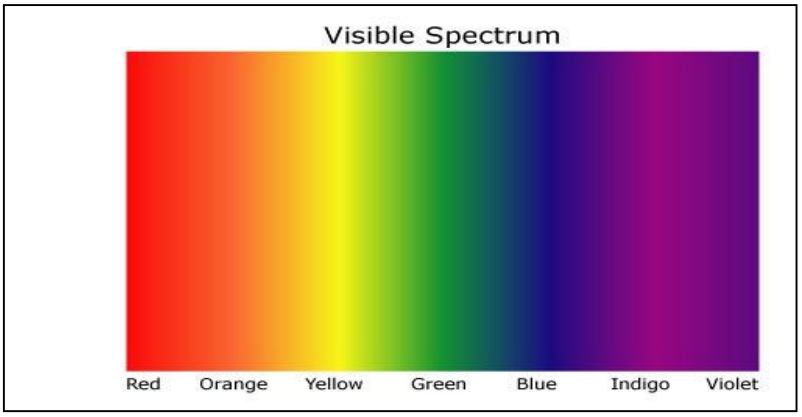
Roy G. Biv: How many bands in your rainbow?

Art is the imposing of a pattern on experience. Alfred North Whitehead

We all know our basic colors before we start to school. We learn early on that there are three primary colors (red, yellow, and blue), from which all others can be created, although designers of color printers apparently missed that lesson. The ancients saw five colors (red, yellow, green, blue, violet) in the rainbow. Newton saw seven, adding orange and indigo (perhaps to align with the *natural* harmony of the universe found in the number of musical notes, days of the week, and known planets; or perhaps he was just buying some vowels.) Recently, indigo seems to have gone the way of Pluto in scientific discourse.

Figure 1: The Visible Spectrum of Light or Colors of the Rainbow in THz



The spectrum can be described much more precisely in tera-Hertz (*THz*) for frequency or in nanometers (*nm*) for wavelength than with the rather arbitrary labels *roy g biv*. Much of the science done on light has been done in the *nm* or *THz* metrics[1]. But never, in my personal experience, have I heard a mid-life physicist exclaim, "I'm driving a *650nm* convertible," or rhapsodize about "the *650THz* bird of happiness on my shoulder."

Table 3: Newton's Seven Color Bands

Color	Wavelength	Frequency
Violet	380–420 nm	715–789 THz
Indigo	420-450 nm	665-715 THz
Blue	450–495 nm	606–665 THz
Green	495–570 nm	526–606 THz
Yellow	570–590 nm	508–526 THz
Orange	590–620 nm	484–508 THz
Red	620–750 nm	400–484 THz

When we look at a rainbow, we see the colors, but the bands we *see* are the colors our brains have named. Our eyes are physically detecting the full and continuous spectrum of visible light, frequencies of 400 to 790 THz or wavelengths from about *380 nm* to about *750 nm*. The labels we chose to attach to the spectrum are for our convenience, whether those labels are the

[1] The figure is plotted against frequency, which is inversely and not-quite-linearly connected to wavelength, to put the colors in the Roy G. Biv order to avoid the rather awkward mnemonic, Vib Gyor. I'm not even going to try to bring the wave versus particle theories of light into this metaphor.

qualitative colors from nursery school or the quantitative nanometers from physics lab. Labels of either type are arbitrary but at the same time, necessary and important. We can chose the labeling that is most useful to us for a given purpose, but having chosen, our labels shape the way we think about light without altering its physical realities.

The color bands give the spectrum *qualitative* meaning; the wavelength metric gives the spectrum *quantitative* precision. Educators should edit the previous sentence by replacing *color* with *Performance* and *wavelength* with *Scale Score* and try using it in a conversation.

How many performance bands do you see?