

# JUST PAINT

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## THE SUBTLETIES OF COLOR

*Small Differences That Make All the Difference*

By Sarah Sands

Every painter knows the dance, taking a few steps back from the painting, their head tilted slightly askew, the eyes pulled tight into a squint, or the hand held in front to block off an area from view. The to and fro of action and adjustment, of sense and sensibility. And if color happens to be foremost in that dance, the search is often for still unseen subtleties to be coaxed from the colors at hand. Even if the effect is one of clash, there remains the desire for it to be 'just so'; a clash tuned to the highest pitch or given a particular piquant flavor. In the end, artists thrive on subtleties, on the small differences that make all the difference, and their search for colors that can respond to those needs is endless.

All these immeasurable things, no matter how rarefied they might seem, ultimately have a material basis rooted in the nature of pigments and paint, the common tools of the trade. In the pages ahead we will start by reviewing some of these underlying factors and then examine why some of the subtlest of variations can make all the difference in choosing the right color matching your intent.

### *Beyond All Measure: the Limitation of Colorimetry*

When trying to describe what makes any particular color unique it is tempting to point to a color's location within a well defined system such as CIE L\*a\*b\* or Munsell. Doing so allows us to feel that we can map the color's uniqueness within a mapped and measured space, and even calculate the degree of difference it has from all those other colors that jostle for a treasured spot of their own. But we would quickly learn that it is precisely those subtleties that are lost in the process. For all the accuracy of our spectrophotometer in reading

the exact makeup of the light being reflected back from a sample, nothing in that information really tells the artist what they need to know about actually using that paint: how it mixes with other colors, its degree of opacity, tinting strength, or any number of physical attributes. Paint is ultimately color on the move, dynamic and energetic, and no single snapshot can capture that more vibrant life lived on the palette of the studio.

While clearly no system of measurement is perfect, spectral reflectance curves perhaps come closest to capturing the nuance of a color, especially if the spectrum is available for both masstone and a tint of a known percentage. With these two points as reference one can roughly gauge how a particular paint might perform in mixtures. However, care must be taken as even here there are difficulties. Cadmium and Hansa Yellow Medium, for example, might share nearly identical spectra at full strength but no one would mistake them for the same in practice. Additionally, one must factor in the responsiveness of the eye to various wavelengths, as this can greatly shape how the eye perceives the color – which can be very different from the data itself.

### *Underlying Causes of Subtle Differences*

Nearly all of the subtleties of a particular color can be traced back to the physical attributes of the pigments and the way light interacts with those particles within a paint film through absorption, reflectance, scattering, and transmission. Pigments, in turn, are largely characterized by their underlying chemical composition, along with such factors as particle size, refractive index, and scattering coefficient, while paint

films impact color through their pigment load, thickness, and sheen. Ahead we will touch on all of these briefly, as a way to introduce some of the complexity behind many of the subtle differences we see.

## PHYSICAL PROPERTIES OF PIGMENTS

### *Crystalline Structure of Pigments*

All pigments, with rare exception, have crystalline structures that dictate their color, and even small changes at this level can alter which wavelengths are absorbed or reflected. Phthalocyanine Blue, for example, has two types of crystal formations ( $\alpha$  and  $\beta$ ) that are responsible for their slight leanings toward the Red or Green Shade, while changes to the crystal lattice of Quinacridone is responsible for its broad range that runs the gamut of bright Quinacridone Reds to the ever deeper Magentas and Violet. A third example includes the entire array of Cadmium colors, where cadmium sulfide, which is yellow in its pure state, is made progressively redder and deeper by replacing the sulfur in the crystal lattice with increasing amounts of selenium. This substitution broadens the amount of the spectrum that can be absorbed, and if enough selenium is added, Cadmium can actually appear black.

### *Transparency/Opacity and Tint Strength*

A particle's opacity is greatly dependent on its ability to scatter light, which relies primarily on a particle's refractive index and size. The larger the difference in the refractive index between a particle and its surrounding medium, the more light is scattered and the underlying layer obscured; a phenomenon similar to the way fog scatters a car's headlights. Conversely, the closer these numbers are, the more