COLOR RESEARCH AND APPLICATION
IN THIS ISSUE, April 2015

How many ways can you use the names of hues i.e., color words? They are not just descriptive adjectives that enhance our visions, i.e., the red ball, or blue sky. They also can symbolize emotions or create warning flags for action. In literature they are used in many varied ways seemingly not related to color. John Hutchings opens this issue with a Note about "Colour Words and their uses."

CIECAM02 has been the topic of many recent articles. In the last issue we had an article explaining computation problems of CAT02 and providing methods for solving the Yellow-Blue and Purple problems simultaneously. Now in this issue a "Refined CIECAM02 for Bright Surround Conditions" is presented. Mobil phones present a particular challenge because their displays are used under such varying lighting conditions. YungKyung Park, M. Ronnier Luo, Changjun Li, and Youngshin Kwak joined together to study the usefulness of CIECAM02 for cell phone displays. They first derived a set of equations based on surrounding conditions to be able to define surround parameters accurately. Then they developed a refined version of CIECAM02, MobileCAM-v2, which significantly improved the performance of CIECAM02 for bright surround conditions, improving in predicting the visual results for mobile phone displays.

When using various electronic displays, if one is going to spend a long time reading material on the display, then visual comfort becomes an important issue. In our next article Li-Chen Ou, Pei-Li Sun, Hsin-Pou Huang, and M. Ronnier Luo describe a study the performed involving the results of two experiments studying visual comfort in which parameters that were varied included the type of display, luminance levels, luminance contrast between the text and background, and the observer's age. In "Visual comfort as a function of lightness difference between text and background: a cross-age study using an LCD and a tablet computer," they propose a theory of "ceiling effects" of the maximum display luminance on perceived visual comfort as a function of text-background lightness difference, i.e. the relationship between visual comfort and luminance contrast varies with the maximum display luminance.

Our next article is "Constant Hue Bands in Boundary Colors Discovered Using a Trichromatic Model." In a simple case boundary colors are colors seen at the edge or fringe as white light passes through a narrow slit and the colorimetry of this phenomenon is well understood. However, there are also other cases where boundary colors appear when using patterns of alternating black and white. In this article Louis Adams and Carl Jennings report on a study of 7 cases of this kind using a new appearance model for boundary colors. They challenge that their appearance model will open up new possibilities for color science research.

From researching the scientific aspects of color, we go to the realm of color creation. In the next article Guosheng Hu, Mingmin Zhang, Zhigeng Pan, Ling Lin, Abdennour EL Rhalibi, and Jianwen Song introduce a toolkit in which a six-variable model generates a user-preferred color scheme. In "A User-Oriented Method for Preferential Color Scheme Generation" they show a constructive method of representing color combination in color relations by which features of color combination can be embodied color relation attributes rather than the summation of individual color

components. They explain that this method pioneers a new way of understanding color combinations, and makes color combinations easier to analyze.

Next we present several application areas in our next four articles: food packaging, forensic analysis, sports shoes, and dental restorations. First, in "Psychophysical Models of Consumer Expectations and Colour Harmony in the Context of Juice Packaging," Shuo Ting Wei, Li-Chen Ou, M. Ronnier Luo, and John Hutchings report on two new models that predict consumer expectations of freshness, quality, taste, and color harmony as a function of the consumers perception of the color images on the packaging of fruit juices. One model is a color harmony model and the other is a freshness model.

In the next application Daniela Feraru, Maria Mihaly, and Aurelia Meghea document a forensic analysis for discrimination of a series of ballpoint pastes in order to identify the chromatic components used for blue ballpoint pen inks, and in order to identify the writing instrument used in a questioned document. For this analysis, first a database of known ink pastes for pen is obtained and corroborated by various techniques including: X-ray fluorescence spectroscopy; ultraviolet - visible -near infrared spectrophotometry (in both diffuse reflection and transmission modes and completed by trichromatic analyses); and thin layer chromatography. In "Chromatic Analysis of Blue Ballpoint Pen Inks and Related Dyes" they propose a protocol consisting in 4 steps, in which various components provided by a data base of reference dyes are removed, selected, and combined in order to assess the possible identity of an unknown pen ink paste among a set belonging to the same color pallet

Our next article is about developing the color combinations and design of sports shoe exteriors to meet the expectations and preferences of the customer. Meng-Dar Shieh and Yu-En Yeh describe "A Comparative Study on Perceptual Evaluations of Sports Shoe Exterior Colors in Taiwan." To design their study, six leading sports shoe brands of 2013, namely, New Balance, Puma, Mizuno, Nike, Converse, and Adidas, were selected as the research targets. They examined the current use of solid and trim color on the shoe exteriors. They also surveyed users' emotions based on perceptions and psychological feelings toward the appearance of sports shoes. Then they had participants evaluate realistic color schemes that they had developed for the sport shoe to determine the influence and correlations of Color Area and Color Quantity on the preferences of the participants. Their findings include: 1) Black and white designs were perceived to be more suited to formal occasions, 2) The participants preferred 2-color over 1-color designs, and 3) Women and men evaluated the samples differently both by what parts they looked at and the time to make a decision.

While it is fairly easy to determine the correct size and shape of replacement tooth covers, it is very difficult to select the correct color to coordinate with the other teeth in the patient. Shade Tabs have been used for a number of years to offer the dentist an array of the possible colors for the replacement part. In our next article Cristina Gómez Polo, Miguel Gómez Polo, Alicia Celemín Viñuela, and Juan Antonio Martinez Vázquez de Parga report on a "Study of the Shade Tabs of the Toothguide 3d Master Through Cluster Analysis." Cluster analysis showed the Shade Tabs could be divided into 5 groups with a 3 dimensional grouping that improved the color selection process over the current 2 dimensional arrays used.

Having learned about all the new scientific ideas and application discussions in

these earlier articles, let us end by settling back to read about a "Mood Lighting System Reflecting Music Mood." Chang Bae Moon, Hyun Soo Kim, Dong Won Lee and Byeong Man Kim report on a study showing how lighting system employing selected coordinated colors relating to the music being played can enhance the overall response of the listener/observer. Careful selection of music and lighting can promote a stronger emotional impact.

We close the issue by featuring one Publication Briefly Mentioned.   The work of CIE technical committee 2.60 has culminated in a new CIE Publication 214:2014 Effect of Instrumental Bandpass Function and Measurement Interval on Spectral Quantities, which has the same name as the TC and is now available through the CIE webshop.