COLOR RESEARCH AND APPLICATION
IN THIS ISSUE, JUNE 2014

Our first article in this issue is directed to the printing industry. In "Recovering Neugebauer colorant reflectances and ink spreading curves from printed color images" Thomas Bugnon and Roger Hersch propose a method to recover the Neugebauer primaries, the ink spreading curves, and the Yule-Nielsen n-value using only tiles extracted from printed color images without no prior knowledge about the reproduction device. Applying optimizations of the Neugebauer primaries allows use of the CMYK Ink Spreading enhanced Yule-Nielsen modified Spectral Neugebauer model without printing predetermined patches. By eliminating the need to print the patches, these calibration procedures broaden the field of use of spectral reflection prediction models. The model can be used when it is impossible or too expensive to print extra patches or when the reproduction device is not available.

There is wude spread use of color in printing of maps for example, and on displays including television, computers, and media devices. Realizing that possibly 5% of the user population does not see colors the same as people with normal color vision, there is now a goal to choose colors that avoid creating a barrier for those with color vision deficiencies. Yi-Chun Chen, Yunge Guan, Tomoharu Ishikawa, Hiroaki Eto, Takehiro Nakatsue, Jinhui Chao, and Miyoshi Ayama report on their study investigating the use of three types of color-enhanced images. In "Preference for Color Enhanced Images Assessed by Color Deficiencies" they discuss the enhancements that are most preferred by each group observers (protan, deutan, and normal).

Throughout the color industry we have developed various numerical scales to evaluate the quality a color, such as color difference equations, and the color fidelity index. But we still have the problem of how we convey the relevance of these ratings to users unfamiliar with the rating system? What is good enough for their application? In our next article Peter Bodrogi, Stefan Brueckner, Nathalie Krause, and Tran Quoc Khanh present "Semantic interpretation of color differences and color rendering indices." This semantic interpretation enables non-expert users of light sources to understand the color rendering properties of light sources in terms of common language.

Staying in the area of lighting, "Chromaticity-Matched but Spectrally-Different Light Source Effects on Simple and Complex Color Judgments" is the topic of our next article. With the increasing use of light emitting diodes (LEDs) as common lamps, we are gaining flexibility in the quality of the light. We can choose our lighting to enhance color perception, or improve our own skin attractiveness, or produce the most pleasing color scene rendition. Jennifer Veitch, Lorne Whitehead, Michele Mossman, and Toby D. Pilditch describe an experiment where they show that while one can design several different LED light sources to match the color of a tungsten source, each of the LED sources can have very different results in the tasks mentioned above. This reminds us that this new flexibility can be a boon or a major problem.

In the last issue we discussed the International Commission on Illumination (CIE) technical committee 8.11, which seeks to solve practical problems of CIECAM02. The earlier-posed solutions hinge on adjusting the coordinates for Von Kries chromatic adaptation in CIECAM02, but such solutions seemed unable simultaneously to fit asymmetric matching data and to avoid paradoxical effects of spectral sharpening. Now, in "Chromatic Adaptation by Illuminant-Matrix Products: An Alternative to Von-Kries-Sharpened Primaries," Michael H. Brill and Claudio Oleari discuss a way that offers greater freedom for data fitting. Instead of scaling between an old and a new illumination in a common coordinate system, the new alternative implements adaptation in two stages, one for the input illuminant and one for the output illuminant. Oleari and coworkers earlier introduced the two-matrix solution in the context of color-constancy. The present article applies this structure to chromatic adaptation, and proposes it as a possible solution to the acknowledged problems in CIECAM02.

Although red, yellow, green and blue have held special positions in color discussions for centuries, the experimental determination of unique hue began in the middle of the 19th century. In "Unique hues and their stimuli - state of the art" Rolf Kuehni discusses how far we have progressed. He then gives future challenges to clarify the relationship between lightness/brightness and chroma/saturation on the perceived hue of stimuli, to replicate some findings to improve their statistical validity, and to develop valid mathematical models of the path between light absorption in the cones of the eye and the neural correlates responsible for the experience of unique hues.

Moving on to the preservation of culture and art, mural paintings were exceedingly popular in the 16th and 17th centuries in Portugal. One famous artist, José de Escovar, had a workshop in Évora between 1585 and 1622. Our next article discusses the "Analysis of paint layers color differences within a 17th century mural painting workshop in Southern Portugal by Spectra-colorimetry and SEM-EDS." Milene Gil Duarte Casal, V Serrão, M.LCarvalho, S. Longelin, L. Dias, A.T. Caldeira, T. Rosado, J. Mirão, and António Candeias analyze the material and diagnostic characteristics of the paint layers and pictorial techniques of the Escovar workshop using modern analytical techniques such as visible spectra-colorimetry and scanning electron microscopy coupled with energy dispersive X-ray spectrometry (SEM-EDS) complemented with optical microscopy (OM), micro X-ray diffraction, micro FT-IR and micro Raman spectroscopy.

Before our next article let us stop to picture a beautiful landscape. Looking at natural scenes, in particular green countryside and beautiful flowers gives us a calming and generally enjoyable experience. Hye Sook Jang, Jongyun Kim, Kiseong Kim, and Chun Ho Pak wanted to know more about just how such scenes affect us. In "Human Brain Activity and Emotional Responses to Plant Color Stimuli" they report on their study investigating the influence of 5 different plant color stimuli on human brain activity by analyzing the data in terms of relative parameters of human brain activity and emotional responses. They believe that their results provide a better understanding of the human visual cognitive responses to different plant colors and contribute to the selection of plants for human–plant research.

We close this issue with a communication from Michael H. Brill discussing the "Definition of Chromaticity Coordinates" in the Communications and Comments column. You many think you know what a chromaticity coordinate is, but do you really?