



Inter - Society Color Council Newsletter

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*Cover Photo: Kroon Hall, Yale School of Forestry & Environmental
Studies. Photo by Amy Woolf.*

Board of Directors Corner

ISCC News November 2019
Dave Wyble

Dear Members,
It is great to be writing you again, but I first want to thank you for reading this newsletter and staying connected with the ISCC! Our website iscc.org, and ISCC News are the most important communications tools we have. That you have chosen to spend your valuable time here says that the ISCC, its mission, and the greater color community are all important to you.

By way of introduction, I am currently the ISCC President-elect, and will succeed Renzo Shamey as President in January 2021. I have served on the Board of Directors twice, first from 2009-2011, and more recently from 2015-2017. My first interaction with the ISCC was a technical presentation in 1998 at the Annual Meeting in Baltimore. I have been involved ever since. I also work with other organizations, including our member bodies CORM (Council for Optical Radiation Measurements) and IS&T (Society for Imaging Science and Technology). My approach to color is definitely from the side of color measurement and color physics.

One of the most exciting professional activities I have ever participated in was the ISCC/AIC Munsell 2018 meeting in Boston last year. This was the first time in many years that the ISCC lived up to its true mission, with attendees and presenters representing all areas of color, as shown by the three sides of the triangle in the ISCC logo: science, art, industry and education. When

all of these roles are in attendance, the possibilities for interaction and communication are endless. For too long we have struggled with fostering these relationships. When the organization is run by scientists and engineers, it is no surprise that the meetings take a technical slant that makes them very unattractive to artists and others in the color aesthetics community. But if we do not interact, then we all perform our jobs independently. What good is it for a designer to specify a color that no system can even produce? Why should an ink producer design a spot color that no one would ever specify? Why should a color researcher design an algorithm that no one in industry will ever use? These are simplistic examples, but with them I try to show how we all can benefit when we communicate across our usual "silos."

Finally, in the spirit of communication, I'd like to tell you about two important activities coming up that you will want to participate in. First, we have two great webinars scheduled for this fall. On October 22, Dr. Tony Stanton presented "Color Management in the Graphic Arts," and on November 19, Mr. Roland Connelly will present "Comparison of LED Lighting Adopted by Retailers to Typical LED Spectra Adopted by the CIE." You can register for webinars from links on this page: iscc.org/SeminarSeries. Look for more webinars in the new year, when we will begin to focus on the second activity I want to highlight, our next Annual Meeting: "Color Impact 2020." This joint meeting with the International Association of Color Consultants – North America (IACC-NA) will be held at historic Yale University, in New Haven, CT on June 7-10. The details for this meeting will be forthcoming. Visit colorimpact2020.com for the latest information.

The ISCC is in a very good place right now. We have a bright future, involving the technical and creative sides of color, and all the space on the spectrum in between. Perhaps



Dave Wyble, ISCC President-elect

the most important thing we can take away from these collaborative interactions is this: we all regularly experience color personally and professionally; we all make color; we all use color; we all communicate color; and we are all affected by color. As we each sit in our place along the continuum of color expertise, one goal of the ISCC is to understand how where we sit affects the rest of that continuum, and what each of us can learn from the others.

Dave Wyble

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CIE 2019 Quadrennial Meeting



From June 17-21, I attended the 29th Session of the International Commission on Illumination (CIE) which was held in Washington, DC at the Marriott Wardman Park Hotel, near the Woodley Park and the Smithsonian National Zoological Park in the northwest region of the city. The venue was really lovely with a culturally diverse neighborhood feeling. The Marriott Wardman Park Hotel is very large and located just a block up from the National Zoo metro station, making it easy to find.

As is the case for these once-every-four-years meetings, there were many attendees from all over the world. There were three invited papers, 355 submitted papers broken up into 94 oral presentations, 31 presented posters and 119 poster papers. The conference was split into optical properties of materials, visual aspects of light and photometric properties of light and lighting. There were three days of technical presentations, discussion sessions and workshops. Then there were two and a half days of division business meetings and technical committee meetings.

The three invited papers were given at the beginning of each technical session. On Monday, Dr. William D. Phillips of the National Institute of Standards and Technology spoke on "The Historic Revision of the International System of Units." In case you missed it, 2018 saw a new international agreement on the SI units with some minor adjustments to some of the constants. On Tuesday, Dr. Luc Schlangen of Phillips Research Laboratories in Eindhoven, the Netherlands spoke on "Non-Image Forming Effects of Light and Lighting: New Insights and Metrics" which dealt with the myths and new understandings of the

non-image related light sensors in the retina that have caused the "blue light" phenomenon. On Wednesday, Dr. Kevin van den Wymelenberg, Associate Professor of Architecture at the University of Oregon, spoke on the theme of "Light the UNseen: Research at the Interface of Architecture, Energy Engineering, Microbiology and Daylight and Newfound Gaps." His talk addressed using more natural lighting and more efficient lighting.

The individual paper sessions were not given names but only numeric codes: Oral Papers OP1 through OP94, Presented Posters PP1 through PP 31 and eight workshops, WS1 to WS8. The workshops were presented by the divisions on some relevant topic related to current problems in light and lighting. Workshop 1 was Research Methods for Investigating Light Source Color Rendition. The issues here are that different approaches to assessing the rendering of color by a light source yield different metrics and some lamps outperform others in one metric but not in another metric. So, there is a desire to characterize and specify the metrics and the methods of obtaining the metrics.

Workshop 2 was Measuring Temporal Light Modulation and Assessing its Effects on Viewers: Moving Towards Setting Limits. This workshop was sponsored by Division 3 on physiologic aspects of lighting and dealt with issues related to how flickering light sources can negatively impact some portion of the population, including the potential to produce grand mal seizures.

Workshop 3 was presented by Division 4 and spread out over three sessions. It covered topics related to assessing the long-term maintenance of lighting, including LED street light luminaires and professional LED luminaires. Workshop 4 was Color Quality of Light Sources. There has been much recent public discussion concerning the potential deleterious

effects of LED lighting, the so-called “blue light effect” Workshop 5, entitled Use and Application of the New CIE S 026:2018 Metrology for IPRGC-Influenced Responses to Light – Specifying Light for Eye- Mediated Non-Visual Effects in Humans, addressed this issue by explaining how to specify and tolerance the impact different amounts and qualities that light on the non-image producing light sensors in the retina.

Workshop 6 covered horticultural lighting. Workshop 7 was a joint workshop between Division 8, the Optical Society of America and the Society for Imaging Science & Technology and was entitled Color Imaging, Perception and Reproduction: New Directions in Color Science and Technology. Workshop 8 presented a way forward: Toward an Integrated Discomfort Glare Measure Based on the Human Visual System. Apparently, even though discomfort glare has been studied and reported

at many CIE meetings in the past, there has never been any agreement on how to quantify it. Hopefully, the results of this workshop will change that situation.

For this review, a list of the topics and summaries for every one of the 355 papers would be too much. Fortunately, the CIE took a unique stance with this meeting. All of the papers are available online without cost. You can access the papers at the following website: <http://www.cie.co.at/publications/cie-session-washington-2019>

Danny C. Rich

A meeting of this size could not happen without a lot of sponsors. The major sponsors are listed in the table below and there were many other sponsors at the “friend of the CIE” level who are not listed.

Sponsors	
Everfine	Gold sponsor
Illuminating Engineering Society	Gold sponsor
Sensing Optronics Co., Ltd	Gold sponsor
Cree, Inc.	Silver sponsor
Konica Minolta Sensing Americas	Silver sponsor
LMT Lichtmesstechnik GmbH	Silver sponsor
Eaton Cooper Lighting	Silver sponsor
UL	Silver sponsor
Instrument Systems Optische Messtechnik GmbH	Bronze sponsor
International Association of Lighting Designers (IALD)	Bronze sponsor
Labsphere, Inc.	Bronze sponsor
Virginia Tech Transportation Institute	Bronze sponsor

2020 Nickerson Service Award Call for Nominations

The ISCC Nickerson Service Award was established by the Board of Directors at a meeting held on February 3, 1980. This award is presented as the occasion arises but no more frequently than once a year. The Nickerson Service Award is presented for outstanding, long-term contributions towards the advancement of the Council and its aims and purposes. The contribution may be in the form of organizational, clerical, technical or other services that benefit the Council and its

members. The candidates must be members of the Council and must have been active in the affairs of the Council. A list of previous recipients is here: <https://iscc.org/page-18112>

Please use this form to submit nominations for the 2020 Nickerson Service Award, and email your nomination to isccoffice@iscc.org <https://iscc.org/resources/Documents/PDFs/UniversalNominationForm.pdf>

Color Literacy Project Update

A four-year Color Literacy Project was approved by the ISCC board in August 2019. The purpose of the project is to identify and address the most basic, current misconceptions and misinformation about color, and build a bridge between the art and science of 21st century color education.

The objective of the project is to develop a foundational color education website to provide state-of-the-art, introductory, interdisciplinary information and materials on the art and science of color for use in classrooms. The scope of the project includes outreach to general educators as well as science and art teachers from preschool programs through undergraduate university programs. The color education website will include scaffolded information and materials based on the US Next Generation Science Standards and the US National Visual Arts Standards at the following educational levels:

• **Levels 1 to 4: Age groups 3-6; 6-12; 12-15; 14-18**

• **Level 5: University - Foundational Courses**

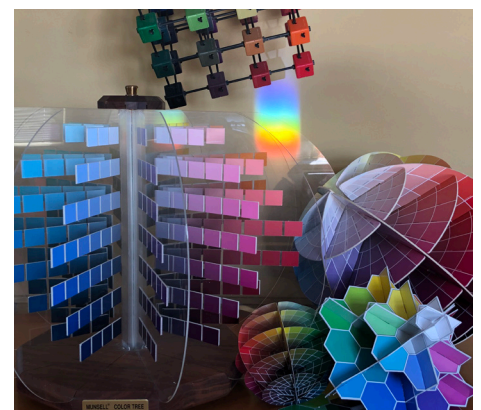
• **Level 6: Industry - Foundational Courses**

The website could also be used to educate color curious adults and

color professionals on foundational concepts outside their discipline. It will include visual easy-to-understand, age-appropriate explanatory text and color educational resources designed to:

- *Emphasize hands-on, experiential education*
- *Work with STEAM (Science, Technology, Engineering, Arts, Math) programs*
- *Be available at low or no charge*

The first phase of the project - research on different models of color education and development of teaching materials for test sites -- is currently underway. Results of the first phase will be presented at the Color Impact 2020 conference at Yale in June 2020.



*Sun shining through the optical glass prism,
Maggie Maggio*

Hue Angles: Black to the Future Redux

A bit more than a decade ago, Hue Angles presented an article called “Black to the Future” [1]. To further darken a black carbon surface, investigators in Rensselaer Polytechnic Institute and at Rice University roughened the surface by a carpet-like arrangement of carbon nanotubes (.01” long, 1/30,000 as wide) standing on their ends. The result was a surface with a reflectance as low as 0.045 percent (three times darker than any previous material) and a refractive index that could theoretically be as low as 1.01 [2]. We proposed possible uses for such a material in spectrophotometry:

1. Black surfaces for minimizing stray light in optical instruments

2. Light traps for suppressing unwanted diffraction orders

3. Gloss traps for removing specular reflection

4. Black calibration standards

Now, after more than a decade, how well did our wish-list work out? Not well, at least for commercial applications. At the ISCC topical meeting on black and white, held that very same year, it became clear that the carbon nanotube technology was too delicate and too expensive for our purposes. But the technology evolved and improved anyway, and new uses were found.

Beginning in 2014, Surrey NanoSystems issued a product called Vantablack, which reflects 0.04 percent of UV, visible, and IR radiation. Vantablack had the same mechanical vulnerability as its predecessors, so it did not find many applications on Earth. However, in space the substance could be undisturbed, and starting in 2015 helped capture stray light to enhance spaceborne imagery (e.g., tracking stars) without a large payload penalty. Also, back on Earth, it achieved an effect that was coveted by artists: three-dimensional objects covered with Vantablack would appear to be flat surfaces because not enough light was reflected to reveal the 3D topography. BMW even painted a car with Vantablack. By 2017, a version of Vantablack (S-VIS) became available in a spray-on form. The reflectance was understandably not quite so low in this form: 0.2 percent. But the material still served its various functions. Although Vantablack is not commercially available, Surrey NanoSystems has licensed the product.

Now there is a material that is still blacker. It emerged from laboratories in Shanghai Jiao Tong University and at Massachusetts Institute of Technology [3], and has a reflectance of 0.004 percent. The discovery was accidental, during attempts to grow carbon nanotubes on aluminum foil. To avoid the formation of oxides between the nanotubes and the foil, the investigators soaked the foil in salt water and moved it into a small oven where the nanotubes could grow without oxygen interference.

tor [4] describes two implications of the new black technology. There is a \$2 million diamond on exhibit in the New York Stock Exchange that has been covered with the material and is invisible on a background of similar black material. Specktor speaks poetically of the black material “eating” the diamond and that it is a “veritable black hole.” Indeed, as he suggests, we may soon be able to see real black holes if the new black material is deployed to optical instruments in space. But I don’t expect to see signs with the words “Schwarzschild radius” on any photos, though we have seen cartoons of other human-created follies (such as Pluto bedecked with the sign “am too a planet.”) Enough about black holes...

In summary, the last ten years have brought a factor of 10 reflectance decrease in the blackest black. We’ve achieved a decade in a decade. Stay tuned for the next decade.

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Send contributions to mbrill@datacolor.com

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A popular article by Brandon Speck-



Humans perceive color through the stimulation of three types of cones in the eye. Thus, a system of tristimulus integration is the foundation of color science. One such system was established by the International Commission on Illumination (CIE) in 1931 for visually matching a color under standardized conditions against the three primary colors (red, green, and blue). A transformation of the resulting tristimulus values are known as CIE X, Y, Z tristimulus values. Can a system of tristimulus integration be developed from the basic tenets of linear algebra? Seeking to answer this question **Hugh Spencer Fairman** analyzes the colorimetric operation of tristimulus integration from first principles by using the basic operations of linear algebra. In the article ***"The Fundamental Theorem of Tristimulus Integration,"*** he describes the derivation of a tristimulus integration and then compares the results with the CIE system.

Starting with a system to specify a color using measurements and relating the specification to the human perception of the color, many color appearance models ranging in complexity have been developed for object colors. However, there have been only a few attempts to extend these models to self-luminous stimuli. These self-luminous stimuli include traffic lights, luminaires, electronic displays, and many more materials. Also, the self-luminous color can be extended to those in movies and televisions and many other things found in the world today. As a beginning, **Thanh Hang Phung, Frédéric B. Leloup, Kevin Smet and Peter Hanselaer** are ***"Assessing the Application of an Image Color Appearance Model to Basic Self-Luminous Scenes"*** in their article with the same name. They begin

with the iCam model developed by Fairchild. Their study shows that iCAM, when applied to simple self-luminous scenes is reasonably successful in predicting the influence of background luminance, background size, saturation and stimulus size on stimulus brightness. They call for a new, more comprehensive image color appearance model dedicated to self-luminous scenes that would be more powerful and able to describe complex scenes.

Colored shadows have fascinated scientists and lay people for centuries. In our next article ***"Coloured Shadows - Why They Can Be Photographed"*** **Cecilia Sik-Lanyi, Veronika Szücs and Robert Hirschler** review the history and explanation of these shadows, then photograph the shadows both with conventional (color slide film) and digital cameras in an effort to explain why the unexpected color of the shadows appears in these photographs. They show that colored

investigate the advantages of using multispectral images instead of RGB images for saliency detection within the framework of unsupervised models. The increase in the availability of multispectral and hyperspectral cameras has facilitated substantial advances in fields such as robotics, remote sensing, satellite imaging, medicine, food control and even object detection. In their article ***"Improving Unsupervised Saliency Detection by Migrating from RGB to Multispectral Images"*** they present the findings of their study, which was aimed at evaluating the decision of stepping up to multispectral images when one has been using RGB images in the past. Such situations arise in the surveillance and security field (to detect objects or events of interest in urban scenes using modified camera surveillance devices to make them multispectral), as well as the active monitorization of the state of preservation of the elements present in urban scenes.

Color Research and Application IN THIS ISSUE Vol. 44 Issue #488, December 2019 By Ellen Carter

shadows are excellent tools for the demonstration of adaptation and simultaneous contrast. Share and enjoy this article.

When you look at an image, what commands your immediate attention? It may be a face or the particularly brightly colored flower. In the creation of art or the advertising of a product, selecting the most salient feature is important for communication between the artist or the manufacturer and the person looking at the image. **Miguel Á. Martínez, Sergi Etchebehere, Eva M. Valero and Juan L. Nieves**

In ***"Subjective Evaluation of Natural High-Saturated Images on a Wide Gamut Display"*** **Erika Kumakura, Katja Schmid, Kazuhiko Yokosawa and Annette Werner** explore observers' preferences relating to chroma in the images. They report on two experiments, the first of which determined the viewer's most preferred level of image chroma. The second experiment investigated the viewer's subjective evaluation of images that were less or more saturated than the previously most preferred one. They found that the increase of the image chroma can improve the impression of the images

on wider color-gamut displays. If presenters desire stronger images, they can simply increase the chroma of images to a slightly higher level. This change should enhance viewers' perception of greater strength without decreasing viewer preference, but can have a substantial influence on the impression images have on viewers.

With the ever-expanding number of light sources, the use of metamerism can bring great benefits to the relevant fields of light source quality control. The authors of our next article used a statistical sampling method to obtain practical long, medium and short (LMS) cone fundamentals to evaluate metamerism degree of a light source. In *"Study on Metamerism Degree Evaluation Based on LMS Weighting Algorithm,"* **Danqing Chen, Wen Xie and Xiaoxia Wan** introduced their new system and verified the validity and universality of the proposed LMS-weighted general metameric index. They also evaluated their proposed method based on statistically sampling results of 1000 observers given by Fairchild and Heckaman.

Bilge Nazli Altay, Alexandra Pekarovicova and Paul D. Fleming explain how to save money while helping the environment by making use of leftover base inks from the printing process. Disposal of ink can raise environmental concerns and require critical disposal procedures subjected to laws and regulations, which can be expensive. In their article *"Formulating Pantone Colors by Unused Base Inks, Formulation Software, and A Spectrophotometer"* they describe the use of extra remaining inks. The process involves gathering the spectral data of unused base inks, using formulation software to select how to mix the leftover inks to generate new colors, then incorporating those colors into print production for small volume jobs. They tested the procedure by formulating 30 different Pantone colors for oil-based offset printing

using unused base inks with their CIE $L^*a^*b^*$ values and a commercial formulation software.

Black coatings and materials with high light absorbance are capable of absorbing photons at visible and longer wavelengths effectively, thus reducing unwanted stray light in optical systems. Several carbonaceous pigments were synthesized for the first time from waste materials, and their optical properties in the visible and near infrared ranges were studied by **Narges Kiomarsipour, Mohsen Ghasemi and Kamal Ghani**. They investigated the new pigments' structure, morphology, and optical properties using a spectrophotometer, and a scanning electron microscopy. The results showed that the mesoporous structures of the synthesized materials had very low reflectance (~ 0.5% or less) that was much lower than carbon black reflectance. The description of their research of these new black pigments is given in *"Synthesis and Evaluation of Several High Absorbance Black Pigments for Spacecraft Thermal Control Coatings."*

The first of two articles coming from the field of gemology is about Zultanite. Zultanite is the trademarked gem variety of the mineral diaspore, which is mined high in the mountains of southwest Turkey. Under different light sources the color of zultanite can appear to be yellowish green, light gold, or purplish pink. Some minerals (used as gems) exhibit a change in color from greenish in daylight to reddish tones in incandescent lighting. This phenomenon was named the Alexandrite Effect in the early 1800s. **Danyi Zhou, Taijin Lu, Ruoduan Sun, Guanghai Shi, Hua Chen and Jie Ke** provide the *"Explanation of the Alexandrite Effect of Zultanite: From the View of Colorimetry and Chemical Analysis."*

In the second gemological article, **Jun Tang, Ying Guo and Chang Xu** discuss the choice of light source for

the grading and display of the gem peridot. Their research examined the color appearance of peridot in six CIE light sources: Standard illuminant A, F12, F11, F2, D50, and standard D65) using the CIE1976 $L^*a^*b^*$ uniform color space system and round RGB diagram system, aiming to determine the most efficient light source for peridot color grading and display. In the report *"Explanation of The Alexandrite Effect of Zultanite: From the View of Colorimetry and Chemical Analysis,"* they found the standard light source D65 is better for distinguishing the hue of peridot especially when the hue is calculated by round RGB diagram system, which was first established by Ichiro Kasajima in 2016.

In the last issue of Color Research and Application in 2018, **Rengin Kocaoglu and Nilgün Olguntürk** published the article "Color and Visual Complexity in Abstract Images" [Color Res. Appl., 2018, 43:952-957]. Now in this issue the authors provide additional research results in *"Color and Visual Complexity in Abstract Images: Part II."* They continued their research on color and visual complexity, and visual interest, in Part II by generating Kandinsky-like abstract image in which they could change the colors systematically. Participants were asked to rate 19 specially generated abstract images according to the level of visual complexity and visual interest with a 5-point scale. Analysis in this study found an inverted U-curve relationship between average Delta E values and both visual interest and visual complexity in abstract images. This study revealed this relationship between color (in terms of color differences between portions of the artwork) and the complexity field, visual interest and visual complexity and brought a new understanding of the fields of visual interest and visual complexity, which was pioneered by Berlyne.

Colors are commonly described in terms of three aspects, e.g. Munsell hue, value and chroma. However,

other researchers have suggested supplementing additional terms. For example, Berns introduced an extension of the CIE L^* , a^* , b^* system by adding Vividness (V^*ab), Depth (D^*ab), and Clarity (T^*ab). During the Japanese Edo period, a color concept known as “48 Teas and 100 Mice” was used to describe tans and browns that seem to have a certain weight or solidness to them, muted colors with paradoxical richness, as well as muddy colors with white or gray undertones and deep colors with black undertones. All of these colors are still commonly used in Japan, often product and commodity design. **Sungmi Oh and Hyunjung Kim** suggest a secondary color aspect **“Perceived Density, a Further Attribute of Color, Revealed by the Colors Favored in Japan.”** The perceived density of color is a phenomenological quality that represents how dense and filled, or thin and airy a color appears.

While we are talking about the perception of stimuli, in our next article **Stijn Valentijn Mentzel, Linda Schücker, Norbert Hagemann and Bernd Strauss** tell us that when **“Perceiving Speed – The Color Can Matter.”** The authors are talking about athletic performance, in cases where the judge’s perception of speed is part of the evaluation of the event such as figure skating, diving, gymnastics, and dynamics in synchronized swimming and rhythmic gymnastics. It is very different from the issue of color for rapid identification of a teammate or the perceived dominance, danger or aggressiveness of an opponent, or even as a crowd-unifier by the color of the home team. The goal of this study was to examine speed perception by observing the color effects present in a non-competitive individualized sport environment, specifically a person running on a treadmill. The experiment results showed a significant color effect for perceived running speed, with participants perceiving runners who wore a red jersey as running at higher

speeds than those in blue, even though the sport context examined was individually performed and non-competitive in nature. This result agrees with previous studies showing that colors can influence time-related parameters, for example, response time and perceived duration of color exposure.

The color preferences across different countries have been widely studied and much commonality between countries is apparent. However, it has been found that the preference of people in China has its own pattern, which was yet to be studied in depth. Therefore, **Yujing Zhang, Pingping Liu, Buxin Han, Yang Xiang and Ligin Li** undertook a study of **“Hue, Chroma, and Lightness Preference in Chinese Adults: Age and Gender Differences.”** They found a unique saturated color preference pattern characterized by red, cyan, and blue being preferred the most, and orange the least. Females liked lighter colors such as a cyan, white, and pink and disliked red, orange, and dark colors more than males did. As people aged, their preference for orange and dark colors increased, while that of bluish colors, purple, black, yellow, white, and light colors decreased.

Pre-Columbian Andean textiles are highly valued for their use of color and the quality of their dyes. In **“Andean Colors: A Colorimetric Registration in Pre-Columbian Textiles from Northern Chile,” Soledad Hoces de la Guardia, Lina Cárdenas, Paulina Brugnoli and Paulina Jelvez** report on an extensive colorimetric study of 42 textiles pieces with a total of 203 colors mostly provided by the Chilean Museum of pre-Columbian Art (MCHAP). The recorded colorimetric data contributes to the preservation of cultural heritage and the esthetics of current Chilean identity, and they can be used in new industries, contexts, and applications. Hoces et al explain that the most critical finding in this research was the relevance of the color red, since the majority of the pieces analyzed are of that hue.

The abundance of shades and their differences could represent different interpretations derived from a common origin: Pachamama (mother earth) blood, feminine, and fertility.

Whether it is a pre-Columbian weaver making textile products or a modern merchant selling their wares, they are always looking for ways to gain the attention of the potential purchaser. The color, the texture, the quality all come into play in the decision-making process, but what about when the producer is distant from the potential buyer and the product is being sold online? **Hosam Al-Samarraie, Atef Eldenfria, Joana Eva Dodoo, Ahmed Ibrahim Alzahrani and Nasser Alalwan** identified and analyzed the causal relationships between the different product design elements that are necessary to stimulate consumers’ decisions to buy products when shopping online. They then went on to model the process. Observation of product design elements’ interaction implied that there is a significant relationship between graphics and colors, colors and packaging materials, colors and shape and size. They present their model in **“Packaging Design Elements and Consumers’ Decision to Buy from the Web: A Cause and Effect Decision-Making Model.”**

The next two articles deal with materials where preservation of color is important in the consumer’s acceptance of the product. In the first study, since drying the mushrooms is one of the most effective ways to extend the shelf life, the possibilities of protecting the color of dried golden and pink mushrooms were investigated. In **“Artificial Neural Network Approach for Protection of the Color of Dried Golden and Pink Oyster Mushrooms with Pretreatments” Ayşenur Gürgen and Sibel Yildiz** determined the color parameters of dried mushrooms modelled by artificial neural network (ANN). All mean absolute percentage error values of models were determined lower than 4.0%. It

was concluded that artificial neural networks can be a good way to predict the color of dried golden and pink mushroom (pre-treated or not) with a high degree of accuracy.

In the second study **Mustafa Zor, Ahmet Can and Douglas J. Gardner** investigated the pretreatment of wood. The aim of this study was to examine the effect of heat-treated lignocellulosic filler on the surface characteristics and decay resistance of the wood flour/Styrene Maleic Anhydride composites. The study, **"Surface Characterization of Weathered and Heat-Treated Wood-Based Composites Reinforced by Styrene Maleic Anhydride,"** showed that color changes developed when heat-treated filler rate is increased in this material. Decay results showed that thermally modified wood has lower mass loss caused by fungal attack than untreated wood material.

Mayuko Iriguchi has been interested in color perception and cognition, particularly for women during their menstrual cycle and in menopause. Earlier this year, an article was published on the "Correspondence Between Colour and Odour for Women in Menopause." Now in this issue, she is joined by **Hiroki Koda, Takamasa Koyama and Nobuo Masataka** to report on the **"Modulation of Visual Attention Assessed Using the Stroop Task During the Menstrual Cycle: Comparison Between the Menstrual and Ovulation Phases."** They investigated attentional interference between colors and emotional facial expressions for women in the menstrual cycle compared to the ovulation phases by color judgment. Although an interference effect was not observed when the participants were asked to identify colors, results showed better performance in the menstrual phase than in the ovulation phase. But in the scrambled face stimuli task, only the reaction time only for happy scrambled face shape and red did not differ between the phases.

In the Communications and Comments Section we have two contributions. First, **Kimberly Jameson and Michael Webster** have written an Op-Ed **"Color and Culture: Innovations and Insights Since Basic Color Terms - Their Universality and Evolution (1969).**

While the studies had begun earlier, it was with the publication of their book, *Basic Color Terms - Their Universality and Evolution*, that Brent Berlin and Paul Kay set in motion a half-century of research studying color naming and categorization from different ethno-linguistic societies. While we pause to remember Berlin and Kay's contribution, we can wonder and be amazed at its continuing effect for research by linguists, anthropologists, cognitive scientists, and perceptual psychologists, who are still contributing to our understanding of the behavior and beliefs of humans from very different societies, which can be understood according to general universals.

Second, we have a Communication by **Rashid Heidari-Moghadam, Alireza Mortezaapour, Saeedeh Mosaferchi and Iman Dianat** entitled **"Colour and Ergonomics: On the Selection of a 'Colour of the Year'."**

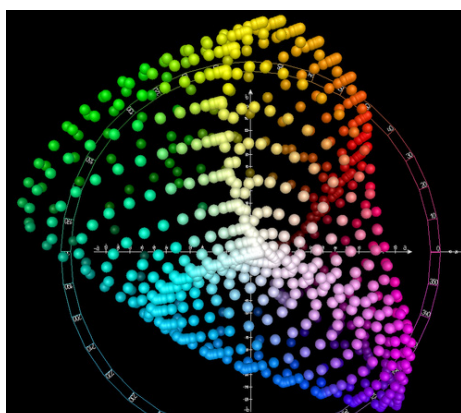
Ergonomics could be defined as the study of people's efficiency in their working environment, or the science of fitting a workplace to the user's needs. The goal of ergonomics is to increase efficiency and productivity and reduce discomfort as one works. Can color help this? The answer varies depending on the task and the person involved. Can a selected "color of the year" highlight a goal or issue, improve sales, enhance safety, etc.? What do you think?

ISCC Webinar September & October Summary

Jodi Baker and Ann Laidlaw presented a webinar on “Introduction to CIELAB” on Sept 24, 2019. The webinar was attended by 54 people, most of whom reside in the US, with a few attendees from Asia and Europe. The presentation included basic information about how we describe colors with numbers, and how we describe color difference between a sample color and a standard color. Best Practices for visual and instrumental colorimetry were reviewed. The webinar was recorded and can be viewed by ISCC members at:

<https://iscc.org/Members-only-content>

The ISCC hosts free webinars open to the public on a range of topics. The webinars are either foundational information, previously published/presented content, or aligned with our upcoming conference. Please reach out to us at seminars@iscc.org if you would like to suggest a



Cielab color space. Image source: iscc.org

**22 Oct 2019
2pm EDT**

Tony Stanton: *Color Management in the Graphic Arts*

Abstract:

This webinar from the Inter-Society Color Council illuminates the sometimes-mystifying world of color management in the graphic arts. The term color management means different things to different industries. The color characteristics of textiles, paints, and theatrical lighting, for example, all rely on precise management of color to maintain consistency and predictability. In the graphic arts, ICC-based color management is woven through the digital workflows that typify today's graphic production processes. In graphic media, color management describes the techniques used to produce consistent color appearance across different instances where an image is displayed.

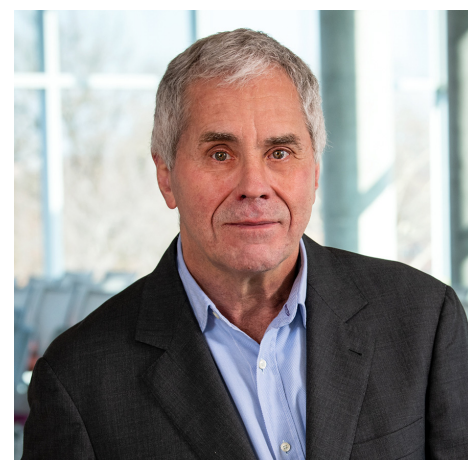
Bio:

Anthony Stanton is a Teaching Professor and Director of Graphic Media Management for the Tepper School of Business at Carnegie Mellon University (CMU).

In addition to teaching, Stanton is responsible for developing the

curriculum, administering over adjunct faculty, and advising students in the graphic media track. Stanton has held this position since 1996. In 2003, he received an award for sustained teaching excellence.

Prior to teaching at CMU, Stanton spent twelve years as Director of Process Controls for the Graphic Arts Technical Foundation. In this position, he was responsible for designing and overseeing the manufacture of quality control devices for the printing industry. He also performed research on print analysis and color reproduction. During his tenure at GATF, Stanton introduced whole-process test forms into the product line, which previously included only individual devices. He also introduced digital targets (and later, native PostScript targets) into the Foundation's product line.



Anthony Stanton. Image source: cmu.edu

Upcoming ISCC Webinars:

19 Nov 2019
2pm EST

Roland Connelly: *Comparison of LED Lighting Adopted by Retailers to Typical LED Spectra Adopted by the CIE*

Abstract:

Many retailers have adopted LED lighting for their stores, and many of them have different characteristics. The CIE has adopted a number of "typical" LED spectra that hopefully represents the majority of types of LEDs that retail, brands and industry are currently using. Using both current methods, such as CRI and CCT as well as newer TM30-18 as well as several other metrics, the variability among all these different LEDs is analyzed. This all relates to the ability of retailers and their worldwide supply chains to effectively communicate about color, both visually and instrumentally.

Bio:

Roland, with RoLyn Group, is currently working part-time as a consultant to industry in matters related to color, lighting and color supply chain management.

Roland was the Director, Global Digital Supply Chain for X-Rite Inc, from 2005

until retiring in 2012. He previously served as Director of Enterprise Color Management with GretagMacbeth, which merged with X-Rite in 2005. Prior to that he was President and co-owner of SheLyn Incorporated from 1987 until 2003.

SheLyn developed color formulation and quality control software for industry. Before founding SheLyn, he was Color Lab manager for Burlington Industries Corp. R&D, where he worked for 18 years. Roland's over 40 years' experience has been in all aspects of color management and control.

He is a frequent lecturer and author of numerous papers on such topics as lighting, colorant formulation, quality control, supply chain management, and instrumental UV calibration. Roland has served as President of AATCC, Chair of RA36-Color Measurement, member of the Board of Directors as well as many other committees.

He is the recipient of the AATCC Chapin Service award and the Education Award. He has also served as President of the ISCC as well as a board member and Interest Group Chair among other duties. He is the Chair of ASTM E-12-Color and Appearance and is active in the CIE as well as IES. He has served for many years as the US spokesman for color measurement in ISO TC38, Textiles. He received his BS in Textile Science and MS in Color Science from Clemson University.



Roland Connelly. Image source: aatcc.org

ISCC 2019 Nominations Committee Report

It's time to announce to all members the candidates running for ISCC Board of Director positions starting in 2020.

This year's Nominating Committee, chaired by Jerry Dimas our Past President, has put together an excellent slate of highly qualified candidates. For the first time in many years we have an embarrassment of riches, having four highly qualified candidates for three open Board positions.

From the By-Laws: The report of the Nominating Committee shall be sent to all voting members at least thirty (30) days before the date on which ballots are provided to the voting members. Additional nominations

may be made at the request of five (5) voting members, provided they are forwarded to the Secretary within twenty (20) days after the report of the Nominating Committee is sent out. The Secretary shall give notice of all additional nominations to all voting members at least ten (10) days before the ballot is provided to the membership at large. This year's candidate slate consists of Shoshana Burgett, Ellen Divers, Jennifer Kruschwitz and Michael Murdoch. Biographies can be found below.

Shoshana Burgett

Shoshana Burgett is a thought leader and industry consultant with over two decades of experience in color management, on-demand printing, manufacturing, and personalization. Shoshana has been at the forefront of personalized production and omnichannel communications. She has served as a senior executive at X-Rite, Pantone, and Xerox responsible for incorporating the Voice of the Customer (VoC) into the company's product, pricing, marketing, sales, and innovation strategies. At Pink Elephant she draws together creative, design thinking, development, lean manufacturing, and marketing to help businesses streamline their product launches and innovate. After decades in manufacturing, Shoshana has turned her sights back to creatives, launching colorkarma, a hub for creatives focused on production. She regularly speaks at industry events and has been featured in HOW, WhichPLM, Quality Digest, Beauty Packaging, Packaging Digest, Printing Impressions, and What they think.

Ellen Divers

Born in the United States and raised in Argentina, Ellen Diver's perspective on color (and life in general) was shaped by navigating between cultures -- an experience that taught her to look beneath the surface of things for common threads and universal connections. Her upbringing, combined with an affinity for design and conceptual thinking, paved the way to her current exploration of how

people respond to color. An interest in the workings of the mind led to a double major in Psychology and Women's Studies at University of Richmond (Virginia) where she was inducted into Phi Beta Kappa and graduated with honors in Psychology in 1985. Perhaps presciently, her senior thesis was entitled Environmental Psychology: Theory, Methodology and Research. She went on to obtain an M.Ed. in Adult Education from Virginia Commonwealth University (Richmond, Virginia) in 1993, and subsequently put her instructional design skills to work, first at First Health Services Corporation, then as a solo practitioner (www.divers-e.com). In addition to training, Ellen's penchant for visual thinking was also put to use designing logos, presentations, process diagrams, and other types of graphic communications. When the opportunity surfaced to explore a lifelong interest in the arts and design, she began studying painting and then ventured toward interior design by taking courses in real estate staging. Eventually, she began to focus on architectural color by completing the seminars offered by Frank Mahnke of the International Association of Color Consultants and Designers (IACC). In search of a thesis topic to complete her course of study, Ellen began delving into research literature on a quest to better understand how color affects people -- in particular, people like her mother who were living with



Shoshana Burgett

dementia. Reviewing studies about best practices in architectural design for this population prompted Ellen to pursue a B.S. degree in Interior Design with a minor in Studio Art from Meredith College (Raleigh, NC), where she graduated summa cum laude in 2018. While at Meredith she conducted a study (currently in the editorial phase) entitled *Beyond Hue: The Affective Response to Color and the Value-Chroma Paradigm*, a work that explores how variations in value and chroma convey distinct impressions irrespective of hue. The study also explores how we conceptualize color and its influence on research and the practice of design.

It asks whether the current hue-based color paradigm may actually be interfering with progress toward understanding how color affects people in the built environment. Ellen plans to continue research in this vein and is working independently to develop a curriculum to address the apparent gap in color education for interior designers and architectural color consultants. When she is not pondering color, she enjoys pondering food, wellness and the subtle (yet potent) forces of everyday life. She lives in Raleigh, North Carolina with husband Greg Martin, dog Juno and cat Gracie. Website: www.ellendiversdesign.com

Jennifer Kruschwitz

Dr. Jennifer Kruschwitz has been an optical interference coating designer for over 30 years. She earned her B.S. and M.S. in Optics from the University of Rochester and worked in optical coatings for companies such as Itek Optical Systems, the University of Rochester's Laboratory for Laser Energetics, and Bausch and Lomb. She left industry in 1998 to start her own consulting company, JK Consulting. She has served as President of the Rochester Local Section of the OSA, and on the Board of Directors for the OSA. In 2012, she won Digital Rochester's Technology Woman of the Year for her contributions to optics and for helping women in her field. She earned her Ph.D. in Color Science from Rochester

Institute of Technology in 2015 where she was a Macbeth-Engel Fellow. She has been an Assistant Professor at the UofR's Institute of Optics since 2015. Professor Kruschwitz holds five patents, authored dozens of peer-reviewed papers, and has written the Field Guide of Colorimetry and Fundamental Color Modeling with SPIE published in 2018. Lastly, Professor Kruschwitz holds a 4th degree black belt in Taekwondo through Kukkiwon in South Korea.

Michael J. Murdoch

Michael J. Murdoch is an Assistant Professor in RIT's Munsell Color Science Laboratory, where he teaches graduate students topics including psychophysical methods, programming, color imaging, and lighting perception. His current research includes the effects of temporally dynamic LED lighting on visual adaptation, color appearance and visual adaptation in Augmented Reality (AR), color and dynamic range in advanced displays, and novel color measurement techniques. Michael has academic and industrial research experience with color system modeling and human-centered design for LED solid state lighting, LCD and OLED display systems, commercial inkjet printing, and film. Prior to coming to RIT, he worked for Philips Research from 2008-2015 and Kodak Research from 1997-2008. He holds a BS in chemical engineering from Cornell, MS in computer science from RIT, and PhD in human-technology interaction from Eindhoven University of Technology in The Netherlands. He has served in several roles in support of IS&T's annual Color and Imaging Conference since 2013, including General Chair for the 25th CIC in Lillehammer, Norway. He has served as Program Chair for the annual Frameless Labs Symposium at RIT since its inauguration in 2016, and on the Program Committee for the ISCC/AIC Munsell Centennial Color Symposium in 2018.

Jerald Dimas



Ellen Divers



Jennifer Kruschwitz



Michael J. Murdoch

COLOR IMPACT



Environment•Education

Save the dates, June 7-10, 2020

The ISCC and the International Association of Color Consultants-North America (IACC-NA) are co-hosting Color Impact 2020 with a dual focus on Color in the Environment and Color in Education.

Yale University in New Haven, CT, has a significant legacy of both color education and the built environment. Yale is the teaching home of Josef Albers, the Faber Birren Library, with an outstanding architectural program and history.

Be sure to check the website regularly as this exciting color conference comes to life with keynote speakers, member presentations, breakouts, workshops and tours being added regularly.

www.colorimpact2020.com

Be a part of Color Impact 2020:

- CALL FOR PAPERS deadline is January 15, 2020.
- Registration and campus housing open in January, 2020.
- Subscribe to the Color Impact Newsletter updates on the webpage.

For students submitting papers or projects, there will be a prize of \$250 for the top submission. Details will be available soon on the website.

You will not want to miss Keynotes:

- Shashi Caan, author of Rethinking Design and Interiors: Human Beings in the Built Environment
- Jill Pilaroscia, Environmental Color Designer and founder of Colour Studio
- Eve Ashcraft, Designer and creator of paint line Eve Ashcraft Color: The Essential Palette

We have more!

Attend General Session Presentations by:

Kory Stamper, Lexicographer and writer of a new book on words for colors.

Renzo Shamey, Professor and writer on Color Pioneer Faber Birren

Robert Hirschler, Chair of AIC Study Group on Education is a chemical engineer, whose current interest is the teaching of color science to architects, artists, and designers. He will be speaking on the legacy of the Bauhaus on color education.

Take advantage of small group breakouts and networking to address all your questions on:

- Lighting with Ann Laidlaw, Consultant, on lighting and color applications
- Environmental Color Research with IACC professionals Ellen Divers, Sheri Petersen, and Karen Collins
- Color Education with Maggie Maggio of Smashing Color and Luanne Stovall from the University of Texas, Austin

Before and after the conference we will have tours and workshops. For up to the minute details watch:

www.colorimpact2020.com

We look forward to seeing you at Color Impact 2020!

Jean Hoskin
Conference Chair

Calendar 2019 & 2020

Calendar

2019

Oct 21-25	CIC27, Paris, France Info: http://www.imaging.org/site/IST/IST/Conferences/CIC/CIC_Home.aspx
Oct 28-31	CORM 2019 Annual Technical Conference and 12th Joint USNC/CIE and CNC/CIE - NRC, Ottawa, Canada Info: Joanne.zwinkels@nrc-cnrc.gc.ca
Nov 15-17	International Summit Color Marketing Group Info: https://colormarketing.org/event/international-summit/

2020

Jan 26-30	IS&T International Symposium on Electrical Imaging, San Francisco Airport, CA Info: https://www.imaging.org/
Feb 5-6	ASTM E12 Atlanta, Marriott Marquis, Atlanta, GA Info: http://astm.org
April 20-24	5th CIE Expert Symposium on Colour and Visual Appearance (also CIE Division 1 on Colour and Appearance meeting Hong-Kong, China Info: http://www.cie.co.at/news/5th-cie-expert-symposium-colour-and-visual-appearance
June 7-10	Color Impact 2020, New Haven, CT Info: http://www.colorimpact2020.com
June 9-10	ASTM E12 International, West Conshohocken, PA Info: http://astm.org
Oct 6-9	AIC Interim Meeting, Avignon, France Info: https://www.aic-color.org/aic-conferences

ISCC would like to thank the following people for volunteering their time and talents to make this issue.

ISCC Newsletter Issue #488, Fall 2019

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Sustaining Members

Sustaining members of the ISCC are organizations who support the mission and goals of the ISCC through financial or other support. With our member bodies, Sustaining Members also provide a critical connection to the color community. If you feel your company or organization should support the ISCC in this way, please contact the office for more information about member benefits.



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