TECH TALK

Printing Consistent Color

Separations That Are Easy to Control On Press

Digital Printing Council

PRINTING INDUSTRIES OF AMERICA

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Printing Consistent Color

More and more printers are implementing the G7® specification and color management—while profiling their monitors, proofing devices, and printing presses. There is no doubt that this process does work, providing accurate, predictable color from proof to press. What should not be overlooked, however, is the notion of maintaining consistent color balance throughout the pressrun. Have you ever had a customer fan out a job, revealing that the colors don't match from sheet to sheet? We have all had to deal with this problem at one time or another. This article can be used as a guide to implementing the first steps to ensuring that the first sheet matches (as close as possible) to the last sheet of a press run.

Maintaining consistent color throughout a press run is a difficult task. The press operator must maintain a multitude of print variables at any given time; things like ink density, dot gain, gray balance, and print contrast, to name just a few. More often than not, these jobs are being printed on less than desirable paper stock, further complicating the process.

The ability to maintain consistent color of images during the pressrun begins with the color separation process. Image conversion, that is, changing images from an RGB or LAB to a CMYK color space, is not as simple as a mode change in Photoshop. Considerations must be made for ink, paper, and the condition of the press, to name just a few.

Color Reproduction Considerations

Gray component replacement (GCR) and undercolor removal (UCR) are color reproduction considerations for the printing press. UCR and GCR determines how much cyan, magenta and yellow are replaced with black within a CMYK

image. UCR and GCR may be incorporated into CMYK color separations during the conversion process.

Undercolor removal reduces the amount of cyan, magenta, and yellow primarily in the shadow areas of an image and increases the black. UCR will only affect the neutral areas of the image and has no effect on the color areas of a printed reproduction (Figure 1). UCR was designed to help alleviate potential printing problems associated with heavy ink coverage such as set off or blocking.

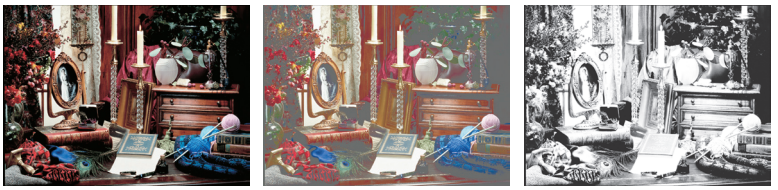

Figure 1: An image separated with undercolor removal. 4 color with 300% UCR (left), 3 color with UCR (middle), and UCR black (right).

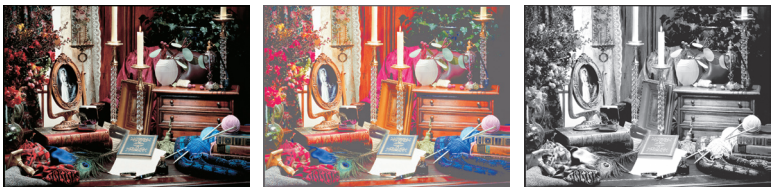

Figure 2: An image separated with gray component replacement. 4 color with 80% GCR(left), 3 color with GCR (middle), and GCR black (right).

Gray component replacement also reduces the amount of cyan, magenta, and yellow in a printed reproduction. However, GCR is more aggressive and affects the neutral and color areas throughout the entire image (figure 2). GCR is the replacement of the gray component of the trichromatic colors with black during color separation. A trichromatic color is any color that is made up of all three of the primary printing colors cyan, magenta, and yellow. The gray component of the trichromatic colors is the level to which all three primaries are equally present. Applying GCR replaces the tertiary color with black (Figure 3).

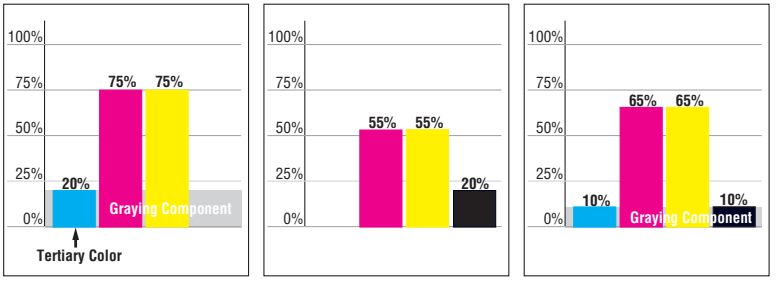

Figure 3: Trichomatic red (left), trichomatic red with 100% GCR, and trichomatic red with 50% GCR (right).

A GCR separation has all of the advantages of a UCR separation with one important addition. A GCR separation will print more consistently throughout a pressrun. This is especially useful for high-speed web presses, where a color shift could affect many sheets in a short period of time. Long run sheetfed work will also benefit, yielding consistent, repeatable color during the entire pressrun. Additionally there is a cost savings associated with GCR, since the more expensive cyan, magenta, and yellow inks are replaced with the cheaper black ink.

A Difficult Reproduction

Probably the most difficult image to keep in color balance throughout a pressrun is a four-color gray. A four-color gray is a black and white image that is reproduced using cyan, magenta, yellow, and black. To show the benefits of GCR over UCR, we will use this as an example. (Figure 4).The image on the top left was separated using UCR and the image on the top right was separated using GCR. The images immediately below have a 5% magenta shift in the midtones. Note the shift in color on the UCR separation, while the GCR separation is still neutral.

While most of us will not be printing a job using four color gray images anytime soon, this example illustrates the color stability of a GCR separation. A four color gray image exhibits little color shift when utilizing GCR. GCR relies on the black separation (instead of equal amounts of cyan, magenta, and yellow) to achieve neutral grays within trichromatic colors. The result is more consistent color throughout the pressrun because the press operator is utilizing black to maintain neutral color consistency instead of the cyan, magenta, and yellow. Apply GCR to a “normal” color image, and color shifts

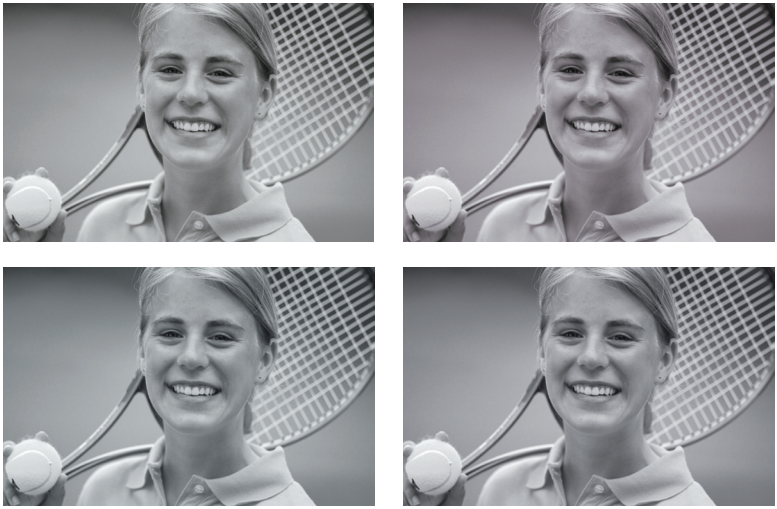

Figure 4: UCR and GCR separations with color shifts. A UCR separation (upper left), a UCR spearation with a 5% magenta shift (upper right), a GCR separation (lower left), a GCR separation with a 5% magenta shift (lower right).

on press will have little effect on the images.

The major benefit of GCR is maintaining color balance of images during a pressrun. However, this benefit can also be a disadvantage. The main drawback of GCR is the reduction or elimination in the ability to make color adjustments on press. If you deal with customers who insist on making the press operator "correct" color during press checks, GCR should not be used.

Undercolor Addition

One consideration that must be made when using GCR is that the more GCR that is applied to an image, the lower the total ink coverage (TIC). Higher amounts of GCR (50% or more) will significantly reduce the amount of cyan, magenta, and yellow being printed in the shadow areas. The black separation alone cannot recover the density lost by removing the cyan, magenta, and yellow, resulting in difficulty producing dense black shadow areas.

The solution is to use undercolor addition (UCA). UCA increases the amount of cyan, magenta, and yellow in the shadow areas of an image. CMY is increased only in neutral colors (grays) and has no effect on the trichromatic colors.

This increase, along with the GCR black separation, results in more dense blacks within the separation. Applying UCA will increase the total ink coverage requirements for specifications such as SWOP®, SNAP®, and other conditions while maintaining the desired amount of GCR in trichromatic colors.

The Keys to Using GCR

- Several points must be considered in identifying and using GCR.
- GCR is total undercolor removal. GCR reduced cyan, magenta, and yellow in the neutral and trichromatic color throughout an image.
- GCR improves color consistency on press. GCR separations will produce more consistent, repeatable color throughout a pressrun. The disadvantage of this, however, is the reduction in the ability to make color changes on press.
- More GCR results in more black within an image. Since most text on a press sheet is black, densities are often run higher to make the text more black. Black densities that are too high can adversely affect GCR separations.
- High amounts of GCR require the use of undercolor addition. Applying UCA to GCR images will result in more dense blacks in the printed reproduction.

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