Natalia L. Komarova & Kimberly A. Jameson

A Quantitative Theory of Color Appearance Similarity Relations.

Abstract: The system for colorimetry adopted by the Commission Internationale de l'Eclairage (CIE) in 1931, along with its subsequent improvements, represents a family of light mixture models that has served well for many decades for stimulus specification and reproduction when highly controlled color standards are important. Still, with regard to color appearance many perceptual and cognitive factors are known to contribute to color similarity, and, in general, to all cognitive judgments of color. Using experimentally obtained odd-one-out triad similarity judgments from 52 observers, we demonstrate that CIE-based models can explain a good portion (but not all) of the color similarity data. We subsequently propose that distance in a CIE model is the first of several layers in a hierarchy of influences that shape triad choices. Other mitigating influences come from language, stimulus set effects, and color preference bias. We create a quantitative model of a lexicographic semiorder type, which shows how different perceptual and cognitive influences can trade-off when making color similarity judgments. We discuss universal and cultural aspects of the model as well as non-uniformity of the color space with respect to different cultural biases.