Test Targets Showcase: Device Characterization by Densitometry

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Objectives

This is a study that illustrates how the IT8.7/3 test target is utilized for characterization. The IT8 target is very effective in obtaining the density values and amplitude response of an output device. The information from the IT8.7/3 target is also useful in analyzing the stability and consistency of an output device. In addition, this study demonstrates how to make the Indigo digital press simulate the output of the Xeikon digital press.

Procedures

1. Digital output

   The Print•RIT test form was printed on the Indigo digital press. The samples were measured with the use of color measurement instruments and computer-aided data entry software.

2. Data collection

   These measurements were obtained by using an X-Rite densitometer (Figure 1). The CMYK ramps and solids were the only values obtained. The density values were saved onto an Microsoft Excel spread sheet. The data from these measurements was first entered into Microsoft Excel template 3_Press_Sheet(v3.x).xls, which calculates density-derived values. The density derived values are dot gain, print contrast, ink trapping, hue error, grayness, and efficiency. This template also calculates the amplitude response of the output device. In other words, the wanted density against dot area.

Figure 1. X-Rite 528 SpectroDensitometer.

3. Data analysis

   The information provided by the IT8 target is useful in two ways: calibrating an output device and characterizing an output device. While calibration is to adjust the device to known values, an output device can be characterized, in terms of %dot area vs. density, once it's calibrated. (Figure 2).

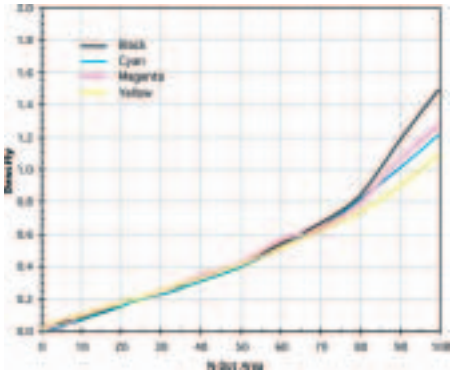

Figure 2. Amplitude responses of Indigo Ultra Stream 2000 at 14% dot gain at its digital front-end.

4. Comparison of two output devices

   If we compare amplitude differences between two devices, e.g., Indigo and Xeikon, as shown in figure 3, we see that Indigo has a higher amplitude than Xeikon. The difference may be reconciled to make the Indigo simulate the Xeikon by means of the transfer curve (Figure 4).

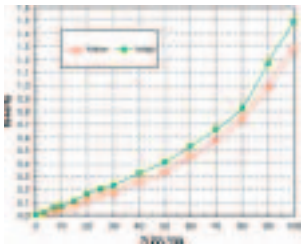

Figure 3. Amplitude responses of the Indigo (solid) and the Xeikon (dotted) digital press.

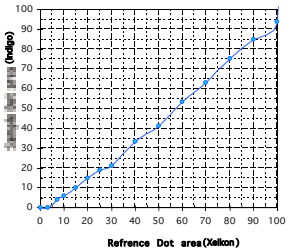

Figure 4. The black transfer curve applied to make the Indigo simulate the Xeikon.

Abode Photoshop was used to achieve the transfer with the use of the ISO 12640 SCID test image. The transfer curve uses relative density as opposed to absolute density. The channels were split into 4 separate b/w images, then the values were entered according to the values calculated from the Print•RIT Excel template.

5. Pagination and output

   The pagination was implemented in Quark 4.0. The ISO image before transfer curve is placed at left (Figure 5a). The images with the transfer curve applied is shown at right (Figure 5b). The page was printed to Indigo UltraStream 2000. It is important

Figure 5a. An ISO 12640 SCID image printed at Indigo calibrated conditions.

Figure 5b. The image at left was adjusted via transfer curves to simulate the Xeikon output.

to keep the conditions of the output device consistent. With out a consistent process, the transfer curve will not be effective.

Discussion

By means of densitometric analysis of the two Indigo press runs, we were able to verify that the first press run and the second press run were consistent. By means of densitometric analysis of an Indigo and a Xeikon press run, we found out that there were noticeable differences in the amplitude response curves of all four process inks. By means of visual assessment, we could see that the appearance of the Indigo printed IT8.7/3 target (Figure 5a) is warmer in color balance and richer in tonal range than that of the Xeikon printed target.

To reconcile the difference between the image printed on the Xeikon (reference) and the image printed on the Indigo (sample), four transfer curves were applied to the image printed on the Indigo. When comparing the source image (Figure 5a) and the image modified by the transfer curves (Figure 5b), we noticed that the modified image, printed on the Indigo, is similar to the image printed on the Xeikon.

Conclusion

Densitometry is a useful quality control tool. It is important in device calibration, e.g., adjusting solid ink density and dot gain to a reference printing condition. It provides data for conformance verification and corrective action. Another reason that densitometry is important is because it can be used, along with custom Excel templates, to alter the amplitude response of the imaging device in order to simulate the amplitude response of another device, as demonstrated in this study. More over, the use of a natural image, available from the ISO 12640, proved to be useful for visual assessment purpose. This is because of the abundance of neutral background and memory color, such as fleshtone, that we can easily associate with than the color patches.

Print•RIT Test Form used in this study: