

# CALIBRATION FOR ALTERNATIVE PHOTOGRAPHIC PROCESSES

## Introduction

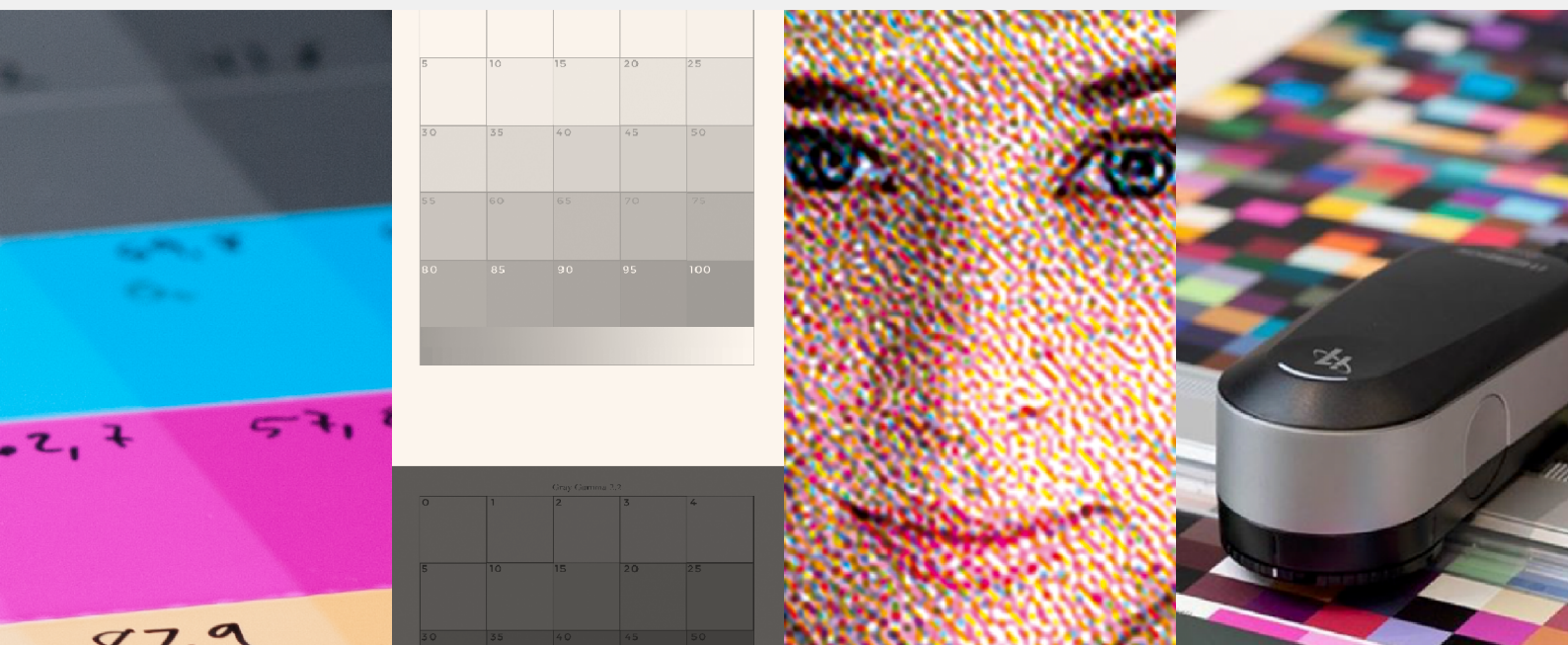
Getting The Right Density  
Linearization  
Tonal Separation  
Printing in Color

Density

Linearization

Tonal  
Separation

Color



**Calvin Grier**

Digital Workshop Series



Calibration for Alternative Photographic Processes  
Introduction

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Design and Images by Calvin Grier

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# How is This Series Organized?



This series is split into four guides. In order, they are: *Getting the Right Density*, *Linearization*, *Tonal Separations*, and *Printing in Color*. Below is a quick overview of what each of these guides will cover.

## Guide 1: Getting The Right Densities

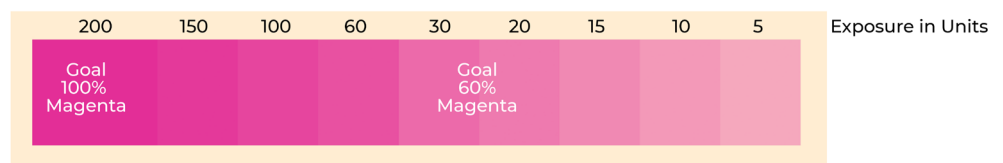
### Choosing Densities

You have to decide the maximum density of the colors you are going to use. Which of the three colors below is ideal as the 100% cyan and why? This guide will teach you how to make that decision in color and b&w.



### Exposure Times

You will learn how to calculate the exposure times needed to achieve the ink densities you have chosen. This will be done by making an exposure step wedge, and comparing the printed values to the exposure. Calculating exposure times for multiple tonal separations, multiple layers, black and white, and color will be covered.



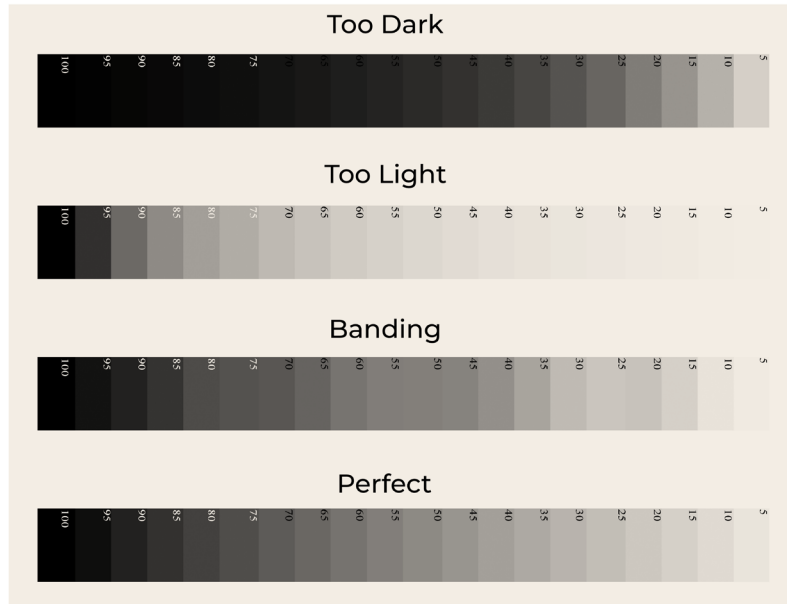
### Theory

When making density choices, and interpolating color data from the step wedge, it's helpful to understand: the Lab color space, what tools to use to read color, and the mathematics of color difference. If you are afraid of math, don't worry. An excel document comes with this guide that will do those calculations automatically.

## Guide 2: Linearization

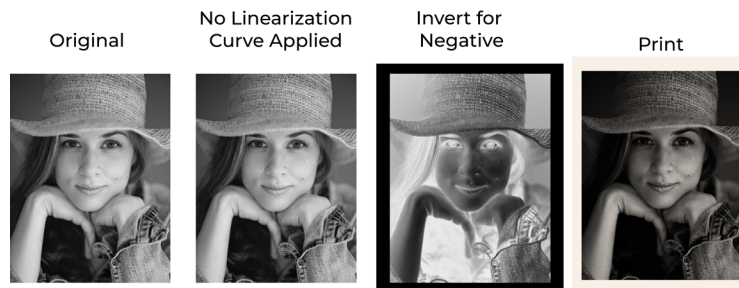
### What is Linearization?

The goal of linearizing a print is to equally space tone throughout the tonal scale. You don't want the tonal scale to be too dark, too light, or have banding, as shown in the first three rows in the image below. A well linearized tonal scale should look like the last step chart below.



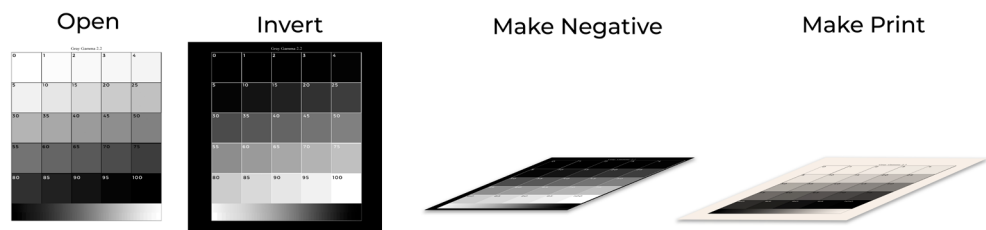
### What Happens if you do not Linearize a Print?

If no curve is applied to a photograph before creating the negative, then the print might be too dark, as shown in the image below. To linearize a print you will need to create a linearization curve in Photoshop.

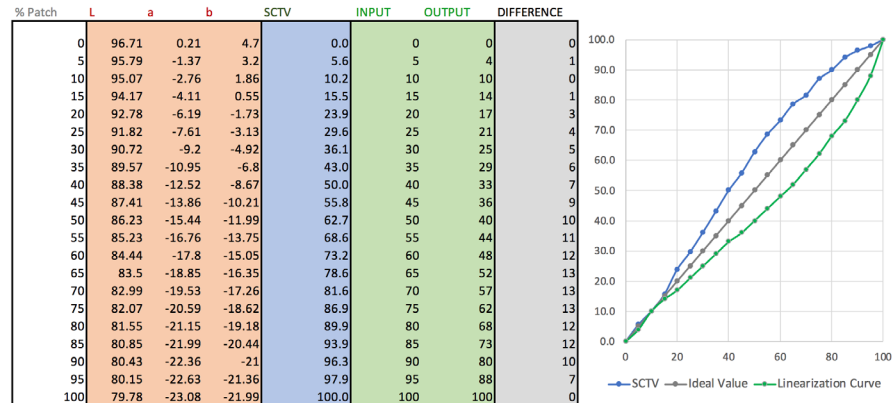


### How do You Create a Linearization Curve?

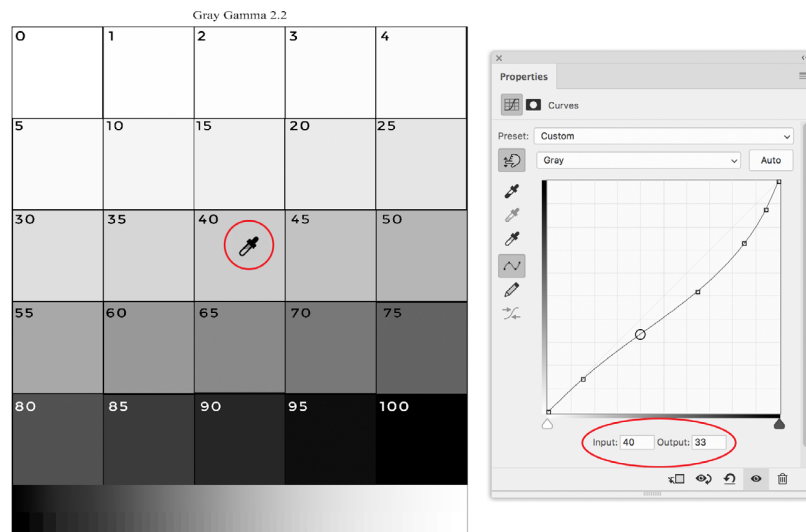
**1) Print a Step Chart:** An image with known values is inverted and printed as a negative. You will use that negative to create a print with your process.



**2) Read Values and Enter Them in Excel:** In this step you will read the patches of the step chart with a spectrophotometer, then copy the values into an excel document that comes with this guide. Regardless of whether you are working in color or b&w, the program will automatically calculate the linearization curve.

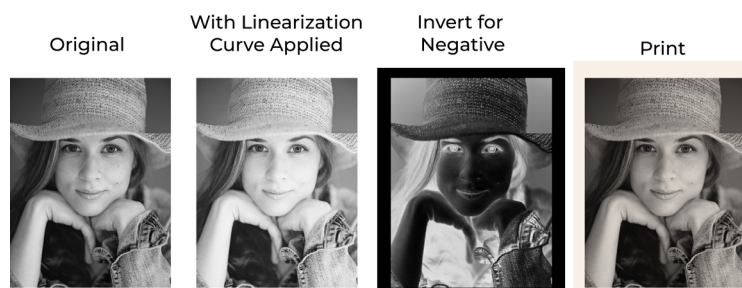


**3) Create The Linearization Curve:** You will then enter the INPUT and OUTPUT values, shown in the green columns above, into a Photoshop curve's adjustment. Shown below is the final linearization curve.



**How do You Use a Linearization Curve?**

After opening an image in Photoshop, you will apply the linearization curve you made above. Notice below, how the curve compensates for the print coming out too dark, by making the photograph lighter. The negative should now produce a print that is close to what you had intended.



### Beyond Basic Linearization

There's a lot of information and books on how to do the steps shown above, but what if you want to linearize a color? Or better yet, linearize multiple tonal separations in color. This adds a fair bit of complexity to the workflow, but hopefully, this guide will clarify the process. This guide will also cover, differences between halftone and continuous tone negatives, and problems such a geometric meta-meric failure, adding gloss, or changing supports.

## Guide 3: Tonal Separations

### What are Tonal Separations?

The idea of tonal separations is to use different colored inks for various tonal ranges in a print. For example, using a light gray ink to print the light tones in a print, or a dark ink for the shadows. Below is an example of an image split into various separations. The separations are labeled ink, but that could represent any material used to create tone in a photograph, such as silver, platinum, or a pigment. The tones in the final combined images should all be the same

	Equal Separations				Combined			
One Ink	100%				=			
Two Inks	50%	+	50%		=			
Three Inks	34%	+	33%	+	33%	=		
Four Inks	25%	+	25%	+	25%	+	25%	=

Usually, tonal separations are used for halftone prints to make the image smoother. In the illustration below, the left image was made with tonal separations and the image on the right is a normal CMYK print.

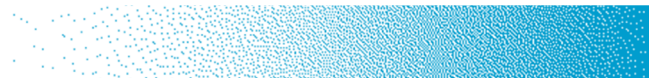


Below is an illustration of what tonal separations look like. The first row shows a gradient made with a light ink that fills in the light tones of the print. The second row is a dark ink that fills in the shadows. Finally, the third row shows the composite of the two separations.

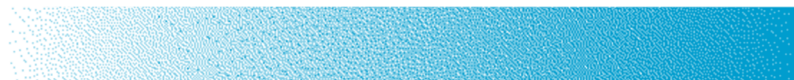
Light Separation



Dark Separation

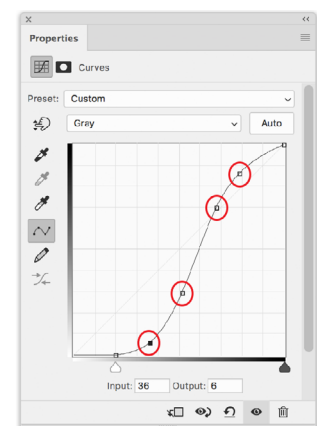


Print



### Separation Curves

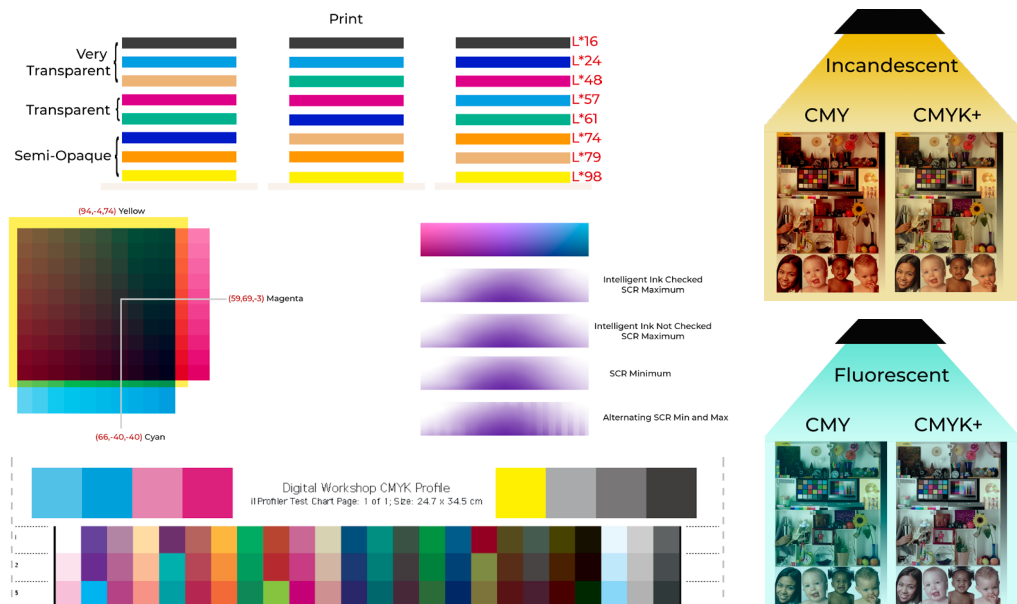
You will create the separations with an adjustment curve in Photoshop, as seen in the midtone separation below. When I first started making separations, I wasted thousands of euros and hundreds of hours trying to make good tonal separations through trial and error. This guide will show you how to take the guesswork out of the process so your separations are perfect the first time



## Guide 4: Printing in Color

Don't be afraid to print in color; it's not much more difficult than making a black and white print with tonal separations. The process of calibrating a color print is almost the same as a black and white print. All one needs to do is repeat the process from the first three guides, for each color used, then put everything together and make an ICC profile. You can then use the profile to convert from RGB to CMYK, and make a print.

The last guide is meant as a supplement to two color management books and a color theory publication. It's not meant as a general color management guide, but rather, how to apply the information from those resources to alternative photographic processes along with theory I wish I had known when starting to print in color. The guide will cover, common mistakes when transitioning into color printing, alternative color management strategies, how layers should be ordered, consistency, making and using CMYK, Multichannel, and RGB profiles, making a grayscale for an RGB workflow, and viewing prints and matching to the monitor. Some illustrations to those items are shown below.



## Notes on the Organization of This Series

Combining the four guides into a simple workflow is a little bit tricky. The process is often circular. I'm constantly going back and changing a factor to improve the print, then repeating the other steps. Also, understanding many of the earlier steps requires understanding how that step fits in with a later step. More or less you are going to follow the steps in the order outlined by the guides. Density will always come before linearization and color management will always come last. The problem when I was creating this series, is where to place tonal separations.

Reasons tonal separations should go first

- The ink density you calculate for the lighter separation will dictate how long the exposure time is going to be.
- Changing the separation will also affect the linearization, so this should be decided beforehand.



Reasons to put tonal separations after linearization

- The knowledge to create separations is built upon the theory of densities and linearizations
- The print has to be linearized before you can use the separation curves.
- The guide on densities could be split into three parts. The first part is finding the maximum density. The second part is calculating and deciding where the separations are going to be. The third part is finding the exposure time for the separations.

It's a bit of a chicken-and-egg sort of situation, but I've decided to put tonal separations as the third guide. That way you can understand the basics instead of starting with the most difficult part of the process. Just keep the idea of making tonal separations in the back of your head while I explain how to calculate densities, exposure times, and linearization. I promise it will work itself out in the end. It might even be useful to quickly skim over the guide on tonal separations, so you have an idea of where the first two guides are going.

## What is This Series?

### **Why Calibrate a Print?**

A well calibrated workflow will allow you to predictably print a digital interpretation of your photograph. An un-calibrated print might come out too light or with too much contrast compared to what you had hoped for. This results in frustration and high costs in having to remake negatives and the print. Good calibration will eliminate trial and error from your workflow.

### **Calibration Should Not be Stressful**

Calibrating a photographic print can be a daunting and often frustrating task if you are wandering around in the dark, banging your head against the wall because an image turned out too dark or has no life to it. I intend to shine light on the various aspects that go into calibrating a print, in hopes that you will be able to avoid obstacles in your path and achieve your goals sooner.

### **Does this Series Teach a Specific Method?**

I've never locked into a specific method to make a print. Technology is constantly changing, I'm constantly having new ideas, and encountering new problems. Teaching a specific method seems silly to me, especially since I don't follow a certain set of rules. Many different workflows will help you achieve similar results.

As those who have taken workshops with me know, I not only teach how to do something, but also why. I think it's much more important that you know the theory behind the hundred or so choices you are going to make when calibrating a print, instead of being told to do this and that, then voilà you have a print. I will give you my recommendations throughout the series, but my technical or artistic choices when printing are going to be different from yours. Understanding why I have made those choices will allow you to make your own decisions and create your own style of printing.

This series comes with several tools that you can use to make calibration much easier. I'll show you how to use these, but you can just as easily use other available programs and calibration systems, it doesn't matter. By the end of this series, you should know enough to even create your own tools or understand why one system might work while another fails.

The calibration presented in the series will mostly be from a digital perspective, although some of the information can be applied to analog.

### **Filling Gaps**

In the alternative process world, there's lots of information published on working with inkjet digital negatives and linearizing those negatives. Unfortunately, I have not come across simple explanations of why I should choose a certain density for a pigment, how to linearize a color, how to proof tonal separations, or mistakes I might run into while making a color print.

While writing this series, I focused on filling in gaps in alternative process literature. Where I've felt information is published somewhere else, I have recommended books and Online resources. I tried to limit basic information only to what was necessary to explain a problem or give a base for explaining something more complex.

### **Are You Going to Learn to Print Negatives?**

This series is not going to cover how to print digital negatives. I think there are enough books out there on the subject, that another one is not needed. Instead, we are going to focus on everything up until the point where those negatives are made.

### **Is this Series going to Cover a Specific Printing Process?**

This series is also not going to cover anything process-specific on how to make a print. I've tried my best to make this series applicable to all processes. But, as many of you will also know, my focus in alternative processes is making color carbon transfer prints, so a lot of the examples are carbon related. Even so, this is not a guide on the carbon transfer process.

A fair amount of the material in this series, probably sixty percent, is about color: how to choose the correct densities for color printing, how to linearize colors, how to color manage a print, etc... So, those parts will only apply to pigment-based processes like carbon, photogravure, and gum bichromate. The other forty percent of the information is applicable to black and white printing and will be very useful for those who practice metal-based processes.

### **Do You Need to Have a lot of Experience to Understand this Series?**

I've tried to make this series as accessible as possible, but it's not a beginner's guide. You don't have to be an imaging scientist to understand the theory in this series, but I've assumed that everyone reading this has a little bit of experience with alternative processes and photography. The last guide, which covers printing in color, is a little bit different. It is meant as a supplement to a couple of books on color management and theory, so I leave out all the basic material.

**Videos**

Apart from the four guides, there are several videos that cover the digital parts of the process. The videos are titled, *Calculating Exposure Times*, *Linearization*, *Making a Proofing Station*, *Split Tones*, *Making an ICC Profile*, and *Preparing an Image to Print*. The information from these videos is also written out as step by step instructions throughout the series.

**Excel Programs**

Calibrating a print, especially in color, requires a number of calculations. There are three Excel documents that come with this series, to automate that process. All you need to do is copy and paste values and Excel will do the rest. The documents are: *Exposure Times*, *SCTV Linearization*, and *Solver*.

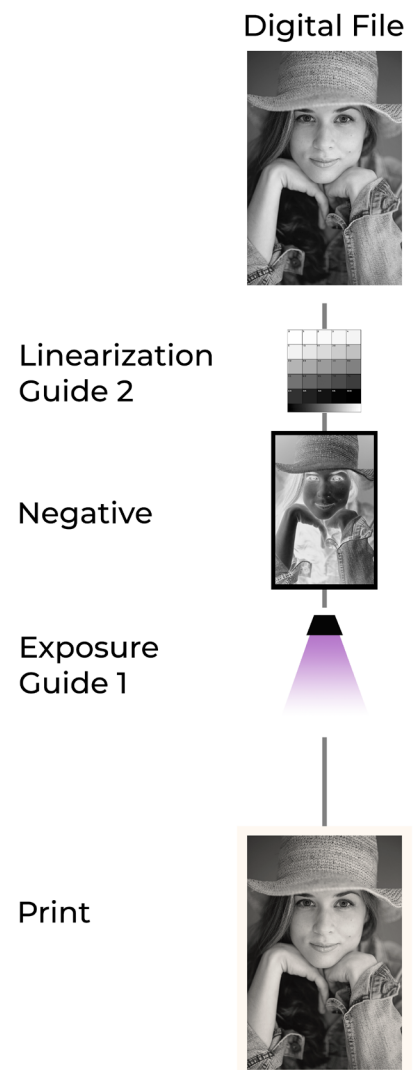
**Documents**

This series comes with a number of documents: test charts, profiles in CMYK, CMYK+1 and CMYK+3, a registration mark, many separation curves, and sample data.

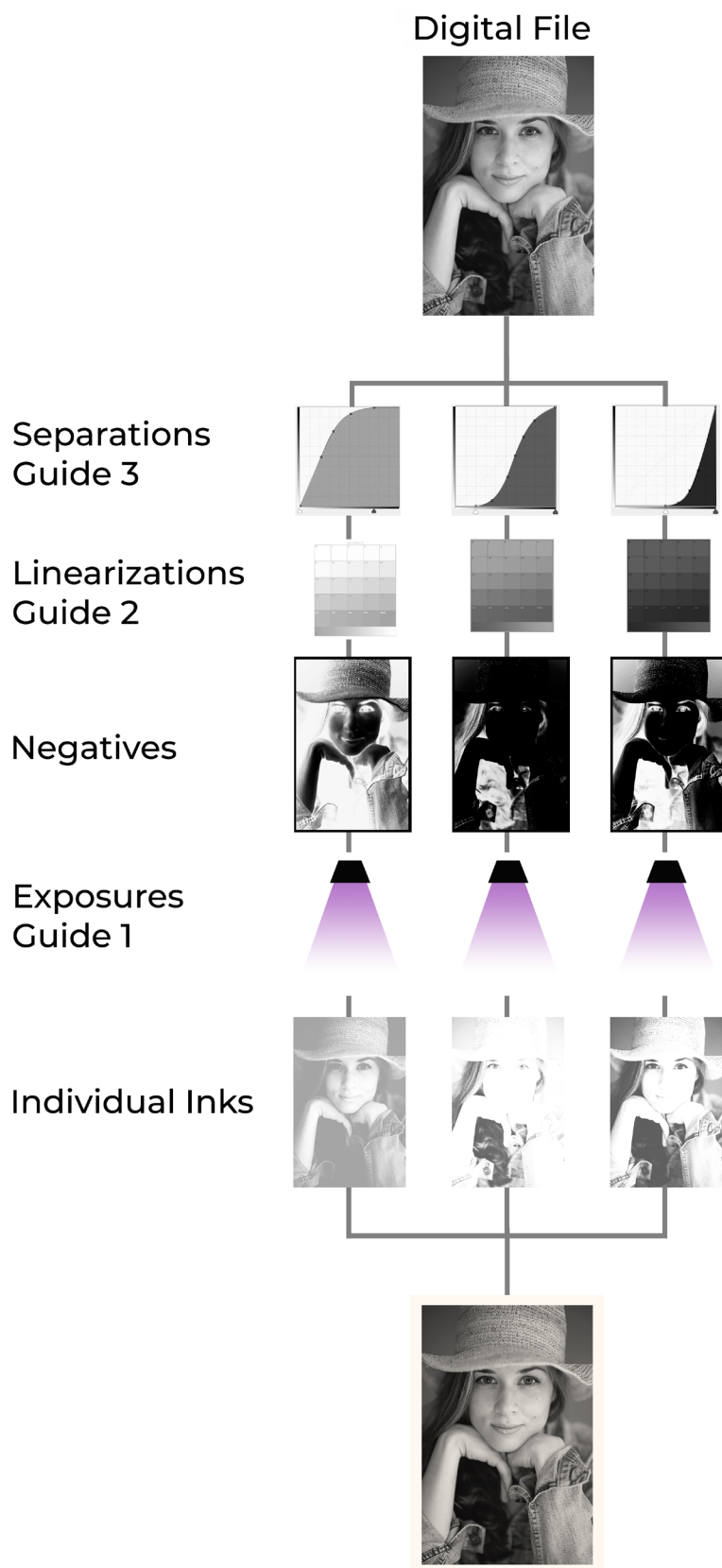
# Simple to Complex

**The Choice is Yours**

You can choose to make simple black and white prints with one negative, as seen in the workflow to the right. To the left of the images, the labels indicate the steps in the workflow and which guide covers that information.

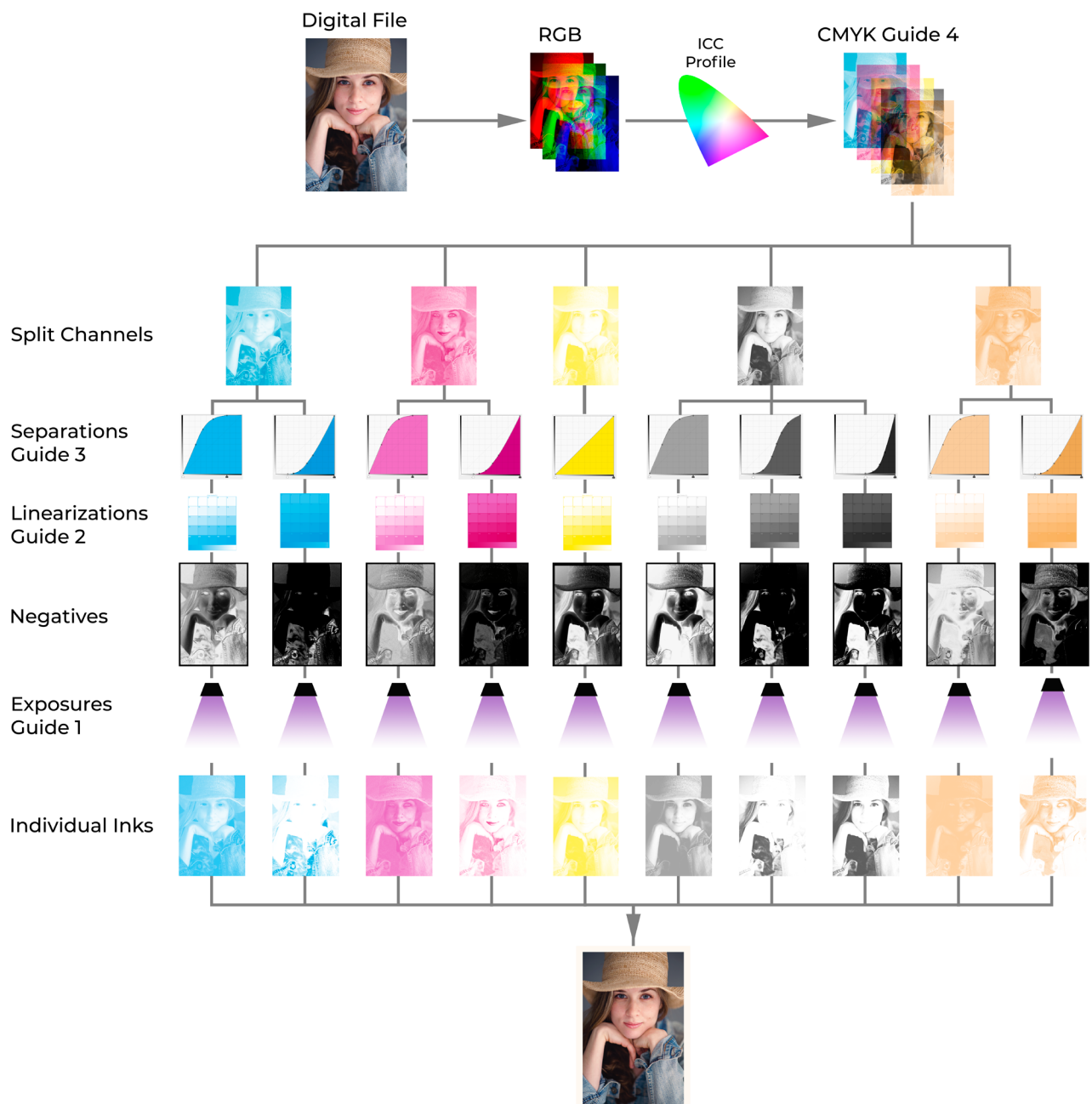


You can also choose to make black and white prints with tonal separations, as seen in the workflow below. You will also learn how to modify the workflow below to allow for two different methods of split toning images.



Finally, you can choose to print in full color, plus spot colors, as seen in the workflow below, or even go beyond what is shown, by incorporating grayscale curves, general correction curves, ink limiting curves, and adding up to 4 extra colors. What this guide does not teach is how to make a print with a specific process. That will be up to you to learn. In the workflow below, I wrote in individual inks in the last row, but that doesn't need to be the case. We will look at how to expose multiple negatives to an individual color as well.

The level of complexity its all up to you. I'll teach you the tools, and you will decide how to use them.



# Vocabulary

## The Problem of Vague Definitions

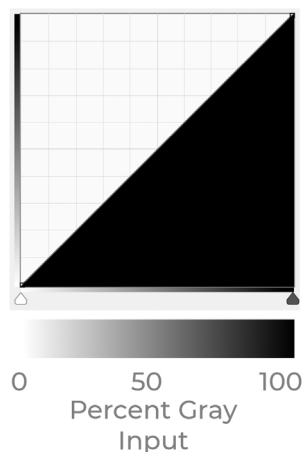
We are going to spend a lot of time looking at and describing colors. How would you describe the color below?



In Photoshop this is 50% gray. In a print we could say it has a luminance value of 54. We could also describe it by how much ink was put on the page, such as 80% light gray ink. With a densitometer this patch might read 0.75 in a print. A press operator would give this patch a tone value of 50%. The possibilities don't end there, because %gray can also be used to describe a print, and % tone value can be used in Photoshop as well as %ink, or Luminance values can define a color in Photoshop. All the definitions and words start to get mixed because they are almost all interchangeable. This is not ideal for a learning environment.

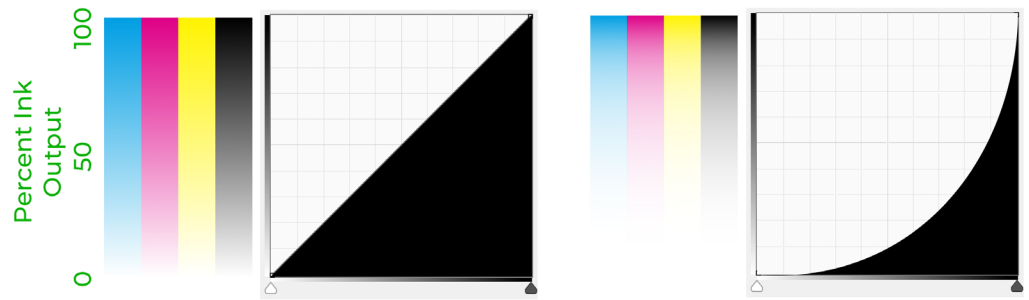
## Definitions Used in this Series

To keep concepts organized, I've tried to follow the definitions below, throughout the series. They are color-coded to help keep things straight. There are four main definitions. First, definitions are split by either describing the digital world, i.e. Photoshop, or the physical print. What is called **percent gray** in Photoshop, will be **overall tone value** in the print. Then the definitions are split again. What was just described is the input, or where on the tonal scale we are talking about. Then there's the output, or how much tone is being applied at that point. In Photoshop we'll call this **percent ink**, and in the print, it will be the **Spot Color Tone Value**.



## Digital World, Photoshop

**Percent gray** is the input on a Photoshop curve, shown on the horizontal axis of the illustration above. These numbers never change and serve only as a reference to where on the curve a **percent ink** is being applied.

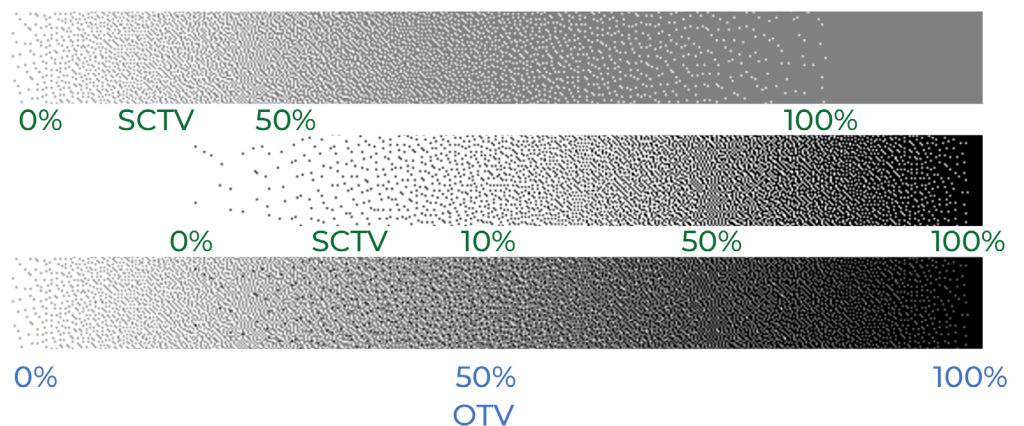


**Percent ink** refers to the quantity of ink being laid down on the support, and is shown on the vertical axis of the illustrations above. I use the term ink, but it could also be an emulsion or metal like platinum and silver. **0% ink** is no ink, **100% ink** is the maximum. With a straight curve like in figure Figure 0-9, the percent ink and percent gray are always the same. At **50% gray**, **50%** of the maximum amount of ink is being applied to the paper. In Figure 0-10, the amount of ink has been adjusted. Remember the **%gray** never changes. At **50% gray**, now only about **10%** of the maximum amount of ink is being applied to the paper. Since the maximum amount of ink is set by the process and exposure time, it is impossible to have more than **100% ink**.

**Physical Print**

**Spot Color Tone Value or SCTV** and **percent ink** are two different ways of describing the same thing, which is how much ink is on the paper. If the linearization was done correctly, they should be the same value. However, to differentiate the digital world from the physical print, it helps to call them two different things. **%ink** is the value being sent to the printer from Photoshop, and **SCTV** is the actual printed value.

**Overall Tone Value** describes the combined tonal value of the separations. When you are making a print with no separations, **SCTV** and **OTV** will be the same value, just as **%ink** and **%gray** were the same. We saw above that it's possible to have only **10% ink** at **50% gray**, so it's also possible to have a **10% SCTV** at the **50% OTV**. This will happen when making tonal separations. There's only **10%** of the dark separation in the example on the next page at the **50%** mark of the **overall tone**. **OTV** will be used to describe the combination of all the separations together, while **SCTV** will describe the individual separations. In a perfectly calibrated print, **OTV** will equal **%gray**.



**One Last Definition**

When we make tonal separations, we will describe the **100% Spot Color Tone Value** or **100% ink** of each separation as the **Ink density**. This value will be chosen in Photoshop and controlled by the exposure time, or coating. You will need to decide what those ink densities are going to be after reading the guide on Tonal Separations. Below are a few examples.



In review, **percent gray** and **percent ink** are going to be the terms used in Photoshop, while **STCV** or **OTV** are going to be the terms used to describe the actual print. I will use **Ink density** in both Photoshop and the print.



**A Word of Encouragement**

Alternative processes are difficult, but the beauty of a well made print is incomparable. Take your time. Don't get discouraged. Learn from your mistakes. More than anything else, I think it's important to succeed at failing. The more you fail, the more you learn, and in the end, you'll be a better printer because of it. I wish you the best of luck, and hopefully, the following pages will make your journey through calibration a bit easier and smoother than it was for me.

**Thank You**

I feel very fortunate to make a living as a carbon transfer printer, which I wouldn't be able to do without your support. Thank you for purchasing this series on calibration, and I hope it is of great help to you.

Thank you to all the beta readers, Greg Brophy, Aaron Chan, Xander Fischer, Steve Grier, Mario Rodrigues, Kane Stewart, Michael Strickland, André Terlingen, and Michael Trupiano. They put in countless hours reading drafts, and this series is much better because of their input.

I would also like to thank my parents and my wife for supporting my endeavor in alternative process photography.

Calvin Grier