

WORKING WITHIN THE LIMITS

In four-color lithographic printing, the illusion of many different colors and gradients is created by varying the size and angle of cyan, magenta, yellow and black (CMYK) dots on paper (see Illustration 1). As white light passes through the dots and is reflected off the paper, certain colors contained in the white light are filtered out — leaving the desired colors for viewing (This is called “subtractive color.”)

Inherent in this process is the fact that some colors within the visible spectrum are difficult or impossible to reproduce. Precise matching of certain blues and greens is typically difficult.

Among the techniques used to overcome this shortcoming is the use of additional colors beyond the basic CMYK. A six “unit” web press, for example, allows the use of one or two additional, specially mixed colors and or varnish.

This additional “spot” color might be used to assure the exact color of a particular blue corporate logo. An additional “bump” color can enhance or correct another color.

Color Gamuts: A review of the maximum capabilities of four-color process printing

The holy grail of serious graphic arts professionals — art directors and designers, production managers, buyers and printers — is superb color reproduction in printed materials. Accurate color reproduction is almost always crucial to clients as well, particularly to those marketing products where color itself can have an impact on sales.

Aiming for accurate color

Reproduction of food photography is a classic example. A wonderful food shot needs accurate color to create appeal. Missing the mark can be just plain unappetizing. Materials like automobile dealer catalogs also demand exacting color. They must create excitement and, at the same time, accurately represent the myriad, often-subtle colors offered.

With so much demand for truly excellent color reproduction, and with so much effort to achieve it, why is it so elusive? Why can matching a proof be so challenging? Why doesn't a printed photograph look just like the transparency? And why is it often so difficult to reproduce that “oh so luscious, slightly dusty, somewhat mauvy, almost peachy rose color” — exactly like it looks in the original art?

The answers lie within the laws of physics. Said another way, modern color film, scanners, color correction systems, proofing devices and state-of-the-art printing presses are all simply the means by which we try to replicate reality. In fact, it is more accurate to say they approximate reality.

A number of physical realities govern how well we can reproduce what we see in nature. Among them is something fundamental, something referred to as color space, or a gamut. Understanding gamuts can help the graphic arts professional envision and predict how a particular graphic will look when reproduced on a printing press. This, in turn, can help professionals communicate realistic expectations to both internal and external clients.

What is a gamut?

A gamut, or color space, can be thought of as a two-dimensional space containing all of the colors a particular device can render or display.

For example, if you think of the human eye as a device, it can be said to render or “display” many tens of millions of colors, the colors of the visible electromagnetic

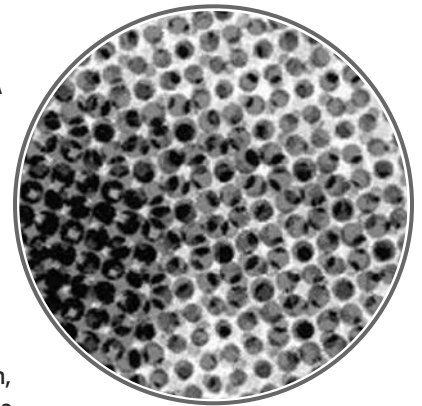


Illustration 1: Four-color process printing relies on dots to create the illusion of many colors and smooth transitions, but some colors cannot be reproduced.

spectrum. Our retinas and brains can resolve a virtually unlimited number of subtle hues creating, say, a breathtaking image of a verdant forest touching a remote shoreline of the misty sea at dawn.

But the gamut of a color transparency of the same scene is smaller. The dyes used in film can reproduce fewer hues. Furthermore, a transparency is capable of displaying a narrower range of shades — of dark and light. So a transparency can be said to reflect a smaller gamut of color than “reality.” Transparencies are good. But they are only a limited approximation of the original experience.

Most designers today perform their work on computer screens, which have their own distinct gamuts. Like original digital art, scanned prints and transparencies are viewed on a monitor — a device which further limits what colors can be displayed. In fact, monitors have a much more limited gamut than transparencies. At best they display 16.2 million colors. But the verdant forest still looks pretty wonderful as it meets the sea, in part because the fluorescing screen, emitting light, makes the image vivid. But while it still looks a lot like the transparency when it was first viewed on a light table, in fact, it replicates many fewer colors.

The last major device in the print production process is the printing press itself and it has the smallest gamut of all. Using only four colors printed in overlapping dots that ultimately fool our brains into “seeing” more colors, the gamut of a modern printing press includes, shockingly perhaps, only about 3.125 million colors — literally a small fraction of the colors seen in the original scene and in the transparency.

A harsh reality

The inescapable reality is that various devices can display only a limited number of the colors found in nature, and the modern printing press — also governed by the laws of physics — can reproduce only a small number of colors when compared with a transparency or monitor, let alone those that can be seen with the eye. Making matters worse, each device’s gamut includes limitations not only of the number of colors it can reproduce but of which colors it can render. Monitors and printing presses, for example, can reproduce many fewer hues of green than photographic film. Four-color process printing presses are further limited in their ability to render a significant number of hues in the violet and purple range. This means that in some cases one simply cannot reproduce that “oh so luscious, slightly dusty, somewhat mauvy, almost peachy rose” — exactly like it looks in the original art. You just can’t. It is, essentially, against the laws of physics. With such limitations how do we achieve high-impact color reproduction?

Making the best of it

While it is important to understand that four-color process printing has inherent limitations (if only so you can explain to your art director or client why it isn’t always possible to recreate the exact hues found in his or her transparency), it is also important to remember that at its best it can produce beautiful reproductions of original art, some astoundingly close to the original.