Creating the Digital Negative

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Preface

I had an opportunity to look at some original copies of Stieglitz's Camera Work, printed at the beginning of the 20th century. I looked forward to being able to view the images, but also got interested in an article that I believe was in the second issue. This article spoke of a new technology that allowed for color photography - perhaps they saw Steichen's three color gum photography work - and announced that black and white photography would go away. Certainly, color photography eventually did end up dominating, but there have always been photographers who have favored black and white.

Similarly, the advent of digital photography has brought portents of the end of analog photography. The demise of Kodak is testament to this, but there remains a dedicated group who continue to use film for their own reasons. For those who wish to take things to another level, we have the ability to enjoy the best of both worlds.

Each person has their own reason for choosing what they like. Personally, I like handling prints. I like the touch and feel of a well-made fiber print. I also like the use of alternative processes and the way a nice Bromoil or Van Dyke print forms on the paper. I completely reject the notion of an image on a monitor being the finished product - "it ain't art until it's printed out."

That leads to the question of why bother with a digital negative in the first place. The easy answer is that it allows one to draw from the strengths of both digital and analog photography. With a program like Photoshop, distracting elements can be removed, burning and dodging can be done in ways impossible within the darkroom, and creating an image is just simply easier.

An example comes with a Bromoil print I made called Afternoon Stroll. This image was photographed using infrared film and shows a family walking under the large canopy of a tree. I wanted to offer this as a Bromoil print and failed time and time again. The problem was that the little girl walking behind the rest of the family was not as visible as she needed to be, and this was an essential part of the image. I tried burning her in, I tried filling her in with ink, I tried everything I could imagine without success, so I set my attempts aside. After learning how to make a digital negative I scanned the original negative, boosted the girl's presence using Photoshop, made a digital negative, and succeeded making the Bromoil print in my first attempt.

Another major benefit for me is that I can use paper that I would otherwise have been worthless. With so many people moving to digital photography, I love offers to take paper that is no longer useful to others. Fixed contrast papers to which I would previously never have found a matching negative are suddenly useful.

For those who work with alternative processes, the ability to create a digital negative can be a real blessing. With the exception of Bromoil, all of these processes are contact printing processes, which means that the negative needs to be the same size as the print. In the past the creation of a print with a different size negative meant that another negative needed to be made. The film that allows such copying is no longer available, which necessitates making a film positive, then a negative from that. This is fraught with variables as well as being time consuming. Even if the negative is the correct size for printing, the contrast of the negative needs to match the process, which means that it will be very difficult to print if the negative will also be used to make a silver gelatin print. And those using expensive processes, like platinum/palladium, may waste money making test strips and mistakes with exposures. Digital negatives resolve all of these issues.

The digital negative is a bridge between digital and analog photography. It allows one to create an image using the digital technologies available to the artist, and translate that image to a finished print that comes from the darkroom. The process of creating a digital negative is simple, and only takes time initially to match the paper, after which the process can be reduced to a single Photoshop action. But I am getting ahead of myself.

Plan of Attack

This publication is written in two parts. The first part is an explanation of what needs to be done and why. I offer examples that highlight the concepts, and show where one can run afoul. The second part is more of a workshop. I go through the process of creating a print and you can be beside me, going through those same steps yourself.

I use Photoshop to perform the digital manipulation. The appendix has explanations of how to do things for those who are not familiar with the program.

What Is Needed

The list of things needed before this journey begins is going to be fairly short.

- Darkroom Equipment
- Computer, Photoshop, and Printer
- Pictorico Premium OHP Transparency Film

Darkroom Equipment

You need to have the same equipment one normally has within a typical darkroom - enlarger, trays, chemistry, etc. If you are working with alternative processes then a light box replaces the enlarger. I have to assume that you know how to use this equipment, as that information is outside the scope of this pamphlet.

Computer and Printer

Photoshop is not absolutely necessary, but I will be using it for all of the examples. What is needed is image editing software that allows one to print with a specific color, and offers the ability to invert tonality and alter an image using Curves. Any computer capable of handling the software will do, and these days it looks like all current printers are up to the task.

Pictorico Premium OHP Transparency Film

The specificity of the brand and product are not important, this is what I, along with most other digital negative creators use. There are other choices that work well, but I urge the beginner to check online forums for recommendations of other possibilities. I make this suggestion because my attempt to buy something cheap resulted in a waste of money.

Part 1

Explanation

It seems like this should be such a simple task - finish a black and white image in Photoshop, flip it horizontally, invert the tonality, and print on a clear film. After all, this would be the negative of the print.

This works in the respect that you can make a print by performing these simple steps, but the results will be disappointing. This will not work properly because the relationship between the tonalities seen on the screen as the result of producing properly colored pixels is not the same as the tonality produced on light sensitive paper as the result of light making its way through a film negative.

A much easier way to look at this is to work with a step wedge. This allows me to see exactly what is going on. I have made a step tablet that can be downloaded at http://glsmyth.com/articles/step-tablet.tif.
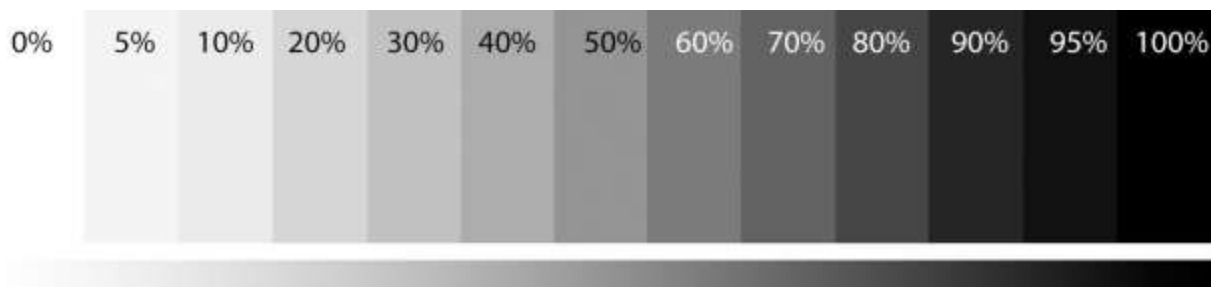
If this step tablet is flipped horizontally, inverted, printed on Pictorico film, and contact printed, I can see what is going on.
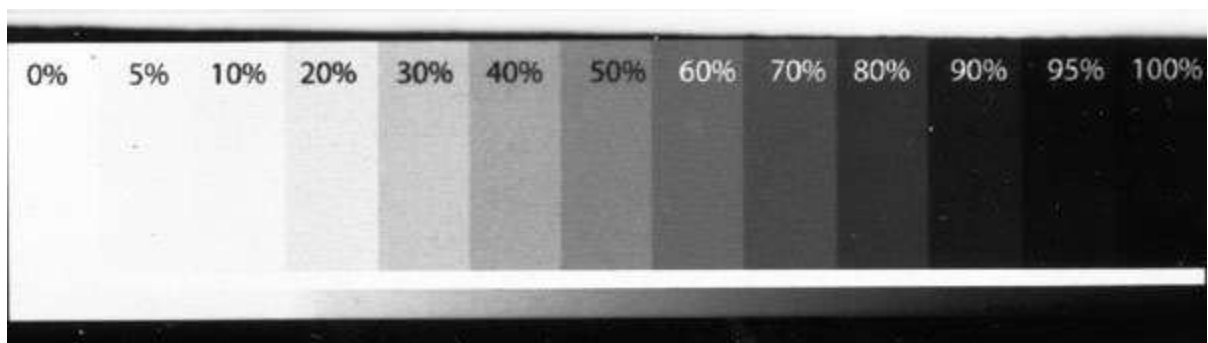
I covered the top of this test strip so that it would not be exposed, and after exposing the paper I covered all but the bottom and turned the lights on. This gives me an idea as to how far apart my whites and blacks are going to be from what I see on the monitor.

A step that needs to be made during the creation of a digital negative is the alteration of the relationship of tonal values to accommodate the difference between pixels and silver grains. This is done with Curves in Photoshop. For those who are not familiar with Photoshop, I have included an appendix at the end of this publication that offers enough explanation for the novice to be able to follow all of the workshop steps. The letter A followed by a number within parenthesis indicates the section number of the appendix that addresses the task at hand.

A Photoshop curve allows us to pick a specific tonal point and give it more or less luminosity. By selecting numerous points and measuring the differences between the screen and the print, a curve can be built that, when applied to the finished image on the monitor, will compensate for those differences within the print.

An assumption, and a reasonable one at that, is that the negative is made with black ink. After all, we have always worked with negatives that are black against a clear base. However, when it comes to printer ink, the black color is not necessarily the most effective color in blocking light.

Effectively blocking the light is the most difficult task. Simply put, ink is not made to block light, so everything that can be done to help with this task should be employed. Finding the best color for the negative and using as little light from the enlarger as possible to get a good black is imperative.

Before starting the workshop, here is a list of the steps that will be taken to create the digital negative.

1. Decide which paper and process will be used. All papers are different and need to be tested. If the developer, enlarger, or anything else within the process is changed then testing will be required for that combination. The good news is that once the testing is complete, it will work with every image going into the future (unless the manufacturer decides to change the paper, but I am going to put fingers in my ears and make believe that this does not happen). The other good news is that when a change of any of these is made, the previous results can be used as a starting point.

2. A test determines the minimum amount of enlarger light to obtain a good black in the print.

3. A test determines the proper color of the negative.

4. A series of tests builds the curve.

5. A print is made as a reality check.

Part 2

Workshop

I am going to go through the process of making the decisions that allow me to create a digital negative. I will be using slightly fogged Oriental grade 1 paper in this example, paper I would normally not be able to use. However, this is for a project that consists of documenting the changes in Braddock, PA, a steel town that has had many years of problems, but with determination, is turning things around. The use of this old paper in this multi-year project is appropriate.

Part 1 - Paper and Process

I will develop the print with Dektol in a 1+2 dilution. Kodak indicator stop and Ilford quick fix are part of the process, though I have not seen a difference in results with different stop or fix. I have a Saunders 4x5 enlarger that will be used with the enlarger head fully extended and no filtration added.

I will be printing the negative on Pictorico Premium OHP Transparency Film. Pictorico offers an Ultra-Premium version that is supposed to be able to hold more ink. If this is the case then there may be a greater ability to block light, which would be worth the extra money.

Part 2 - Determine the Exposure Time

I cut test strips from the paper. The enlarger head is lifted to its highest, not only so that it will accommodate the largest print I might ever need to make, but it also offers me consistency with the amount of light that strikes the paper, as I will not need to measure the head height. A test strip is placed under the enlarger and transparency film is placed over the paper. This test strip is made to determine the point where adding more light no longer makes the paper darker.

I place the Pictorico film over the test strip because the enlarger light needs to go through it. As an example of its effect, a darker strip can be seen at the top of the test – that is where the Pictorico film was not covering it.

The strip is divided into five horizontal sections. There is a big difference between 5 and 7 seconds, a lesser difference between 7 and 10 seconds, and an almost imperceptible difference between 10 and 15 seconds, with none between 15 and 20 seconds. To get a good black from the paper, I need between 10 and 15 seconds of exposure. I am going to begin with 15 seconds.

Part 3 - Determine the Negative Color

Finding the proper color for the negative is simply a matter of contact printing all colors and measuring to see which one gives the best white value. Dan Burkholder has an excellent image at http://www.danburkholder.com/digital-negative-items-2008/spectrum.jpg.zip that can be downloaded and printed onto the transparency film.
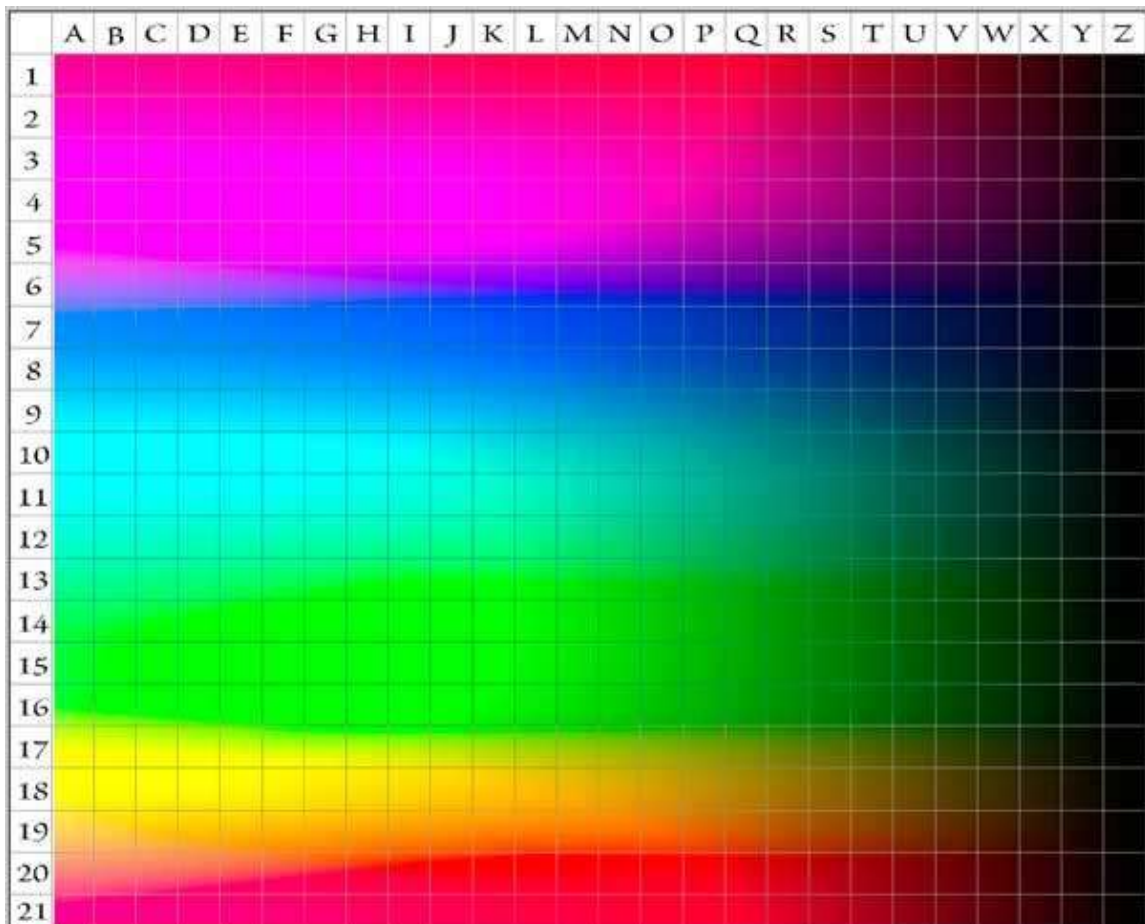
A contact print is made, producing the following results.
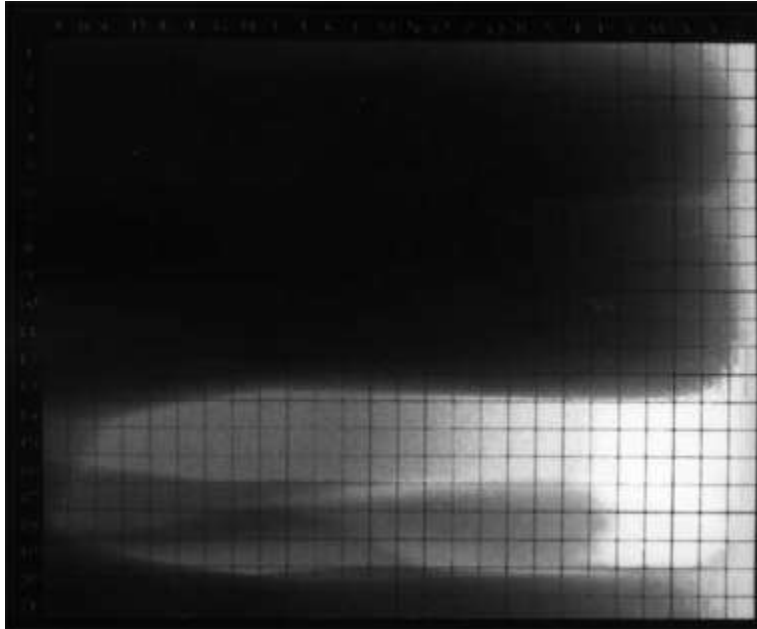
Compare this result with the colors in the original and it can be seen that the black ink, which resides within the Z column, does not do nearly as good a job blocking light as other colors. There is a large patch of white, but I want to find the best color for the negative, which is represented by the whitest area. (A1) Adding a threshold layer to this image and moving the slider most of the way to the right results in this image.
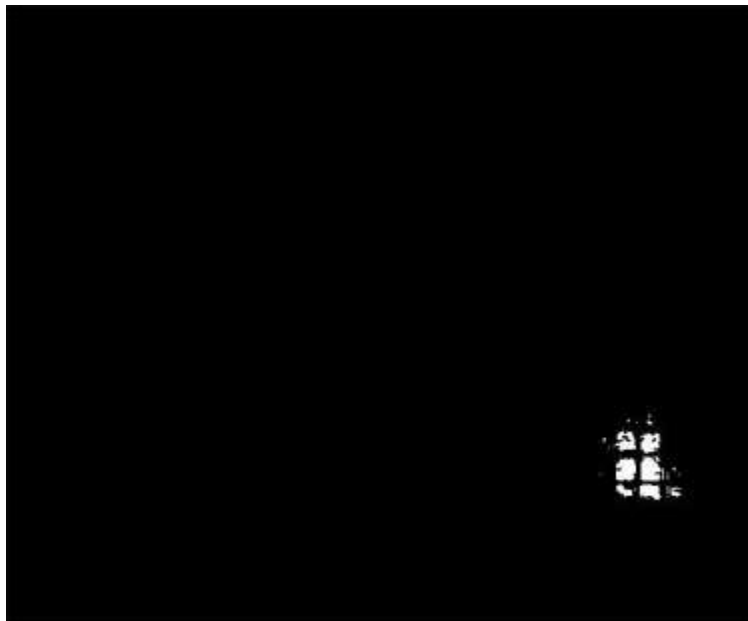
I mark the location by Shift-clicking with the dropper.
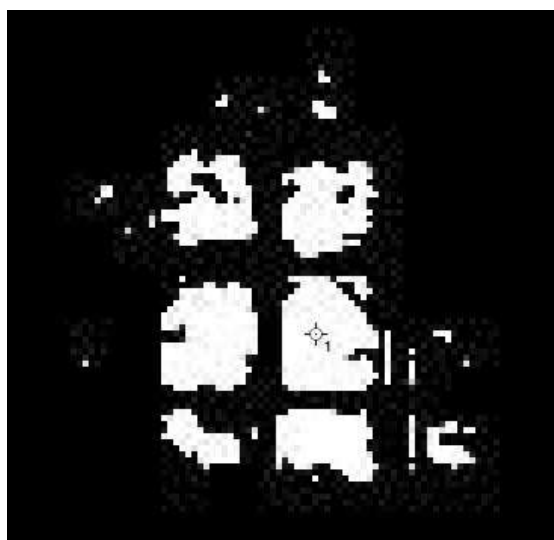
Now the threshold layer can be removed.
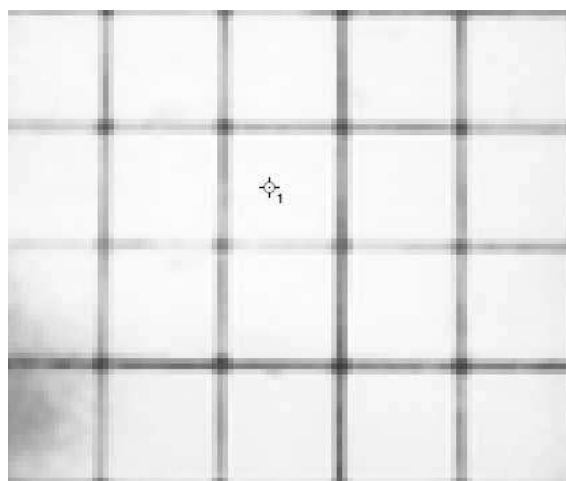
The image of all colors is placed on a layer above the scanned print. (A2) It is then resized so that it matches the underlying layer exactly. Using the dropper tool I click in that same location and determine that this color is #003c00, a shade of green. This is a little unusual, as I am accustomed to seeing some variation of red being the most efficient color for silver gelatin. A variation of green is oftentimes a good color when making negatives for use with alternative processes.
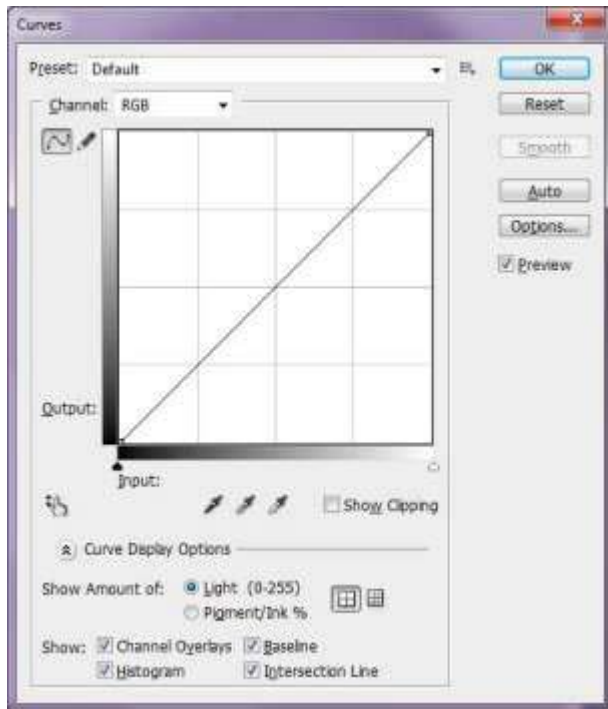
Part 4 - Determine the Curve

This is the most time-consuming part of the process, and can be rather frustrating. However, once done, the process will be repeatable.

(A3) The curve allows for the alteration of tonality of the image. To the right a straight diagonal line represents no change. The bottom left corner represents the 0% end of our step tablet and the upper right represents the 100% value. (Later on I will be speaking of these points in the opposite manner because we will have inverted the tonality of our image.)

The curve can be altered by clicking on the line and moving it up or down. When this is done, the tonality is made lighter by raising the value of the line, and darker by lowering the line.

When multiple points are selected, they can be individually modified. This is what allows us to alter the tonality of the image so that it matches the paper.

The curve window contains a histogram of the image in light gray at the bottom. The histogram of the step tablet allows us to observe the spikes that result from the strong bands of tonality. I place an adjustment point on the diagonal line at each point where these strong bands are located. I then adjust each point until the altered tonality matches the paper.

I open the step tablet in Photoshop and add a Curves adjustment layer, then click on the diagonal line at each point where there is a thick grouping at the bottom of the matrix. This results in 13 points, from left to right representing the 0%, 5%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 95, and 100% sections of the step tablet. Chances are that you will not be able to keep the line perfectly straight, but these points can be easily accessed by holding down the Shift key and pressing the + or - key. Once the adjustment point is selected, use the arrow keys to straighten the line. This is the starting point.
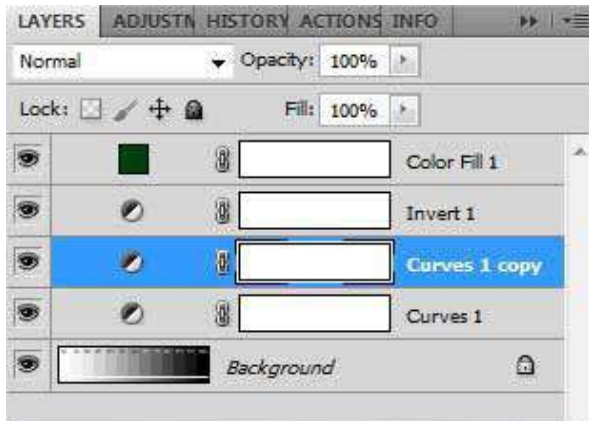
I will make a contact print, measure the amount of black in each section, and then adjust the curve in an attempt to get each section close to its target value.

The image will include three layers, a curve adjustment layer, an inversion adjustment layer, and a color fill layer. Sometimes I like to make a copy of the initial Curves layer (Ctrl/Command- J) just in case I decide to start all over again. As this will be a color negative, I make sure that the image is in (A4) RGB mode.

Since I am making a negative from this positive, I invert the tonality of the image by adding an Invert adjustment layer. I make the negative the color that was determined earlier by adding a color fill with that color (Layer - New Fill Layer - Solid Color). I determined that the color 003c00 was best suited for my purposes, so when the "pick a solid color" window appears, I enter that number next to the pound sign (#). This color covers the image completely, but I change the Blending Mode to Screen to colorize the image.

To make a print of the step tablet initially I leave the curve unchanged to see what I have for a starting point. Before I send to the printer, there are some printer settings that need to be considered.
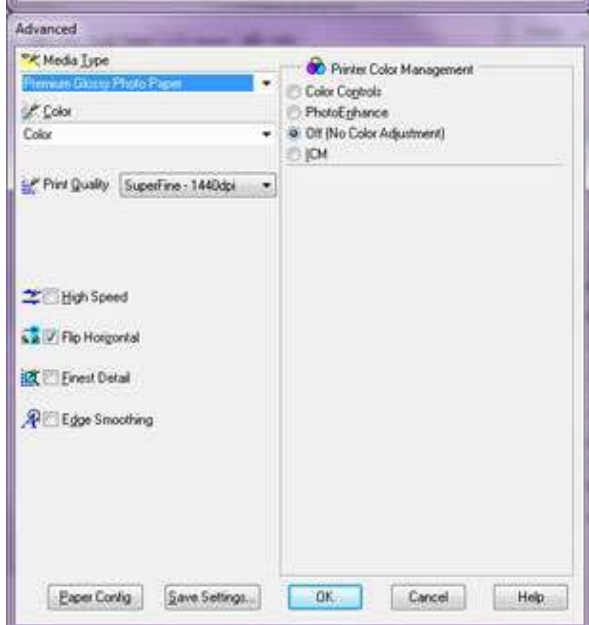
All printers are different so I will show the settings I use on my Epson 3800 printer in the hopes that you will be able to replicate these on your own printer.

For the Pictorico film I select Premium Glossy Photo Paper, as per the company's recommendation.

Working with the Custom settings mode offers flexibility, so I change the radio button from Automatic to Custom. Entering the Advanced Settings I select SuperFine print quality. HighSpeed was checked and since I am not in a hurry and this

might affect quality, I uncheck it. Flip Horizontal is an option, so that is checked, which means that I do not need to remember to flip the entire image. If your printer driver does not have this option then you will need to flip the image horizontally or else the contact print will be printed backwards. I turn off Color Management so that the printer does not interfere with what I want it to do. Finally, I save these settings so that I can simply select them next time without having to make all these settings each time.
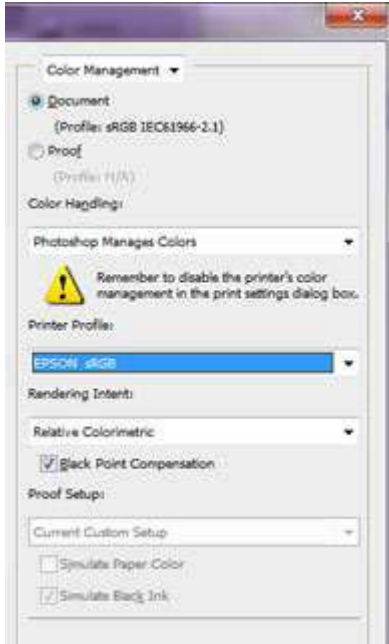

After saving this information there are a couple of other things that need to be addressed. It is essential that the settings indicate that Photoshop Manages Colors. For the Printer Profile I select the generic Epson sRGB printer profile, since there is no profile specifically available for the Pictorico film I am using.

When printing the step tablet, it makes little sense to use an entire page. I size the image to four inches width and print in the upper left corner. As this step tablet will be printed over and over again, moving the location each time allows a single page of Pictorico film to be used to find the values for the curve.

Before exposing the paper through the ink on the step tablet, make sure that the step tablet is completely dry. This actually makes a difference. My hair dryer has a cool air setting that I use to hurry the process.

So it is time to print a test strip. After printing the test strip I dry and scan it, using 8 or 16 bit grayscale. Since this is a test strip and not a museum print, a few seconds in the fixer and a few seconds in the washer will suffice. I dry the strip with a blow dryer.
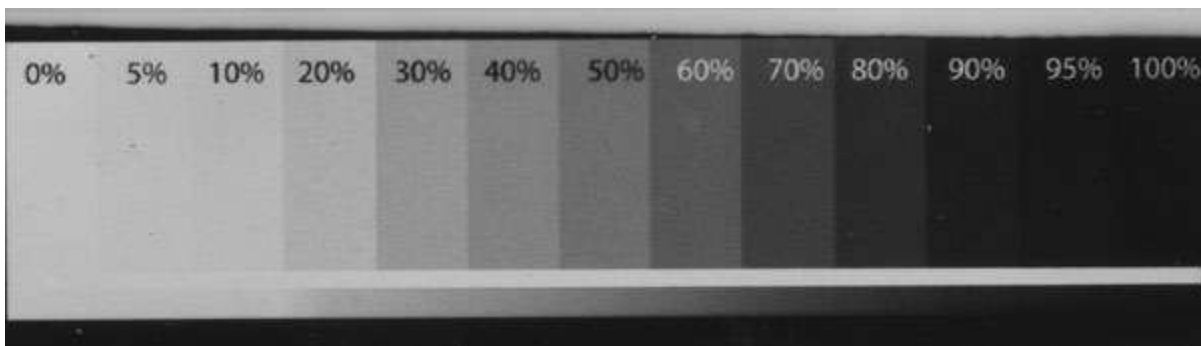
Admittedly, this looks pretty bad. Your test strip may not look as washed out as this because I am using fogged paper for this project. However, that whatever paper you use, your whites will never be as white, and your blacks never as black, as the monitor.

If I make a measurement of the 0% mark at this point it will be nowhere near 0%. However, this is as close to 0% as I can get (without reducing the amount of light the paper receives), so to get measurements that will be meaningful, I need to adjust this area so that it measures close to 0%. This is also the case with the 100% point.

The best way to bring the white and black points to their proper values is to use the droppers within the Levels adjustment layer. Under the Options button in the Levels adjustment palette are three droppers, representing black, white, and the mid-gray point. Click the black dropper to select it then click within the 100% area. Then click the white dropper to select it and click within the 0% area.
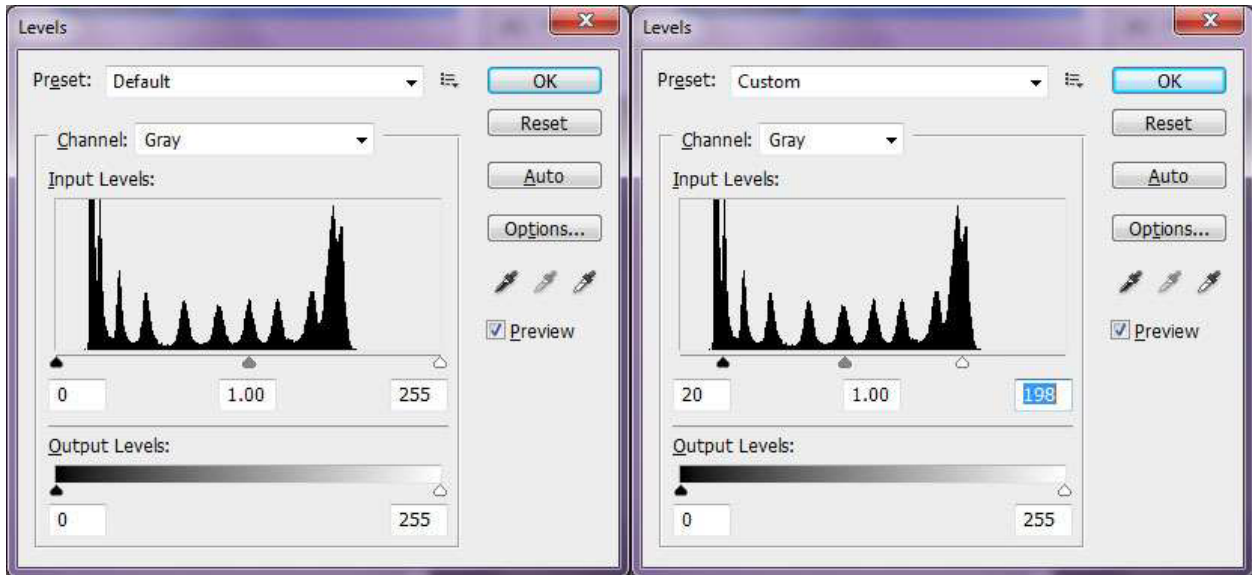
Doing this moves the black and white sliders within the sections that represent those areas. One might think that moving the sliders manually to the edges of the histogram would be the way to go, but that keeps the end points from measuring within a couple of percentage points of 0% or 100%.
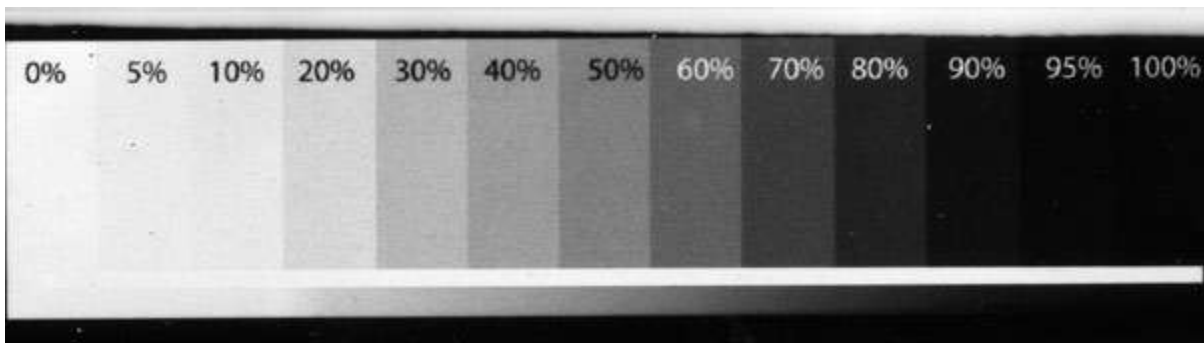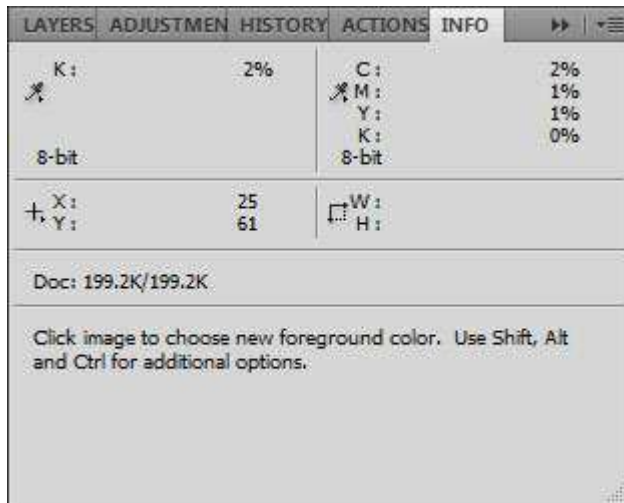
This is now something that allows me to meaningfully compare the information on the screen with the test strip.

Eyeballing the situation does not offer a successful route to getting this test strip close to the monitor display. What is needed is a densitometer. Fortunately, you already have one - it is called Photoshop. I convert the Image Mode to Grayscale, open the Info palette, and select the Eyedropper. I change the Sample Size to 11 by 11 Average and now I can measure the amount of black in the image. This sample size returns the average of all values within an 11 pixel square. I hover over the 0% area and see a value of 2%. I will probably not get 0% or 100% measurements, so that is not something to worry about. If instead of "K:" you are seeing three rows starting with R, G, and B then you are in RGB Color mode, so change the mode to Grayscale.
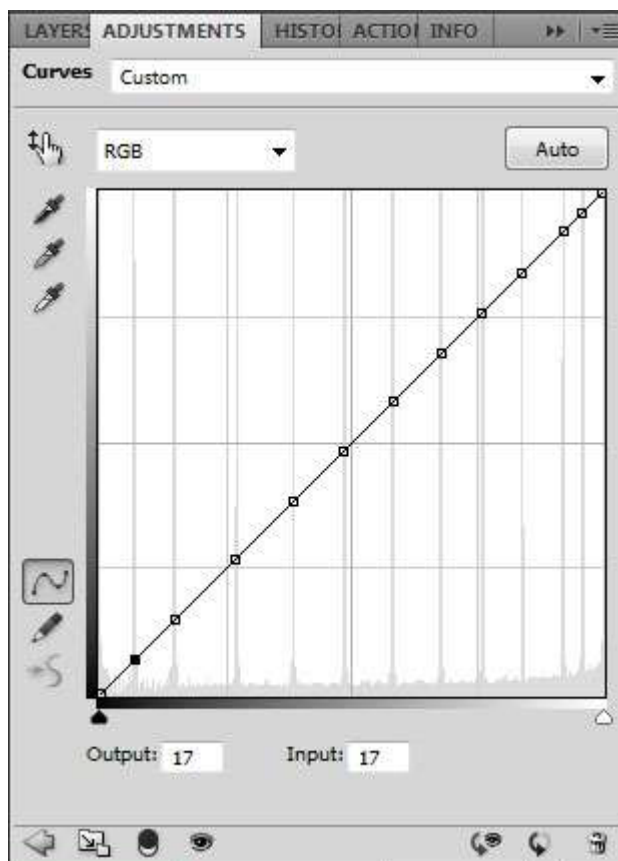
Measurements are then made of each area. I use an Excel spreadsheet, but just entering the values down on a piece of paper will be sufficient.

I return to the Curves Adjustment layer. Note that there are Output and Input values at the bottom of the palette. The Input value indicates the point's horizontal location, and the Output value indicates the point's vertical location. At this point there have been no changes to the curve, so the Input and Output values will be equal, since the curve is a 45 degree angled line. I will alter the Output value to change the tonality of that point.

This is how my worksheet starts. The output value in the location that represents the 100% target value is 0, the value for the location that represents 95% is 17, etc. Note that because the image is inverted, the 100% point is represented by the lower left corner.

	A	B	C	D	E	F	G	H	
1	Oriental G-1								
2	Color: #003c00								
3				Output	Measure		Output	Measure	
4	100			0					
5	95			17					
6	90			38					
7	80			68					
8	70			98					
9	60			123					
10	50			149					
11	40			173					
12	30			194					
13	20			214					
14	10			236					
15	5			245					
16	0			255					
17									

Using the Eyedropper and viewing the K value in the Info palette, I measure each segment of the scanned test strip and enter the values in the corresponding locations on the spreadsheet.

	A	B	C	D	E	F	G	H	
1	Oriental G-1								
2	Color: #003c00								
3				Output	Measure		Output	Measure	
4	100			0	98				
5	95			17	98				
6	90			38	95				
7	80			68	88				
8	70			98	78				
9	60			123	63				
10	50			149	51				
11	40			173	39				
12	30			194	28				
13	20			214	16				
14	10			236	9				
15	5			245	8				
16	0			255	1				
17									

The idea is to get the values in the Measure column as close as possible to the values in the target column. I consider any measurement that is within a couple of percentage points of its target to be successful. I look at the successful values, which are the 0%, 10%, 30%, 40%, 50%, and 100% rows, and copy the Output values into the next column.

The biggest differences are in the 70-90 range. I see that an Output of 38 (in the 90% row) results in a measurement of 95, so that is entered into the 95% row. The Output value of 68 measures 88, which is close to 90% so I enter it in that row. Similarly, I enter an Output value of 98 into the 80% row.

	A	B	C	D	E	F	G	H
1	Oriental G-1							
2	Color: #003c00							
3				Output	Measure		Output	Measure
4	100			0	98		0	
5	95			17	98		38	
6	90			38	95		68	
7	80			68	88		98	
8	70			98	78			
9	60			123	63			
10	50			149	51		149	
11	40			173	39		173	
12	30			194	28		194	
13	20			214	16			
14	10			236	9		236	
15	5			245	8			
16	0			255	1		255	
17								

Now I do a little estimating. An Output value of 123 is a little higher than its 60% target, so I raise the output value a little to 126 in the hopes that it will measure just a a little lower the next time. When looking at the measured values in the 60% and 70% rows, they appear to be equidistant from the 70% target, so I average their Output values and enter 110 in the 70% row. The 20% row's measured value is low, so I lower its Output value to 210. 245 was apparently too close to the 10% mark, so I change the Output value to 248. Below is the completed worksheet.
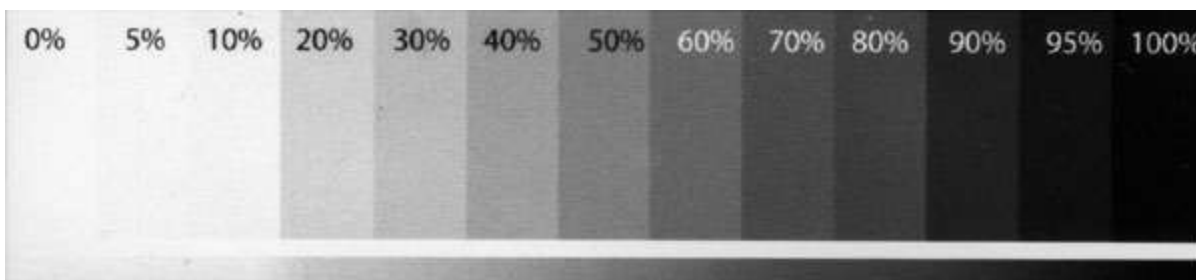
	A	B	C	D	E	F	G	H
1	Oriental G-1							
2	Color: #003c00							
3				Output	Measure		Output	Measure
4	100			0	98		0	
5	95			17	98		38	
6	90			38	95		68	
7	80			68	88		98	
8	70			98	78		110	
9	60			123	63		126	
10	50			149	51		149	
11	40			173	39		173	
12	30			194	28		194	
13	20			214	16		210	
14	10			236	9		236	
15	5			245	8		248	
16	0			255	1		255	
17								

I return to the Curves Adjustment layer. By pressing "Shift +" I go to each point and change the Output value by using the up or down arrow. To the right is what the new curve looks like.
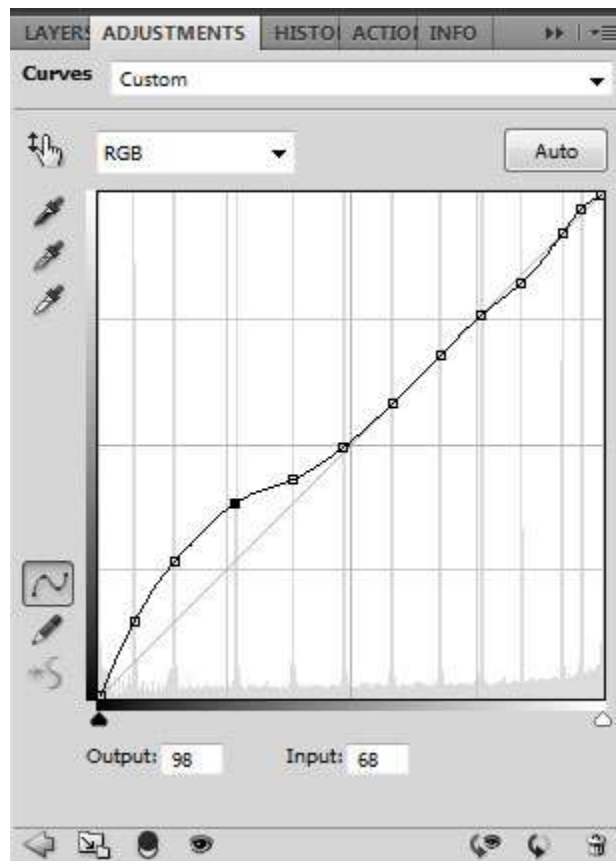
With this change a new test strip is printed on Pictorico film and contact printed. That test strip is then dried and scanned, and using the Eyedropper tool, each segment is measured and entered into the worksheet.

Here is the new test strip.

And here are the measured values.

	A	B	C	D	E	F	G	H	I	J
1	Oriental G-1									
2	Color: #003c00									
3				Output	Measure		Output	Measure		Output
4		100		0	98		0	98		
5		95		17	98		38	94		
6		90		38	95		68	88		
7		80		68	88		98	76		
8		70		98	78		110	71		
9		60		123	63		126	61		
10		50		149	51		149	51		
11		40		173	39		173	39		
12		30		194	28		194	27		
13		20		214	16		210	18		
14		10		236	9		236	5		
15		5		245	8		248	4		
16		0		255	1		255	1		
17										

It looks like the 80% row needs another value and the 5% and 10% rows need output values to separate them. There is no need for me to continue documenting the iteration of this procedure, but basically, this routine is done over and over until the measured values are close to the values in the first column. In this particular example the curve started rather close, so few iterations were required. Normally the curve is drastically different and more time and effort are required to get things right.

Once the measurements are close to the target values, (A5) I save the curve so that it can be retrieved at a later time, after all, I certainly do not want to go through this for each printing session.

Finally, I make a print and include a step tablet under the image. As I am now working with a full piece of paper, there could be small differences that change the results slightly. The step tablet is used as a reality check.

Part 3

Oddities

I spoke with someone a while back who told me that they did not need to do any testing because someone else had already published curves for the process in which he was interested. I tried to explain that he at least needed to verify the curve through testing but do not think that he took my advice. Another individual's curve might work well as a starting point, but one always needs to test to make sure that the curve works properly for them.

When I started putting together a curve for the cyanotype process I entered "digital negative cyanotype curve" into Google and grabbed the first curve I saw, which was at http://www.alternativephotography.com/wp/negatives/curve-corner-photoshop-curves. This is an excellent website that offers a wealth of information on alternative processes. I thought that copying this curve would be a good place to start.
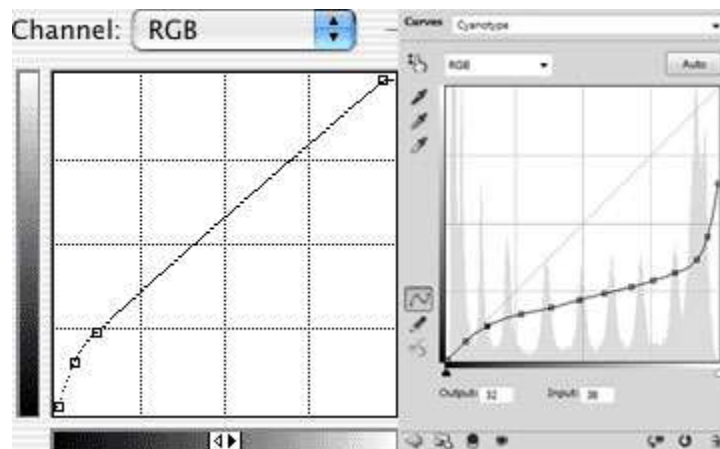
As you can see, my curve is pretty much the opposite of Jim Read's curve.

This works just fine for me. Jim Read's curve works for the way he makes his prints, and mine works for me. I built an exposure unit and perhaps he uses the sun, but the bottom line is that even though you may find a curve by someone who is knowledgeable, their curve may not be your curve. Take nothing for granted.

Another oddity is that the white point may not necessarily be in the upper right corner of your curve. Note my Cyanotype curve only goes about two thirds of the way up. As I was testing I came to realize that I did not need that area, so I simply placed the white point lower.

When making a silver gelatin print you will find that the most difficult task is to block the light as completely as possible, so you will need to get the color right and keep the exposure time as short as possible to get a good black. When testing Oriental Seagull Grade 1 paper I noted that the 10% section was lighter than the 0% area. I had to test to find the best location on the curve so that I would be able to block the light as efficiently as possible. This is apparently not an isolated event, as this behavior also exists with my favorite paper, Fomabrom Variant IV 123.