

A Comparison of Color Conversion between Photoshop & ICC CMS

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Keywords

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Introduction

Gray Component Replacement (GCR) is a technique that replaces roughly equal amounts of cyan, magenta, and yellow ink in a given process color mix with an appropriate amount of black ink. GCR affects the shadows, grays, colors, and details throughout a picture.

One of the advantages is, that in the shadows the total ink coverage (TIC) is much smaller, relying more on the black separation to provide details in the shadows. GCR images are also less sensitive to the variability of the process of printing, as well as saving Cyan, Magenta, and Yellow inks being used in the image.

Black point compensation will also be tested in conjunction with the differences in GCR settings. Black point compensation finds the darkest point on a source image space and matches it to the darkest point on the ICC color managed image space.

The objective of this study is to examine the visual differences in GCR settings in color profiling software, in particular the Kodak ColorFlow profiling software package.

Procedure

The Heidelberg Sunday 2000 web press was used for the testing purposes of this study. Kodak ColorFlow v2.1 (TF_08) was used to create 4 separate ICC press profiles with the following characteristics:

- a. 0% GCR / 280 TAC
- b. 40% GCR / 280 TAC
- c. 88% GCR / 280 TAC
- d. 100% GCR / 280 TAC

All profiles were measured using the GretagMacbeth Spectrolino Spectroscan, and identical settings, as seen in Figure 1, were used for all profiles: 100% Max Black,

0% Black Start and applied through the same procedure in Adobe Photoshop 7.0, shown in Figure 2. These settings were applied to an Adobe RGB tagged TIF file for use in this study. Because of this, a perceptual rendering intent was used when applying the pro-

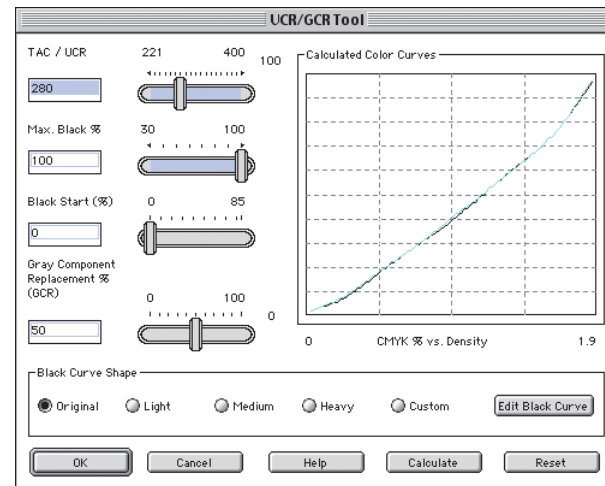


Figure 1: Kodak Advanced Black Settings

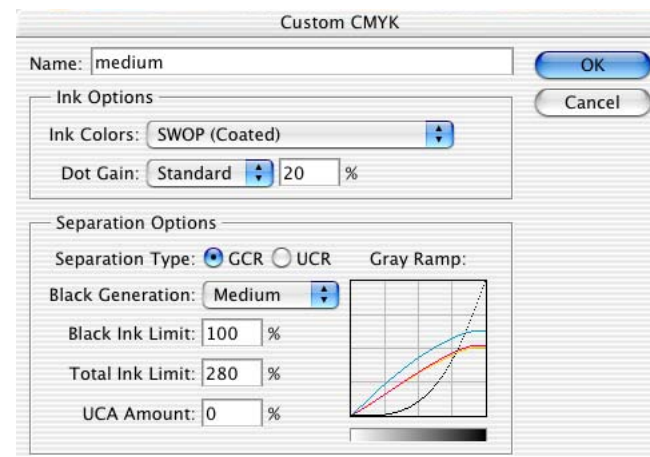


Figure 2: Photoshop Custom CMYK Settings

files to the images, which would allow for a visual analysis of the images side by side.

It is sometimes hard to see the differences between GCR settings because, if they do what they should, you shouldn't be able to see a difference in the actual image. To compare the different settings, a separate image file



Figure 3
ICC GCR

Images courtesy of Patti Russotti

Figure 4
Photoshop GCR

using only the black channel was created to be able to show the differences in GCR settings. As shown in Figures 3 and 4, the black channel is on the right of the image for which it is being used.

After creating the ICC GCR files, the same image file was used to create 4 different Photoshop-created GCR files. These files had characteristics similar to Kodak ColorFlow:

- a. Low GCR / 280 TAC
- b. Medium GCR / 280 TAC
- c. High GCR / 280 TAC
- d. Maximum GCR / 280 TAC

Figure 4 shows the Custom CMYK Settings in Photoshop 7 that was used to create one of the four test images.

Another test was performed using Photoshop's Black Point Compensation (BPC) function. This option determines how the dark image information is handled within the CMM. When leaving the BPC box checked (which is the most common procedure when creating a profile), the darkest neutral color of the original color space is mapped on to the darkest neutral color of the new color space. When the box is unchecked, the darkest neutral color is mapped to absolute black. After creating the original 4 profiles, black point compensation was enabled for comparison. The images in Figure 5, when compared to the Figure 3 and 4 images represent this function including the different GCR settings for comparison.

Results

When evaluating the differences in GCR settings there is little difference in the images visually. When com-

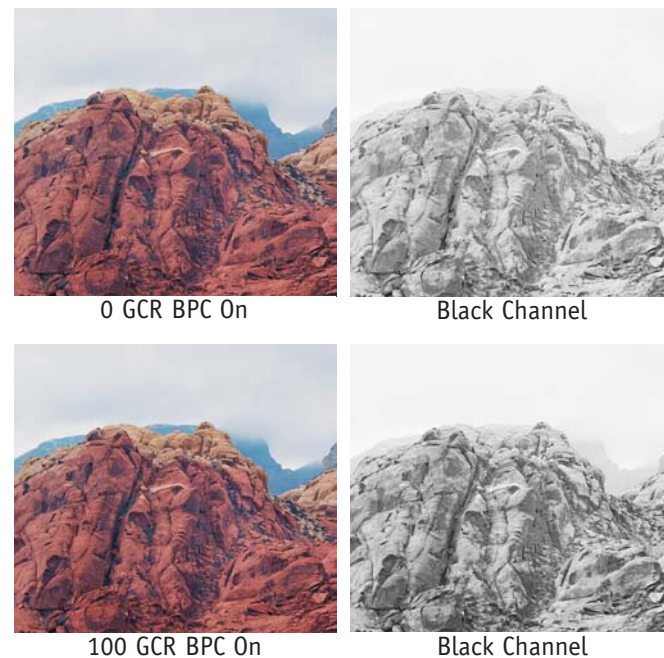
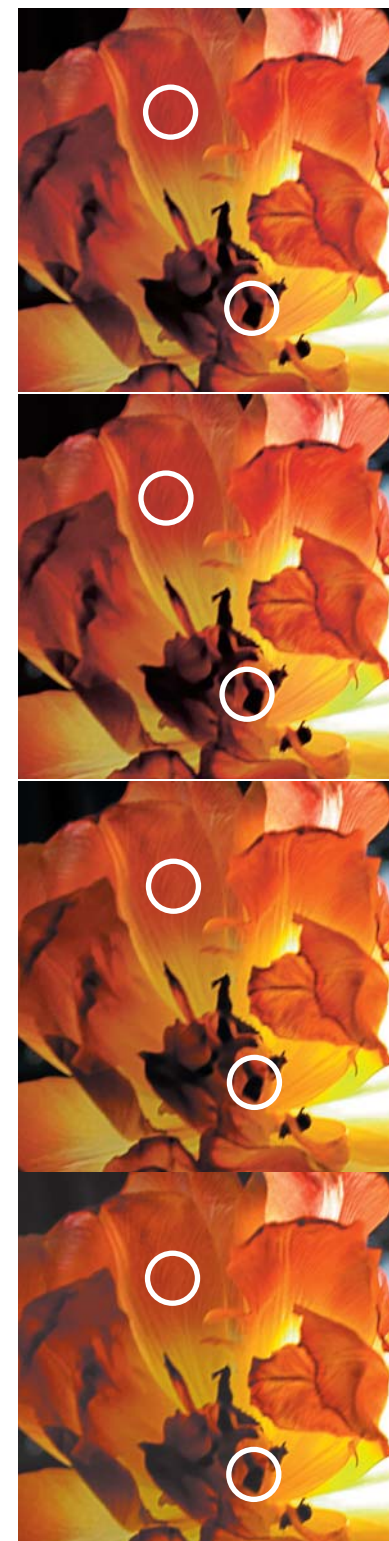


Figure 5
Black Point Compensation

paring Photoshop to ICC-based GCR implementation (Figure 6) using Photoshop's Info Palette, there is a significant difference in the numerical values of the same measured area. As shown below, the ICC 100% GCR used over 100% total ink correctly. The Photoshop 100% used less than the 100% GCR for a very dark area. Photoshop might assume that a very high density color can be achieved with black only, which might not be appropriate. Both images look pleasing to the eye, and show very little color difference except a little less modulation in the dark areas for the 100% Photoshop image.

For the images tested in this study, the black point compensation test showed the same results as the GCR test. No real difference was noticed between the images, and GCR settings.



ICC 40% GCR	
Point 1 (Top)	Point 2 (Bottom)
C 16	C 60
M 92	M 60
Y 89	Y 59
K 11	K 98
Total 208	Total 277

ICC 100% GCR	
Point 1 (Top)	Point 2 (Bottom)
C 4	C 60
M 85	M 60
Y 80	Y 58
K 31	K 98
Total 200	Total 276

Photoshop Medium GCR	
Point 1 (Top)	Point 2 (Bottom)
C 20	C 62
M 87	M 52
Y 80	Y 51
K 9	K 96
Total 216	Total 261

Photoshop Max GCR	
Point 1 (Top)	Point 2 (Bottom)
C 0	C 0
M 82	M 0
Y 95	Y 0
K 24	K 98
Total 201	Total 98

Figure 6

Conclusion

SWOP's specification for Gray Component Replacement states that the maximum GCR that should be used would be 60%, because if GCR is used in excess it can limit options for editorial color changes in prepress or interfere with color adjustments for precise matching on press. It can also result in shadows and black areas that have a loss in detail and color. At GCR levels above 60%, SWOP recommends that the printer use caution in printing, and use appropriate testing. This was true for a film workflow, but might not apply for color managed digital workflows as shown in this report.

It is unknown how Adobe and Kodak implement GCR into their products or what the algorithms are that create the black channels. We can assume that Kodak uses LAB values to create their black. However, when the tests were conducted, the values of the ICC-based GCR images did not correctly implement GCR, as shown in Figure 6, but all images looked similar to each other. Photoshop was able to use GCR correctly, however, each image was slightly different. From this experiment we can see that the algorithms used in Photoshop and Kodak Colorflow differ in implementation, and visually.

References

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