The Color Separation Mystique

From the dawn of published color pictures, the alchemy of color separation technology has held the masses in awe. Those not involved in "the trade" were purposely never told the secrets; it was a "need to know" kind of thing. Somehow, everyday, ordinary color photographs containing untold numbers of colors were reproduced on printing presses using only four colors of ink. It was all quite mystical and magical.

Actually, until the mid-nineteen-eighties there was little reason to educate the masses about the topic. Performing color separations prior to then was still the right and responsibility of the select few highly-trained, and highly-specialized craftsmen in the engraving trade. Nobody else cared to know! It was like Optometry. We were glad someone knew that stuff, but we were real glad it didn't have to be us. They enjoyed the admiration, and we were glad to give it to them

In 1985 desktop publishing became the rage and everything changed.

Now I Are One

Early in the nineties, software packages began to appear on the Macintosh platform that claimed to perform this rocket science called color separation. Right there in the Print dialog box was an ominous button labeled Color Separation. Now, anyone (it would seem) could perform the magic! It was apparent that the magic was in the button. Push the button and you performed a separation. Why, this wasn't complicated at all! What's all the fuss?

This new authority swelled many a head in those early days. Color separations were churned-out with presumptuous impunity. Desktop publishers produced, and service bureaus soon generated, massive numbers of four-color separations destined for print.

The Feud

That's when the wheels came off. When printing companies all over the country attempted to print these jobs, they found out that the pictures looked muddy and off-color. Since there was no way to provide the printer with a color "proof," most of the jobs didn't turn out like what the DTP folks saw on the screen. This created a serious slug-fest between the desktop publishers and the printers.

The DTP folks claimed that the printers ruined their masterpieces, and were incompetent fossils trapped in ancient technology. The printers claimed that the DTP folks knew nothing about color separations (quite true), and had no business producing pre-press materials (also true). Soon desktop publishers had a difficult time finding printing companies that would print their jobs without insisting on producing expensive proofs.

Ready, Fire, Don't Bother to Aim

The problem was (and still is) presumption. Many presume that color separations are all based on a single, simple mathematical formula that converts RGB colors (red, green, and blue) to CMYK colors (cyan, magenta, yellow, and black). Ah, the simplicity of it all! Red turns into cyan, green changes to magenta, blue converts to yellow, and black comes from... well, somewhere. The truth is, there's a lot more involved in the separation process than a single formula. That kind of one-size-fits-all naiveté has led to a serious misconception on the part of the desktop publishers and digital photographers.

Actually, the term "separation" has no single definition, separation is the process of conversion whose formula is defined by the device & paper it will be printed on.

Different Strokes…

Separations should be designed around the specific requirements of printing devices and presses, their inks/ribbons/toners, and the ink absorption characteristics of the substrate (technical word for paper). In other words, effective color separations are uniquely tailored for the specific printing process to be used.

How it works...

Highlights. If the RGB highlight (lightest tone in the picture) is in the 245-250 range, the desire is for the printing process to deliver the lightest printable "dot." That requirement means different things for each process. If the picture prints on an aging non-heatset web letterpress on a poor grade of newsprint, the lightest printable dot (of each color) could be 7-12%, but if the picture is to be printed using a well maintained sheet-fed press on a cast-coated sheet (as close to glass as paper gets), the lightest printable dot could be as small as 3%. Any generic separation table/profile designed for one system simply will not reproduce well on another.

Midtones. Even more significant is the way different printing processes reproduce middle-tones. This phenomenon is known as dot gain. Dot gain is the measurable amount that a 50% dot enlarges during the printing process. This change is due to many factors, but is most affected by how much the ink absorbs (and spreads) into a particular paper.

Imagine an eyedropper containing black ink. Now picture dropping a single drop of this ink onto a paper towel. Can you picture the way the ink would soak into the paper towel and spread? Now picture dropping a single drop onto a glass tabletop. Can you see the way the ink sits on the surface of the glass and holds its shape? This is the biggest sourceof dot gain. Dot gain is measured by the way an ink/paper combination alters the size of a dot.

Dot gain is inevitable. The best defense is calculated compensation. Different papers print a known-value dot (in this case, 50%), well... differently. The amount that a dot typically enlarges from its original shape during the printing process is the same amount that the dot should be diminished in the separation process, in order to compensate for the expected gain.

OK, one more time in plain English. If we know that the 50% tone of an image will actually measure 65% when printed on an uncoated type of paper, then we know that the dot gain is 15%. THUS, if we adjusted the 65% area of the tonal curve of the picture back 15%, when the picture was actually printed, the 50% dot would gain 15% and print visually correct at 65%.

Shadows. Why do some pictures show significant detail in the darkest tones, and others just show solid black blobs? Without exception, the pictures that print well in the darkest areas of the picture were prepared to meet the printing characteristics of a specific process, ink, and paper. Much in the same way that midtones are affected by how papers absorb ink, shadows are similarly affected.

Both separation tables and ICC profiles must be designed to account for what the printing trade calls the "maximum printable dot." This means that each paper must be tested for the biggest dot it can print without plugging up, and an appropriate separation table/profile concocted to accommodate that limit. This "limit" is tied directly to "total ink limit."

LPI and Dot Gain

One little-publicized factor in the composition of separation tables is the "screen frequency" to be used. Screen frequency is the number of printing dots in the space of an inch. The more dots in the inch, the more dot gain on the press.

This means that two copies of the same picture, printed on the same sheet of paper, going through the same press can look different simply because one is printed at 120lpi and the other at 200lpi. If both pictures use the same separation table/profile, the 120lpi picture will print lighter than the 200lpi picture.

Welcome to litho. This won't hurt, did it?

What Does This All Mean?

Simply put, many factors determine the makeup of a suitable separation. One thing is for certain. Never NEVER simply select "Separation" from the Mode menu in Photoshop without first knowing what will be "done" to your image. ONE SIZE FITS NOBODY! Take care.

Color Separations and ScanPrepPro

ScanPrepPro generates color separations using two methods, traditional separation tables and ICC profiles. Both are handled automatically and without user expertise. ScanPrepPro provides seven different tables that address most press/paper combinations, as well as complete custom dot gain control.

For those who desire to take a "hands-on" approach, ScanPrepPro provides the ability to choose either specific profiles or separation tables. For the stout of heart, ScanPrepPro also provides the ability to specify custom tables (including dot gain compensation).

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