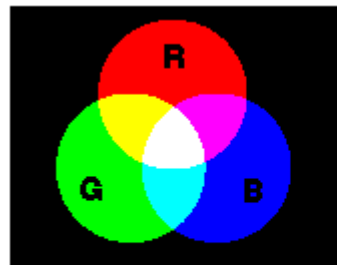


# RGB COLORSPACE:

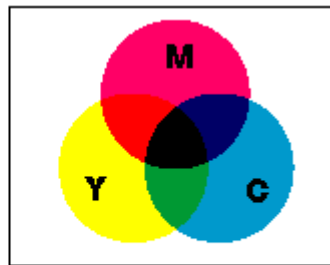
## The Colors of Televisions and Computer Monitors

The color space used to create color on a TV or computer monitor is completely different than the color space used to print color on a press:

The RGB color space, used by televisions and computer monitors, is made up of three luminous or glowing colors:



RGB: TV's and Monitors  
Use Additive Color



CMY: Color Printing Press  
Use Subtractive Color

When these colored lights are either projected on top of each other, or lit up next to each other, in different intensities, we can see millions of different colors (or thousands, depending on the bit-depth of your monitor).

Understanding the RGB color space is important to printing because it is the native color space of the computers (and monitors) which create the documents that we print on a press. Yet, RGB is a color space that is totally incompatible with any printing press.

Also known as LUMINOUS or ADDITIVE colors, RGB lights behave just the opposite of color inks printed on paper. For example, black is displayed on a TV by REMOVING all three sources of color, and white is displayed by ADDING maximum amounts of all three colors.

Contrast that with the printing process, where (on a white piece of paper) black is displayed by adding color and white by removing, or not printing it. (In the example above, we ignore the fourth process color, black. It is used to darken hues created by the other three process colors.)

The RGB color space is capable of producing many more colors than the process (CMYK) color space.

***Therein lies the danger of creating RGB colors on the computer that will later be reproduced with inks on the press.*** Many RGB colors you make on the computer simply cannot be reproduced on the press with process colors.

## I've got the RGB blues

For example, let's take RGB "Blue." It is a beautiful, vibrant blue that simply jumps out of your monitor. In order for you to print, on a printing press, the items you made blue on your computer, it must be converted to the CMYK color space. In virtually any program that supports CMYK, on any platform, your beautiful RGB blue, when converted to CMYK, will in fact end up purple.

### *Why does blue turn to purple?*

#### **The short answer:**

Your computer will convert RGB blue into a combination of 99.6% Cyan and 95.7% Magenta. That's purple, and that's how it will print on the press.

#### **The long answer:**

Because we said so. Stop asking so many questions. Oh, OK. But it's boring.

In 1931, in France, a group of people decided to get together and do something that had never been done before: Create an international standard for color. Considering their lack of technology to analyze the color spectrum, the Commission Internationale d'Eclairage (CIE) did a bang-up job. They came up with a standard for color which is still in use today, called L\*a\*b.

The L\*a\*b range of colors follows a specific pattern of colors blending into one another, somewhat like a 3-D, cylindrical rainbow. It encompasses most of the colors that humans can see. What does this have to do with RGB and CMYK? Well, RGB colors occupy a *smaller* part of that same pattern (RGB's gamut), and CMYK occupies an *even smaller* piece of the RGB pattern.

The result is this: The gamut or range of colors we humans can SEE is huge. The range of colors that an RGB monitor can reproduce is LARGE, and the range of colors that CMYK printing can reproduce is PATHETIC.

But CMYK printing is the best we can do for now. At least until someone gets filthy rich by inventing a better way.

If you pinpoint RGB blue on the RGB gamut, then overlap the CMYK gamut, you will find that RGB blue is outside of CMYK's gamut. CMYK simply cannot reproduce that shade of blue. So, the computer substitutes the closest color to it. Technically, that color is (yuk) purple.

The process of determining this color is flawless, in a technical world. But we live in an interpretive, visual world, where blue and purple are definitely not similar. After all, a blue sky is beautiful, and a purple sky is, well, purple. It's just not right.

So, we must make adjustments in the case of blue, when we convert from RGB to CMYK. We must remove about half the Magenta to make it *look like the blue we expect to see*.

Incidentally, if a person sends a file with RGB blues to a prepress house, those blues will probably be converted to CMYK purple. The prepress house will assume that the designer knew what the result would be. After all, it is not their job to second-guess the designer.

Most colors convert reasonably well from RGB to CMYK. These colors are within the overlapping gamuts of each color space. But there are, unfortunately, many colors that do not convert well. Those colors are outside of CMYK's gamut.

### **Exercise 1**

In PhotoShop, Illustrator, QuarkXPress, or any other graphics program\* that supports CMYK, convert RGB blue to CMYK (consult your manuals). Watch what happens to the color (keep in mind that the program is simulating, in RGB, what the conversion will *look like* in CMYK). Now reduce the percentage of magenta by 50%. Ah, now that's a blue we can live with.

\*NOTE: Microsoft Word, PowerPoint, and Publisher do not support CMYK colors. Don't give yourself a headache by laying out a color document in any Microsoft program, if you intend for it to be printed on a press.

### **Exercise 2**

Look at different color areas of your monitor with a strong magnifying glass. Notice how the colors red, green and blue combine to create different colors. Now look at a color photo on a printed page, and notice how cyan, magenta, yellow and black combine to create the colors.