

EXPLORING THE WORLD OF Piezography

by **John Custodio**

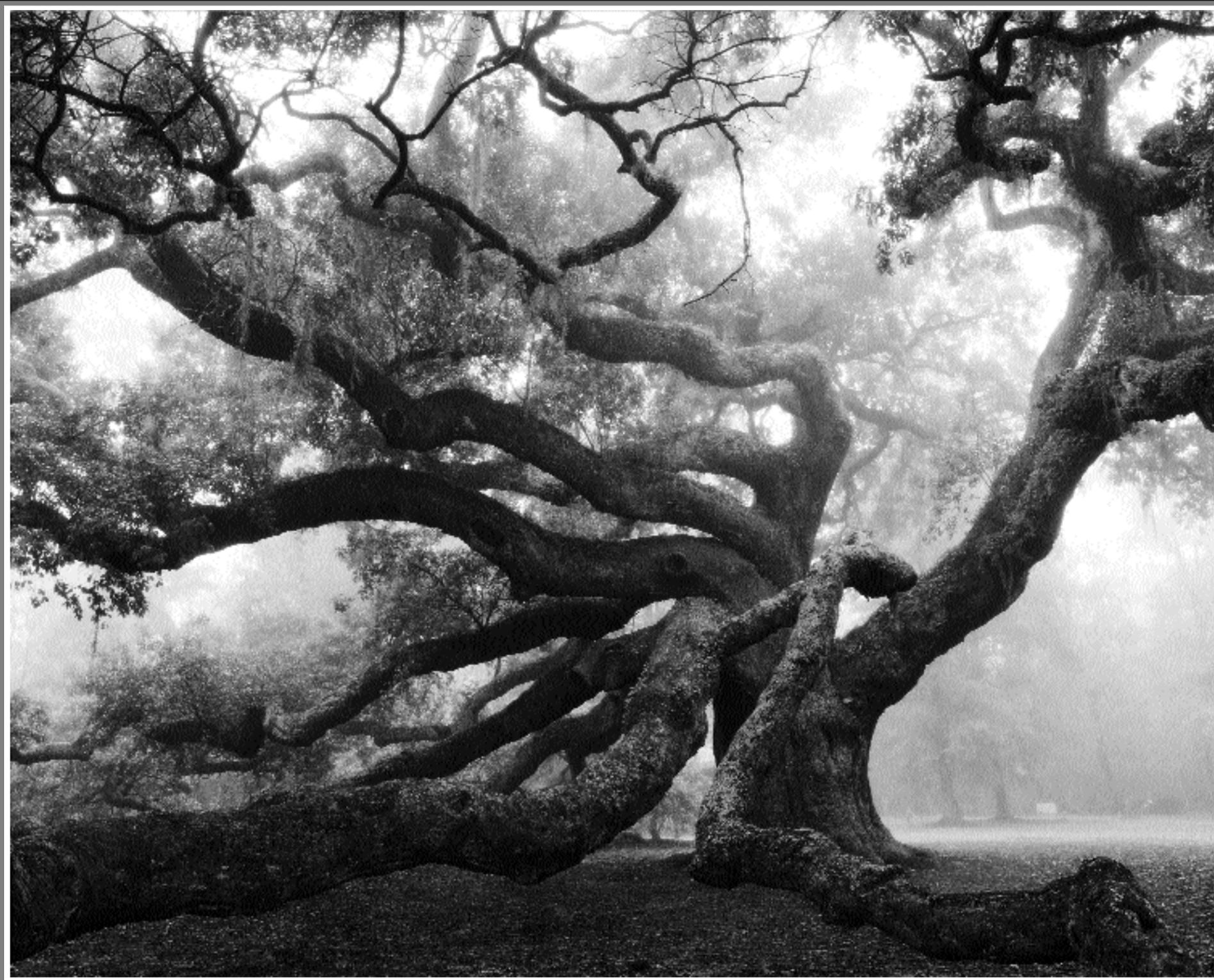
I started doing digital imaging in 1994. I bought a computer equipped with Photoshop and worked on negatives that I scanned. It was a fairly steep learning curve, but I soon became proficient. Having done conventional darkroom work in black-and-white and color for many years, I knew what I was looking for in the images I worked on. I began to appreciate that the amount of control I was able to exercise over the images I created on screen was far greater than what I was able to do in a conventional darkroom.

Epson Stylus color printer

A few months later, I saw sample prints from the Epson Stylus Color printer. Even though the quality was nowhere as good as a conventional photographic print, it was a lot better than I thought could be attained from an inkjet printer. I bought one to do rough prints of my black-and-white and color landscapes. Unfortunately, these prints were not anything I could sell or exhibit. The inks weren't long-lasting, and the prints appeared grainy, especially in the highlights. At this time only one paper worked well with Epson inks – Epson's Photo Quality Inkjet paper. This paper (still available) was thin and probably not archival.

New Epson printer improves quality

My print quality improved significantly when I bought an Epson Photo EX printer. Graininess, especially in the highlights, was significantly re-



▲ **Angel Oak**, Charleston, South Carolina.

◀ **Gibson Beach**, Point Lobos, California.

duced. These prints were almost as good as conventional photographic prints. Better Epson papers were available, such as Photo Quality Glossy paper, a semi-glossy paper with a surface similar to an air-dried fiber-based paper. Poor light-fastness of the inks

and doubts about archivability prevented me from using this paper for print sales. But I was able to make prints for gallery exhibition; if the viewer didn't look too closely, the prints could be mistaken for conventional ones.

Difficulty of printing black-and-white with color inks

By now, most of the images I was working on were black-and-white. Before "going digital," I spent years shooting color landscapes and making darkroom



Hoh Rain Forest #1, Olympic National Park, Washington.

prints. I also shot a fair amount of black-and-white landscapes, but didn't print many. When I began working on the computer, I scanned a few black-and-white negatives to see what I could do in Photoshop. I realized I preferred my black-and-white work better than my color work, and decided to spend my time in black-and-white.

However, printing a black-and-white image on an inkjet printer with color inks presented new problems. It was difficult to get a neutral image tone throughout the entire grayscale from shadows to highlights. Making shades of gray with color inks required precise amounts of cyan, magenta, and yellow in the correct proportions. If one ink was out of proportion by even the slightest amount, you'd get a color cast in that shade. What usually happened was that a color cast in the highlights was different from the one in the shadows. This could be corrected by converting the black-and-white image to color, and manipulating the red, green and blue curves, which was difficult and time consuming.

Even worse, Epson inks in a black-and-white print exhibited a good amount of metamerism—the image color would change when the color of the light illuminating it changed. Typically, there would be a magenta-to-green shift when going from incandescent light to daylight. If the print looked good under incandescent light, it would have a green cast in daylight. If the

image color looked good under daylight, it would look magenta under incandescent light. Because of the poor light stability of the ink, the image color also shifted over time. I soon realized that making a black-and-white inkjet print with color inks was futile. (This has changed recently. The Epson line of 2200, 7600 and 9600 printers, which use five color inks along with a black and a gray ink, can produce good-to-excellent black-and-white prints depending on what RIP and profiles are used.)

No good way to make prints

By now, I had 30 or 40 black-and-white landscapes I was happy with. However, these images looked best on the computer screen. Although I wasn't satisfied with the image color of my black-and-white prints made with the Epson color inks, the prints looked pretty good otherwise. I began to enter prints in photo competitions with good results. But it was frustrating when people asked me to sell them prints. Due to the poor ink longevity and questionable paper quality, I had to politely decline.

Quadtone printing to the rescue

One solution to the black-and-white inkjet printing problem is quadtone printing. Instead of using cyan, magenta, yellow, and black inks to make a black-and-white print, four black inks are used: black, dark gray, middle gray, and light gray. The image's gray tones

are separated into four channels, with each assigned a shade of gray. This information is sent to the printer, which prints the ink shade appropriate to each channel. Printing black-and-white with gray instead of color inks solves the problem of color casts, and increases image longevity since gray inks are less susceptible to fading.

When several companies introduced quadtone inks for Epson desktop printers, I realized this was the solution I was looking for. First, a pigment-based inkset from MIS Supply was announced. Then, Lyson came out with dye-based quadtone inks, and Cone Editions' Piezography system followed. After experimenting with all three, I chose Cone's Piezography for my work.

Why I chose Piezography

I opted for Piezography for several reasons. First, it was a system, composed of pigment-based inks and software. (This has now changed somewhat. The new system is discussed later in the article.) The software, available as a Photoshop plug-in or as a stand-alone RIP, serves two functions—it separates the black-and-white image into four gray channels; and it sends information for each channel to the printer. The Piezography software directly controls the printer; the Epson driver is not used. This way, PiezographyBW is able to use its own screening algorithms, bumping up the effective printing resolution from an interpolated 1440 to an effective 2160 dpi. Also, printing profiles for more than 40 papers were built into the software—you selected the paper you wanted to use from a pull-down menu.

On the other hand, although both used the Epson driver, the Lyson and MIS inksets required some degree of experimentation. Lyson had profiles for a limited number of paper-printer combinations posted on their web site. MIS posted several "workflows" on their web site for various printer-paper-ink combinations. The MIS "workflows" are contributed by users since MIS only produces the ink. The user must figure out how to print with it. I wanted to start printing my images, and didn't want to waste time experimenting. I also chose Piezography over Lyson's quadtones because it (like MIS) is pigment-based, while Lyson is dye-based. Pigments tend to have a greater light-fastness than dyes.

Also, Cone Editions is a service bureau. Not only does Cone produce

the inks and software, they also use what they sell in a production environment. The Piezography technology is new and not without its problems, especially when inks and software are used on printers that were not originally designed for it. Cone's tech support has been excellent, because they use the product and are familiar with what can go wrong.

I bought an Epson 1160 printer and a CIS (Continuous Inking System) system to save on ink costs. (A CIS has bottles of ink feeding into modified cartridges via tubes; it saves money by using ink in bottles instead of expensive cartridges.) Now I was getting the print quality I wanted. In June 2001, I exhibited 23 landscapes printed with Piezography at a photo gallery in New York City. I received many favorable comments, selling a few prints.

After "retiring" the 1160, I upgraded to the Epson 7000, a more sophisticated printer capable of making 23.5-inch wide by any length prints. This is the printer I now use.

More like platinum than silver

Piezography uses a carbon-pigment-based inkset. These inks are generally more resistant to fading than dye-based ones. However, the maximum black attainable (Dmax) with pigment-based inks is not as great as with dye-based inks. Pigment inks also don't print well on glossy or semi-glossy papers. The ink doesn't absorb into the paper if it is too smooth. Instead, it sits on the surface and has a tendency to smear and rub off.

Matte papers don't have this problem, but with matte papers the Dmax is not as great, so prints don't have as much "snap." However, an advantage of printing on matte paper is the total lack of any distracting reflections. Matte papers also tend to have a more luxurious, fine art feel than glossy or semi-glossy papers. A Piezograph on matte paper is more akin to a platinum print than an air-dried, glossy, fiber-based, silver print. This takes some mental adjustment if you are used to the latter.

Some people use Piezography with glossy paper, then spray the print to prevent smearing. Printing on matte paper, then spraying with a semi-gloss spray is also possible, but is messy and potentially hazardous.

Some problems

Printing with the Epson 1160 and the

original PiezographyBW inks wasn't entirely trouble-free. Nozzles clogged occasionally, especially if the printer wasn't used for a while. Usually a cleaning cycle or two would clear it, but sometimes I had to put Windex on the cap assembly (the pad on which the print head sits when the machine is off). The printer would have to sit for a few hours while the Windex cleared up the clog. However, when I switched to the Epson 7000, clogging problems decreased significantly.

One thing I didn't like about the original PiezographyBW inks was the way the image color became warmer as the print was exposed to air and light. This warm shift would proceed up to a point, then stop. Even though the original PiezographyBW inks are mostly carbon pigment, they contain a small amount of dye. There are two problems with carbon pigment—it doesn't have as great a Dmax as a dye, and the natural color of carbon pigment is not black, but instead is a warm brown. Adding a colored dye increases Dmax and shifts the image color to a less warm brown. The problem with this dye component is that it fades more rapidly than the pigment one. As the dye fades, the original warmth of the carbon is revealed, and since the dye component contributes to the original Dmax, there is also a loss in Dmax as it fades.

PiezoTone Inks

Some people who use CIS systems have reported a loss in density and a greenish color in their prints. This was caused by some of the greenish dye component in the ink separating from the carbon pigment. This only occurred when the printer was not used for a long time.

This problem was solved with the introduction of PiezoTone inks. A completely new formulation, PiezoTones differ sharply from the original PiezographyBW inkset. One of the features of PiezoTones is a less volatile solvent, which greatly reduces clogs. Because of the new solvent, the ink is non-reactive with CIS tubing.

PiezoTone inks are available in four different gray tones: Cool Neutral, Selenium Tone, Warm Neutral, and Carbon Sepia. There are also three types of black ink available. There is no dye in the gray inks, so there is no warm shifting due to dye-component fading.

The inks dry to their final image tone soon after printing. The different image tones are achieved by changing the size

and shape of the carbon particles and, in the case of Selenium and Cool Neutral, by also adding small amounts of colored pigment (not dye). The image tone of Carbon Sepia resembles the original Piezography ink after the dye component has burned off (it's not really sepia, but a slightly reddish brown). The image tone of Warm Neutral is the same as the original ink (sort of an olive brown). Cool Neutral is a slightly bluish cold tone. Selenium is the closest to being neutral, resembling a selenium-toned silver print. The paper you use also influences the image color of a Piezography print. A cooler paper yields cooler results, while a warmer one yields warmer results.

Pigment inks don't yield as much Dmax as dye inks. One way to increase Dmax of a black pigment ink is adding various amounts of black dye, but with a corresponding loss of light-fastness. The Dmax issue is addressed by the three varieties of black PiezoTone ink. The blackest, but least light-fast, is called Black Black—it has a Dmax of about 1.83 on Hahnemuehle Photo Rag paper (HPR) and a dye component of 16%. Museum Black, with no dye at all, has the lowest Dmax (1.68 on HPR), but the greatest longevity. Portfolio Black, with a dye component of 8%, is a compromise between the two. It has a Dmax of about 1.73 on HPR, and an intermediate light-fastness. So you have three choices when balancing Dmax and longevity. Unfortunately, at this stage, it's not possible to have a black with both a high Dmax and a high degree of light-fastness.

Longevity

Earlier I gave the reasons why I chose Piezography over other quadtone printing options. I believe that PiezoTone inks are probably the best quadtone inks on the market, especially in terms of longevity and stability. The absence of dye in the gray inks and the availability of a black ink without dye (Museum Black) make this inkset very long lasting.

Cone Editions publishes fade data for each of the PiezoTone inksets, as well as the original Piezography ink and MIS FS ink on their web site. After 1,000 hours under Xenon light (which corresponds to three years in bright sunlight), the PiezoTones with Museum Black exhibited very little density loss and very little color shift. The original Piezography ink and the MIS FS ink faded and shifted color substantially.

The new Piezography

The original Piezography system, developed about three years ago for the Epson 3000 (and subsequently for various other Epson printers), required its own proprietary software. Epson's printer driver was not used—the software separated the inks into four quadtone channels and created the dither pattern that was sent to the printer. The disadvantage of this approach was that new software had to be developed whenever a printer was added to the Piezography line. Developing software could take up to a year. In addition, buying special software was an additional expense—\$149 for the Photoshop plug-in (which supported various Epson desktop printers), and \$1,500 for a stand-alone RIP (which supported Epson's wide-format printers, as well).

This has changed. Piezography now uses the printer manufacturer's driver and dither pattern. The quadtone separations are handled by ICC-compliant profiles produced by a profiling application that Cone Editions developed for quadtone printing. Because these are ICC profiles, any program that can open a grayscale image and print it can be used for Piezography. And, if the program you're using is ICC savvy (like Photoshop and other image editing programs), the ICC profiles can be used for soft proofing. This means that you can see not only the color of the paper and the hue of the inks on your monitor, but also the contrast and tonal range of the image as it will print. By using the printer's own driver with quadtone profiles, Piezography can be used with Canon, as well as Epson printers.

Recommendations

For anyone interested in pursuing Piezography, I recommend visiting Cone Editions' Piezography web site at www.piezography.com. There is more information there than I can provide in this article, including prices and what printer/paper combinations have profiles. Cone Editions can send you print samples of each of the four PiezoTone inksets. You can also check out the Piezography discussion forum on Yahoo Groups—go to www.yahoo.com and sign up for the Piezography



Flaming Gorge, Utah.

3000 group.

If you already have a supported desktop printer, or if you decide to buy a printer for Piezography, you can start off using cartridges. This gives you the opportunity to try the four different varieties of PiezoTone ink. Afterwards, you can buy a CIS and purchase PiezoTone ink in bottles.

Epson's Archival Matte paper (now called Epson Enhanced Matte) was my favorite paper for printing Piezography. It had great tonality, good Dmax (around 1.65 with the old Piezography inks), a smooth matte surface, and was inexpensive (about 90 cents for a 13×19-inch sheet). It's not a very thick paper (10 mils), but is thick enough so it doesn't buckle under a lot of ink.

However, the archival quality of Epson's "Archival" Matte was always questionable. This paper is neither 100% rag nor purified wood pulp. There are now better papers available. I now use Archival Matte to print promo cards and as a proofing paper since it's cheap and looks as good as the other papers.

Legion Photo Matte is a good substitute for Epson's Archival Matte (EAM). It's about as thick as EAM, but it's made of purified wood pulp and is acid free. The surface is as smooth as EAM, but the paper base is whiter. However, the paper cost is about double that of EAM.

My favorite paper is Hahnemuehle Photo Rag, which is becoming very popular. It's a 100% rag, acid free paper with

a smooth matte surface and slightly more texture than EAM. The paper base is also warmer. It's available in four varieties: lightweight (about 11.5 mils) coated on one side; lightweight coated on both sides; heavyweight (19 mils) coated on one side; and heavyweight coated on both sides. The dual-coated paper can be used for making books, calendars, or anything that requires two-sided printing. This paper produces the greatest Dmax (so far) available with Piezography inks. Paper cost is between \$3.50 and \$4.00 per 13×19-inch sheet, depending on thickness and whether its single or dual-coated. I prefer single-coated, heavyweight paper for my exhibition prints.

What's coming

New developments in inkjet printing (especially in quadtone printing) occur almost weekly. For instance, Epson recently introduced Ultrasmooth paper, said to yield a Dmax of almost 1.90 with Ultrachrome matte ink. This paper may have the possibility of a greater Dmax with PiezoTone Museum Black. If Dmax can be increased substantially, this could be the definitive paper to use for Piezography, with great blacks and great longevity.

Cone Editions will soon introduce profiles for the new Piezography system on a printer-by-printer basis. No longer limited to Epson printers, these profiles will include Canon printers, as well.

In a follow-up article, I'll report my findings testing the new profiles on an Epson 7000 and Canon s820 printer. I'll also report what Dmax I attained printing Piezography on Epson's new paper. ■

A standard and panoramic photographer, John Custodio has photographed landscapes in the West and Southeast since 1988. He has a bachelor of fine arts degree in photography from the School of Visual Arts in NYC, and works as a video editor on documentaries for independent producers. His work has been seen in NYC exhibits at Soho Photo Gallery, E-3 Gallery, and The Camera Club of New York, among others. For information, visit www.johncustodio.com.