INTER-SOCIETY COLOR COUNCIL

QUARTERLY NEWSLETTER

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516



Contents



Cover Art

David Edward Harmon
Discoid #7, 2023
Acrylic on panel, 12 x 12 inches

High-chromatic acrylic impasto was applied with a palette knife, pressing the colors onto a panel covered with burlap. The process enables the colors to naturally intermix directly on the surface, creating dynamic color sensations with little or no preplanning.
davideharmonstudioartist.com/

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Leadership

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Director's Corner

Brittany Cox



Dr. Brittany Cox
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I have been interested in art and color for as long as I can remember. I can recall spending countless hours sitting on my living room floor, before and during my grade school years, watching Bob Ross on PBS. I was fascinated watching him mix colors on his palette and apply them with confidence to his canvas. I can remember thinking, "It really doesn't take much phthalo blue mixed with a lot of titanium white to make such a beautiful ocean color."

As I got older, I recognized early on that I had an aptitude for STEM (Science, Technology, Engineering, and Mathematics), and being the practical person that I am, pursued that avenue predominantly during my school years, thinking I would eventually become a math teacher. But I never quite left Bob Ross behind. I spent many of my afternoons painting and drawing or participating in a photography club after school. In college, I continued to focus on science and math and majored in physics. But when burnout started to settle in, I found myself signing up for as many art classes as my schedule could accommodate, eventually culminating in an art minor. Nearing the end of my undergraduate degree, I started looking into grad school options, but I couldn't find what seemed like a good fit. While working in the physics office one afternoon, one of the new professors in the department told me about the Imaging Science program at RIT, his alma mater. I did a little digging and found a link to the Munsell Color Science Lab and knew then that I had found what I always wanted but never knew existed. I immediately started my application.

I was lucky enough to be accepted as one of three color science Ph.D. students that fall. During my first quarter as a grad student, I knew I had finally found the link between art and science that I had been looking for all this time—that math and science could be used to study, document, and provide insight into beautiful things. I learned that color, something most of us started learning about before we ever started

school, was more complicated and nuanced than I ever could have imagined while watching Bob Ross at five years old.

While at RIT, I worked predominantly as part of the Studio for Scientific Imaging of Cultural Heritage funded by the Mellon Foundation. During that time, I specialized in improving the 4-Lights Imaging technique and continued software development for capturing image data that could be used for tracking color and surface changes of cultural heritage. This afforded me the opportunity to work with some wonderfully talented and supportive individuals at various museums including MoMA (The Museum of Modern Art), the Art Institute of Chicago, and the Smithsonian's Museum Conservation Institute, where I was also able to give talks and workshops to those working with cultural heritage. One of the projects I am most proud of is the work I did with Roy Berns and the Art Institute of Chicago to produce a digital recolorized visualization of Vincent van Gogh's The Bedroom, 1889, from data collected using the 4-Lights method.

After leaving RIT where I earned my Ph.D. in Color Science, life took me down a few more turns away from the color community I wanted to be a part of and back towards engineering where I eventually became a research scientist and R&D engineer for a manufacturing company that had little connection to color. This shift in career direction provided many opportunities to hone a myriad of important skills in my professional life but the spark I had while working with color and cultural heritage was missing, and after a while I couldn't ignore that any longer. In 2025, I began looking for a way to reconnect to the color community, my community. When I saw that the ISCC was hosting a symposium at RIT, I signed up to attend and started searching for flights. I was a little nervous I had been gone too long, but going to all the talks and networking events made me feel like I had never left and confirmed that my passion for color and the arts hadn't gone anywhere. I knew I wanted to get involved, so here I am a year later, proudly serving on the Board of Directors and starting my own color science consulting business. I'm excited to be back amongst friends and working alongside them to share our knowledge and passion for color—both the science and art sides of it.

> *...color...was more complicated and nuanced than I could have imagined...*

Student Ambassador

Sofie Herbeck



Sofie Herbeck
PhD Candidate at the Munsell Color Science Laboratory
sofie@herbeck.com

Hi, I'm Sofie Herbeck and I'm the ISCC's current Student Ambassador! I'm in my fifth year of the Color Science Ph.D. program in the Munsell Color Science Laboratory at the Rochester Institute of Technology (RIT).

I stumbled into color science, as I think many of us do, by chance. I was a junior majoring in Computer Science at UC Berkeley when Ren Ng gave three lectures on color in my computer graphics class. Those lectures were the only ones of the semester that held my attention for the entire hour and a half; this topic made my brain go fast in the best way, and I knew I had to explore it further!

The following semester, I took Ren's graduate seminar on computational color, which, thanks to being virtual, featured color experts from all over the world as guest lecturers. This was my first exposure to Mark Fairchild and to the Munsell Color Science Lab. His lecture sparked the idea that I could keep thinking about color through a graduate degree and led me to apply to RIT and other Ph.D. programs conducting color-related research. I chose Munsell because I wanted to be able to pursue color science for its own sake, rather than as one facet of neuroscience or vision science or psychology.

While still at Berkeley, I was invited to join Ren's research group with Austin Roorda; they were trying to elicit an entirely new color percept in humans through real-time direct laser stimulation of individual cone cells. Specifically, the isolated stimulation of the M cone cells, whose sensitivity overlaps completely with the L and S cone cells, such that the M-cones can never be stimulated independently with any natural light. Accomplishing this involved using an adaptive optics scanning laser ophthalmoscope (AOSLO), which was also my introduction to psychophysical experiments—a bit of a plunge into the deep end of the pool, but very cool! My main role for that year was to increase automation and thus efficiency

in the setup process for each experimental session on the AOSLO. Setup could take up to 3 hours, often due to human error in the many, many steps that had to be completed in sequence. Through creating programs that automated these steps, this time was cut in half, reclaiming that additional time for data collection. I also wrote user guides for our constellation of systems and software, distilling technical details into approachable steps. I'm most proud of these contributions, but my favorite times were being in the lab, helping run the AOSLO as we chased the super-saturated blue-green percept of our new color, "olo." You may recognize this name (coming from the stimulation sent to the cones: [0,1,0] meaning 0 stimulation to the L cones, full stimulation to the M cones, and 0 stimulation to the S cones)—when we finally published the results in 2025, it was exciting to see the work receive a lot of media attention. This was a singular first research experience, and I'm glad for all it taught me about the joys and trials of conducting perceptual experiments, about the importance of streamlining, and about the sometimes lengthy arc of academic research and publishing.

When I started my Ph.D. at RIT, I briefly dabbled in AR perceptual research before returning to one of my original interests from Ren's seminar: individual differences in color perception. My dissertation work is a comparison and evaluation of multiple methodologies for characterizing individual color-matching functions (CMFs). The goal is to provide a recommended CMF method—or devise a new method based on existing ones—that will jointly maximize efficiency of collection and quality of results (CMF experiments are notoriously time-intensive, on the order of 20 hours per person for traditional methods). After facing various challenges in getting my different experiments set up, I'm excited to be shifting into data collection mode and starting to think about the preliminary results!

...my favorite times were being in the lab, helping run the AOSLO as we chased the super-saturated blue-green percept of our new color, "olo."...

ISCC Annual Meeting

Jennifer Kruschwitz, Ph.D.



Jennifer Kruschwitz, Ph.D.
Associate Professor of Optics
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ISCC Annual Meeting

Friday, December 4, 2026

3:00–4:30 p.m. EST (over Zoom)

The ISCC Annual Meeting will take place on Zoom on Friday, December 4 from 3:00-4:30 p.m. EST. Join Jennifer Kruschwitz, ISCC President, and the Board of Directors for a review of all 2026 events. The meeting will include the presentation of the Macbeth Award and an address by the awardee, followed by a formal business meeting.

Look for the formal announcement in an email. Registration information will also be available on LinkedIn, Facebook and Instagram. The event is free, and members are encouraged to attend.

Colour Literacy Forum

Luanne Stovall

Upcoming 2026 Forum Series

Colour Literacy Forum #17 - Date TBA

Stay tuned for the 3rd and 4th Forums in the 2026 Colour Literacy Forum Series with a focus on working with colors in future-focused applications across several disciplines. Join us to meet an international roster of innovative experts who will share their insights and experiences with us. The dates are not yet available. As soon as the information is confirmed, details will be posted on the Colour Literacy Project website: https://colourliteracy.org/

Summary of Past Event

Colour Literacy Forum #16 - 2026 Series – Material Lives of Colour, from Heritage to Innovation

Friday, July 17, 2026

Check out the video recording for the Forum on YouTube at: Colour Literacy Forum #16 - 2026 Series, Material Lives of Colour, from Heritage to Innovation



Speakers: Anahí Ray, Lara Martínez, Francisco Guichón, Silvia Vignolini, Riikka Räisänen

Speakers:

Anahí Ray, Ph.D. in Archeology, University of Buenos Aires (UBA) Professor and an Independent Researcher, National Scientific and Technical Research Council at the National Institute of Anthropology and Latin American Thought (CONICET).

Lara Martínez is currently pursuing a Ph.D. in Archaeology at UBA and has a doctoral scholarship from CONICET.

Francisco Guichón, Ph.D. in Archaeology from UBA; Assistant Researcher at CONICET based at the National Space Activities Commission (CONAE).

Silvia Vignolini, Ph.D. in Physics, University of Florence; Director of the Max Planck Institute of Colloids and Interfaces in Potsdam, Germany.

Riikka Räisänen, Ph.D., Professor in craft science and craft pedagogy at the University of Helsinki, Finland.

Talk 1 — Anahí Ray: Colors of the Past in Southern Patagonia: An Archaeological Perspective (in collaboration with Lara Martínez and Francisco Guichón)

> It's very important for us to remember that the landscapes and the material remains we observe today are not identical to those that existed in the past. So, in archaeology, it's very important to take into account the processes that affected these materials over time.
>
> — Anahí Ray

The research site in the steppe of central-western Santa Cruz lies at the southern tip of South America where the earliest human presence dates back some 12,000 years. The team's entry point was rock art, understood as a medium of past communication, but the work widened from images to the colored substances themselves: which surfaces received paint, which recipes produced the pigment mixtures, which colors were chosen, and why.

Answering these questions required an interdisciplinary toolkit — the preserved archaeological record; remote sensing and satellite imagery to locate potential pigment sources; experimental work with collected samples; a multi-technique protocol for analyzing pigment-bearing grinding stones; and historical and oral accounts of uses now archaeologically invisible, such as painted leather garments.



Image from the team's field work understanding the use of colored pigments

The results point to a broad palette used unevenly across material classes: white, yellow, orange, pink, red, violet, and possibly green all appear in rock art, but only red appears on portable items such as necklace beads and animal bones — suggesting that different categories of material culture carried different color conventions. Red dominates overall, spanning the widest range of motifs and objects. Early and Middle Holocene rock art is polychrome yet accompanied by few production artifacts, while the last 3,000 years show markedly more evidence — more shades, more implements, wider distribution — a pattern Ray linked to changing mobility and land use. She attributed what survives to three factors: preservation constraints on organic substrates like leather and skin; uneven access to pigment sources and the knowledge to prepare them; and human choices driven by distinct uses and communicative needs.

Talk 2 — Silvia Vignolini: Structural Color in Nature: From Function to Fabrication

Silvia Vignolini directs the Max Planck Institute of Colloids and Interfaces in Potsdam, Germany, where she leads the newly established Department of Sustainable and Bio-inspired Materials, developing materials with predominantly optical functions.

> Can we make color in the same way that nature does — not only using the same architecture, but also using the same material? The answer is yes, it's possible. We can take cellulose from any type of plant, from wood pulp to banana peel to orange peel, to even old wood that has been recycled… and with simply one material, you can make all the colors in the spectrum.
>
> — Silvia Vignolini

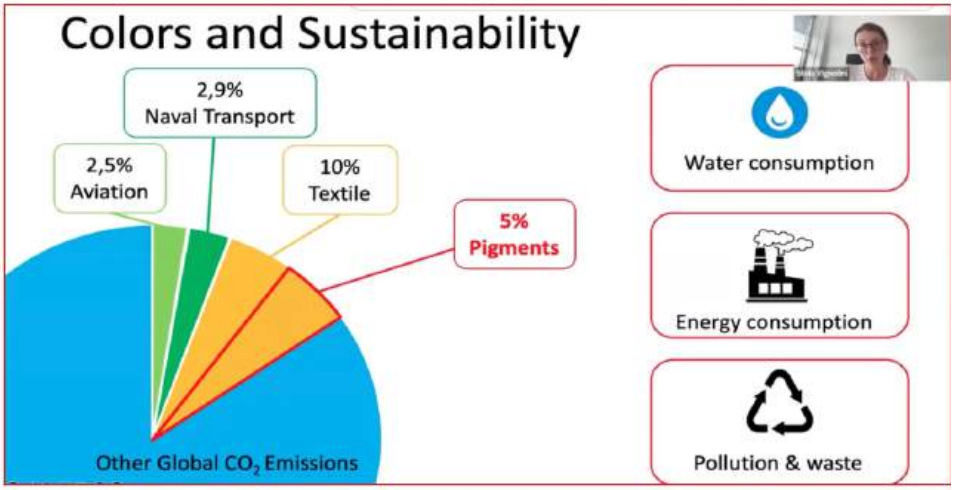


Diagram charting the global use of colors related to sustainability

Vignolini opened with a distinction. Conventional pigments take their color from the material itself — part of the light is absorbed, the rest scattered back. Structural color arises instead from the way light interacts with structure, so it can appear even in colorless materials. A soap bubble is the everyday example: water and soap are clear in a glass, yet shimmer iridescently when drawn into a thin film. Because the effect is structural rather than chemical, it can be made from almost any material, and it shifts with the viewing angle.

Nature uses it everywhere, mostly to communicate — a peacock advertising fitness to a mate, a weevil tuned blue-green to vanish into foliage, flowers and vivid blue fruits drawing in pollinators and seed-scattering birds. Vignolini asked how plants manage it, and the answer is remarkably economical: their blues manifest almost entirely from cellulose, the ordinary plant fiber we eat in vegetables, but arranged structurally in a very particular way.

So, she set out to do the same in the lab, with the same material — and it worked. Cellulose from wood pulp, fruit peel, or reclaimed wood can be coaxed into every color of the spectrum, from one biodegradable source at room temperature. That matters because textile dyes are a growing share of global emissions. Her lab now produces sheets of structurally colored cellulose, cut into glitter or pigment and commercialized through the spin-off Sparxell, the world's first 100% natural, high-performance, biodegradable color platform.

Vignolini closed her talk on white, the hardest color to make efficiently: a white weevil achieves it in a layer twenty times thinner than a human hair, where white paint needs many times that. Mimicking it led to a second company, Seprify — and an invitation to researchers, artists, and scientists to collaborate.

Talk 3 — Riikka Räisänen: Color for Crafts: Transferring Traditional Craft Skills into Future Sustainable Color Practices

Riikka Räisänen, Ph.D., is professor of craft science and craft pedagogy at the University of Helsinki. Her work centers on natural and bio-based colorants, sustainable textiles, and textile heritage.

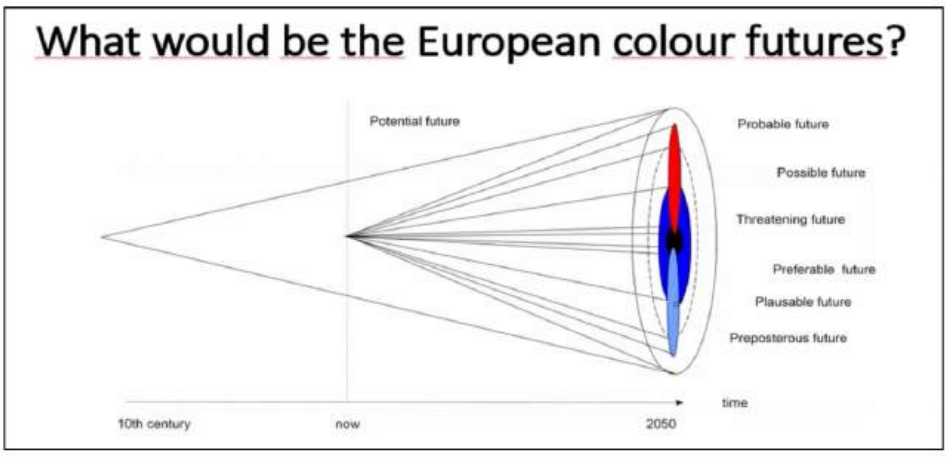
> When we think about the theories of sustainability, nature is kind of seen as the most important value. Society comes second, and then the economy. This was also found from our research data.
>
> — Riikka Räisänen

Räisänen shared the results of Colourful Crafts, a three-year European project uniting six partners across Finland, Estonia, the UK, Belgium and France. Historians, craft researchers, scientists and futures thinkers worked on one question: how does the know-how of coloring cloth carry from the past to the present and into the future? Their span was enormous — from crafts practiced in the 10th century to future visions for 2050.

Looking backward, the team identified the dyes in 269 textile fragments from the northeastern Baltic, spanning nine centuries. A notable discovery: the reds often came from local plants such as alder and alder buckthorn bark, confirmed by both archival records and traces in the cloth itself. The team also dyed nearly 890 swatches as a reference collection for future researchers, and shared the story publicly in exhibitions, including one in Estonia titled "Colours of Our Clothes: The Local and the Global."

Turning to the present, they asked 51 teachers, students, and dyers what drives their work, and found six shared values — nature, heritage, skills, the pleasure of making, dye performance, and sustainability. Though each group leaned toward a different value, sustainability mattered to all.

Looking forward, one partner found a way to manufacture indigo dye in microbes instead of growing the indigo plant in fields, using a fraction of the land; denim dyed this way appeared in the project's exhibitions. Others tested dyes from 72 plant and fungal species, seeking natural colors that hold up as well as synthetic ones. The findings are gathered in two books — one on natural dyes for teaching and experimentation, available now, and another on carrying craft knowledge forward, due later this year.



Timeline Cone mapping European color futures goals





Colour Literacy Forum Partners: *The International Colour Association (AIC); Inter-Society Color Council (ISCC); AIC Study Group for Colour Education (SGCE), and Cumulus, the leading global association of art and design education.*

Cutting Edge Color

Ann Laidlaw

CUTTING EDGE COLOR

A Tale of Three Novel Colors: Olo, Keef and Litz

Presented by Ren Ng

November 17, 2-3 p.m. EST

This talk will be about research into novel human color perception. We showed human subjects a novel color, olo, by individually stimulating thousands of cells on the retina with laser microdoses, using a system we call Oz Vision. Olo corresponds to targeting only M cone cells and not L or S cones, which never happens in natural vision. Olo appears blue-green of unprecedented saturation. In theory, there are other novel colors that could not be as easily described. This talk will present the mathematical theory of two such tetrachromatic colors, keef and litz, and work towards prototyping them in the real world.

Ren Ng is a professor in Electrical Engineering and Computer Science at the University of California, Berkeley. His research interests are in imaging, graphics, and human and computer vision. Research contributions include the novel color olo produced by the Oz Vision system, and the volumetric scene inference method NeRF. Before Berkeley, Ren was founder and CEO of Lytro, Inc., which commercialized his Ph.D. research on light field cameras. Ren completed his Ph.D. in computer science at Stanford University and received the ACM Doctoral Dissertation Award. Ren has received the Jim and Donna Gray Faculty Award for Undergraduate Teaching, Sloan Research Fellowship, IS&T Image Engineering Innovation Award, RIT's Imaging Hall of Fame, the Selwyn Award from the Royal Photographic Society, MIT Tech Review's TR35 and Entrepreneur of the Year, Fast Company's 100 Most Creative People in Business, and is a Kavli Fellow and Optica Fellow.



Ren Ng

REGISTER
https://iscc.org/event-6842923

Fluorescent Fridays

Luanne Stovall



Upcoming Events

More details will be posted to the ISCC website once the speakers and dates are confirmed.

SAVE THE DATES

Fluorescent Friday #19

Friday, October 16, noon-1:00 p.m. EDT via Zoom (free)

Register

https://iscc.org/event-6848429

From Plant to Pattern: *Exploring Natural Fashion Colors with Almonds and Indigo*

Speakers: Dr. Jiangning Che and his students from the Department of Apparel Merchandising and Management, California State Polytechnic University, Pomona



Project 1: Almond Waste for Textile Coloration: This study investigated the use of almond byproducts as an agricultural waste resource for innovative and sustainable textile coloration. Overall, the findings highlight the potential of almond byproducts as an innovative, eco-friendly natural dye source that supports agricultural waste valorization while providing functional performance for sustainable textile applications.

Project 2: From Plant-to-Pattern: Exploring the Indigo Dyeing and Fashion Design Process: The micro-internship project explores the complete "plant-to-pattern" lifecycle of indigo, emphasizing environmental sustainability, craftsmanship, and experiential learning. The initiative demonstrates how natural dyeing can bridge agriculture, design, and manufacturing while fostering creativity, technical skills, and environmental stewardship within contemporary apparel and textile practices.



Fluorescent Friday #20

Friday, December 4, noon-1:00 p.m. EST via Zoom (free)

On Teaching and Learning Colour for Architecture

Speakers: Fiona McLachlan and students, Edinburgh School of Architecture and Landscape Architecture, Edinburgh College of Art, University of Edinburgh

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. Fluorescent Fridays are curated by Luanne Stovall and Jean Hoskin, with host Dr. Lina Cardenas.

Pebbles on the Beach

John Seymour



The Laws of Color Harmony, Part 1

Figure 1 is from my high school yearbook, the year I graduated. The really good-looking guy with the Fu Manchu (second from the left) is me, singing bass in the barbershop quartet, *The Thundertones*.



Figure 1 – Kenny, Denny, Johnny, and Chip (not in that order) made up the world-renowned barbershop quartet, *The Thundertones*

I don't share this picture as an advertisement for gigs. While there is probably some obscene amount of money that could bring us out of retirement, it would have to include flights from around the country and flights of expensive bourbon as well as the cost of letting out my vest just a tiny bit. The reason I share this picture is to show that I have been interested in harmony (in the musical sense) ever since I was at a healthy weight. Judging from my moniker ("the Math Guy"), it would be reasonable (and correct) to assume that my interest in the subject included a mathematical exposition of the science of musical harmony.

The Laws of Musical Harmony

I believe it was Pythagoras (who was in my homeroom class senior year) who stated the law of musical harmony very succinctly: *Two notes are harmonious if and only if there is a simple ratio of their frequencies.*

As a first example, the simplest type of harmony is the *octave* – from one C on the piano to the next C up – it has a ratio of 1:2.

The *fifth* may immediately make you think of the fifth of Basil Hayden bourbon in my liquor cabinet. Or, since you have been primed to think of music, you may have thought of Beethoven's Fifth (which I believe was a cognac, and not a bourbon). But in musical harmony theory, a fifth is the interval between Do and So, that is, from C to the G above it. The ratio of this interval is 2:3, again very simple, and these two notes sound very harmonious when played together. And they sounded even better when sung by the Thundertones![1]

The *third* is the next example of a harmonious pairing of notes. This is the interval, for example, from Do to Mi, or from C to E. The ratio is 4:5. Again, very simple. Small integers.

Most music that is written in a major key will resolve at the end to a combination of these simple ratios. In barbershop music, the bass (me, Johnny) ends on a low B-flat[2], the lead (Kenny) is an octave higher, the baritone (Chip) is on the fifth above the bass (an F), and the tenor (Denny) is on the third above the lead (a D). All simple ratios, and this B-flat major chord is the most harmonious, and soothing. Mid-song, barbershop arrangements will add a "seventh" to the chord. This note has a slightly more complicated ratio 4:7. This adds a bit more spice – a bit more tension. Barbershop arrangements will frequently pass through chords with lots more tension, which is to say, they have very complicated ratios. A barbershop aficionado would say that these chords "can peel the paint off the wall," at least when perfectly tuned.

The law of simple ratios tells us when two notes are harmonious and when they are dissonant. The law is quite parsimonious. A whole theory of musical harmony can be built on this simple rule. The beauty is that the rule works!

For more on this, including why pianos can never be tuned perfectly, check out my blog post about tuning pianos.

[1] This is actually a true statement – not just a joke. Pianos are intentionally mistuned so that the tuning is moderately good in all keys, but (aside from the octave) never perfect.

[2] Since virtually all barbershop music is written in B-flat.

Myths of Color Harmony

The *popular rules* for color harmony that we all grew up with are also quite simple, although the Colour Literacy Project might call these into question. There are 897 trillion websites that explain the rules, but I will save you the time to read all 897 trillion of them. The color harmony rules are based on the red-yellow-blue primaries. These primaries are used to define secondary colors (orange, green, and purple) which are mixtures of the primaries. These six colors are arranged in a circle called a color wheel, which forms the basis for explaining the five myths of color harmony:

- **Monochromatic rule** – Colors in the same *color family* are harmonious. Each of the positions around the color wheel defines a color family which includes the basic color along with all mixtures of white, black and that color. In other words, the colors all have the same *hue*.

- **Complementary rule** – Colors that are opposite one another on the color wheel are harmonious. For example, red and green are considered harmonious.

- **Analogous rule** – Colors next to each other are considered harmonious. This includes the set of yellow, green, and blue.

- **Triadic rule** – Colors that form an equilateral triangle on the color wheel (such as orange, green, and purple) are harmonious.

- **Tetradic rule** – Colors that form a rectangle on the color wheel are harmonious.

My initial reservations

I have just a few reservations about this color-wheel-based harmony theory.

The first reservation is that this theory is (usually) based on the artist's primaries (RYB). I may have mentioned once before that this does not mesh well with Science with a capital S. (Seymour, 2024) Science is kind of a big deal for me.

My second reservation is that, while the theory of musical harmony is very simple (all the harmonious chords can be predicted by simple

ratios), there are five rules listed above. The color harmony rules can be remembered by looking at a color wheel, but the color wheel itself can't predict the five rules.

My third reservation is that, by using all five rules, you can find that all colors are harmonious with each other. I write that hesitantly, since I am unsure about what the rules really are. The Analogous Rule mentions three colors that are adjacent on the color wheel. Do you need all three to be present to achieve harmony?

And speaking of color wheels, my fourth reservation is that the rules have been described in terms of multiple color wheels. The traditional artist's color wheel says that red and green are complements. The printer's color wheel (based on RGB and CMY) says that red and *cyan* are complements. The printer's color wheel is a bit closer to the science, and red and cyan are complements if you define complements in terms of afterimages, so maybe this is closer to being correct? But somehow, we still have 893 trillion websites using RYB as primaries and telling us that red and green are complements and are therefore harmonious together.

That was my fourth reservation. (I am struggling to keep count.) The whole bit about red and green being harmonious is my fifth reservation. Really? Call me a Scrooge if you like, but I really don't like this combination of colors!

I'm sure I could make more reservations at the "I Think Traditional Color Harmony Theory is Bogus" hotel, but I think you may be getting the point.

Testing color harmony – First thought

This is all leading to a point. I am motivated to get to the bottom of this color harmony stuff. As an applied mathematician, it warms the cockles of my heart when I see small parts of the world calmly wrapped up in a small set of serene equations. As a color scientist who writes the most widely read column about pebbles in the ISCC newsletter, it cools the rankles of my heart to think that there are people who believe that red and green make for a great color palette. I mean, everyone should have the same opinions about color harmony as I do! (Disclaimer: My wife has not *yet* given me permission to believe that my color harmonies are correct.)

So, I did what any somewhat indignant color scientist/applied mathematician would do. I went out and bought books on color harmony, each with thousands of color palettes, curated by six different sets of professional color palette creators. (See Figure 2 for the books.)

All I need to do is get out one of my spectrophotometers and scan all the color sets in all of these books. Then all I need to do is feed these 10,000 color sets (an estimated number) into Mathematica, do a little quick math, and come out with the Ultimate Formula to Determine Achromatic Harmony (UFDAH).[3]

For some reason, I just never got around to the simple task of measuring the colors.



Figure 2 - The books

Testing – Second thought

When I started teaching, I found a more direct way to answer my questions about how people actually perceive color harmony. When I started this experiment, I had 35 students who were given a two-part assignment. In the first part, the students had a PowerPoint with two slides. On the first slide, they had two adjacent white squares on a gray background. They were asked to change the colors of the squares in the first slide to create a harmonious pair. The second slide was a copy of the first, except they were asked to create a pair of colors that looked bad together.



Figure 3 - Research material for color harmony

These 70 pairs of colors (two from each student) served as part of a database that should include both good and bad harmony. I added a few pairs of my own. One pair of mine was red and green, and another red and cyan, both to test the "complements are harmonious" theory. I also duplicated some of the pairs, swapping right to left, to test for consistency, that is, to test the test.

Altogether I had 80 pairs of colors. I randomized these and put them in a PowerPoint. This PowerPoint was the "question sheet" for the second half of the assignment. Students were asked to rate the harmoniousness of the pairs on a scale of 1 to 5, with 1 being bad harmony and 5 being good harmony. Students were offered a few

[3] For those of you who did not grow up with Scandinavian roots, *ufda* is a Norwegian interjection that roughly translates to *oy vey* in Yiddish, *ay caramba* in Spanish, *wū dá* in Mandarin and *jeepers criminy* in Minnesotan.

bonus points to go through the assessments a second time, giving me another opportunity to test for consistent scorings.

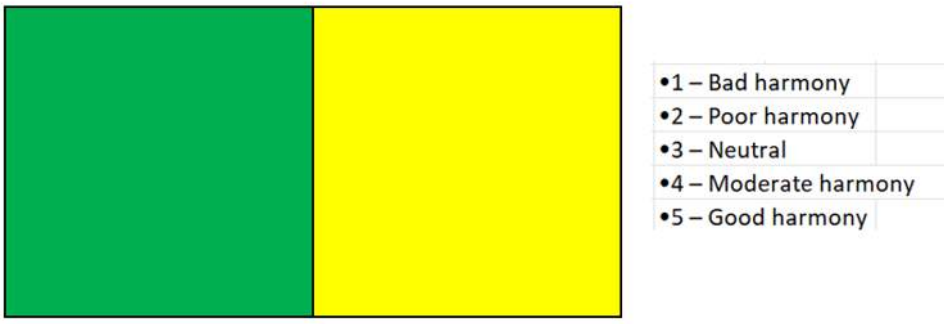


Figure 4 – This color pair was presumably contributed by a Packers fan

The second half of the assignment was repeated from Fall of 2021 to Fall of 2024. Altogether, there were 137 students submitting 225 trials (sets of ratings).

Were the results consistent?

As I said, I used two measures to determine the reliability of the data.

Are the results for individual colors consistent?

I duplicated five color pairings. The duplicates were separated from each other, and I swapped right-to-left. If someone gave a rating of 2 on the first and 5 on the second, then I would say they were not consistent. But, if the ratings differ by only one, then they are being pretty consistent.

How to quantify the consistency? I chose the highbrow statistical approach. For each duplicated pairing, I have 225 ratings for the first pair and 225 ratings for the duplicate. I used Pearson's correlation coefficient (usually called *r*) to assess how well the two track each other. If the coefficient is +1, then it means they track perfectly. If it is 0, then there is no evidence of any relationship between the two. A coefficient of -1 means that the two sets track opposite, in other words, if the person rated the pairing low on the first try, then they would rate it high the second time around.

The correlation coefficients in the table below are all fairly high, at least as psychophysical testing goes. For 225 data points, any number above 0.181 means that I can say with 99% certainty that the students were looking at the same pairs of colors the first time they saw them and the second time. This is admittedly a very low bar, but the students well exceeded this.

First Pair	Duplicate	Correlation
29	62	0.732
18	50	0.695
2	37	0.528
22	73	0.683
44	69	0.703

Looking at this another way, the average correlation coefficient is *r=0.668* which means that about 45% of the rating has to do with the actual pair of colors, and 55% is random. This is perhaps a bit… underwhelming? But it is people's subjective judgment, and people are not incredibly precise when it comes to subjective assessments. That may have something to do with why we call these ratings *subjective*?

So far, we see that the results for individual colors are *moderately* consistent.

Are the results for individual colors consistent?

There were 225 trials done by 137 students. That means that 88 diligent, hard-working people-pleaser students earned some meager bonus points by repeating the test. Once again, I used

Pearson's correlation coefficient to assess how well they agreed with themselves. The correlation coefficients for the 88 people are shown below.

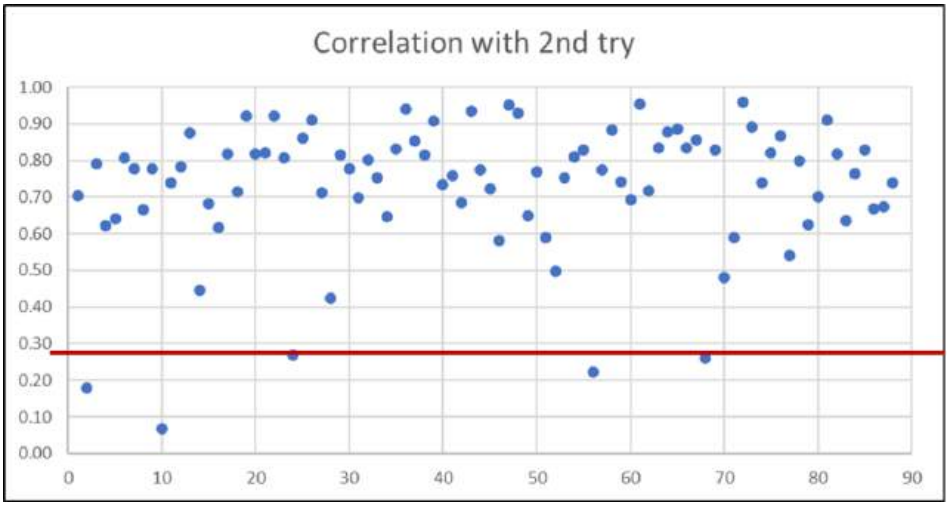


Figure 5 - How well do students agree with themselves between assessments?

There are two interesting findings from this. The first finding is that the average correlation coefficient is about *r=0.73*, meaning that 53%, about half, of the variation in answers was some real effect. That's reassuring, and somewhat better than the first consistency test.

The second finding was that 5 of the 88 students were below the statistically significant line. For these students, I could not conclude with statistical certainty that they were looking at the same color pairs the second time around! I don't have an explanation for this. Perhaps these folks have not yet developed solid opinions about color harmony? Perhaps they got messed up in tabulation between PowerPoint and Excel? Or maybe they just didn't care???

Do people agree with each other?

All in all, the students were moderately consistent, so we can start drawing some conclusions. Now for something interesting!

The first analysis test asks a key question: are people overall consistent with some set of "standard ratings" of color harmony? To test this, I determined the correlation coefficient between individuals' ratings for the color pairs with the average rating

for each pair. The average of everyone should be a reasonable "standard" set of ratings, right? The correlations are in the Figure 6 to the right. Note that the red line is the 1% statistical significance level.

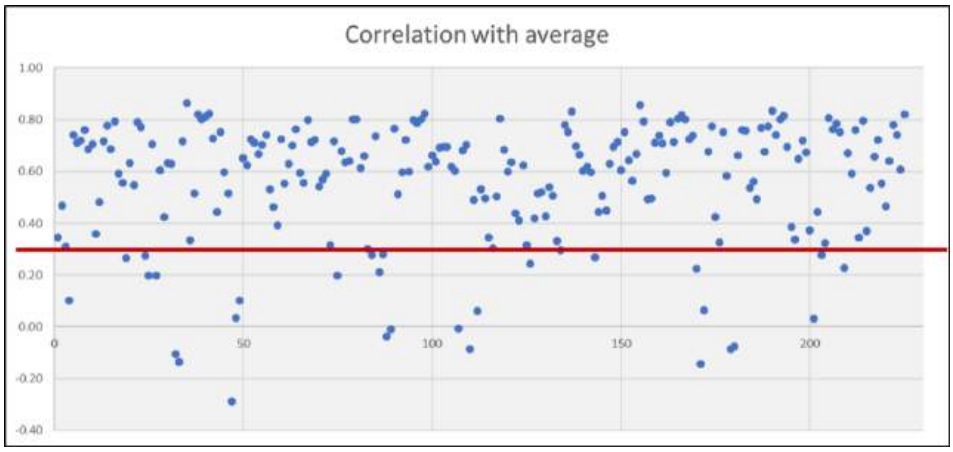


Figure 6 - How well do individuals agree with the group average?

There are 29 of the sets of ratings that fall below the level of statistical significance. This is about one out of eight. Hmmm!! Recall that the initial data set of 70 color pairs (to which I added 10 more) were chosen by individuals to either be harmonious or not harmonious. One would expect that there would be few color pairs with ambiguous harmony. People should largely agree! That is, *if color harmony is universal.*

This is an important question! Is color harmony truly universal? If not, then it is not even *possible* to put together one hard and fast set of rules that can reliably predict color harmony!

There is one possible explanation that could save the universal color harmony hypothesis. The failure of one-in-eight to agree is suspiciously close to the portion of the male population that is color deficient. Unfortunately, I did not assess students' color vision, so I don't know if color deficiency could explain these results. I admit that this experiment is not at the level of peer-reviewed science!

But I would argue against this as a potential explanation. First off, my students were all taking a class in *color science*, so I would expect that people with color deficiency would be less motivated to take the class. Also, there were considerably more females than males in my classes. This is generally true in the Clemson Department of Graphic Communications, which most of my classes were sponsored by.

This analysis of the graph in Figure 6 is rather negative—I was looking at failures. Instead, let's consider successes. Since people agree with themselves with *r=0.73*, I will arbitrarily categorize *r>0.60* as "agrees with the average." By this criterion, there were 75 out of 225 trials (one-third of the trials) that agreed with the average. This is also a bit disappointing.

This analysis used the correlation coefficient, which is a bit slippery to understand. Let me take an approach that is a bit more tangible. I ask the simple question, "if I pick two people at random, what are the chances that they will 'agree' on the harmoniousness of a pair of colors in the data set?" I will define "agree" as scoring within ±1. This means that "good harmony" and "neutral" would not be considered a match. The answer to this question is an optimistic 64.9%. Roughly two-thirds of the time, two people will agree on whether two colors look good together.

Why are these two results so different? The "two-thirds agree" answer is a measure of how well people agree on one color. The "one-third agree" answer is a measure of how well two people agree on the whole collection of colors.

My tentative conclusion is that the rules for color harmony are not quite cut and dried. We should not assume that people agree on whether two colors look good together.

The careful reader will recognize that I have not yet answered an important question, the question that kept me up at night. The readers will have to wait until the next *Pebble* to find out if red and green are truly harmonious.

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Color Research & Application Highlights

Michael J. Murdoch

This fall, I'm highlighting three recent articles from CR&A issues 51(4) and 51(5). The first is about assessing color vision deficiencies, the second is about defining an updated surface color gamut, and the third is about gloss perception in solid and metallic car paint. Quite a variety, illustrating the fascinating breadth of color science in CR&A.

Optimizing Pseudo-Isochromatic Plates Based Testing Through Adaptive Spatial and Chromatic Modulation

Peter Nussbaum, Marius Pedersen, Phil Green, Anders Lunde Hagen
https://doi.org/10.1002/col.70122

Can you find the number disguised in a field of colored dots? Pseudo-isochromatic plates (PIPs), the most famous of which are the Ishihara plates originally from 1917, are commonly used by pediatricians, optometrists, militaries, and some industries to identify and estimate the severity of red-green color vision deficiency (CVD). The ubiquity of these tests is driven by their simplicity—within five minutes, a rough CVD result is clear, despite their inability to make a specific diagnosis.

In this paper, Nussbaum et al. dive into the details of PIPs, some of which have been studied before, and explore the value of an adaptive test, which could be more sensitive than the static, printed version. They begin with a short but reference-rich review of the history of the understanding of dichromacy and confusion lines, which are sets of colors that are indistinguishable to an individual with specific types of CVD, typically shown on chromaticity diagrams.

They then explain a custom interface they built to generate PIPs interactively, starting with the selection of confusion lines from a chromaticity diagram, controlling for the gamut limitations of typical sRGB displays. Separate controls are provided for relative luminance, dot size, noise (by which they mean random deviations from the chromaticity points), borders around the dots, background luminance, dot shape (circle, square, triangle), and color noise (foreground colors are used for some random background dots). Stepping through variations in each of these parameters, the authors defined an adaptive visual PIP test.

This test was set up in a university library, and 80 observers participated in it. The test provided a large dataset that reveals some interesting effects. Firstly, the analysis shows that increased values of several parameters, including noise, color noise, dot size, and relative luminance, made the PIP task more difficult (meaning, observers were less likely to correctly identify the character in the PIP). Notably, background luminance, dot shape, and border did not have significant effects on accuracy. The fact that the border does

not affect accuracy is surprising! The authors include several other comparisons, showing that the choice of confusion line makes little difference for color-normal observers, but has a small effect on accuracy for CVD observers (whose status was inferred from the test results), and that correct answers are on average reached quicker (2.3 s) than incorrect answers (4.8 s). Additionally, CVD observers took slightly more time to answer overall. No significant differences were found between genders or age groups. The test results seem to show that PIP parameters can make the task more difficult for all observers. What is not clear is if the task can be made more discriminating: easier for color-normal observers, while more likely to result in errors for CVD observers.

Surface Color Gamut and Its Visualization

Cheng Gao, Kaida Xiao, Michael R. Pointer, Changjun Li
https://doi.org/10.1002/col.70103

What is the practical limit of colors? This question has been asked countless ways over hundreds of years, and these authors attempt to make a final statement that is comprehensive and flexible enough to finally answer it. A color gamut is generally a boundary, like an outer shell enclosing a cloud of possible colors. For example, a printer gamut describes the range of possible printable colors, and similarly a display gamut describes the range of possible displayable colors. A surface color boundary, however, is meant to be universal—rather than tied to a specific color device, it describes the outer shell of all real surface colors. Surface color is important, because that means reflectance spectra that are bounded by [0,1], and real is important because the spectra should be actual measured reflectance spectra. An alternative to the real constraint would be optimal colors, which are a theoretical construct in which synthetic reflectance spectra are created from reflectance values of only 0 or 1 at each wavelength. Real spectra vary naturally between these values, generally smoothly across wavelengths.

In this paper, Gao et al. review some previous publications on surface color gamut and point out a major limitation, which is illuminant dependence. Even Pointer's gamut, which has been cited for decades as the main authoritative measure of real surface color gamut, is tied to Illuminant C (CR&A 5, 1980). Note that Pointer himself is a co-author on the present paper! Removing the illuminant dependence requires spectral reflectance samples along with a thorough sampling of illuminants to test generality. By starting with a very large set of 143,000 measured reflectance spectra, including natural foliage and flowers, paint chips, printed samples and color order system samples, skin, and textiles—samples collected by ISO, the University of Leeds, and the University of Alicante—the authors eliminate the illuminant dependence.

Generating a surface color gamut from reflectance spectra involves computationally illuminating and observing the spectra, for example using D65 and the CIE 1931 standard observer. The resulting tristimulus values form a cloud in 3D, either directly in XYZ space or after transformation to CIELAB; however, only the former is mathematically convex, which is essential for sampling the outer shell of the cloud as a convex hull. Of all the thousands of color samples, only a small fraction, on the order of 200, lie at the outer boundary, and thus the surface color gamut is only dependent on these extreme colors. The quirk that the authors identify is that it's not always the same

reflectance spectra that end up at the boundary when the illuminant is changed. Their clever solution is to find the outer boundary colors for 422 illuminants, including CIE standard illuminants and many measured light sources. The union of the set of boundary colors for all these illuminants is a universal set of 501 spectral reflectances—501 surface colors that are guaranteed to define the outer shell for any reasonable light source.

The authors go on to describe some transformations for visualization. The outer boundary colors can be defined by a convex hull, which is then a continuous surface, essentially an irregular polygon made up of many triangles. The hull can be sampled and transformed, so the authors provide examples of sampling the XYZ hull at discrete levels of luminance Y, forming a set of rings that are visually understandable in visualization, and then transforming these rings to CIELAB, where they come out at discrete levels of L*. Due to the nonlinearity of CIELAB, the authors describe a further detailed conversion that samples the rings at 1-degree increments in CIELAB hue angle.

Finally, the paper includes comparisons with Pointer's 1980 surface color gamut, showing that the new iteration is smoother and somewhat larger, at least for darker colors. There are some lighter colors where the Pointer gamut is larger, which the authors attribute to the unjustified treatment of CIELAB as convex in the gamut generation. They also compare the surface color gamut to modern RGB display gamuts and the set of optimum colors (equivalently, all colors in the CIE chromaticity diagram). All of these gamuts are larger in CIELAB volume than the new surface color gamut, but that doesn't imply that all surface colors are reproducible with the RGB displays. Overall, the authors have shown the value of a new definition for surface color gamut, specified in terms of surface reflectance, that can be used for comparisons with color systems.

Gloss Appearance of Metallic Coatings

Eric Kirchner, Unnikrishnan Koodali, Pim Koeckhoven
https://doi.org/10.1002/col.70101

What makes a surface look glossy? Visually, gloss seems like an uncomplicated concept—a surface can be shiny, dull, or somewhere in between. However, it's tricky to measure, and gloss measurements don't always correlate with perceived gloss, which is affected by lightness, shape, illumination, and additional coating characteristics like metallic effects. The authors of this paper present a comprehensive study on gloss perception for car paint samples, including metallic and solid coatings of a range of lightness and gloss level. Interestingly, they find that the lightness of a paint color is more important than whether it is metallic in determining perceived gloss.

The article begins with a primer on the measurement of car paint, including multi-angle measurements of spectral reflectance, to characterize the color, measures of texture or sparkle under diffuse and specular illumination, and measurements of gloss. They then discuss gloss perception, which has been understood to be driven by two different characteristics, depending on gloss level. For high-gloss surfaces, the main perceptual differentiator is distinctness of image, which describes how sharp and clear an image is reflected in the glossy surface. For low-gloss surfaces, a perceptual description is contrast gloss, the visual contrast between

a specular highlight and a neighboring non-highlight region. The authors summarize some findings that point to the 60-degree gloss value, Gloss60, as the most informative instrumental measurement of gloss. However, they also point out that much of the research on gloss perception has left out metallic and pearlescent effect coatings, leading them to a study that includes metallic and solid paint coatings for comparison.

Kirchner, Koodali, and Koeckhoven provide a detailed explanation of their gloss scaling study. They designed a set of 119 car paint samples with a two-layer structure including a base coat that determines the color and a clearcoat that determines the gloss level. A total of 17 base coats comprised a variety of colors in solid (8) and metallic (9) effects. The clearcoats were done in 7 levels of gloss ranging from low- to high-gloss. All the samples were scaled visually using a perceptual ruler, which was created using a set of black samples treated with the same 7 clearcoat gloss levels. This means that observers were given the ruler set and asked to choose the ruler gloss level that was closest to the perceived gloss of each sample, thereby scaling the perceived gloss equivalency with the ruler. Interestingly, they also used two lighting conditions for the study: a light booth in which the light source is clearly defined, providing crisp reflections on glossy samples, and a room with a large diffusely lit ceiling that provided no clear highlights in reflection. Observers were free to rotate the ruler and samples in both conditions to investigate the appearance and reflection changes. The study included 8 individuals who participated, scaling all 119 samples and then repeating half of them, randomly selected.

In their analysis, the authors first looked at intra- and inter-observer variability in gloss scaling. Overall, they found that people agree fairly well, and for most samples the intra-observer variation is smaller than the inter-observer variation, true for both solid and metallic samples. They did see a gloss dependence, where scale values for middle-gloss samples were somewhat more variable than for either high- or low-gloss samples. Results show that gloss is most identifiable in the darkest samples (perhaps both because darker colors make the contrast of gloss clearer and because darker samples are also most similar in appearance to the ruler). They show a systematic overestimation of gloss for darker samples in the light booth with distinct reflections, and underestimation of gloss for some lighter samples in the diffuse room. For all colors, the scaled gloss level was most consistent for the highest-gloss clearcoats. Based on these findings, the authors conclude that metallic paints behave similarly to solid paints in gloss appearance, and they suggest further experiments to create a gloss appearance model that depends on sample lightness and gloss value.

A Blast from the Past

Dave Wyble



ISCC Newsletters 50 Years Ago – No. 244 September-October 1976

Introduction

Issue 244 includes a few standard sections for this time of year. In particular, the ballot of candidates for the upcoming Director terms and a report on the September Board of Directors meeting. Beyond those items, there were columns listing new members, news from the Member-Bodies, offerings of companies related to ISCC, and more.

Ballot of Directors for the 1977-1980 term

As is nearly always the case, then and now, the Nominations Committee proposed a ballot of three Directors for the three open positions. Apparently, contested elections—then and now—were, for whatever reason, frowned upon.

The candidates were Therese R. Commerford, AATCC; Karl Fink, CAUS; and Alan R. Robertson, OSA. Note that candidates are identified with a member-body that they are associated with. These three member-bodies represent good coverage of the interests of the Council: textiles, marketing, and optics.

Annual Meeting Location Survey

Another thing that has not changed in 50 years: the Board of Directors needs to occasionally poll the membership. In this case, they were reacting to some members being dissatisfied with the perennial location of the Annual Meeting at the Statler-Hilton in New York City, and a few other topics related to the Annual Meeting. For Question #5, which refers to the specifics of duration and arrangements of the meeting, the following list includes the most frequent responses, verbatim:

- Banquet dinner should not be held on the final night, if at all.
- A campus environment, with less big-city rush, would be desirable.
- Make the business meeting more lively and meaningful.

I can imagine the modern membership answering identically! Banquet dinners are expensive! Leaving on the final night in lieu of attending a banquet might be desirable for many. Our two most recent in-person meetings have been on campus at RIT. And who wouldn't prefer a lively and meaningful business meeting? The conclusion from this survey?

- Have the meeting in New York City every other year;
- (This one should sound familiar.) Try to have the meeting coincide with or adjacent to the annual meeting of a member-body; and

- Change the business meeting program to maximize communication between individuals as well as between organizations.

As the French say, *plus ça change, plus c'est la même chose (the more things change, the more they stay the same).*

Actions Taken at the 1976 Annual Meeting

In response to the survey discussed in the previous section, the Board voted to significantly change the format of future Annual Meetings. In particular, the Problem Committees were to be held consecutively as opposed to concurrently, allowing interested members to attend all meetings. The evening banquet was changed to a formal luncheon, where a lecture would be presented (e.g., If the Godlove Award was given in the year preceding the meeting, it would be featured at the luncheon).

For more traditional Board meeting decisions, the Gemological Institute of America was accepted as a new Member-Body, and the topic for the next Williamsburg Conference would be Pictorial Color Reproduction. For a reminder of what Williamsburg Conferences were, see this column in Issue 514.

A final note on the meeting: The board approved a new category of membership, "Retired," with an annual fee of $7. In 1976, $7, when inflated to 2026 dollars, is about $41. What a deal ISCC membership is, especially for retirees!

New Members Approved

Almost 30 new individual members were approved. There was the usual spread of interests: paints and plastics, design, marketing, color theory and measurement, and more. This entry, for Miss Karyn L. Martin, caught my eye:

> Utilization of principles of color in the healing arts; the study of the relationship of health, physically, mentally, spiritually to cosmic color, light rays, direct application of the healing influence of color in homes, school, industry, etc.

On a personal note, we are getting to the point in history where some of these new members were known to the author of this column. In particular, my friend and mentor Dr. Danny C. Rich, who in 1976 was a graduate student at Rensselaer Polytechnic Institute (RPI), was working towards his Ph.D. under Dr. Fred Billmeyer. As most of you know, Danny sadly passed away in 2022 and is memorialized by ISCC with the Danny C. Rich Memorial Lecture at each in-person Annual Meeting.

News of Members and Member-Bodies

As was the custom, members and member-bodies submitted events, activities and milestones for publication in the newsletter. In this issue we learned that Milton Pearson took over as the new secretary of a technical committee of the CIE (Commission Internationale de l'Eclairage). J. Tom Morgan was presented the 1976 Technology Award by GATF (Graphic Arts Technical Foundation). Four ISCC members, Richard S. Hunter, William N. (Nick) Hale, Jr., Raymond A. Kinmonth Jr., and Duane H. Wahl, will serve as the officers on ASTM E-12 Committee on Appearance of Materials.

Also part of ASTM E-12, a Subcommittee on Definitions consisting of Calvin McCamy, Isadore Nimeroff, Harry Hammond, Charles Ray, and Alfred Webber, will revise the standard ASTM E-284, Definitions of Terms Relating to

Appearance of Materials. One interesting note connecting this subcommittee's work to the keynote address at Color Impact 2025 by Kory Stamper: The subcommittee will specifically not include words that are adequately defined in Webster's unabridged dictionary. They apparently, and rightfully, trusted Kory's predecessors to properly define those color terms.

Finally, there were reports on future and past meetings of three organizations. The Society of Plastics Engineers, Color and Appearance Division (SPECAD) held their 1976 RETC (REgional Technical Conference) and ANTEC 1976 (ANNual TEchnical Conference) in September. The Society of Photographic Scientists and Engineers (SPSE, now IS&T) announced their Symposium on Photographic Technology, to be held in December. Last, the Council for Optical Radiation Measurements (CORM) held their fifth annual meeting in June, which included a workshop on the silicon detector measurement problems.

Products and Services

This issue closed with a series of products and services provided by a variety of organizations and companies. These include courses put on by companies, new products, and even new measurement procedures. Readers of this column may be surprised at some of this content; such material can be reasonably called blatantly commercial. By including commercial content, readers are reminded that ISCC is in fact not a 501(c)(3) charitable organization. We are incorporated as a 501(c)(6), which is an organization or persons having common business interests.

As we know, the ISCC has evolved significantly since 1976, and we are actually much closer to a 501(c)(3) today than we were in 1976. Our focus is much more on educating the membership and the general color community, and much less on supporting specific companies.

Links to Organizations and Other Material Related to this Column

All are active as of this writing.

American Association of Textile Chemists and Colorists (AATCC)
https://www.aatcc.org/

Color Association of the United States (CAUS)
https://www.colorassociation.com/

Optica (previously Optical Society of America, OSA)
https://www.optica.org/

Commission Internationale de l'Eclairage (CIE)
https://www.cie.co.at/

ASTM International (previously American Society for Testing and Materials)
https://www.astm.org/

Society of Plastics Engineers, Color and Appearance Division (SPECAD)
https://www.specad.org/

Council for Optical Radiation Measurements (CORM)
https://www.cormusa.org/

To review Issue No. 244 in its entirety, see:
http://www.iscc-archive.org/Newsletters/ISCCNews244.pdf

AIC 2026 Midterm Summary

Paula J. Alessi

September 2-5, 2026, Florence, Italy

The International Colour Association, AIC, 2026 Midterm Meeting was held in Florence, Italy from September 2–5. The meeting was hosted by the Gruppo del Colore – Associazione Italiana Colore. The theme of the meeting was "Colour and Cultural Heritage."

The original meeting plan needed to be revised after organizers received an unexpectedly large number of abstracts for oral presentations. Although the strong response was welcome, it created several logistical challenges. The program was initially designed with two parallel sessions, but a third parallel session was added to accommodate the additional presentations. To support the expanded schedule, the local organizers secured additional classroom space at the Santa Teresa complex within the University of Florence.

The organizers had expected 150 registrants, but the total reached 200. Registrants came from five continents. What a pleasant surprise in the midst of the current international situation—the world is facing wars, natural disasters, and economic difficulties. Florence, Italy, is known as the cultural capital of Europe. It is a small city, but it is culturally rich with some of the greatest art and architecture in the world. This was most likely an irresistible allure for members of the International Colour Association. Participants were treated to the cultural richness of the Museo di San Marco, the Museo Archeologico, the Museo Bardini, and the Museo dell'Opificio delle Pietre Dure, to name a few of the treasures of Florence.

The general sessions featured presentations aligned with the meeting theme. Four specialized research sessions—*Colour Photography and Film*, *Shedding New Light on Cultural Heritage*, *Colours of Historical Cities*, *and Colour and Perception*—ran concurrently with the general sessions.
Since I was unable to attend the Florence Meeting, I asked two of my ISCC colleagues, Maggie Maggio and Luanne Stovall, to share highlights from their experiences with us.

Highlights of Maggie Maggio's Experience

On Thursday, September 3, the AIC Executive Committee meeting and Welcome Reception took place at the Social Hub Hotel, on the northern edge of the city center. That evening, guests gathered on the hotel rooftop for the Welcome Party, taking in spectacular sunset views of the distant Duomo while reconnecting with friends and meeting new colleagues in the color community.



Duomo Photo Social Hub Hotel Rooftop (courtesy of Maggie Maggio)

On Friday, September 4, the Opening Ceremony included welcome remarks from the organizers and AIC President, Maria João Durão. The AIC Study Group Chairs reported on progress since the previous meeting, and Ingrid Calvo Ivanovic, Co-Chair of the AIC Study Group on Colour Education, shared updates on the AIC/ISCC Colour Literacy Project (CLP). These included the publication of the project's first book in a planned annual series, featuring chapters by CLP Forum presenters—an announcement that was warmly received.

Maggie's favorite keynote was Pietro Palladino's presentation, *Colour Rendering Variations in Paintings in Function of their Surface Reflection Characteristics*. Palladino, an acclaimed Italian lighting designer and electrical engineer, created the specialized architectural lighting system for the Gallerie d'Italia in Naples. His talk focused on the restoration and lighting of Caravaggio's *The Martyrdom of Saint Ursula*, painted in 1610 shortly before the artist's death and widely regarded as his final masterpiece. Palladino described the restoration process and explained how precise lighting can enhance the painting's intense chiaroscuro (the dramatic contrast of light and dark) and intimate emotional weight, characteristic of Caravaggio's final brushstrokes.



Caravaggio's The Martyrdom of Saint Ursula and one slide from Palladino's Presentation (courtesy of Maggie Maggio)

After the Opening Ceremony, organizers arranged taxis to take participants across central Florence to the University of Florence's Santa Teresa Campus for the remainder of the meeting. From the fourth-floor window of one of the meeting rooms looking north, architect Filippo Brunelleschi's magnificent Duomo was clearly visible against a cloudless, sunny sky.



Duomo Photo 4th Floor Window on Santa Teresa Campus (courtesy of Maggie Maggio)

Maggie also highlighted John McCann's presentation, *The Different Images Made by HDR Vision and HDR Photography.* His talk examined how glare affects color appearance and addressed the question, "Why does vision respond differently to edges and gradients?"



John McCann giving his presentation (courtesy of Maggie Maggio)

Highlights of Luanne Stovall's Experience

Luanne's favorite keynote was Marco Leona's presentation, *The Art and Science of Colour: Four Thousand Years of Experimentation and Discovery through the Collections of the Metropolitan Museum of Art*. The talk was especially engaging because it explored the intersection of color science and art. Before joining The Met, Dr. Leona worked at the Freer Gallery of Art in Washington, D.C., and the Los Angeles County Museum of Art (LACMA). He pioneered the use of surface-enhanced Raman spectroscopy to study natural and synthetic dyes in artworks. In addition to his museum work, he teaches analytical chemistry at New York University's Institute of Fine Arts Conservation Center.

Another highlight was *Heritage Accuracy in the Light of Public Familiarity: Who Defines Authenticity?* by Kine Angelo (presenter) and Alex Booker of the Department of Architecture and Technology, Faculty of Architecture and Design, at the Norwegian University of Science and Technology.

A conflict over color and authority: Kine Angelo's insightful presentation used the debate over the façade color of Stiftsgården to show that conservation is not simply a matter of restoring a building to an earlier appearance. As an artist, Luanne was especially drawn to the idea that color carries both material history and shared memory, and that any understanding of authenticity must allow for both. The presentation offered a valuable way to view heritage as something that continues to evolve. (See Figures 1 and 3)



Figure 1 Left: Stiftsgården, Munkegata 23, Trondheim, in 2024. Right: colour-manipulated image from NIKU Report 374 illustrating how Stiftsgården might appear if painted grey. Photo: Dag Øyvind Engtrø, NIKU



Figure 3 Left: 'what colour should Stiftsgården have?', public poll in Adresseavisen, 20 September 2025 Right: excerpt fromFarger i Trondheim, Trondheim's colour guide, published in June 2024

Juan Serra presented *Methodological Approach to the Chromatic Restoration of Historical City Centers: Case Studies in Valencia*, with co-authors Ana Torres, Pedro Verdejo, and Ignacio Cabodevilla of the Instituto Universitario de Restauración del Patrimonio, Universitat Politècnica de València, Spain.

Color restoration as urban archaeology: Luanne found this presentation especially compelling because it combined scientific evidence with visual imagination. Archival research, paint samples, microscopy, and precise color measurement established the historical basis, while on-site observation and watercolor renderings showed how those findings might come alive again in Valencia's streets. The approach was impressively thorough, presenting color as material, perception, history, and lived experience. (See Figure 4)





Colours Chart Proposal for *Punt de Gantxo* House

Element	*NCS*
Background colours	S 2010-Y40R
RED *Sgraffito*	S 3030-Y80R
BLUE *Sgraffito*	S 2020-R80B
Carpentry	S 5500-N
Locksmith	S 1505-Y40R

Figure 4. Colours chart proposal, elevation and photograph of a detail of the Punt de Gantxo *House, Valencia.*

Juan Serra also announced the AIC '27 Congress in Valencia, Spain taking place next fall and previewed the venue and amenities. The event offers a promising opportunity for the Colour Literacy Project to collaborate with Serra's team and the AIC Study Group for Colour Education as the Colour Literacy Project expands its programming.

Fiona McLachlan of the University of Edinburgh presented *An Evolving Identity Through Colour: Balancing Authenticity and Change.*

Reweaving civic fabric through color: Fiona McLachlan showed how thoughtful color design can extend the life of existing buildings while reshaping how communities see and use them. Her "warp and weft" strategy draws colors from the surrounding neighborhood and develops them through paintings, collages, models and community consultation. This strategy offered a compelling alternative to color as a quick cosmetic fix. The presentation framed it as a sensitive yet confident tool for renewal, helping valued buildings evolve with a stronger identity and a more useful future.



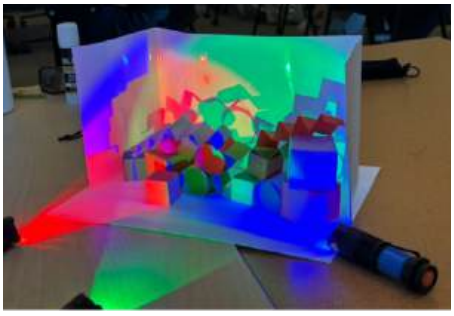
McLachlan, "Warp and Weft" Color Strategy, based on Bernard Klein textiles, hand-painted acrylic collages



McLachlan, color of environment surrounding area

Esther Hagenlocher and Maggie Maggio of the University of Oregon's Department of Interior Architecture presented *Light and Shadow: Exploring Dimensional Colour in Interior Architecture Education.*

Moving color from two-dimensional surfaces into three-dimensional space: Maggie Maggio and Esther Hagenlocher showed how the CLP Light and Shadow exercises can broaden color education for architecture and design students. Using cubes, folded strips, and paper tubes under various lights, students explored how color can expand, recede, vibrate, and shift with the viewer's position. The exercises presented color not as a decorative surface choice, but as an active element in shaping space and human experience.



Students created "stages" to document lighting variations with LED and RGB lights

Ingrid Calvo Ivanovic[1] (presenter), Luanne Stovall[2], Elisa Cordero[3], and Esther Hagenlocher[4], presented *Local Colour as Material and Immaterial Heritage: A Catalyst for 21st Century Colour Literacy.*

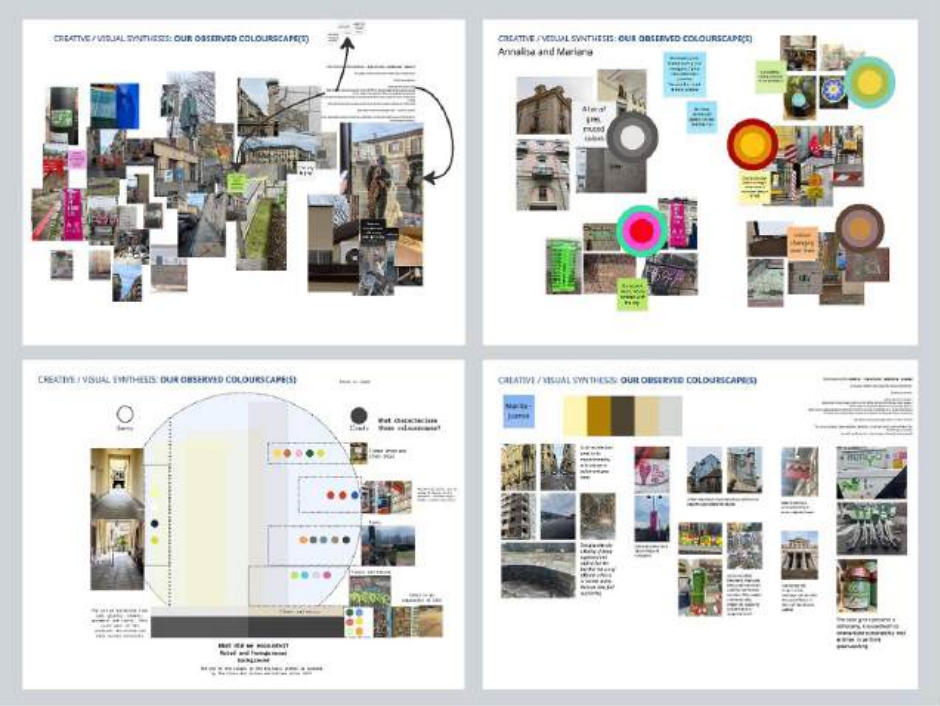
From observation to future-focused design: Ingrid Calvo Ivanovic described a field-based method that guides students through three essential steps: observing local color, collecting and interpreting their findings, and applying that knowledge to design. Projects in Turin, Valdivia and Oregon showed color as a way to understand social life, create living archives, and develop place-based proposals. The approach matters because it prepares students not only to select colors, but also to understand their cultural and ecological meaning and use them responsibly.

Personal reflections from Luanne: "Above all, the most outstanding highlight was the opportunity to meet new colleagues from around the world and to learn about their research interests. The conference setting, Florence, added a remarkably inspiring layer of cultural beauty, especially for me, with my background as an artist. It was magical to take part in the conference while soaking in the color, light, architecture, art, and sights and sounds of this unique and iconic Italian city."



Elisa Cordero images from field-based color safaris in Valdivia, Chile

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[2]Department of Arts and Entertainment Technologies, University of Texas at Austin, USA
[3]Escuela de Diseño, Universidad Austral de Chile, Valdivia, Chile
[4]Department of Interior Architecture, University of Oregon, Eugene, USA



Ingrid Calvo Ivanovic images from field-based color safaris in Turin, Italy

My closing remarks: Many thanks to Maggie and Luanne for sharing their highlights. Their words and vibrant images brought Florence to life, allowing me to vicariously experience the meeting. I hope you, my fellow ISCC colleagues, enjoyed the journey as much as I did.

Calendar

Jodi Baker

NOV 2 – 6
IS&T CIC 34 Color & Imaging Conference, Barcelona, Spain
https://www.imaging.org/IST/Conferences/CIC/CIC2026/CIC34_Home.aspx?WebsiteKey=6d978a6f-475d-46cc-bcf2-7a9e3d5f8f82&hkey=ed1ff42c-2567-4a3e-9c8f-9956598d2198&8a93a38c6b0c=1#8a93a38c6b0c

NOV 8 – 11
IES Street & Area Lighting Conference 2026, Sheraton Phoenix Downtown, Phoenix, AZ
https://web.cvent.com/event/2d762e88-7817-4df4-a008-172e68217f5b/summary

NOV 12 – 13
2026 Joint CNC/CIE, CIE-USNC & CORM Conference, Virtual
https://cormusa.org/news-events-3-2/

NOV 17
ISCC Cutting Edge Lecture – Ren Ng: A Tale of Three Novel Colors
2:00–3:00 p.m. EST Virtual
https://iscc.org/event-6842923

NOV 17
AATCC 2026 International Conference on Textile Standards and Technological Innovation, Shanghai, China
https://www.aatcc.org/events/upcoming/

DEC 1
Abstract and Summary Submission Deadline Optica Design and Fabrication Congress, Antwerp, Belgium
https://www.optica.org/events/congress/optical_design_and_fabrication_congress/submit_papers/

DEC 1
SID Display Week 2027 Call for Papers
https://www.displayweek.org/program/authors-presenters/

DEC 9 – 10
AATCC Workshop Specifier's Edge
https://www.aatcc.org/events/aatcc-workshop-specifiers-edge

DEC 10
ASTM December 2026 Committee Week, E12 Color and Appearance Retroreflection, Hyatt Regency Jacksonville Riverfront, 225 East Coastline Drive, Jacksonville, FL
https://member.astm.org/meeting/search-keyword?keyword=e12

DEC 19 Submission deadline for ASPRS 2026 Annual Geo Challenge
https://www.asprs.org/iCore/Events/Event_display.aspx?EventKey=GEOC2026

JAN 24 – 27 2027 IS&T Electronic Imaging Symposium 2027, Burlingame, CA
https://ei2027.imaging.org/

JAN 26 – 27 2027 E12 January 2027 Meeting, ASTM International Headquarters, 100 Barr Harbor Drive, West Conshohocken, PA
https://member.astm.org/meeting/search-keyword?keyword=e12

FEB 26 2027 ICC DevCon Tokyo, Japan
https://www.color.org/schedule.xalter

MAR 1 – 2 2027 ICC Meeting Tokyo, Japan
https://www.color.org/schedule.xalter

MAR 7 – 11 2027 OFC Conference and Exhibition, Los Angeles Convention Center, Los Angeles, CA
https://www.ofcconference.org/program

MAR 15 – 18 2027 IES Light + Intelligent Building North America, Las Vegas Convention Center
https://registration.experientevent.com/ShowLIB271/

APR 11 – 15 2027 Optical Design and Fabrication Congress, Antwerp, Belgium
https://www.optica.org/events/congress/optical_design_and_fabrication_congress/program/

JUNE 8 – 11 2027 SID Information Display Technical Symposium at Display Week, San Jose, CA
https://www.displayweek.org

SEPT 9 – 12 2027 2027 ASPRS Fall Symposium Las Vegas, NV
https://www.asprs.org/Main/News---Resources/ASPRS-News/Save_the_Date_2027_International_Technical_Symposium.aspx

OCT 4 – 8 2027 AIC Valencia 2027 17th International Colour Association Congress, Valencia, Spain
https://aic-color.org/events

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