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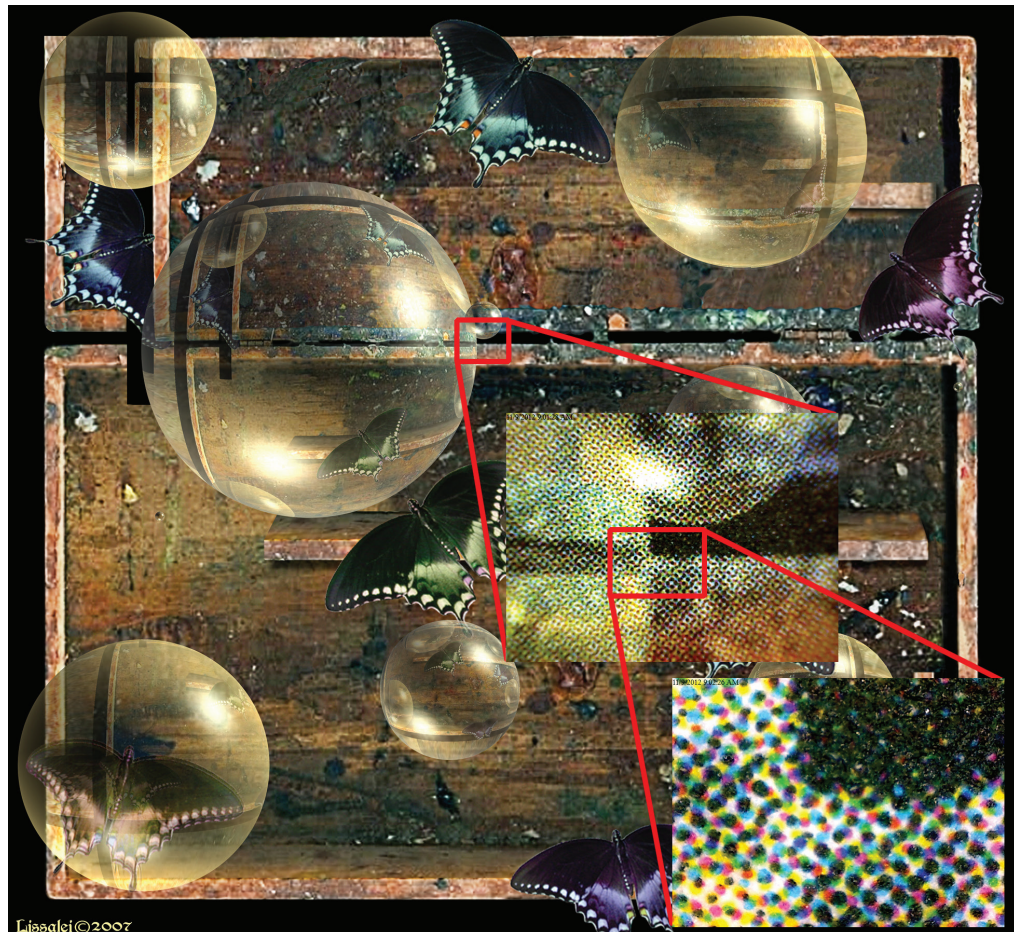
Images in Books: an Overview

The cost of printing a book through CS is the same whether it is all text or all images. For example—these are CS's minimums—the cost of printing a black and white book is \$2.15 for 24–108 pages, 0.012/additional page; for a color book the cost is \$3.65 for 24–40 pages and 0.07/additional page. You supply the print-ready PDF, therefore the additional cost of including images—preparing the art work for print, increased layout time—is met by you, not CS.

If you want even one color image or a single word in color, your entire book will be considered color: type of paper (no choices, 60 lb coated white offset), pricing.

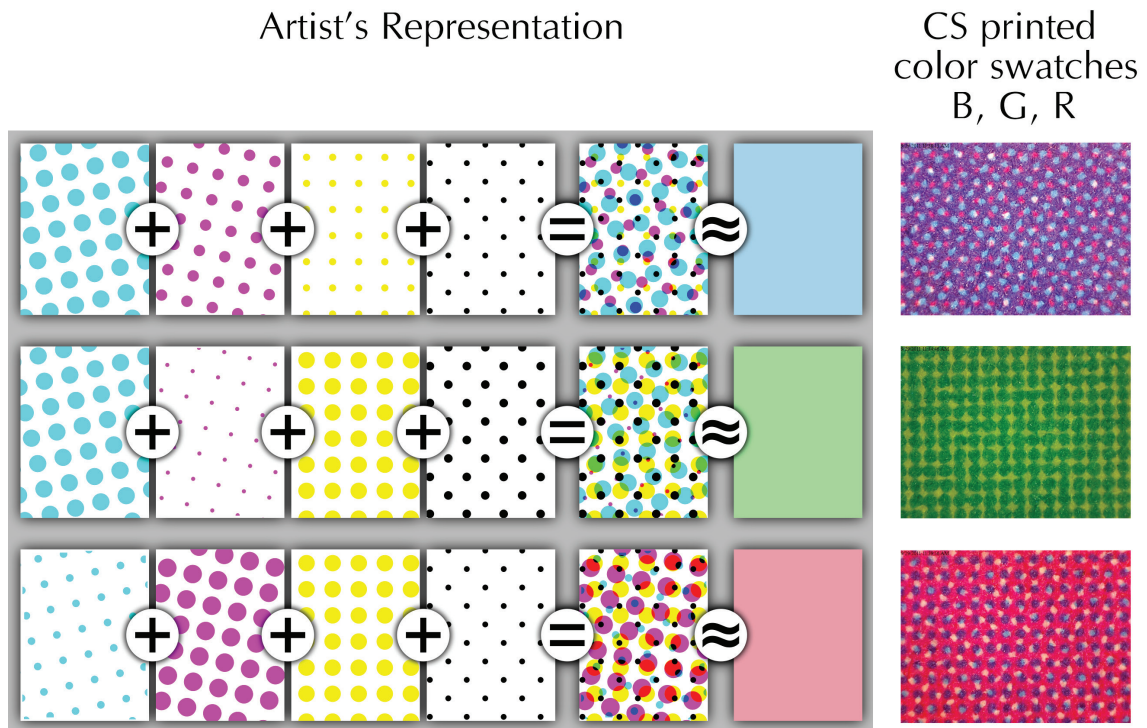
Covers are included in the pricing, and all covers are assumed to be color, although you can create grayscale covers, the price is the same.

Most commercial printers print text as solid, smooth and crisp edged shapes. Images, where there are gradation of tone from light to dark, are converted into dots, which vary in size or spacing, that simulate these gradations, called continuous tone.



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As you can see from the above example, the illusion of a continuous tone image is made up of lots of tiny dots of ink. In this case, the full color of the image is achieved using four colors of ink—Cyan, Magenta, Yellow, Black (CMYK), called process colors.



Black and White Books

You can insert color and/or grayscale images, and CS can print a black and white book. It will automatically convert all images to grayscale, if you select Black and White when you set up the book. On the Interior Type panel, you select Black and White/Full Color, and for Black and white books you select the paper color, White/Cream.

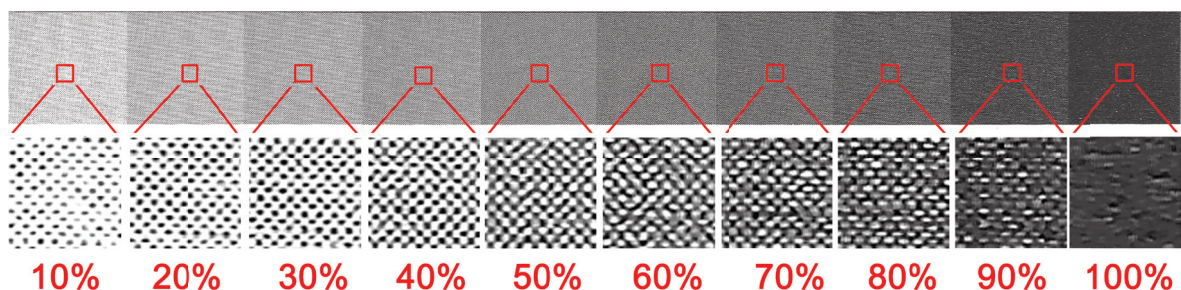
If CS is able to print a black and white book with images from “anything,” are there any issues?

Surprisingly, there are quite a few.

Printing involves converting images and text into dots of ink on paper. For text the dots are so small as to create very smooth and sharp edges.

Black

If you have black graphics—sometimes this will happen with type itself—the system will screen your art if it is not 100% black only:

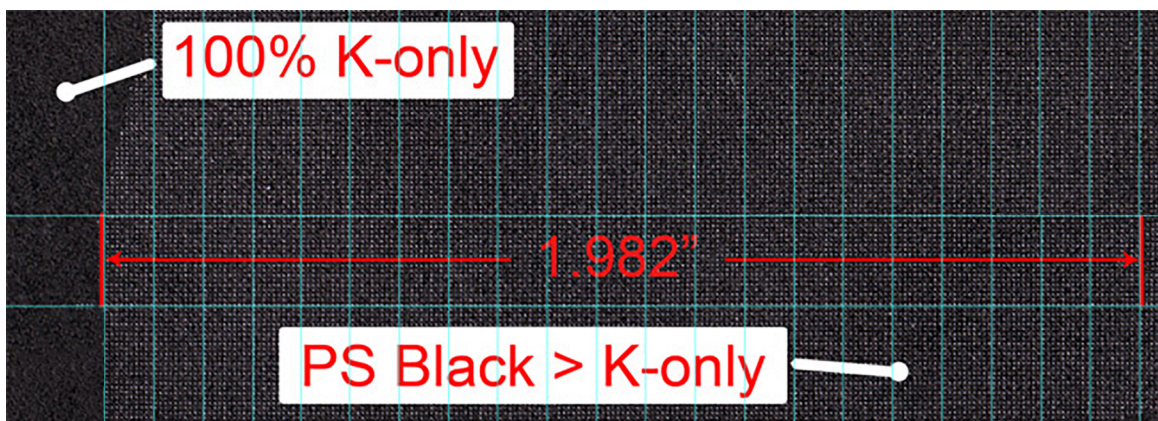


The 100% black does not have a dot pattern, the light spots are due to reflection coming off the paper fibers, imperfections in the printing and the scanning.

Here is the problem. Top is a standard black in most graphics programs, often called Photoshop Black (75% cyan, 68% magenta, 67% yellow, 90% black, written as C75 M68 Y67 K90). Is a rich black: it is deeper and richer than just K100.



But when it is printed as black only (K-only), this is what happens:



Because any color value less than 100% will be screened, if CS converts Photoshop Black, it will be screened, as shown above. Some people use C75 M68 Y67 K100, which should be screened.

Another black issue, one that is more likely to plague professional graphics people, in color, not all blacks are equal, but it's easy to using several different blacks after all, on a monitor black is the absence of color, whether it's warm, or cool, it appears the same way:



A working answer is to use levels to exaggerate any differences.

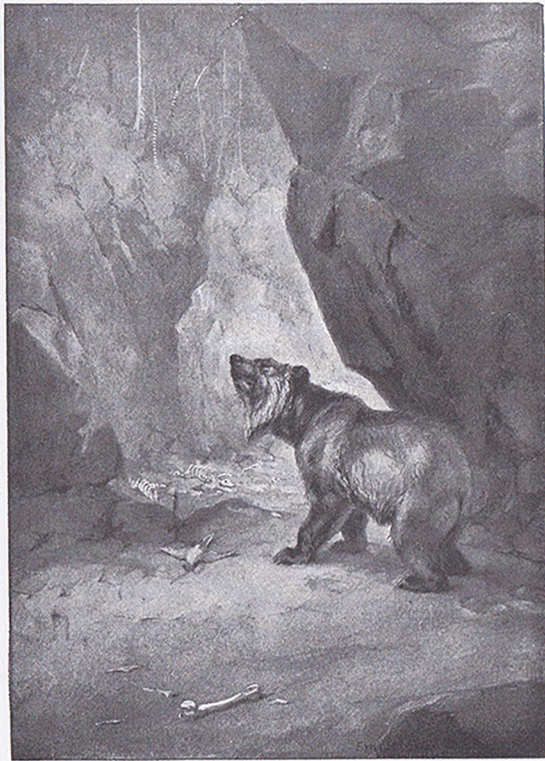
Don't worry if this gets your eyes rolling. CS is set up to handle most of this seamlessly. But sometimes things go wrong, or you want to finesse an image: unless you have some idea of what happens behind the scenes, you'll have difficulties.

Back to inserting black and white images into your book.

- Keep copies of your original images safe and sound.
- Adjust copies of the images for print:

- exact size at 300 dpi.
- adjusted for print (see below)
- Keep the adjusted images in their own folder.
- If you are working in Word:
 - make sure that image “compression” (downsizing: as in taking a 300 dpi image and reducing it to 96 dpi) is disabled *before* you insert your images.
 - Do not use Word’s Save as PDF feature, it will downsize your images, use a PDF conversion program: Acrobat (best but pricey), or free ones like primoPDF, doPDF, PDF995, cutePDF, etc.

Here are two scans of the same image, printed on cream and printed on white:



Most fiction is printed on cream paper. While the image on the right (on cream) appears less contrasty, softer, etc., no one is going to be comparing it to the image on white paper (left). Also, our eyes adjust to the context—thus, while the image on the right seems less powerful, the reader is likely to adjust to it. Cream is easier on the eyes, arguably the advantages of printing on cream outweigh printing white. However, the decision is yours.

The question at this point is whether you can just insert a grayscale image and have the book printed, or if you have to prepare the image for print. Arguably most images need some preparation. This can be done in Photoshop, GIMP, PaintshopPro, etc.

The basic issue at first is this: if your original image is in color, and it has to be converted to grayscale, will any significant colors be lost? We do not know what method CS uses to convert to grayscale. It will accept a book with color images and will print it in black and white, converting the images to grayscale on the fly. You won’t see the conversions until you get the printed proof.



GIMP desaturated average



GIMP desaturated lightness



GIMP desaturated luminosity



GIMP grayscale



Original sRGB Image



Converted with Grayscale Mode



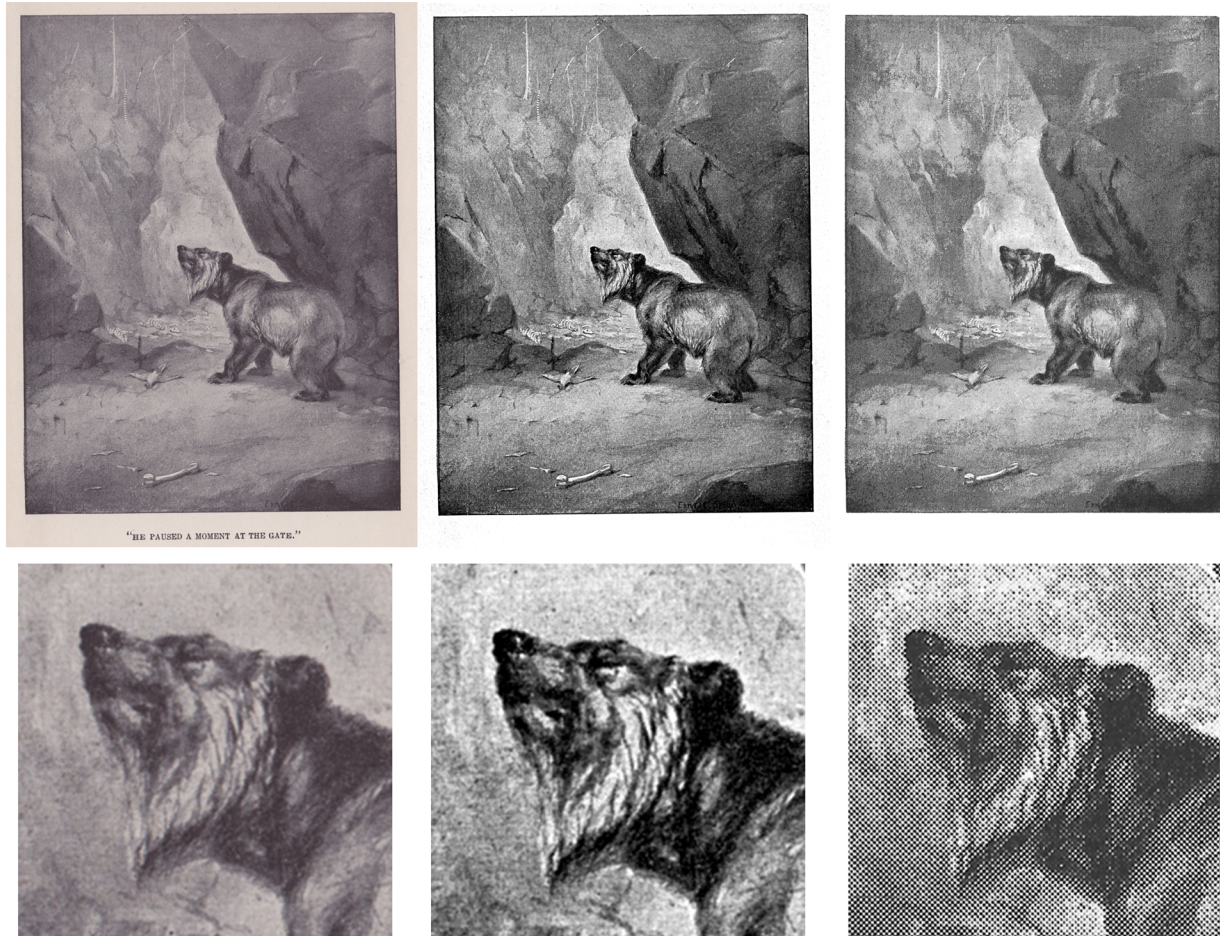
Converted by CS for B&W Book



Converted to Maximize Image

Obviously, from the above we can see:

- RGB Red and Green in some conversion methods could be identical, as could other color combinations. If an image has important colors, like the logo, test to see if those color relationships hold after conversion.
- While the logo example is extreme, the woman's sweater got lost in the conversions as did some of the punch of the image. In maximizing the image, i.e. preparing it for print, various colors were altered to hold the interest of the original. This took about twenty minutes. Is it worth it? That depends on your book, your goals, and your images



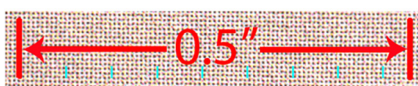
Original Scan

Print-ready JPG

Printed Piece

The original scan of a black & white, made in color to capture as much information, is soft. The print-ready image was modified to slightly exaggerate what I wanted. The printed piece is close to what I wanted. To keep the image from being covered in Moiré patterns, it has been slightly blurred (top). This took about forty minutes. If this were for an high-end art book, I probably would have spent many hours and done at least one test book.

CS prints black and white with a 106 lpi screen, and 170 lpi for color; 106 lpi is fairly coarse for images. B&W photo books usually print using duotones or tritones (duotone: black for the shadow and midtones, and gray for midtone to highlight detail; tritone: a black ink for the shadow and 1/4 tones, a dark gray for the midtones, and a light gray for highlights) and at a higher lps screens. You won't get art-book quality images, but the printing is not bad. I tend to scan more often at 600 dpi and full size, if the image



Color: 10 dot increments, 85dots/0.5"

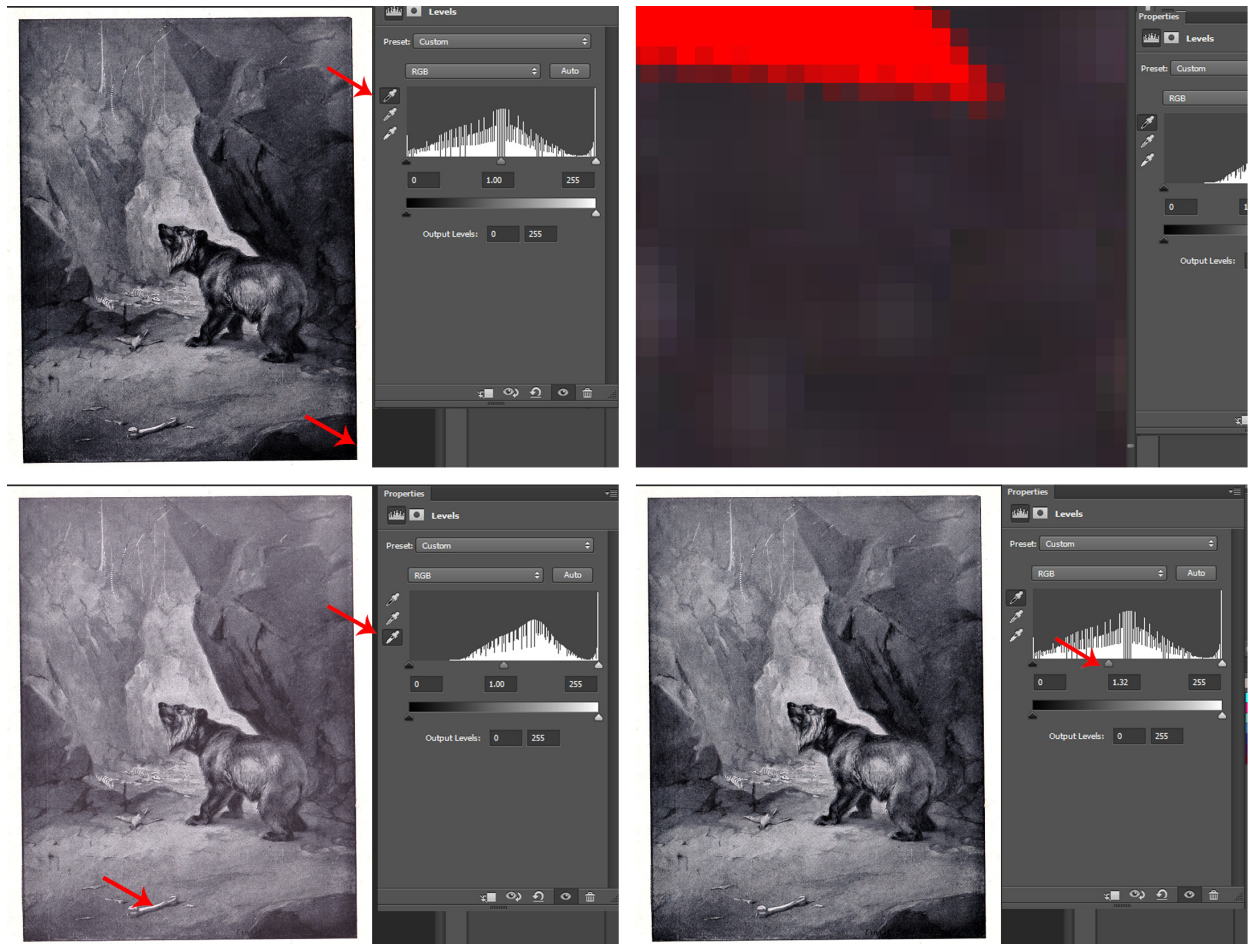


B&W: 10 dot increments, 106/1.0"

has to be enlarge, I might go higher. You can always get rid of image information, but inventing to go bigger it is less reliable. Once the image is about the size I need it, trim enough to be manageable, I set the white point and the black point. In this image it is obvious that both are much more compressed than they should be.

Color and Grayscale Image Preparation

Most graphics programs have levels and possibly curves. And these usually have eye droppers for sampling. Set the eye dropper for as small a sample as possible, I use 1 px x 1 px.

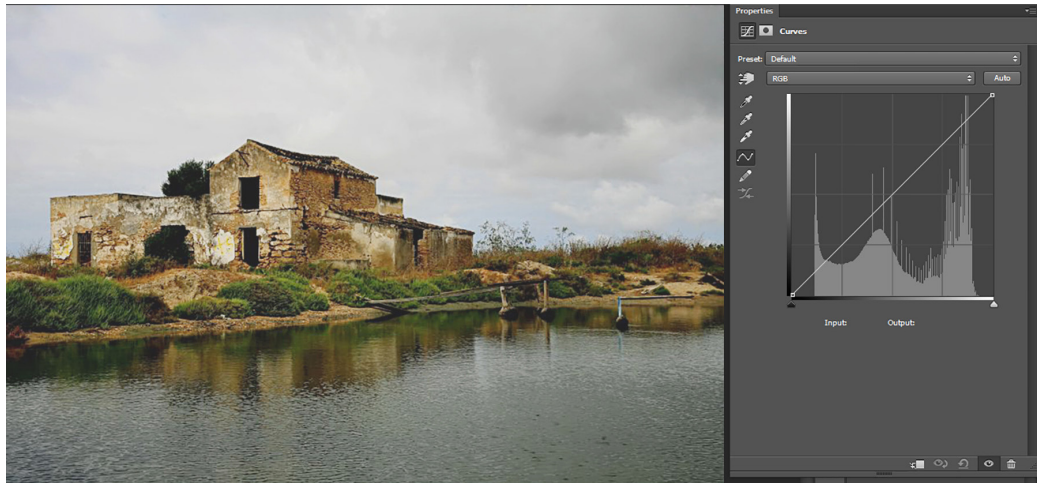


Examining the scan, the blackest area is at the bottom right (top left example shows the effect). I magnified the image 3200%, and selecting the Shadow Picker tool, I clicked on the blackest pixel. The whitest point is the pager edge or bone, I chose the bone, magnified it, selected the Highlight Picker tool, and clicked on a white pixel (bottom left example shows the effect). For the middle grays, I could not decide on a point, so I did not use the Middle Gray Picker tool, instead I used the middle gray slider button, although I could have typed a number into the box below.

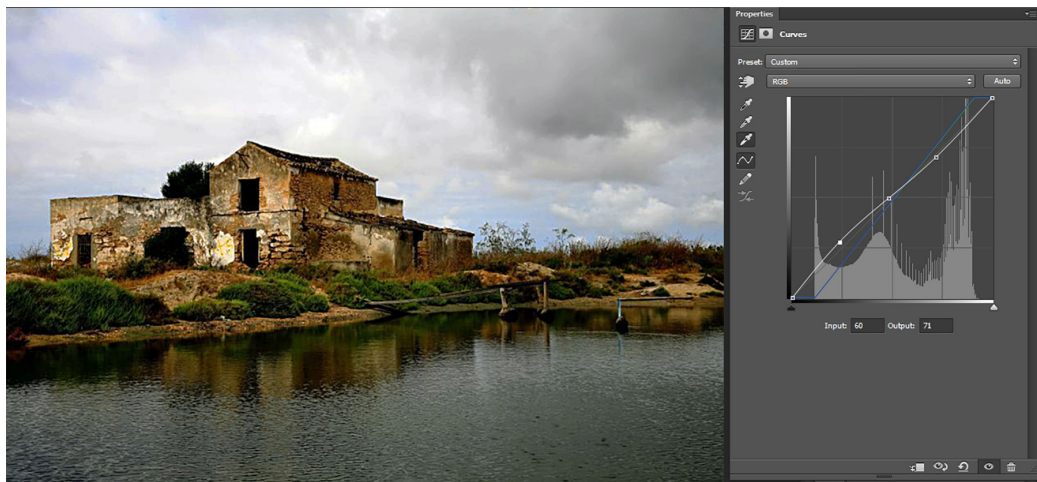
A word of warning, while PhotoShop had adjustment layers, which can be adjust a million times, most others have Image Adjustments, and these are destructive: that is they alter the image. In those programs, I will duplicate layers, so that if I do not like the effect, I have a clean untouched layer to play with. Turn off the visibility for those clean layers.

This can also be done with Curves, which I prefer, but fewer programs have curves, and people tend to gravitate away from them. But Curves are significantly better than Levels: giving much more control over regions of the black to white curve.

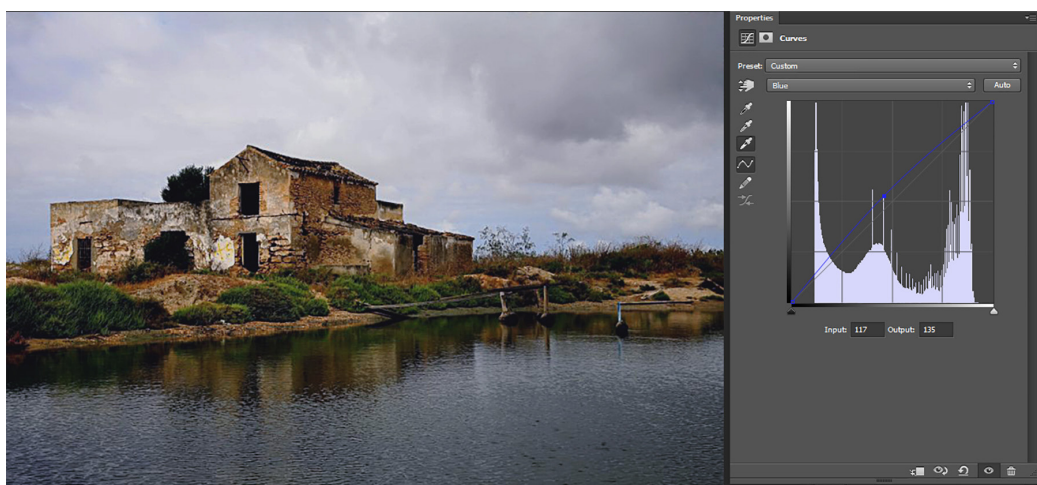
Similarly, we do this with color images. I'll use Curves, so that you can see the difference between it and Levels. In both Levels and Curves, you adjust the overall color space, grayscale, RGB, or CMYK, and in the case of color, the individual red, green, or blue channels, or the cyan, magenta, yellow, and black channels.



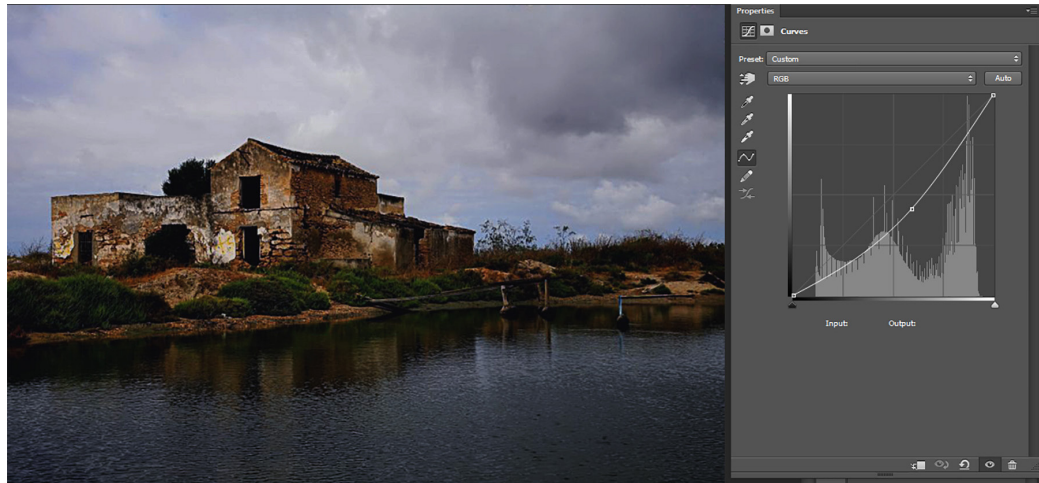
This is the original image, with the Curves palette open.



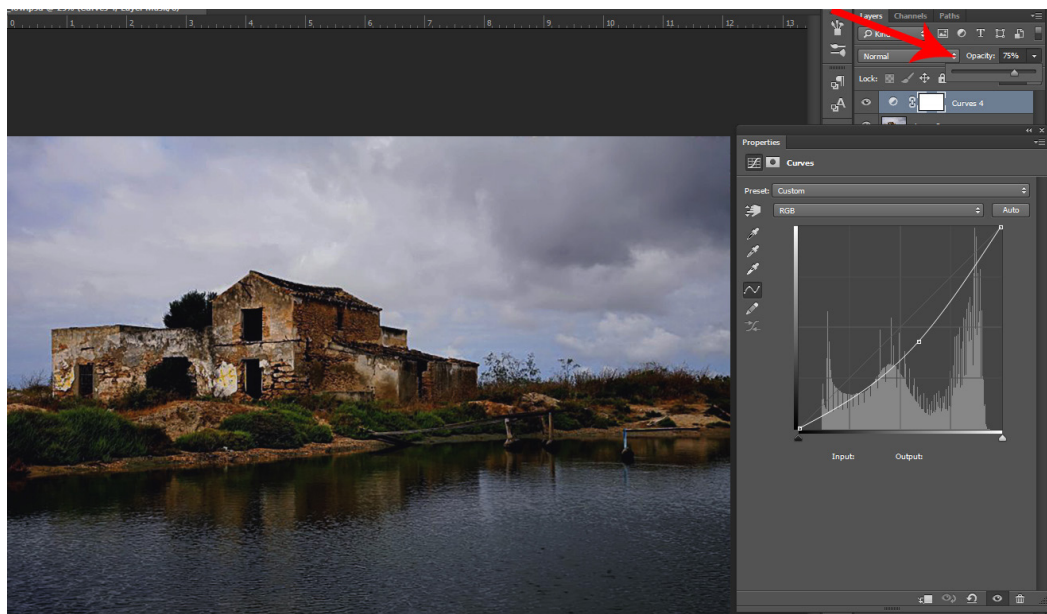
I've applied both the Shadow Picker and the Highlight Picker (for the black and white points), which you can see in the blue curve. Also I've tweaked the curve itself, compared to original curve above, it now has a slight S shape to it. This is why Curves are superior to Levels.



Selecting the Blue channel, I increased the blue (last image above). This may or may not be what the image needs, but I wanted to show how, in color image, playing with the individual color channels can make dramatic effects. However, just following from there:



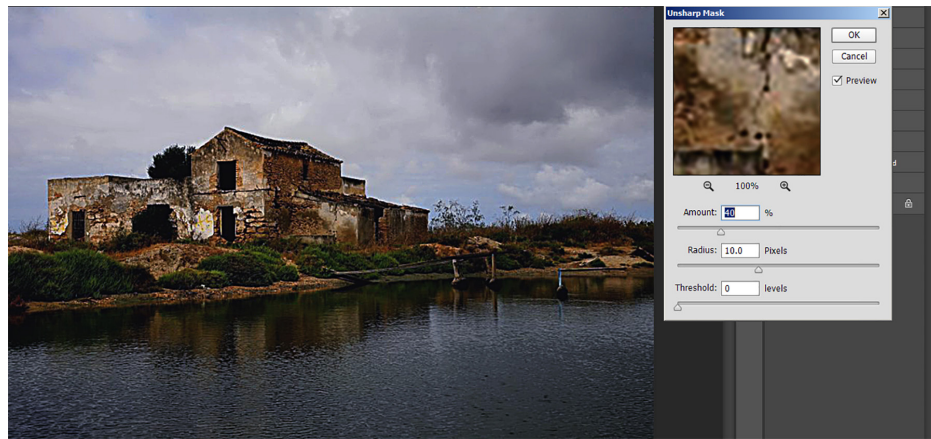
Here I have added another curve adjustment to the image. Obviously, it is too much. There are two ways to handle this, one would be to re-adjust the curves. The other would be to move that Curve's layer opacity slider: this is one of the most important tools in a graphics program. It is often quite difficult to make subtle adjustments, e.g. sharpening. If you sharpen a copy of the image on its own layer, if it's too much, you can reduce the opacity, provided what is visible below it is the same thing but without sharpening.



Here, I have reduced the opacity (that is, in this case the curves layer), to 75%.

Sharpening is usually the last step. It should be used sparingly: too much is obvious.

There are many sharpening techniques. I find the most effective is Unsharp Mask, although I often use several of them, hypass, emboss, etc. Copying the image to a single new layer, I'll apply some additional sharpening, and by reducing the opacity, sometimes to as little as 1-2%, little things can be tweaked. And by using masks or selections, specific areas can be sharpened, or blurred.



Here I used what is called hiraloom: high radius, low amount. Most people use low radius (1-3 px) and a high amount 150–350%. I generally use this as my second or third choice. I used the opacity slider to reduce this—note the light line around the roof tops.



Normal Sharpness



Over Sharpness



Blurred



Sharpened from the Blurred Image

Above you can see the dangers of over sharpening. There is almost a reciprocal relationship between blurring and sharpening. As the bottom two examples show, a blurred image, made by blurring the original, top left, can be almost brought back to acceptable sharpness. The fact that it cannot be made truly sharp shows the loss due to an images initial sharpness, and the importance

of starting with as good an image as possible. But all digital images, photographs and scans, are somewhat soft, and scanners and camera generally do some sharpening. This is often not enough, and if you have a choice between adding sharpening on your scanner or camera, it is generally better to do it yourself: your software and computer have far greater resources for this.

I've made all of the changes above using adjustment layers (a PhotoShop feature) or to merged copy layers. If at the end, I were to decide that I had gone too far, which I did, I can go back and tweak things and not just start over. This can take planning, because you can find yourself with dozens of layers.

Here is a possible finished image compared to the original:



If you work on an image for a few hours, your eyes become unreliable, for example I thought the opacity adjustment of 75% was almost okay, it really was not! But instead of going all the way back, in this case, I applied another Curves layer above the Sharpened layers, and made the corrections you see above. There is the fear that the shadow details might plug up, so I would certainly test this image.

On the Levels palette note the range is 0–255. There is a school of thought that recommends setting them to 5–250. **Do not do this.** Almost everything in image preparation, is about handling compressions. A sunny day at noon in the desert in Arizona could have a luminance range of 10,000, from the specular light on a leaf or shard of quartz to the darkest shadows deep between large boulders. Film, if you remember film, had a 200 lumen range, and photographic paper 100. The goal in printing is to create the illusion of the much greater range than is possible on paper. The same is true when using a commercial printer and halftone screening—we need as much expansion of the image as possible, although there are images, e.g. low key or high key images, that might not have a white or black point and do not benefit from expansion. But these are rare.

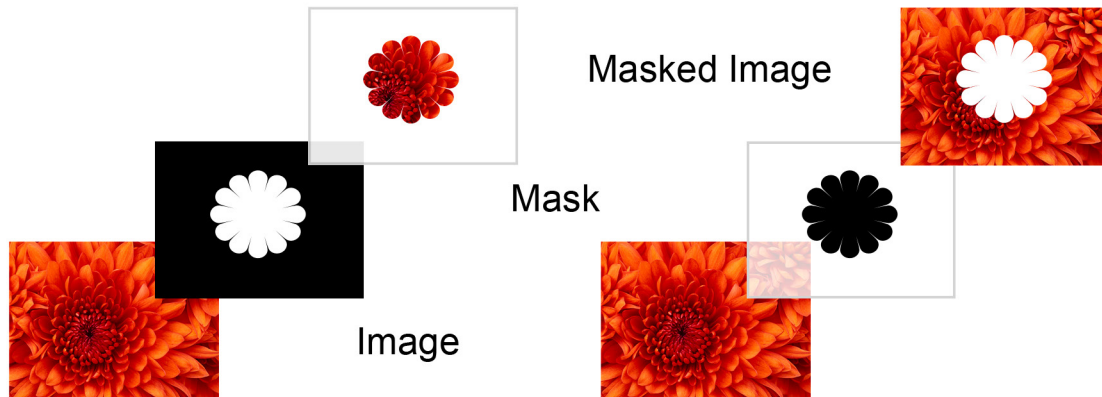
Also, two things you need to be aware of, dots of ink spread, called dot gain. Shadow detail tends to plug up and get lost, and highlight detail tends to blow out and disappear. This may be the mistaken reason for moving the range in to 5–250. If you need to open up shadow details or darken highlight details there are better ways to do this, rather than subject the image to a global change, see masking below.

The inks that CS use develop or oxidize over a 1-2 week period. Shadow detail will develop a little after you get your book. If you are concerned about shadow detail, you should wait at least a week or two before evaluating it.

Masking

This little PDF cannot substitute for a good book on Photoshop or GIMP. But I would be remiss in not showing the benefits of masking. Like the opacity slider it permits changes to be made

quickly and to be altered easily. Here is the general idea:



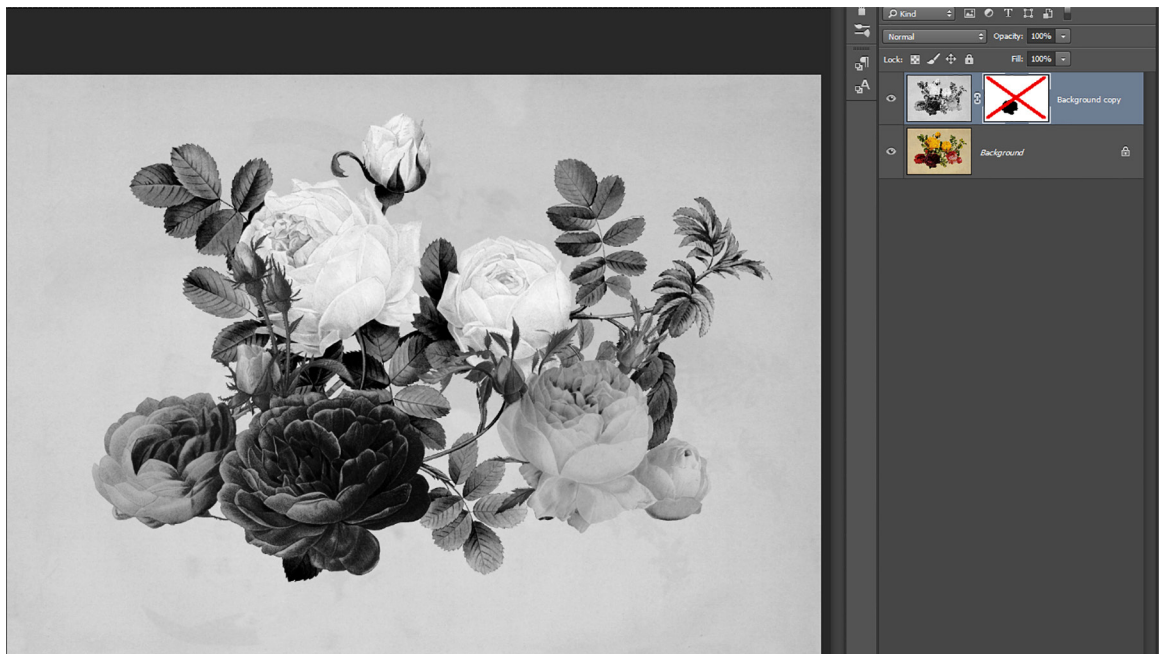
If you use a graphics program, you probably use selections, with marching ants (a moving dashed line) around something. This is a mask. The major difference between a selection and a mask, is that once you've made the selection and performed something to it, generally, that's it. Whereas, a mask can usually be revised and revised and revised.



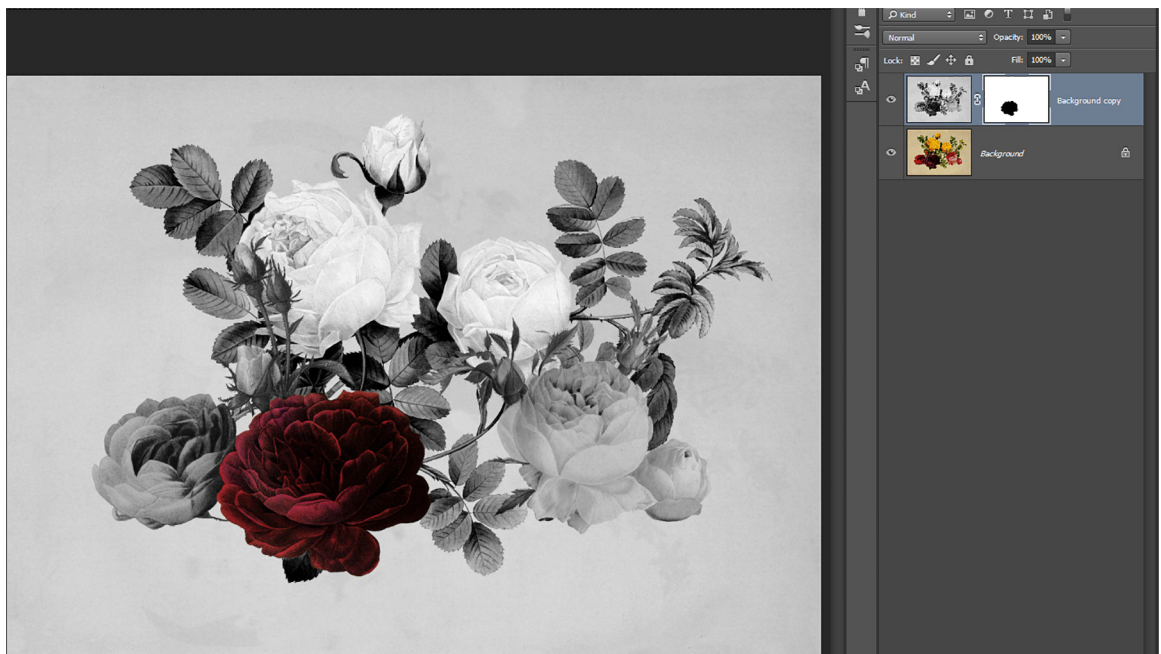
There are marching ants around the flower, left, which selects (masks it either it or the area around it). On the right, I simply darkened the area around the flower.



On the left I darkened the background to black, on the right I played the flower on white and enlarged it. I can make a selection from the mask. I can re-select the selection only if it was either saved in some way (e.g. a path), made a mask out of it, or I used it to extract the flower to its own layer. Perhaps a better example of a mask is this:



Here, the flowers in color are the bottom layer, and copy above them has been turned into a grayscale image. I added a layer mask, which appear to the right of the grayscale on the same layer. And I painted (when the mask is active, you can paint black (hides), or white (reveal), or gray (which partially hides) black over the red rose. I have deactivated the mask, so it all appears grayscale.



Activating the mask, above, the black hides the grayscale over the rose so the bottom layer shows, while the white reveals the rest of the grayscale.

The key is, this mask or selection, can be used to adjust the levels, apply curves, change the color, contrast, or saturation, all ways to enhance the image prior to printing.

At this point, print out at least a few images. See how they look on photo paper (ideally, glossy for covers, matte photo for color interiors, good bond paper for grayscale in black and white books. Look at the over all image and at the shadow and highlight details.

Color

For most books and most images printed with CS, the above information will serve you well. But if you are doing an image book (photos, painting, illustrations for a children's book), you need to be aware of more.

Working with a printer, you will be told and asked about color space:

Color space: a model for describing color, for example RGB, CMYK, Grayscale, which are the three color spaces you'll be concerned with for preparing your images for print. (There are other color spaces, for example Lab, which is my favorite for working on images, but that's a book, which, if you are interested, was written by Dan Margulis.)

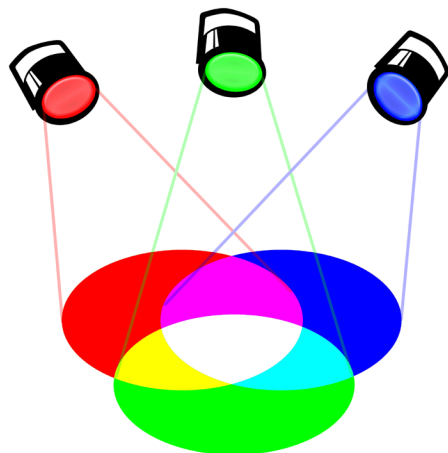
RGB: red, green, blue, is the transmitted light, our monitors are in RGB, our eyes see in RGB.

CMYK: cyan, magenta, yellow, black (because sometimes printers use B to indicate blue), is reflected light, and is the color scheme for most commercial printing.

Gamut: is the full range of colors contained within a color space.

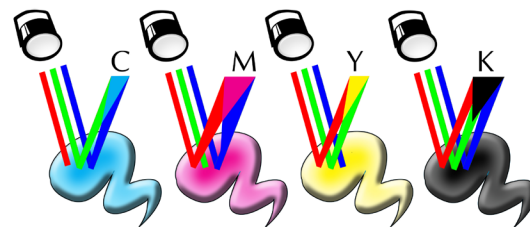
Out-of-gamut: colors from one color space that cannot be represented in another, usually deep, saturated colors in RGB cannot be reproduced in CMYK.

In-gamut: color contained in a color space



RGB

Transmitted light, additive



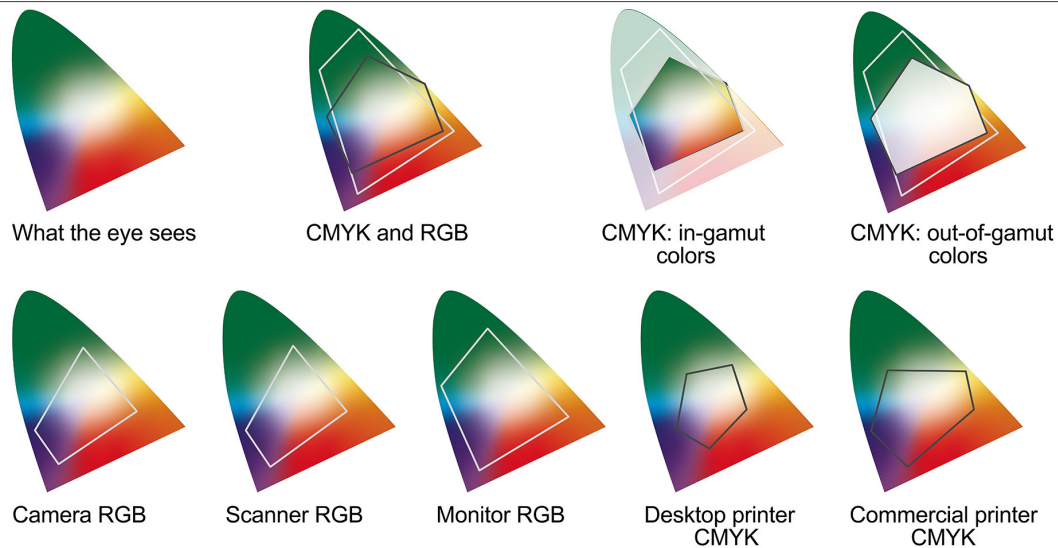
CMYK

Reflected light, subtractive

The primary colors represented by the lights (RGB) or reflected light (CMYK) produce secondary colors, where two colors overlap. The secondary colors correspond to the primary colors of the other system. Both the primary and secondary colors in CMYK are flat compared to RGB.



Large, solid areas of rich, saturated color in RGB are out-of-gamut color in CMYK. What you see is here are flat, dull colors in CMYK. Looking at the models:



Here the full color shape represents what we can see. The white outlined areas are the RGB gamut, which varies depending on what kind of device is using it, and the black outline represents the CMYK gamut. RGB is simply a bigger gamut.

At this point in describing this, you must be thinking that CMYK is a terrible system for printing: why would anyone use it? The simplest answer is the we can print full color images with CMYK and not as well with RGB.

In practice, RGB, which would also have to contain Black, is an additive system: combine the colors and you get white, but not when these are pigments/inks. If you've ever watched a child mix paint colors—lots of muddy colors. Also, in terms of printability, RGBK (with black, e.g. for text) is wetter than CMYK and causes problems in printing, not least because it is wetter, of ink set-off (in printing, sheets of paper are stacked as they are printed, the printed side up, set-off is ink transferring to the backside of the sheet above it).

But the reality is much different. Here are two images, the RGB version on the left and the CMYK version on the right:



In most continuous tone images, the out-of-gamut colors are much less obvious. In the case of CS, it uses nontraditional process colors (CMYK), proportional rendering intent, and color Simplistically, this is the basic set of instructions that convert RGB to CMYK, which map (convert) RGB to CMYK where 1) they match exactly what matches (all in-gamut colors) and out-of gamut color are clipped to the nearest reproducible color; or 2) all colors are remap, so that they maintain their same relative values to each other, but they may not exactly match where they could as in the previous method.

profiles that accommodate the paper and ink colors unique to CS. As the examples above show, most images will print well, but images or graphics with large, solid areas of out-of-gamut color will not work. HDR (high dynamic range) might be problematic—the reason for test how the images print.

Some artists, knowing their work is for print, will work in CMYK on the computer. Most graphics programs won't permit this. Corel Painter, Adobe Photoshop and Illustrator permit working in CMYK. GIMP can show you CMYK (this may be a plug-in). You can print your work on your desktop printer, which is CMYK. This will give you a relative idea of how things will look.

I should add that there are different RGB color spaces, sRGB (the nearly universal consumer color space), Adobe RGB, cieRGB, etc. If these are things that will be an issue, you need to dive into this and deal with it in depth. Or, at least for at test book, ignore them and see how CS prints.

CS has tried to make the color space a non-issue. Submit your work, CS will accept it—unless the actual layout specs or content are wrong—and print it. CS assumes that you do not know what color space you are working in, and don't care. From my experience on the CS forum, this is probably what 99% of CS customers experience. But it all depends on your work: knowing that out-of-gamut colors are a problem, and many graphics programs can at least show you what is out-of-gamut, you can take steps to avoid problems before you get a proof and are shocked.

As an interesting aside, look at the picture on the first page. In the close-up detail, You will see not only CMYK dots, but RGB dots! While CMYK is reflective, where dots of ink overlap, they are actually transmitted light, filter the underlying color, producing non-CMYK color! This suggest the complexity of what happens inside the press when it translates your image into addressable dots of ink.

Conclusion

This little PDF is not meant to teach PhotoShop or GIMP. It is meant give some idea about how to enhance an image for printing. If you need to learn how to use Photoshop, I recommend almost any book by Katrina Eismann or Dan Margulis. Both of whom take both a wide view of image enhancement and can be very specific, and practical—while writing well! You do not need Photoshop to benefit from Photoshop books. Every graphics program is different, the desktop, where they put the basic tools, what filters or brushes come with the program, etc. But at the end, they are are dealing with pixels, and there is only so much you can do with pixels and how. At the professional level, there are distinct advantages to PhotoShop (e.g. actions, live styles, adjustment layers, being able to work in CMYK or Lab, etc.). But other than styles, most people will never need those things to make or edit great images.

Here is a rough list of steps covered in this PDF for image preparation:

- Re-size a copy of your image to what you need, at 300 dpi
- Set the black and white points (using Curves or Levels: use an adjustment layer if you have them or a duplicate layer(s))

- Adjust the midtones
- Being aware that shadow detail will plug up and highlight areas will blow out, look to see if there is something you can do: e.g. a feathered (e.g. softening the edges by 2px) selection could be lightened with curves, or a feathered selection could be darkened, etc.
- If your images are color, print them out, your printer is in CMYK, and see how they look.

Finally a couple of warnings: The image you put in your file to be converted to PDF and printed, should be a single layer, for example a JPG. Obviously from this little guide, your working image could have dozens of layers. Do not merge or flatten these. Save the file with all its layers. Flatten a copy of this file. Keep a folder of prepared images, and a separate folder for the working images.

All good graphics programs permit working in layers. In the many of the examples above, I created a layer to adjust the levels, change the colors, etc. Sometimes as you work on an image you will see something that needs to be dealt with, a scratch, and dot, etc. If you are working “through” an adjustment, when you flatten the image you might see that your corrections are a different color. I will create a new layer with all that is visible merged into it, then when I correct it, I don’t have to worry if the adjust will mess things up.

At the risk of too much repetition: Make a test book if the images are critical. Test different methods of image preparation.

Always get a printed proof. If it is okay, and you approve it, save the proof. It is a contract proof, that is, it represents what CS can print from your files, and with your acceptance, you are indicating that CS’s quality is acceptable. If something goes wrong down the road, it is your reference. It has the date and place of manufacture on the last page, with the word Proof.

I have printed thousand of color images through CS. I’ve only had a few problems. CS has maintain quality over 14 years for some books (CS grew out of BookSurge). I think that people who have had problems didn’t have experience with commercial printing and were expecting inkjet quality (no halftone screen), didn’t prepare their images well (from muddy shadow detail to large patches of out-of-gamut color), didn’t do test books, etc.

CS cannot compete with high-end, glossy, cast-coated, image books, where images might be printed with 6-8 colors, 1-5 days to prepare each image, etc. But that is not why you use CS.

If you want more paper and binding choices, but still have the advantage of print-on-demand, take a look at 360 Digital Books (www.360digitalbooks.com/). If you want a beautiful, hardbound coffee table book, take a look at Oceanic Graphic Printing (http://www.ogprinting.com/about_intro.php), but you will have to buy a lot of books.

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