POST EXPOSURE

Advanced Techniques for the Photographic Printer

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This book is dedicated to Ray Bradbury and Charles Smith,
without whose encouragement I would not have become the photographer I am today.

It doesn't matter how you get there, if you don't know where you're going.

—The Flying Karamazov Brothers

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PREFACE

Ansel Adams observed that the film is the score and the print is the performance. When I exhibit my best prints to an appreciative audience, I feel akin to the Wizard of Oz. Dorothy and her companions were supposed to see only that majestic head with the spouting flames and smoke and to ignore the little man behind the curtain pulling the levers. If I am successful as a printmaker, my viewers look at my work with joy at its beauty. They don't note the tricks, manipulations, and outright visual deceptions that go into making a print that inspires awe.

I've been doing serious photography for 34 of my 48 years. By the time I'd taught myself how to make dye transfer prints from my color negatives, back in 1975, I thought I was a pretty hot printer. I now know I wasn't half as good as I thought. 20 years hence, I'll look back and again be embarrassed by how much I thought I knew. Fine printmaking is an everlasting learning experience for all of us.

When I began my life in the darkroom, prints were still universally made on fiber-base paper, C-22 processing was standard for color negatives, E-3 was still common for some transparency films, and Cibachrome (now Ilfochrome) had yet to take its place in the darkroom community. Many materials available to the typical darkroom worker have improved immensely. We have also seen changes for the worse. Dye transfer printing was killed by Kodak in 1993. Although a few other printers and I still make these finest of prints, our supplies are limited and our prospects for ever getting more are uncertain.

Although materials have changed over the years, I've found the principles of fine printing haven't. Master printmaking is a discipline requiring both talent and knowledge and no small amount of legerdemain. The discipline doesn't come from the specific printing materials one uses or whether one prints black and white (B&W) or color or even whether one works in the darkroom or at a computer. The methods of fine printmaking are rooted in our own perceptions, the ways the human vision system sees the world, the ways that photographic materials see it differently, and immutable laws of optics and nature.

This book is not a primer on photographic printing. I'm not going to tell you how to develop a roll of film or process a print, and I assume you have a working knowledge of photography. Its purpose is to teach photographers the refinements of photographic printmaking, to take them from making those merely competent prints to making excellent ones.

This book brings together disparate fields of knowledge, distilled from my three decades of learning and experience in color and B&W photographic printing. In learning about both a human's and a film's perception of the world, you'll pick up some informational tidbits about color theory, the nature of the human visual system, information and measurement theory, neurophysiology, and other arcane topics. Still, most of this book is about tools, techniques, and darkroom procedures; I intend this to be a practical book, not one of difficult-to-apply theory.

Even novice printers can learn from this book. Some of what I say is pretty fundamental, but it is information most photographers don't know and won't find in the average photography book. I intend this book to be useful to anyone making color or B&W prints, including people working with a computer instead of an enlarger. One can't entirely fix an ineptly photographed image on a computer any more than one can fix it in the darkroom. If one doesn't understand the principles of good printmaking or have a real understanding of what the viewers truly see when they look at a print, one is no more likely to produce a truly fine print with the aid of a computer than with an enlarger. The tools change, but the principles don't.

Results speak for themselves. You can see several dozen of my finest photographs on your computer. I've created a Web site called Ctein's Online Gallery (http://www.plaidworks.com/ctein/), which contains very high-quality screen images of some of my dye transfer photographs. My site also includes a smattering of articles by me, including a lengthy one on dye transfer printing, and hints and tips for viewing images on your computer with the best possible fidelity. You can also reach me through my e-mail address (71246.216@compuserve.com). I do enjoy hearing from my fans!

Acknowledgments

So many people have helped me over the years that there is no way I can thank them all. I feel a special appreciation must go to Frank McLaughlin and Bob Nadler; their support and sage advice helped make me the fine printmaker and photographic writer I am today.

I am grateful to Tammy Harvey, whose very hard work made this book possible. I am equally grateful to Jodie McCune, whose equally-hard work made it *real*.

For everything, from suggesting the structure of this book to suggesting its title, I owe an enormous debt to Laurie Toby Edison, a fine photographer and my finest friend, now and always.

Last, and most definitely not least, I thank my dear housemate, Paula Butler, for contributing unflagging love and support, helpful feedback and commentary, and a knowledge of grammar vastly superior to mine.

Introduction

A photographic print is not reality but interpretation, a mere mapping of reality. This simple core truth of photography is ill-understood and frequently ignored. The photographic map of visual reality is no more accurate than the familiar Mercator map of the earth, with its huge Greenland and diminished tropics.

At the beginning, there is a photographer looking at the real world; at the end, a viewer looking at a photographic print. In between lies a long, narrow, twisted pipeline called the photographic process, which stretches, squeezes, and rearranges the world. Each segment of that pipeline adds its own biases that emphasize its strengths and introduce new weaknesses. The photographer and printer direct the overall interpretation, but results are equally controlled by the characteristics and limitations of each of the components of that process—the film, the paper, and human vision. For photographers to make truly excellent prints, they need to understand how the entire photographic pipeline works and how they can manipulate it to their ends. To extend Adams' metaphor, although a master printer can produce a superb print from a less-than-masterful slide or negative, it's a lot better to have a great score and play in a good hall.

One can be an entirely competent printer yet still not know how to make quality prints. Understanding the twists and turns in the photographic pipeline, taking advantage of the components' strengths and knowing where the weaknesses lie is how one makes truly effective photographic prints. As photographers, we try to photograph what we see. Even if our ultimate objective is to utterly transform that vision in the darkroom or the computer, we usually begin with what our eyes perceive, and we always end with what the viewer sees in our images. Densitometric measurements do not define a superb print; the viewer's reactions do. Only a handful of printers know much about what viewers actually see when they look at a print. You must understand something of that, or you won't be able to figure out what your printing objectives are; you'll be like a gourmet cook who doesn't know what tastes good. Consequently, the very first chapter is about human vision because that's critical to understanding how we choose to make photographs, how we need to print them and display them, and the ways in which those prints cannot live up to our expectations.

We're not talking about creating art, per se; we are talking about how the many steps in the photographic process confine the artist and about what those steps' potentials are so that the artist can create art that speaks to the viewer in the way the artist wishes it to. Films simply don't see the world the way humans do; they do not reproduce color or tone as we see it. Few photographers really understand how the film sees light differently from humans; it's the next twist in the pipeline and the subject of the second chapter of this book. Most darkroom workers do not really understand how their print materials respond during printmaking—yet another bend and another chapter.

Although I hope that you will sit down and read this book cover to cover, I'm a realist. Each chapter stands on its own as much as possible. When chapters build on material that I have covered previously, I'll point this out and direct you to the appropriate portions of the book. I've put as much of the theory in the early chapters as I possibly could. If you just want to learn from my techniques and don't care (or already know) how they and why they're important, you can skip ahead.

I believe that *why* you do something in the darkroom is perhaps even more important to knowing how to make truly fine prints than is knowing *what* to do. Mere technique won't make you a great printer; you also need to understand your goals. This book will help you understand where you're going and how to get there.

CHAPTER 9

TRICKS OF THE TRADE

SAVE A TREE: LEARN TO PRINT

A friend asked how many sheets of color paper it takes me to get a good print. It seems he had resumed printing after a moderate hiatus and found himself using 7 to 14 sheets to get the print exactly right. He felt he ought to do better than that. I felt he could do a lot better.

I use about 0.2 sheets per negative for the proof sheet (two half-sheets and one full sheet to make a good proof of 10 medium-format negatives). With the proof sheet to guide me, I need an average of two half-sheets for test prints. Sometimes, I get the print after one test, but just as often I find I have to make a third test. There's another sheet for the final print. One of three or four times, I look at that print and realize I missed a burn-in or some such subtlety. That adds another 0.3 sheets, on average. Total: 2.5 sheets to get a cropped, color-balanced, masked, and dodged and burnt-in final print that would make any custom lab proud.

I'm not counting the obvious blunders, such as failing to stop down the lens or flip in the filter pack in the color head. I still commit goofs like this frequently enough to embarrass me. Even counting all my brain-dead mistakes, I use well under 3 sheets of paper per final print. Part of the reason for this low level of waste is decades of experience and a very good eye. It typically takes me 3.5 to 4 sheets to get a good black and white (B&W) print. I think the difference is primarily because 95% of my printing these days is color, so I'm always a little rusty when it comes to B&W. The rest of the savings come from my economical tricks and techniques.

First, I proof all my negatives religiously. I'm 10 years behind in making enlargements, but my proof files are up to date. Good proof sheets provide accurate information about the relative color balance and density of negatives and show what areas of the image will need local exposure correction. I make my proofs with the enlarger height set for the same print magnification I would use to make an 8 x 10 print from the negatives I am proofing. I write the exposure data in my printing log and on the edge of the proof sheet for future reference (Plate 19).

If you work with slides, you don't absolutely need to make proof sheets, but remember that it is difficult to judge the relative density and color balance of two slides on a light box because the human eye tends to normalize the appearance of "luminous" objects like backlit slides. Worse, different brands of slides require different print filtration even if they look identical on the light table (see Chapter 1). You can't rely on your eye to tell you whether an Ektachrome 64 slide will need the same filter pack as a Fujichrome Velvia slide did. If you've had trouble estimating the exposure for your slide prints, start making proof sheets. They will solve the problem.

I derive my starting filter pack and paper grade from the proof sheet. I don't mean that I blindly use the same exposure settings; I treat the proof sheet like a first test print to which I'm applying corrections. I don't use a densitometer or an on-easel color analyzer. I've got nothing against them, but they don't improve my productivity. If they help you, more power to you! Video analyzers are another matter. I think they're great; if only I could afford one. I do use Kodak Print Viewing Filters. They're worth their weight in platinum.

One can't do precise color correction or selection of paper contrast (B&W or color) until the exposure's in the ball park, but one can correct gross errors. If the first test looks 40 CC too cyan, it doesn't matter how bad the exposure was—you *know* you have to wipe out some of that cyan. My print tests always include a series of exposure steps. How tightly I cluster the exposure times depends on how confident I am that I know how the neg will print. When I am clueless, the steps may run 5, 7, 10, 14, 20, and 28 seconds. They'll run something like 14, 16, and 18 seconds when I am more sure or when I'm fine-tuning the density. My final print is usually within 1 CC filtration and 3% exposure of what I want.

Don't sneak up on the correct filter pack, contrast, and exposure time from one direction because that produces a lot of wasted prints. It is much more efficient to overguesstimate the correction. You will then have test prints that bracket the correct filter pack or paper grade. One can always interpolate more accurately than one can extrapolate.

Box-to-box consistency for any particular color or B&W paper is now very good. Kodak Portra II shows less than 5 CC variation, for example. Switching from brand to brand can be a different story. Kodak Portra II and Supra need almost identical exposures, but Ultra is very different—roughly a stop faster with about 15 CC less red filtration. Some Fuji papers have almost the same filter packs (as each other and as Portra II); others don't. Note that this can all go out the window when a product line changes. For instance, Polymax II B&W paper doesn't look at all like the original Polymax—paper grades are anywhere from a half-contrast grade to two grades different.

For color, I write the relative filter pack used on each box of paper. For example, I made prints that matched as closely as possible using my current batches of Portra II and Fujicolor FA-C. I found that FA-C needed 71% of the exposure of Portra II and a -7M, -9Y filter change, so I wrote that on the Fuji box. Thus, if I try a print on one paper and don't like it, I can go to the other with almost no waste.

You can also record relative filter packs for films. It may not be accurate without carefully matched negatives or slides, but you'll have some sense of what exposure a "normal" print from each roll of film requires. Even if your relative film data are no closer than a half-stop and 10 CC, it's still a lot better than printing blind. It's also worth noting the relative packs for images shot under incandescent, fluorescent, and sunlight. By keeping track of films' relative filter packs, you'll save yourself a lot of frustration, wasted time, and paper. Tape a little card with the starter packs on the wall near your enlarger.

I save darkroom time with an old trick for previewing wet color prints. If you take a wet chromogenic print, wipe the excess water off the surface, and immerse it in a tray of Rapid Fixer or Color Fixer concentrate, the bluish veil over the image immediately clears and the print looks exactly as it will after it is dry (this trick does not work with Ilfochrome).

I rinse a print in water for about 15 seconds to clear out the orange bleach stain before the print goes into the fixer concentrate. I pull the print from the fixer, ready for inspection. If the print is good, I fully wash it. If it's bad, I can make another print a minute or so after the first print exited the processor. You haven't lived until you've enjoyed this kind of turnaround on making test prints.

Finally, I keep a printing log of every print I make. I write down the date of printing, print title, negative number, print size, paper used, filter pack and exposure data, whether I had used a contrast-control mask, and any dodging or burning-in I did. This helps me home in on a correct filter pack for other negatives on that roll and on others. It beats starting cold!

Periodically, I type up my logs, which go back more than 20 years. About 12 years ago, I started typing the data into a simple Lotus 1-2-3 spreadsheet, with entry macros to handle repetitive formatting. The spreadsheet allows me to reorganize these order-of-printing logs. For instance, I've also sorted them by negative number instead of printing date. When I want to find out whether I have printed a particular negative and when (not to mention how), I can easily find it on my sorted-by-negative list. Lately, I've taken this one step further and started scanning my old hand-typed log pages, with an eye toward converting them to my spreadsheet format. Then I'll be able, through the miracle of optical character recognition and some heavy editing, to incorporate all 20-odd years of printing into one database.

All these little tricks keep my printing bill down. My first prints may still be guesses, but they're educated guesses. If you start keeping track of these kinds of data and make good proof sheets, you'll find yourself spending a lot less time in the darkroom (or being a lot closer to caught up than I am).

Keep Those Negatives Popped

Film popping is a persistent source of trouble for those of us who don't religiously use glass negative carriers (yes, I admit it). As your film basks in the toasty glow illuminating the negative stage, it expands. As it expands it flexes, buckles, and shifts position. If you focus your image when the film is cold, it will be out of focus when the film warms up. If you focus when the film is warm, it may be out of focus after the film cools down during the time between when you focused the image and when you began exposing print paper. Obtaining precisely reproducible print sharpness without a glass carrier is impossible for many people.

Although I usually work with a glassless carrier, I manage to get precise focus with an exceptionally simple trick I hit upon over 20 years ago. I don't adjust my focus until I've given the film plenty of time to warm up and stabilize, and I don't turn off the enlarger until after I've made my print exposure. If you start doing the same thing, I guarantee you far less wasted paper due to unsharp prints.

To accomplish this, you will need an under-the-lens filter holder and a sheet of cardboard. Cut out a piece of cardboard that will fit into the filter holder. The next time you print, don't turn off the enlarger lamp after you've got the focus finally set. By doing this, you are only giving the film a chance to cool down and move out of position. Instead, put the cardboard dark slide into the filter holder to block off the light. Then you can safely load the paper into your easel with the enlarger lamp on. It won't take more than a few seconds to turn off the enlarger light, pull the dark slide, and start the exposure; there is not enough time for the film to cool off and shift focus.

I've been doing this for every single exposure for over two decades. It's the next best thing to printing with a glass carrier, and there are fewer hassles with dust and cleaning.

Making Black and White Prints from Color Negatives and Slides

Sometimes a photographic subject shows the promise of being equally interesting as both a black and white (B&W) print and a color print. The traditional way to deal with this situation is to expose both B&W and color photographs for later printing, but there are two good ways to make B&W prints from color negatives. One is by using Kodak Panalure Select paper, which is a panchromatic B&W resin-coated (RC) paper that develops in any standard B&W paper developer. The second is by using Kodak Ektamax RA paper, a panchromatic RA-4 RC paper that produces a B&W image.

There's also a bad way—printing color negatives onto variable-contrast (VC) paper. I wouldn't even bring this up except that many people seem to think it's a good idea. VC papers supposedly do a better job of printing a color negative than graded papers because VC papers are sensitive to both blue and green light. Unfortunately, VC papers are blind to the cyan-dye image; they render red and yellow as near black

Worse, color negatives are flat by B&W standards, so you'll find yourself printing with a heavy magenta filter pack to get adequate contrast. That means you're throwing away most of the green light. As Figures 9–1 and 9–2 show, VC paper prints color negatives only slightly better than ordinary orthochromatic paper does, and nowhere near acceptably. Compare these figures with the Macbeth chart in Plate 6; all were printed from the same 35 mm Fuji Reala negative (a low-contrast, high-saturation film). Both the VC and graded paper prints render reds, yellows, and greens far too dark (notice what happens to the daffodil) and blues far too light. You can see the impact of these distortions on a pictorial scene in Plate 26 and Figures 9–6 and 9–8. These prints of Lake Shasta and Mt. Lassen were all made from a 120 format Konica Impresa 50 negative (a normal-contrast, normal-saturation film).

Panalure is a slightly warm-tone paper that comes in three widely spaced contrast grades. In terms of midtone contrast, the L, M, and H grades correspond roughly to conventional grades 2, 3.5, and 5 (see Figures 9–3 through 9–5). These papers have unusually long shoulders. The shadows cover a considerable exposure range before they produce a true black, so the total exposure ranges are more like grades 0, 2, and 3.5. Using the same kinds of specialized developers that B&W printers use, you can modify the paper contrasts. Unfortunately, Panalure only comes in F surface and has ugly veiling unless you heat-dry it (see Chapter 11).

You usually have to use some filtration to get accurate color rendition in a panchromatic print. I printed Figure 9–3 and Figure 9–5 with no corrective filtration. As you can see by comparing it with Plate 6, the reds and pinks are too dark relative to the other colors. Figure 9–4 shows the improvement that adding 35 CC yellow and 45 CC red makes.

We can use color filters to adjust the tonal rendition in the print in the same way we'd use them on camera with B&W film. Red filtration creates dramatic clouds; green filtration lightens foliage. I printed Figure 9–7 of Lake Shasta with a 50 CC red filter pack, to approximate the tones in Plate 26. A 200 CC red filter pack produced Figure 9–9 and gave much the same effect a red-orange filter would have during exposure of B&W film. The sky and foliage are darkened, the orange rocks are dramatically lightened, and Mt. Lassen stands out clearly against the sky.

Ektamax RA paper has two grades that are barely a half-grade different in contrast. The contrastier M grade comes in both N and F surfaces. Ektamax's notable advantage is that you can make B&W prints from your color or B&W negatives without switching your darkroom over from color to B&W processing. Ektamax produces a dye print, so you can't adjust the image after development with local bleaching, toning, and similar B&W-image-modification techniques. Dye images suffer from photometamerism (see Chapter 1), so the color of Ektamax

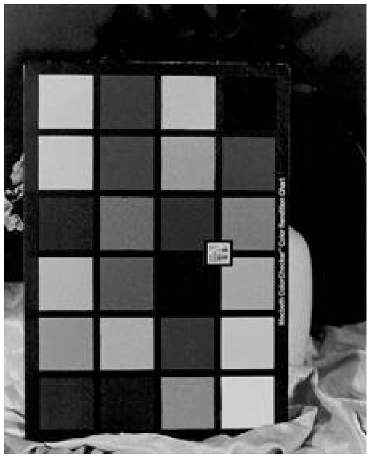


Figure 9–1 All the figures on this page were printed from the same 35mm Fuji Reala negative used to print Plate 6. This print is on grade 4 Kodak Kodabrome II RC paper. The reds are black and the yellows dark gray. The daffodil in the background is almost black.

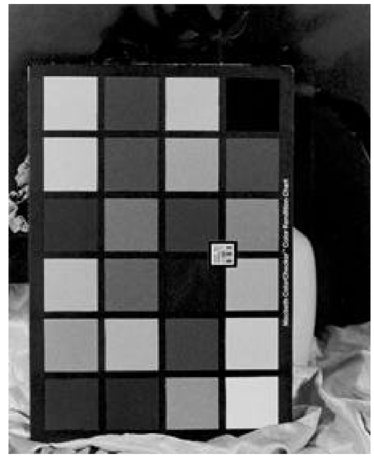


Figure 9–2 This print, printed on Ilford Multigrade IV RC paper, with 150 CC magenta filtration to produce the correct overall contrast, is barely better than Figure 9–1. This shows that variable-contrast papers are only a slight improvement over graded papers.

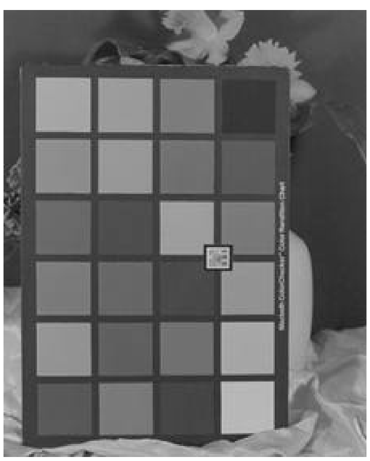


Figure 9–3 The three prints in this row are on different grades of Kodak Panalure RC paper. This is grade L, the softest. This print and Figure 9–5 were printed with no filtration; the reds and magentas are a little dark compared to the other colors.

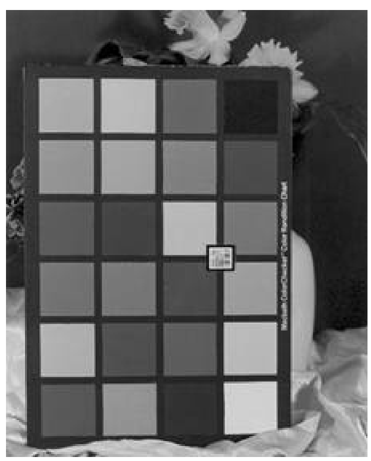


Figure 9–4 This print, on Panalure grade M paper, is a little soft, but it's close to the correct contrast. I made this print with a 35 CC yellow + 45 CC magenta filter pack, to correct the tones in the reds. All the colors are a good B&W match in density to the values in Plate 6.

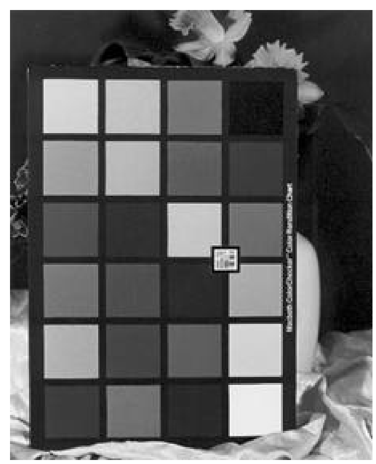


Figure 9–5 This print, on Panalure grade H paper, is much contrastier than Figure 9–4. This would be a good paper for a flat negative. The print is a little too contrasty, although Reala is a low-contrast film. I made this print with no corrective filtration to fix the tones in the reds.

Figure 9–6 Kodabrome II does a very poor job of printing this medium-format Konica Impresa 50 negative. Compare this to Plate 26. The shoreline is too dark and Mt. Lassen (in the background) isn't even visible.

Figure 9–7 This print on Panalure M paper, printed with 50 CC red filtration, closely matches the tones in Plate 26. It's a very good B&W interpretation of the photograph. Mt. Lassen is clearly separated from the blue sky, and the yellow-orange slopes take on their proper tones.

Figure 9–8 This Multigrade IV print is only little better than Figure 9–6. This print, made with 125 CC magenta filtration to correct the contrast, renders the greens somewhat better, but the blues are still too light and the yellows and reds far too dark.

Figure 9–9 Panalure M, printed with a 200 CC red filter pack, closely approximates the effect of photographing this scene with an orange filter. The foliage and the blue sky and water are darkened, making Mt. Lassen stand out clearly against the horizon. The shoreline is rendered nearly white.

prints looks different under different light sources, varying from only slightly warm under skylight to brown under incandescent lights. Furthermore, Kodak warns that these prints are not as stable as Panalure prints. Kodak says these prints are less stable even than regular color prints and shouldn't be used for anything but temporary work.

Despite these serious limitations, I think Ektamax is worth some attention. Ektamax paper is a panchromatic VC paper. Unlike conventional VC papers that rely on the ratio of blue to green light to control contrast, Ektamax's contrast changes with the ratio of red to cyan light. Adding red filtration increases contrast; removing it lowers contrast. Ektamax does not have a contrast range as wide as conventional VC papers. A 90 CC red filter pack gives me a grade 2 contrast for printing B&W negatives. Using 150 CC red raises the contrast to a maximum grade 3.5 to 4. Using 50 CC red drops the contrast to about grade 0.5. If you reduce the red filtration more than that, the midtones lose their tonal separation because of serious curve splitting.

Ektamax apportions more of its exposure scale to the shadows and less to the midtones than Polymax II paper. Midtones are very contrasty—the same exposure range produces a greater density range than it does in Polymax II. Prints on Ektamax look more brilliant than on most B&W papers of the same overall contrast. That helps provide tonal separation in prints from color negatives, in which different colors may have similar luminances, but it means a sacrifice of highlight and shadow separation. This paper is best suited to subjects whose most important detail falls in the midtones.

For color-negative printing, start with the filter pack you'd use to make a Portra III print. Because Ektamax's contrast is linked to its color balance, you can't fine-tune both contrast and color rendition. The spectral response of the Ektamax paper is excellent, but juggling the contrast and the color response presents problems. For instance, the Macbeth chart photograph from the Reala negative (Figure 9–10) renders reds too light when the contrast is best. The print with the best color rendition was too flat. Panalure printed this negative better.

On the other hand, Ektamax matched the contrast of the Impresa 50 negative of Lake Shasta well. It produced an even better conversion of color to tone than Panalure did. As long as the negative approximates normal contrast, Ektamax provides a more pleasing print than Panalure. When the negative contrast is unusually high or low and the accuracy of the color to tone conversion is paramount, I'd use Panalure.

Because they're panchromatic, Panalure and Ektamax are far more sensitive to safelight fogging than conventional B&W papers. In theory, you can use a No.13 (amber) or No.8 (dark yellow) safelight for a very short time. In practice, I

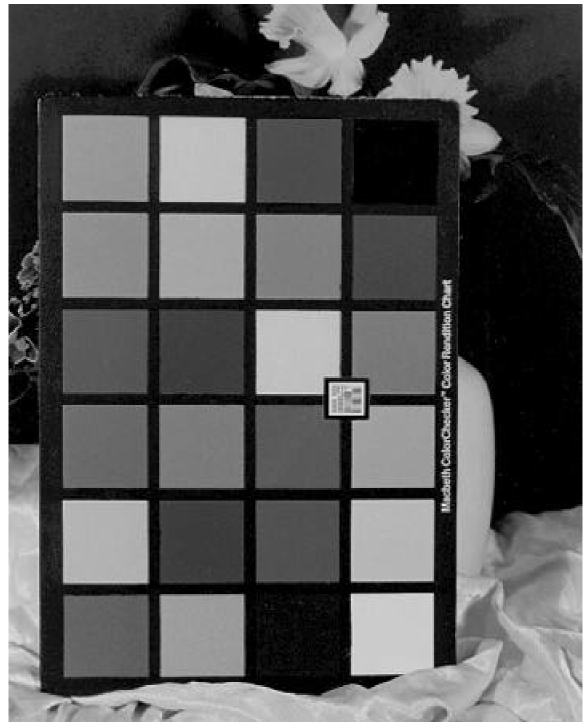


Figure 9–10 This is a Kodak Ektamax print from the same 35mm Fuji Reala negative used to print Plate 6 and Figures 9–1 through 9–5. Ektamax is a variable contrast paper. Reala being a low-contrast film, I got the best print contrast with a 120 CC yellow + 110 CC magenta filter pack. This rendered the reds a little too light relative to the other colors.

think you're better off working in the dark as you would with color paper because it is *very* easy to fog these papers.

Printing a color negative on panchromatic paper opens up brand new possibilities for image control. With precise dodging and burning in during printing, we can apply selective filtration to different parts of the photograph. No on-camera filter could do that! I made Plate 27, of the Painted Dunes and Fantastic Lava Beds, from a 120 format Vericolor III negative. Figure 9–11 is an unmanipulated print on Panalure M paper, exposed with 50 CC red filtration. The clouds have gone to dead white, losing most of the detail we see in the color print. The red dunes in the foreground are too dark. They don't separate well enough from the lava beds behind them, and there's not enough contrast between the sunlit and shadowed portions.

Figure 9–11 This medium-format Vericolor III negative printed adequately on Panalure M with 50 CC of red filtration, but it's not a great print of the Painted Dunes and Fantastic Lava Beds (Plate 27). The clouds are harsh and there is a lack of highlight detail, while the foreground shows poor separation from the lava fields behind it.

Figure 9–12 Same paper and negative as Figure 9–11, but a much better print. I printed the foreground with 120 CC red filtration to bring out the orange dunes better, and I printed the sky with 50 CC cyan filtration, which let me increase the exposure and bring in the clouds. This local tone correction is only possible with a panchromatic print from a color negative.

Fixing these problems would not be easy in ordinary B&W work.

Figure 9–12 shows my corrected version of this print. I printed the sky with a 50 CC cyan filter pack, which lightened up the blues and allowed me to print that part of the picture down and pull in the details in the clouds without the sky going black. For the rest of the picture, I upped the red filtration to 120 CC, which let me lighten the sunlit foreground dunes, the reddest portions of the scene, while leaving the shadows and background unchanged. Burning in three of the corners evened out the tones. This superior rendition shows the aesthetic potential of making B&W prints from color negatives.

How to Process Black and White Prints in Color Processors

A while back, I read an article by a well-known color printer bemoaning the hassle of tearing down his color printing setup whenever he needed to do B&W printing. Like me, he printed both B&W and color. Like me, he used a compact tabletop roller-transport processor for handling his color prints. Unlike me, when he wanted to do B&W printing, he cleaned and dried his machine, moved it off the table, and set up trays for B&W work. When he was ready to switch back, he cleaned and dried the trays, moved his processor back in, and set it up. That kind of busywork inhibited him from printing B&W when he was doing color and vice versa.

He didn't realize that any tabletop processor that can handle color prints can also process B&W RC papers. With processors designed for the RA-4 process (which takes less than a minute per process step), machine processing of B&W prints is no slower than tray processing and a lot more convenient. If one is making several identical prints, it's a lot faster.

You don't need a fancy processor with adjustable process times or more than two tanks. I use a Durst/Nutek RCP 20 modified to run at RA-4 speed. I can regear the machine for different process speeds, but it's a major nuisance. When I want to run B&W instead of RA-4 color, I drain the color chemistry and rinse the tanks with a few flushes of clean water. Then I pour in Dektol 1:2, 2% acetic acid stop bath, and hardening rapid fixer at film strength. I'm ready to roll. Reversing the process gets me back to RA-4.

The reason this works is that I can trade off time against developer temperature with no loss of print quality. Most B&W papers do not develop fully in 45 seconds at 68°F but will at 75°F. I haven't found any that won't develop fully at 80°F. I've run both developer-incorporated and conventional papers made by a variety of manufacturers including Kodak, Agfa, Ilford, and Oriental. I've yet to find an RC paper I can't process this way. I have to use trays for fiber-base papers because they're too flimsy and jam up in the rollers.

Newer processors often have only two tanks—one for developer and one for fixer. Don't worry; the paper's RC base and the processor's roller squeegees ensure that almost no developer carries over into the fixer. You can check the pH of your fixer periodically with pH test paper and add a little acetic acid if you find it's rising. I'm guessing you won't ever have to.

Whenever I use a new B&W paper, I calibrate it to my machine. I make two B&W test prints in trays with fresh chemistry. The first is a sheet of paper that is half-unexposed and half-exposed to enough light to produce a maximum black. The second is a decent-looking print from any negative I have handy.

Next, I run a half-unexposed/half-black test print through my RCP 20. If the whites are as white as the tray-processed print, and the blacks are as black, I'm set. If the whites show fog, it means I'm running too hot and I cut back the temperature by several degrees. If the blacks are lighter than the tray print, it means I'm running too cold. Typically, there is a range of 10°F wherein I get the full D-max but no fog. I set my RCP's temperature control for the middle of that range. To fine-tune the process, I machine-process a print of the test negative. If it isn't identical to the tray print, I tweak the temperature up or down a bit until it is.

Although I trust the roller transport to do a good job of developing, I am less confident about the fixing step. Most inexpensive machines don't have pumps in the fixing tank to circulate the chemistry. For RA-4 it's enough to have just the motion of the print through the bleach-fix, but I'm not convinced this is sufficient agitation for B&W fixing. Because the print motion is very uniform, I don't trust spot tests for residual fixer. I put the print into a tray of fixer after it leaves the processor, agitate it for 30 seconds, and then put it into the wash. Okay, so it isn't 100% automatic. It's close enough.

If I'm printing over several days, I pull the racks each evening, rinse them, and float a sheet of plastic wrap on the tanks of chemicals. This excludes the air well enough that the chemicals last 4 or 5 days before the developer loses potency. It's much easier than draining the tanks each night. Black and white developer and fixer are so cheap that I don't care whether it's a bit less economical than draining the machine would be; my paper costs are still over 10 times greater. Now, if I could only figure out how to feed fiber paper through those rollers.

Control Strips

I made my first color prints in 1970 with Unicolor color-negative paper and chemistry, a Unicolor tricolor filter wheel for making color-print exposures, and a Heath-Mitchell Color Canoe. The Color Canoe was an ingenious and indestructible stainless steel tray curved into a U-shape. You'd put print paper and chemicals in the Canoe, set the Canoe in a tray of warm water (which acted as the temperature control), and rock it back and forth.

Within a few years, I was printing on a Super Chromega Dichroic D enlarger, which served me for 2 decades. I used Kodak's Ektaprint 3 process and Ektacolor RC papers in trays. One year I processed everything from single 8 x 10s to a dozen interleaved 16 x 20s, with an arm in a cast! I used up about one-third as much chemistry per print as with a color drum or canoe. It was fast; at the very least, I'd process the final print for one negative along with the test print for the next. I could interleave up to a dozen 16 x 20 prints when volume production demanded it.

Tray processing required considerable skill. I had to devise ways to warm the solutions and deal with the pitfalls of replenishing during batch processing. I didn't give up tray processing until the early 1980s, when my Ektacolor printing became so infrequent that I couldn't economically use replenishable chemistry. I switched to color-print drums, which were a lot slower but better suited to occasional printing.

With both drums and trays, I got consistent results; Caltech-trained lab skills kept the gremlins at bay. Most of the time. Every so often, I'd misgauge the state of the soup and blow a batch of prints. Every so often, I'd toss out some developer and bleach-fix just in case.

That changed when I started working with RA-4 materials in a tabletop roller-transport processor. RA-4 was such a different beast that I decided I better try dealing with process-control strips. I'd never considered them, in part because I don't own a color densitometer, in part because I didn't know better. With RA-4 they seemed the only way to be sure I wouldn't mistake my errors for a valid test result.

Well, it turns out that RA-4 and R-3/3000 control strips are a snap to use. If you can tell a good print from a bad, you can eyeball a control strip well enough to diagnose and correct most processing problems. Control strips are pieces of photo paper that the manufacturer precisely exposes and stores at 0°F to prevent any changes in the latent image. Modern strips, shown in Plate 28, rely on a few simple gray patches for comparison with the reference strip. The human eye is especially sensitive to differences in grays, which is why you can evaluate control strips by eye. A reflection densitometer is more precise, but if the differences between the gray patches are too small for you to see, you certainly won't be able to see them in the prints you make. Plus, you can't print or control what you can't see; so don't worry about it.

Any good printer will benefit from control strips. A box of control strips comes with a preprocessed reference strip. It may also have a sheet of density correction factors for the reference. If the corrections are 0.05 or less, ignore them. Consistency is much more important than absolute accuracy. (I'll cover correction factors later.) The proper method demands a densitometer and process-control plots, but we're going to be highly improper and eyeball them. Trust me, it works.

When you need to check your process, pull a packet of strips from the freezer. There are only five strips to a packet, so it warms up to room temperature in 15 minutes. Process one and compare it to the reference strip the manufacturer includes. One RA-4 control strip costs about as much as 2.5 8 x 10 sheets of paper. If you run one every 10 or 15 prints, you'll increase your printing costs by 15% to 20%, but you'll make it up saving otherwise wasted chemicals or paper.

RA-4 Strips

What have RA-4 control strips done for me? They told me that, due to an error in the early instruction sheets, I was mixing the developer to the wrong strength. It was a subtle change, but it would have slightly degraded my prints, and I might never have caught it in normal printing.

Later, when I forgot to add the developer starter to a batch of fresh developer, a control strip caught my boo-boo before I wasted time on real prints. I would definitely have seen the change in those prints, but without a control strip, I would not have been able to figure out what was wrong with the chemistry and would have dumped $6 worth of developer. Recently, the strips told me my starter was getting old and weaker and that I needed to add more to the initial mix (and buy a new jug).

Control strips even told me that there was something wrong with Kodak's original Portra paper. Because the strips were fine, Kodak and I knew the image defects weren't due to processing. If you've ever been hit with defective materials, you'll appreciate how much time and effort the control strips saved. Kodak took my results very seriously. Kodak created Portra II paper, in part, to successfully fix the problems I reported. Thus, a few control strips led to a major product revision.

Here's what you do. Process a Kodak RA-4 control strip in new chemistry. To compare it to the reference, cut the strip down the middle so you can lay the two sets of gray patches directly next to each other without any white paper between them. You can see 1 or 2 CC differences that way.

The strip should be nearly a neutral match; ignore differences of less than 5 CC. If you forgot to add starter to the developer or if your starter is getting weak, the patches will be slightly dark and about 15 CC red; that's easy to fix by adding starter. If you see a large color or contrast shift from the reference, you have bad developer. You either contaminated it (a few drops of bleach-fix will ruin it) or mixed it incorrectly. Putting the wrong amount of water in the developer mix has little effect on RA-4 unless you're way off.

If the patches are a little darker than the reference, you're overdeveloping—too hot or for too long. Lighter means not enough development. Extreme underdevelopment makes the black patch look blue (minus yellow). Too little Part A in the developer makes the strip both darker and more contrasty, but it stays neutral. If you're positive that your time and temperature are right, you can add Part A to correct this, but that's a last resort before dumping the chemistry. Balance your process at the beginning so you only have to monitor for changes from that pristine state.

If you're running a replenished system, underreplenishment looks a lot like too-cool developer, but with more loss of yellow. Check your time and temperature. If it's correct, dump in some extra replenisher. It's harder to overreplenish RA-4 than to underreplenish it, although I've done it; patches then go dark and warm. Never run EP-2 paper in RA-4; it'll ruin the developer and the results will be light and very blue.

Increased stain in the whites means either exhausted bleach-fix or seriously aged developer (especially if the gray patches look a little dark). Replace 25% of the bleach-fix with fresh solution. If that doesn't work, replace 10% of your developer with fresh replenisher. If neither of these steps improves matters, dump your chemistry.

RA-4 chemicals are hardy. I can make RA-4 prints for a week and then not do any for a month. At first, I tossed my RA-4 chemistry between runs. Control strips showed me that one batch of developer would hold up for months in a tightly sealed jug. I didn't expect that, but the control strips say all is well with a little extra replenisher thrown in at the start of a new printing stretch, so I save money on chemicals.

R-3 Strips

Kodak R-3 (or Agfa AP-63) is easy to monitor because the B&W and color development steps are separate, and every step after the first B&W development should go to completion. I prefer Agfa's AP-63 strips, which use four gray patches and three primary color patches, to Kodak's, which use a full gray scale step tablet. It's easier to visually interpret Agfa's strips.

If you forget the color-developer starter, the patches will be too magenta and the blacks will be too dark. If the blacks are going bluish (minus yellow), the color developer isn't doing its job. Check the time, temperature, and replenishment (TT&R). It's much harder to overdevelop or replenish this step than to underdo it.

All other readily correctable errors produce neutral control strips; if you see a major color or contrast shift, you probably have bad chemistry. If the patches look too light, you're overdeveloping in the first developer. If they're too dark, you're underdeveloping. If you see too much density in the whites, it's usually due to too little bleach-fixing. Check your TT&Rs. That's how easy it is to use control strips!

To use correction sheets, remember that 0.01 density units (d.u.) of correction equals 1 CC of color shift and that the corrections are measured through additive filters, which are the complements of subtractive dyes and filter packs. For example, if the correction sheet says the green correction is +0.05, it means the control strip should have 5 CC more magenta (the complement of green) than the reference strip. If you're good with numbers and have good eyes, you can take all this into account. For example, suppose a data sheet gives corrections of red +0.02, green +0.05, and blue +0.08. Translation: the control strip patch should look 2 CC darker, 3 CC more magenta, and 6 CC more yellow than the reference patch. You can use color-print viewing filters to help match a control strip to a reference. For most people, an easier approach is to use your first good control strip as the new reference for future tests and not worry about the correction sheet.

Some people have an aversion to paying for manufacturers' control strips and prefer to make their own calibration prints. Personally, I don't think there's enough savings to justify doing this. Remember, you still have to pay for the photo paper. I have better things to do, such as trying (futilely) to get caught up on my printing. I also believe you will have trouble coming up with a test image that will let you *objectively* judge the process variations as well as the simple gray patches of a real control strip.

For those of you who are insistent about making your own controls, here are some pointers. It's not enough to simply reprint a standard negative each time you want to check your process. Your paper batch will have changed, and your enlarger bulb will have aged, for a start. You have to expose many control prints at the same time, on the same batch of paper, using identical exposures. Freeze all the exposed sheets of paper that you aren't going to develop immediately. Keeping the paper at 0°F almost halts the changes in the latent image characteristics. I'll stick with prepackaged strips.

Room Temperature RA-4 and R-3000

As I said earlier, I processed chromogenic prints in trays for half of my color-printing life. It was tough, and I'm glad that part of my life is past. Today, it's possible to process both color-negative (RA-4) and color-slide (R-3000) prints in trays, at room temperature and without replenishment! It's as easy as B&W print processing, and it's economical. Two chemical kits from Tetenal, Mono RA-4 AT and 3-Step for R-3000 papers, allow RA-4 processing at 60° to 77°F and R-3000 processing at 64° to 82°F.

The Tetenal kits (distributed by Jobo) come in 1 liter and 2.5 liter sizes. The 2.5 liter kit costs about the same as what Kodak charges for a gallon kit of comparable chemistries, but the Tetenal chemicals process up to 38 prints in a liter of solution. That works out to be twice the price per print as standard replenishable chemistry but only half as much as one-shot processing.

Each chemical comes as a premixed concentrated sludge; in most cases, one dilutes 1 part concentrate with 4 parts water to make a working solution. The bottles must be shaken furiously to mingle the solids with the liquid, and they reseparate instantly, making accurate subdividing nearly impossible. I dilute the concentrates 1:1 with water and store them in larger bottles. I still get the estimated 6-month shelf-life, and the diluted sludges are much more manageable.

One can use the Tetenal chemistry in trays, print drums, or roller-transport machines. I found that the RA-4 AT chemistry was actually a little easier to use in a tray than in my converted RCP-20 processor. My darkroom is normally at 70° to 72°F, and the heat of the pumps and the drive motor gradually raises the solution temperature 10°F above ambient, which is too high for the RCP's fixed development time. Every half hour, I have to pop the lid on the machine and cool the solution with some ice cubes in a bag or stainless steel film tank.

The RA-4 AT chemistry produces control strips that are outside RA-4 process specifications—they're too cyan and too dark—but this produces no visible loss of print quality. I could exactly match a print made with standard "on-spec" RA-4 chemistry by reducing my print exposure by 15% and subtracting 8 CC red from my filter pack. After I ran 80 prints through the chemistry, the filter pack had shifted by barely 2 CC, and the exposure time had gone up by 10%.

Tray processing RA-4 is just as easy as processing B&W RC paper, except that you have to work in nearly total darkness. You'll need a timer whose numbers glow in the dark. I'm used to processing sheet film, so tray work in total darkness doesn't faze me. I mixed up a half-liter of solution at room temperature, stuck the probe of my digital thermometer in the corner of the developer tray, and used whatever development time matched the temperature. I processed most prints at 70° to 73°F, with a development times from 60 to 85 seconds. Add 20 seconds in the stop and 30 seconds in the bleach-fix, and we're talking roughly 2 minutes from start to wash.

My tests indicate that the recommended tray development times are too short. Underdevelopment causes a loss of both magenta density and overall density. For best results, use a development time 25% longer than the data sheet suggests (e.g., at 68°F, use 90 seconds instead of 75). Overdevelopment produces a darker print but doesn't produce any significant color shift. I'd give the temperature tolerance as -0°F, +2°F. Letting the temperature float causes no problems; there was almost no difference between prints I made at 67° and 76°F with apprropriate time changes.

If you want to use the RA-4 AT chemistry in a print drum, here are two tips to maximize consistency:

1. Don't presoak the paper. A typical 8 x 10 print drum will retain about 20% of the presoak water, which then dilutes your developer. Reusing diluted developer can produce nonidentical prints.

2. Use fresh developer for each print. Save the used soup in a separate container until you've used (once) the entire amount you mixed up. You can reuse the saved developer at least once (maybe twice). You'll get a change in print exposure when you go from fresh chemistry to recycled, but that's a lot better than having it constantly drift because you mix used solution with unused.

Like RA-4 AT, 3-Step is suitable for transport, tray, or drum processing. I use five process steps for trays. At 70°F, the steps are:

1. 1:55 minute development
2. 20-second water wash
3. 3:40 minute color development
4. 20-second 1% acid stop bath
5. 3:00 minute bleach-fix

The total process time is around 9 minutes. That's comparable to R-3000 processing at 95°F or Ilfochrome P-30 at room temperature. Step 4 isn't in the Tetenal recommendations; I added it to ensure that the bleach-fix stays at the proper pH.

As with RA-4 AT, you can let the solution temperature float. 3-Step prints processed for appropriate times at 70°F and 75°F were identical in color balance and almost identical in density. Avoid underdevelopment in the first developer (the other steps go to completion). Prints will be dark and noticeably magenta. Tetenal's recommended process times work fine, and 20% overdevelopment produced prints minutely lighter with no shift in color balance.

Control strips showed that this process also does not match official aim points. It's slightly too light and 5 CC too magenta compared to standard R-3/R-3000, but whites are pure and the D-max is just fine. I can adjust print exposure to produce excellent results almost indistinguishable from on-spec R-3000 prints. Over the course of a test run, the control strips ran progressively darker and more magenta, but the whites stayed white and the blacks stayed black. When the 3-Step chemicals reached their limit (after 30 prints in a liter of solution), it was like falling off the edge of a cliff. Prints suddenly had a significant amount of density in the "whites" and the "blacks" became a lighter blue-cyan.

Effect of Drying on Color and Contrast in Black and White Papers

The B&W paper expert at the Charles Beseler Company, Krys Krawczyk, provided me with some fascinating information about the effect of drying methods on some fiber-based B&W papers. I'm not talking about "dry-down." Black and white printers know all about dry-down. A wet print looks lighter than a dry one. The difference in lightness depends on the print paper. Some papers show almost no dry-down; others get as much a 0.15 d.u. darker when they're dried. Krys discovered something else—the method of drying can alter the appearance of the dry print.

In the days of fiber-and-nothing-but-fiber papers, just about everyone who had to turn out numbers of prints used a heated print dryer with a chromed-steel plate or rotating drum and a canvas belt stretched tightly over the chrome. The print was sandwiched between the canvas and the chrome. If you wanted a mirror-glossy "ferrotyped F" finish, you put the print emulsion down on the hot chrome. If you wanted an "air-dried F" surface, you laid the paper down emulsion up. Then you baked it until it was dry, at temperatures near the boiling point of water.

Black and white printing has changed enough that I feel obligated to write a description of what used to be a basic part of printmaking. Now, few fine printers heat-dry their fiber prints; room temperature drying racks are the norm. "So what?" you say, "Is this another expostulation by some old-timer who thinks pyro-darkened fingernails and the pervasive odor of thiosulfate are nostalgic?" No, I'm telling you this because of complaints Krys got from long-time Agfa customers who said that Agfa Portriga Rapid had gotten lower in contrast, had a less glossy "air-dried F" finish, and was colder in tone. Naturally, these folks assumed that Agfa had changed the formulation of the paper.

What Krys discovered was that the printers' drying methods had changed. Heat-dried Portriga Rapid looked as warm, contrasty, and glossy as it always had. But air-dried Portriga Rapid had a more matte luster (which reduced apparent contrast) and a colder tone. How much colder? About the difference between Portriga Rapid developed in Agfa Neutol warm-tone developer and developed in Agetol or Kodak Dektol.

The changes are reversible. Rewet a heat-dried Portriga print, air-dry it, and it becomes cold and matte. Rewet an air-dried print, heat-dry it, and it looks just like Portriga always did. The samples Krys showed me displayed striking visual differences.

Not every paper responds to heat this way. For instance, heat drying does not change surface luster or print color of Agfa Multicontrast Classic paper. It's an experiment worth trying with your favorite fiber-base paper.

What About Dye Transfer?

I'm not going to devote much space to dye transfer printing, even though I am first and foremost a dye transfer printer. In fact, I sell only dye transfer prints. Dye transfer printing is far more complex and involves many more steps than any of the conventional printing processes, color or B&W. The tools and techniques are an entire book in themselves. A condensed course in dye transfer printing would take up 25% of this book. If you would like to learn more about dye transfer, visit my Online Gallery at http://www.plaidworks.com/ctein/ where you'll find a long article I've written describing what's involved when I make dye transfer prints.

Furthermore, the future availability of dye transfer materials is problematic. Dye transfer materials were commercially available for about 60 years until the mid-1990s. They were made exclusively by Kodak. Several years ago, Kodak abruptly stopped making dye transfer supplies, with no advance warning to printers. A few other printers and I put in the heroic effort required to stockpile supplies for future use. I'd guess that there are maybe a dozen or so of us left in the world actively engaged in dye transfer printing as of this writing. Most dye transfer printers simply gave up the medium.

Dr. Jay Patterson has started up a company to manufacture and sell dye transfer paper, chemicals, dyes, and matrix film. I applaud Dr. Patterson for this effort! I am hoping for his company's survival, but his materials are not on the market as of this writing. To be added to the mailing list, should Dr. Patterson ever announce products for sale, write to his company.[1] The future of dye transfer is still much in doubt, but we can wish for the best.

1. The Dye Transfer Company, 3935 Westheimer Rd., Suite 306, Houston TX, 77027.

Caption Information for Color Plates on Following Pages:

Plate 6 This is a Macbeth Chart, photographed on 35mm Fuji Reala film and printed on Kodak Portra II paper. This chart is an excellent test subject because it is standardized and reproducible and is made up of both realistic and difficult-to-photograph color patches.

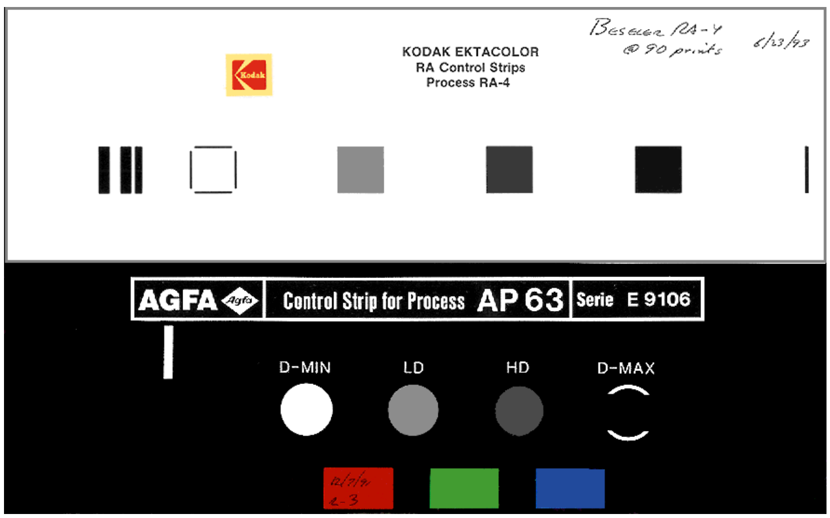
Plate 19 A typical proof sheet, punched to fit a three-ring binder. In the white border, I've written the filing code for this roll of film (071491-3, meaning the third roll I exposed on July 14, 1991) and the exposure information for the sheet. In this case, I printed at f/11 with a "D"-type diffusing chamber in my SuperChromega enlarger. The filter pack was 39 CC magenta plus 45 CC yellow. Exposure times were 16 or 22 seconds, depending on the negative. In the lower corner is the date I made this proof sheet and a code indicating the brand of paper it was printed on.

Plate 26 I made this photograph of Lake Shasta with Mt. Lassen in the background at the peak of the 1991 drought. I used medium-format Konica Impresa 50 color negative film and printed this negative on Kodak Portra II paper with a contrast-reducing mask. I burnt in the lower 20% of the picture by a half-stop.

Plate 27 This is a photograph of the Painted Dunes and Fantastic Lava Beds in Lassen Volcanic National Park. I made this photograph from the top of a 1000-foot cinder cone on medium-format Kodak Vericolor III (VPS) and printed it on Portra paper with a contrast-reducing mask.

Plate 28 These are process control strips. The Kodak strip is for the RA-4 process for color-negative materials. The Agfa strip is for the AP 63, R-3 and R-3000 processes for color-reversal materials.


Macbeth ColorChecker Color Rendition Chart



Beseler RA-4
@ 90 prints
6/23/93
KODAK EKTACOLOR
RA Control Strips
Process RA-4
AGFA
Control Strip for Process AP 63
Serie E 9106
D-MIN
LD
HD
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12/7/91
2-3

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Photography

POST EXPOSURE

Advanced Techniques for the Photographic Printer

Written by an expert printmaker, *Post Exposure* teaches photographers the underlying principles and practices needed to produce truly excellent photography prints. Distilled from more than 30 years' experience and addressing both black-and-white and color, the author teaches photographers the refinements of photographic printmaking, taking them from making merely competent prints to making excellent ones.

Post Exposure provides clear explanations of principles and theory, but the focus is on practical techniques. *Post Exposure* contains numerous illustrations, including 16 pages of color.

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—Arthur Kramer, author of "Kramer's Korner" for *Camera 35*, "View from Kramer" in *Modern Photography*, and "Pro View" in *Popular Photography*

"*Post Exposure* provides unique background information for printers, including all of Ctein's significant researches into a variety of issues of importance to serious darkroom workers. More intelligent and scientifically literate by far than the standard fare, it is the best such synopsis to be found in any current book directed at a lay audience. *Post Exposure* is the essence of Ctein's distinguished career as one of the nation's leading magazine writers on photographic technique."

—Mike Johnston, editor, *PHOTO Techniques*

Ctein is a photographer and artist. He has a degree in both English and Physics from Caltech and has written over 150 articles and manuals on photographic topics for such magazines as *PHOTO Techniques* and *Darkroom User*. Specializing in dye transfer printing, Ctein has been recognized as one of Kodak's featured photographers.

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