



Inter - Society Color Council Newsletter

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Photo by Cotton Bro, Pexels

Board of Directors Corner

Hello! I'm Mike Murdoch, and I'm very honored to join the ISCC Board of Directors (BoD) this year and happy for the chance to introduce myself. I'm proud to be part of the ISCC, a color-centric organization that is as broad and multidisciplinary as color itself.

My first introduction to ISCC was at the ISCC-hosted 2001 AIC Congress in Rochester, NY. I was but a young local at this gathering, which drew experts from around the world to discuss topics ranging from color order system optimizations to color harmony in architecture. I was struck by the breadth of color (which, admittedly, can feel like a pretty small niche sometimes). I truly appreciate the ISCC's goal to bring together science, art, industry, and education, and the diverse community it engenders. For me, the community, the symposia, the webinars – where the conversations happen – are the jewels of ISCC.

Now, maybe it would sound dramatic if I could say I'd been a member of ISCC since 2001, but in fact I've taken a circular path before returning to the ISCC. I was going to attempt a joke here about that path being a hue-circle, but I realized my stopping points were neither opponent-based nor perceptually-spaced. In any case, color has been a consistent theme along my journey. I studied chemical engineering at Cornell (Big Red!) and followed my interest in photography to the research labs of Eastman Kodak (Big Yellow!), where I became instantly hooked on Color Science. I moved from film to digital imaging, did an MS in computer science at RIT (Orange!), and worked on OLED displays and inkjet printing

before moving to the Netherlands (Oranje!) to join Philips Research (Blue!). There, I worked on displays and LED lighting (Green?), and in the meantime finished my PhD at Eindhoven University of Technology (Magenta!). In 2015, I returned to Rochester to join the Munsell Color Science Laboratory at RIT (Munsell notation: 2.5YR 6.5/18).

My current research focuses on two topics: augmented reality (AR), in which transparent displays create optical blends of real-world environments with virtual overlays, and dynamic LED lighting. My main tools include color system modeling, for display and lighting systems, and psychophysics, for example measuring and modeling adaptation and visual sensitivities to color combinations and temporal changes. I'm currently supervising four PhD students on related projects, and I teach courses in colorimetry, psychophysics, imaging, and lighting.

I'm excited to bring my mix of science, industry, and education perspectives to the ISCC BoD. I hope that my experience with a long list of different color technologies, along with my interest in teaching and symposia, can be helpful in connecting people and finding synergies between fields. I especially hope to help plan and execute ISCC events over the next few years, whether virtual or in-person. I look forward to meeting (and reconnecting with) ISCC members and finding out exactly how each of you sees and organizes color.



Michael J. Murdoch. Photo by Sue Weisler, RIT

Dr. Michael J. Murdoch

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Hue Angles

The Revolving Door between Color Science and the English Department

Past Hue Angles columns have featured examples of career changes from color science to other areas. (See Issue #250 [2011] on Terry Benzschawel's transition to Wall Street quant and Issue #475 [2016] on Mike Stokes's transition to data privacy.)

In this article, I describe Suguru Ishizaki's transition from color science to an English department. Such experiences can inspire hope for successful career transitions in the field of color science even in the current job crisis.

Ishizaki's contribution to color science is heralded by his 1994 Color Imaging Conference paper [1], also extended in a successive paper [2]. He undertook the prodigious task of coloring sub-areas on a color-coded map or chart so that each sub-area, subject to spatial induction from its neighbors, would match an intended color in the key to the chart. The task is hard because every time you change a sub-area color, you must also change the neighboring areas to preserve all the color matches with the key. The process is iterative and multi-dimensional. To my knowledge, Ishizaki's is the first and only attempt to capture and control such complicated and inter-dependent conditions for asymmetric matches. (Usually investigators look at only a center field as influenced by a single surround, and do not ask the matching question.)

Starting with this work (which led to his Ph.D. at the MIT Media Lab),

Ishizaki built a career, alternately in academia and industry, based on a broader over-arching theme of human communication through design. He started at the Design School at Carnegie Mellon University (CMU), then worked at Qualcomm on early mobile applications, and ended up at CMU's English Department, where he is now an Associate Professor. Dr. Ishizaki's current research area is Technology-Enhanced Learning for writing and Computer-Assisted Rhetorical Analysis [3].

Several people I know started as English majors and ended up in color science. Bob Karpowicz, who became a product manager at Datacolor, had an undergraduate English major. Mike Tinker (who became an expert in color digital cinema at Sarnoff) started from a B.A. in English literature; then, as a graduate student in English, he wrote a computer program that recognized writers by their word patterns. That wasn't accepted as a thesis topic, so Tinker pursued another topic to a Ph.D. in English with a minor in computer science.

And I myself was an undergraduate English major, though this is unacknowledged on my diploma due to a binary choice being given to me on graduation day. (How English departments have changed since then!)

But whereas in all these cases the door of the English department was marked "Exit," Dr. Ishizaki found a door marked "Enter." I hope some-

day that he returns to color science to continue the career he started and that nobody else can match. Or perhaps someone else will continue his pivotal work.

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[1] Ishizaki, S. Adjusting simultaneous contrast for dynamic information display. Proceedings of IS&T and SID's Color Imaging Conference, Scottsdale, 1994: pp 137- 140.

[2] Ishizaki, S. Color adaptive graphics: what you see in your color palette isn't what you get! CHI '95: Conference Companion on Human Factors in Computing Systems. May 1995, pp. 300-301.

[3] <https://design.cmu.edu/people/courtesy-appointment/suguru-ishizaki>

Eating Color

Color Perception in Plants



The Photosynthetic Restaurant, Jonathon Keats, Crocker Art Museum, Sacramento, CA. Photo: the artist

For experimental philosopher and artist Jonathon Keats – the world is a playground. Unbound by conventional thinking, he pushes at the limits of our experience by creating physical manifestations of imaginative thought experiments. Such experiments challenge us to consider and contemplate our world in a way that is both concrete and tangible, not detached and academic like most forms of philosophy. One of these experiments, the Photosynthetic Restaurant, is literally a “restaurant” for plants. We all know plants need light to survive. You could even say they “eat” light, as photosynthesis is the process whereby plants convert sunlight to energy and food. The Photosynthetic Restaurant is an attempt to play with this notion of light as food by exploring and imagining the different effects and possibilities of spectral light. To make his restaurant, Keats positioned a series of colored acrylic filters in the garden at the Crocker Art Museum in Sacramento, California. These transparent gels, mounted on copper poles, manipulated the portion of the electromagnetic spectrum the plants received throughout the day as the sun moved across the sky. According to Keats, “For nearly a half billion years, plants have subsisted on a diet of photons haphazardly served up by the sun and indiscriminately consumed, without the least thought given to culinary enjoyment.”¹

by Carl Jennings

¹All quotes are taken from: Twilley, N. (2011, April) “A gourmet restaurant for plants, not people,” The Atlantic. Retrieved from <https://www.theatlantic.com/health/archive/2011/04/a-gourmet-restaurant-for-plants-not-people/237536/>

It has been known for some time that plants respond selectively to different wavelengths of light. For Keats, this was an opportunity to explore parallels to culinary practices in human culture, while at the same time imagining plant functions from an aesthetic point of view rather than just a biological one. For instance, plants use far-red light (between red and infrared) to detect other plants nearby, as this type of light is often reflected off of leaves. The presence of other plants is not necessarily a good thing, “If you’re a plant, you don’t want others getting too close because then your sunlight is occluded, and so plants have a sort of fear response to the far-red part of the spectrum.” For Keats, the dietary equivalent in humans might be something like a habañero pepper or spicy food. “We get an enjoyment out of eating them, in spite of the physiological panic that they cause, because spicy cuisine brings about that sort of panic in a controlled way.” At the Photosynthetic Restaurant, the red filters became the culinary equivalent of spicy food for the plants!



At the other end of the spectrum, one way that plants often discern the end of the day is through short-wave light (deep blue to ultraviolet) along with far-red light². To this end, Keats employed violet filters late in the day to provide the plants with a sunlight version of a *digestif* – a nightcap of sorts, to “aid digestion.” To mix things up a bit, he also developed what he called an avant-garde menu for some plants. He did this by juxtaposing the violet digestif with an orange mid-day light in order to play a sensory trick on the plants. He describes this menu as “playing against the expectations of the organisms that are my patrons. Just as in the case of human cuisine, when it becomes avant-garde, there’s an element of surprise and disrupted expectations, and what comes naturally is put out of order.”

Though Keats’ projects often use animals or plants to contemplate human behavior, the photosynthetic restaurant does raise some interesting points about color and plants. Plants don’t see, in the sense that we understand the term, but they do “perceive” color. Their sensory apparatus is incredibly sophisticated. Being sessile (unable to move), they have developed some amazing abilities to adapt to and exploit their environments. One of the key components of this ability is their response to light. For most people, the obvious example is *phototropism* – the ability of plants to bend towards the light. Experiments by Darwin and others, in the latter half of the 19th century, demonstrated that this has nothing to do with photosynthesis but rather with a type of “rudimentary sight” (photoreceptors) on the tip of new shoots that is responsive only to blue light³! Cover these “eyes” on a plant and it will not move toward the light; it becomes blind to this possibility. But phototropism is only one of many plant behaviors that depend on specific wavelengths of light – others, like we have seen, involve detecting the presence of other plants, knowing the changing length of the day (and hence the season), knowing when to germinate, or grow, or flower, and knowing when not to grow or blossom. All of this is achieved through the presence of a wide variety of photoreceptors in the plant that respond to the specific wavelengths of sunlight.

Humans have four types of photoreceptors in the eye: rhodopsin in the rods and three types of photopsin in the cones, one each for detecting short, medium, and long-wavelength light. Most plants, however, have many more than four. For example, *Arabidopsis thaliana*, a type of wild mustard, has eleven types of photoreceptors that fall into a variety of different classes, such as phototropins, phytochromes, and cryptochromes. At the level of these chemical photoreceptors, sensitive to the spectral composition of light, one might speculate that color perception in plants is even more sophisticated than humans!

Keats’ Photosynthetic Restaurant is more than just a speculative exercise in “solar gastronomy,” it is an opportunity to reimagine our relationship to the non-human world. An opportunity to contemplate the intelligence and sophistication of all living things.

²Tibbitts, T (1994) *International Lighting in Controlled Environments Workshop, Conference Proceedings March 1, 1994 NASA-CP-3309 Retrieved from: <https://ntrs.nasa.gov/citations/19960011687>*

³Chamovitz, D. (2012). *What a plant knows: A field guide to the senses. Scientific American/Farrar, Straus and Giroux*

In the end, however, all is not haute cuisine. For that particular class of domesticated plants, limited to the confines of the house, Keats has developed (literally) the ultimate TV dinner, a DVD of colored light that you literally play on the TV for your houseplants. "I filmed the sky through different color filters and then made an hour-long movie that plants are able to consume."



TV Dinner for Plants, Jonathon Keats. Photo: the artist



Color Research and Application

IN THIS ISSUE

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By Ellen Carter

The last issue of 2020 begins with the study of color as the light stimulus enters the human eye. Our eyes adapt to the illumination level, and the pupil (by changing aperture size) is the eye's first responder to adjust the amount of illumination entering the eye to the appropriate level for sight. Claudia Beatriz Sandoval-Salinas, Stijn Hermans, Jose Domingo Sandoval, Kevin A.G. Smet, Peter Hanselaer, and Elisa Margarita Colombo report on **Relationship Between Pupillary Size, Brightness and Photoreceptor Responses for Unrelated Self-Luminous Stimuli at Low Photopic Light Levels**. Stimulation of the retinal L-cones, M-cones, S-cones and rods and the intrinsically photosensitive retinal ganglion cells (IPRGC) triggers changes in the pupil size ranging from roughly 2 to 8 mm, depending on the light level. While most analytical models describing the pupil size use luminance as input, these researchers found that different colored stimuli induced different amounts of change in the pupil diameter. Besides measuring the observer's pupil diameter, they also examined the observer's brightness estimations as a function of the stimuli luminance and saturation. They found that the effect of the rod and ipRGC excitations on pupillary size variation seem to be larger than that of the other photoreceptors. However, for the working conditions prevailing in this research, it was not likely

that rods were very active, thus one could conclude that the ipRGC response might be the major driving mechanism for pupil response.

In the 16 years since the International Commission on Illumination published CIE 159:2004 A Colour Appearance Model for Colour Management Systems: CIECAM02, the CIECAM02 color appearance model has been widely used in color imaging, but mainly for indoor use with illumination generally below 700 cd/m². Following up on a recent finding that CIECAM02 may have problems characterizing the color appearance accurately when light levels are extremely high, Minchen Wei and Wenyu Bao, report on their study **Testing the Performance of CIECAM02 from 100 to 3500 cd/m²**. This study involved two experiments: In the first, both the reference and matching stimuli were always presented under the adapting conditions with the same correlated color temperature. In the second, similar color matching experiments were carried out under six pairs of adapting conditions where the matching stimulus were at six luminance levels, but the reference stimulus was always fixed at luminance level 150cd/m². They determined that CIECAM02 could accurately characterize the five color attributes (hue, lightness, chroma, colorfulness, and saturation) of the stimuli under such a wide range of

adapting luminance levels. However, the brightness of the stimuli under extremely high adapting luminance levels was not accurately characterized by CIECAM02—the higher the adapting luminance level, the worse the performance, with underpredictions as large as 200%. In contrast, a model that directly uses the adapting luminance level to characterize the cone compression in the post-adaptation process was found to have a much better performance in characterizing the brightness of the stimuli over the wide range of adapting luminance.

Maxim Wasyl Derhak and Roy S. Berns first introduced the concept of Waypoint in 2015 [CR&A 40(6):535-549] followed in the same issue with a Uniform Material Color Equivalency Space [CR&A 40(6):550-63]. Then, earlier this year Lin Luo joined the other two authors extending to Waypoint Shift Manifolds [CR&A 45(3):377-92]. Now in this issue Maxim Wasyl Derhak, Lin Luo, and Roy S. Berns discuss **Wpt (Waypoint) Shift Manifold Difference Metrics for Evaluation of Varying Observing-Condition (Observer+Illuminant) Metamerism and Color Inconstancy**. They propose four Waypoint Shift Manifold difference metrics to evaluate not only observing-condition metamerism of metamers and paramers, but also observing-condition color inconstancy of single objects. The metrics

are: Mean Object Inconstancy Index, Mean Object Color Difference, Object Metamer Index, and Object Hue Similarity Index. The authors discuss, compare and evaluate these new metrics with those of existing color difference equations.

In the 20th century, most color measurements were made by spectrophotometers or colorimeters designed especially for that purpose, but in the 21st century much color is recorded digitally with cameras, including those built into cell phones. The colorimetric data is then taken from the pixels of the images. Jing Ji, Suping Fang, Zhengyuan Shi, Qing Xiz, and Yibao Li propose a non-linear method for the color characterization of input devices. The approach for deriving a colorimetric mapping between digital RGB signals and CIELAB tristimulus values uses the polynomial modeling by considering the interrelations among the standard CIE color spaces. A polynomial root terms extension is constructed for further improvement of the transformation accuracy. In **An Efficient Non-Linear Polynomial Color Characterization Method Based on Interrelations of Color Spaces**, they give various computational results to demonstrate the efficiency and capability of their proposed method and show how it out-performs its predecessors in color characterization accuracy.

Here is a simple question that perhaps many people just learning about the International Commission on Illumination (CIE) color systems have wondered...**Why Does the CIELAB a^* Axis Point toward Magenta instead of Red?** In his article by the same name, John Seymour takes the reader through an inter-

esting discussion of colors and the development of color order systems, explaining how the a^* axis anomaly might have come about. He created a color space similar to CIELAB but based on the cone functions instead of the tristimulus functions. He concluded that the a^* axis not pointing toward red was due to the seemingly arbitrary decision to use tristimulus functions. While the direction that the a^* axis points is relatively inconsequential, the revelation of this decision foreshadows ongoing work regarding more significant repercussions. Will this new work come from CIE or elsewhere?

The next article is an announcement that **A Multi-illuminant Synthetic Image Test Set** has been developed and is publicly available to users. This data set (called MIST), which consists of 1,000 full-spectrum stereo image pairs, is a compilation of physically correct, photorealistic, multi-spectral, stereo images based on three geometric scene models. Each model is rendered from 50 different viewpoints, and each camera location and orientation are rendered using six different light settings. As the creators Xianpeng Hao and Brian Funt explain, MIST will be useful for the testing of computer vision methods aimed at recovering "intrinsic" image properties, and especially those directed at estimating the incident illumination in multi-illuminant scenes.

The transition from traditional (tungsten-based) lighting, which was rich in the longer wavelength "warm-colored" part of the visible spectrum, to light emitting diodes (LED) lighting, which tends to be blue-rich, has led to new discoveries in how the light entering our

eyes affects our bodies. At first introduction of light emitting, the concern was mainly color fidelity. Although for about 20 years it had been known that melanopsin-expressing intrinsically photosensitive retinal ganglion cells affected our circadian rhythms in a daily cycle, now a deeper understanding that retinal light detection performs a broad range of non-visual functions has developed. In **A High Efficacy and Tunable White LED Cluster with Both Color Fidelity and Non-Visual Performances Close to Natural Lights**, Xinhao Li, Ding Ke, Ping Zhong, and Guoxing He explain their luminous efficacy model for the white LED cluster lighting and compare its non-visual performance relative to natural light using five α -opic efficacy ratios of intrinsically photosensitive retinal ganglion cells, better known as ipRGCs.

To many of this journal's readers at first glance the title of the next article, **Electroluminescence Performance of a Serial Fluorene/2,5-Di(2-Thienyl)-1H-Pyrrole Polymers** may not be enticing to them. However, conjugated polymers, such as the ones in this article, are superior materials in the family of optoelectronic applications that includes organic light emitting diodes (OLEDs). Because of many of their properties, OLEDs have gained interest in displays and lighting areas, especially with applications with blue, green, red and white colors. Many photo and electroactive conjugated polymers including polyfluorene have been introduced. Through their study of electroluminescence performance, Hakan Bilgili, Koray Kara, Esmay Yenal, Mahmut Kus, Serapettin Demic, and Sermet Koyuncu reveal the importance of minimiz-

ing the effect of molecular packing of the polymer chains on OLED device performance. They show that HS-4 electroactive polymer could be a promising material for display applications and its contribution to OLED efficiency and the path for investigating methods to fabricate more efficient OLED devices.

Exploration of oceans has moved from the surfaces to increasing depths as our technology has improved. With each new invention, our knowledge has broadened. Now humans can use remote underwater imaging to show us places that are approachable for human beings and not easily observed. However, the images are limited by the amount and quality of light as well as the clarity of the water. For the restoration of hazy and colorcast underwater images, Bindhu A. and Dr. Uma Maheswari O. developed a method to improve underwater images using a color corrected single scale retinex that employs an illumination enhancer and an intensity shifter to correct colorcast. In **Color Correct-ed Single Scale Retinex Based Haze Removal and Color Correction for Underwater Images**, they describe their method, discuss the quality metrics and quantitatively compare the results with seven algorithms.

Industrial standards are important and widely used in coatings, textiles, plastics, and many other industrial arenas. They allow verification of quality during production, communication within companies, and ensure that products meet customers' expectations, especially in the current era of global supply chains. In a movement toward developing industry-wide standards for dental materials, Rade Paravina, Natalie

Pereira Sanchez, and Rubens Nisie Tango evaluated a proposed method of harmonizing color measurements for dental application using different dental materials with clinically relevant color range, translucency, and thickness. In the next article, **Harmonization of Color Measurements for Dental Application**, they report on a multicenter study evaluating the effect of harmonizing spectrophotometric ($d/8^\circ$) color measurements by using actual dental materials of clinically relevant thickness and translucency as "calibration tiles." The obtained results validated the proposed method of harmonizing color measurements for dental application as a reliable quality control tool for dental research laboratories and industry.

Remaining in the category of color science applications in dentistry, Bindhu A. and Dr. Uma Maheswari O. report on tooth bleaching, a popular aesthetic dental treatment for whitening teeth. Many methods, which vary in time of treatment and materials used, have been tried to restore whiter, brighter teeth. The harmful effects of high concentrations of bleaching agents have led researchers to look for safer and more efficient, longer lasting formulations. In **Three-Month Evaluation of a Low Concentration (6% Hp) Experimental Bleaching Gel Containing TiO₂ and Chitosan: an in Vitro Study**, the authors examined three bleaching procedures. They determined that low concentration (6% HP) experimental gel containing TiO₂ and chitosan provided effective whitening, and the whitened color persisted throughout the three-month period.

The next three articles are in the

textile field. The first of these articles discusses a new method for assessing light fastness, one of the important qualities of dyed textiles. In the past this has often been evaluated visually, see ISO standard test for evaluating light fastness called ISO 105-B02 for example. Since an instrumental method could remove some of the variability of human assessors, Samaneh Karami, Hossein Izadan, and Ali Hamadani Zeinal developed **A Neural Network-Based Instrumental Method for Light Fastness Assessment with Dataset Validation**. In their study, they first look at the variability of experienced and inexperienced assessors and developed a dataset of samples to use for the comparison of visual versus instrumental methods. Then they implemented different neural network structures to design a highly accurate approximation function for light fastness assessment. Finally, they compared the neural network-based light fastness assessments to assessor judgements of test dataset, and found that proposed instrumental method yielded a highly accurate approximation function for light fastness assessment.

It has been noted that lighting affects the appearance of various fabrics or fabric combinations. (Readers will remember the fairly recent discussions and arguments that arose about "The dress.") In the article, **Affective Matches of Fabric and Lighting Chromaticity**, Juhee Kim and Hyeon-Jeong Suk report on two experiments they designed relating to the topic of lighting effects, particularly the color of the lighting. The first experiment established a synergetic combination between colors of lighting and types of fabric. In the second experiment

synergetic combinations between colors of lighting and fabric color combinations for fashion styles were evaluated by observers. The scales of “preferred,” “luxurious,” and “harmonious of lighting” were additionally presented. The statistical analysis showed that colors of lighting and fabric color combination influenced subjects’ perceptions of quality. Additionally, high similarity between fabric color and lighting hue led to positive assessments of harmony for the two stimuli.

The third article regarding textiles deals with shortening product development cycle and designing the products that meet the consumer’s preferences, both of which are urgent demands in industries. One of the first steps in the process is designing the pattern to be put on the textile. Ning Zhang, Ruru Pan, Lei Wang, and Weidong Gao proposed a novel pattern retrieval method for yarn-dyed plaid fabric. Given certain designer and customer clues, the pattern retrieval algorithm quickly searches for similar patterns that meet the consumer’s demands. The algorithm is based on a modified iterative genetic algorithm that simulates the natural evolutionary process to search for optimal patterns. The article **Pattern Retrieval of Yarn-Dyed Plaid Fabric Based on Modified Interactive Genetic Algorithm** describes the details of the development of the algorithm, the experimental implementation, and the testing and analysis of the new algorithm.

Even though paints and printing will never achieve the striking brilliance of colored lights, industries are constantly pushing the gamut toward brighter more colorful possibilities. In the printing industry, halfton-

ing uses very small, different-sized colored dots that are printed side by side. With halftoning, the observer’s eye is stimulated by the color of the dots merged together, so the message from the eye produces a perception of a single, combined color in the brain that is much brighter than colors produced by subtractive mixtures. In this issue, Shmuel Borenstain, Bar-Haim Gil, Keren Goldshstein, and Gili Cohen-Taguri set out to obtain a color-gamut-optimal set of cyan, magenta and yellow inks. Their article, **Optimization of Quinacridone Magenta, Cu-Phthalocyanine Cyan and Arylide Yellow Ink Films Formulated for Maximum Color Gamut** describes: 1) using the Kubelka-Munk model to predict the spectra of the solid CMY inks as a function of ink film thickness and 2) tuning the ink film thickness to obtain the largest printing gamut.

Staying in the printing industry, resins or resin solutions are the vehicle for transporting and adhering the ink film to paper or other substrates. The resin affects the hardness, gloss, adhesion, flexibility and endurance of the ink film. In the next article, Cem Aydemir, Semiha Yenidogan, and Kandirmaz Arman discuss their study of **The Use of Natural (Pinus Pinaster) Resin in the Production of Printing Ink and the Printability Effect**. Their goal was to discover, develop, and promote the use of natural resin in the ink system to achieve high bio-renewable content, environment-friendly use of resources and reduction of carbon footprint. The results of the study show that Pinus Pinaster resin had a positive effect in high print gloss, high light fastness, good set-off and rub resistance of ink, and hybrid uses of natural Pinus Pinaster

and alkyd resin balance viscosity, flow, tack and yield stress values of varnish and ink.

Most cities around the world grew without a specific plan. Then as cities became larger and more diverse within the confines of the urban development, particularly in the last 50 years, they undertook renewal. Tehran, Iran was no exception, and during the 1990s, it formulated and carried out a color plan with the primary purpose of restoring color consistency particularly to the historic center of the city. It was successful in bringing unity and avoiding color pollution on the urban scale, but some of the constituent elements of the image of the city, including the landmarks and nodes, have been missed. Karim Asarzadeh, Alireza Gholinejad Pirbazari, and Paymane Ghazanfari discuss **Recovering Figure-Ground Perception in Tehran’s Color Plan**. They show how keeping foreground/background relationship in balance maintains excitement and relaxation within the visual field. Their findings suggest a role for figure-ground perception in promoting the hierarchy, order, and image of the city.

Color sells. When choosing apparel, customers often want to “try it on” to examine how the garment looks. However, new imaging techniques make it possible to do a virtual examination of the product’s appearance directly on the person, considering skin tone and other personal characteristics. It is a valuable technique for online shopping, as well as for testing makeup in a physical store. It is important that colors in the image are an accurate reproduction of how the color appears on the person, particularly for

cosmetics. In recent times, several makeup software applications have been released. Meereh Kim and Ji-Hyun Lee conducted a study to analyze and predict the correct color representation in virtual makeup environments. In their article **Color Reproduction in Virtual Lip Makeup Using a Convolutional Neural Network**, they propose an accurate lipstick color reproduction method using a convolutional neural network algorithm. The findings of their study indicate that the proposed method with a convolutional neural network results in the smallest color difference as compared to linear regression and multilayer perceptron algorithms.

Color sells, again! In China, “Chinese Brand Days” have been established to focus shopping activities. Getting the customer’s attention and giving them confidence on the quality helps customers feel good about their purchase. Xinxin Zhang, Minggang Yang, Jianning Su, Wenjin Yang, and Kai Qiu report on their **Research on Product Color Design Decision Driven by Brand Image**.

They focused on guiding product color design decisions in two aspects: 1) producing quantitative predictions of product color trends and 2) correlating product color design elements and brand image. To reach these goals, they used the Gray theory combined with Kansei engineering to mine the macro and microscopic factors in the product color design decision process based on the product color brand image. As exemplified by their study of a mid-sized sedan, using their product design procedure helps the producer grasp the trend of the user’s emotional color choices as early as possible, and then guide the direction of product color design macroscopically.

Not all products are taken home... others are enjoyed in situ; one class of site products is dining in a restaurant. In this case, the customer chooses both where they want to go and how much money they will spend on this activity. Thus, **The Influence of the Color of Light on the Customers’ Perception of Service Quality and Satisfaction in the Restaurant** not only provides the title of the last article in this issue, but also discusses the key factors on whether the customer will return often and how much they will spend while dining out. In this study, Emrah Özkul, Bilsen Bilgili and Erdogan Koc extensively discuss the background and factors, while studying the diners’ responses to eating under different colored lighting effects. Here also color does make a difference; in their study they found that relatively inexpensive changes in lighting color could improve the perception of service quality and the level of satisfaction for young adults aged 18 to 24.



AIC 14th Congress Milan 2021

August 30 – September 3, 2021

Ca' Granda, Università degli Studi di Milano Via Festa del Perdono, 7 – 20122 Milano, Italy

The International Color Association (AIC) is proud to announce their 14th Congress to be held in Milan, Italy from August 30 to September 3, 2021. The organization hosting this congress is Associazione Italiana Colore. This is the first time an AIC Congress has ever been hosted in Italy.

The venue is the historic Renaissance building in the city center known as Ca' Granda on Via Festa del Perdono, the street named Feast of Forgiveness. In 1456, Francesco Sforza, the duke of Milan, commissioned this building as a public hospital to be designed by il Filarete, the famous Florentine architect. Bombs damaged this building during World War II, but it was repaired using original materials wherever possible. Its reconstruction is considered a masterpiece of conservative restoration. Every effort was made to recover the original materials. Since 1958, it has been the headquarters of the Università degli Studi di Milano.



Outside of Ca' Granda on Via Festa del Perdono

<https://www.touringclub.it/notizie-di-viaggio/tre-giorni-di-cime-a-milano>



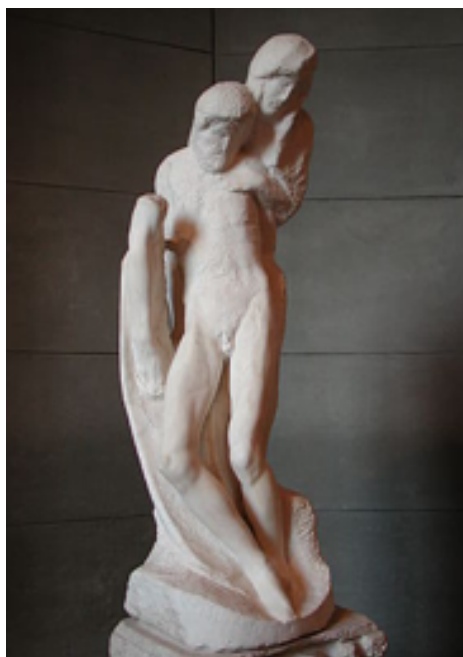
Inside a Conference Room at Ca' Granda

<https://www.theplan.it/eng/architettura/ristrutturazione-aula-magna-auditorium>

Milan is the second largest city in Italy behind Rome. It is nestled in the Po Valley near the Alps and Lake Como. Recognized as the world capital of fashion and design, Milan is also a scientific, finance and cultural center for Italy. Furthermore, Milan, being in northern Italy, is a multi-ethnic city where central European and Mediterranean cultures mix. Its multi-disciplinary characteristics make it a perfect venue for an AIC Congress! Participants can enjoy such iconic works of art as Leonardo da Vinci's Last Supper painting and Michelangelo's last incomplete sculpture, Pietà Rondanini.



da Vinci's Last Supper ([https://en.wikipedia.org/wiki/The_Last_Supper_\(Leonardo\)](https://en.wikipedia.org/wiki/The_Last_Supper_(Leonardo)))



Michelangelo's Pietà Rondanini (https://en.wikipe-dia.org/wiki/Rondanini_Piet%C3%A0)

Participants can also enjoy the Duomo, the Gothic cathedral in the city center that took nearly six centuries to complete (from 1386 to 1965). A visit to Castello Sforzesco, known for being one of the largest citadels in Europe in the 16th and 17th centuries, reveals a great sightseeing spot filled with museums and art collections.



Castello Sforzesco https://en.wikipedia.org/wiki/Sforza_Castle



El Duomo <https://www.truemilan.com/place/the-duomo-of-milan-duomo-di-milano/>

This 14th Congress in Milan, Italy promises to be filled with culture, art, design, fashion, museums, cathedrals, theaters, castles and plenty of colorful conversations. So mark your calendars for August 30 – September 3, 2021!

PLEASE NOTE: DUE TO THE COVID-19 PANDEMIC, IT MAY BE NECESSARY TO CHANGE THE CONFERENCE ATTENDANCE TO A HYBRID MODEL OR COMPLETELY ONLINE. IN THAT CASE, THE DECISION WILL BE COMMUNICATED BY THE END OF APRIL 2021.

**Paula J. Alessi, ISCC
Liaison to AIC**



First Call for Papers

AIC 14th Congress Milan 2021

Abstract Deadline: March 31, 2021

This is the first Call for Papers for the 14th AIC Congress to be held in Milan, Italy from **August 30 to September 3, 2021**. Authors are invited to submit papers that deal with any of the following 13 topics:

1. Color and Measurement/Instrumentation
2. Color and Digital Technologies
3. Color and Lighting
4. Color and Physiology
5. Color and Psychology
6. Color and Production/Manufacturing
7. Color and Restoration
8. Color and Environment
9. Color and Design
10. Color and Culture
11. Color and Education
12. Color and Communication/Marketing
13. Color and Autonomous Driving

All submissions must be in English and describe original work that has not been published or submitted elsewhere. Presentations can be oral or poster. All abstracts will be reviewed by at least two members of the Scientific Peer Review Committee in a double-blind peer-review process. Authors can indicate their preference for an oral or poster presentation, but the final decision will be made by the Scientific Peer Review Committee. ***The abstract submission deadline is March 31, 2021.***

Abstracts sent by email will not be accepted. Abstracts must be uploaded to EasyChair, the on-line management conference system at:

<https://easychair.org/conferences/?conf=aic20210>

To send contributions, first register on EasyChair and create an account; or, if you are already registered, you can use the one you have. To register for the first time, choose "Sign up for an account" on the first page and follow the instructions. It is important to enter complete data by carefully filling in the form, entering real data and valid e-mails so that the congress organization can contact you.

To send the abstracts, connect to the EasyChair system by entering the login and password obtained from the previous registration and choose “New Submission” from the top menu, then:

- Fill in the data for the authors and tick “Corresponding Author” so that the email address indicated (at least one) receives communications from the organizers
- Enter the title and abstract in the designated fields (maximum 4000 characters including spaces)
- Choose among the 13 topics above to characterize your abstract
- Enter at least 3 keywords relating to your abstract

A confirmation e-mail will be sent to the corresponding author who has correctly completed the above abstract submission process.

Here are the **2021 oral and poster presentation deadlines** that are worthy of note:

- March 31 – abstract submission
- April 20 – abstract acceptance notification and poster or oral designation given
- May 15 – authors’ registration
- May 30 – preliminary program issued
- June 10 – end of early registration by at least one author
- July 15 – paper submission deadline

The final manuscript must be sent by July 15, 2021. Instructions for final manuscript format will be posted on the AIC2021 Congress website (www.aic2021.org).

Each author and/or co-author wishing to participate in the congress must pay the registration fee. Please note that at least one of the authors of the accepted submissions must register for the congress by June 10th 2021, participate in the congress and present the work in the format decided by the Scientific Peer Review committee (oral or poster). The registration of one author is valid for the submission of a maximum of 2 papers. People who have not previously registered to the Congress and paid the registration fee will not be admitted to the Congress.

Only the accepted papers that are presented (oral or poster) during the Congress will be published in the AIC2021 Proceedings. Plans are underway to have the best papers, in extended version, selected for possible publication in a reputable journal as a special issue. Detailed information on this special issue will be available soon on the Congress website (www.aic2021.org).

Citation for 2020 Macbeth Award

Recipient Roland L. Connelly, Sr.

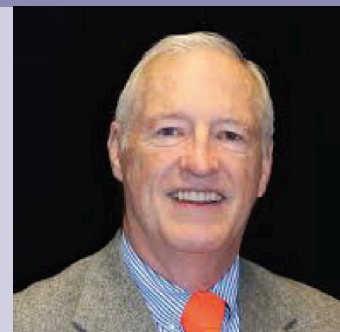
This award was presented at the ISCC meeting on October 2, 2020.

The ISCC Macbeth Award is given for one or more recent outstanding contributions in the field of color. It is to be presented to a member, or former member, of the Inter-Society Color Council. The contributions shall have advanced the field of color, interpreted broadly as in the objectives of the Council as defined in Article II of the Constitution. The merit of a candidate shall be judged by his or her contributions to any of the fields of interest related to color whether or not it is represented by a Member-Body. The contribution to color may be direct, it may be in the active practical stimulation of the application of color, or it may be an outstanding dissemination of knowledge of color by writing or lecturing. The candidates for the Macbeth Award need not have been active in the affairs of the Council. Recent recipients include Andrew Stockman, Max Derhak, Françoise Viénot, Joanne Zwinkels, and Harold Van Aken.

I would like to thank Joanne Zwinkels, chair of the Macbeth Award committee, and her team for their selection this year of Roland L. Connelly, Sr. Roland is being recognized for his contributions to the field of color through his focused work in the practical application of color science to color measurement. This included milestones such as UV measurement of textiles

and standard CIE illuminants for LEDs. The textile UV Calibration program permits improved agreement between instrumental and visual evaluation of color and color difference of optically-brightened materials. The procedure also improves inter-instrument and inter-lab agreement in the evaluation of optically-brightened textiles. Roland has provided ongoing education around lighting (especially LED technologies) and color for global supply chain organizations. Roland continues to be active in improving the industry understanding of the effect of solid state lighting technologies on global color communication. He has leveraged his ASTM activity and AATCC activity to produce illuminant weighting tables for use by all commercial color instrument companies so that global partners can achieve consistent colorimetric results from spectral data.

Roland is an innovative thinker and an enthusiastic teacher. He uses his technical gifts to improve the practice of color measurement and communication. He has also been an active, long-time member of the ISCC. He is a past-president of the ISCC, and faithfully encouraged his colleagues to participate in the ISCC. I am delighted to present the 2020 ISCC Macbeth Award to my friend and mentor, Roland L. Connelly, Sr.



Roland L. Connelly, Sr.

To view a recording of Roland Connelly Senior's acceptance of the Macbeth award view the link provided.

[http://www.iscc-archive.org/organization/2020 Virtual Annual Meeting/6b Macbeth Presentation.mp4](http://www.iscc-archive.org/organization/2020%20Virtual%20Annual%20Meeting/6b%20Macbeth%20Presentation.mp4)

Ann Laidlaw

Citation for 2020 Nickerson Service Award

Recipient Maggie Maggio

This is the speech that was given at the Virtual ISCC Annual Meeting on October 2, 2020 when this award was presented.

It is with great pride that I appear before you today to announce that the recipient of the 2020 ISCC Nickerson Service Award is Maggie Maggio! 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.

It is my honor and pleasure to give this Nickerson Service Award citation for my dear friend and dedicated ISCC member, Maggie Maggio. Maggie joined ISCC in 2015 just 5 years ago. It is amazing to realize that Maggie's detailed and visionary contributions to our organization reach way beyond her 5-year membership timeline!

I first came to know Maggie in late 2015, when, I was the ISCC Newsletter Editor. I asked her to write the "Meet Your Fellow ISCC Members" column for the winter 2016 issue. This started out as a welcome to ISCC phone call that I made to her. We talked for quite a while as I acquainted Maggie with ISCC and made her more comfortable about writing a column to introduce herself to us! Maggie wrote a very delightful full-page entry introducing us to her concepts for Teaching 21st Century Color. Maggie is an architectural designer, artist and color educator. As Maggie taught color to adults, she became more aware of the problems that an elementary color education gave children when it was centered around a red, yellow and blue primary system. She found that teaching adults to "unlearn" the RYB system and learn, for the first time, the RGB and CMYK primary systems gave them confidence and satisfaction that allowed them to better understand color and color mixing. Maggie described why she closed her architectural office and began her color education quest for more accurate and timely methods for teaching color to children worldwide. In 2015, these concepts had not been discussed in any ISCC circles. So, Maggie's article was very well received among our members! Quite honestly, something magical happened as Maggie found ISCC, an organization of artists and scientists who could actually help her more effectively fulfill her color

education quest. Furthermore, ISCC found Maggie, who could help us bridge the gap that we have been experiencing between artists, scientists and industrialists in color education. Also, her newsletter article was the birth of Maggie's highly successful Color Literacy Project that is very active now within ISCC and internationally with AIC. More on that project later.

In 2017, Maggie was elected to serve on the Board of Directors. She voluntarily took on the role of co-chair of the 2018 Munsell Centennial Color Symposium. I was the other half of her co-chair for this monumental event. Working on this meeting truly was a chance of a lifetime for both of us. Our relationship worked so well together. At times, we were very much in tune with each other's thoughts. At other times, when we were doing totally different tasks, some of which seemed insurmountable because of obstacles along the way, we would lift each other up and work on solving the problems together! We fed off of each other's energy. If there was a job that needed to be completed and I felt my skill set would not work well to complete it, Maggie freely took it on and vice versa. In actuality, Maggie did the lion's share of the detail-oriented work that made the meeting a success. She met with MassArt to arrange all venue details, including dormitory availability for participants. She did the budget and made sure we stuck to it. She composed the program book. She helped get the website up and running and sent out frequent communications to the attendees. In short, Maggie made sure that the symposium would run like clockwork. It was an international success that honored the legacy of Albert Munsell while bridging the gap between artists, scientists and industrialists through the common thread of color education. It started a conversation that is still going on today!

For the ISCC Joint Meeting with TAGA in 2019, Maggie partnered up with John Seymour to give a delightfully humorous role-play on communication difficulties between designers and printers. It was called "The Grand Canyon of Color: How to Talk Color Across the Creative/Technical Divide." Maggie played the part of an inexperienced graphic designer and John played the part of a frustrated but helpful printer. This role-play

was very instructive and enjoyed by all! Another very important part of the 2019 ISCC/TAGA meeting was the Color Literacy session. Here Maggie and Luanne Stovall shared information about the 21st Century Color Literacy Project, a newly formed, long-term initiative to identify misinformation about color in education and promote updated color competencies relevant to 21st century industries and disciplines. Maggie introduced us to the fact that many United States pre-university (i.e. K-12) school standards require teaching color in both art and science disciplines. However, the curricula are not integrated to reflect the multi-disciplinary nature of color. In 2020, with the proliferation of digital technology and computer availability for most students, the opportunity to teach things like the three-dimensionality of color is possible for all ages. Maggie's passion for this key color education deficiency led her to blaze a trail for the Color Literacy Project to solve some of these problems.

Maggie discovered that these color education deficiencies occur not only in the U.S. They are also pervasive in many other countries throughout the world. So her Color Literacy Project that was born nationally within ISCC has gone international as a joint ISCC/AIC Color Literacy Project and was approved by the International Color Association (AIC) in January of 2020. Thus, what started out as a lone woman's crusade to rectify color education misconceptions has wound up becoming a major international project that will change the world. The main objective of this Color Literacy Project is to develop a foundational color education website that provides state-of-the-art, introductory, interdisciplinary information and materials on the art, science and industry of color for use in classrooms. This will be Maggie's legacy!

Continuing with our chronological path of Maggie's impact on ISCC, we are now in June of 2020 in the midst of a pandemic. Yet, we were hosting Color Impact 2020 Virtual Symposium: A New Vision for Color Education. Maggie was intimately involved in planning this very successful 6-hour virtual conference. There were 269 participants from 29 countries around the world! This was a first for ISCC and we were thrilled with its success!

In closing, I must say that I have been on the Nickerson Service Award Committee for quite some time now. Maggie Maggio is a very unique recipient. After joining ISCC in late 2015, she has been a major contributor to the fabric of what ISCC is on an annual basis for each year that she has belonged. This is truly amazing! Her energy is never-ending and infectious! She is a pleasure to work with. Her ideas have catapulted ISCC into the 21st century. Her presence has allowed us to revitalize the art and design portion of the ISCC triangular logo.

On a personal note, I must say that since that first phone call in late 2015, Maggie and I seemed destined for a long-term friendship in spite of the fact that she is an artist and I am a hardcore color scientist. It never mattered. We found a way to communicate that I have never found with anyone else in the color community. The kinship that I have found with Maggie will always hold a special place in my heart. Maggie, thank you so much for asking me to give your citation. Without further ado, it is with great pleasure that I introduce you to Maggie Maggio, the recipient of the 2020 ISCC Nickerson Service Award.

Here is a link to the recording of the citation from the meeting and the acceptance from Maggie Maggio.

[http://www.iscc-archive.org/organization/2020 Virtual Annual Meeting/5 Nickerson Citation.mp4](http://www.iscc-archive.org/organization/2020%20Virtual%20Annual%20Meeting/5%20Nickerson%20Citation.mp4)



Maggie Maggio and the Nickerson Service Award

**Respectfully submitted,
Paula J. Alessi**

ISCC Annual Meeting Summary

Friday, October 6, 2020 the first virtual ISCC annual meeting was held with 30 - 40 people attending throughout the meeting. The meeting covered a number of topics over the two-hour duration.

President's Report

Renzo Shamey provided the president's report which discussed the Council's work in the last year related to:

- ISCC Newsletter
- Webinars
- International Colour Day
- Update to the standing rules
- Nominations for the board

He also thanked outgoing board members and officers.

President-Elect's Report

Dave Wyble provided the report which included a brief report on the Fundraising team, Membership numbers and the response to the Member Survey. His report focused on the survey results. The council received 70 responses from the survey. The survey will help the council focus on growing the membership and understanding the needs of the existing members. Overall the survey indicated that the membership would like:

- More interactions with colleagues in all fields of color
- To be further educated in color
- Find more ways to connect, especially on-line

Treasurer's Report

Frank O' Donnell provided the treasurer's report:

Bank Statement was \$61,814.89 in Dec. 2019

Total expenses for 2020 were \$7,841.55

Total income for 2020 was \$30,549.82 and transfer from PayPal \$4,000.00

Current balance in the bank account is \$85,052.47 with an additional \$1,278.76 in Pay Pal account.

Secretary's report

See the link to board meeting minutes. You must be logged in as a member on the website to access this link.

<https://iscc.org/page-18114>

Special Topics Report

Special topics were presented by Ellen Divers, Maggie Maggio and Jean Hoskin. The topics were visual identity, summary of color conference, Color Impact 2020, Color Literacy Project, Color Impact 2021 and Student Engagement.

Brand Virtual Identity team is Luanne Stovall, Lina Cardenas, Viviana Buvinic, and Ellen Divers. Originally this activity began as a conversation about updating the logo. But it did not stop at updating the logo and a more comprehensive look at expanding this to a full rebranding of the ISCC is underway. It will be driven by a survey that will define the brand attributes. This will drive the definition of the student competition. The survey will be defined and sent out in 2020. The competition will begin in the Spring Semester and end in the fall 2021. Visual identity will be defined and then implemented across a variety of social media platforms.

The next two topics, Color Impact 2020 and Color Literacy Project, were presented by Maggie Maggio. Color Impact was a joint conference with ISCC and International Association of Colour Consultants North America (IACC-NA). Color in Education and Color in the Built Environment were the themes for the conference which was scheduled to be held on the campus at Yale. Due to the pandemic, the on-site conference was cancelled and a virtual conference was quickly put in place. GoToSeminar and Zoom were tools used to hold the meeting and Color in Education was the only topic covered in the day-long conference which had 14 presenters, and approximately 200 people in attendance. The recordings are available to all registrants. This provided \$18,000 net income which has been designated to fund three ISCC programs:

- Color Impact 2021
- ISCC/AIC Literacy Project
- New ISCC Student Outreach Program

In the Color Literacy report, the work of the ISCC/AIC Joint Colour Literacy Project steering committee was recognized. This international group meets monthly to work on the project with the ultimate goal to build bridges between the arts and sciences in color education at all levels. This international group meets monthly to work on this project. This is to bridge gaps in introductory information in Color Education. The three phases of the project will be complete in 2025. The first phase is to identify core and basic concepts, Phase 2 is to test prototypes and review materials, and Phase 3 includes teacher training and feedback. The end result is to create a resource website for teachers that will make it easy for them to teach from an interdisciplinary perspective about color. The core concepts the project has identified and will address are that color is:

Experiential – color is a fundamental part of life
Perceptual – seeing color is a perceptual system
Measurable – describing color and color specification
Relational – interactions and color in context

These will be the cornerstones of color education literacy. It is hoped that the cornerstones will support an interconnected, scaffolded learning system for teaching color from pre-school to professional levels.

In phase two, the development, review and testing of resource materials for educators will be completed. This will include an ISCC Student Poster Competition in conjunction with Color Impact 2021. Information about the project and the poster competition can be found at www.colourliteracy.org

Color Impact 2021 information and Student Engagement was presented by Jean Hoskin. She outlined the speakers who have agreed to present in either a virtual, on-site or hybrid conference depending on what is possible in 2021. Keynote speakers will be:

- Eve Ashcraft author of “The Right Color”
- Shashi Cann, distinguished thought leader for architectural design
- Jill Pilaroscia, Designer, Architectural Color Consultant and founder of Colour Studio
- Spencer Finch, American Artist. Studies in light, color and perception.

The ISCC will begin looking at ways to have more student engagement that aligns with the organization’s charter and focuses on an exchange of interdisciplinary ideas through interviews, discussion and webinars. **The first event will be held November 13 at 3 PM EST.** It will be the first in a series of events called Fluorescent Fridays.

Awards

The meeting also included presentation of the Nickerson and Macbeth awards. The Nickerson citation was given by Paula Alessi and accepted by Maggie Maggio. The Macbeth citation was given by Ann Laidlaw and accepted by Roland Connelly. These are covered in detail in separate articles in this newsletter.

Closing and Meeting Details

Renzo Shamey hosted a question and answer session, and provided a closing statement. The meeting was recorded and can be viewed on the ISCC website.

**Here is the link to the
recordings of the virtual
ISCC Annual Meeting:**

<https://iscc.org/Virtual2020>

COLOR IMPACT 2021

For the Built Environment

Targeted for June 2021. Specific dates to be confirmed.

Due to the ongoing pandemic, the event plans are not final. We continue to juggle a live conference, with a virtual symposium or a hybrid experience. What can you do? If you have had a creative Zoom experience this year, let me know about it. Send me your ideas to make this event engaging and informative.

Based on the success of the Virtual Symposium on Color in Education at Color Impact 2020 (see ISCC Annual Meeting Summary in this newsletter), we are energized by the possibility of international speakers, audience, and students. Continuing to focus on the built environment, our speakers are able to join us in 2021. We have some great additions in areas of science, materials, and technology for design.

Whether you are an architect, interior or industrial designer, artist, student or color scientist, we invite you to explore the influence of lighting and color science on design and to meet researchers who have developed innovative studies and applications in many facets of color. Internationally known art and design professionals will be keynote speakers on the impact color has had on their lives and careers. If you are familiar with their work or not, you will leave the conference inspired.

Enhancing the program, we have added a Welcome Keynote presentation by **David Kastan**, author of *On Color*. Dr. Kastan is the George M. Bodman Professor of English at Yale University. He is also our premiere guest on the new interview series *Conversations on Colour* beginning in 2021.





Shashi Caan, distinguished thought leader for architectural design internationally. Founding partner of The Collective US / The SC Collective UK. She is dedicated to furthering human betterment through and by design.



Eve Ashcraft, designer and author of *The Right Color*, founder of Eve Ashcraft Studio, and creator of paint collection "Eve Ashcraft Color: The Essential Palette". She designs a variety of products for exteriors, interiors, corporate branding, and knitting yarns.



Robert Hirschler is Chair of the AIC Study Group on Color Education. He has been actively involved in all aspects of color theory color science and color technology. His recent article in *Color Research and Application* is titled, "How Much Color Science Is Not Too Much?"



Jill Pilaroscia - Accredited IACC Designer believing in the power of color, which shaped her quest to educate the public and design professionals about the value of color. She is Architectural Color Consultant and founder of Colour Studio.



Spencer Finch is a contemporary American Artist who studies time, light, color and perception. He is best known for his ethereal light installations. His work integrates science, poetry, art and philosophy. His practice embraces color in all its paradoxes and ambiguities.



Renzo Shamey, author of a soon to be released book, *Pioneers of Color Science*, is the CIBA Professor of Color Science and Technology at North Carolina State University and ISCC President.

In addition, we will hear from four expert researchers on education and application of color.



Leslie Harrington is Co-founder of HueData, a color intelligence company and Vice President of AIC.



Kory Stamper is a Language Specialist and the author of the best-selling book, *Word by Word: The Secret Life of Dictionaries* and will speak on "Rose" by any other Name, The Color Name Problem.

Additional learning opportunities for attendees include:

- A webinar series starting in 2021
- Breakout Sessions
- Research and Design Posters
- Lighting Panel and Materials Panel
- Networking Events
- Expanded Student Poster Competition with prizes
- Short Courses on Color Literacy, Josef Albers Color Experiments, Measuring Color, and Humane Color Design
- Tours of the campus architecture, the Birren Library, and the Albers Foundation
- ISCC and IACC-NA Annual Meetings

Color Impact 2021 is a collaborative event with the International Association of Color Consultants - North America.



*See you in 2021.
Jean Hoskin, ISCC Secretary,
Color Impact 2021
Conference Co-Chair*

Fluorescent Fridays

Launches as a webinar series for students!

GOT COLOR? Attention color-curious students from all disciplines! You are invited to be part of a new webinar series exploring the interdisciplinary nature of color.

Calling all faculty to alert your students to a new opportunity to network with industry professionals and fellow students from all disciplines!

Fluorescence is the process whereby an object absorbs energy at one wavelength, and re-emits that energy at a different wavelength. On Fluorescent Fridays, students absorb energy from industry experts for them to re-emit in their careers.

How Do You Organize Your Crayons?

A panel discussion introducing CIELAB for your "Color Management Tool Kit"

WHAT: Fluorescent Fridays

WHO: University students

WHEN: Friday, November 13, 3:00 pm EST

WHERE: ZOOM Link below

WHY: A new International Student Chapter focused on interdisciplinary color topics

PANELISTS:

- John Seymour, Clemson University and John the Math Guy, LLC, Color Science Consultant
- Mary Mello, Science & Technology Color Stylist Specialist, PPG
- Ann Laidlaw, Color Consultant, ACL Color Consulting LLC.

Color is a multisensory phenomenon vital to our lives. The Inter-Society Color Council (<https://iscc.org/>) is creating Fluorescent Fridays for university students from all disciplines (including Science, Arts, Design, Communication, Social Sciences) to network with fellow students and industry professionals and explore cutting-edge information about the nature of color and its applications in the world. In 2021, students will be invited to plan the program of Fluorescent Friday events. We encourage a focus on an exchange of interdisciplinary ideas in an interactive format of interviews, discussions, webinars, and papers.

Join Zoom Meeting:

<https://clemson.zoom.us/j/92613871206?pwd=QTdyZWZNR2Nk5EVjJ5SnJlUTNlMlRlU09>

Meeting ID: 926 1387 1206

Passcode: 329875

FLUOR- ESCENT FRIDAYS



Color Impact 2020: Summary- Part Two

Part One of this article, published in the last issue of the newsletter, described the shift of the Color Impact 2020 conference, which was originally planned to be at Yale and became the first ISCC virtual symposium on June 6, 2020 due to COVID-19. The previous article included a summary of the first half of the program for the one-day symposium. Here is the program summary for the second half of the day.

Hands-On Color Activities and Interactive Polls

Paul Green-Armytage, Designer, Educator, Researcher and Writer

Paul Green-Armytage engaged attendees in two activity sessions featuring presentations on the evolution of the “Color Clues” naming game that was played during the pre-symposium Zoom sessions. Green-Armytage explained how the game grew out of his realization many years ago that “Many of the confusions around color are to do with the way we use language in relation to colors,” and noted that the game was inspired in part by Dimitris Mylonas’ Colors of Babel card deck.

The colors on Chart A* used for the “Color Clues” game in the pre-symposium sessions were based on a prototype color sorting set designed by Green-Armytage and Maggie Maggio for exploring colors in early education programs. The set introduces two terms—family and character—that are currently being tested for use in sorting colors with young children.

Families divide colors based on similarity in hue. For example, all variations of orange can be grouped into the Orange Family. In addition to sorting by hue, colors can also be sorted into Characters based on similarity in tone or nuance. For example, the vivid colors from all the hue families share the same characteristic of high chroma and can be grouped together into a subset of Vivid Characters.

Green-Armytage shared that he initially asked his grandchildren for feedback while attempting to come up with easily understood terms for the sorting categories. The resulting terms of family and character were tested by asking “Here is a set of colors in the same family, can you put together other families?” and “Here are a few colors with the same character, can you pick out other colors with the same character?” After the new terms were illustrated with examples, the kids “got it” very quickly and had fun sorting colors.

by Maggie Maggio

After explaining these terms, attendees had the chance to give them a try. Following the presentation, Chart A was used for a series of interactive polls. Participants were asked to:

- Match the first color in a row of six to another color in the row with the same family.
- Match the first color in a row to another color in the row with the same character.

The results of the polls were instantly available. Because the responses to the first question were all over the place, Green-Armytage took a minute to clarify the terminology. After that, the polls came in with a high percentage of attendees choosing the matching color.

In the second session, Green-Armytage used Chart B* from the activity sheets with colors that were more muted and harder to sort. The same questions were asked of the attendees and this time the responses came in quicker and more accurately, even though there were much smaller differences in the appearance of the colors.

By the end of the two sessions, the majority of the attendees “got it” and were able to identify colors in the same family and in the same character.

The feedback from the follow-up survey showed that the interactive sessions were a hit with the attendees. They broke up the day, created a sense of community, and demonstrated how hands-on interactive learning experiences can be both fun and educational at the same time.

* You can see Chart A and Chart B on the CI 2020 website at: <https://www.colorimpact2020.com/charts>.

Point-Counterpoint Debate

Moderator: Robert Hirschler, Chair, AIC Study Group on Colour Education

A Defense of Traditional Color Theory by Zena O'Connor, Principal Research Consultant

Widening Our Vision by Maggie Maggio, Chair, Joint ISCC/AIC Colour Literacy Project

O'Connor and Maggio each shared their position on Traditional Color Theory (TCT) in five-minute presentations.

Ms. O'Connor began by describing traditional color theory (TCT) as a phrase specific to the world of art and design. “Traditional color theory is a fit-for-purpose bundle – a series of constructs, conceptual models and conceptual mapping of color relationships for the identification and description of color attributes, relationships and effects in respect to substance color.” Reflecting on the use of TCT concepts as the basic learning components in a scaffolded color educational program, O'Connor stated that “Like basic music theory and algebra, TCT is a foundational conceptual framework to explore color. Just as basic music theory does not and algebra does not represent the complexity of quantum mechanics, TCT does not represent the complexity of color.”

One of the strongest arguments O'Connor made was in defense of TCT terminology. Recognizing that many disciplines use different words for the same concept, she advocated for the continuing use of TCT terminology. Due to its role as a common language in art and design, the terminology is also used in industry, manufacturing, advertising and branding.

In her short presentation, Ms. Maggio illustrated Traditional Color Theory by showing a reference card designed by Heather Carr, a K-3 Art Teacher and available for purchase on the Teachers Pay Teachers website (www.teacherspayteachers.com). The card is a good example of how color theory has been reduced to a simplistic “rehash” of five basic teaching topics. In early education classes students learn how to:

1. Use a Red, Yellow, Blue (RYB) color wheel.
2. Mix paints with RYB primaries.
3. Select hue combinations from the RYB wheel.
4. Divide the RYB wheel into warm and cool hues.
5. Assign universal meaning to the hues. For example, Red = Anger.

These five components are ubiquitous in “Intro to Color Theory” courses, articles, books, videos and websites. The pervasive nature of this skeleton version of color theory reinforces out-of-date and ineffective strategies for understanding, mixing and combining colors.

Because all the above components are focused on only one dimension of color – hue – TCT neglects the three-dimensionality of color and needlessly limits students’ understanding of color. One of the first steps in expanding TCT is to introduce students to a simple 3D model in the early educational system in both art and science classes.

Maggio ended with slides showing that we don’t need to throw the baby out with the bath water but we do need to expand foundational color education. This can be done by relating the basic concepts of TCT to core concepts across all disciplines. As the moderator asked a number

of pointed questions, it became clear that the terms color theory and Traditional Color Theory did not mean the same thing for both the speakers. For the purposes of the debate, color theory encompasses the large field of information and research on color topics while TCT refers to the oversimplification of theories summarized and popularized in books by Johannes Itten and standardized in K-12 art classes all over the world.

In the back and forth discussion that followed, two key points of consensus emerged. Both participants agreed that:

- It is important to recognize that many disciplines currently communicate using the vocabulary of TCT.
- It is time to move beyond this over-simplified version of color theory and take up the challenge to expand and update foundational colour education across disciplines.

Panel Discussion

2020 Forward Vision: Next Steps in Color Education

Invited Panelists:

Panel Moderator: Luanne Stovall, Lecturer, University of Texas, Austin and ISCC Board Member

Leslie Mutchler, Chair, Foundation Department, Pratt Institute, NY
Alicia Keshishian, Board Member, and Chair, Education Division of Color Marketing Group (CMG)
Nader Sadoughi, a senior in the BFA program at the University of Texas, Austin

Each panelist presented a short slide show to describe their approach to

color education. The presentations were followed by a group discussion on expanding color education programs specifically for artists and designers.

Ms. Mutchler shared how a creative approach to teaching color influenced her redesign of the art foundation programs at the University of Texas, Austin and Pratt, and emphasized that she was "... always focused on both the spiritual, the slippery, the emotive along with the formal, the scientific and the concrete." She ended the presentation by showing photos of her work on a fictive course "Geochromatic Studies" with partner and fellow teacher Jason Urban, and noted that "The research, the play, the experimentation enters constantly into our classrooms and our teaching then feeds our itch for further research."

Ms. Keshishian teaches intense and immersive color workshops for artists and designers and also offers courses for color professionals from a wide range of industries. The goal of the CMG course she team teaches with designer Roz Kavander and Art Schmehling from X-Rite/Pantone is to "... bridge communication between the creative and technical teams." The course recognizes that there are specific color systems used in different disciplines and her approach is based on the principle that "If you have your fundamentals in order, and you are able to address them, then you can apply them to the different systems."

Mr. Sadoughi is an enthusiastic student color researcher and advocates teaching the CIELAB system in art and design degree programs. He shared highlights of his recent research and ended his presentation with the statement "In conclusion, I believe it is time to start teaching art

and design students the quantitative aspects of color and to retire some of the 18th and 19th century color theories that were outdated even before people started teaching them at the Bauhaus over 100 years ago."

Strong personal connections between the panelists were evident throughout the session and their shared experiences resulted in a lively discussion following the presentations.

Report on the Colour Literacy Project

Maggie Maggio ended the day by announcing the public launch of the new Colour Literacy Project website. She stressed that the four-year project is at the very beginning and that, while the website is just a landing page at this point, the long-term plan is to expand the website into a comprehensive resource for color educators at all levels.

See the *ISCC Annual Meeting Summary* in this newsletter for more info on the first year of the Color Literacy Project. It also contains the official report on the Symposium.

**Check out the new
website at:
www.colourliteracy.org**

Nominating Committee Report

This is the announcement of the candidates running for the ISCC Board of Directors with terms starting in 2021. The term of service is three years for directors and two years for officers.

Candidates

We have an excellent slate of highly qualified candidates. This year we have four candidates for two open director positions. We also have officer candidates for President-elect, Secretary and Treasurer. (Photos and biographies follow.)

Slate

Director (2 openings):

Shoshana Burgett
Anthony Calabria
Kate Edwards
Mary Mello

President-elect: Maggie Maggio

Secretary: Jean Hoskin

Treasurer: Jerald Dimas

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 serves as the report of the Nominating Committee to the membership. In 30 days, the ballot will be sent as a link via email to all members capable of receiving it. Ballots shall be due on the following January 4. On January 15, the secretary shall report the results of the election to the Board of Directors.

Thank you to this year's Nominating Committee: Jerry Dimas (chair), Danny Rich, Rachel R. Schwen, Amy Woolf and Dave Wyble.

Biographies

Board of Director Candidates:

Shoshana Burgett



Shoshana 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 creative for 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.

Anthony Calabria



Anthony is the Global Color Technology Manager for the Research and Development group at Axalta Coating Systems; he has been involved in Color Technology for the coatings industry for more than 15 years. In his current role, Anthony manages teams responsible for color data modeling, visualization, measurement, pigmentation and dispersion development. Since joining Axalta in 2014 he has been involved in color development, color formulation systems, data management, and process optimization for the automotive and industrial coatings businesses. Prior to joining Axalta, he held color technology roles in architectural coatings at Benjamin Moore Paints, and graphic arts at Sun Chemical. Anthony has a BS in Imaging Science and an MS in Color Science from Rochester Institute of Technology. Anthony lives in the Philadelphia area with his wife and two daughters, he enjoys the outdoors, photography and coaching soccer.

Kate Edwards, Ph.D.



Kate is a member of the Research group at Datacolor, where she focuses on improving the color performance of the company's instruments. She is involved in the ASTM Committee E12 on Color and Appearance. Earlier she managed the Advanced Technology Group at Ocean Power Technologies, preceded by working as a researcher at the University of Washington's Advanced Physics Lab. She did a postdoc at the University of Washington and has a Ph.D. in physical oceanography from UCSD.

Mary H. Mello

Mary is the Science & Technology Color Specialist at PPG Industries in Oak Creek, WI, and has over 25 years of color education from industry color programs designed for color matching, color database development, color theory, and pigment and effect pigments vendors. As the On and Off-Road Vehicle Color Stylist at PPG, Mary takes a customer's vision for industrial coatings and makes it reality through color technology and development. She intuitively sees the opportunity that can bring the customer, color, and PPG together into long-term vision. She has a unique background in color and industry, including color batch adjustments, color education, effect pigments analysis, digital imaging, and color trend research. Her passion for color started when she was only 12, and she continues to collect color books and art.

She has advised PPG Aero space segment with effect pigment knowledge, and PPG Automotive refinish contributing to the colorant

consolidation within PPG segments. She is active on many social media sites, sharing color trend data, the latest coatings technology with color and sharing developing color projects from across the world. She is also a member of Detroit Color Council since 2019, ISCC since 2018, and Color Cares since 2015.

Previously, Mary worked in various industry segments using color, including: Automotive Color Specialist at Worwag, Architectural R&D Color Group Leader at Sherwin Williams, Wood Coatings Specialist at Nicoat, and Automotive Color Technology Group at Sherwin Williams.

**For President-elect:
Maggie Maggio**

Maggie Maggio holds a B.S. in Interior Design from Drexel University and an M. Architecture degree from Syracuse University. She became a member of ISCC in 2015 after closing her architectural design business to focus on teaching 21st Century

Color classes for adult artists. In January of 2017, she joined the Board of Directors and co-chaired the Munsell Centennial Symposium with Paula Alessi in 2018. Last year, she and Jean Hoskin joined forces to co-chair the planning committee for the Color Impact 2020 Conference and, due to COVID-19, successfully pivoted the event into the first virtual ISCC Symposium in June of this year. While serving on the board, Maggie proposed, and now chairs, the Joint ISCC/AIC Colour Literacy Project to address common misconceptions and provide foundational resources for teaching color from a multi-disciplinary perspective. Looking forward, Maggie would like to see ISCC continue to expand opportunities for students, teachers, professionals and the public-at-large to learn more about color across all disciplines.

**For Treasurer:
Jerald Dimas**

Jerald is Director of Color Science Applications for Color Communications, LLC Chicago IL. He has spent 42 years in the field of applied color science. Jerald has made substantial color technology contributions to his organization helping to make Color Communications a leader in the production of color collateral and decorative surface products. He's been an active member of the ISCC since 1987 and has served as Director, President and most recently Past-President of the ISCC. He has also been a member of the DCC since 1994 and is member of ASTM Committee E12 and ASTM Committee D01. Jerald looks forward to continuing his service to the ISCC.

***For ISCC Board Secretary:
Jean Hoskin***



With color experience that balances theory and application, art and science, Jean Hoskin retired from Macy's Merchandising Group as Director of Color Services in 2016. Since her retirement, she has been writing

and reading on color. She is currently co-chair for of the ISCC 2021 Color Impact Conference and Secretary of the ISCC Board of Directors.

Majoring in textiles, Jean holds a BS from Iowa State University and an MA from Michigan State University. Her PhD from the University of Tennessee focused on color in Textile Design, Testing, Dyeing & Printing. Jean began her career at the University of Kentucky developing courses on Color Theory for apparel and interior design students.

During a university sabbatical, Jean built a textile screen-printing program for Kentucky Textiles responsible for design, color matching, and prepress. Leaving full time teaching, she remained with the project and was promoted to creative design manager, supervising apparel design, color and material development.

In 1995, Jean jumped from manufacturing to retail, joining Lane Bryant at Limited Inc. in Columbus, OH as color manager and then at May Merchandising Company in St Louis, MO creating an international color management program. In 2006, she moved to Macy's in New York, where as Director of Color Services she implemented a global color approval process. Jean co-managed an international team of 35 and was responsible for training, color systems and analyzing trends in color management technology

Always a teacher, Jean is a frequent presenter on innovation and process improvement at professional meetings and webinars for AATCC and ISCC. She is a member of AATCC, former president of IACC-NA and a former board member of CMG.

Calendar 2020- 2021

Oct 28	CMG Virtual Workshop Experience : Future Thinking 2030 Info: https://colormarketing.org/event/future-thinking-2030/
Nov 2-13	CIC28 Virtual Color and Imaging Conference Info: https://www.imaging.org/Site/IST/Conferences/CIC/CIC_Home.aspx?Website-Key=6d978a6f-475d-46cc-bcf2-7a9e3d5f8f82&hkey=d2cf3f19-87b4-4164-8274-c40180e9dfa7
Nov 16	ICC DevCon 2020: The Future of Colour Management Info: http://www.color.org/DevCon/devcon2020/index.xalter
Nov 18-19	CMG Virtual International Summit Info: https://colormarketing.org/event/international-summit-update/
Nov 23	ICC DevCon 2020: Colour Appearance Info: http://www.color.org/DevCon/devcon2020/registration.xalter
Nov 30	ICC DevCon 2020: Display and Print Info: http://www.color.org/DevCon/devcon2020/registration.xalter
Dec 1-5	The International Conference of the Color Society of Russia Info: http://www.ad-chroma.com/index.php?article_id=89&clang=2
2021	
Apr 13-15	AATCC International Conference, Charlotte, North Carolina Info: https://www.aatcc.org/events/callforpresentations/
June 6-9	ISCC Color Impact 2021, New Haven, Connecticut Info: www.iscc.org

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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