iSCC
INTER-SOCIETY COLOR COUNCIL

Inter - Society Color Council

Quarterly Newsletter

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Email: isccoffice@iscc.org
Address: Inter-Society Color Council 712 H Street NE, Suite 1640
Washington, DC 20002

Directors Corner

Justin Laird

Hello ISCC community. My name is Justin Laird, and I am starting my term on the Board of Directors. I currently work in manufacturing at Apple where I help to ensure that Apple's hardware products meet the color appearance intent of the industrial design team. This involves understanding and implementing concepts of metrology, psychophysics and quality control, and collaborating with many other teams in our organization.

My journey in color science really began as I was getting out of the Air Force. I was shown a description of a career in photographic engineering and decided that is what I wanted to study. It's a whole other story on how I ended up at RIT with lots of twists and turns and involved me calling places like Kodak and Xerox and asking to speak to a scientist or engineer! But I eventually landed at RIT studying Imaging and Photographic Technology and that is where I first learned about the field of color. However, it wasn't until my internship at Gretag Imaging that I really learned how to work in the field of color science utilizing its principles to achieve an engineering goal. Afterwards, I met Roy Berns at the Munsell Color Science Lab back at RIT and worked the following summer as an intern which really cemented my interest in color.

My thesis addressed displays and my first job coming out of MCSL was focused on LCDs with LED backlit televisions. I had a growing interest in working with surface color – making actual products in a manufacturing environment and so made the move from display R&D to manufacturing and engineering where color science principles were utilized as a quality metric. This has continued to my present job where I work correlating color perception to measurement data across different metrologies.

In addition to my work described above, I also spend a fair amount of time teaching an Intro to Color Science class for new engineers. Over the years I have found a knowledge deficit regarding color science in industry even for companies whose product has color as a primary driver of quality. Therefore, I think it is in our best interest to make sure engineers, even marginally involved in color, have a basic understanding of color science, and know where to go to get

Justin Laird

more information. This blend of engineering troubleshooting and technology development along with color education I think fits nicely with ISCC goals.

ISCC, along with other organizations, was on my radar as a student at RIT. I had articles in TAGA, CRA and presentations at CIC and EI but it was really the 2018 Munsell conference in Boston that I started paying more attention to information coming out of ISCC. So as a student I had an awareness of the ISCC, but I didn't appreciate the background and history until further in my career where I was putting into practice the principles of our predecessors. As I gained more experience, I began to appreciate the work of ISCC past and present.

I am still early in my tenure and learning how I can best serve. Part of what interested me in being on the board was the focus on educating the public about color science. I really like how the ISCC pulls from all manner of color experts to give talks about their field and expertise. I would like to make sure we continue offering high quality speakers that can engage the public while also providing time for experts and users of this information to meet at conferences. Because I am focused on the technical side of industrial color science, I have found great benefit in learning from designers and artists on how they interact and use color in their work. I want to make sure the ISCC continues this path. I would also like to see the ISCC continue to be seen as a resource for color science–either through publications generated by the ISCC or by us highlighting/housing important literature, studies and experiments over time to the present. I think this could be how the ISCC can most effectively bridge work done by different entities.

I am looking forward to working with other board members and the larger ISCC community over the next few years. I am always happy to talk color science and about the ISCC, so do reach out!

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Hue Angles:
How They Measured Color 100 Years Ago

Guest author John Seymour

I am sure all my fellow color aficionados have had this experience. I woke up at 11:30 this morning and found myself wondering how they measured color a century ago. I mean, before they had these fancy spectrometers, and before they had these fancy computers powerful enough to control automated corkscrews, and before they had blue teeth to connect the spectrometers to the computers.

I start the story with James Clerk Maxwell, a physicist whose name is right up there with Isaac Newton and that other guy whose name I can't remember. Maxwell built a color mixing instrument in 1855 that was in a 6-½ foot long box that some people call his color coffin. He revised this in 1860 to be more compact. This was a big improvement to the user interface, since the person looking into the box could actually reach the apertures! In his words:

> "I am so well satisfied with the working of this form of the instrument, that I intend to make use of it in obtaining equations from a greater variety of observers than I could meet with when I was obliged to use the more bulky instrument."

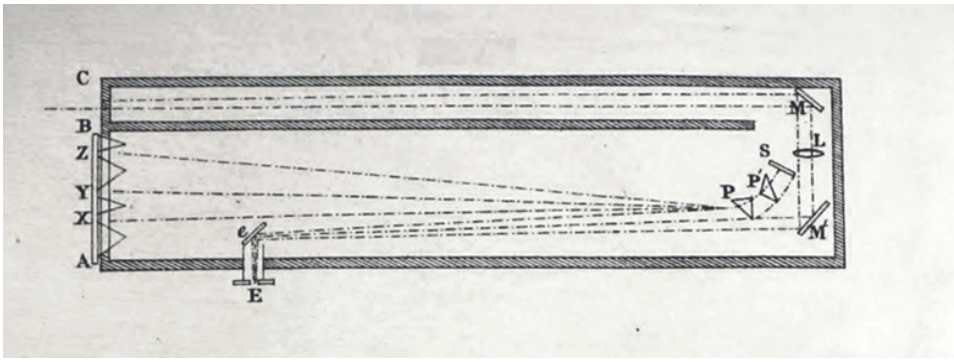


Figure 1 – Maxwell's second color box

The basic idea is to select (at positions X, Y, and Z in the diagram) the amounts of three different wavelengths of light. The mixture is seen on one side of the field of view. The other side of the field of view is a slice of the rainbow. What is not obvious from the diagram is how those three slices of the rainbow get mixed.

Any fan of Pink Floyd knows that if you pour light into one side of a prism, you get a rainbow draining out on the other. You could put three adjustable apertures on the rainbow side, but the different wavelengths of light are diverging from each other, so Maxwell would have needed some additional stuff to combine these rays into one.

Faster than you can say Helmholtz Reciprocity Principle, Maxwell had a clever solution. Figure 2 shows how we normally think of prisms working. But Helmholtz taught us that any arrow in an optical diagram can be reversed, and everything will all magically still work. So, on the right, the arrows have been reversed. Another feature – an aperture – was added with slits in the positions corresponding to where the red, the green, and the violet rays would normally be draining out.

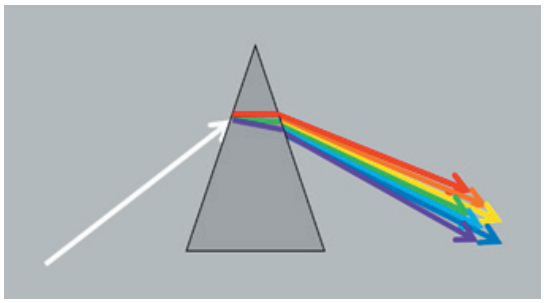


Figure 2

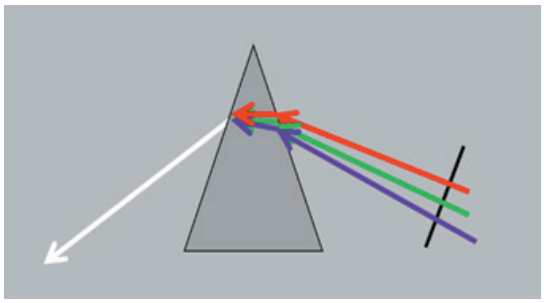


Figure 3

As clever as Maxwell's color box was, it was not a color measurement device. He set it up so that people could match a combination of red, green, and blue light against the color of slices of the rainbow. Maxwell was ultimately after the spectral response of the cones. Maxwell did not use his color box as a color meter, but it inspired two developments in colorimetry.

Frederic Ives is best known for his contributions to color photography, but he also developed the first additive trichromatic color mixing colorimeter in 1907 [Ives 1907a]. He makes it clear, though, that it was not his original idea:

> "It has long been recognized that a universal color meter, capable of measuring all colors and expressing them in numerical terms, must be based upon the principle of Clerk Maxwell's "color box," in which half of a divided field is illuminated with ordinary white light, while the other half is illuminated by an adjustable mixture of the three simplest colors of the spectrum, isolated bands of pure red, green and blue-violet."

In the diagram below, the telescope-looking-thing has a diffraction grating at the lower left with three adjustable apertures for the three primaries. The upper portion of the light passes directly through the tube. To measure the color of a reflective sample, the sample is placed on something white (like paper) with the edge of the sample aligned so that the reflection from the sample enters the top portion and the reflection from the paper enters through the three apertures.

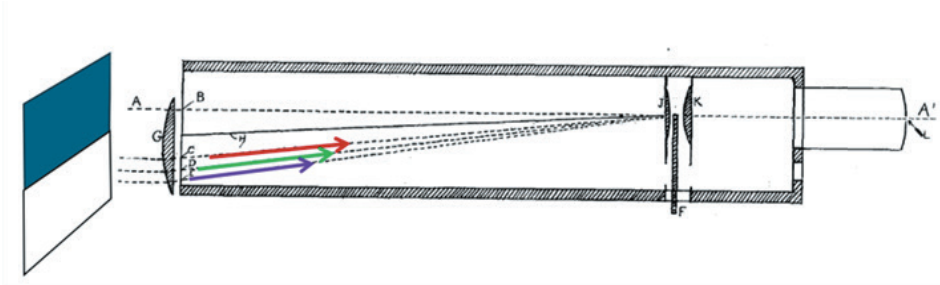
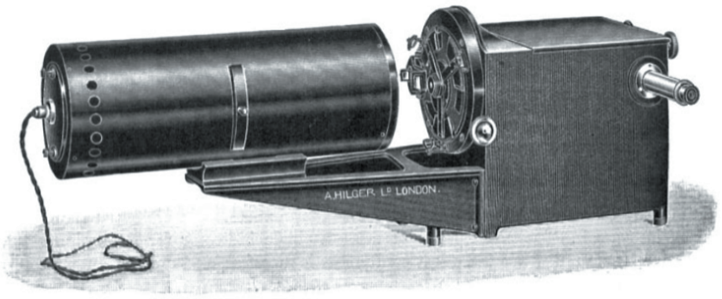


Figure 4 - Ives first trichromatic colorimeter

This design proved to be a bit fidgety because the slits were very narrow. Ives later hit on the idea of using "dyed gelatine films" to provide red, green, and blue-violet light instead of doing this with a diffraction grating. He also found he needed a way to mix the primaries uniformly across the field of view and provided several means for accomplishing this. He filed for a patent on this [Ives 1907b] and presented a paper on it [Ives 1907c].

Several similar devices were developed in the next 20 years, including Alfred Bawtree [1919], Frederick Ives' son Herbert [1921], Frank Allen [1924], John Guild [1925], and Carl Keuffel [1926]. Anyone who did engineering, chemistry or physics before 1980 will recognize that last name. Carl Keuffel worked for Keuffel and Esser, manufacturer of the most coveted slide rules in the world and manufacturer of color measuring devices.



Guild Trichromatic Colorimeter

Figure 5 – Adam Hilger (known today for textbooks) sold Guild's colorimeter [Anderson]

So it is that Maxwell's scientific apparatus for investigating color vision inspired a variety of devices to measure color.

But these trichromatic colorimeters did not get glowing reviews. A. Ames [1921] was dismissive about the role of instruments in the practical measurement of color. "As any instrument is too complicated for general use…" Luckiesh [1921] stated that measurements from trichromatic colorimeters "can hardly be considered more than approximately comparative and of limited usefulness." Martin and Gamble [1926] were slightly more positive when they said the accuracy was "just significantly good to make the instrument of practical use."

Irwin Priest [1918] directed us toward a solution. "Of whatever value the so-called "Colorimeter" may be in special cases, it must be admitted that the fundamental basis of color specification is spectrophotometry…"
If you don't believe Priest, here is what K. S. Gibson [1919] said: "… for it is generally admitted that the fundamental basis of color specification is spectrophotometry…"

Sometime in the 1920s, someone invented a way to use a spectrometer to emulate a trichromatic colorimeter. I have yet to find the first reference. It may have been first described by Priest, or maybe Deanne Judd, but it was certainly known by John Guild in 1926 when he started using a color mixing system based on Maxwell's work to determine the Standard Observer, which is the bridge between spectral data and trichromatic colorimeters. But that's another story.

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Frederick E. Ives (b), Color-meter, US Patent #894,694, filed Oct 22, 1907

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Irwin G. Priest, The Work of The National Bureau of Standards on the Establishment of Color Standards and Methods of Color Specification, Transactions of The Illuminating Engineering Society, Vol. XIII, January – December 1918

A Blast from the Past: SCC Newsletters 50 Years Ago

ISCC Newsletter No. 229 March-April 1974 & No. 230 May-June 1974

Paula J. Alessi

This article will start with a summary of some of the tidbits featured in ISCC Newsletter No. 229 March-April (13 pages).

ISCC NEWSLETTER NO. 229 MARCH-APRIL

Rochester Color Group

As a native Rochesterian, I was shocked to read that Rochester had a "Color Group." Moreover, this was the fourth meeting of such a Color Group. Now to be fair, I was not even in college in 1974 and a Color Group would never have interested me at that age. But I wish that this group had thrived for many more years after its inception so that I could have joined it after receiving a degree in Color Science.

Anyway, the Rochester Color Group met at the Graphic Arts Research Center of the Rochester Institute of Technology (RIT). Milt Pearson hosted these meetings, and he took pride in emphasizing that they were "informal without any organizational structure, dues, or parliamentary formalities and usually included a sherry hour or a dutch-treat dinner." The purpose of these meetings was to provide a comfortable forum for those interested in color to share ideas and exchange thoughts on any aspects of color from the world of art, science or industry. Sound familiar? This was one of the goals of ISCC since its inception in 1931. The hope was that in 1974, Rochesterians could get a better grasp on color issues that were still misunderstood by sharing those issues informally without administrative pressures weighing them down. About 25 people participated in these meetings indicating that they were successful for a while.

I am not aware of when they stopped holding these meetings or what revelations these meetings produced. As I peruse ISCC newsletters, I will try to gather more information. If anyone knows more about this subject, please get in touch with me at geinhaus@frontiernet.net.

Relationship between our senses and color

Maurice Déribéré, President of the Centre Information de la Couleur (Color Information Center), gave a talk in Paris on his research into sensory correspondences associated with the perception of color. His research was centered around the fact that particular stimuli that elicit sensations are transmitted and interpreted by the visual cortex. As Déribéré put it, these sensations "may be deduced from literary fantasies or poetic reconstructions like those found in Rimbaud's celebrated sonnet or the verses of Verlaine, ideas expressed by Father Castel, or musical transcriptions by Scriabine. Musicalistic painters like Blane-Gatti and Valensi have painted sonorous impressions that even physicists may visualize."

Research showed that some stimuli resonated on a second sense that corresponded to a first sense. It was possible to establish strong relationships between sound and color, odors and color and tastes and color. These relationships are intuitive and more psychological than physiological responses. Nevertheless, an acid taste is likely to be associated with a citrus fruit like a lemon or a lime and hence a yellow or yellow green response for color. A menthol taste elicits a green response. A specific example was given of an overheated mechanical facility where female employees worked so hard that some days the energy was drained from them so badly and their hands were put through so much stress that they could not continue to work. To alleviate this problem, the facility fine-tuned the illumination conditions, changed the color of the walls to two tones of blue, played sweet music as the women worked and they released a lavender perfume as the women pulverized the green plants. As a result of these changes, the women avoided the hand pain they had experienced. Countries like France experimented with blind workers and found that they could tell whether they were in an illuminated room or not. Amazingly, blind workers could also sense whether they were in a red room or a blue room. Other experiments showed that the sense of color and touch is singular. It is possible for people to judge object weight based on the color of the objects. No details were given to explain this further, but this is very interesting!

Color and Packaging Design

This article began with an excerpt titled “Packaging: The Contemporary Media” by Robert G. Neubauer from Von Nostrand Reinhold Co., New York (1974). Psychologists performed experiments to determine the importance of shape and color in packaging design. When observers were exposed to packages of different shapes and colors for a short period of time, their recall of color was much more accurate than their recall of shape. So, for packaging design, color is more important than shape. Next, they studied the feelings, moods and motivations that the colors evoked. Not surprisingly, they found that red evoked action and blue evoked calmness. If the traditional red moved more toward a crimson, vermillion or flamingo red, it still was called red and evoked a feeling of action among observers. If the traditional blue moved toward a cerulean, ultramarine or sapphire blue, it still was called blue and evoked a feeling of calm. So, color was determined to be a key factor in good package design.
This article then went on to discuss the importance of each color in package design.

Yellow

Yellow was a strong color to use because its cheerful, vibrant qualities easily captured the attention of potential buyers. Wrigley’s Juicy Fruit gum is an example of the use of yellow in packaging in 1974. This packaging made history in 1974 as it became the first product to use a barcode for checkout.

Notice that in 1974, 5 sticks of gum cost 25 cents. If we look at the packaging for Wrigley’s Juicy Fruit gum in 2024, we find that yellow is still the dominant color, blue has been introduced and the package contains 15 sticks at a cost of $1.38 at Walmart.

Orange

Orange was a targeted color in packaging in 1974. One very popular product that used it in packaging was Orange Crush. This is its 7-ounce amber soda glass bottle with a ribbed design vintage 1974.

Orange Crush is still available in 2024. It is now available in 12-ounce cans and the orange packaging color is much more vivid.

Red

Red was known as an eye-stopper as it became one of the most popular packaging colors. In 1974, Frito Lay Cheetos used this eye-catching red packaging front and back.

Today, in 2024, the Frito Lay Cheetos packaging is very different as you can see from the images below. Some of the red has become orange. There is a significant amount of blue on the package and the animal is a cheetah to better represent the product name and not a mouse.

Purple

Purple was usually reserved as a color to represent royalty. Thus, it was not used often in packaging. However, Cadbury, was and still is a British multinational confectionary company. They introduced the purple packaging color in 1914 as a touching tribute to Queen Victoria. In 1854, the company was given a royal warrant making Cadbury the official cocoa and chocolate makers for the British monarchy. Cadbury was happy to keep using this color because it made them stand out from the competition throughout history.

This is a collage of Cadbury Dairy Milk Chocolate Bars throughout history. It is interesting to note that the royal warrant has made it possible for the purple to stay constant throughout the years.

Blue

Blue has never been considered an appetizing color. It usually stands for "refinement, conservatism, sensitivity and cleanliness." It has been popular for cleaning products. It has been reserved as a background type color or used for decorative purposes. In 1974, Miller Lite used it as a decorative background color in the product packaging design.

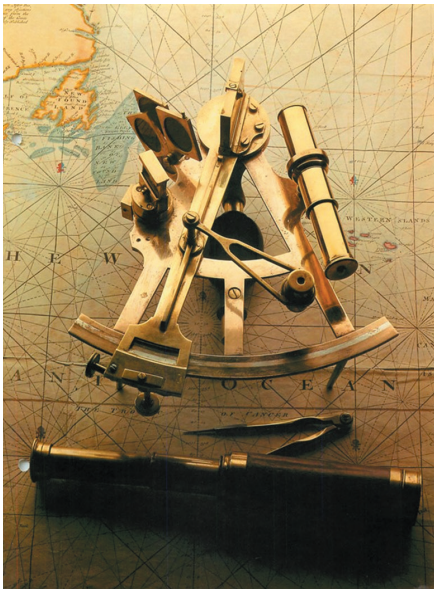
In 2024, the Miller Lite can looks very similar to the one from 1974. The logo is smaller and the Lite name is larger. The usage of blue in package design is very similar.

This is only a sampling of the packaging design colors. To obtain a complete listing, go to the ISCC Newsletter archive at http://www.iscc-archive.org/Newsletters/ISCCNews229.pdf

ISCC Newsletter No.230 May-June

Now our focus will shift to ISCC Newsletter No. 230 May-June 1974. This was the 25-page Annual Report issue discussing the details of the 1974 Annual Meeting. Reports from the ISCC Officers were given, followed by Problems Committee reports and then 25 ISCC Member Body reports. These were the days when Member Bodies were the lifeblood of the ISCC. This era also featured a flurry of activity in Problems Committees that worked on different art, science and industry color problems plaguing the color community in 1974. If you are interested in learning about the work of Problems Committees such as Indices of Metamerism, Colorimetry of Fluorescent Materials, Color in the Building Industry, and Human Response to Color, or Member Bodies like American Artists Professional League, Institute of Food Technology, and Society of Motion Picture and Television Engineers, then go to the Newsletter archive at http://www.iscc-archive.org/Newsletters/ISCCNews230.pdf .

Finally, I will leave you with this stunning color reproduction of a sextant provided by David W. Fream, Group Advertising Manager, Corporate Advertising Dept., Westvaco, Fine Papers Division, New York, NY. The paper was 80# Sterling Litho Gloss; the photographer was Phil Marco; advertising agency: McCaffrey & McCall, Inc.; printer: Herbick & Held, Pittsburgh, PA. It was included as an insert with the mailing of this newsletter. Enjoy!



AIC 2024 Midterm Meeting Congress

São Paulo, Brazil

Paula J. Alessi, ISCC Liaison to AIC

The AIC 2024 Midterm Meeting will be held in São Paulo, Brazil from September 16-19 2024. The theme of the meeting is Color Design, Communication and Marketing. The meeting is hosted by ProCor Brasil and Escola Superior de Propaganda e Marketing (ESPM). The conference venue is ESPM University.

Photos of ESPM University

Three hotels have been suggested for participants at a discounted rate. See https://aic2024.org/home/attendee-info/ for information on how to secure the special AIC 2024 rate.

Visas Required for Some

Participants with an Australian, Canadian, or USA passport must obtain a visa before entry into Brazil! If you already possess a valid physical visa in your passport for your visit's purpose, you do not need to apply for a new visa. It is strongly recommended that you apply for your visa well in advance of your trip to Brazil. It can be a long process to get one. So, visit the AIC2024 website at https://aic2024.org/home/attendee-info/ for details on how to get an eVisa in advance.

Technical Presentations

Technical papers will be in the form of oral and poster presentations. Abstracts for all paper submissions were due March 31, 2024. Papers were accepted on the following topics:

- Color in Branding and Marketing
- Color and Consumer Behavior
- Color in Design and Visual Communication (all forms of Design)
- Color and Consumer Products
- Industrial color application (Cosmetics, paints, textiles among others)
- Color in Interior Design and Architecture
- Color Semantics and Semiotics
- Color and Psychology
- Color and Physiology
- Color and Physics
- Colorimetry and Color Control and Color Order Systems
- Color Education
- Color in Art, Culture, and History

Other important deadlines to remember are:

May 31, 2024 – Abstract acceptance notification and oral/poster designation assigned

August 15, 2024 – Full paper due

May 31-August 15, 2024 – Early bird registration

Selected conference papers will be invited to submit extended versions to a special 2024 issue for Color Research and Application, Color, Culture and Science Journal or Journal of the International Colour Association.

The three best poster presentations will receive The Colour Group (GB)'s Robert W. G. Hunt International Poster Awards. The AIC Student Paper Awards will be given to the best student papers. Six awards will be given to the winning paper, the first runner-up, the second runner-up and three honorable mentions.

For more information on the Technical Presentations, visit https://aic2024.org/home/call-for-papers/ .

Keynote Presentations

There will be seven keynote presentations.

Professor Ph.D. Antal Lechner, Professor of Business Management at the NYU Stem School of Business, will be giving a talk entitled “Color Strategy in the Age of Artificial Intelligence.”

Leatrice Eiseman, the Executive Director of Pantone Color Institute will also give a keynote presentation.

Patricia Fecci, Marketing Manager for Sherwin Williams, will give a talk on “Color Trends for 2025.” Designer Ciça Costa, Founder

Laboratório Cores Da Floresta, will speak on “Natural Pigments from the Brazilian Rainforest.”

Professor Ph.D. Larissa Noury, President Founder Colour, Space, Culture, will talk about “Ecology of Colour in an Urban Environment.”

Polar Design Studio, LAD awarded as Best Design Studio in Brazil, will discuss “Chromatic Design Cases.”

Professor Ed.D. Petronio Bendito, Professor of Art and Design at Purdue University, will give a presentation on “Algorithmic Digital Color Expressions.”

For more information on these keynote speakers, visit https://aic2024.org/home/program/

Workshops

There will be three workshops offered to participants. Registration for these workshops will open soon.

Workshop 1 is "Watercolor of Brazilian Plants and Landscapes." This workshop will be conducted by Professor Artist Maria Ines Lukas and Professor Artist Lilian Arbex both from the Brazilian Watercolor Society. This workshop will take place on Monday, September 16 from 10 a.m. – 12 p.m. This workshop will be offered to the first 20 registrants.

Workshop 2 is "RGB Color Mixing Through Microscopic Pixel Exploration." This workshop will be conducted by Professor Ed.D. Petronio Bendito, Professor of Art and Design at Purdue University. This workshop will take place on Monday, September 16 from 1 – 4 p.m. This workshop will be offered to the first 30 registrants.
Workshop 3 is "Natural Pigments from the Brazilian Rainforest." This workshop will be conducted by Designer Ciça Costa, Founder Laboratório Cores Da Floresta. This workshop will take place on Wednesday, September 18 from 4:30 – 6 p.m. This workshop will be offered to the first 12 registrants.

Program

Here is a snapshot of the entire program of this AIC Midterm Meeting from September 16 – 19, 2024.

<table>
<tr><td colspan="2">Monday
September 16th</td><td>Tuesday
September 17th</td><td>Wednesday
September 18th</td><td>Thursday
September 19th</td></tr>
<tr><td colspan="2"></td><td>Opening Ceremony</td><td>Plenary Lecture</td><td>Plenary Lecture</td></tr>
<tr><td rowspan="11">10:00
EC Meeting</td><td rowspan="3">10:00-12:00
Workshop 1
Watercolor Painting of Brazilian Plants and Landscapes</td><td>Plenary Lecture
Invited Speaker Prof. Anat Lechner Stern University</td><td>Technical Sessions
2 Parallel Rooms</td><td>Technical Sessions
2 Parallel Rooms</td></tr>
<tr><td>coffee
10:30-11:00</td><td>coffee
10:30-11:00</td><td>coffee
10:30-11:00</td></tr>
<tr><td>Technical Sessions 2 Parallel Rooms</td><td>Technical Sessions
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<tr><td>Lunch
12:00-13:00</td><td>Lunch
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<tr><td rowspan="7">13:00-16:00
Workshop 2
Digital Color Mixing</td><td>Plenary Lecture</td><td>Plenary Lecture</td><td>Plenary Lecture</td></tr>
<tr><td>Technical Sessions
2 Parallel Rooms</td><td>Technical Sessions
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<tr><td>Technical Sessions
2 Parallel Rooms</td><td>Technical Sessions
2 Parallel Rooms</td><td>Closing Ceremony and Awards</td></tr>
<tr><td rowspan="2">17:00
Registration
Welcome Reception with Samba Percussion Show</td><td rowspan="2">Study Group Meetings</td><td rowspan="2">Poster Session</td><td rowspan="2">16:30-18:00
Brazilian Rainforest Natural Pigments Workshop</td></tr>
<tr></tr>
<tr><td colspan="2"></td><td colspan="2">Optional Gala Dinner at SELVAGEM RESTAURANT in Environmentally Preserved Rainforest Area</td></tr>
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Registration

Early bird registration will be open from May 31 – August 15, 2024.
Registration fees are:
Early Bird Regular: US$200
Early Bird Student: US$150
Standard Regular: US$220
Standard Student: US$180
Accompanying Early Bird: US$180
Accompanying Regular: US$200

Registration fees for regular and student participants include workshops (upon registration), E-Proceedings, program book, conference materials and EcoBag, welcome reception, lunches and coffee breaks. Accompanying persons fees include welcome reception, lunches and coffee breaks.

If you would like to stay updated on registration information, visit https://aic2024.org/home/registration/

ISCC Participation

The 2024 AIC Mid-Term Meeting is shaping up to be a fabulous event. Thank you to the many ISCC members who have submitted papers. We hope that ISCC members will begin making plans to attend this meeting. More detailed information can be found at https://aic2024.org

Color Research and Application Highlights

Michael J. Murdoch

In this column, I highlight articles by ISCC authors in Color Research & Application. The most recent issues, 49(1) and 49(2), include one Research Article and one Editorial by ISCC members.

The brightness of chromatic stimuli

Luke Hellwig, Dale Stolitzka, Mark D. Fairchild
https://doi.org/10.1002/col.22910

Brightness is perhaps the most basic perceptual attribute of reflective and emissive objects, yet describing it accurately remains tricky. One well-known complication is the Helmholtz-Kohlrausch (H-K) effect, which basically says that colors with higher chroma generally appear brighter than colors with lower chroma, even if they have the same luminance. Even at the time that the V(λ) function was standardized as a way to integrate power spectra to a single value representing luminance, it was known that equal-luminance didn't necessarily mean equal-brightness. Color notations like CIELAB built directly on tristimulus XYZ values retain this known flaw: equal lightness L^* does not necessarily mean equal brightness if the chroma or hue are different. Color appearance models generally make a partial accounting for the H-K effect, and Hellwig, Stolitzka, and Fairchild previously published improvements to brightness and colorfulness predictions (CR&A 47(7), 2022).

In their new research article, Hellwig, Stolitzka, and Fairchild provide details of a series of visual experiments involving brightness matching between pairs of samples differing in chroma, lightness and hue. They begin with a good retrospective on visual brightness, the H-K effect, and previous modeling attempts. The authors develop a new paradigm for experiments, comparing more closely spaced pairs of colors (rather than comparing chromatic colors to neutral, as in previous work), and showing the transitivity of brightness matches across different pairs. Through a calculus-based derivation supported by their data, they present a new computation for brightness J_{HK} that is a function of the original J and the chroma C. Interestingly, there is no explicit hue dependence in their formula, which may surprise readers who expect this in an H-K model. However, this is not because the authors ignored this factor, but because they instead built it into their formulation for chroma C itself, using data from the Munsell color order system. A trigonometric fit to Munsell data leads to a hue-dependent C adjustment that affects the chroma C values directly, and the J_{HK} values indirectly. Testing their new formulas, the authors present comparisons of accuracy of predictions with preceding models (including their 2022 model, cited above), and show that the new model is in fact better.

This paper should be useful to anyone who wants to put a number on perceived brightness and those who are working with chromatic color samples. The included math derivations and formulae are essential for those who would like to improve their implementations of CIECAM16, but the descriptions are informative and detailed enough for the non-math-expert to understand the reasoning behind the model changes and the resulting improvements.

Special collection: Color and emotion

Domicele Jonauskaite, Christopher A. Thorstenson
https://doi.org/10.1002/col.22911

How are colors associated with emotions? There are a thousand opinions on this topic, along with some – but maybe not enough – scientific answers. In this editorial, CR&A special collection editors Jonauskaite and Thorstenson explain their interest in soliciting and curating a special collection of articles in CR&A regarding color and emotion. Perhaps because both color and emotion are experienced by every individual and seem "intuitive," the authors acknowledge that people often underestimate the complexity and previous scientific literature supporting each field of study. They point out the need for – and the availability of – precision in the use of terms and experimental methods in both fields, and they encourage collaboration between experts in each field in order to bridge them with scientific rigor.

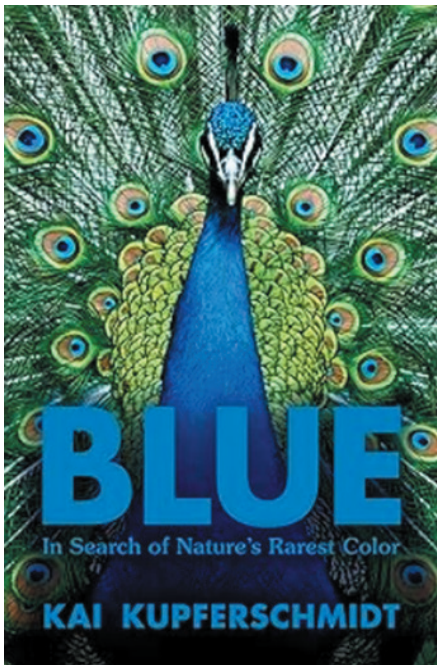
With a combination of caution and excitement, Jonauskaite & Thorstenson invite submissions to CR&A that "report the latest research that advances scientific knowledge and theory regarding the interplay between color perception, color cognition, and emotional processes." There is plenty to be learned and conveyed in the interdisciplinary space of color and emotion which can be applied in many visible ways in our world. Readers whose research, ideas, and applications align with this special focus are invited to submit articles and can contact either editor for further information.

ISCC Webinars Report

Ann Laidlaw

Blue – The Science of Nature's Rarest Color by Kai Kupferschmidt

George Carlin noted the absence of blue foods, "because it probably bestows immortality!" (Thanks, Amy Woolf!). The April 23, 2024 ISCC webinar featured Kai Kupferschmidt, author of Blue – The Science of Nature's Rarest Color. The color blue has challenged scientists for as long as they have investigated the natural world. From trying to isolate the blue of the cornflower or producing a blue rose to investigating why the word for "blue" appears to come particularly late in most languages. In his talk, Kai examined the history and mysteries of the scientific investigation of how nature makes blue and how humans talk about it.ad at how contemporary artisans and manufacturers are working towards a more sustainable future for fashion.



Kai Kupferschmidt is a science journalist based in Berlin. He has worked as a freelance editor and writer for numerous German newspapers and is a contributing correspondent for Science Magazine. Kai has been fascinated by the color blue since he was a child and has written a book called "Blue: The Science and Secrets of Nature's Rarest Color" which has been translated into several languages. He has received numerous awards for his work, including the Media Prize of the German Aids Foundation and the NIHCM Trade Journalism Award (shared with Gretchen Vogel). He is currently an MIT Knight Science Journalism Fellow focusing on misinformation and still discovering new things about the color blue.

Kai Kupferschmidt

Luanne Stovall

Upcoming Event

The next Fluorescent Friday (FF) event is May 10, 2024.
See all details below.

What: Local Colour Chart of Valdivia, Southern Chile –– Color, Harmony & Contrast

Who: Professor Elisa Cordero-Jahr, Color Consultant Ingrid Calvo Ivanovich & Design students from Architecture and Arts, Universidad Austral de Chile

When: Friday, May 10, 1 – 2 p.m. EST

Where: Zoom link for Registration (free):

Link: https://us06web.zoom.us/j/86812060921?pwd=wHz6aaaplusYaMeYtaHPYUWtdT6FV3.1
Meeting ID: 868 1206 0921
Passcode: 155345

For this event, the FF spotlight illuminates Elisa Cordero-Jahr, Ingrid Calvo Ivanovich and design students from the Universidad Austral de Chile as they describe their experience creating an identity color chart of the Los Rios Region, a territory with more than 60 rivers, 11 lakes, and different types of vegetation and soil. The main objective of this survey was to highlight the value of local identity for design and architecture using local colors that are characteristic of the territory.
On Friday, October 27, the 11th Fluorescent Friday event showcased the innovative color design program at Purdue University's Rueff School of Design, Art, and Performance led by Dr. Petronio Bendito.

Speakers:

Elisa Cordero-Jahr, Master's degree in Knowledge Modeling for Educational Virtual Environments, Universidad Austral de Chile, is a member of the Academic School of Design, Faculty of Architecture and Arts, UACH, and President of the Chilean Color Association.

Ingrid Calvo Ivanovich, Ph.D. in Design Research, Politecnico di Milano, is a Colour Designer, Researcher and Educator, member of the International Colour Association Executive Committee, Editorial Board of the Color Research & Application Journal, and member of the Steering Team of the AIC+ISCC Colour Literacy Project.

Past Event

What: Exploring Color's Role in Visual Storytelling Experiences

Who: Dr. Elizabeth Easter and seminar students from University of Kentucky

When: Friday, April 26, 1 - 2 p.m. EST

To see the video, go to:

Link: https://us06web.zoom.us/j/86812060921?pwd=wHz6aaaplusYaMeYtaHPYUWtdT6FV3.1
Meeting ID: 868 1206 0921
Passcode: 155345

Speakers:
University of Kentucky professor Dr. Elizabeth Easter and her seminar students presented their in-depth semester projects on ways that color and lighting choices have impacted diverse experiences in our lives, from colorful Crayola products to the pomp and circumstance of graduation regalia, to installations in retail environments.

Dr. Elizabeth Easter, M.S. and Ph.D. in Textile Science, University of Tennessee-Knoxville is a Professor in the School of Human and Environmental Sciences in the Martin-Gatton College of Agriculture, Food and Environment at the University of Kentucky and senior students in her seminar "Color in the Merchandising, Apparel & Textiles Industry." Dr. Easter directs the Textile Testing Laboratory that provides contractual fee-based services to more than 50 corporations and organizations to test textiles during product development and evaluate performance and durability. A significant accomplishment of the laboratory is that it employs both graduate and undergraduate students, enabling them to obtain problem-solving skills and experience researching industry problems.

The Inter-Society Color Council created FLUORESCENT FRIDAYS as an online platform for international university students from diverse color-related disciplines to share their research and network with color professionals. The goal is to build a global student chapter that positions color as a multidisciplinary STEAM model (Science, Technology, Engineering, Arts, Math) and provides state-of-the-art color research by scientists, artists, designers, industry professionals, and university students.

The Glamorous World of ASTM E12

John Seymour, March 22, 2024

Intrigue. Sequined gowns. Suspense. High speed chases and catchy show tunes. This new column of the ISCC newsletter may help you decide which of these terms best describe meetings of the ASTM E12 committee.

The alphabet soup

First, let me clear up some of the alphabet soup. ASTM International is a standards organization. The initials formerly stood for American Society for Testing and Materials. When they decided to go global, they (apparently) felt that the American part of that was a little too American. Now ASTM stands for ASTM. And E12? That's the committee in the ASTM whose goal is to "promote knowledge of color and appearance properties and characteristics, and to encourage the improvement and development of standards for describing and evaluating appearance properties." https://www.astm.org/get-involved/technical-committees/committee-e12/scope-e12

How does it compare to the CIE and ISO, which are also standards organizations? The ISO, which formerly stood for the International Standard Organization (and now stands for ISO) is an umbrella organization that CIE belongs to. The acronym CIE (naturally) stands for the International Commission on Illumination. And despite the fact that the name implies that they only deal with illumination, these are also the people who write standards that have to do with color and appearance. This is distinguished from ASTM Committee E12, which writes standards that have to do with color and appearance.

Just in case that didn't make everything perfectly clear, let me provide an example. If you are into color measurement you have probably heard of the CIE blockbuster standard CIE 15.2. This standard defines, among other things, the Standard Observers, the idealized spectral outputs of various illuminants, and how to compute CIELAB values from spectra. Some pretty heavy stuff.

If I can make a sweeping generalization, the CIE bunch tends to lean a bit toward the scientific side, and the ASTM leans a little more to the engineering side. So, when it was noticed in 1985 that different pieces of software computed slightly different CIELAB values for the same spectrum, ASTM E12 responded by publishing the companion standard E308 which clarified what to do if your spectrum did not have 5 nm spacing. This standard includes a whole bunch of tables that combine the spectra of all the standard illuminants and recommended representative sources with those of the two standard observers. As you might expect, ASTM E12 was awarded two Grammies and a Tony nomination for this standard.

But what has the ASTM done for me lately?

Unless you have been living in a non-illuminated cave for the past decade or so, you will know that there has been a revolution in illumination. Back when I was a kid, we used candles to read our ISCC newsletter at night. Then we had the whole Thomas Edison thing with incandescent bulbs, which doubled as a great way to waste electricity by creating way more heat than light.

Several developments in LEDs provided us with a much more efficient way to light up your local Walmart at 10 PM. First, we had the invention of the blue LED so that white light could be created by mixing red, green and blue LEDs. But this did not have great color rendering. The blue LED was then augmented with a YAG phosphor, which greatly improved color rendering. It also had an advantage over fluorescent tubes for people who don't like mercury poisoning, since this white LED does not involve passing a high voltage through gaseous mercury to create UV light. Finally, white LEDs do not emit a great deal of heat, but the LED die (that little puppy is the silicon crystal where all the action takes place) gets hotter than my cast iron skillet when I'm deep-frying hushpuppies. Those dies just die if they get too hot. The final improvement that made white LEDs practical is in bonding the LED die to a heat sink (a piece of metal) to dissipate that heat.

Today, LEDs have all but eliminated incandescent and fluorescent lights. The CIE reacted to this by adding a large collection of potential white LED spectra to the standard illuminants in the technical report called CIE 015:2018. The 2022 version of ASTM E308 (remember the standard that clarified how to compute tristimulus values?) now has tables for 18 illuminants, each with the two Standard Observers.
But it is recognized that LED technology is still in a state of flux (hats off to you if you recognize this pun), so people are likely to require tables the next time someone has a brilliant idea for making brilliant white LEDs. ASTM E12 is there for you. They have started writing a new standard that goes into the painstaking detail of how to do the computations without the aid of the tables in E308. My contacts at Wikipedia say this is gonna be big.

Gonioappearance

As Louis Armstrong once said, "If you have to ask what gonioappearance is, you'll never know." All this math stuff is obviously very exciting to the general public but let me tell you about another new development that really sparkles! I mean, literally sparkles. How do you measure the color of something that changes color when you change viewing angle?

Automotive finishes, makeup and dresses at the Oscars often have little sparkly bits. Coatings can be pearlescent AKA nacreous AKA opalescent AKA margaric AKA iridescent. These all go under the title of gonioapparent materials. Measuring such materials involves even more cool phrases like bidirectional reflectance distribution function, anisotropy factor, and flake disorientation statistics. ASTM E12 has a new work item (WK84807) titled "New spatial and color appearance attributes of gonioapparent materials." With only two meetings of the subcommittee under its belt, there is still time for you to come in on the ground floor of the groundbreaking work of trying to standardize just how we measure the color of effect pigments!

And so much more

I would love to tell you more about the current efforts to change up E1345 - Standard Practice for Reducing the Effect of Variability of Color Measurement by Use of Multiple Measurements. I mean, I know that there are at least five people who are in the intersection of "people who love color science" and "people who love statistics." Unfortunately, this is so new that people with more intellect than me are still in the process of telling me how little I know.

I would also like to inform everyone to be on the lookout for someone interested in leading the new work item WK77169 "New Practice for Measurement of Fluorescent Materials Using Hemispherical Geometries." The current recommendation (in E991-21) is to use either the 45:0 or 0:45 geometry, but spherical geometry is more common in the textile and paper industries. The problem is that in a spherical device, there is a certain amount of "re-illumination", where light reflected from the sample illuminates the interior of the sphere and subsequently provides additional illumination to the sample. If you understand why the difference in the spectral signature between the initial illumination and the re-illumination might be a problem, then you might be a candidate to lead this work item!

Contact:
Jack Ladson, Chair E.12.05 Fluorescence,
Jack.Ladson@Gmail.com
+1-267-981-7112, if you fit the bill.

Colour Literacy Forum #7

Luanne Stovall

The Colour Literacy Project launched a new Forum Series - Colour in Context - in celebration of International Color Day!

Colour in Context Series - Part 1 took place via Zoom on Friday, March 22, 2024.

Talk 1: The Identity and Ambiguity of Colour from a Philosophical Perspective by Valtteri Arstila

Valtteri Arstila

Valtteri Arstila is a Doctor of Philosophy, and Full Professor in theoretical philosophy at the University of Turku in Finland. His research focuses on the empirically informed philosophy of mind. In particular, he has concentrated on subjective time, the relationship between experiences and cognition, and sensory qualities, especially colors and sounds.

Talk 2: Colors are Contextual by Harald Arnkil

Harald Arnk

Harald Arnkil is a Finnish artist, writer, colour researcher, and member of the Colour Literacy Project Team. He has published many research papers and is the author of Colours in the Visual World, a textbook for artists, designers and architects. Harald taught art and colour studies at Aalto University School of Arts, Design and Architecture for 30 years, and is currently working on a doctoral thesis on colour in contemporary art.

Two Talks and a Panel Discussion

Following the previous "Color Perception Series", this new 4-part "Colour in Context Series" of Forums explores the ways that different contexts change our perception of color. Before introducing the speakers, Forum host Luanne Stovall welcomed everyone with an overview of the series and an introduction to Part 1, an exploration of the concepts of identity and ambiguity of colors from the viewpoint of two different perspectives: the philosophy of color and the perception of color with examples from art and design.

After the 20-minute presentations, Colour Literacy Chair and ISCC President Maggie Maggio moderated a panel discussion to dive deeper into questions about the corresponding difficulties encountered when we attempt to reconcile objective reality with our subjective perception.

So, what is the color of an object? Key takeaways from Valtteri's Arstila's talk relate to his discussion of different philosophical positions about the nature of color. His first example was color realism, where colors are considered properties of physical objects that exist outside of us. Color objectivism maintains that colors are properties of objects that are determined independently of observers' color experiences. On the other hand, in color relativism colors are defined as properties of objects that are defined in relation to the color experiences of an observer. From another very different perspective, color eliminativism takes the position that external objects are not colored, and that colors can be defined as sensations. He also touched on the intrinsic nature of colors by introducing psychophysics as a branch of psychology that deals with the relationship between physical stimuli and the sensations they produce.

> "To see is not so much about looking at waves of light, but about looking at external objects mediated by these waves; the task of the eye is to enlighten us, not so much about the intensity or quality of light reaching us from some object at a given moment, but about the object itself."
>
> –– Ewald Hering (1834-1918)

Harald Arnkil quoted Ewald Hering as he unpacked the many contexts that impact the ways we see colors. He pointed out that we have finely nuanced preferences for certain colors; and yet, our perception of colors seems highly dependent on their specific contexts – including the spatial and environmental context, sources of illumination, viewing distance, time and movement, adaptation, mode of attention, and our intentions and expectations. Showing examples from art history, he illustrated this phenomenon with Claude Monet's enigmatic painting Impression Sunrise and Josef Albers' Homage to the Square experiments that show how two colors can look very different depending on the surrounding colors.

An example of color constancy: how the same color can look very different in relation to changes in illumination.
From Colours in the Visual World by Harald Arnkil

To see the video, go to: https://www.youtube.com/watch?v=TAT4436Gnz8

Colour Literacy Forum #8

Stay tuned for more information about Forum #8, Part 2 of the Colour in Context Series planned for June!

The Colour Literacy Forum is a virtual platform featuring presentations and interactive conversations focused on expanding 21st century color education at the university and post-secondary level. The Forum is an international effort of the joint ISCC/AIC Colour Literacy Project and Cumulus Association, the leading global association of art and design education and research.

The goal of this global collaboration is to recognize color as a meta-discipline that strengthens the bridge between the arts and sciences, aligns color education with current research and design needs, provides cutting-edge resources, and offers dynamic networking opportunities for all stakeholders. For more information, see https://colourliteracy.org/colour-literacy-forum.

Note: The ISCC is a U.S.-based organization and the terms in its newsletter follow the rules of American English unless a specific word appears in a title. For instance, in the name of the initiative "Colour Literacy" the word "Colour" follows the British spelling, because it's the official name of the project.

Colour Literacy Forums are organized by the AIC-ISCC Colour Literacy Project with:

AIC · Color Council · Cumulus Association · AIC Study Group on Colour Education

Calendar 2024

May 8	Colorful Connections 4 PM Eastern Time https://iscc.org/events
May 9	UF/FL ASPRS Spring Geospatial Workshop 2024, Apopka, FL In-person and Virtually via ZOOM https://my.asprs.org/ASPRSMember/Events/Event_Display.aspx?EventKey=SPRING2024&WebsiteKey=9126ee3f-e9e1-43bd-a00c-0cfa63182579
May 10	Fluorescent Friday 1-2 PM Eastern Standard Time virtual event https://us06web.zoom.us/j/86812060921?pwd=wHz6aaaplusYaMeYtaHPYUWtdT6FV3.1
May 14-17	SID International Symposium, Seminar & Exhibition Display Week 2024 San Jose, CA https://www.displayweek.org/
May 20	IS & T Color Imaging Conference 32 Call for papers for journal https://www.imaging.org/IST/IST/Conferences/CIC/CIC2024/CIC_Home.aspx
June 4	Coloful Connections 5 PM Eastern Daylight Time https://iscc.org/events
June 11	ASTM E12 Color and Appearance June 2024 Committee Meeting, Philadelphia Marriott Downtown 1201 Market Street https://member.astm.org/meeting/event
June 12,13	Color Literacy Forum #8 https://colourliteracy.org/colour-literacy-forum
June 13	IS & T Color Imaging Conference 32 Call for papers for conference https://www.imaging.org/IST/IST/Conferences/CIC/CIC2024/CIC_Home.aspx
June 24	IS&T Image Capture From Photons to Photos, London, UK In-person and Online https://www.imaging.org/IST/IST/Conferences/LIM/LIM2024/Home.aspx?hkey=d591c145-92b3-478e-b01f-672dc473c7f2
June 26-28	14th International Conference on Optics-Photonics Design and Fabrication Tucson, AZ https://www.optica.org/events/global_calendar/events/2024/14th_international_conference_on_optics-photonics_design_and_fabrication/
July 10-12	NAPIM 2024 Summer Course Clemson University https://www.napim.org/aws/NAPIM/pt/sd/calendar/357693/_PARENT/layout_details/false

July 15-19	NAPIM 2024 Summer Course Clemson University https://www.napim.org/aws/NAPIM/pt/sd/calendar/357693/_PARENT/layout_details/false
Aug 28-31	Poster abstracts due for 2024 AATCC Textile Discovery Summit https://www.aatcc.org/summit/
September 17-19	AIC 2024 Midterm Meeting Color Design, Communication and Marketing Sao Paulo, Brazil https://aic2024.org/
September 22-25	IES Street and Area Lighting Conference Atlanta, GA https://www.ies.org/events/street-area-lighting-conference/
September 23-25	SPE CAD RETEC Sail Away with Color Technical Conference Tampa, FL https://specad.org/2024-cad-retectm-homepage/
September 25	2024 NAPIM Annual Convention/Technical Conference, Milwaukee, WI https://www.napim.org/aws/NAPIM/pt/sd/calendar/352795/_PARENT/layout_details/false
September 29 - Oct 4	CMPA Fall Meeting (CAD RETEC) Tampa, FL
Oct 6-8	AATCC Textile Discovery Summit, The Westin Savannah Harbor, Savannah, Georgia https://www.aatcc.org/summit/
Oct 19	ISCC Annual Meeting 12:00 -3:00 PM Eastern Standard Time virtual meeting https://iscc.org/events
Oct 28-Nov 1	IS & T Color Imaging Conference Montreal, Canada https://www.imaging.org/IST/IST/Conferences/CIC/CIC2024/CIC_Home.aspx
Oct 29-Nov 1	Illuminating Engineering Society Street & Area Lighting Conference (IES) Indianapolis, Indiana https://www.ies.org/events/street-area-lighting-conference/

Save the Date

Reminder

Wednesday, May 8, 2024 @ 4 pm EDT for ISCC members

Tuesday, June 4, 2024 @ 5 pm EDT for ISCC members

Colorful Connections is an opportunity to gather informally with other members of ISCC for a little socializing, networking and learning from each other. Discussions are wide-ranging and depend on attendees, their current interests and past experience. Consider this the online version of coffee breaks and happy hours at a color conference. BYO coffee or beverage and join in the conversation!

ISCC Annual Meeting

Saturday, October 19 from 12:00 - 3:00 pm Eastern

The Annual Meeting will feature the presentations of the Macbeth and Godlove award winners which will not be announced until this summer.

Colour Literacy Forum

Thursday, June 13 10 am -11:30 am ET

Colour Literacy Forum Series: Color in Context, Forum #2, focused on the role of color and light in spatial environments.

3 Speakers and panel discussion with moderator Maggie Maggio

- David Briggs, Vice President, NSW Divisional Chair and AIC Representative of the Colour Society of Australia.
- Sylvia Pont, Professor, Delft University of Technology, Delft, Netherlands
- Kine Angelo, Associate Professor, Department of Architecture and Technology, Norwegian University of Science and Technology.

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.

Avian Technologies LLC

P.O. Box 716
Sunapee, NH 03254
Website: https://aviantechnologies.com
Contact: Art Springsteen
Email: arts@aviantechnologies.com

Datacolor

5 Princess Rd
Lawrenceville, NJ 08648
Website: https://www.datacolor.com/
Contact: Kate Edwards
Email: kedwards@data.color.com

Konica Minolta Sensing Americas

101 Williams Drive Ramsey. NJ
Website: https://sensing.konicaminolta.us/us/
Contact: Jodi Baker
Email: jodi.baker@konicaminolta.com

Radiant Vision Systems LLC

18640 NE 67th Court
Redmond, WA 98052-6728
Website: www.RadiantVisionSystems.com
Contact: Scott McLead
Email: info@radiantvs.com

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isccoffice@iscc.org

Editor: Madelaine Yafet

Layout and Design: Lina Cárdenas, Josefina Rojas Dezerega

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Quarterly Newsletter

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