Color Spaces

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Abstract

I will first discuss the importance of an inner product on the space of spectra. Since "Cohen's Matrix R" depends on this inner product for its definition, the choice of inner product affects the structure of fundamental space (and thus color space) in a nontrivial way. The choice has to be made on considerations of physics and physiology. Usually this goes unnoticed and a choice is made implicitly. With the metric of the inner product one proceeds to construct a distortion free color space that reflects the metric of the space of spectra veridically.

Next I will discuss the structure of the Schroedinger object color solid. Although Ostwald's original constructions are attractive because firmly founded on colorimetric principles (whereas e.g., Munsell's atlas is not based on colorimetry but on "eye measure"), they are marred by a number of unfortunate flaws: Not all object colors can be represented, the structure depends on the spectrum (not just the color) of the illuminant, and the "Principle of Internal Symmetry" used to mensurate the color circle is flawed because the locus of "full colors" is not a planar, but a twisted space curve. I show how to amend these flaws in a principled manner.

When Ostwald's mensuration of the color circle (which result from purely colorimetric calculations) is compared to eye measure results (e.g., Munsell's) I find that (perhaps surprisingly, because colorimetry concerns only judgments of equality) they correspond closely.

Biography

Jan Koenderink studied physics, mathematics and astronomy at Utrecht University. His thesis (1972) is on neural networks, the structure of color space and psychophysics of spatial vision. He joined the faculty of Psychology of Groningen University where he worked (among more) on the theory of optical flow and shape from shading. Late 70's he joined the faculty of Physics and Astronomy at Utrecht University where he now holds a chair "The Physics of Man". In 1987 he received the honorific doctorate in medicine from Leuven University (Belgium), and in 1990 he was appointed by the Queen a member of the Dutch Royal Society of Arts and Sciences. He founded the Helmholtz Instituut in which multidisciplinary work in biology, medicine, physics and computer science is coordinated. His current interests include the mathematics and psychophysics of space and form in vision and active touch, the structure of perceptual spaces, and ecological physics, including applications in art and design. He serves currently on the boards of a dozen scientific journals in various fields.