COLOR RESEARCH AND APPLICATION
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In terms of color, do I see what you see? This is a question that is difficult to answer. When there is obvious disagreement between us on what we are seeing, we may conclude one of us has a color vision deficiency. In our first article "On the colours dichromats see," Alexander D.Logvinenko discusses the differences between what we classify as normal color vision (using 3 types of cone cells) and what people who are missing one type of cone cell (termed dichromats) see when looking at colored lights and also when looking at colored objects. It turns out that what dichromats see is different for object colors than light colors.

While we are discussing color vision deficiencies, let us look further. Sometimes the deficiencies are caused by the genes we are born with, but other times our color vision can be affected by our environment or disease. In the study reported by David Bimler, Claudia Feitosa-Santana, Galina Paramei, Nestor Oiwa, and Dora Ventura the color vision of people exposed to mercury and those people with diabetes are examined. In "Saturation-specific pattern of acquired colour vision deficiency in two clinical populations revealed by the method of triads" they show that there is color distortion, and that individuals in these groups place higher weight on lightness differences to compensate for decreased hue desaturation. The results have implications for stimuli and diagnostic procedures for testing individual differences in color vision, and for analyzing the responses.

Color measurements are usually performed with either colorimeters that report resuls in terms of tristimulus values that can suffer from metamerism, or with spectrophotometers that use many more measurements across the visible spectrum. However, when using spectral data researchers often look for ways to reduce the number of dimensions employed while keeping the greater detail than colorimeters. Often to this end, they use principal component analysis. In "Compression of Spectral Data Using Box-Cox Transformation," Arash Rayat, Seyed Hossein Amirshahi, and Farnaz Agahian introduce the Box-Cox Transformation and examine its effective effectiveness as a pre-calculation step before applying principal component analysis. They find that the Box-Cox transformation is a useful technique that has more impact on the datasets that show a larger departure from a normal distribution.

The International Commission on Illumination (CIE) introduced the CIECAM02 color appearance model in 2004. Since then it has enjoyed wide acceptance particularly in the color management area, but also a number of problems were discovered with the metric. Therefore, Division 8 of the CIE formed a technical committee TC 8.11 to investigate possible solutions for the problems relating to CIECAM02 for practical applications. To this end the chair of TC 8.11, Changjun Li has joined with M. Ronnier Luo, and Zhifen Wang to present "Different Matrices for CIECAM02" in which they incorporate most of the previous TC suggestions and makes some further tests to report the current status of CIE TC8-11 on repairing the CIECAM02.

For our next articles we turn to displays. In the highly competitive display industry, image quality is an important factor. Our first article describes a method for measuring and improving the color image quality. Hung-Shing Chen, Shih-Han Chen, Yen-Hsiang Chao, M. Ronnier Luo, and Pei-Li Sun have developed a method that provides a solution to correct familiar colors on a displayed image, while maintaining the original color gamut and tone characteristic in the cross-display systems simultaneously. It can be applied by using the proposed color palette characterization routine described in their article "Applying Image-based Color Palette for Achieving High Image Quality of Displays."

The second article focuses on wide-gamut, multi-primary displays. Michael J. Murdoch, Dragan Sekulovski, and Ingrid Heynderickx describe a two-part experiment: the first part examines observer preferences for images with increased chroma; the second part evaluates various chroma-boosting algorithms. In "Preferred Color Gamut Boundaries for Wide-Gamut and Multi-Primary Displays," they report that it is clear that viewers prefer an increased chroma image, but not an equal increase for all hues. While this boost in not modeled easily, a content-independent chroma boost created by aggregating preference over many images performs well, on average.

Next we have two articles that discuss effects of illumination on the colors of objects. Some color-constancy algorithms make use of prior knowledge about illumination effects on ensembles of object colors to be found in an image. One such theoretically possible ensemble is the set of optimal-color reflectances, which populate the bounding surface of the object-color solid in tristimulus space. In "Geometric invariants under illuminant transformations," Paul Centore explores properties of the object-color solid (and its bounding surface) that are invariant under illuminant change. For example, as long as the illuminant is nowhere zero in the visible spectrum, optimal-color reflectances take the same Schrödinger form, and no two optimal colors are metameric. Furthermore, all object-color solids have the same shape at the origin: they all fit perfectly into the cone generated by the spectrum locus. The object-color solid for one illuminant can be transformed into the solid for another illuminant, by an easily visualized sequence of expansions and contractions of irregular rings, called zones. These zones emerge from the zonohedral analysis Centore brought to bear on the object-color solid in an earlier article in this journal.

Our next article is "Estimation of Illuminant Chromaticity Based on Highlight Detection for Face Images with Varying Illumination." Skin color is an important topic, not only for pleasing displays, but also for facial recognition, and tracking. However, when the illumination is different, the skin color can vary widely. One can first estimate the illuminant color, then correct for the illumination to get a truer representation of the skin color. Oh Yeol Kwon and Sung-Il Chien propose a simple and effective method to estimate the illuminant chromaticity by using highlights from the facial region. They go on to an elaborate estimation method, which effectively readjusts the candidate points of the highlight regions according to the conditions derived from two ethnic and three illuminant groups.

In the field of textiles and nature, color has long been used to camouflage people, animals or objects for various reasons. As the use of infrared cameras and detection devices has increased, it is not sufficient to consider only the spectral signature in the visible part of the spectrum. Uranous Goudarzi, Javad Mokhtari, and Mahdi Nouri describe the development of "Camouflage of Cotton Fabrics in Visible and NIR Region Using Three Selected Vat Dyes." In particular they not only seek to have the fabric color mimic the colors of green-leafy foliage, but also to have important light fastness and wash ability characteristics to keep the desired effects the clothing over the period of usage.

Adam Pazda, Andrew Elliot, and Tobias Greitemeyer close out our issue with their discussion of "Perceived Sexual Receptivity and Fashionableness: Separate Paths Linking Red and Black to Perceived Attractiveness." There have been many reports of the effectiveness of the color red in women's clothing for gaining attention. See for example, Nicolas Guéguen and Céline Jacob's article, "Color and Cyber-Attractiveness: Red Enhances Men's Attraction to Women's Internet Personal Ads" in Vol. 38:309-312, 2013. However, recently black has been one of the most fashionable colors. In their article in this issue, Pazda, Elliot, and Greitemeyer confirm their dual hypothesis that that red leads to attractiveness via perceived sexual receptivity, while black leads to attractiveness via perceived fashionableness.