



The Trouble with Color *an industry op-ed by Steve Wright*

In my role as a visual effects compositing teacher, trainer, and author I have encountered hundreds of visual effects artists (over 600, actually). One thing I've often encountered is a lack of a solid understanding of color – specifically digital color, where color hits the computer. I've identified two causes of this trouble with color.

The first cause is a lack of training. Visual effects artists are often self-taught through the proliferation of on-line training courses or they may have attended a training institute. The problem with these is that they tend to focus on the app – Maya, After Effects, Photoshop, Nuke, etc. – rather than the underlying theories of how digital color works. This is especially true today where virtually all images are digital; photographs, video, motion graphics, visual effects - in fact, the entire movie. It is very difficult to imagine any picture that is not captured, manipulated, displayed, and stored digitally any more.

Another issue is the complexity of the subject. Allow me to illustrate. Let's say we just want to brighten the picture shown in Figure 1. Simple, right? We will just increase the brightness or, more correctly, apply a gain to the image to make it brighter. However, we just introduced clipping in the whites. To illustrate this, Figure 2 shows the original picture with the gamma dialed way down so we can see all the sky detail in the upper left corner.



Figure 1 – original picture



Figure 2 - Gamma way down

When a gain is applied the sky detail gets horribly clipped (or clamped, if you prefer) as you can see in Figure 3, again with the gamma dialed way down to reveal the sky detail. Note how the sky is now clipped into a solid white slab and a cyan band has appeared along its right edge. However, if we use a color curve to apply the same gain with a soft clip we can retain the sky detail as shown in Figure 4. While the sky detail is compressed a bit compared to the original in Figure 2, at least it still has detail.



Figure 3 – brightness with gain



Figure 4 – brightness with soft clip



So we might conclude that gain is bad and a soft clip with a color curve is good. Well, that depends. If you are working with an 8 or 16 bit integer image then the gain is bad. But if you are working in floating point (float) gain is good because while the sky detail pixels go above 1.0 they are not clipped in float. However, if you are working in float then write the image to disk as an 8 or 16 bit tiff the sky will become clipped again. However, if you save it as a float image like .exr then it will not be clipped. Of course, you could save it out as a log image like Cineon, DPX, ViperLog, REDLog, or any of a dozen other log type color spaces so that it will not get clipped. Yikes!

This brings up yet another color conundrum, and that is the proliferation of color spaces. Used to be we had film, video and print. No problem. No more. We now have film (log), workstations (sRGB), HD TV (rec709), DSLR cameras (Adobe RGB), print (SWOP), linear lightspace, and a long list of unique log color spaces for each digital cinema camera like RED and Viper. No wonder the kids are confused.

The Great Color Quiz

You look like a smart digital artist, seasoned and wise in the ways of digital color. Perhaps you could easily pass a little color quiz challenge. Give it a go here:

- 1) To make an image cooler what color would you add?
- 2) What is the main reason for converting an image to luminance and chrominance?
- 3) Would you use Gain or a Color Curve to prevent clipping?
- 4) Which has the greatest gamut – workstation monitor or TV set?
- 5) What gamma correction value is “baked” into all video images?
- 6) How many color channels does a 24 bit image have?
- 7) Which color space has the largest gamut – sRGB, rec 709, or Adobe RGB
- 8) Do photographic images use a lossy or lossless compression?
- 9) Is 4:1:1 video suitable for greenscreen keying?
- 10) Are HDR images used for visual effects or photography?

To see the answers, click [here](#) then scroll to the bottom of my **Color for Digital Artists** webinar page. If you find that you missed more than you would like you might check out the webinar. It will help you avoid trouble with color in the future.

Steve Wright