figure shows the high resolution preview that Imacon's ColorFlex provides. It gives on accurate representation of how the sharpening will be applied at the scan stage.

software packages have sharpening controls that are worth using, primarily because sharpening is both resolution-and-output dependent. A 10MB file destined for output to a four-color press will need a much different degree of sharpening than a 50MB file destined for a film recorder.

ColorQuartet's Densitometer Tool

Here is a scanning interface tool to die for. It is just one of the many ScanView ColorQuartet tools that we use to drive our ScanMate drum scanner. This one palette has several incredibly useful tools for adjusting the prescan. Notice the large preview window to the right of the palette, which shows a magnified view of the prescan where the cursor is set. The pull-down menu allows the user to pick five different samplings from a single pixel to an average of 37x37 pixels. This sampling is updated in the numeric boxes seen in the interface. The software provides numeric figures in LCH, CMYK, or RGB. In fact, the pull-down menu above the LCH readout allows the user to change the readings to LAB, XYZ, or XYY. In the Edit labels above three or in the numeric readouts, you can enter numbers in any color space and update the prescan to these figures.

A feature unique to this palette, one I wish all scanning interfaces had, is the sampling area with eight color patches. When you click on one of these color patches, the software will
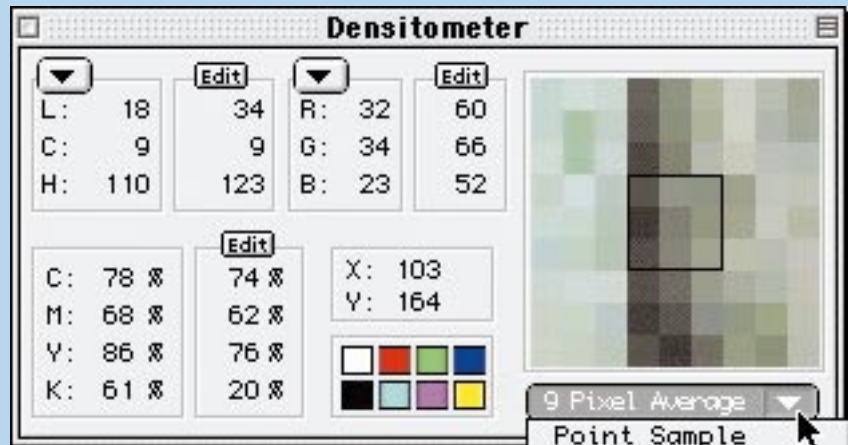

Figure 9. ScanView ColorQuartet has a unique and powerful interface.

go out and examine the entire prescan to find the closest matching colors. For example, say you want to find the blackest black in the image. Simply click on the black square, and a few seconds latter, the darkest set of pixels will be located, and the magnifying window will update to indicate where in the preview these pixels reside. Pick a sampling size with the pull-down menu (e.g., a 9x9-pixel sampling), and then

you can precisely set the shadow end of the tone scale by clicking in one of the editable fields and updating the numbers. If the black is reading 0R/0G/3B, and you want to target the darkest pixels to 5R/5G/5B, simply type those figures into the field. Unlike the Eyedropper tools, which require the user to manually find the darkest area of the image, this interface does all the work for you, and very precisely.

What complicates matters further is that it's nearly impossible to know how much to sharpen a file without seeing it at 100 percent. Since we are dealing with low resolution prescans, visual sharpening isn't going to work well. Better scanning packages overcome this problem by controlling the scanner and instructing it create a small section of the image at high resolution. Notice that in Figure 7 I have clicked on two different areas of the low-resolution prescan. The FlexTight scanner then scans both areas at the resolution I've set in the main dialog box. As a result, I see a small, full-resolution preview, and I can use various controls to precisely set the sharpening parameters.

Scanner packages that don't allow this kind of control make it difficult to visually pick the correct sharpening parameters. In some cases,
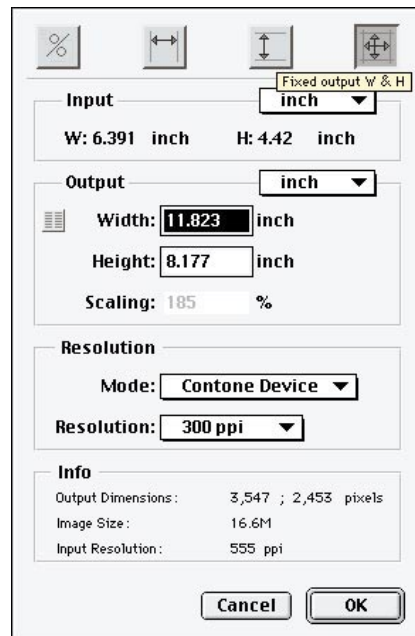

Figure 8. Agfa FotoLook 3.0 allows the user to set sizing and resolution by selecting the appropriate icon at the top of the interface.

it's not even worth setting the sharpening controls at all when

scanning, but rather save all the sharpening for Photoshop. I recommend implementing a double dose of sharpening, especially for files that will have multiple output requirements. Try to sharpen only a small amount to overcome the inherent softness in the scanning process, and then archive that file. When the time comes to send the file to its final output device, sharpen it again appropriately. You may be able to find a setting in your scanning software that produces that first round of sharpening, even without the elegant controls of ColorFlex.

Fine Tuning

I've covered most of the tools necessary for a good scanning interface. Other controls may also be important, such as the ability to descreen previously printed artwork.

Usually there isn't much involved here from the perspective of the user interface. What is important is knowing (or guessing) the linescreen resolution at which the original was printed, and more important, the quality of the descreening algorithm. I've worked with several scanners that did an amazing job of completely removing any sign of the original dot pattern.

Other areas to consider are how the scanner implements color management features. Can the scanner accept an input ICC/ICM profile? With the exception of the Sprintscan, all the scanners I've discussed allow the user to load input profiles for the scanner, profiles to describe the monitor, and output profiles. This allows the scanner to be fully color managed. We can now see an accurate soft proof on screen that shows how the file will ultimately output, thanks

to the use of ICC/ICM profiles.

These scanners also allow the user to scan directly into a CMYK or RGB color space for a specific output device. This can be a great time-saver. Be aware that most, if not all, scanners that are driven directly in Adobe Photoshop 5.0 may not be aware of the currently selected RGB setup, and could produce scans that don't match the preview. This means the user must run the raw scan through the Profile to Profile command in Photoshop to bring the scan from the monitor RGB into the correct RGB color space (for more information on Photoshop 5.0 and its behavior with Working Color Spaces, see *PEI* August 1998). As time goes on, scanner manufacturers will update their TWAIN or acquire modules to keep track of the RGB setup in Photoshop 5.0.

Another useful feature of some scanning software packages is the ability to save the high-bit files to disk for further work in Photoshop or archival purposes. If you have a 10-, 12-, or 16-bit-per-color scanner, it's often very useful to do all the corrections possible in the scanning interface and still ask the software to provide a high-bit file to disk. With the speed of today's machines and the low cost of storage, plus the uncertainties of future output requirements, many users want to have this high-bit data.

Size Does Matter

One feature most scanning interfaces seem to ignore is an easy-to-use set of controls for setting file size and resolution. Many users require different methods of requesting a scanned image size: Some go by percentages, some by megabytes, and others specify size based on the final output resolution. With ColorQuartet, you can toggle the interface five different ways, depending on what you wish to accomplish with the scanner. Want a 25MB file? Simply click on "File Size," enter 25, and the software does the rest. Agfa's FotoLook provides a number of methods of setting resolution/file size, depending on which button you pick (see Figure 8). You can size up a file in percentages, or simply ask the scanner to produce a file that has a certain number of inches at a specific resolution. ◀

More Info? Circle Reader Service No.:
Adobe Systems Inc.   (170)
Agfa Gevaert LLC   (171)
Imacon Inc.   (172)
Heidelburg-Druchmashienen AG (173)
    (LinoColor)
Polaroid Corporation   (174)
ScanView Inc.   (175)

Andrew Rodney operates Camera & Darkroom Digital, a service bureau and training center in Santa Fe, New Mexico. Reach him at rodney@peimag.com.