BY ANDREW RODNEY

FILM VS. DIGITAL

The Bout Continues as Film and Digital Capture Duke It Out in an All-New Test

In "Film vs. Digital" (April 1998 *PEI*), I compared the quality of images I captured with a high-resolution scanning back to the quality of images I scanned from 4x5-inch film. I used the same colorful artwork in the test shots. I captured a 121MB file with a Phase One scanning back, then scanned the 4x5 film capture into a 121MB file. I had expected the quality of the digitally captured image to be better in some areas than the scanned film image, but I was amazed to discover that in virtually every aspect, the digitally captured image file thoroughly out-classed the file scanned from film.

Since that article appeared, I've been able to examine nearly all of the new professional digital cameras that shipped in late 1998. A new generation of CCDs began to show up in such instant capture cameras as the Scitex Leaf Volare, the Kodak DCS-560, the MegaVision S3, and the Phase One LightPhase. The new chips produced files of roughly 18MB and, with the exception of the three-shot Leaf Volare, they could all capture images in an instant, just like conventional film cameras.

At the trade shows I attended, virtually all of the digital camera manufacturers displayed poster-sized examples of images captured with their cameras. Could 18MB files really produce such amazing quality in such huge prints? I decided it was time to make another test of film vs. digital.

To the Laboratory

For my latest experiment, I wanted to see how instant capture digital cameras compared with conventional film cameras, and I also wanted to examine a scanning back and a three-shot camera.

Scitex Corporation Ltd. was kind enough to loan me a Leaf Volare three-shot digital camera (one shot each with red, green, and blue filters). For my comparison of a true color capture device with large-format film capture, I used a Better Light 6000 scanning camera back, which fits most 4x5 view cameras. With a resolution of 6,000x8,000 pixels, the Better Light 6000 can produce a 137MB file in 24-bit color. I also used a Leaf Cantare single-shot digital camera back, which fits on a conventional Hasselblad medium-format camera. This combination of test cameras gave me the flexibility to easily remove each digital back and insert a standard film back to make a film capture of the same scene.

The CCDs in these systems are not the same size as the film you would normally use with these cameras. In the case of the Leaf Cantare and the Leaf Volare, the actual CCD is nearly the same size as 35mm film. This presented two issues: First, the film image taken with this camera would be far larger than the image captured with the CCD back. Second, since the CCD image area is smaller than the film image area, the equivalent lens field of view would not match.

To stack the deck in favor of film capture would mean moving the camera exactly, or else using a another lens with a different focal length to make the digital and film images match. In the end, I decided it would be better to leave the camera and lens in the same position and shoot the digital and film test shots in the same way (in essence, the digital capture would match 35mm film more closely than medium-format film).

Exactly what could you do with the 18MB file captured by a camera like the Leaf Cantare anyway? A half-page repro, a two-page spread? I wanted to get an idea of the quality you could expect from such an apparently small file, and perhaps to illustrate that an 18MB file captured with a digital camera is in no way equivalent to an 18MB file scanned from film. With the Leaf Cantare and the Leaf Volare, it was obvious that I would need to interpolate the 18MB file if I wanted to produce a two-page spread—an ambitious challenge! Few photographers would use 35mm film for a

A small section of an image shot with the Better Light 6000 scanning back at 19MB, then interpolated to 102MB.
Insert: A second image I shot with the camera back set for a true, non-interpolated I02MB capture.

A small section of the 4x5 film scanned to 102MB on the drum scanner. Grain and lack of fine detail should be evident.

The 18MB images from the Leaf Cantare (top) and Leaf Volare (middle). The insert shows a section of the file interpolated to 102MB in ColorShop. Sharpening was applied at the default settings in ColorShop 4.1 and the supplied ICC profile for the camera.

A small section of the 120 film scanned to 102MB on the drum scanner.

two-page spread, unless special circumstances required the particular capabilities of the 35mm format.

I used both Adobe Photoshop and Leaf ColorShop software to interpolate the 18MB Leaf Cantare and Leaf Volare captures to l02MB (see sidebar, "ColorShop vs. Photoshop and Interpolation").

I also digitized the film versions of my tests into approximately l00MB files on a drum scanner—essentially, I was producing true, non-interpolated data. I figured that scanning the film original to 102MB would really challenge the digital images. After all, film, unlike digital files, can be scanned to virtually any size without interpolation. Why not test the flexibility of this capture mode against the fixed file size of the Leaf cameras?

With the Better Light 6000, I also produced an image file of approximately 18MB, then interpolated the file to 102MB. Certainly the Better Light 6000 can produce files much larger than 18MB and of better quality, but this allowed me to examine a true color scanning capture against the interpolated color files and the non-interpolated scan made from conventional film. Again, I scanned the 4x5 film to produce a l02MB file.

The 18MB files from Leaf ColorShop with the custom ICC profile I made in Color Solutions ColorBlind Pro. Compare the color accuracy and saturation with the tops two images on page 36, which were processed using the supplied ICC camera profiles from Scitex.

Methodology

I tested the Leaf Cantare and the three-shot Leaf Volare against Kodak Ektachrome 100 Professional (EPN) 120 film using the same still life for each capture. I placed a MacBeth color chart and a Kodak Q60/IT8 chart in each shot to use as targets for generating custom ICC profiles for the cameras. With the Leaf backs, I used a standard Hasselblad camera with a 120mm lens. The cameras were tethered to a 366MHz Power Macintosh G3 with a Miro PressView XL-calibrated display. The still life was shot with a single soft box, and all of the film images were bracketed at $1/3$ stop over and $1/3$ stop under the light meter readings of the set. The exposure adjustments were made with the power variation on the flash power pack so I could leave the f/stop set to f/8.5 for every shot. True to past experience with such digital camera backs, the software was of great assistance in composing and lighting for these tests. The large preview and such tools as the densitometer made the job much easier than shooting with conventional film.

The Leaf backs will operate well enough with studio flash, but since the Better Light 6000 needs a continuous light source, I opted to shoot on location at the Greek Church in Santa Fe, New Mexico. I used a Calumet 4x5 view camera with a 180mm lens with the Better Light back, which I connected to my Macintosh G3 PowerBook. Exposure time was 1/125 second at f/32.5 on Kodak EPN 100 ISO film. Because I was unable to set the Better Light digital back to make a file of exactly 18MB, I settled for a 19MB file. It took 2.5 minutes to scan the image at a resolution of 3,000x2,250 pixels in 24-bit RGB.

I had saved the Leaf camera captures as standard RGB TIFF files of 18MB (3,144x2,060 pixels with a few pixels of black around each capture), and interpolated them 235 percent (102MB) in both Leaf ColorShop and Adobe Photoshop. The 19MB image captured by the Better Light was interpolated 230 percent (6,900x5,175) in Photoshop to produce a 102MB file.

Once the film was processed and I had selected the best exposures, I scanned it to match as closely as possible the pixel dimensions of the 102MB interpolated digital captures.

Leaf Cantare

The new Scitex Leaf Cantare is virtually identical to the Leaf Volare I reviewed in March, except that the Leaf Volare is a three-shot system, and the Leaf Cantare is an instant capture back. The 2,048x3,096-pixel image area produced with the active cooling CCD chip housed in the back is capable of capturing 14 bits per color. Like the Volare, the Leaf Cantare mounts on conventional camera bodies such as Hasselblad, Mamiya, and the Fujifilm 680. Also like the Volare, the Cantare has a V-twist feature that allows the rectangular CCD to be instantly moved into either horizontal or vertical format. The Live Video Preview functions allow you to focus, compose, and adjust lighting in real time as you examine a black-and-white, high-resolution preview on the computer monitor. The Leaf Cantare is expected to ship this month, with a price tag of $23,000.

Observations

Prior to scanning the film, I spent a good deal of time comparing the Leaf Volare capture to the Leaf Cantare capture. I was quite impressed with both the normal and interpolated versions of the Leaf Cantare image. There was a tiny amount of color aliasing present in the single-shot Leaf Cantare image, but none at all in the three-shot Volare image. I had expected to see an abundance of artifacting in the business card, teddy bear, and fireplace grate—but you be the judge of the quality of the printed piece.

Naturally, interpolating the files 230 percent exaggerated artifacting, but using ColorShop to interpolate and sharpen the HDR file produced about the best quality you could expect under the circumstances. The interpolated Leaf Volare capture shows no artifacts, yet there is a slight decrease in apparent sharpness. The Leaf Volare capture was also more vibrant and saturated (notice the colors in the MacBeth color chart), possibly due to the ICC camera profile supplied with Leaf ColorShop 4.1, which I used with both Leaf cameras. With ColorShop 4.1, the user can specify a camera profile and embed it into every file it saves.

When opening Photoshop 5.0, I was able to convert the supplied profile into my RGB working space, thus ensuring a match in previews between the two applications. In addition, I made a custom color profile for both cameras by using the IT8 target in the scene and loading that portion of the image into ColorBlind Pro from Color Solutions. Notice the difference in quality between the supplied "canned" profile and the custom profile that I made (page 37).

The difference in color and saturation was astounding! Clearly, creating a custom profile makes a profound difference in image quality. For the comparison images using the interpolation tests, I used the supplied Leaf profile (top and middle images on page 36).

When it came time to compare the scan of the 4x5 film to the interpolated Better Light 6000 file, I was surprised (top image on page 35). First, I looked at the image from the scanning camera and noticed the typical stair-stepping associated with interpolation. I wasn't pleased.

However, viewing the drum scan of the 4x5 film changed my mind (bottom image on page 35). While it wasn't interpolated at all, it was, in my opinion, an inferior image. Viewed at l00 percent in Photoshop, the film grain—and lots of it—was all too obvious. I also saw far less detail in some areas of the image, like the fine texture in the roof section of the church. In contrast, the detail in the image captured with the scanning camera was quite evident, and there was no graininess.

No matter how I scanned the film capture, I simply could not get detail in the highlights of the roof unless the film was underexposed by at least one half stop. But scanning the underexposed film resulted in great loss of shadow detail in the foliage below the church. In fact, even with the "properly" exposed film capture (with no highlight detail), the detail in the shadow areas was still far less evident than in the digital capture. There was no question that, even with severe interpolation, the digital capture appeared sharper, with no sign of grain, had a wider tonal range, and suffered only a bit of stair-stepping and artifacting from interpolation. The scanned film image of the still life didn't look much better (bottom image on page 36); the grain was evident and the image had a far narrower tonal range than either the Cantare or Volare capture.

The Proof

I was able to visually inspect the files on a high-end display, but the

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ColorShop vs. Photoshop and Interpolation.

For years, the Scitex folks have been boasting that ColorShop, the software that drives their cameras, has an interpolation algorithm superior to Adobe Photoshop. This, they claim, is one reason users can enlarge camera files so greatly with no apparent loss of quality. I decided now was the time to test this claim.

What you must understand about ColorShop and the files the Scitex Leaf cameras produce is that they are in a proprietary file format called HDR. This file contains 14 bits per color. When ColorShop applies corrections and sizing, it does so on this high-bit data. For my tests, I exported an RGB file from ColorShop to interpolate in Photoshop, after which I applied the Unsharp Mask filter and attempted to match the degree of sharpening in both files. When I interpolated the 42-bit HDR file to 230 percent and interpolated the 24-bit file to the same size in Photoshop (using Bicubic interpolation), I saw a slight difference in quality with the Leaf interpolation.

A small section of the Leaf Volare capture interpolated in ColorShop (top) and Photoshop (bottom).

Viewed at 100%, the ColorShop file looked sharper with less of the stair-stepping that is typical of interpolated images. It's difficult to say whether this difference would be noticeable on output to a halftone dot, but in this test at least, ColorShop provided a compelling advantage over Photoshop for sizing-up images. The fur of the bear and the text on my business card are areas to examine for quality in sharpening.

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best way to evaluate the differences in quality is to look at the output. We can do just that as we compare the images on these pages—ink on paper. Keep in mind that the 19MB file I produced with the Better Light 6000, then interpolated 230 percent, could actually be printed larger than 23x17 inches at 300 dpi to a halftone process, using a quality factor of 2X. This means the interpolated images captured by all three cameras could be reproduced far larger than a two-page spread. For continuous-tone output on large-format digital printers, these files could produce a 34.5x25.8-inch, 200 dpi print—and who knows how far beyond 230-235 percent you could interpolate the files!

The vast majority of professional imagers could use these 18-19MB files in a number of ways, and achieve excellent quality. While I can't comment on film's ability to reproduce images in print as compared to an interpolated digital file—at least not until I see this article in print—I'm pretty sure that, once again, digital capture will give film a run for its money. Film has grain, and grain seems to obscure a great deal of detail that digital capture completely eliminates. This, combined with the far wider dynamic range of digital cameras, seems to put conventional film to shame. I'd love to know your impressions; e-mail me and let me know. ◀

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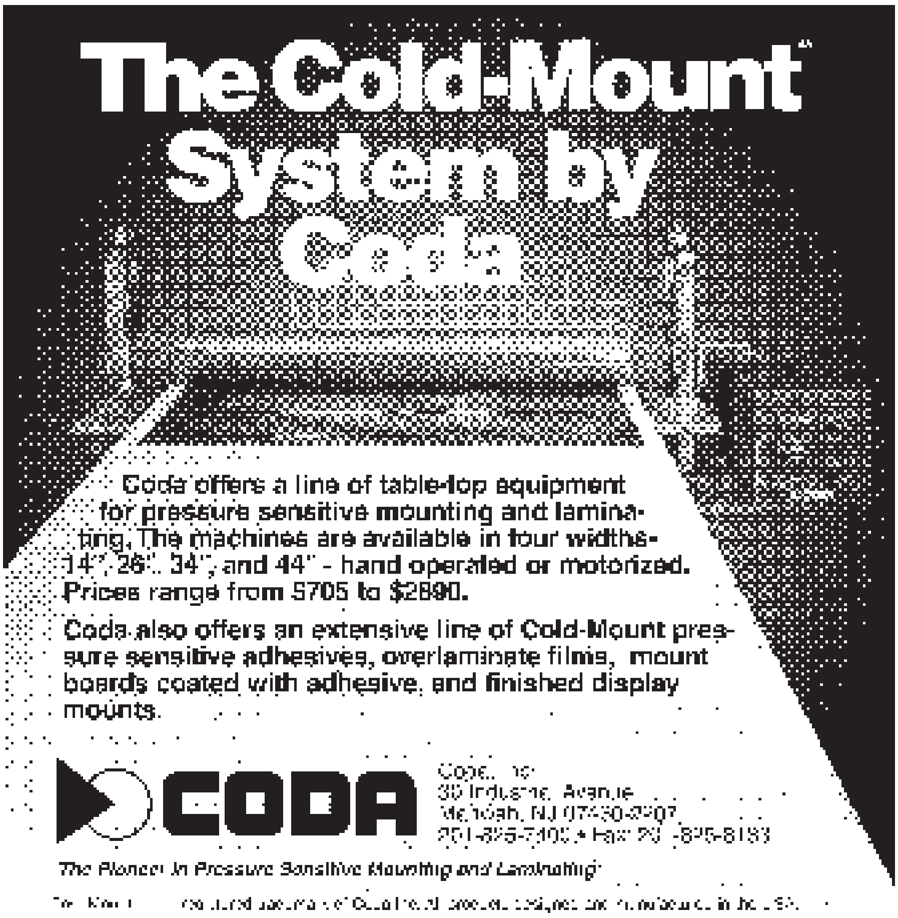

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