Embedding Photoshop Curves in ICCs

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This tutorial shows how to use Roy Harrington's "Create ICC-RGB" to make ICCs that can control B&W inksets that utilize Photoshop curves. These include the new UT-3D as well as other variable-tone inksets and older monotone inksets with partitioning curves.

Using the "Create ICC-RGB" program, the basic process is to embed the Photoshop curve into the ICC as well as the information about the densities that curve prints on the targeted paper using the curve. To do this, one makes 2 files – one with the curve color information and one with the density information – and then drags and drops them into the Create ICC-RGB icon on the Desktop. While the process may seem complex at first, it is really very simple, especially if one has a good instrument for reading the required test strip and the Photoshop curve is already made.

This ICC approach works for not only the variable-tone inksets like the new UT-3D or older UT2, but also older partitioned monotone inksets.

Once complete, the ICC in the printing workflow will take care of both converting the grayscale file to RGB, applying the curve, and linearizing the output to match the monitor, taking into account the variables of the particular printer, paper and ink batches.

Downloading the Create ICC Program

This workflow requires that the user purchase a copy of Roy Harrington's "Create ICC," which is part of the QTR package found at http://www.quadtonerip.com/html/QTRoverview.html . When the appropriate version is downloaded and installed the "Create ICC" components will end up in Program Files\QuadToneRIP\Eye-One folder for Windows, CurveDesign/Eye-One for Mac.

There are actually two versions of "Create ICC" in the folder. One passes a grayscale file to the driver and the other handles RGB curves and passes an RGB version to the driver. It is this later one that we are interested in for the workflow described here. So, put a copy of the "Create ICC-RGB" program on the Desktop. It is there that the ICCs are made.

Place the Curve on the Create ICC-RGB Raw File

The variable-tone or partitioning Photoshop (*.acv) curve you want to print with needs to be put on a Photoshop Raw (*.raw) file for embedding. Use the small file "rgb-raw-16.psd" that is contained in the Eye-One folder, noted above.
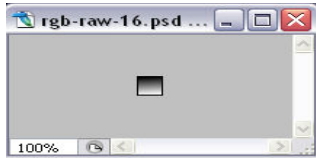
Open this file in Photoshop and place the curve on it in the usual manner (Image>Adjust>Curves>Load …). In Elements you'll need to have the curve on an adjustment layer. Then you can drag it to the rgb-raw-16.psd file. If the curve that you're interested in is not posted on a layer, e-mail me and I'll send it.

The file is then saved as a "Raw" file on the Desktop. Use an appropriate name for the file that tells you what it is for. I tend to do the following for naming: "Printer_Inkset_Paper_Curve-tone." Sometimes I'll add settings if they are different than usual for the particular inkset.

When I save one of these files on my Windows system, the only non-default setting is that the Byte Order is "IBM PC." Other than that I simple hit OK with the suggested settings.

Once you've done this once, it takes about a minute to open the file, place the curve on it, and save it to the Desktop.

Print a 21-Step Test File with the Curve

The Photoshop curve must also be used to print a test strip on the paper that is being profiled. Use the settings and procedures that are outlined in the Readme file for the inkset and paper type. The same driver settings will be used once the ICC is made. I always use working space Gray Gamma 2.2, and it appears that this workflow requires the test strip to be in that space. Be sure the test strip is dry before reading it. I use a hair drier.
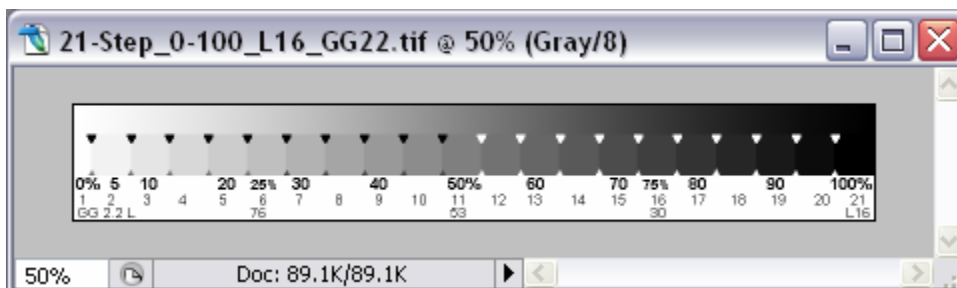
A 21-Step test file with Gray Gamma 2.2 profile has been posted here:
http://www.paulroark.com/BW-Info/21-Step-GG22.html

Make a Text File of the Lab L* Readings from the above Test Strip

The Create ICC program linearizes the system by taking the readings from the 21-step test strip and correcting for differences from the ideal distribution of densities. So, the 21-step test strip must be measured to see what the printer without these corrections is doing. The measurements are put into a text file in a particular format so that the Create ICC program can read them.

This is the format that I use when making the text file manually with my X-Rite spectrophotometer (the columns are separated by a Tab, with a return/enter at the end of each line):

Gray	Lab_L
0.00	97
5.00	92
10.00	87
15.00	83
20.00	79
25.00	74
30.00	71
35.00	67
40.00	63
45.00	59
50.00	55
55.00	50
60.00	45
65.00	40
70.00	34
75.00	30
80.00	26
85.00	22
90.00	19
95.00	17
100	15

With the ColorVision Print Fix Pro ("PFP") spectro I am currently using (with software version 1.1b7), this is a sample text file it produces when I start at 0% and read consecutive test strip patches down to 100% (takes less than a minute):

```
95.43  0.8    1.06
90.13  0.82   0.66
85.65  0.87   0.91
81.22  0.84   0.97
77.73  0.87   0.86
74.31  0.86   0.91
71.32  0.83   0.88
68.09  0.92   0.8
65.07  0.89   0.94
61.15  0.9    0.94
57.06  0.85   0.89
51.25  0.82   0.76
46.43  0.81   0.99
41.91  0.8    0.96
36.48  0.74   0.9
31.02  0.6    0.92
25.14  0.71   1
18.79  0.76   0.99
10.9   0.27   0
7.18   -0.18  -1.26
5.11   -0.41  -1.02
```

Both of these formats work with the program.   The PFP output includes Lab a* and b* data, but this is ignored by the program for printing purposes.

(The program does take the color information if there are headings added to the columns: LAB_L, LAB_A, and LAB_B (or simply L, A, and B). This information can then be used for soft-proofing, but I am not dealing with that subject here and do not use it.)

For those who have densitometers, another option is to use density values. They should be between 0.00 and 4.00; a heading of D, Dens, or Density works for this.

Those with spectros that read strips can usually generate text files like this also.

For those who do not have a spectro but do have a flatbed scanner, the test strip can be read and text file made using the procedure I've outlined at http://home1.gte.net/res09aij/Making_B-W_ICCs.htm .

Save the text file to the Desktop with a name that is similar to the curve used to generate it.

With the ColorVision spectro it takes me less than a minute to read the 21-step test file. It makes the text file automatically. At about $500, it seems like the best buy. The Eye-One would be the next step up.

Drag and Drop the Text File and Raw File into the Create ICC Program

With the raw file and text file on the Desktop, the Create ICC-RGB has all the information it needs to make an ICC. The raw and text files are simply dragged and dropped into the Create ICC-RGB program at the same time. (Click on one, then control-click on the other, then with the control key down, drag the 2 icons to the Create ICC-RGB icon.) On my Windows system a white bar appears over the Create ICC-RGB program when the other files are on top of it.

The Create ICC-RGB program will generate an output text file that you'll see immediately. This as well as the ICC should be on the Desktop. I discard the text files.

The ICC is then placed in the usual Color folder with your other ICCs.

How to put the ICC in the correct folder -- Windows XP

ICCs are put in the following Windows XP folder:

c:\windows\system32\spool\drivers\color\

I recommend you highlight and copy this c:\ ... \color path and make a folder shortcut on your Desktop that allows you to simply drag the ICCs to the shortcut to put them into the correct folder location. This is the procedure to make such a folder shortcut:

1. Right click on the Desktop (anywhere on your computer monitor where no icon appears and when no program is running there.

2. On the menu that appears, highlight "New."

3. On the new menu that appears, click on "Shortcut."

4. In the space where it asks you to type in the location, copy & paste, or type in the full path:

c:\windows\system32\spool\drivers\color\

5. Click on the Next button. "Color" should appear in the box. You might want to also add "ICCs" to this name so that it reads, "Color (ICCs)."

6. Press "Finish" and a folder icon should appear on your Desktop. This is a shortcut to the proper folder.

To use this, simply drag the ICC icon that has been saved to the Desktop over to the Color (ICCs) shortcut folder icon. The ICC icon should be transferred to the proper folder.

Note that if Photoshop Elements has already been opened, it will not "see" the new ICCs until the Color Settings box (Edit>Color settings) is opened and closed.

Location of ICCs in different OSs

Mac OS 9.x: -- Systems Folder/ColorSync Profiles

Mac OS X -- Library/ColorSync/Profiles

Windows 98/M --: \Windows\System\Color

Windows NT/2000 or XP upgrade from NT/2000 -- \Winnt\system32\spool\drivers\color

Using the ICCs for Printing

If Photoshop was already running when the ICC was put into the Color folder, it will not be seen. Click on Edit>Color Settings to refresh the ICC list.

The basic workflow is to print through the Photoshop Print Preview (File>Print with Preview). PS Elements 4 always utilizes a print preview.

In the box that appears below the Preview image, check "Show More Options" Select "Color Management." In CS2 select "Let Photoshop Determine Colors" in the Color Handling box. Then click the arrow to right of the "Printer Profile" to show the list of ICCs. ICCs that are made with the Create ICC programs will all start with "QTR" and be grouped together on the list.

The lower part of the Print Preview box in CS2 is shown below (after an ICC has been selected).
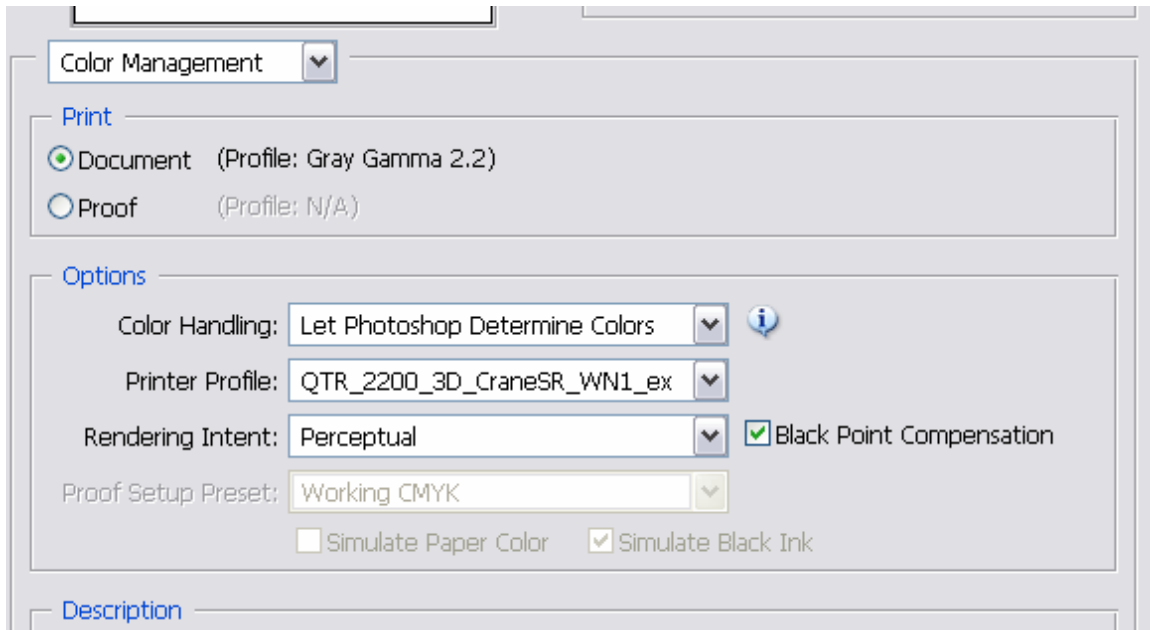
Note that Perceptual and Black Point Compensation are selected.

When one pushes the "Print" button in the Preview, the usual Epson driver boxes appear. Use the settings that were originally specified for the inkset-paper-curve combination and were used when the ICC was made.

This should result in a print that has the tones that are set by the curve and a density distribution that is determined by the gray working space. This density distribution may, however, be different than what was being used previously in the workflow that had the file converted to RGB and curve applied in Photoshop.

Gray Working Spaces and Density Distributions

I use and recommend others use Gray Gamma 2.2 and Adobe RGB (1998). These are set in Edit>Color Settings. The Create ICC-RGB appears to require Adobe RGB. Gray Gamma 2.2 is the most common grayscale space, is a subset of Adobe RGB, and is what the Web uses. So, there are a number of reasons to use these spaces.

My older workflows used a different density distribution or grayscale ramp than Gray Gamma 2.2. To get the monitor to match the print, I used a custom dot gain curve in Photoshop. The use of ICCs avoids the need to do this, but my old files now need adjustment for the new printing approach. To make this easier, I made a curve that can be used as a layer on the file for this purpose. If the file is 16 bit, it is likely no significant information is lost. Aside from the obvious (0, 0) and (255, 255) end points, there are just four internal points on this grayscale curve: (12, 34), (25, 50), (63, 82), and (128, 153).

Using Gray Gamma 2.2 ("GG 2.2"), I found that the 95% to 100% densities are very compressed. At first that seemed like a waste of limited grayscale space, but with a 16 bit file, it's insignificant.

What I've also found is that, especially with the high dmax glossy papers, while the 95% - 100% densities look virtually the same in normal office or home lighting, outside or under a good spot light the very deep shadows that looked totally black open up and the full range is visible. The differences between a matte paper with a 1.6 dmax and a glossy paper with a 2.3 dmax also becomes very obvious. The higher dmax papers look much better with good lighting.

The downside of this is that when working in GG 2.2 I've missed things going on in the shadows because my monitor did not display them well. While I thought the image was ready to go, and while it looked fine under normal office lighting, under a spotlight or outside defects in the shadows became apparent. What I've done to avoid this is temporarily switch the gray working space to Dot Gain 20% and check the shadows. The shadow detail that is only visible in that Dot Gain 20% may not show when printed in GG 2.2 and viewed under normal lighting, but under a spot or outside the additional detail – and defects – will become visible.

To switch working spaces in full Photoshop you can use Edit>Assign Profile. (Don't convert the profile because it will affect the file values as well as the view.)

In Elements the controls in Edit>Color Settings are used. If the file was opened when "No Color Management" was checked in Color Settings it will be an un-tagged file. Un-tagged files display as GG 2.2 by default. With this type of file you can switch the view to Dot Gain 20% by going to the Edit>Color Settings menu and checking "Always Optimize for Printing." I would not save or print the file with this setting, however.

That's it for now. Good luck with your printing.

To return to my index of printing information, click here:
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