

Black and White Processing

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Introduction

This document provides an overview of some of the features in Picture Window Pro related to processing black and white – for more detailed information on the individual operations, please see the help file or the document Transformations.pdf. Most of these techniques also work for adjusting the tonality of color images

When possible, always work with 16-bit black and white (or 48-bit color) images. Otherwise, you risk introducing banding and other artifacts.

Converting Color Images to Black and White

Most digital cameras and scanners capture color images, so if you are starting with a color image, one of the first steps is usually to convert it to monochrome. The default method of conversion from color to monochrome is to extract the luminance channel which is computed as a weighted average of the red, green and blue channels. The green channel has the largest weight and the blue channel the smallest. These weights are based on the relative sensitivity of the eye to each of the primary colors. While the result looks natural, it may be flat and lack contrast. You are not limited to this type of conversion however and can lighten or darken the gray levels of selected colors in the image to refine the resulting image.

You can also pre-process the color image to make global or selective color corrections to further influence the conversion, but in most cases, there are other ways to produce the same effect. However, if you are planning to dehaze your image, you should do this before converting to black and white. More importantly, you may find it much easier to create masks that isolate different image elements such as the sky based on color information in the image.

You may be starting with a monochrome image – for example if you are using a digital camera such as the Leica Monochrom or the Pentax Monochrome that captures monochrome images natively, if you are scanning black and white film or prints, or if you are using a monochrome- or infrared-converted camera that removes all or nearly all the color from the images. While starting with a monochrome image means losing the ability to make tonal adjustments based on hue or saturation, there are still many ways to develop the final image.

Making Tonal Adjustments

Once you have a monochrome image, since all the color information has been removed, all that is left to adjust is the brightness of each pixel. You can make global adjustments to the entire image or, what is far more powerful, you can make local adjustments to different parts of the image to emphasize or obscure details, to direct the viewers eye, to change the mood, to increase or decrease contrast, to lighten or darken, or to selectively sharpen or blur.

Other Adjustments

Just as with color images, you can apply a host of other transformations to your image to crop, distort, sharpen, blur, retouch, or create special effects.

Printing Images

Due to unavoidable differences between monitors and printers, printing remains something of an art that involves choosing an appropriate paper and inks and making multiple test prints while fine tuning the image.

Converting Color Images to Black and White

Assuming you are starting with a color image, at some point you need to convert it to black and white. The Monochrome transformation is the primary mechanism for performing this conversion, although if you just want to do a quick, default conversion, you can use the Convert transformation instead.

Using the Monochrome Transformation

The Monochrome transformation dialog box has four tabs (Method/Curve/Texture/Tint) along the bottom which correspond to four operations you can perform as you develop the monochrome image. The Method tab creates a black and white image using one of a several different methods. The Curve tab applies a brightness curve to the result of the Method tab. The Texture tab adds texture to the output image, and the Tint tab tones the final image by mapping different brightness levels to different colors. If you ignore the Curve, Texture and Tint, by default they will have no effect on the output image.

Method Tab

The Method tab does the heavy lifting of the conversion process – it lets you control what colors in the input image come out lighter and what colors come out darker when converted to black and white.

Once you select a method, various settings for that method become available. There are five conversion methods – the first three are fairly straightforward while the last two are more complicated but offer more control.

Extract Channel

Extract Channel is the simplest method – it simply extracts a color channel from the input image. For example, extracting one of the RGB channels makes the selected color lighter and the others darker. You can quickly flip through the available channels using the left and right arrow buttons, watching the effect on the output image. This method is quick and easy, but there are limits to how much you can lighten or darken different colors.

Filter

The Filter method simulates photographing a color scene using black and white film while placing a color filter over the camera lens. The effect is similar to Extract Channel, but by selecting different filter colors, you have finer control over the conversion.

Channel Mixer

The channel mixer computes the output image as a weighted sum of the RGB channels in the input image. If all the weights were positive, this would create results similar to the Filter method, but by making some weights negative you can produce very dramatic conversions. For example, if you want to darken a blue sky you can set the blue weight to a negative value, but extreme negative values can cause clipping and can amplify noise in the input image. Similarly, to lighten green foliage, you can increase the green slider while reduce the blue and red.

Hue Curve

The Hue Curve method lets you lighten or darken colors in the black and white image according to their hue in the input image.

Hue-Saturation

The Hue-Saturation method lets you lighten or darken colors in the black and white image according to their hue and saturation in the input image.

Curve Tab

The Curve tab lets you apply a brightness curve to the converted black and white image. This is a good place to adjust global brightness and contrast. If you notice unwanted highlight clipping in the histogram, go back to the Method tab and dial back the Exposure.

Texture Tab

The Texture tab lets you add texture to your black and white image. You can add one of a variety of texture patterns such as film grain or mezzotint screens that come with Picture Window, or you can create your own texture pattern.

Tint Tab

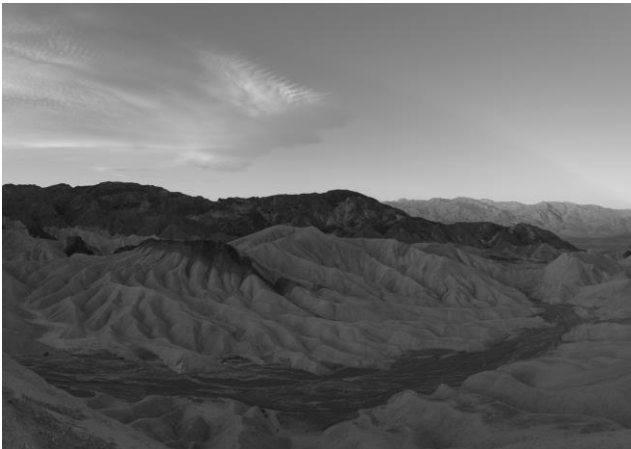
Finally, the Tint tab lets you map different brightness levels in the black and white image to different colors in the output image, via a Color Line. The most common use for this feature is to warm up or cool down the grays in the image, but it can also create simulated sepias or cyanotypes or create various wild effects.

Example

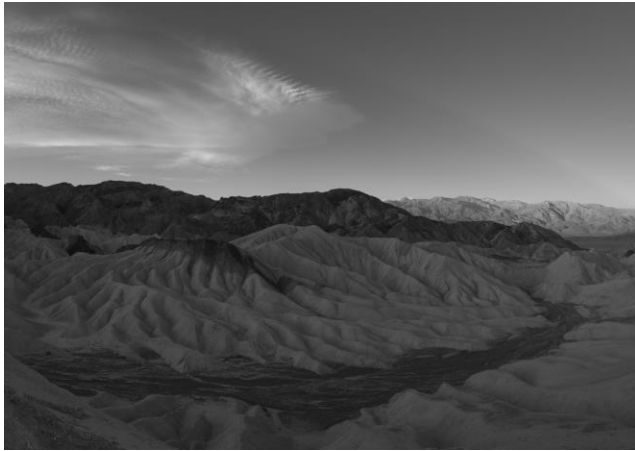
Suppose you want to convert this color image from Death Valley to black and white and make the sky come out very dark in order to contrast it with the rock formations.



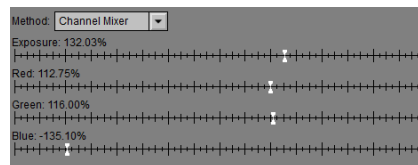
The default conversion (extracting the Luminance channel) looks like this:



Simulating shooting with a red filter by extracting the Red channel makes the sky a little darker:



Using the Channel Mixer with a negative Blue slider, you can get a much darker sky:



This makes a better starting point for subsequent tonal adjustments such as brightening the mountains.

Making Tonal Adjustments to Black and White Images

Brightness Curve

The most powerful tool in Picture Window's arsenal for adjusting the brightness and contrast of black and white images is the Brightness Curve transformation. Without a mask, this transformation can make precise global adjustments to the entire image. When used with a mask, however, it can narrow its effects to specific areas of the image, letting you make local adjustments to brightness and contrast.

To see how this works, let's look at an example. You can download the following image and a script file that processes it from the same place you downloaded this document.

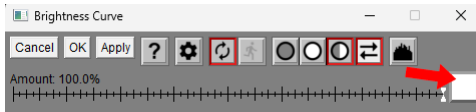


This is a black and white infrared image more or less the way it came out of the camera. It was converted from a raw file using the default settings, processed using Topaz Photo AI to sharpen detail and reduce noise, and some dust specks were removed.

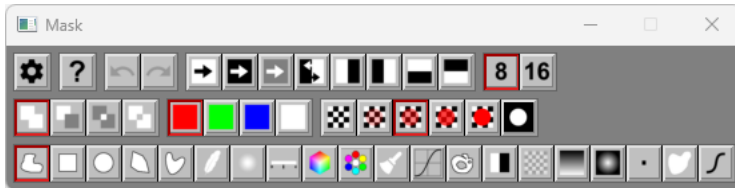
As with many landscape images, the sky needs to be treated differently from the rest of the image. Consequently, we need to create a mask that more or less isolates the sky. Rather than try to create a precise mask that includes just the sky pixels, it is better to use a soft-edged mask that makes a gradual transition at the sky boundary. This minimizes artifacts that occur at the edges of the mask and produces a more natural effect.

Step 1 – Creating a Mask

Starting up the Brightness Curve transformation, the first step is to create a sky mask. To do this, double-click on the white box at the right side of the Amount control.



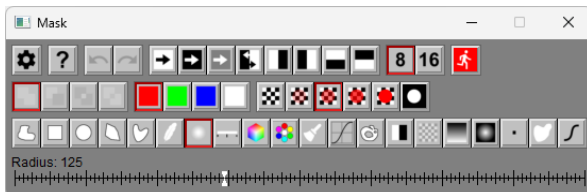
This brings up a Mask dialog box.



Crudely outline the sky area using the Freehand Outline mask tool.



Next, select the Mask Blur tool and move the Radius slider to about 100-125. This blurs the mask leaving a very soft edge.



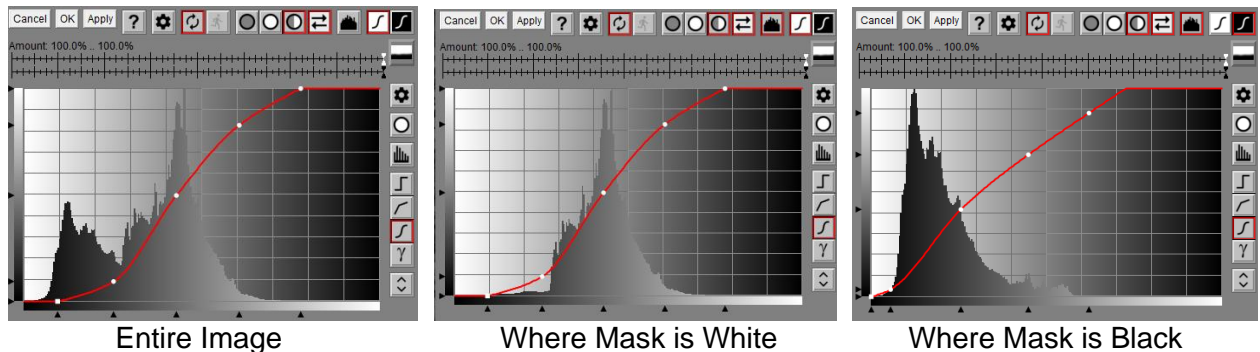
At this point, the mask is ready to use and you can close the Mask dialog box to hide the red overlay.

Step 2 – Increasing Sky Contrast

Returning to the Brightness Curve dialog box, notice the three buttons in the upper right corner:




Normally, the histogram displayed behind the curve is based on all the pixels in the input image. However, if you depress the first button, the histogram is computed based on just the pixels where the mask is white or black, depending on which of the other two buttons is depressed. The black and white buttons are only displayed after you have created an Amount mask.

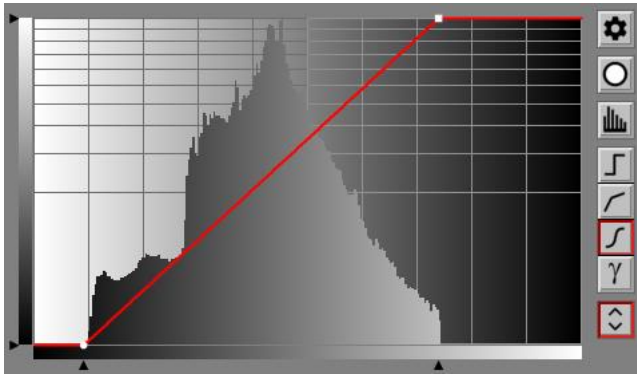


Ignoring the curves for now, you can see the histogram for the entire image has two peaks, the left one corresponding to the darker area of the fields and the right one to the lighter area of the sky. By displaying just the histogram for the area where the mask is white you can see the histogram of the sky. Similarly you can isolate the histogram of the fields.

Once you create a mask, you get two curves you can adjust independently, one for the area where the mask is white and one for where the mask is black. You can switch back and forth between the two curves by clicking the black or white curve buttons. As usual, where the mask is an intermediate gray, the results are a blend of the two curves. This means you can now independently adjust the brightness, dynamic range and contrast of the sky and the rest of the image.

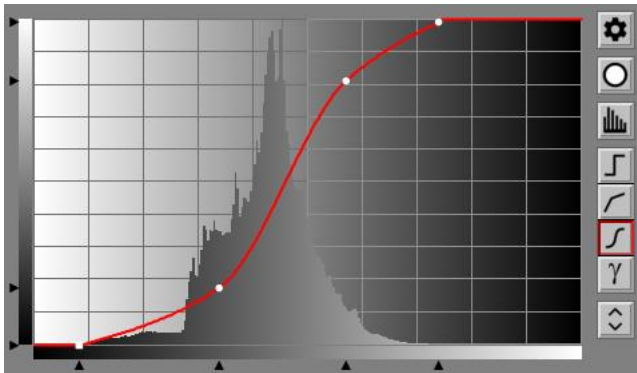
To create a curve for the sky, first click the white button so you are creating a curve for the parts of the input image where the mask is white. You can now see the histogram of just the sky.

Assuming you want to boost the contrast of the sky and make it more dramatic, the first step is to set the black and white points of the curve based on the sky histogram. To clearly see where the black and white points are located, it's a good idea to first expand the histogram by depressing the  button. Then slide the left control point to the left edge of the histogram and right control point to the right edge of the histogram. Once you are done, you can turn off histogram expansion as it distorts the histogram.



This curve causes the sky's dynamic range to run from full black to full white and, since it has a slope greater than 45 degrees, the contrast of the entire sky is also increased. If the effect is too strong, you can make the shadows lighter by moving the first control point left or you can make the highlights darker by moving the second control point right.

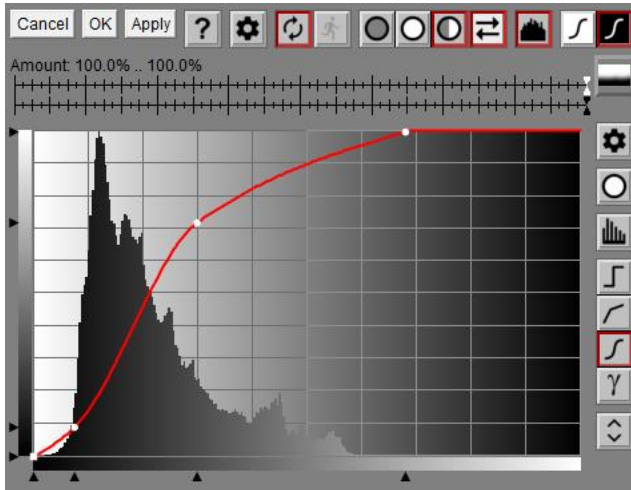
To further boost the sky contrast, you can add two more control points on either side of the peak of the histogram to further increase the slope of the curve in the area corresponding to the greatest number of pixels in the sky. This reduces highlight and shadow contrast somewhat so you can try different locations for the control points to get the best effect.



If you are unsure what part of the curve affects a particular part of the image, click and drag on the image and red marker lines will be displayed on the histogram at the image brightness levels where the cursor is located.

Step 3 – Increasing Field Contrast

Next, you can do more or less the same thing for the area where the mask is black. First click on the Black button in the upper right corner to switch to the black curve. Then you can proceed as before to set the dynamic range, and create a contrast-boosting S-curve.



Here is what the input and output images now look like. You can see how much more dramatic and alive the image has become:



If you decide you want to scale back either the effects of the white or black curve, you can use the white and black Amount double sliders. The black slider is only displayed if you modify the black curve from its default.

At this point, the tonal adjustments are complete so you can go ahead and click OK and close the Brightness Curve dialog box.

To make further tonal adjustments, you can create one or more additional Brightness Curve transformations targeting different parts of the image. For example, you might want to lighten up the clump of trees in the bottom right corner to reveal a little more shadow detail. Or you might want to create a vignette to draw the eye to the center of the image.

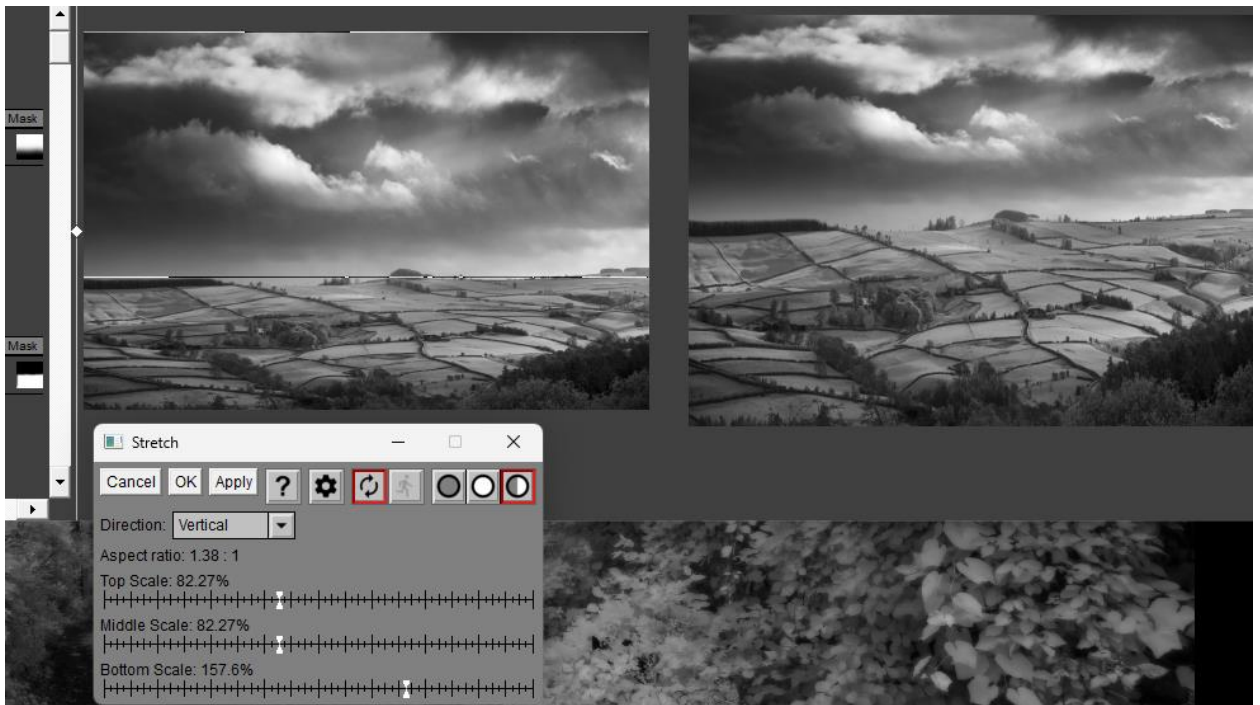
Other Adjustments

Other transformations in Picture Window Pro you might otherwise apply to color images also work well with black and white images. Operations such as blurring or sharpening can be applied either before or after conversion to black and white and the final effect will be more or less the same.

Continuing with the example, I chose to apply several other transformations to the image to give it more impact.

Step 1 -- Stretch

First, I used the Stretch transformation (Transformation/Geometry/Stretch) to alter the perspective by enlarging the fields and shrinking the sky:



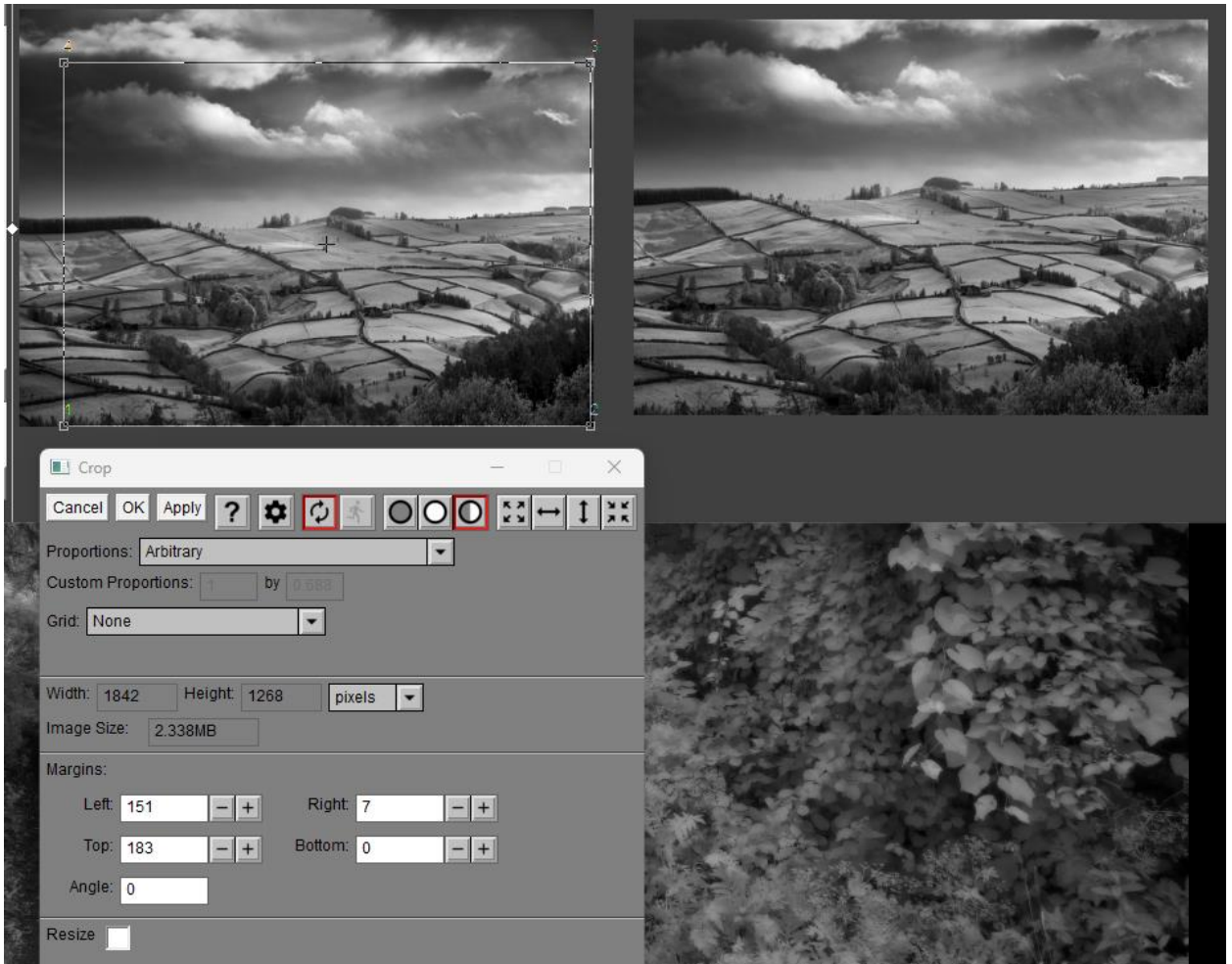
Step 2 -- Sharpening

Next, I sharpened the fields while leaving the sky unsharpened using Multipass Sharpen. This involved making another soft-edged mask to isolate the fields from the sky:



Step 3 -- Cropping

Finally, I cropped the image a little to fine tune the composition:



Comparison

Here is a comparison of the starting and final images:



Printing Black and White Images

While on-screen viewing may be fine, you may want to print at least some of your images to create a more permanent record, to display them, to sell them, or to share them with others.

Printing black and white images is easier than printing color images since you don't have to worry as much about color profiles and color gamuts. You can treat black and white images as color and print them normally, but often printers have a special mode for printing black and white which uses gray as well as black ink to render smoother tonal gradations and higher resolution. For Epson printers this is called ABW (Advanced Black and White).

The ultimate system for inkjet printing of black and white images may be Piezography (www.piezography.com) developed by Cone Editions Press. This is a process that involves replacing all the colored ink cartridges in your printer with different gray inks and using special software (Quadtone Rip) to print. In most cases this means setting up and maintaining a dedicated inkjet printer for black and white printing only.

Anyway, if you are lucky, the first time you print your image it will look great. However, you are likely to find that when printed, your images lose a little or even a lot in translation. There are several reasons for this, even if you use a calibrated monitor and a color-managed workflow.

Contrast Ratio

Contrast ratio is a measure of the relative brightness of pure white compared to pure black. Monitors have a very high contrast ratio, typically 1000:1 or more, depending on the monitor, brightness setting and viewing conditions. On the other hand, prints typically have a contrast ratio less than 100:1. This major contrast reduction can make prints look dull compared to the screen.

Print contrast depends on the paper and inks you are using as well as the viewing conditions. The whiter the paper and the blacker the ink, the greater the contrast. Some papers contain optical brightening agents (OBAs) which absorb light outside the visible spectrum and re-emit it as visible light. Prints made on paper without OBAs may however have a longer lifetime since OBAs may break down over time and turn yellow. Printing on glossy paper produces darker blacks since the ink sits on the surface of the paper instead of being absorbed into the paper fibers, but then you have annoying reflections to deal with.

The darkest black a printer can achieve is measured by its DMax, the maximum density it can produce. The higher the number, the darker the black. On the very best matte papers, you might be able to get a DMax of about 1.7-1.8. On glossy paper you might be able to get a DMax of about 2.0. Since density is a reciprocal logarithmic scale, a density of 2.0 corresponds to 99% of the incident light being absorbed and 1% reflected, or a contrast ratio of 100:1.

Viewing Conditions

Unless prints are viewed in sufficiently bright light, they will lose shadow detail, and consequently may look dull and muddy. Since prints are rarely viewed under ideal lighting conditions, this is a common problem – the only fix is to print the image lighter and accept some loss of contrast.

Similarly, if your monitor is turned up too high, images will appear to have more contrast on-screen than they will have when printed. Dimming your monitor shows the image closer to what it will look like when printed, although images may then look worse on the monitor.

You can try using the Monitor Curves feature of Picture Window to help preview on your monitor what the print will look like. Ultimately, you may need to create two versions of your image – one optimized for on-screen viewing and one optimized for printing.

Resolution

On the plus side, depending on how large you print and close to the print you view it from, printers can generally resolve far more detail than monitors so high-resolution images may look a lot better when printed.

Also, the optimal amount of sharpening for a given image is usually different for printing versus on-screen viewing. Determining the best way to sharpen your image for printing may take some trial and error.

In any case, the various differences between monitor and print naturally give rise to an iterative process of printing the image, adjusting it, re-printing, and re-evaluating the result.