Optimizing special images for print

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Abstract

What you see on the monitor is not necessarily what you get in print. A black and white image may look neutral on screen, but has a color cast when printed. An Excel graph may look OK on the monitor, but when printed, because of rich blacks, perhaps slightly out of register, it looks awful. This article discusses how such images can be processed to make them print well.

Grayscale images

One way to print Grayscale images would be to print them in black only. This way it would be neutral and easy to print, however it would also result in low image contrast because of limited solid density (fig. 3). Some CMY color needs to be added underneath the black printer. This could be accomplished by converting the Grayscale image to CMYK mode in Photoshop (using the active output profile). If this is done, we likely end up with more CMY than Black, which makes for an image that will be strongly affected by possible variability of inking on press and variability of registration. Fig. 1a shows the effect of using a SWOP profile (perceptual rendering): black is a skeleton black, there is a lot of color in the midtones and highlights, and black does not go to 100% dot area, which is not good for contrast. Fig. 1b shows another profile with maximum GCR. This helps, buts is not yet good enough.

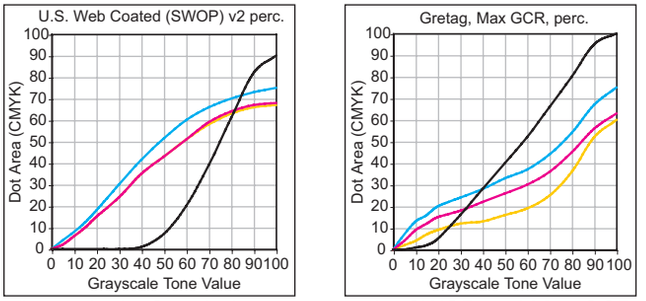

Fig. 1a & 1b: Gray balance curves for SWOP and Max GCR

Ideally we only want some color to support the shadows. And, particularly when FM screening is involved, we can do one more trick (courtesy Dr. Granger): at low dot areas, the FM dots have to be far apart. This makes them more visible and can cause a grainy appearance. To avoid this, we use for the lightest highlights only CMY. This way more dots need to be used (because the CMY colors are lighter than black) and therefore more paper gets covered with ink, making for smoother highlight areas. In other words we would like a relationship as shown in Fig. 2. In addition, this makes it easy to have a slight color cast to the image, such as “sepia”, which imitates old photographs.

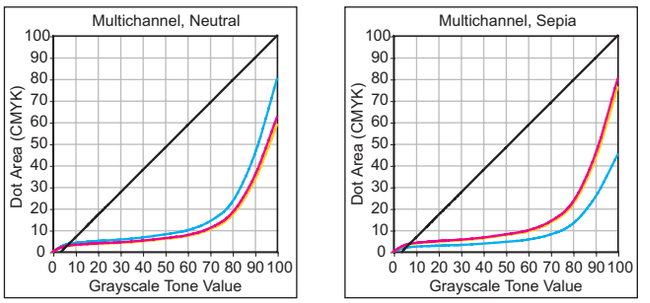

Fig. 2a & 2b: Gray balance curves for Neutral and Sepia color

These gray balances are very stable on press, have high contrast, and smooth tints in the highlight areas. For all these setups, the total area coverage is a maximum of 300 percent dot area. (The figures on pages 6 to 8 of this booklet were done using the curves of Fig. 2a.)

Multichannel conversion methodology

The following is a method to convert Grayscale to CMYK where we have full control over gray balance. It consists of making 4 channels, then converting these to CMYK.

1. Open the Grayscale image (RGB would first have to be converted to Grayscale) in Photoshop and convert it to Multichannel mode by going to Image > Mode.

2. Go to Window > Channels, the channel panel opens with one channel, labelled Black. Click on the upper right corner arrow of this palette and duplicate the channel. The new channel will become cyan. It can be named, but this is not necessary because Photoshop will rename each channel when they are going to be converted to CMYK.

3. Go to Image > Adjustment > Curves, and make a curve similar to cyan of figure 2a. (Consider the Total Area Coverage when setting the highest value.)

4. Duplicate the cyan channel to get the magenta channel. Again apply a curve, this time only the difference between cyan and magenta. For a neutral gray, magenta has to be about 80% of cyan. Therefore, simply set one point for this curve: input 100% output 80%.

5. Duplicate the magenta channel to get yellow. If yellow and magenta are the same, then no additional curve needs to be applied.

6. Select the black channel, and with curves, set one point at the lower left corner: input 5% output 0%. This makes black lighter, compensating for CMY in the highlights.

7. Now drag the black channel to the bottom of the list. The four channels represent cyan, magenta, yellow, and black. Go to Image > Mode, CMYK. You are done with the images. However, be careful with color management settings of InDesign and Distiller. Later CMYK to CMYK conversions could reset curves to the working space.

You can record this procedure using Photoshop Actions to facilitate conversion of multiple images.

Fig. 3 shows images using these curves. The SWOP version might by coincidence look similar to the neutral version, but, with changes in inking, the SWOP version would no longer be neutral. This is simulated in Fig. 4 by applying in Photoshop a curve that reduced cyan by 20% (compare Neutral C80% with SWOP C80%). In addition, in Fig. 4, we can see that the SWOP version is more sensitive to misregistration (use magnifier). Again, this was simulated in Photoshop by moving cyan channel right and down.

Black only SWOP Neutral Sepia

Fig. 3: Effect of different grey balance settings

Neutral C80% SWOP C80% Neutral misreg. SWOP misreg.

Fig. 4: Sensitivity to ink variation and misregistration

Optimizing Excel graphs for print

Simply copying and pasting an Excel graph does not make good graphs for printing. They end up with rich black text and lines and degraded color on the curves. The way to make good printable graphs is to use Illustrator to edit the Excel graphs. This way the graphs remain scalable vector files. (Photoshop would make undesirable raster files.)

1. Open a new Illustrator file in CMYK mode. Copy the graph from Excel and paste it into this new Illustrator file. (If RGB mode were used, you still get rich blacks.)
2. Select All, and then go to Type > Font and select an easily readable sans serif font such as Helvetica. Make the font as big as possible relative to the overall graph. This way graph size can be reduced later on (say to a text column width), keeping the text still readable.
3. While all objects are selected, observe that there is a box around say the title line. Unselect All, and then (using the empty arrow tool) select this box only. Go to Select > Same > Fill and Stroke. This selects all empty boxes (which are unnecessary clipping boxes).

   Now observe a vertical text line (Y axis label), and then delete the selected boxes. Notice that now a horizontal text line is revealed in addition to the vertical line. This shows a trick that is used by Excel: because non PostScript printers may not be able to form vertical text, Excel saves vertical text once as a horizontal vector text and once as a vertical bitmap text. The horizontal text was covered by the clipping boxes. Remove the vertical texts, and rotate the horizontal vector texts one by one. Now you have high quality, vertical PostScript text.
4. Illustrator needs to have a frame around the whole graph in order to define image size (BoundingBox). Use the frame from Excel, or make your own.
5. To remove unwanted colors (rich black), select an item which is say black and then goto Select > Same > Fill color and then change the fill color of all selected items to black only. Do the same for stroke colors.
6. You may have to use the same procedure for colored objects. They often are not converted to saturated colors and have small amounts of unwanted black or complementary color. Set those unwanted components to zero and may be the wanted ones to 100%.
7. Set the gridlines to 30% black only, using the same technique. While they are selected, adjust the line width to an amount proportional to the overall size of the graph. Lines that are too thin may not show. Take into account that the graph might be reduced when placed in a document. (By the way, it is much preferable to use *gray* grid lines rather than *dashed* grid lines. Each dash is a separate object in Illustrator, making for large and slowly printing files.)
8. The frame around the plot area actually consists of several lines on top of one another. It may be tricky to select the desired one. It may be necessary to select the 4 solid lines around the graph and move them out of the way by a fixed distance, delete the other lines that are left, and then move the frame back by the same fixed distance. This way you make sure there is only one line left. While they are selected, adjust line width to some sensible amount.
9. Now you *may* have a clean graph. Save it as a PDF file. Open the PDF in Acrobat. The image that you see should be just the graph without any other objects around it. In Acrobat go to Advanced > Output Preview and unselect the black printer. All that should remain are the colored graph lines, the black text and frames and gray gridlines should no longer be visible. If that is the case you are done. Making the PDF is not trivial. Depending on color management settings in InDesign and/or Distiller, the file may be converted again to CMYK with rich blacks.

If you have several similar graphs, you can process them all at the same time in Illustrator, and, when you are done editing, you can copy and paste each graph to a separate new Illustrator file out of which you make the PDF. This way it is easy to make all graphs the same size and the same colors. Figs. 1 and 2 were edited this way.