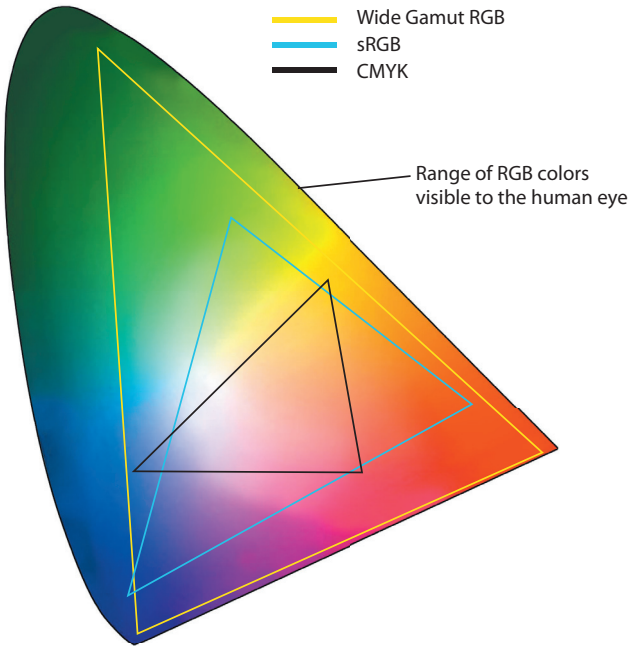
RGB to CMYK... what rendering intent do I use?

Choosing the correct rendering intent is important for creating predictable color. First, what is rendering intent? Rendering intent is a way of converting colors from one gamut (color range) to that of another. For example, the color gamut of your RGB monitor is much greater than that of your CMYK printer or a printing press. Therefore, when converting an image from one color space to another, say RGB to CMYK, there may be some colors that fall outside of the reproducible color range and need to be "mapped" or compressed into a color inside the color range of the destination space, your color inkjet printer or printing press. This is where choosing the proper rendering intent comes into play.



The diagram to the left shows the entire human visible color range with the three most widely used gamuts (color ranges) ruled out within the color graphic. As you can see from the chart, the CMYK printable range is very small compared to the Wide Gamut RGB range. This is why it is advisable to convert RGB to CMYK on your computer instead of at the printers RIP. By converting colors at your computer you can see the results and make necessary changes *before* you get charged for color proofs! For example, your RGB monitor color value of 0,0,255 is not reproducible in print. We need to do something about these out-of-gamut colors, hence the need for rendering intents.

There are four methods of rendering intents to choose from: Saturation, Perceptual, Relative Colorimetric and Absolute Colorimetric.

Let's start with Saturation. This method is used for comics, business graphics and cartoons because it will remap out-of-gamut colors to the nearest in-gamut color without regard to the surrounding pixel colors. It also slightly moves the colors within the gamut to a more saturated value. Now to show you what this means.

On Diagram 1 below are marked 3 points of color all in a row, one inside the destination (CMYK) gamut and two outside of the gamut. In the Saturation method, both points outside the gamut are mapped to the **same color value** inside the gamut, and the one inside is moved slightly to become more saturated. You can see that the pale orange and the brighter red/orange color both get mapped to the same pixel color inside the CMYK color range. For this reason, the Saturation rendering intent is rarely used for print production workflows.

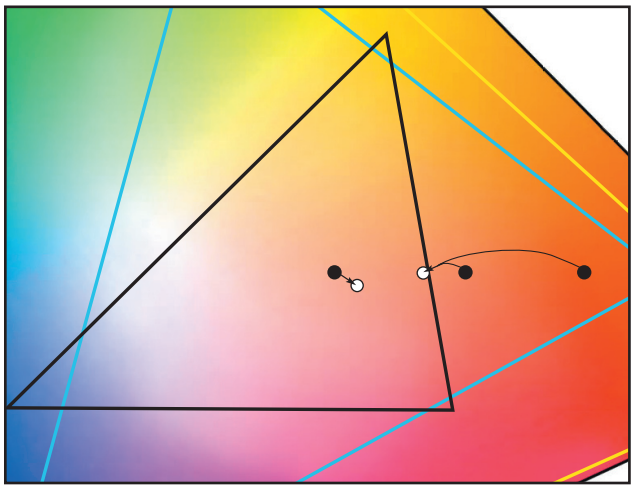


Diagram 1: Saturation Rendering Intent

On to Perceptual rendering intent. This is one of the most common rendering intents for conversion from RGB to CMYK for the print production workflow. Perceptual rendering intent takes ALL the colors and adjusts them to fit inside the destination gamut. Unlike Saturation, Perceptual treats color changes with respect to adjacent color pixels. This means, out-of-gamut colors ***are not*** just moved to the nearest in-gamut color. Diagram 2 will demonstrate this color movement. Typically the Perceptual rendering intent desaturates all the colors to bring the out-of-gamut colors into the target gamut while maintaining the overall relation-

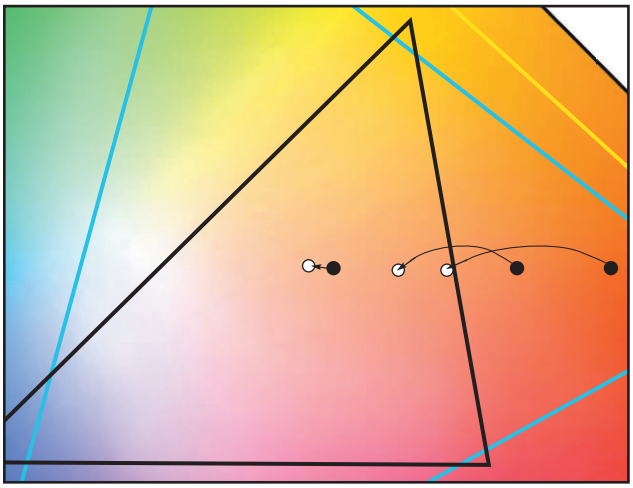


Diagram 2: Perceptual Rendering Intent

ship between all the colors in your image. Preserving this relationship helps to maintain the overall appearance of your image. This seems to be the best overall choice for CMYK workflows.

As shown in Diagram 2, all of the colors are moved proportionally in relationship to each other to create a desirable end result color adjustment. Even though the in-gamut colors are moved, the shift is so slight that most people would not notice the change. At this point, if so desired, you can make other color movements, like hue, saturation, levels, etc. to help bring back some of the vibrance of your image if needed. However, don't go overboard with the changes, because your picture may begin to show posterization or artifacting.

Remember that the moves shown in the diagrams are very exaggerated to be more obvious.

Now for the last rendering intent Colorimetric, which has two styles: Relative and Absolute. As shown in Diagram 3, only the out-of-gamut colors are mapped, each is done individually the same way it is done in the Saturation style. So, while the in-gamut colors remain the same, the out-of-gamut colors are moved to the nearest target color. This change in the relationship between colors often destroys the look of the image.

Using this rendering intent could introduce banding and posterization into your image especially if you are going from a much larger gamut to a smaller one, like Wide Gamut RGB to CMYK.

Now for the choice of Relative vs. Absolute. Both these rendering intents treat colored pixels in the same manner, they only differ in their treatment of white point pixels. When we are looking at color, our eyes search for "white" and compare the relationship of colors to the white we see. Our eyes can accept a wide range of colors as "whites" so the white of the image we are evaluating alters our perception of all the other colors. Also, your eyes are much better at evaluating color relationships than they are at evaluating an absolute color.

With that in mind, by choosing the Absolute style you almost always introduce an unwanted hue in the white and grayscale areas of your image since this method tries to imitate the white point of the target gamut. For example, if you are printing on newsprint stock, the white point of the paper is not white but has a slight tint of color. This tint effect would be added to your image to simulate the target space. For this reason, the Absolute method should only be used to simulate an output on your monitor and NOT be used for final output conversion.

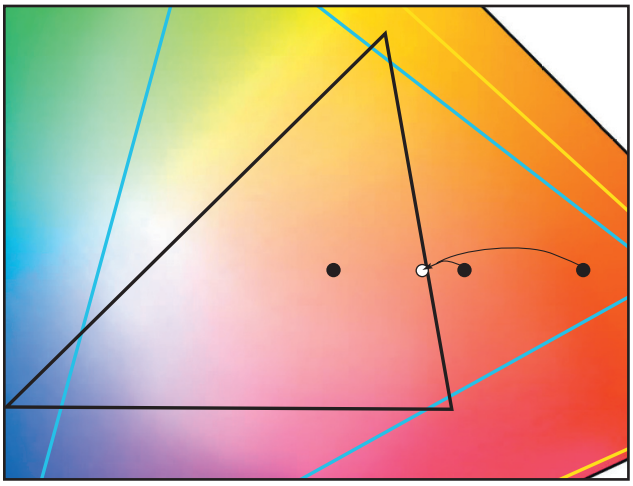


Diagram 3: Colorimetric Rendering Intents

However, in the Relative method, the white point of your image doesn't change. Again as stated before, it does shift all out-of-gamut colors to the nearest in-gamut color without using the proportionality of the Perceptual method. This could easily introduce banding, posterization, etc. into your image. However, this intent may be useful if your image has pastel colors or colors that are close to the target gamut since color saturation will remain stronger than using the Perceptual version.

So, for the bulk of your work you should choose the Perceptual rendering intent. This will give you the best overall results when converting from the wider RGB color gamuts to the smaller CMYK gamut with minimal amounts of banding, posterization or artifacting, while still maintaining color relationships.

To make this rendering choice in Photoshop, you go to the Edit menu, scroll down to Color Settings, and click the "More Options" button to show the Conversion Options area. Next to Intent select "Perceptual". Also put a check next to"Use Dither" and "Use Black Point Compensation". This will remap the maximum black in the source gamut to the slightly less dense black of the target gamut and all of the other tones will scale accordingly.

That's it. If you are still unclear or unsure you understand this concept there are a number of articles on the web for you to research which may shed some more light on the subject.

Some information taken from *Out of Gamut: Realizing Good Intentions with Rendering Intent* by Bruce Fraser