Hue, Value, Chroma — Seeing Color

The idea for this paper comes from two sentences from Art and Visual Perception by Rudolf Arnheim. He states “Strictly speaking, all visual appearance owes its existence to brightness and color. Visions capacity to distinguish between areas of different brightness and color lets us derive boundaries that determine the shape of objects.” All visual appearance is defined as the act of coming into sight. The sense of sight builds from color. Color functions on physiological, psychological , cultural , and perceptual levels, often at the same time.

I've chosen to think about color by arranging my sources in chronological order starting with the ideas of von Helmholtz in 1852. He said color works in three dimensions — hue, value , chroma.

Hue is the name of the color, like we learn from Elmo on Sesame Street or from Daniel Striped Tiger on Mr. Rogers.

Value is the lightness or darkness of a color. When we look at a scene and want to organize or reproduce it we have to get the value right. We can do this by comparing the color to a grey scale. Think black and white photography . The similarity of values form recognizable patterns.

Chroma = Brightness . Here light creates space. The gradients of brightness (chroma) are the most efficient ways to create depth. We have what are called warm (red, yellow) colors and cool (blue) colors. To visualize the depth we see from brightness picture a full moon, bright but not so much detail. As the moon waxes and wanes the mountains and craters stand out in relief. When lighting is uneven it introduces a gradient of shading and gives us a strong three dimensional effect, revealing the object .

So for a hundred years humans played with these dimensions of color and still do today. Let me mention a philosophical twist to our understanding of color. Maurice Merleau-Ponty in L’Oeil et l’esprit (1961) writes “Color is the place where our brain and the universe meet.” There is a dimension of color, that dimension of color which creates identities, differences, a texture, a materiality, something — creates them from itself, for itself…. Color has the merit of getting somewhat nearer to “the heart of things”.

Next in 1969 Rudolf Arnheim in Visual Thinking established that color vision is mediated by three light sensitive pigments segregated in three different kinds of receptor cells in the retina. They are blue light 450 nm, green light 540 nm, and yellow light 577nm (millimicrons). The curve peaking in the yellow extends far enough into the red region of the spectrum to let the corresponding receptor cell sense red as well. That was always confusing to me as we look at wavelength and retinal cone pigments.

In 2010 David Briggs on his blog huevaluechroma.com states while the number 4 is key to color perception , three is key to color stimulus and color technology .
Red, Green , and Blue cone cells do not detect individual wavelength band or colors of the spectrum , but respond to very broad and overlapping ranges of wavelengths .
Color is created in the brain in the form of color-opponent signals based indirectly on wavelength information . So we have three additive and four psychological primary colors.

Mark Changizi in The Vision Revolution (2009) has an interesting twist on all of this. He says color vision is meant to see skin and in particular is meant for sensing moods and emotions. Our cone sensitivities are just right for distinguishing between the different spectral changes that occur in our skin. Human skin can hit every hue. Color vision thus gives us the ability to

sense illness and injury. As doctors we need to observe the skin. It seems this is well developed in moms.

James Gurney in Color and Light (2010) gives a clear and comprehensive volume on color and brightness. One point that I think will add to our observations is the the three zones of color in the complexion of light skinned faces. The forehead is a light golden color. From the forehead to the bottom of the nose is reddish. The zone from the nose to the chin tends toward a bluish or grayish color. In real life, these zones can be extremely subtle. They are more pronounced in men.

The number of colors we can recognize with ease is around six. Yellow ,red, and blue plus the secondaries connecting them. We distinguish with confidence redness, blueness and yellowness and the grey scale. It is interesting how painters choose the palette they work with. One that I was taught by Jaison Schafer is the Zorn palette used by Anders Zorn (1900). The colors used are Ivory Black, Ultramarine Blue, Cadmium Red, Yellow Ochre and Titanium White. Applying the principles of huevaluechroma some of the best paintings have been created. I have three examples I made from this palette.

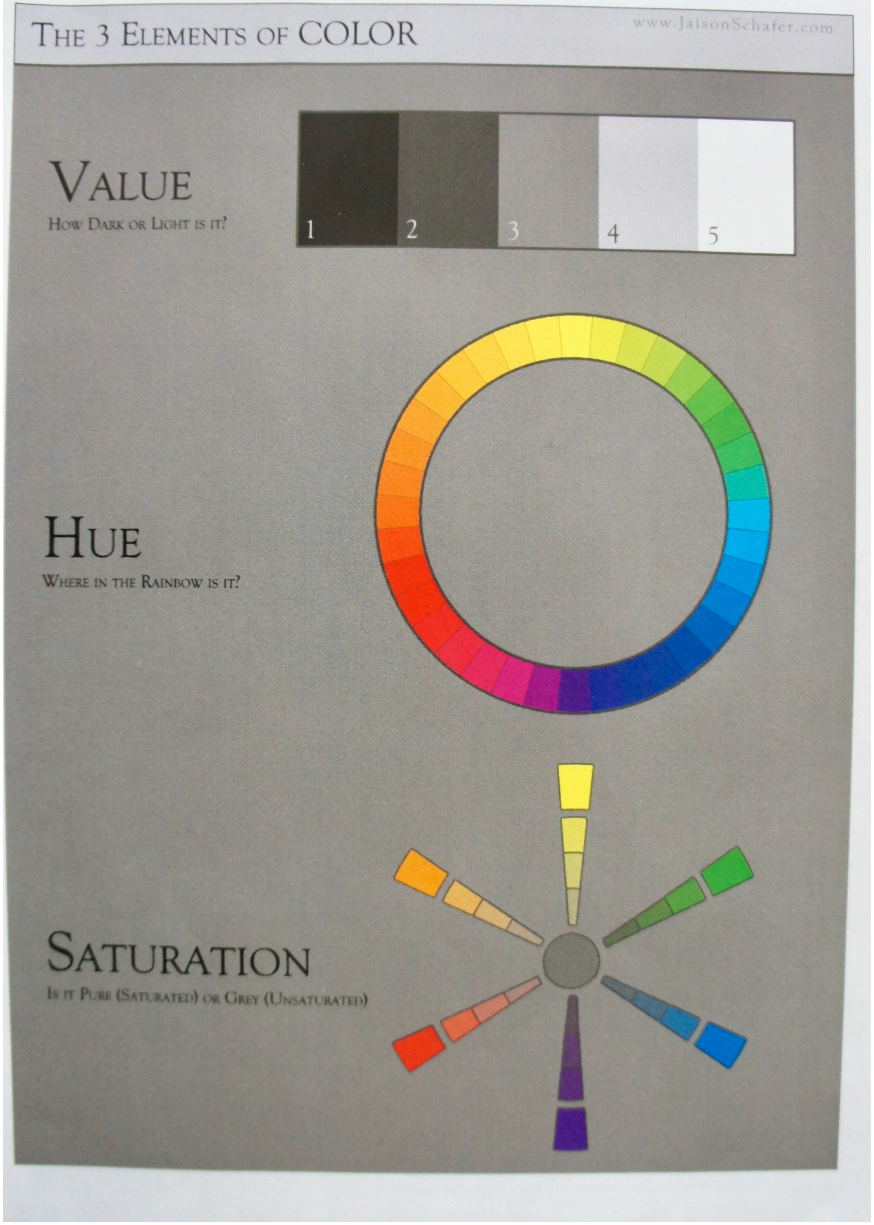
Finally, the key to all of life's work is to tell a story.
The portrait of Parker was taken on his wedding day while we were at his coffee shop which he and his bride were starting.

The self portrait of me is critical thinking 🤔 at its finest.

The story behind the next painting goes back 30 years to a Mid-Atlantic congress.

Thank you and think of this the next sunset you enjoy .

Elmer W. Ebeck O.D.
January 2020



Color	Wavelength	Frequency	Photon energy
Violet	380–450 nm	680–790 THz	2.95–3.10 eV
Blue	450–485 nm	620–680 THz	2.64–2.75 eV
Cyan	485–500 nm	600–620 THz	2.48–2.52 eV
Green	500–565 nm	530–600 THz	2.25–2.34 eV
Yellow	565–590 nm	510–530 THz	2.10–2.17 eV
Orange	590–625 nm	480–510 THz	2.00–2.10 eV
Red	625–740 nm	405–480 THz	1.65–2.00 eV


1/5
1/5
1/5
1/5
1/5
Trichion
Glabella
Subnazale
Menton
1/3
1/3
1/3

Mixing Skin Tones

Using the ZORN Palette:

Ivory Black

Cadmium Red

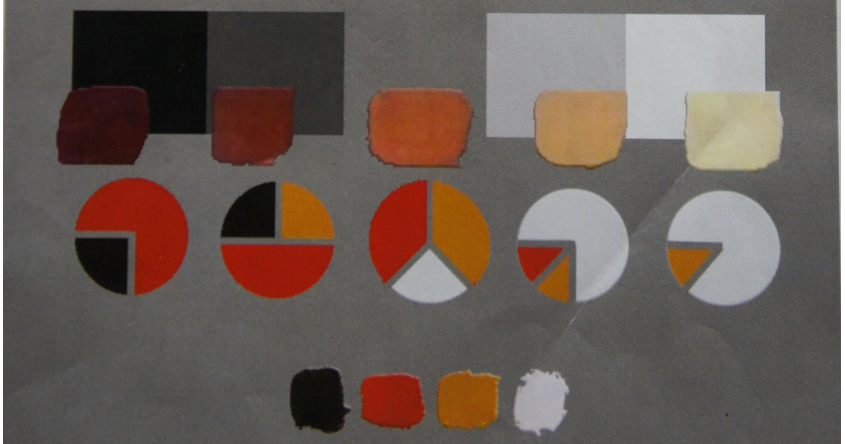
Yellow Ochre

Tit. White

* Mix 1 part blue into the black to make it a cool black

Hue: Lean RED <=======> Lean ORANGE

Value: 1 2 3 4 5



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Alex Tzavaras

Marco Bucci