The G7 Process: An Introduction

The G7 Process is based on controlling visually predictable midtones during printing.

By Larry Warter

The following is one man's interpretation of the G7™ process developed by GRACoL®. It is intended as a subset of the G7 "How to" document freely available on www.gracol.org. Any apparent conflicts are not intended. This article is divided into the philosophy behind the article, a barebones description of the process, and some general guidelines and wisdom that the GRACoL Committee has picked up along the way.

Philosophy

The G7 process is based on controlling visually predictable midtones during printing. Highlights are greatly influenced by the paper and the shadows by inks, the densities selected and trap; but midtones, while controlled during the printing process, have not been predictable from press to press. No more should be expected from G7. Color is a complicated process and any system that attempts to control color is doomed to become complicated. The G7 process has proven itself to be successful in improving color control on press during many trials, but with those trials came errors and revisions. As a result the present process is necessarily complex in order to deal in advance with all eventualities.

It is sometimes hard to remember that we started this process in order to improve printing process control through simplification of measured variables. This article is an attempt to rediscover our roots. It includes the basic process and a list of guidelines. The basic process should address the needs of most people to help them get started. When they run into problems, they should refer to the guidelines, which will give general statements on how many issues were generally addressed. Beyond that, they should refer to the G7 "How To" and the GRACoL experts for advice.

Process

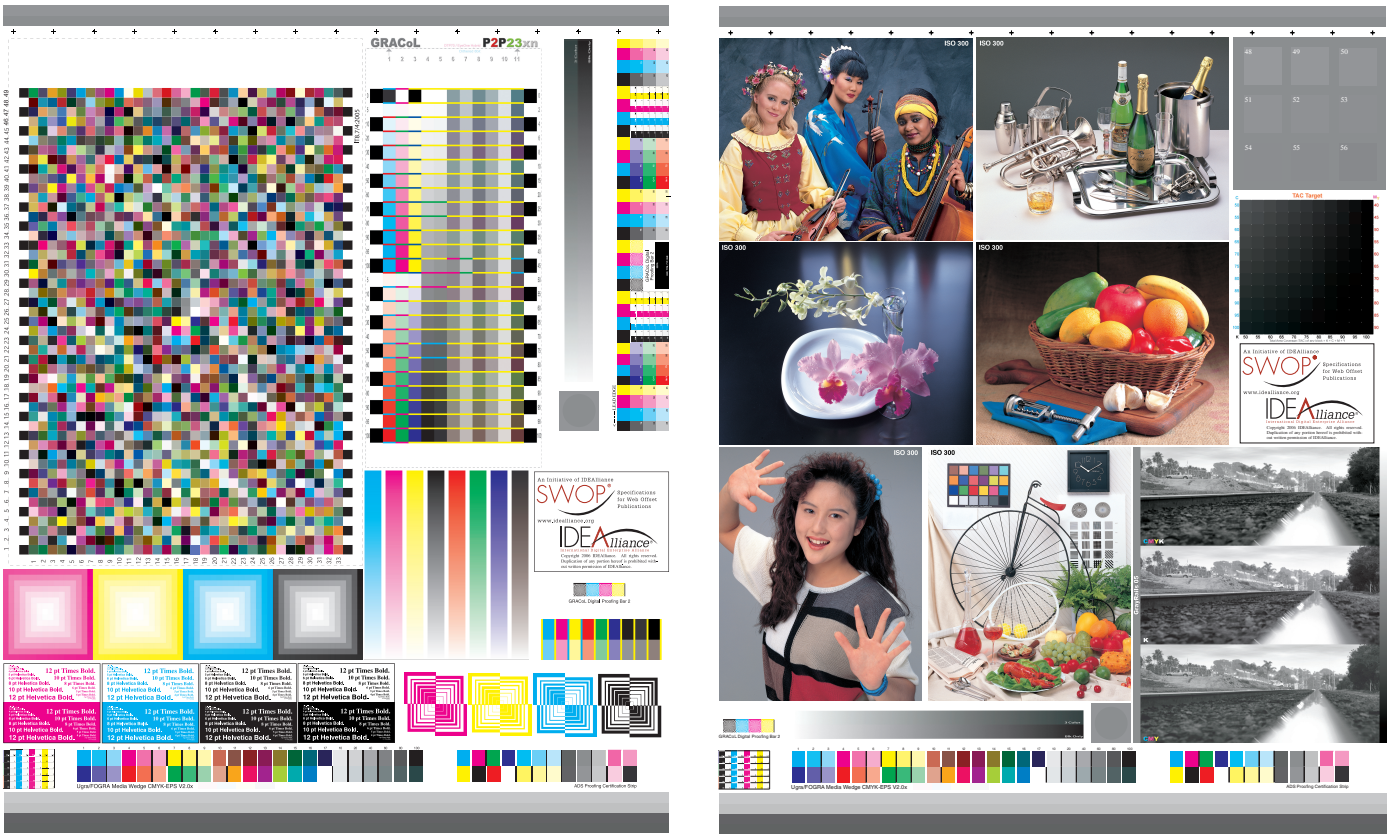
1. Materials include:
   a. Press form from IDEAlliance SWOP®/GRACoL;
   b. P2P target (values 0,2,4,6,8,10,15,20,25,30,35,40,45,50,55,60,65,70,75,80,85,90,95,98,100);
   c. GRACoL *New Bar,* FOGRA or similar press target (shown on bottom of each press sheet).

2. Rip in your normal way to "uncalibrated" plates (plates with no curve adjustment). If possible under the manufacturer's guidelines, adjust the process (light levels, etc.) so that the 50 percent on the plate measures as close to 50 percent as possible. This is a "want" to improve the efficiency of the exposure process not the image quality, which will be established by the subsequent G7 process. Record the dot percentages to confirm subsequent calibration adjustments.

3. Print to your normal target solid ink values using your normal process (coatings, etc.). Make sure printing is under control by your normal methods and uniform across the sheet. Midtones should not vary by more than 1 delta E (especially in delta a) and must not vary by more than 2 for any hope of predictability in measured areas. GL (General Guidelines) 1-4.

4. The pressman should then further adjust densities until the desired midtone values are reached for the CMY patch and for the K midtone patch. GL 5,6,8. If this is not possible to achieve within a reasonable solid ink density range, outside help is required.

5. Record all solids and midtone densities/colors as production target conditions. GL 2.



Press form from IDEAlliance SWOP/GRACoL.

6. Measure the black column (next to the single colors) and the three-color column (next to the black) on the P2P target using visual density. GL 1.

7. To get adjustment factors for the RIP, use Curve Link software from IDEAlliance or use the NPDC target "Fan Graphs" available free at **www.gracol.org**. The graphing process is in GL 9.

8. Apply the RIP correction factors.

9. Create new plates of the same test form using the new RIP curves and compare the plate values on the P2P target patches to the un-calibrated plate curve patches recorded earlier. Make sure that the required changes have been achieved (if you want larger dots you got larger dots).

10. Print to the same target solid ink values using your normal process (coatings, etc.). Make sure printing is under control by your normal methods and uniform across the sheet. GL 1-4.

11. The pressman should then further adjust densities until the same desired values are reached for the CMY midtone patch and for the K midtone patch. GL 5,6,8.

12. Look at the three-color neutral scale on the P2P target. If there are significant color shifts in highlights or shadows, GRACoL Experts help or profile adjustments will be required. GL 7.

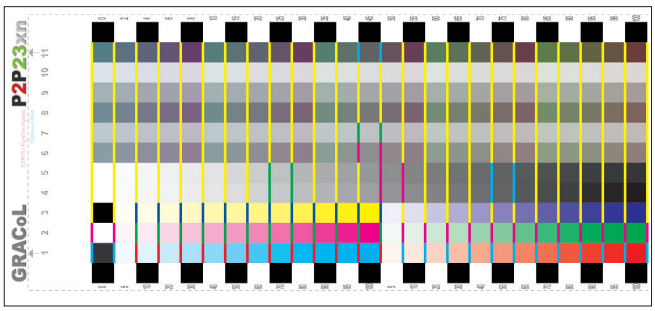
13. Measure and plot the CMY and K P2P curves on the Fan Graph, and confirm that they fit the referenced curve. If not, the process is not under control. GL 2.

14. If press profiles are required to correct for trap or you are printing to match a known characterization data set like SNAP, GRACoL or SWOP, measure characterization data from selected sheets representative of the run with a spectrophotometer, then build an ICC press profile from the averaged data.

15. If possible, save the original measurement data in spectral format rather than CIE Lab D50. With suitable software and spectral data measured from a specific light source, spectral characterization data can yield an improved ICC profile that reduces the metameric problems caused by non-standard viewing conditions, or variations between standard light sources.

General Guidelines

1. The user must understand simple density and colorimetric concepts to use this process. Use D50 in all measurement and viewing conditions. Since these are relative measurements (not intended to be reported), in most cases self backing is adequate. Measurements should always be made at several



P2P target (values 0,2,4,6,8,10,15,20,25,30,35,40,45,50,55, 60,65,70,75,80,85,90,95,98,100)

areas on the sheet or plate and averaged. Variations indicate lack of process control.

2. The G7 process should be used in conjunction with classic density and dot gain measurements. They determine when the process is out of control. G7 adds metric for image appearance to that control. When G7 and the classical process are in conflict, determine which is more likely to cause problems to the user.

3. G7 can be used with any printing condition (SNAP, GRACoL, SWOP shop standards, coatings, etc.) even non-lithographic printing.

4. For SNAP, GRACoL and SWOP printing, use standard inks produced to ISO 2846 conformity. Density and colorimetric references and suggested ranges are available on the latest BRIDG'S chart and will be published in GRACoL 7.

5. G7 is based on keeping the three-color midtone (50C, 40M, 40Y) constant in density and neutrality when compared to the paper. At present this has been chosen to be a relative density of .54 above paper for all papers in grades 1-5 (conversions to an absolute density constant is recommended for production use). If gamuts are limited (as in newspapers), this highlight range will need to be adjusted to fit the condition. Neutrality for the midtone patch is defined in absolute colorimetry as a*=0 (± .5) and b*= -2 (±1) for most typical papers. With papers that have color or brightness extremes, these can be shifted toward the paper values to give visual approximations (especially the b* for very bright papers), but standard conditions could be violated and profiles are probably required for a good image match.

6. Black has been chosen to have a highlight range of .5 for historical, not necessarily visual, reasons. Note: this process will expose non-neutral blacks which should be avoided.

7. The Neutral Print Density Curve (NPDC) expands this midtone concept to control the weight of selected neutrals from highlights through shadows for both three-color overprints and black separately. With good representative trap, it will give neutrality throughout the scale. With poor but consistent trap, a more complicated version of G7 or color profiles are required for neutrality. Without consistency, see guideline 2. Some papers are now becoming too bright (blue/UV) to be able to correct the highlight color to a measured neutral. For these papers, the visual results should be reasonable, but standard characterizations data sets may not be achievable.

8. All press tests should have a minimum run length of at least 1000 sheets with reasonable uniform measurements before and after to ensure that the recorded values represent the running press. Ink dry back should always be taken into account. The amount and therefore importance of dry back may vary depending on the process, drying between cylinders and coatings used.

9. Fan Curves Rip correction factors require two curves, one for CMY and one for K. To get each set of factors:

A. Plot the visual densities measured for each step in the K and CMY columns on the P2P target opposite the proper dot values (listed in step 1 for the P2P target) on the Fan Graph.

B. Find the closest approximate reference curve.

C. Depending on RIP requirements choose the minimum number of points where it appears that you would want to move your curve so the final resulting curve lies on top of the reference curve (points where your curve bows away from the reference curve). For each of these points and any other reference points required by the RIP on your trail curve, the dot percentages at the bottom of the graph would correspond to the final or wanted values in the RIP.

D. Then, for each point on your curve, track horizontally across to the reference curve and note the dot value of that intersection. This corresponds to the measured or starting value for the rip. (It's supposed to seem backward, you are undoing a problem.)

General Observations

1. The committee was warned that pressmen would fight process control methods. We discovered that,

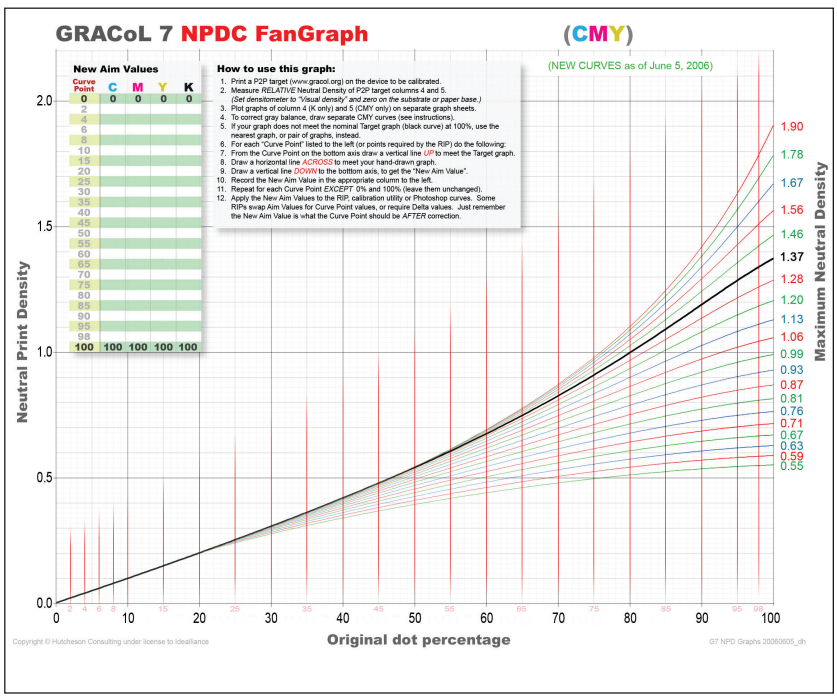
as soon as they realized that midtone adjustment was telling them to make the same corrections that their eyes did, these pressmen became enthusiastic supporters of the process.

2. The GRACoL Committee originally anticipated that the G7 technique would be a means for printers to print consistently using higher densities, which were assumed to be desirable. All original trials were run at two or more density levels. We discovered that, after adjusting for the proper midtone weight, the different density levels were only distinguishable in very limited numbers of images in the shadow detail. It was also noted that G7 samples properly done for SWOP publication were remarkably close visually to the GRACoL images. The committee determined that densities higher than GRACoL had very limited application and probably would not require a standard.

3. The G7 process has almost nothing to do with the GRACoL characterization data set that will replace TR004 except that they are both intended to represent quality commercial printing. The G7 process is a quality control device for consistent visual printing. The characterization data set is the color reference that should be used for designers who want to print a good commercial job. Each can exist without the other, but, of course, they work best together when the designer designs for the proper output and the printer maintains the press to be able to consistently print to achieve that result.

4. Characterizing a press is far more significant than any normal print run. The printed sheet from which the characterization data will be measured must be as "perfect" as possible, in all visual terms, including solid colors, gray balance, NPDC and trapping; and these characteristics should be as even as possible across the whole sheet, or at least the area of the characterization target.

5. Offset printing is much harder to control consistently and evenly than a typical proofing system. Even the best press operated by the most experienced workers under ideal conditions can vary considerably from run to run due to small changes in materials, temperature, humidity, length of run, etc. The chances of a "perfect" press sheet from any particular offset press run are very small. If gray balance and other tolerances cannot be controlled precisely during the characterization test, aim for the best possible result but remember that the resulting characterization data will probably NOT represent the average performance of the device being characterized. In this case either use the standardized characterization data for that printing type—for example, GRACoL 7 Characterization Data—or repeat the characterization process several times over a period of days or weeks and average the results.



The NPDC target "Fan Graphs" are available at www.gracol.org.

Conclusion

This is the simple, straightforward version of G7. If it is too simplified for you, see the full G7 "How to" which gives more complicated options. If it is too technical for you, consult a G7 Expert to install the process. Once installed, it becomes a simple matter of tracking density, dot gain and the color of the midtone patches for process control purposes.

By comparison to classical printing process control, you may not see much difference if your printing, dot gain, trap, and ink colors are already tightly controlled to standard aim values; but it has been my experience that even the best shops need the subtle adjustments that this process offers to give predictable image color results. Good luck and good printing. IPA

For additional information about the G7 Process, go to www.gracol.org. Illustrations for this article are from the GRACoL website.