THE DIGITAL PRINTING QUICK START GUIDE

JOHN PAUL CAPONIGRO

R/Evolution

Alignment IV

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Excellent detail and color rendition are the products of a total solution – file, color management, printer, ink, paper, and light.

1 Introduction

Einstein said, "Make things as simple as possible, but not simpler." In creating this guide, I've tried to adhere to this principle. It keeps things simple, without making them simplistic.

The goal of this Digital Printing Quick Start Guide is to help you make high quality digital prints (especially inkjet prints) in a minimum amount of time without sacrificing quality.

While digital printing is a fast-evolving field that is both sophisticated and deep, it can be made practical.

Each one of this guide's chapters details a step you need to take to ensure you get great print quality. Some of these steps are ones you'll only need to take once; others will be steps you'll repeat many times.

As an added bonus, the captions for the framed images highlight classic printing issues to be mindful of and you can click on them to find out more about the images.

There's enough explanation here of how digital printing work and why you might make certain choices to make these steps clear, and hopefully not more. There is more, sometimes a lot more, to each of these subjects, but this isn't the time for that, and there are other related subjects, but this isn't the place for them.

While better files make better prints, this guide does not cover the many ways you can adjust a file – that's a subject far too large for a Quick Start Guide and perhaps too large for a single book.

You will find a great deal more detail on my website (much of it is free or discounted for my newsletter members), in my DVDs, and in my digital printing workshops.

If you find this guide useful please share it with others by asking them to visit my website.

The Digital Printing Quick Start Guide

Printing Resources

Workshops

DVDs

Sounding XVII

A precise printer dot structure and smooth paper surface are necessary for rendering the finest gradations.

2 Environment

Control Your Environment

Control your environment and you'll control the color you see. It's one critical aspect of color management that has nothing to do with either hardware or software. Computer desktop, walls, decorations, fashion, viewing light, secondary light sources, ambient light – it all matters.

Keep It Neutral

Color influences color. This is sometimes physical, when filtered or reflected color alters the appearance of another color. This is always perceptual, when one color surrounds another color you'll experience them differently. You can't measure this perceptual change in the physical world because it takes place in your brain. While simultaneous contrast is a perceptual adaptation that you can't turn off, you can be aware that it's happening, understand how it's influencing you, and minimize it's effects. How? Surround yourself with neutral colors; they influence our experience of other colors least. Neutral colors produce the least contamination and the least adaptation. And, medium gray values produce the least brightness compensations of all neutral colors.

Computer Desktop

You may be tempted to make the appearance of your computer desktop colorful and lively. That's fine for many non-color-critical tasks. However, when you're adjusting color, make your desktop neutral. You won't be able to see the color you're adjusting accurately unless you do.

Walls

Make walls and decorations in your immediate field of view neutral. Any neutral color is better than a saturated color. Choose white, gray, or black. Don't choose designer whites, grays, or blacks, which contain trace amounts of color that can still influence your perception enough to be significant.

Fashion

Wear neutral colors for color critical tasks. If you wear bright colors, they'll influence your perception too, especially if light reflects off of them and onto your surroundings or images.

Light

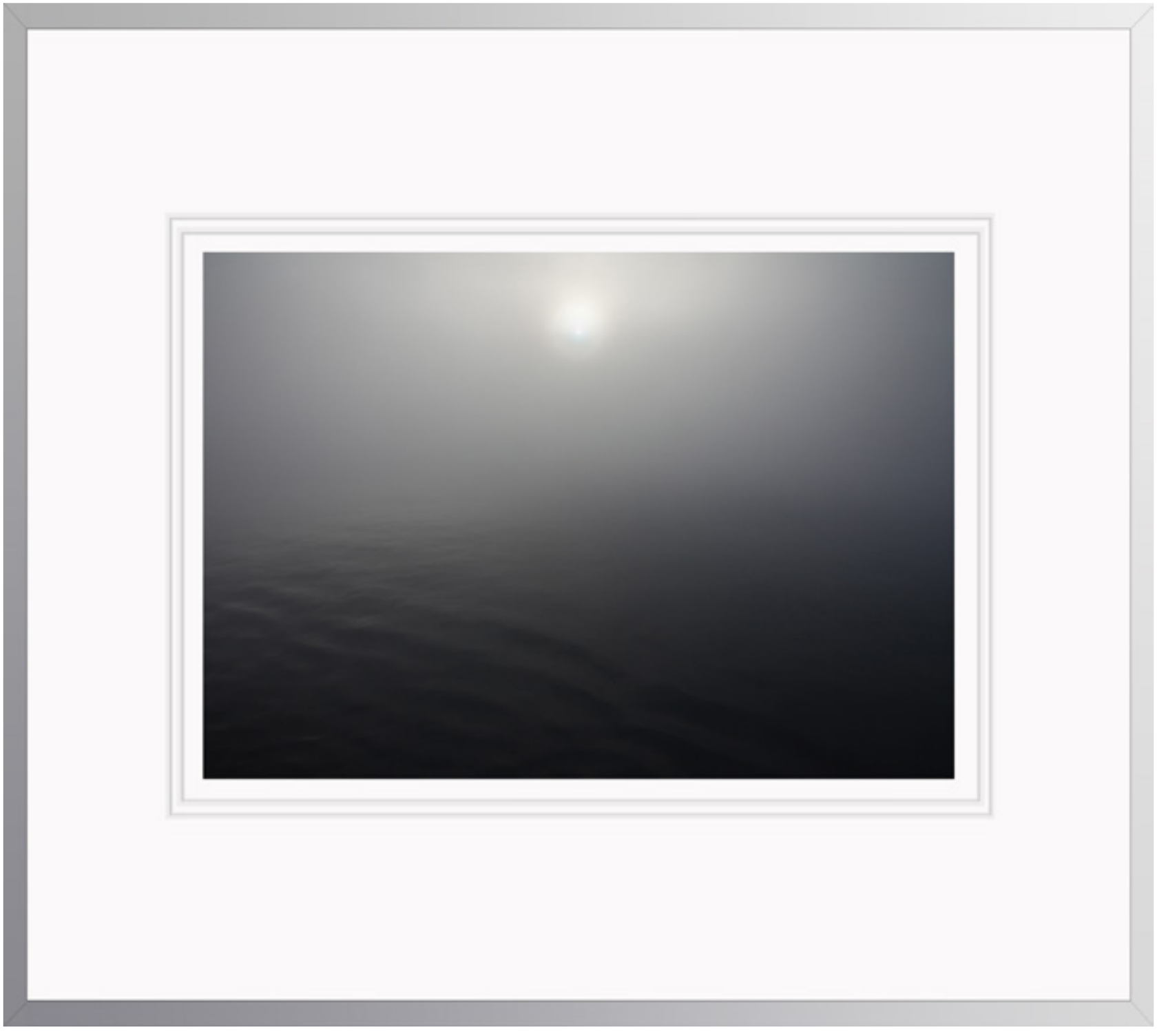
The most important thing to control in your environment is light; viewing light, secondary light sources, and ambient light First, you'll want to consider the amount of light – measured lux. It's better to have too much light than too little light; colors will appear dull if you don't use enough light; just don't produce glare or make viewers squint. (A CRI of 90 or higher is recommended.)

Make your computer desktop neutral.
Download this desktop image here.

Control your light sources.

Second, consider the color temperature of light – measured in Kelvin degrees. While 5000K is the industry standard (most viewing boxes and printer profiles are made for the 5000K), in real world situations very few people view printed color under such a cool light. For the end user, viewing light for the end user, not just from user to user but also throughout the day. So, what do you do? Make prints for a specific lighting condition if practical. Otherwise, standardize on a viewing light temperature that can be least adversely affected in as many real world situations as possible. More people prefer the taste of 3500K than any other light temperature and full spectrum lighting (like Solux) renders all colors equally producing a clearer more saturated appearance.

Third, consider secondary and ambient light sources. Avoid backlighting; don't position your monitor or proofs/prints with bright light sources behind them. Eliminate reflections; use blinds for windows and reposition lights that reflect off monitors. Remove glare and flare as much as possible. Reduce eye strain and make your viewing experience as easy as possible. With a few careful choices you can make sure your environment supports your efforts to see and adjust color precisely everyday. It's time well spent. Without this attention to detail, even the most sophisticated color-management systems may be compromised. With this attention to detail, you can rest assured that you've done everything physically possible to control color. In a controlled environment, your color will truly shine.



Condensation CX

Use high quality printer profiles to render uniform neutrality (gray balance) throughout the tonal scale.

3 Monitor

Profile Your Monitor

If you want to display your images accurately, and make sophisticated decisions about how they will look, calibrate your monitor. The ICC profile created by monitor calibration will help your monitor display files better but it won't change them – that's what image editing software does. Without monitor calibration (accurately seeing your files) how would you know what to change or how to change it? Monitor calibration is a must. It's easy. You need a device to do it well.

Colorimeters don't have favorite and least favorite colors, don't have color deficiencies, don't get fatigued, don't drink caffeine or eat sugar, don't change over time or adapt to their environments, and don't have emotions. You do. All of these can affect your perception of color at one time or another. Colorimeters are in a stable state. You're not. So when it comes to making sure that your monitor displays color as accurately as possible, use a colorimeter.

You don't need a colorimeter if you have a spectrophotometer. Unlike a colorimeter, a spectrophotometer has it's own light source that can be used to make monitor, projector, or printer profiles. Spectrophotometers do more and cost more.

Calibrating and characterizing your monitor is a simple process. Use the profiling device and software of your choice. (I personally use X-Rite products. The EyeOne Display 2, ColorMunki, or EyeOne Pro.)

Set Gamma and White Point

Using your color management hardware's software, specify a Gamma 2.2 and a white point of D-65. These are the defaults for most monitor calibrations software today. The gamma is specified based on the operating system of your computer, now the same for both Mac and PC, not the gamma of your editing space, monitor, or output device. The white point is specified to simulate a clean white, neither too blue and bright nor too yellow and dull. While the industry standard for building ICC printer profiles and viewing prints is D-50 or 5000K, if you specify this setting during monitor calibration, more often than not your whites will appear to dull and yellow. This is due to limitations in monitor technology; their white points are so high, well above 7500K, that when you simulate a white point lower than 6500K the monitor's response starts to physically fail. A white point of D-65 is a simulation that generates a standard preferred appearance – or a good clean white.

Set The Brightness Of Your Monitor

Use your monitor's buttons or onscreen menu. The calibration software you use should help you confirm that you have set the brightness to a target range between 90 and 100 lumens. If your monitor is brighter than this target range, it will be more difficult to predict what your image will look like on other devices and it's likely your prints will appear too dark. If your monitor is darker than this target range, your whites will appear too dull and you may not see subtle shadow detail that exists in your files.

Measure Your Monitor's Color Space & Build The Profile

Once you've set, Gamma, White Point and brightness, all you have to do is click go and let the software do the rest. After measuring your monitor's color capacity, your color management software will generate an ICC profile that maps it. When you save the results, make sure the title for the resulting ICC profile contains the date. This profile will be loaded automatically whenever you restart your computer, until you build a new one. Repeat this process once a month.

Confirm Monitor Calibration

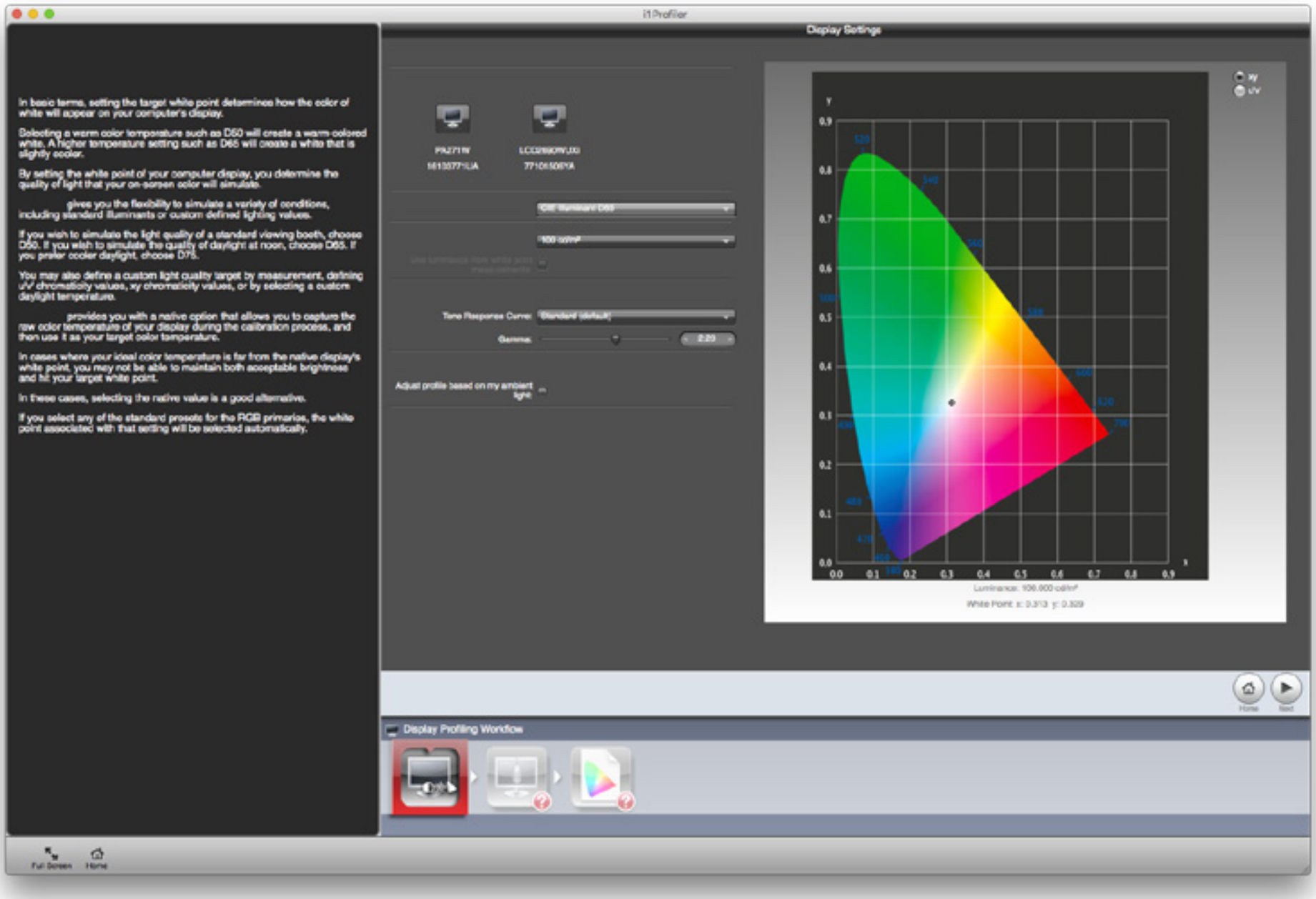
After calibration, view both synthetic test files and real world images. (You can find many on my website.) If neutral gradients contain color casts or crosses, repeat the process.

Repeat this process monthly or when conditions change substantially.

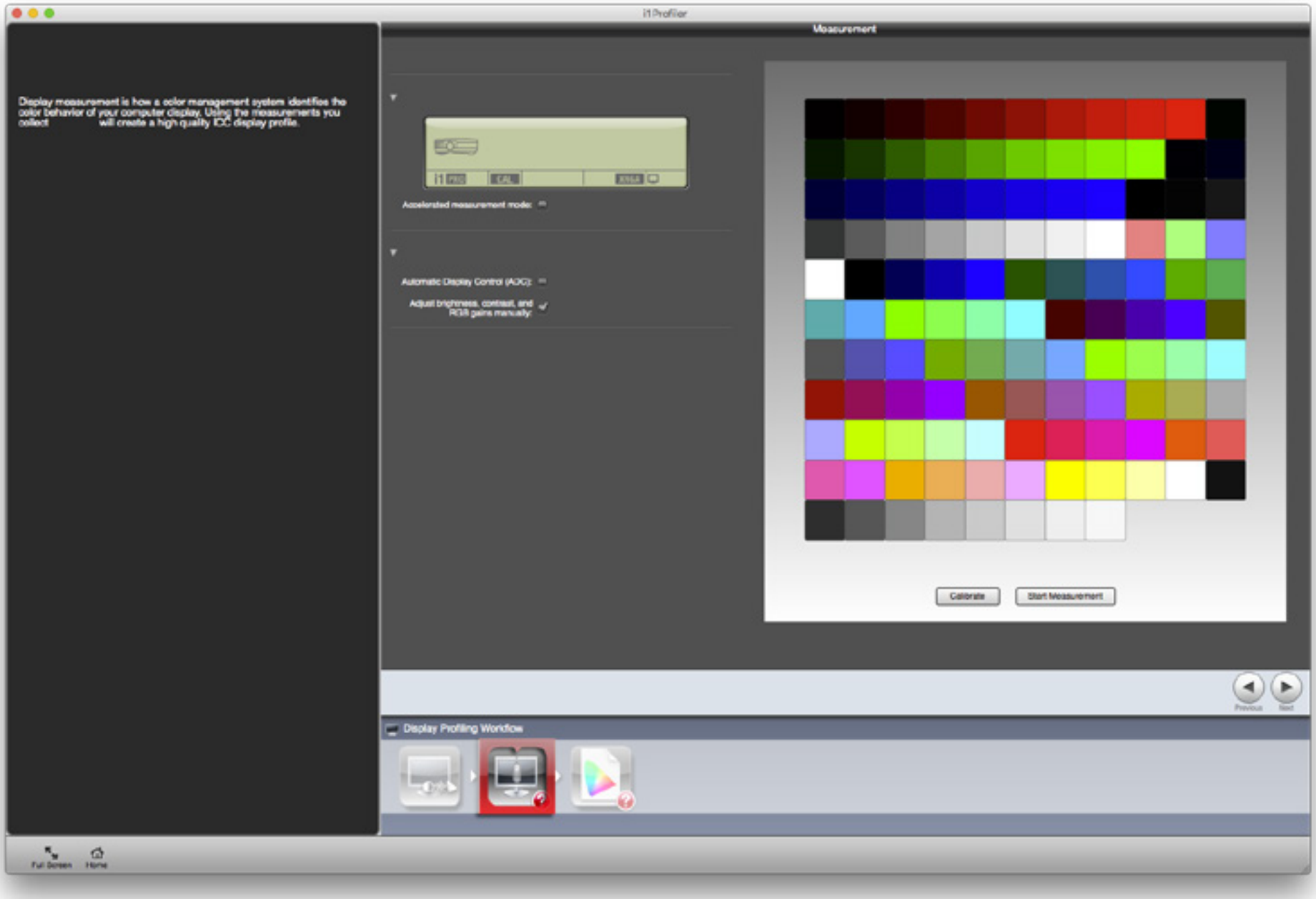
One of the advantages of calibrating your monitors to a device neutral standard is that when properly calibrated, all monitors, old or new, should generate very similar if not identical appearances with the same files. You will not have to adjust your files when you look at them on other monitors – someone else's or when you replace your old monitor.

All monitors are not created equally. Smart monitors cost more and offer more saturated color (wider gamut Adobe 1998 instead of sRGB) and the ability to set brightness more precisely. (I use NEC's PA272W.)

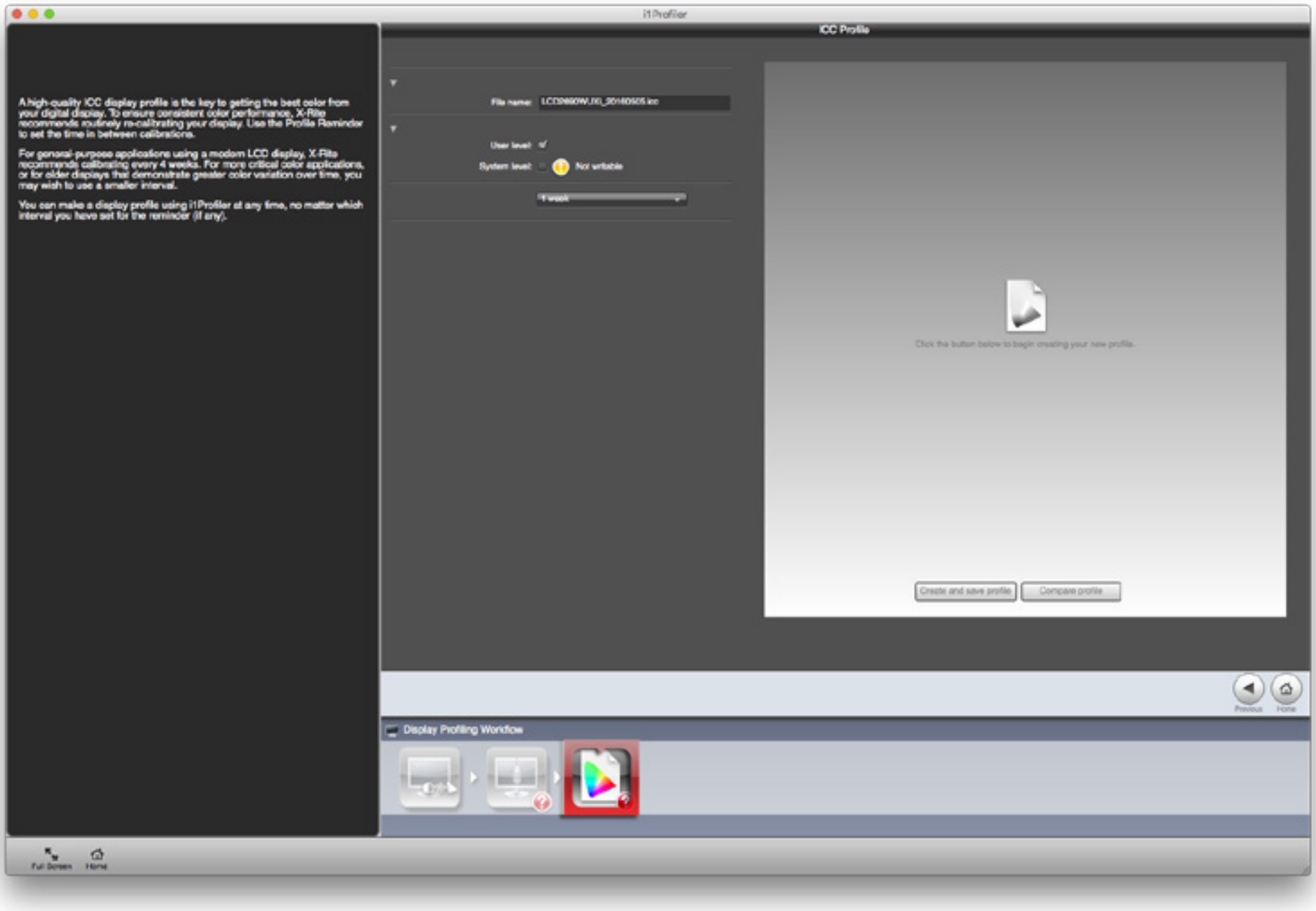
The value of the time and money invested in a good monitor and in calibrating and characterizing any monitor simply can't be over stated. Once you've made this investment, you'll reap countless dividends. And, you'll get more enjoyment out of the process and your images.



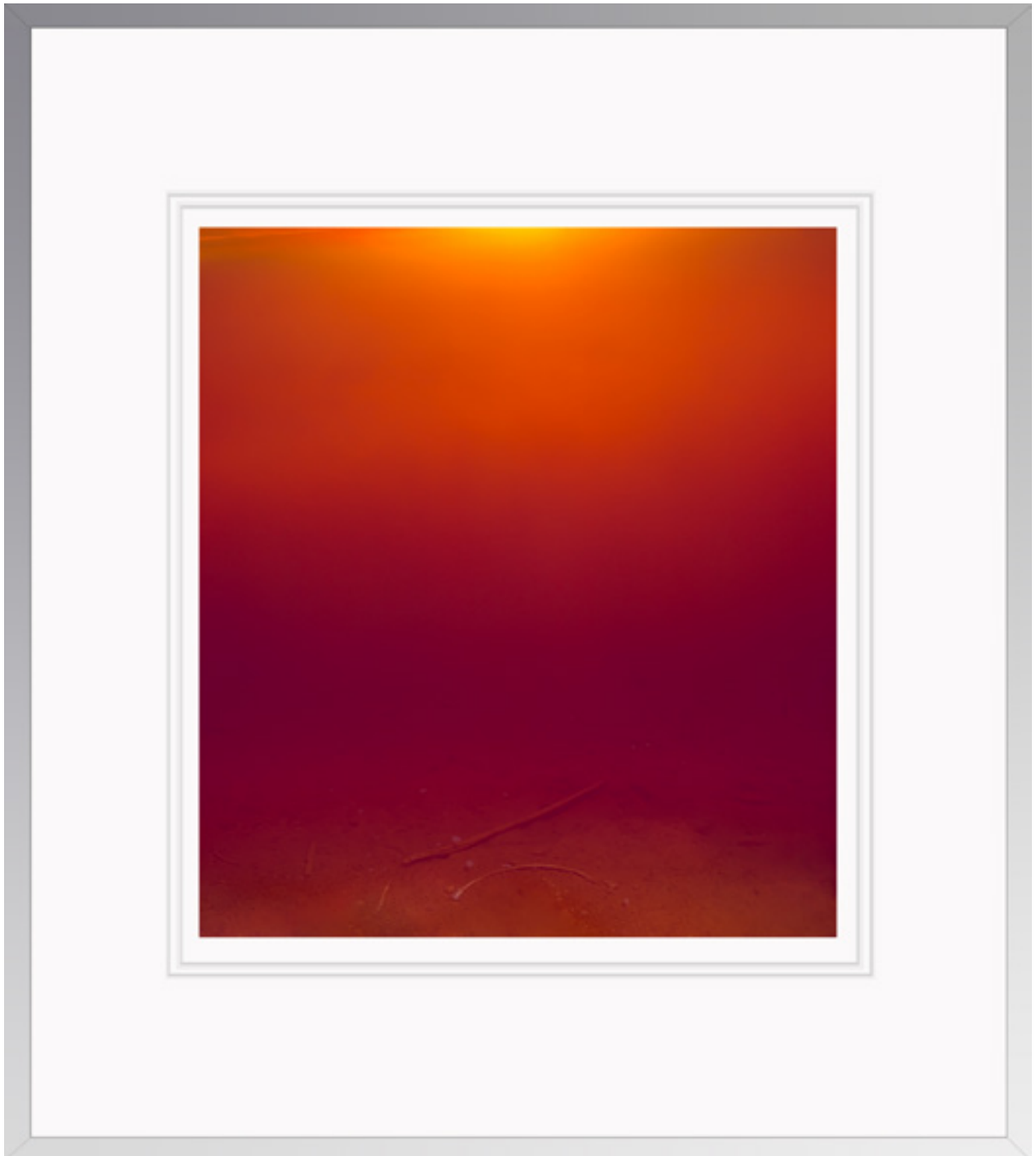
Specify Gamma 2.2, white point D-65, and set monitor brightness to target 90-100 lumens.



Start measurement.



Save the profile with the date in the name.



Reflection XVIII

The saturation of some printable colors can't be accurately displayed on current monitors. Print them to see them.

4 Wide Gamut

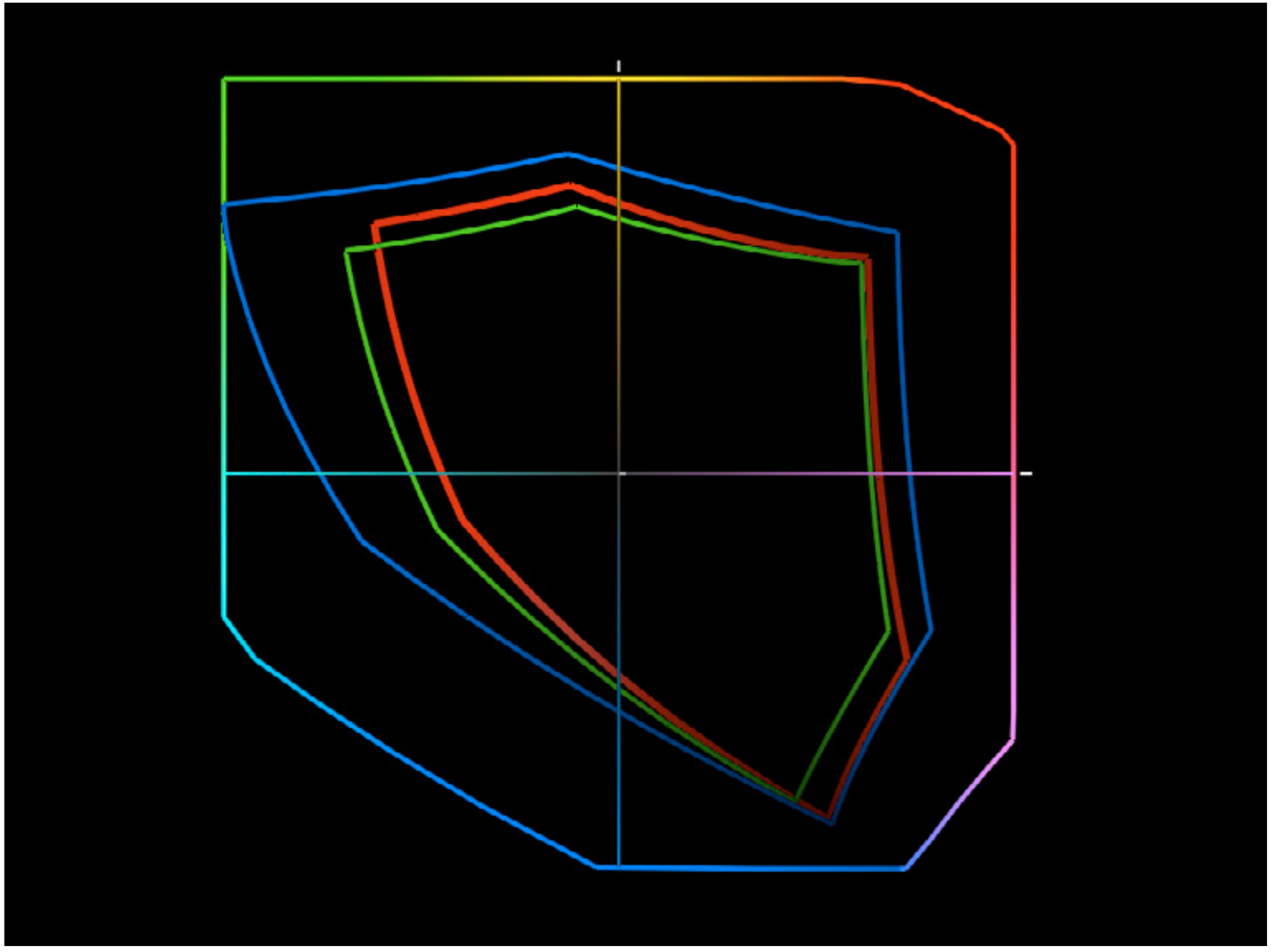
Use A Wide Gamut Color Space

Standard RGB editing spaces include sRGB, Colormatch, Adobe RGB (1998), and ProPhoto, from smallest to largest gamut. I recommend choosing ProPhoto RGB as your standard color space for image editing because among these four it's the only one that can contain as much color saturation as your camera can capture. If you use another editing space, your images may lose some color saturation.

Start wide and stay wide. Capture your images in wide gamut color (Raw) and edit and print them in wide gamut color (ProPhoto RGB). Convert only copies of your master files into smaller gamut spaces for specific uses. Converting images from wider gamut spaces to smaller gamut spaces reduces saturation. Converting images in smaller gamut spaces to wider gamut spaces doesn't increase saturation. Why? Think of a bucket full of water. If the water is color, then the bucket that holds it is the editing space. If you pour water from a big bucket into a small bucket, some of the water will be lost. Pouring the smaller volume of water back into the larger bucket won't make the total volume of water larger; it will be the same amount of water in a larger bucket.

ProPhoto is so wide gamut that when you use it, you need to edit 16 bit mode. Basically, the steps between individual values is much larger than smaller gamut editing spaces, so without enough shades of gray, significant edits may produce posterization or banding. In contrast to the 256 shades of gray in 8 bit files, 16 bit files provide 65,536 shades of gray – more than enough to eliminate this problem.

When you use ProPhoto, be careful when increasing saturation. ProPhoto exceeds the gamut of even the most sophisticated monitors, so it's possible to oversaturate values in files without seeing it. In a majority of cases you won't be able to display or print these values, but in some cases you may be able to, and in the future you most certainly will. So, in general, when you use Saturation or Vibrance sliders stop at the point where you don't see changes.



Four standard device neutral RGB editing spaces compared – sRGB, Colormatch, Adobe RGB (1998), ProPhoto RGB (full color).

Antarctica CLXVI

A paper's white (ISO brightness) significantly impacts the color of highlights. Cooler is more versatile.

5 Soft Proof

Soft Proofing

Ink on paper absorbing light can't reproduce all the colors a monitor emitting light can display. So when you print images the colors you see on a monitor will change, sometimes only a little, sometimes a lot. Soft proofs show you the limits of prints on a monitor. Not to be confused with a hard proof or physically printed piece, a soft proof uses the ICC profile you plan to print with to create an onscreen simulation of an image as it will appear after printed.

A soft proof can show you the differences your choices between inks and papers will make. When you soft proof, look for three things: one, how much duller (possibly yellower) is a specific paper white when compared to the monitor's white; two, how much weaker is the black of ink on a specific paper when compared to the black of the monitor; three, how much less saturated are out of gamut (unprintable) colors and do any hues become warmer or cooler.

A soft proof's simulation won't change your file, just its appearance. It is essential that you specify the correct ICC profile and that the profile be accurate; the soft proof is only as good as the profile used. Once soft-proofed, you can make adjustments to your file before printing to get a better first hard proof.

Soft proof images before printing them to determine what rendering intent to use and make printer/ink/paper specific adjustments to files.

Soft Proof Comparing Two Views At Once

It's helpful to simultaneously see a file both before and after it has been soft-proofed. Comparing these two versions will help you see more accurately how your image will change when printed and how to compensate for these changes with additional adjustments.

To do this in Lightroom's Develop module, with the toolbar open (T), check Soft Proofing and next to that check box click on the Cycles between before and after icon. Under the Histogram check Simulate Paper & Ink, choose Intent, and pick a printer/paper profile.

To do this in Photoshop, first, soft proof the file (View > Proof Setup > Custom), then in the resulting Customize Proof Condition dialog box, choose a Device To Simulate, Rendering Intent, check Black Point Compensation and Simulate Paper Color. Next, duplicate the file (Image > Duplicate), the duplicate file will not be soft-proofed and won't be used for anything but visual comparison.

Use Black Point Compensation

Check Black Point Compensation. If you don't, detail in shadows may be lost.

Simulate Paper Color and Simulate Black Ink

Because a monitor is capable of displaying a brighter white and a darker black than a print, checking the options Simulate Paper Color (dulls whites) and Simulate Black Ink (weakens blacks) is advisable. Activating these features will not make the image look better but it will make the preview more accurately match the print.

Choose A Rendering Intent

Your choice of rendering intent may have a significant impact on print quality. Rendering intents are methods of gamut compression (rendering unprintable colors printable), or how out-of-gamut (unprintable) values are treated relative to in-gamut (printable) values. Your choice of four rendering intents can be simplified to two. Forget about two rendering intents, Saturation (It's useful for bold graphics but causes color distortions in continuous tone images) and Absolute Colorimetric (It's useful for proofing other devices.) – neither will make the best quality print a printer is capable of. Instead, choose between Relative Colorimetric and Perceptual. Use Relative Colorimetric to maintain tonal relationships; its side effect is lower saturation. (This makes it an excellent choice for rendering semi-neutrals and neutrals.)

Use Perceptual to maintain more saturation; its side effect is overall lightness and sometimes out-of-gamut hues shift temperature. These are generalizations rather than hard and fast rules. Actual results can be unpredictable. So, always compare these two rendering intents when you soft proof. Then, pick the rendering intent that gives you the appearance you like.

Make Output Specific Adjustments

Sometimes the difference between the unsoft-proofed image and the soft-proofed image is minimal (typically when printing colors of average saturation) – sometimes it is not (typically when printing very saturated colors).

Once a soft proof shows you how an image will change when printed, you may decide to adjust the file to compensate for those changes, before printing.

In Lightroom, for more sophisticated adjustments than the Print module's Print Adjustment sliders Brightness and Contrast, under the Histogram check Create A Proof Copy and use any of Lightroom's Develop module sliders.

In Photoshop, use one or more adjustment layers to make the soft-proofed image match the unsoft-proofed image as closely as possible.

More often than not, increased mid-tone contrast is needed – to compensate for dynamic range compression as monitors have a contrast ratio of 1000:1 while prints have a contrast ratio of 100:1. Frequently, increased saturation is needed to boost in-gamut colors (Remember, the rendering intent has already dealt with the saturation of out-of-gamut colors.). Infrequently, additional adjustments are needed.

Don't try to get a blacker black or a whiter white by further adjusting your file's black points and white points; you'll only lose detail.

Don't try to saturate out-of-gamut colors; you'll only distort in-gamut colors. (The only way to expand gamut is to choose a different ink and/or paper.)

Ignore Lightroom's and Photoshop's Gamut Warnings. They often don't accurately indicate which colors are out of gamut and don't show you where in-gamut colors are affected.

Use output specific adjustments only for printing to one specific paper and ink combination. Make new ones for new combinations.

It's inevitable that an image will undergo changes when printed; sometimes a little and sometimes a lot. Always soft proof an image before you print so that you can frame reasonable expectations, choose a rendering intent, identify how an image will be affected by gamut-compression, and make corresponding output specific adjustments.

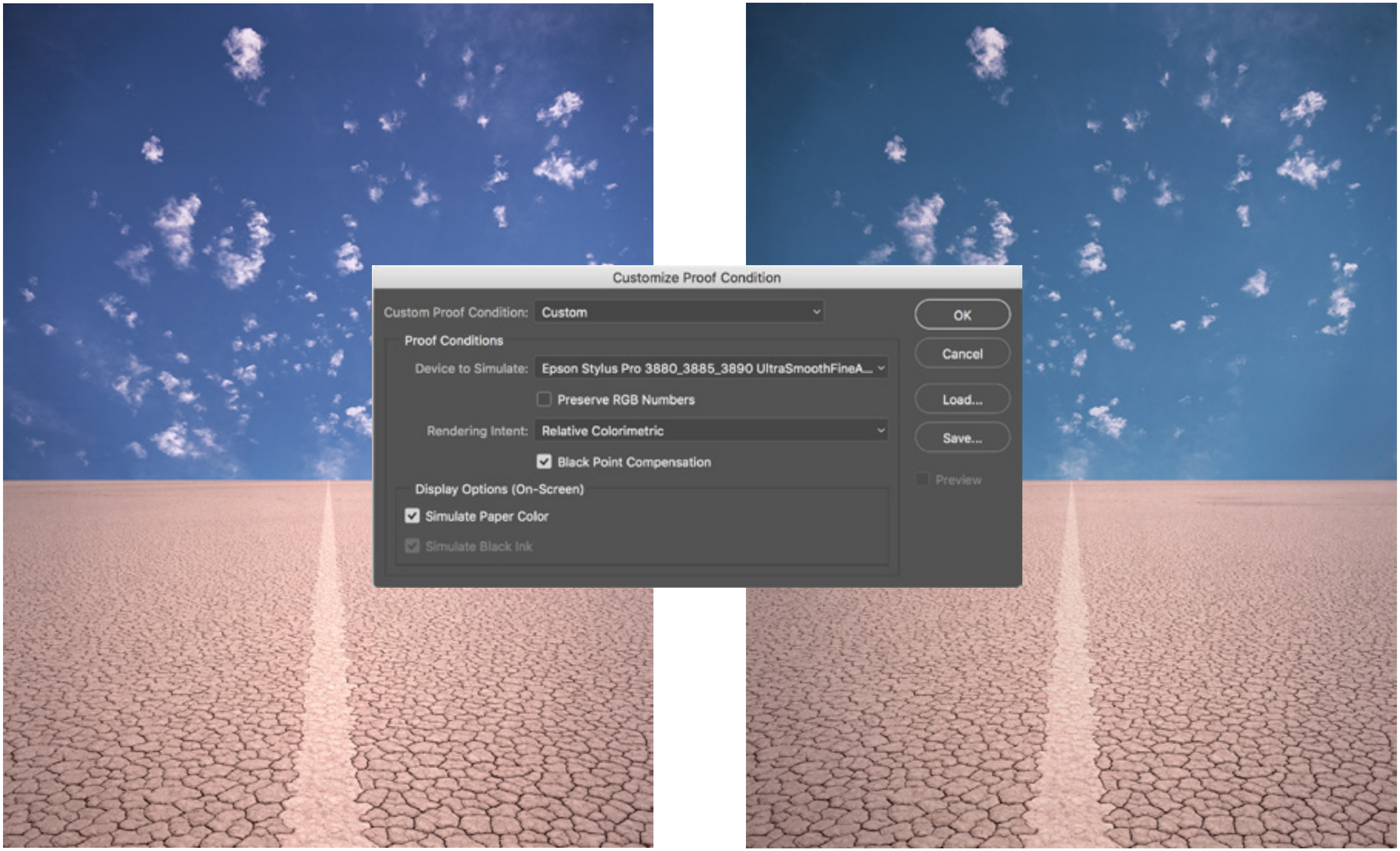
Glass (or plastic) emitting light will always look different than paper (or something else) absorbing light. However, you can get one to closely simulate the appearance of the other.

A soft proof gets you the best first hard proof possible. Soft proofing will save you time, materials, and money. Soft proofing will help you make better prints.

While it's greatly reduced in digital printing, there's still a use for and an art to hard copy proofing – after softproofing.

Find out more on my website.

Lightroom's Soft Proofing interface



Photoshop's Proof Setup dialog box Customize Proof Condition

Illumination VI

Large fields of color look brighter, so plan to darken larger prints.

6 Lightroom

Printing With Lightroom

To get great prints you have to navigate printer software successfully. Even if you get everything else right in color management, if you take a wrong turn here, you still won't get the results you're looking for.

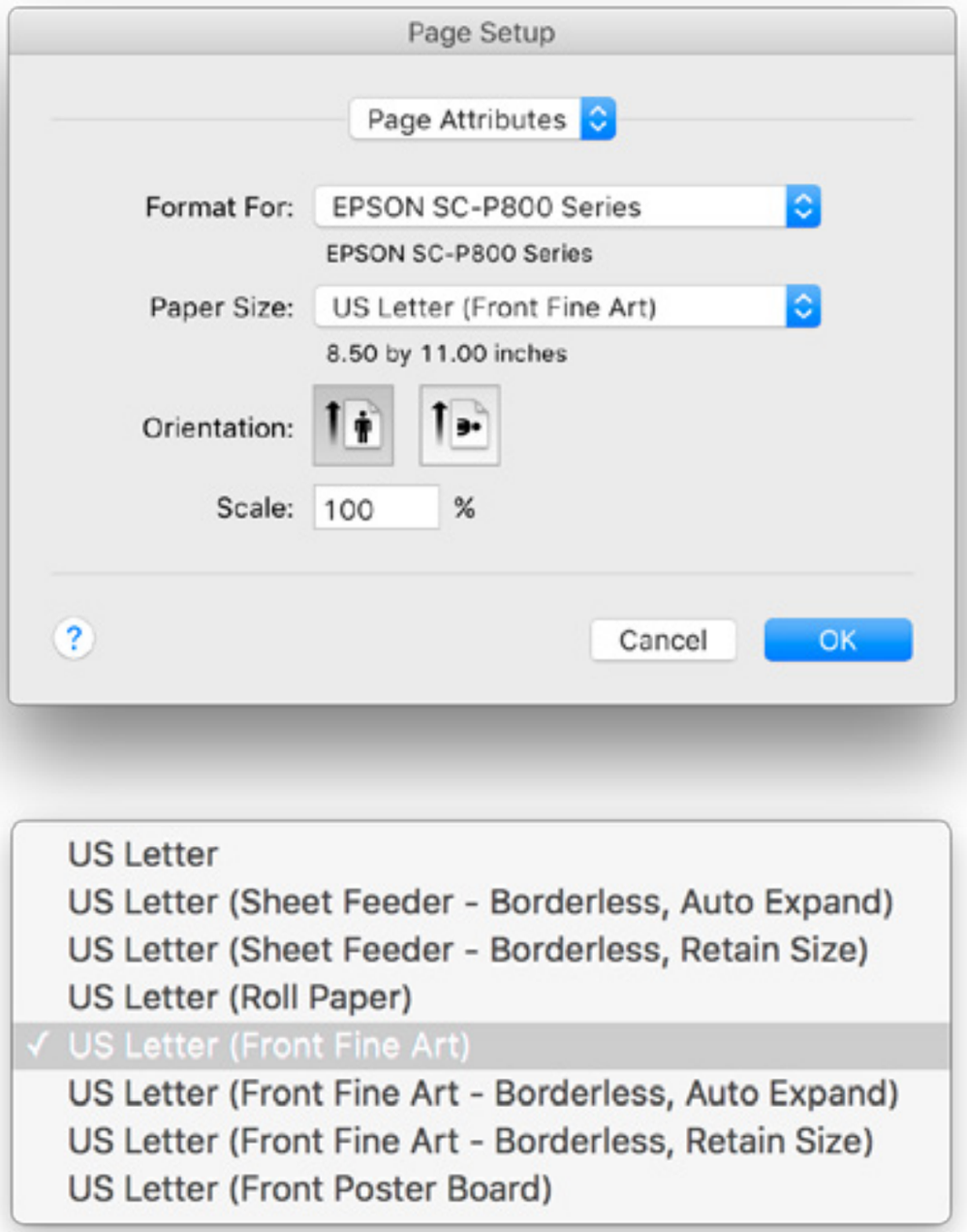
Successfully managing color for digital printing requires that the color in an image file be converted from its device neutral color space (like Pro Photo RGB) to a device specific color space (as defined by an ICC profile characterizing a specific printing situation –printer, ink, paper, and driver.)

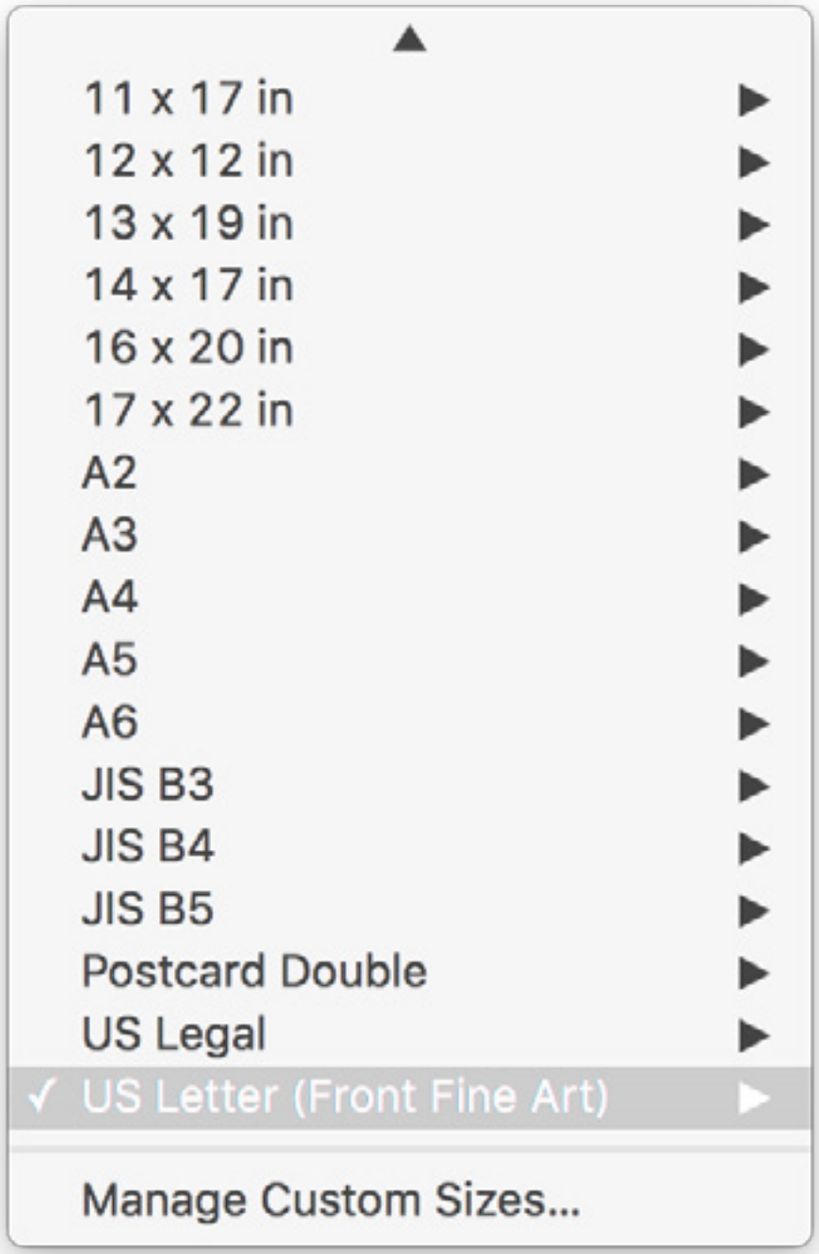
You can let the imaging software make this color conversion or you can let the printer make this color conversion. For most color printing applications, let Photoshop manage the color; this is the only way you can use a custom profile, which is necessary when using other manufacturer's papers.

Take these steps using Lightroom and the Epson driver.

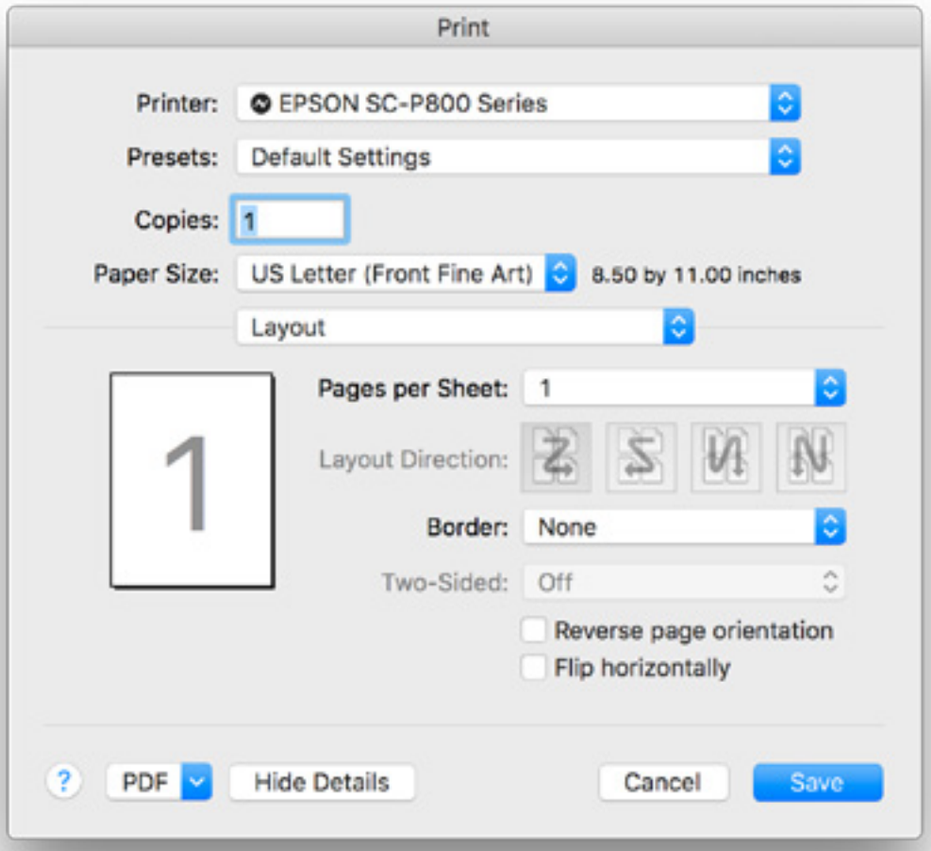
1. In Lightroom's Print module click Page Setup.
2. Set Paper Size and paper feed method.
3. Click on one of the two Orientation icons – portrait or landscape.
4. Click OK.
5. Click Print Settings to activate the printer software.
6. Under Printer choose your printer
7. Change the Layout drop down menu to Printer Settings.
8. Choose Media Type.
9. Set Output Resolution. Choose SuperFine -1440 dpi for media using Ink : Matte Black or SuperPhoto – 2880 dpi for media using Ink : Photo Black.
10. Uncheck High Speed only if printer banding occurs.
11. Click Save.
12. Optionally, use Lightroom's Layout panel to adjust margins.
13. Open Lightroom's Print Job panel.
14. If the file's resolution (seen as an overlay on the print preview) is 240 ppi or higher leave Print Resolution unchecked. If the file's resolution is lower than 240 ppi, check Print Resolution and set it to 240 ppi.
15. Check Print Sharpening and select your desired level of output sharpening – Low, Standard, or High.
16. Set Media Type to Matte or Glossy.
17. Check 16 Bit Output.
18. Under Profile select the ICC profile that characterizes your choice of printer and paper.
19. Under Intent, click on either Perceptual or Relative. (See Soft Proofing.)
20. Click Print.

Lightroom's Print module

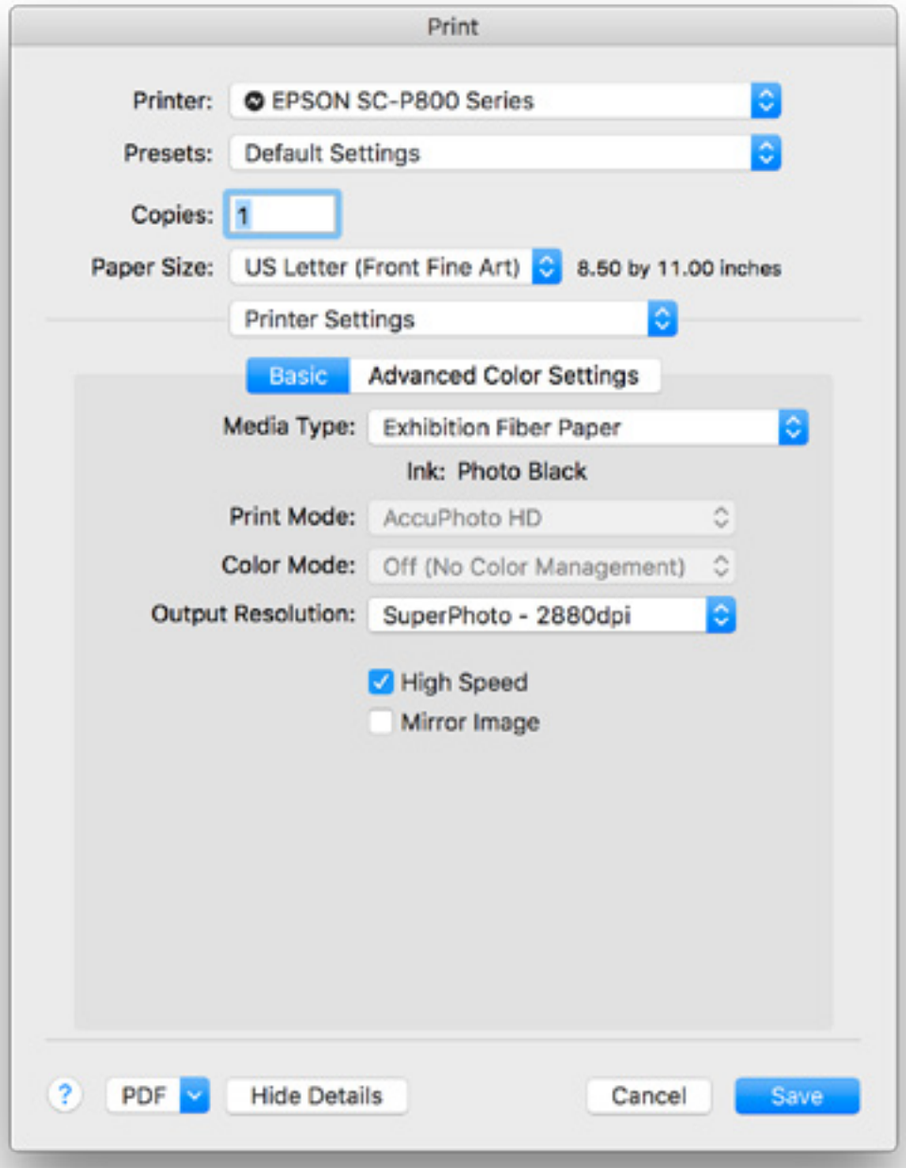




Epson Page Setup



Epson Print Dialog Box



Print Settings Dialog Box

Correspondence III Sonata In Blue

Not enough or too much saturation can reduce a print's luminosity. If printer profiles distort colors, compensate by making output specific adjustments.

7 Photoshop

Printing With Photoshop

To get great prints you have to navigate printer software successfully. Even if you get everything else right in color management, if you take a wrong turn here, you still won't get the results you're looking for.

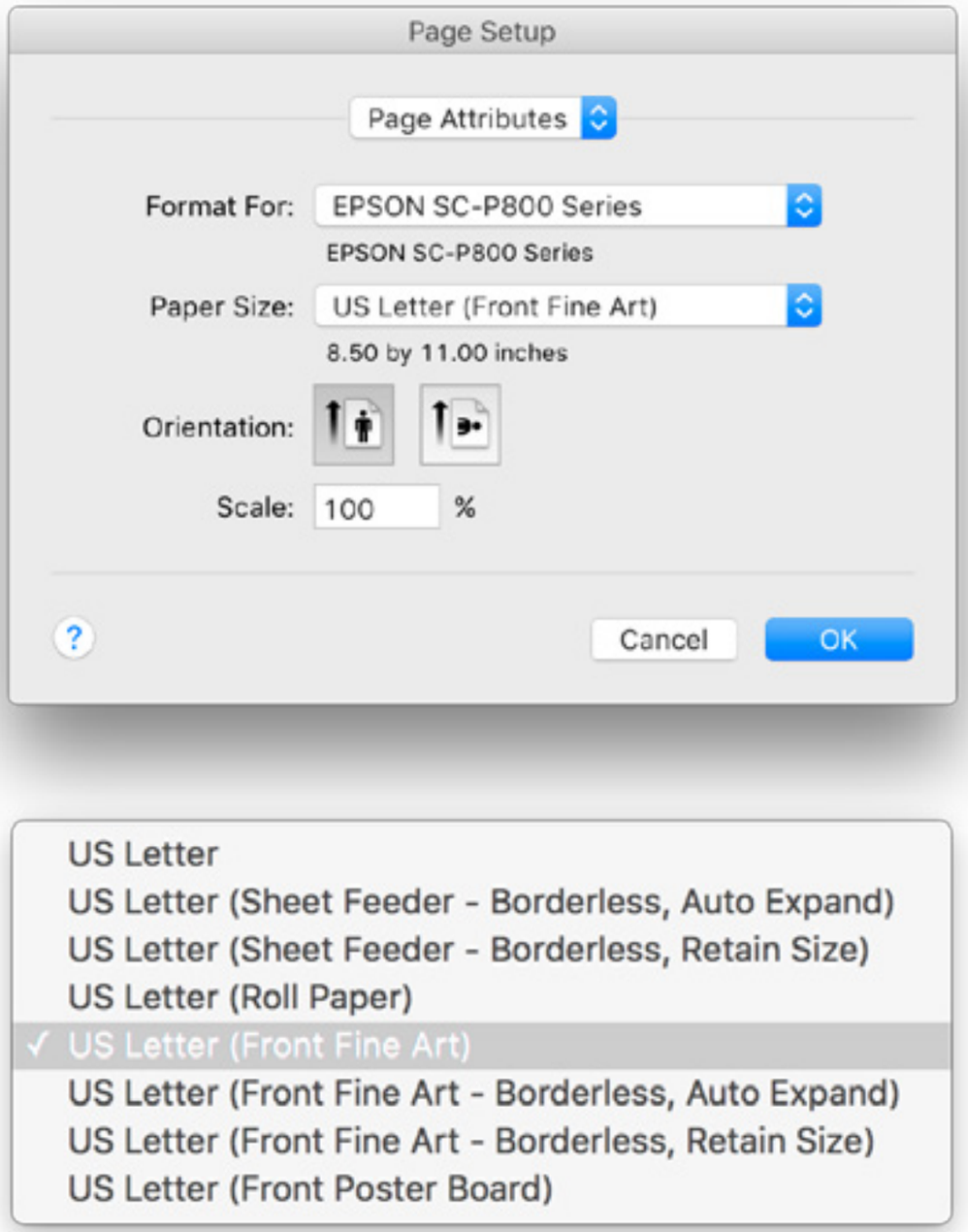
Successfully managing color for digital printing requires that the color in an image file be converted from its device neutral color space (like Pro Photo RGB) to a device specific color space (as defined by an ICC profile characterizing a specific printing situation –printer, ink, paper, and driver.)

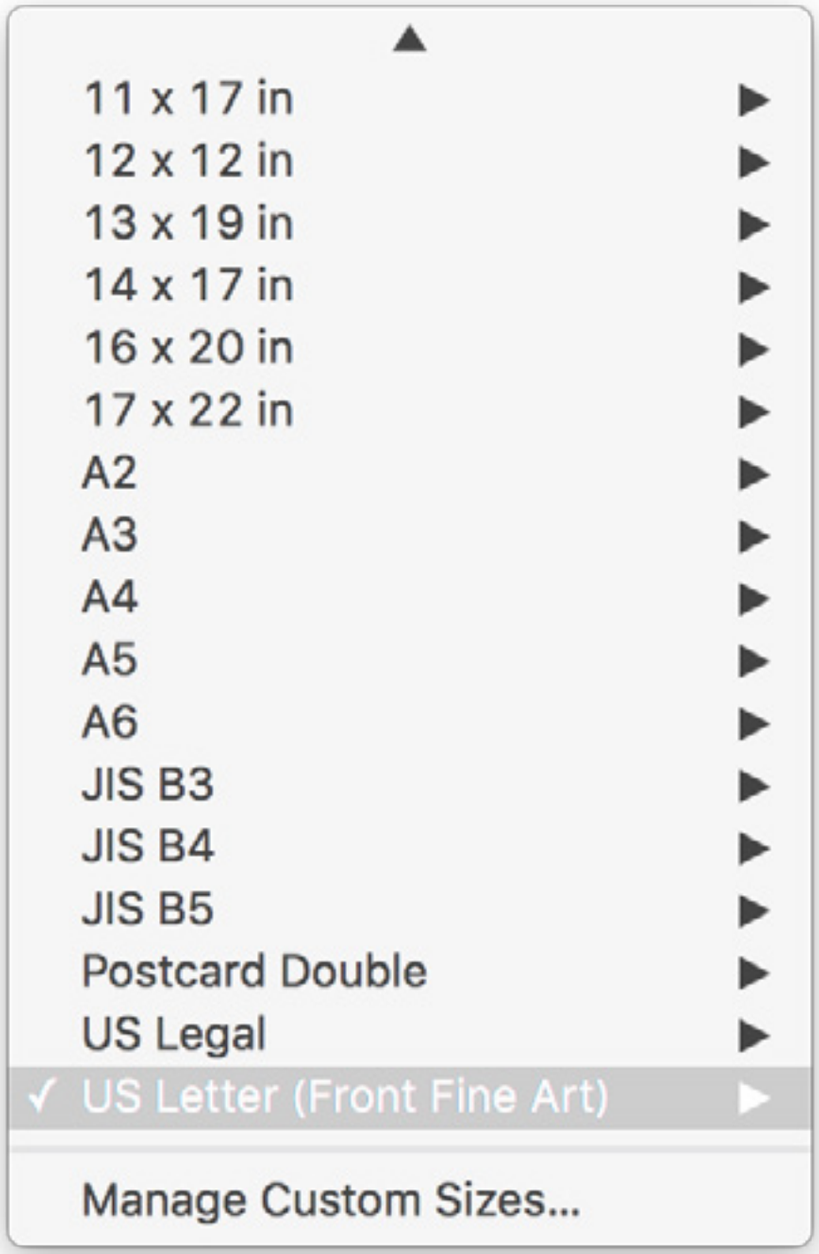
You can let the imaging software make this color conversion or you can let the printer make this color conversion. For most color printing applications, let Photoshop manage the color; this is the only way you can use a custom profile, which is necessary when using other manufacturer's papers.

Take these steps using Photoshop and the Epson driver.

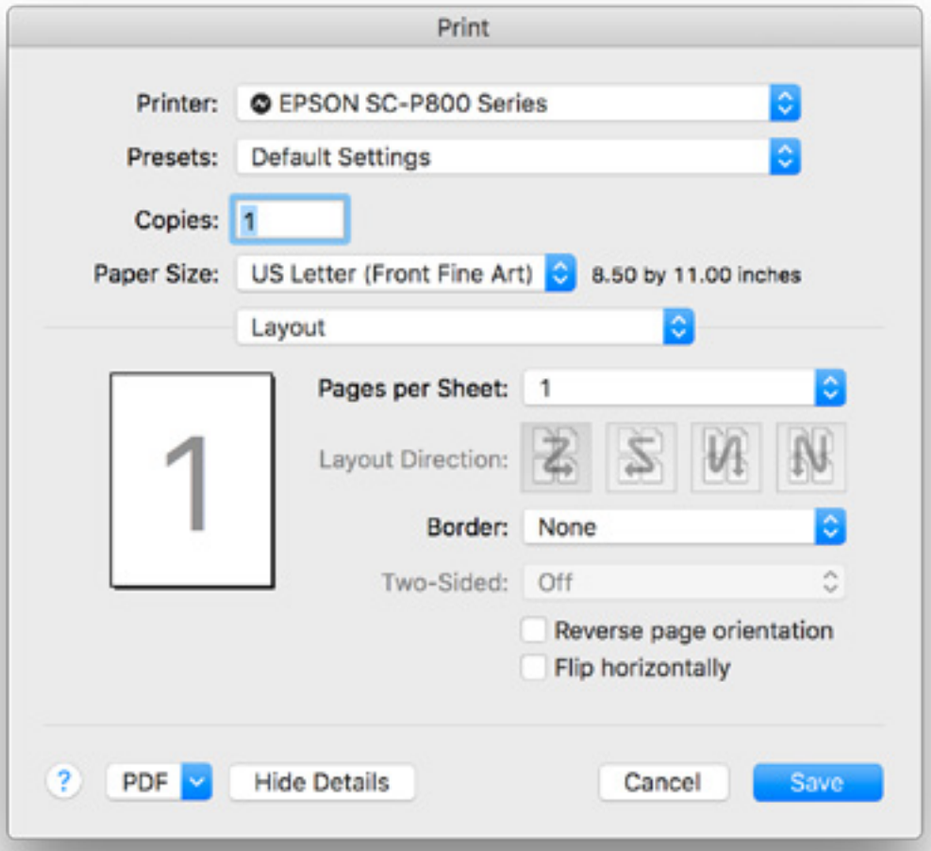
1. Under Photoshop's menu File choose Print.
2. In Photoshop's Print Setting dialog box, under Printer choose the printer you'll use.
3. Click Print Settings to activate the printer software.
4. Set Paper Size and paper feed method.
5. Change the Layout drop down menu to Printer Settings.
6. Choose Media Type.
7. Set Output Resolution. Choose SuperFine -1440 dpi for media using Ink : Matte Black or SuperPhoto – 2880 dpi for media using Ink : Photo Black.
8. Uncheck High Speed only if printer banding occurs.
9. Click Save.
10. Having returned to the Photoshop Print Settings, under Layout click on one of the icons for orientation – portrait or landscape.
11. Open the Position and Size panel. If your file does not fit in the preview window, check Scale to Fit Media. Make sure Print Resolution is 240 PPI or higher; if Print Resolution drops below 240 PPI, return to Photoshop and resample the file to 240 PPI and return.
12. Open Photoshop's Print Setting's Color Management panel.
13. Set Color Handling to Photoshop Manages Colors.
14. Set Printer Profile to the ICC profile that characterizes your choice of printer and paper.
15. Check Send 16-bit Data.
16. Set Rendering Intent to the rendering intent you preferred when you soft-proofed the file. (If you didn't soft proof the file, click Match Print Colors and compare the rendering intents Relative Colorimetric and Perceptual.)
17. Make sure the default setting for Black Point Compensation stays checked.
18. Click Print.

Photoshop Print Settings

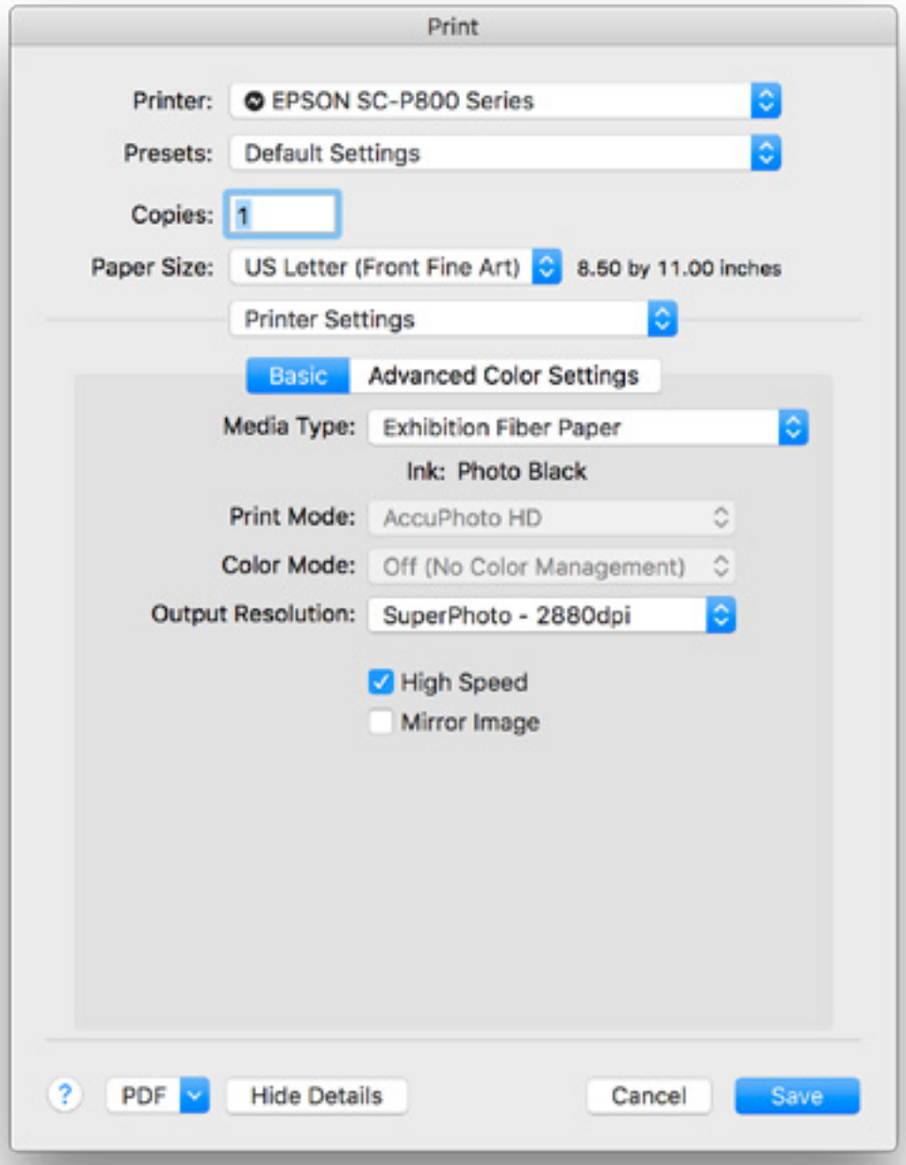




Epson Page Setup



Epson Print Dialog Box



Print Settings Dialog Box

Suffusion XV

For the deepest blacks in black and white prints, select a glossy paper and print with the printer driver's black and white feature.

8 Black & White

Advanced Black & White Printing

Inkjet printer manufacturers provide proprietary software solutions to separate black-and-white digital files differently than color ones. Using more black and less color ink to make a print does several things. It makes it easier to achieve a truly neutral color. It makes it easier to achieve gray balance or a consistent hue throughout the entire tonal scale. It increases the density of the black. It reduces metameric failure or the tendency of a print's appearance to shift under different light sources. It increases longevity, by more than 50%, because black is the least light sensitive ink.

Because these proprietary solutions are non-ICC compliant, you can't soft proof the results. This also means that previews inside these advanced black-and-white solutions won't be of the image you are printing, so previews default to a standard image provided by the manufacturer. To accurately see the results, you need to make a variety of hard proofs or test prints. As well as accessing default settings these solutions offer the ability to adjust print appearance by varying ink density, rather than changing values in the file being printed. Use printer driver features to optimize ink densities (overall, blacks, whites) and tone (hue). Make all other adjustments with your imaging software. When you first do this, start with a representative image, note the settings on the various proofs you make, and save the results for future reference. With a little testing, your options will be clearly displayed before you.

You can only make a black and white print using this solution. If you send a full color file to the printer driver using this printing route, you'll get a black-and-white print, which is not the best way to make a black-and-white conversion. While you can make warm or cool toned prints with this solution, you cannot print selectively toned treatments created in Photoshop.

Epson's Advanced B&W Photo offers several features.

There's a Tone feature, which will enable you to adjust the brightness of your image with several options: Darkest, Darker, Dark, Normal, Light. The default Dark may be a little dark, while Normal may be a little light.

There are Brightness and Contrast sliders. Both can have adverse side effects. The Brightness slider can reduce dynamic range, graying blacks or whites and losing detail in either highlights or shadows. Contrast can be added to an image with greater precision by adjusting a file prior to printing.

There are Shadow Tonality and Highlight Tonality sliders. Both work to preserve details in their respective targets. Watch them carefully. When used aggressively, they can affect the lightness of and the reduce contrast of mid-tones.

There's a Max Optical Density slider, which reduces the density of the printed black and may lighten the entire image.

There's a Highlight Point Shift check box that, unlike the Highlight Tonality's slider, offers a one-click solution to preserve maximum highlight detail. It's quite useful for reducing gloss differential.

There's a Color Toning wheel, which offers the option to tint images. Default settings are available in a pull down menu - Neutral, Cool, Warm, Sepia. Fine Adjustment is accessed through the color-toning wheel, where any hue can be mixed in varying degrees of intensity.

This is a uniform toning solution and does not offer the ability to cross tone or selectively tone an image. (Perform these types of toning in Photoshop and print the result as a color image.)

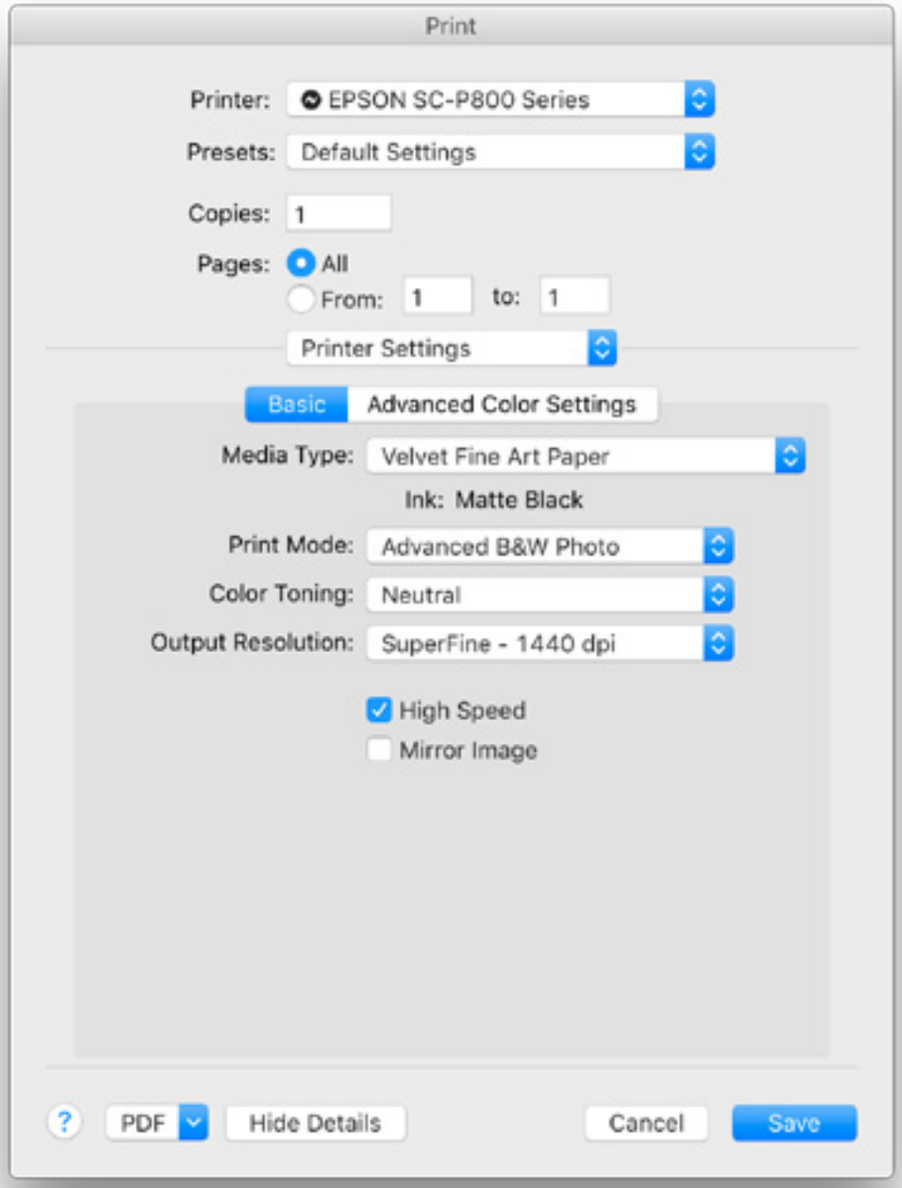
Take these steps to use Epson's Advanced B&W Photo feature.

Photoshop

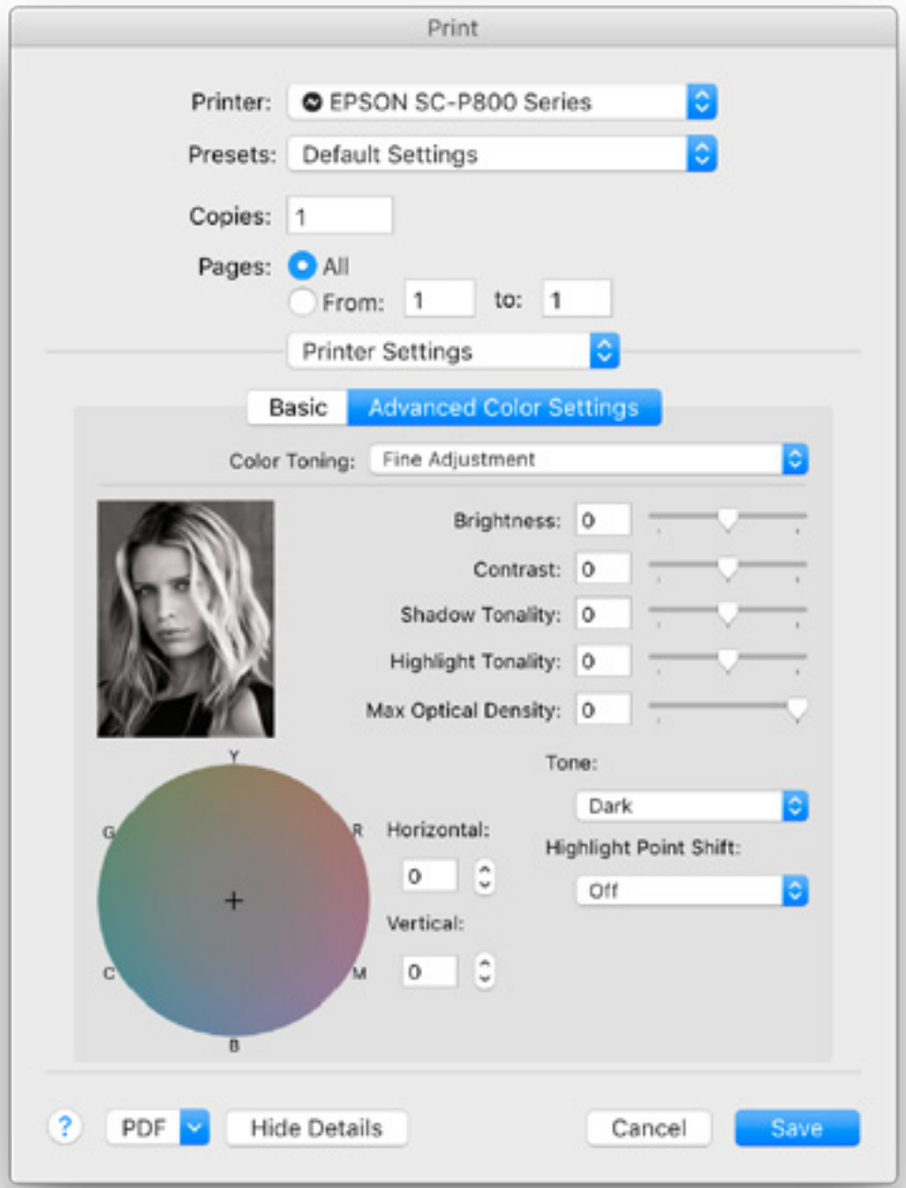
1. Under the File menu choose Print.
2. In the Photoshop Print Settings dialog box select your Printer.
3. Under Color Handling Select Printer Manages Color.
4. Click on Print Settings.
5. Now in the Epson driver, select Printer Settings.
6. Set Media Type.
7. Set Print Mode to Advanced B&W Photo.
8. Set Color Toning or click Advanced Color Settings for more options.
9. Set Output Resolution.
10. Click Save.
11. Optionally, save a new Preset to use these settings with other images.

Lightroom

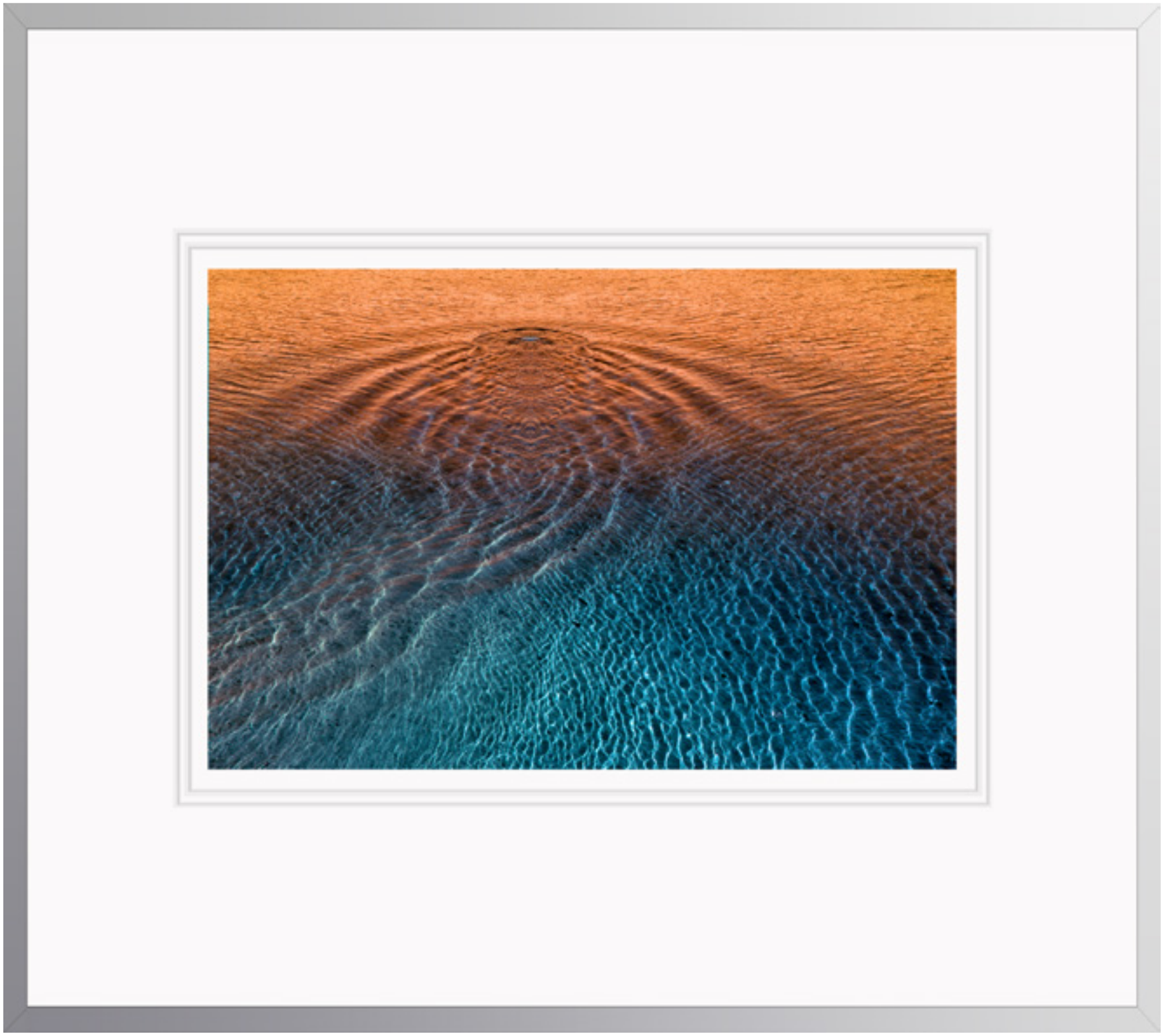
1. In Lightroom open the Print Job panel and go to Color Management > Profile > Managed By Printer.
2. Access the Epson driver by clicking Print Settings.
3. Now in the Epson driver, select Printer Settings.
4. Set Media Type.
5. Set Print Mode to Advanced B&W Photo.
6. Set Color Toning or click Advanced Color Settings for more options.
7. Set Output Resolution.
8. Click Save.
9. Optionally, save a new Preset to use these settings with other images.



Epson Printer Settings



Epson B&W Advanced Color Settings



Wake I

To preserve it, deep shadow detail may need to be lightened before printing.

9 Ink

Ink

The science of ink formulation is one of the most significant, factors driving the current inkjet revolution. Ink is complex chemistry. It's colorants (dye or pigment varying in type and density), resins (protecting colorants and reduce metamerism), mediums (suspending the colorants), solvents (increasing viscosity to deliver it through tiny nozzles), and drying agents (decreasing drying time and reducing dot gain).

Dye VS Pigment

While there are profound differences between dye-based and pigmented inks, the differences in image quality are frequently overstated and sometimes misstated. In the past, pigmented inks suffered from reduced gamut (saturation) and dmax (maximum density or black) and increased metamerism. Today the differences lie largely between cost (Dye is less expensive.) and longevity/durability (Pigment reigns supreme.).

Multiple inks

To improve gamut and dmax manufacturers have been adding more inks to inksets; using alternate colors (variants of offset's high-fi orange and green, light cyan and magenta, or red, green, and blue) and additional blacks (lighter blacks or blacks optimized for matte or glossy surfaces) combined with C, M, Y, and K (black) inks.

Do more inks yield better image quality? Typically. But not necessarily. Image quality is the result of a combination of a number of factors. Both the physical makeup of ink and its application are important. To assess print quality, you have to assess the total printing solution – ink, profile, rendering intent, driver, screening algorithm, ink limit and substrate. Compare gamut, dmax, ISO brightness, neutrality, graybalance, metamerism, gloss differential, bronzing, gradation, fine line detail, longevity and durability. Ink solves a lot of problems.

Gamut and Dmax

The impacts of increased gamut and dmax are both easily seen. Gamut has a dramatic impact on color but not black-and-white print quality – more saturated color. Dmax has a tremendous impact on both color and black-and-white print quality – blacker blacks.

What is not obvious is that greater dmax extends gamut by increasing the saturation of dark colors. Dmax and gamut figures for inkjet prints are at a photographic all time high; both significantly exceed historic print materials.

Neutrality and Graybalance

Inksets with multiple black inks not only deliver the best dmax, they also deliver the best neutrality and graybalance

(consistent tint throughout the tonal scale). Producing truly neutral and consistently neutral colors with supersaturated inks is quite challenging; black ink becomes a stabilizing factor. While ink is an essential factor, drivers and profiles play a significant role.

Highlight Detail

Light inks, including light black inks, aid in the reproduction of highlight detail. They hold detail with not just smaller but also less visible dots.

Metamerism

Metamerism, the tendency for a color's appearance to shift under different light sources, has been reduced by coating irregularly shaped pigment particles with polymers, making surfaces more uniform and reducing light refraction and by using multiple black inks and heavier black plate generations (using more black ink to reproduce the image).

Bronzing

Bronzing, an iridescent flash of colors mostly seen on glossy surfaces at different viewing angles, has been greatly reduced in current inkjet printing technologies, by changing ink choice and placement – heavier black plate generation and alternate screening frequencies (dot placement).

Gloss Differential

Gloss differential is an uneven sheen due to varying ink densities in highlights and shadows that affects glossy surfaces significantly more than matte surfaces. Gloss optimizing additives are incorporated into ink formulation to dramatically reduce gloss differential. Sprays, coatings, and varnishes applied after printing can also help reduce gloss differential. When using these types of non-native chemistry guard against staining and poor adherence, the tendency towards additive failure (reduction of gloss, dmax, or gamut), and possible reductions of longevity.

Longevity

Dye ink achieves significant lightfastness and ozone resistance only with a limited choice of swellable papers, which are not water resistant and prone to running in high levels of humidity. Pigmented ink offers superior longevity and durability with lightfastness, water and humidity resistance, and ozone resistance on all media (swellable, porous, rag). Inkjet longevity ratings are reaching new highs in photography – over 150 years for color and over 300 years for black and white. (See wilhelm-research.com for more information.)

Longevity is derived from a complex set of factors chemistry, adherence, lightfastness, and exposure are a few of the key elements. Where longevity is a concern, use tested materials whenever possible.

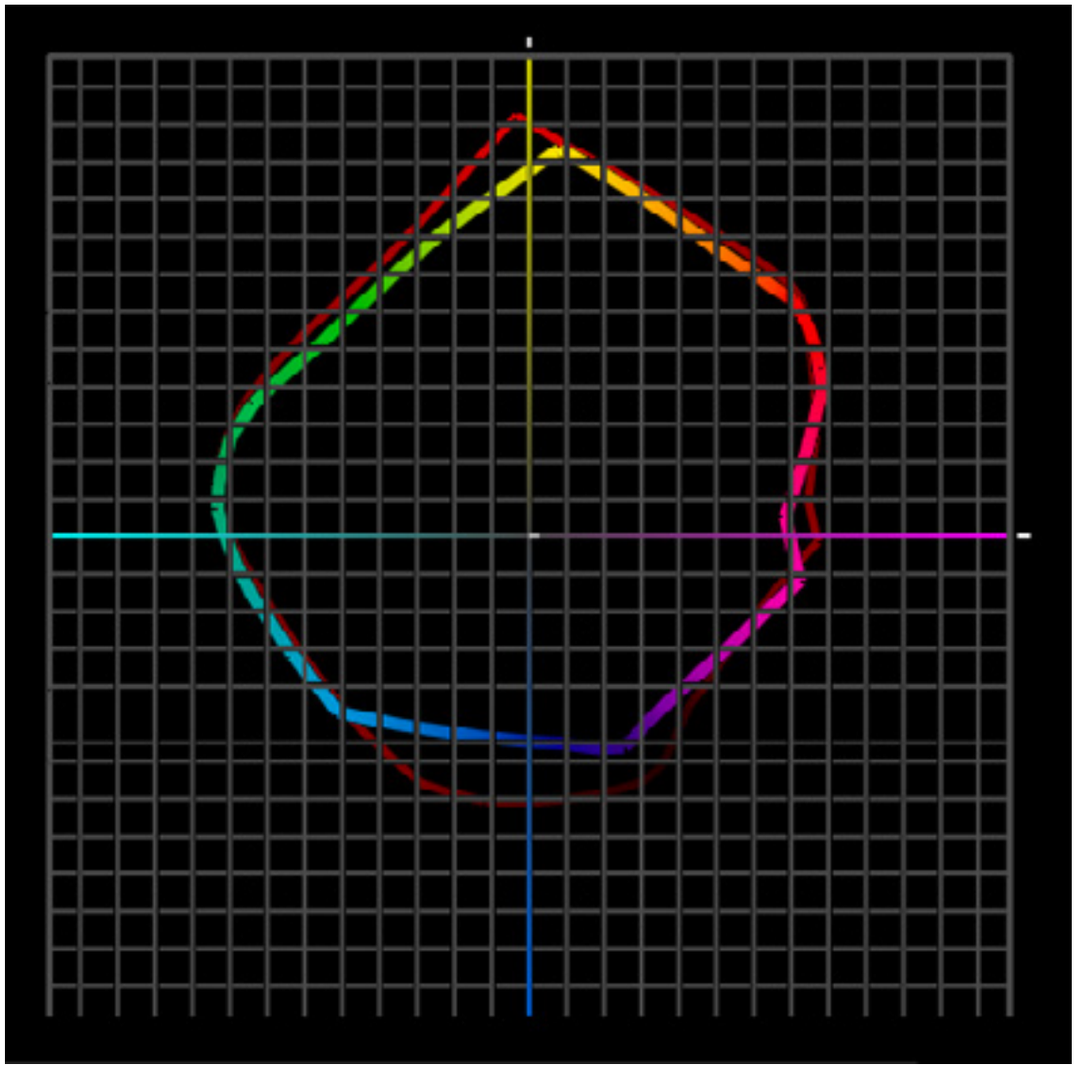
Durability

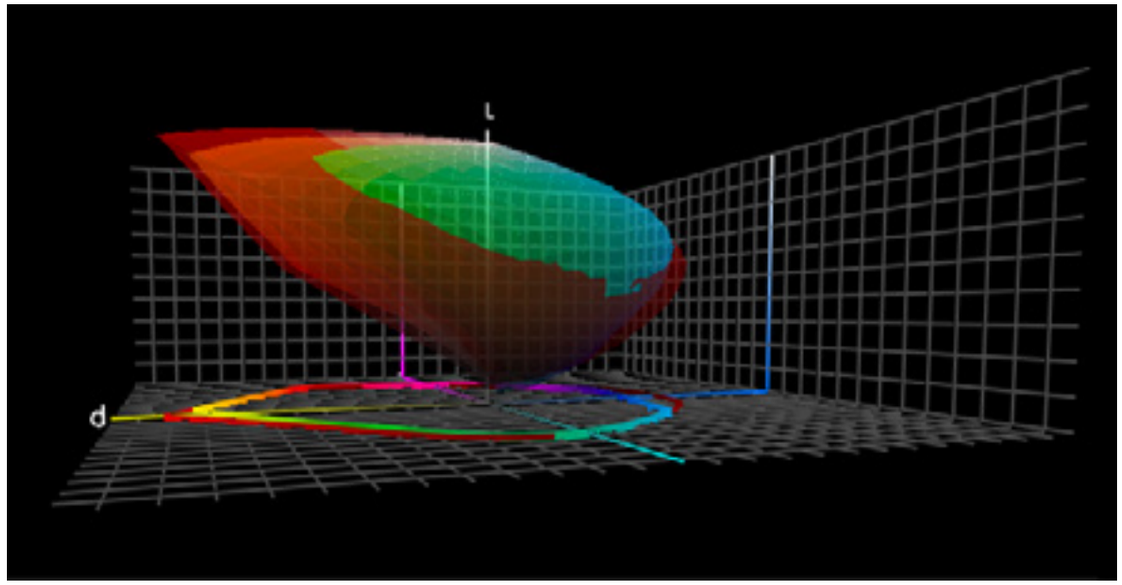
Durability can be seen as separate from longevity or an extension of it. Ink plays a role. Pigmented inks are prone to scuffing and burnishing. Coatings can reduce this tendency somewhat. Handle with care. (Download a free PDF review of PremierArt's PrintShield sprays at www.johnpaulcaponigro.com.)

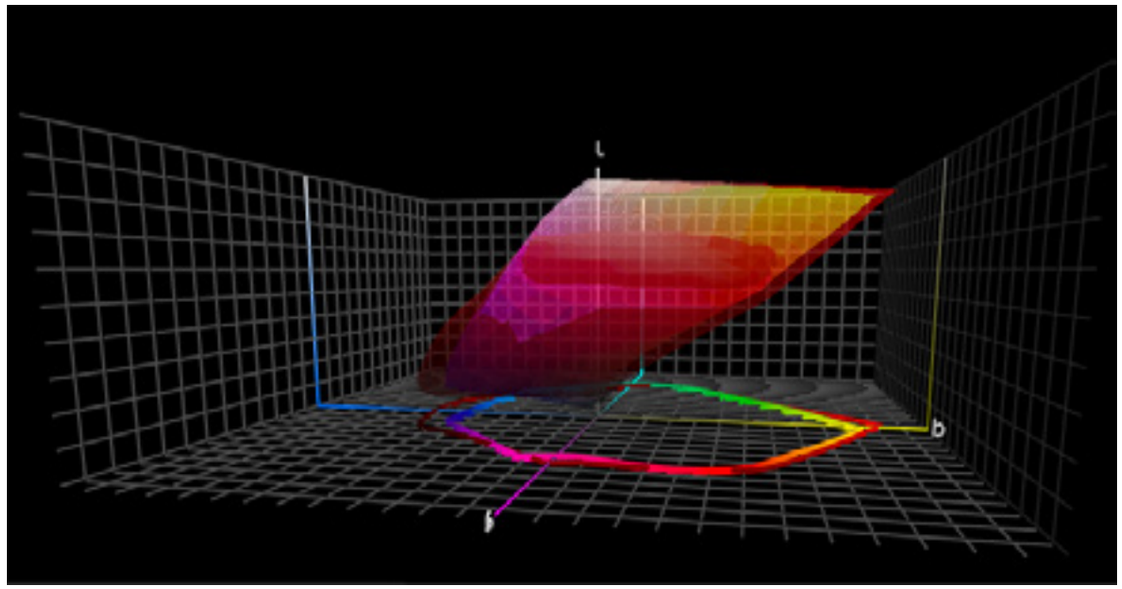
Switching Inksets

Choosing an inkset determines and limits your choice of printer model. Printers are usually designed for one specific inkset. Avoid switching inksets in the same printer, such as dye with pigmented (causes ink contamination) or with a third party manufacturer's inkset (voids manufacturer's warranty). Don't confuse this with swapping inks within the same inkset, such as changing ink cartridges of the same ink or different black inks designed for specific substrates, such as matte and glossy.

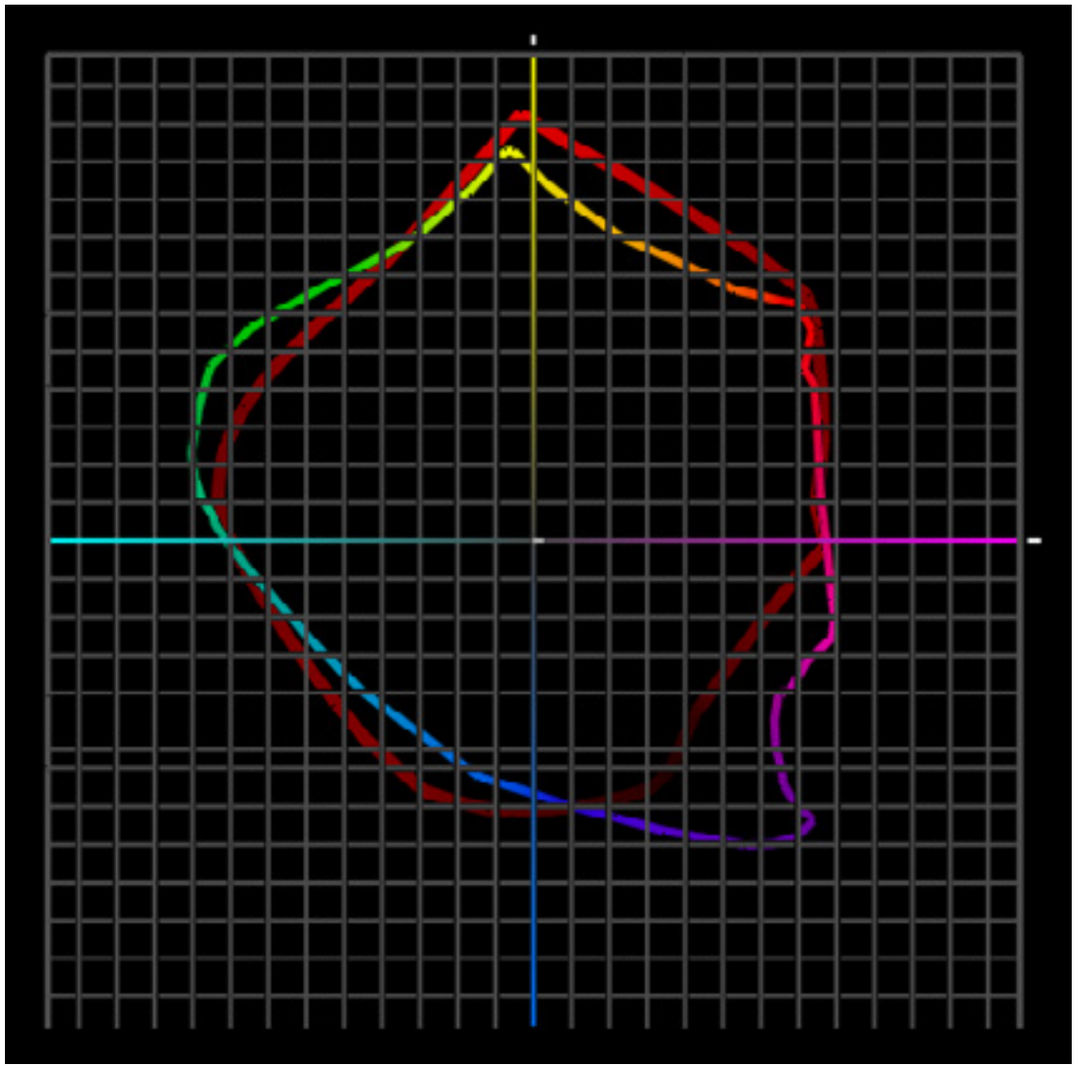
While it is only one factor you should consider when evaluating print quality, ink is of paramount importance. Choosing an inkset is one of the most important decisions you can make when selecting tools and materials to make fine prints with. Research your options thoroughly and explore all the related variables carefully before committing your images to print. Continue monitoring this rapidly evolving field. Recently, its arc has been so stunning that in less than a decade, inkjet printing has changed the nature of the photographic print.

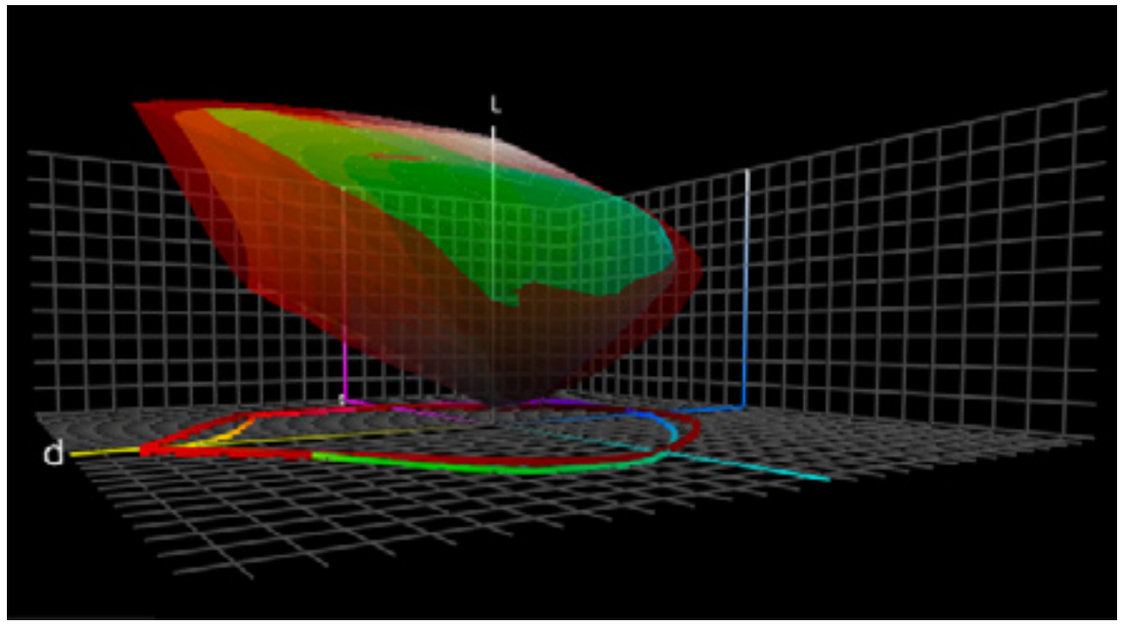


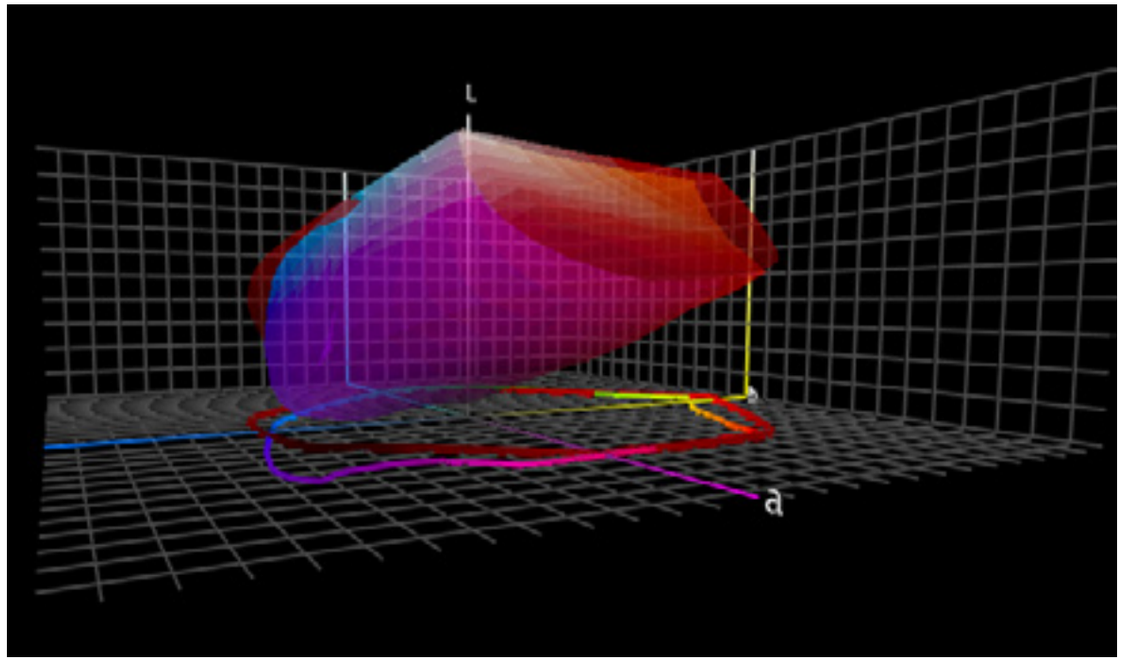




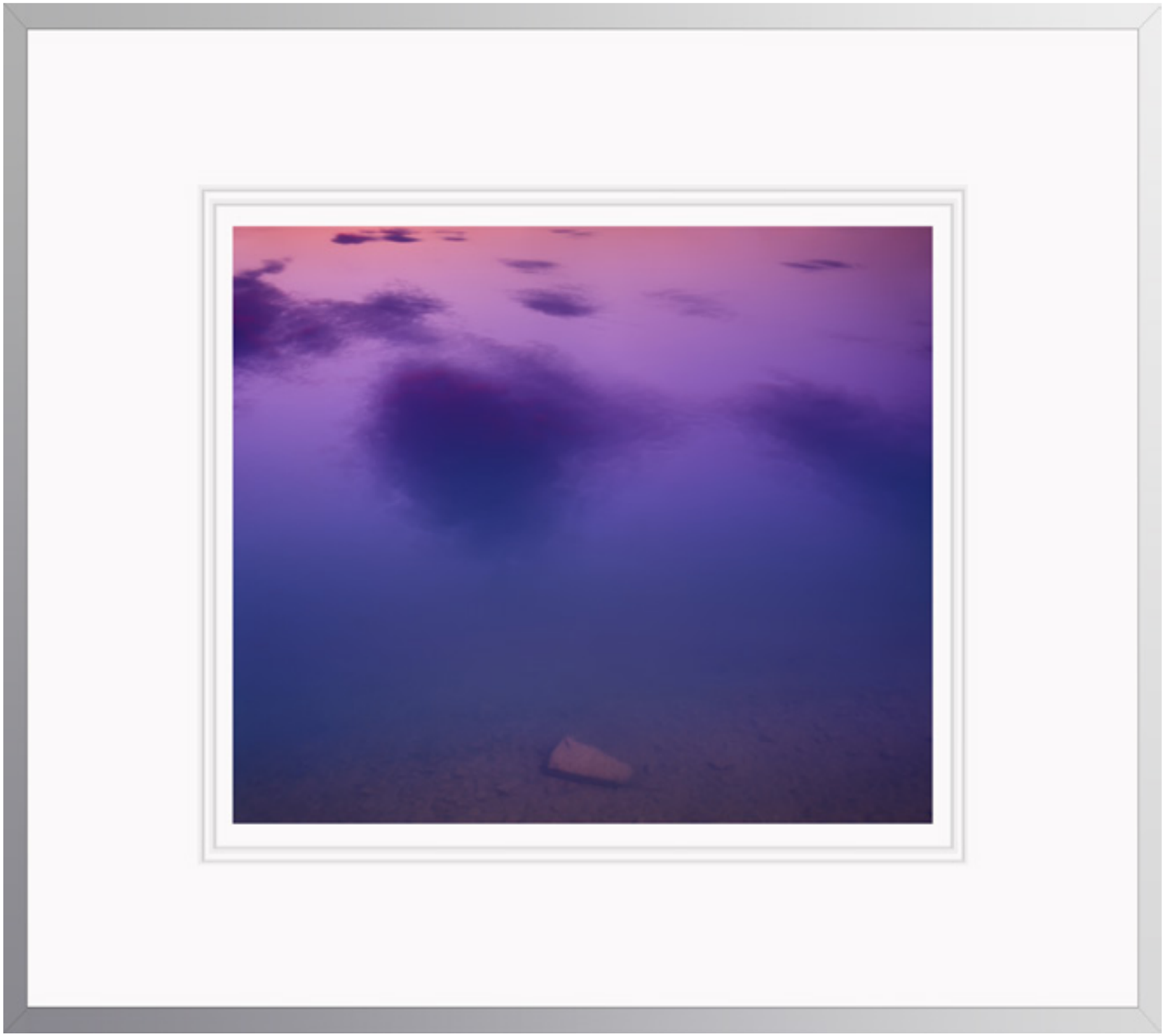
Epson Ultrachrome HD VS Epson Photo Dye







Epson Ultrachrome HD VS Canon Lucia



Reflection XIV

Choosing a paper surface is both technical and aesthetic. There's no right choice, only your choice.

10 Paper

Choose A Great Paper

There's an art to making paper. Since its invention, thousands of years ago, paper has had a long and interesting history, perhaps never more so than now. There are many ways to make paper and many kinds of paper. Paper is used to architecture, furniture, crockery, fashion, sculpture, and of course the display of text and images in a variety of forms. Contemporary printmakers don't print exclusively on paper; they also use canvas, metal, plastic, and wood too.

Paper dramatically impacts print quality.

ISO Brightness

The white of the paper determines the brightest values achievable and the quality of the highlights in a print. Some papers have bright cool whites, while others have duller warmer whites, some are so dull they look antique. Short of bleaching or coating a paper with a brighter substance, this is something you can't change about the paper.

Ink Limit

Paper has a dramatic impact on ink limit, how much ink can be put down before detail begins to be lost. Droplets of ink spread when they come in contact with paper before they dry. Dot gain specifies how much a dot spreads. A dot spreads more on an uncoated paper than it does on a coated paper. A dot spreads more on a matte paper than it does on a glossy paper. This has a number of consequences.

Detail

Because dots don't spread as much on glossy surfaces, they render fine detail more precisely. Similarly, even on matte papers, smoother surfaces render subtler detail finer gradients.

Dmax

More ink, blacker black, higher dmax ratings.

Gamut

More ink, more saturated color, wider gamut.

Coatings

Most inkjet papers are coated. Print on the coated side of a paper. Printing on the uncoated side typically yields soft under-saturated results. Printing on uncoated papers yields similar results. Coatings reduce the spread of ink, allowing less of it to sink into the base and more of it to sit up on the surface. Most coatings contain drying agents to increase drying time and reduce dot gain. Many coatings contain optical brighteners (OBAs) to render brighter, cooler whites and more saturated colors. Some optical brighteners actually fluoresce, emitting more light than they receive. Many optical brighteners are not stable and prints

made with them typically display reduced longevity ratings. If print permanence is a significant concern avoid them.

Longevity

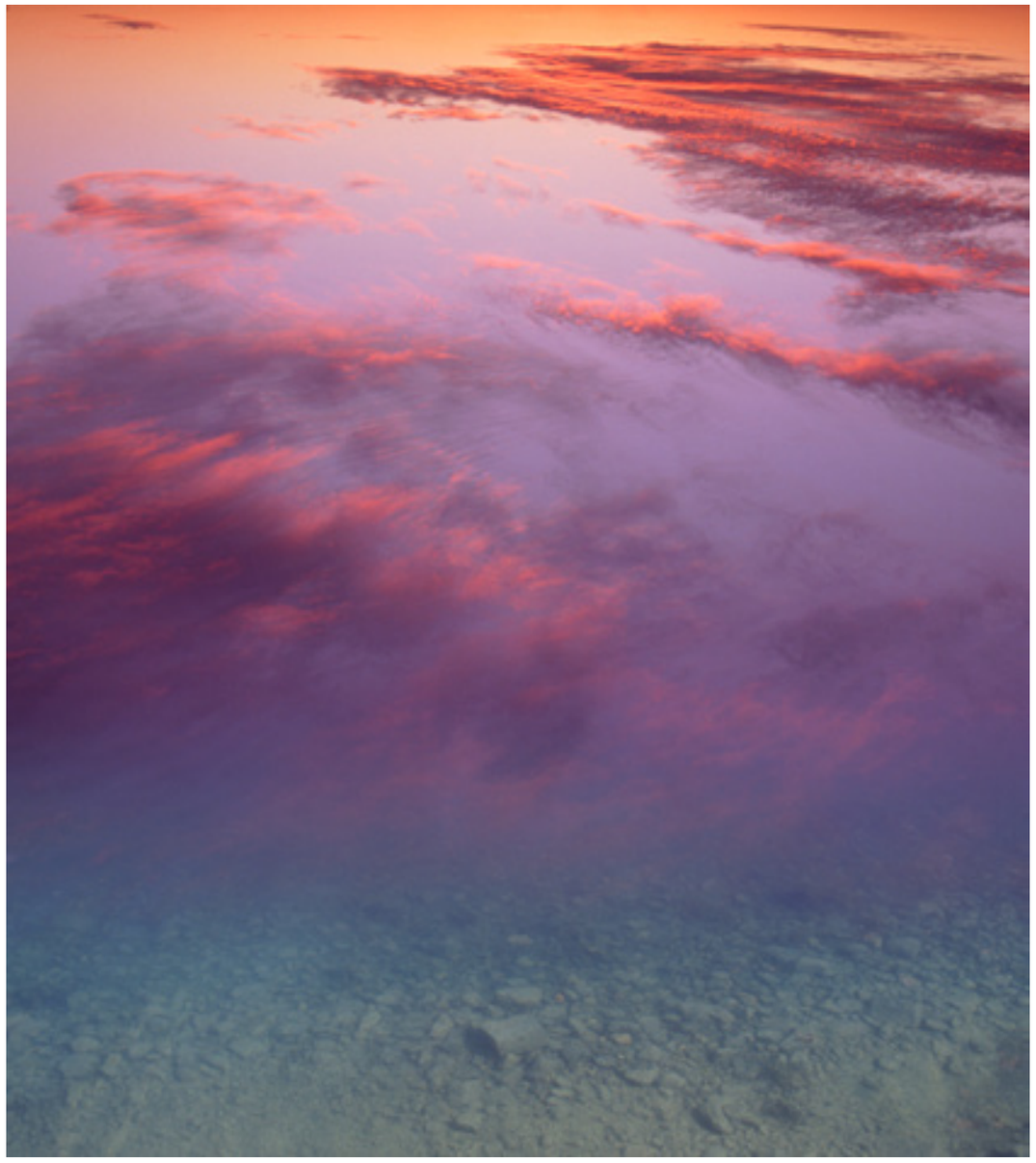
Paper and ink combinations determine longevity. Different papers yield different longevity ratings. If longevity is a significant concern, research the most current data. (Visit Wilhelm-research.com for a wealth of information from one of the most definitive and respected resources.)

Look & Feel

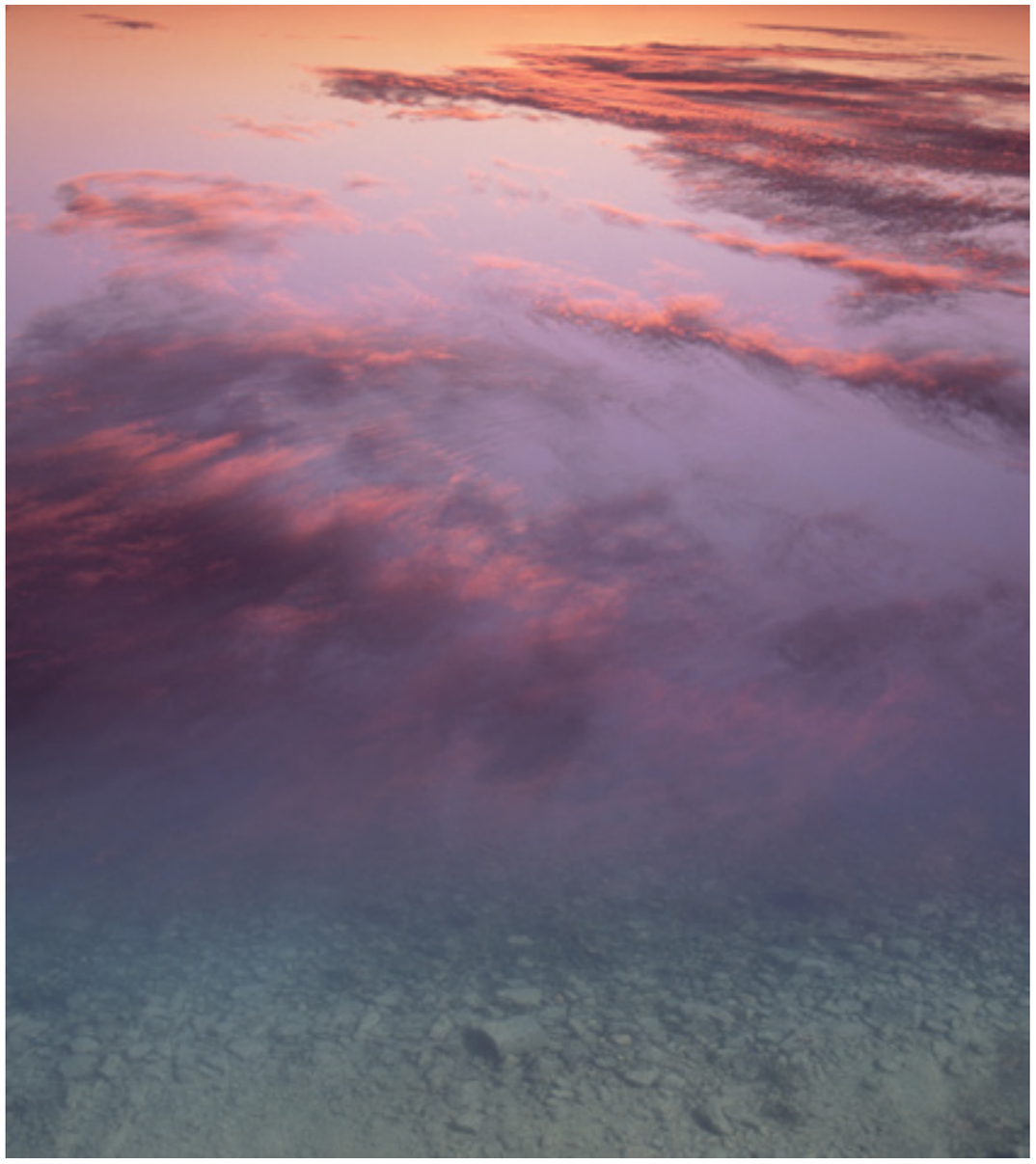
Aesthetics may win out over technical considerations. While it's useful to identify quantitative criteria (such as ISO brightness, dmax, gamut, ink limit, and dot gain) other qualitative aspects of a paper may be as or more important. Papers come in various weights; some are so thick they don't need mounting while some are so thin you can see through them. Papers have different textures; some are wavy or ridged, some are woven or cratered, some are fibrous or fuzzy, some are very smooth. Some papers have distinctive edges, such as deckling or excess fiber. Papers have different reflectivities; some are so glossy they are mirror-like reflecting everything in front of them, while others are extremely matte exhibiting no surface reflections. The material characteristics of a paper may carry specific connotations; one may look synthetic while another looks organic, one may seem commercial while another seems artistic. These qualities, in combination with one another, may be extremely useful for enhancing the expressive characteristics of your prints.

Variety

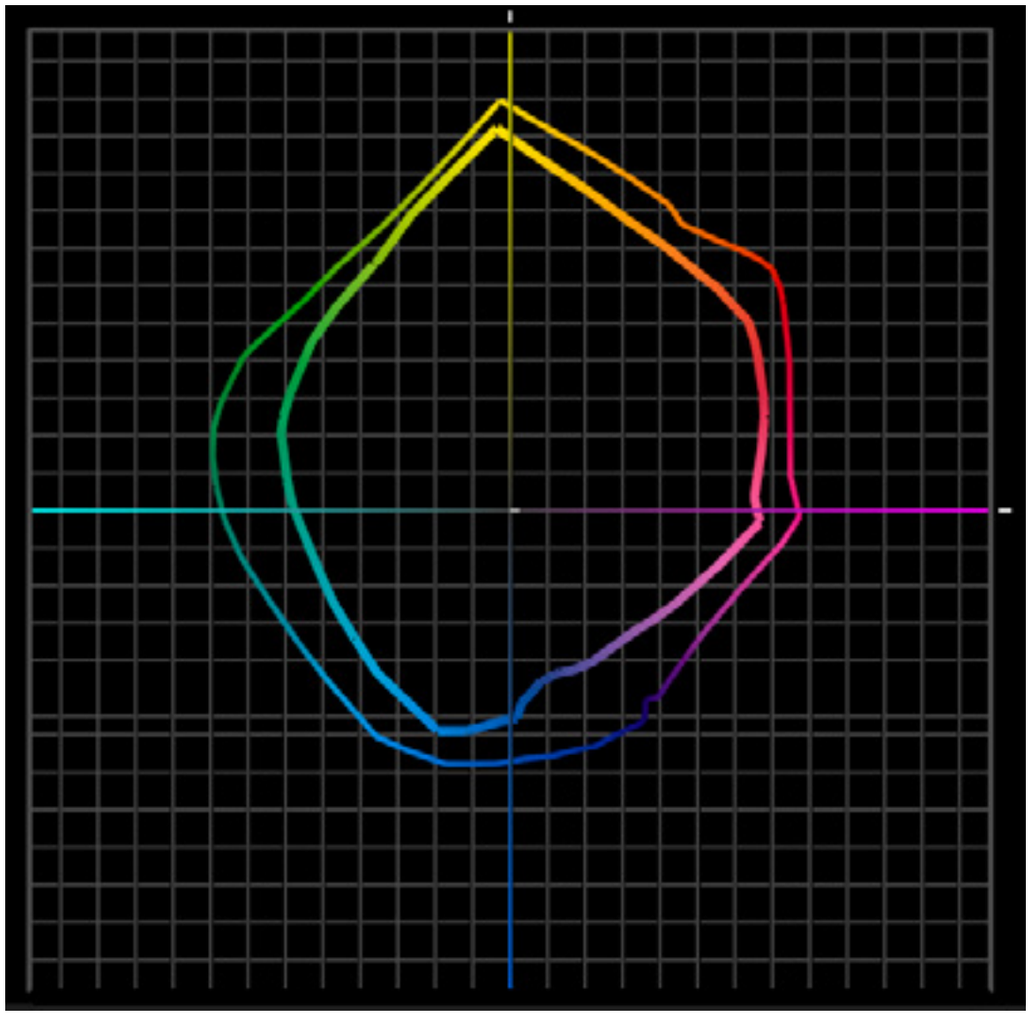
Today, you have an amazing array of papers to choose from. The astonishing array of choices available for inkjet printers today should suit almost every need. With a single printer, you can print on surfaces that span the gamut, from matte to glossy. You'll find fiber, plastic, and metal. Uncoated, hand-coated, mechanically-coated. Machine-made or hand-made. Silk, canvas, foil, and transparent mylar don't seem exotic in comparison to the most unusual substrates people have tried to feed through their printers. Experiment! Try many papers. There's only one way to truly find out how the look and feel of a paper will impact your work – use it. Research your options thoroughly to help you make more informed decisions before you commit your images to print. It will be time very well spent.



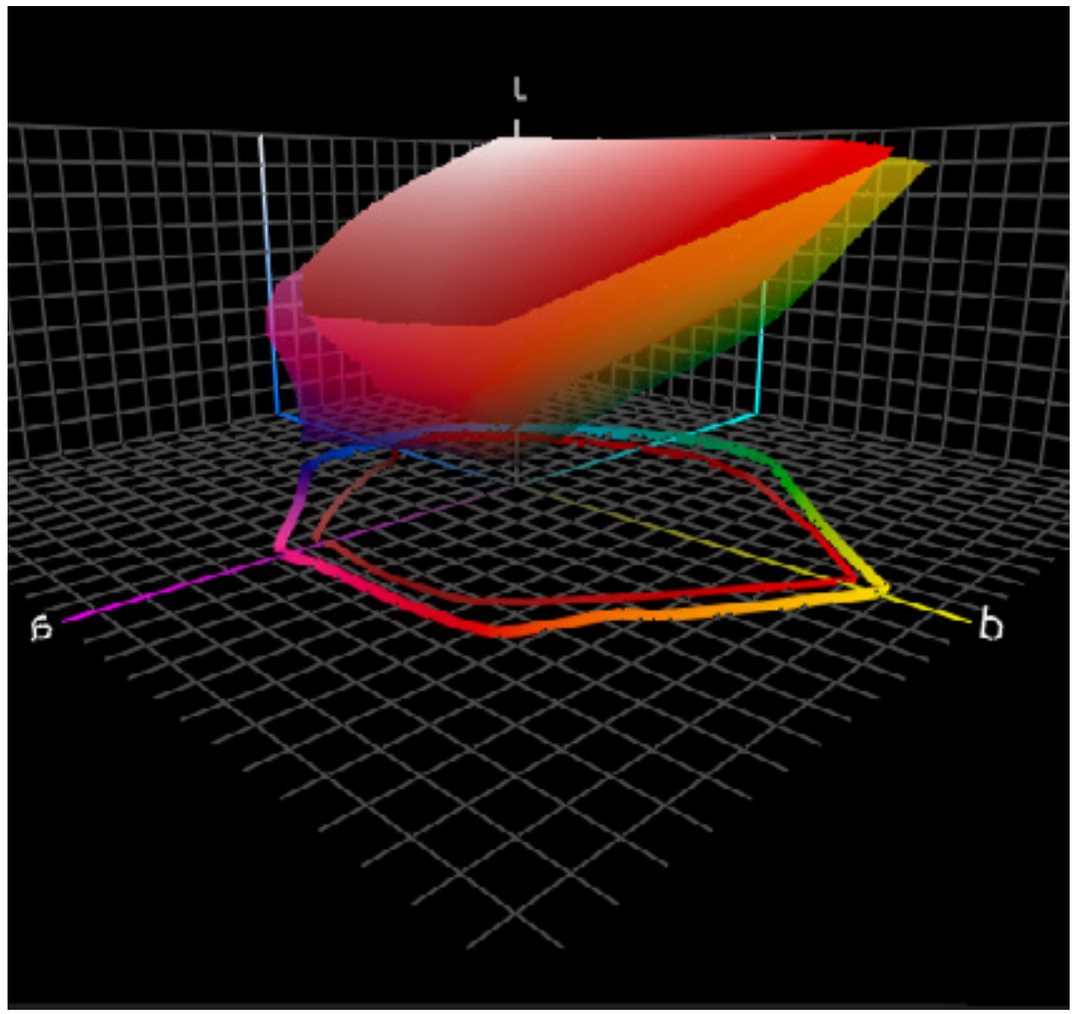
Semigloss



Watercolor



Semigloss vs Matte 2D



Semigloss vs Matte 3D

Antarctica CLXXI

While our eyes adapt to viewing light, it still affects our experience – i.e. warmer light makes whites look yellower.

11 Light

View Prints In Great Light

To see, you need light. So it stands to reason that the light you view your prints in is extremely important. All lights are not created equally. For the best results, choose a high quality light source.

Amount

The quantity of light is important. In inadequate levels of light prints will look dull; whites will not appear bright and saturated colors will appear under-saturated. Amounts of light are typically specified in units of lux (candelas per square meter) or footcandelas. (Alternately, lumens measure quantity as perceived by the human eye.) Here are a few approximations of light levels in a variety of viewing conditions: museum - 10-40 footcandles; indoor – 75-150 footcandles; outdoor cloudy – 3500 footcandles; outdoor sunny – 14,000 footcandles. Roughly, lighting between outdoor, indoor, and museum levels vary by a factor of 10; daylight is 100x indoor lighting and 1000x museum lighting.

Pigments appear brighter with more light. The more light you have the better your prints will look, up to a point. You can have too much of a good thing; too much light may produce glare and eye strain. Ironically, while you need ample light to see prints in the present, to see prints in the future, reducing exposure to light is ideal, increasing longevity. When prints are not being viewed, reduce exposure to light; for long-term storage, store prints in the dark.

The quality of light is as important as the quantity. While light has many important qualities, two are particularly significant; temperature and spectral distribution.

Temperature

Not all white lights are the same. Differences in white light are commonly described by color temperature. A light source's color temperature is determined by comparing its hue with the hue of a theoretical heated black-body radiator. Heat the object and it begins to glow. The more you heat the object the more it glows and its color changes. Temperature is rated in Kelvin degrees, named after the 19th-century British physicist William Thomson, 1st Baron Kelvin. The lower the number, the warmer the light; the higher the number, the cooler the light. Manmade light sources vary in temperature dramatically and change over time - tungsten 2800K, halogen 3600K, fluorescent 5000K, etc. The changing appearance of the sun as it passes across the sky can be rated on the same Kelvin scale - 2000K sunrise/sunset, 4300K morning/afternoon, 5400K noon, 6000K overcast, 8000K shade. The color temperature of the viewing light will significantly influence the appearance of

colors, particularly neutrals, including the very important white paper base.

The industry standard for viewing light is 5000K, meant to simulate daylight, on a clear midday. It's useful because it is a standard that makes color communication more precise. As most printer profiles are optimized for the 5000K standard, it is a particularly good light source for evaluating the quality of those profiles. But, most prints are viewed under light temperatures warmer than 5000K, typically a mix of tungsten (2800) and daylight (variable). Galleries and museums favor halogen (3600K). Studies suggest that more people prefer viewing artwork under warmer light temperatures (3600K).

If you choose to make prints for temperatures other than 5000K with printing profiles optimized for 5000K, you'll want to adjust the hue of your image before printing. When using 5000K printing profiles, a common adjustment for moving to a 3600K viewing light is to add a little blue and cyan. Make prints that are too cool, for a viewing light that is too warm.

Smooth Spectrum

While light level and color temperature are discussed frequently, the spectral distribution of light is discussed infrequently. You can have a lot of light of an appropriate color temperature and still not achieve true color accuracy. In order to see colors accurately a light source needs to be full and smooth spectrum or containing all the colors of the rainbow in equal amounts.

Light sources that are not full smooth spectrum contain an uneven distribution of colors. Graphs of light sources with uneven spectral distributions display spikes in specific regions of the spectrum. When a spectrum is uneven, hues that are found in elevated levels appear brighter while hues that are found in low levels appear duller. Spikes create an imbalance in the relationships between hues.

Incandescent light contains large amounts of yellow, orange, and red light. In incandescent light, warm colors appear brighter than cool colors. Though not as extreme, halogen suffers from the same tendencies. Cool white fluorescent light may produce a white that is cooler in appearance, but has a different uneven spectral distribution. In cool white fluorescent light, cool colors appear brighter than warm colors.

The only full smooth spectrum natural light source is the sun. Daylight is a combination of direct sunlight and skylight. (The full smooth spectrum manmade light source that most accurately reproduces daylight is manufactured by Solux – www.solux.net. Color Rendering Index (CRI) ratings are used to describe the quality of light.

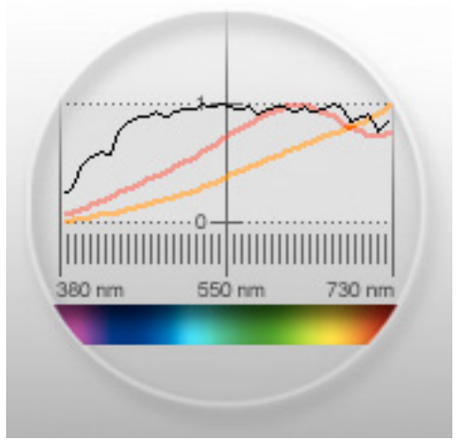
Solux CRI ratings are 99 on a scale of 100.)

UV

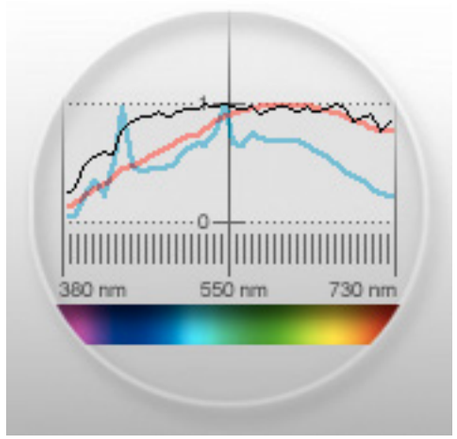
If optical brightening agents, which flouresce under ultraviolet light, are used in a print, UV retardants (whether in or over a light source, in the glass in front of a print, or in a sealant on top of a print) may reduce or prevent flourescence and subtly alter the appearance of a print.

Light matters. It's important to understand the influence of light, how to control it, how you can compensate when you can't, and what the limits to the lengths you can go are. What can you do? Implement color management as precisely as practical. Control the editing, printing, and display environments. Use a full smooth spectrum light source with a desired color temperature. Recommend others use the same optimum light source for display. When necessary, compensate for alternate viewing light by making a custom printing profile or by editing files to adjust prints to appear correct under that light.

Good light makes your prints appear even more beautiful. Get good light. It's one of the most essential elements in any photographic image, at the point of capture, during processing, and at the point of display.



3500K



5000K

Refraction LXXIII B

Rendering fine detail is more dependent on precise focus and sharpening than perfect file resolution.

12 Conclusion

Take the steps outlined in this Digital Printing Quick Start Guide and you should be able to make high quality digital prints in comparatively little time.

Making prints does many things for your images and your vision. When you make prints, you consider your images more carefully for a longer period of time, usually multiple times. This adds up. It's quite likely that along the way you'll find many ways to improve your images. Repeat this process and you'll find that your vision as a whole will improve.

One of the best ways to learn more about making great prints is to look at great prints. I encourage you to visit museums and galleries as a way of growing your vision. I know from personal experience that some of what you find there will be truly inspiring.

Remember, you will find a great deal more information and inspiration on my website (much of it is free or discounted for my newsletter members), in my DVDs, and in my digital printing workshops.

I hope you've found this Digital Printing Quick Start Guide useful. If you have, please share it with others by asking them to visit my website.

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