iSCC
INTER-SOCIETY COLOR COUNCIL

Inter - Society Color Council

Quarterly Newsletter

Winter 2024
Issue #505

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

Hero's Journey I: VI New Leaf
Luanne Stovall
Gouche on arches paper photo credit: Bill Kennedy

President's Message

Maggie Maggio

When I joined ISCC in 2016, I was excited to be part of an organization whose members were both passionate and knowledgeable about color. Since then, I've served on several committees responsible for conferences, events and project initiatives, and it is clear to me that inter-disciplinary educational programming is at the very heart of our organization.

As the current president of ISCC, I am thrilled that we have a growing number of regularly scheduled programs that focus on state-of-the-art color topics and connect people across color disciplines. In addition to the ISCC professional webinars, our programming now includes the student focused Fluorescent Fridays, the Colour Literacy Forums and the new Colorful Connections monthly networking events for members. We are also planning to host another Color Impact conference in person in 2025.

To support this significant growth in our inter-disciplinary educational programming, the Board of Directors voted last year to raise the cost of individual membership. This increase will ensure that our income from membership covers the annual costs of maintaining the ISCC website, publicizing and hosting events, and producing the ISCC Quarterly newsletter.

I invite you to attend as many events as you can this year and encourage you to share the links for our events with your color colleagues. We would like to bring a larger audience to the work of the organization and hopefully grow our membership.

Feel free to contact me with suggestions for taking our educational outreach to an even higher level.

Thank you for being a member of ISCC!

Maggie Maggio

In early January, we emailed the following information to all members:

Dear Fellow Members of ISCC - Happy New Year! I hope your holidays were filled with color and light!

Over the past several years, ISCC has developed a number of new programs and enhanced existing resources for you, our members. These programming efforts come with real costs, both financial and in volunteer hours. To keep up with these costs, the ISCC Board of Directors voted last year to increase the annual dues for individual members from $50 to $75 (USD) for 2024.

***Note:* If you have already renewed, or if you renew your membership before January 15, 2024, you will get the $50 rate though 2024.**

To renew your membership, go to: https://iscc.org/Renew-Now

This change will not increase the annual cost for the rest of the membership options:
Library - $75.00 (USD)
Student - $10.00 (USD)
Retired Membership - $10.00 (USD)
Sustaining Membership - $500.00 (USD)
Corporate Membership - $250.00 (USD)

Your membership supports these programs and resources:

- Fluorescent Fridays, a quarterly online program aimed at university students studying color.
- Webinar Series, online approximately quarterly, for color professionals and students.
- Colorful Connections, a monthly online gathering, bringing members together for networking and more.
- Color Impact Conference, our new bi-annual color conference which has been held online and in person.
- Visual Identity Project (VIP), an ongoing effort to upgrade our online presence to attract future generations.
- Programs Committee, to coordinate. publicize and host all of our online programs.
- The Wave, our email broadcast of upcoming events in the world of color.
- ISCC Quarterly Newsletter, with timely articles on the world of color
- The Joint ISCC/AIC Colour Literacy Project, beta-testing a foundational 21st century colour education curriculum.

The Programs Team is busy lining up the schedule of events for 2024 and we invite you to join us for as many events as you can.

ISCC winter events:

- ISCC Webinar with Elisabeth Berry Drago
  Jan 23 2:00 p.m. EST

- Colorful Connections
  Friday Jan 12 noon EST
  Monday Feb 12 4 p.m. EST
  Tuesday March 19 10 a.m. EST

I want to let you know that the decision to raise the individual membership rate was made with careful consideration. Our goal is to keep ISCC relevant and up to date for current members and also appeal to the next generation of color professionals. We hope you understand our need for this increase and look forward to your continued membership.

Please contact us if you have any questions or concerns about the new rate, or if you have any other thoughts regarding the organization.

I am looking forward to another year of growth at ISCC!
Best regards,

Maggie Maggio
President, Inter-Society Color Council (ISCC)

Table of Contents

Hue Angles:
Blue Morphos Have a Cool Color

Michael H. Brill

Lately I've noticed a presence that has accompanied me from room to room, fluttering over the pages I read and landing on a surprising number of them. This presence is the blue morpho, a large butterfly (8-inch wingspan) that inhabits Central and South America and is celebrated for its beautiful electric-blue color. That color is structural: it is caused by the interaction of incident light with the shape of a light-receiving surface, not by wavelength-dependent light absorption by that surface.

I first encountered the blue morpho in Kai Kupferschmidt's book, Blue: In Search of Nature's Rarest Color, which I reviewed in Issue 504 of ISCC News. There I learned about a tricky problem that the butterfly appears to have solved through natural selection. Interference patterns can lead to brilliant structural colors, but the color you see generally depends on the angles of illumination and viewing. As the viewing geometry changes, it is difficult to preserve the color of the butterfly's wing at all angles. Kupferschmidt notes that scientists have only recently understood the angle-independence of that color. The proof of their understanding was their effectiveness in imitating the butterfly's color and is the subject of several U.S. patents (see U.S. Patent Nos. 11,428,854 and 11,200,583, and also Patent Application No. 20210018659). The inventor is none other than Andrew Parker, who gave one of the ISCC presentations on color and evolution last September, a month or so after I had encountered Kupferschmidt's book.

Parker's solution is a multi-layer composite of scales similar to the microscopic scales on the wings of the morpho butterfly. Normally, a set of nearly identical features with even spacing would cause an interference pattern. The trick inspired by the morpho butterfly is to add a constrained randomness in the orientation of the scales. Besides being randomly oriented, Parker's scales are convex, and that convexity causes the incident light to diverge into a variety of directions, while keeping a sufficient intensity and wavelength selectivity to stay electric blue. This convexity seems to be the main mechanism of the solution: Parker designed his multi-layers so as to minimize the effects of interference in the light scatter. To this

end, he forced the refractive index to have a smooth dependence on spatial location within the layer, which encourages a ray-optic analysis. (This could be a big surprise to those of us who assume that iridescence is a natural and unavoidable property intrinsic to a structural color – but remember Newton's prism can serve as a light-dispersing element.) You have seen the ray-spreading behavior before, in the convex side mirrors on your car ("objects in mirror are closer than they appear"). When you look at this mirror's reflection of a localized light source, it indeed seems farther away than a flat-mirror reflection. The source retains its intensity but occupies less visual angle and (in compensation) visibility in a wider range of scattering directions.

At about the same time I learned of Parker's invention, I received my August issue of Optics and Photonics News, and there was our blue friend again, now in the context of "Radiative cooling in living color." The research was done by Wanlin Wang et al. in Shenzhen University in China. The primary research publication is W. Wang et al., Cooling colors below ambient temperature, Optica 10 (2023), 1059-1068.

As did Parker, the Chinese group claimed a blue-morpho-inspired composite layer that achieves the viewing-angle insensitive blue color. For angle diversity, they found that frosted glass provided a satisfactory solution. But the Chinese group simultaneously strove for a different objective. Their angle-constant blue layer also provides substantial radiative cooling – up to 2 degrees C lower than the ambient and better than using a white reflector. To achieve this cooling performance, they adjusted the spectral properties of the layer over all visible through mid-IR electromagnetic wavelengths. In particular, the absorbed part of the incident solar radiation heats the surface and converts the heat to black-body radiation with a mid-IR component that is much stronger than the passive cooling emission that would otherwise be present in mid-IR. It turns out that the Earth's atmosphere is completely transparent to mid-IR radiation (8000 to 13000 nm). Because of that transparency, radiation in the mid-IR window promptly leaves the Earth and never returns. For us it might be a window of escape from global warming.

Having read about the Shenzhen group's radiative-cooling layer, I tried to tie the design back to the morpho butterfly but found the analogy wanting. It seemed to me that their device comprised two independent inventions – one for angle-invariant color and one for radiative cooling – only the first of which pertains to structural colors and thereby to the blue morpho. The main emphasis of the Optica article was radiative cooling, which is not a property I've ever seen attributed to the blue morpho. How, then, can one convincingly assert that this research is related to the blue morpho?

The plausibility seems to hinge on the choice between two alternative words: "imitate" versus "inspire." The Shenzhen group used both words to describe the connection. On one hand, they imitated the structure of the blue morpho's wing (presumably in solving the color-versus-angle problem), but they were not imitating it anymore when they were solving the cooling problem. On the other hand, they could have been inspired by the blue morpho to do the entire project including the cooling problem. Unlike an object of imitation, an object of inspiration does not imply technical transfer to the project from the source of inspiration. Imitation is hard, as implied by Yogi Berra: "If you can't imitate him, don't copy him." So, the blue morpho as inspiration is more inclusive (perhaps all-inclusive: anything can be inspired by anything else).

I tried to be tolerant of the looser connection implied by "inspired," but ultimately its all-inclusiveness turned me off and I remained unswayed.

Suddenly, the butterflies that were fluttering around me disappeared.

The blue morpho is indeed a beautiful creature and a wonderful muse. It's not often I see a single actor participating in so many shows at the same time. But the radiative-cooling show seems far-fetched for this actor. I question the relevance, other than to say that the blue morpho has a cool color.

Michael H. Brill

Blue Morpho, Female, Dorsal view. Source: Wikipedia.

A Blast from the Past: ISCC Newsletters 50 Years Ago

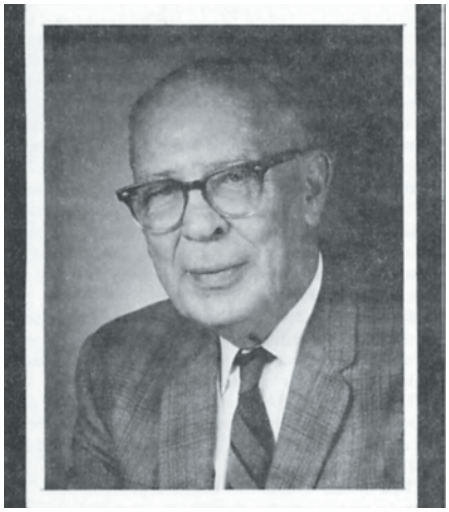
ISCC Newsletter No. 228

Jan. – Feb. 1974

Paula J. Alessi

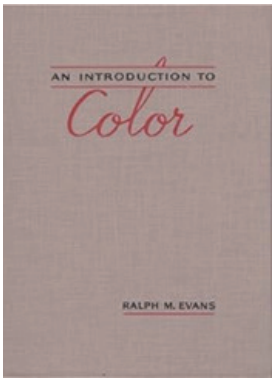
As we face the new challenges of 2024, it is instructive to look back 50 years to see if we can gain wisdom from the issues of 1974. Excerpts will be featured from ISCC Newsletter No. 228 January-February (25 pages).

Goodbye to Ralph M. Evans

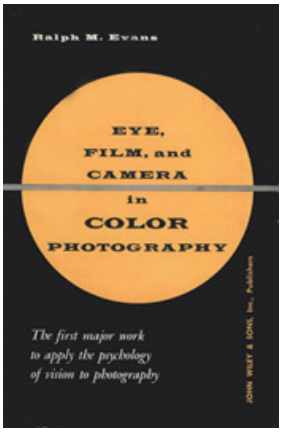


This newsletter opened with the very sad news that ISCC lost one of its iconic color experts, Ralph Merrill Evans, at the age of 68. He served as ISCC President from 1946-1947 and ISCC Secretary from 1951-1970. As usual, Dorothy Nickerson wrote a beautiful tribute to her very dear colleague. Dorothy praised Ralph as a "man of ideas in color, a pioneer in opening up new fields for color study. Many of Ralph's ideas were first presented in lectures, ideas which he never accepted until they could be successfully illustrated. His slides are memorable—prepared by unusually capable and talented associates whom he had a knack for discovering." Ralph graduated from Massachusetts Institute of Technology (MIT) in 1928 with a degree in Optics and Photography. He spent a good part of his career working at Eastman Kodak Company in administrative roles while at the same time performing his own color science research and fostering the color work of other ISCC prominent color professionals, such as Newhall, Burnham, Leo Hurvich and Dorothea Jameson. Being a Kodak alum myself, I have a soft spot in my heart for the mark that Evans left on Kodak history in color research and development. Thus, I encourage readers to go into the ISCC archives at www.isccarchive.org/Newsletters/ISCCNews228.pdf and read Dorothy's tribute to this great man.

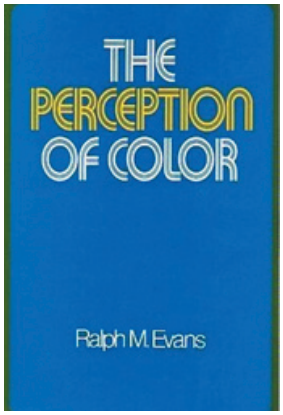
Here I would like to honor the memory of Ralph Evans by highlighting some of the classic books that he wrote on the subject of color. First in 1948, he published An Introduction to Color, which brilliantly emphasizes that color is multi-disciplinary in that a complete understanding of color involves knowledge of physics, physiology, and psychology. First, physics is important because color perception begins with a color stimulus defined by the radiant energy that enters the eye.



Next, physiology comes into play as the radiant energy of the color stimulus gets interpreted by the human visual system. This includes the photochemical reactions in the eyes' receptor cells, the neural connections to the brain, and the brain itself. Finally, psychology is required because the interpretation of the information coming from the visual system is subjective, meaning that color perception is a unique experience for each human being, influenced by such things as culture, context, age, memories, preferences, etc. Evans admits that it is a difficult dynamic between the physicist, physiologist and psychologist because they are not always on the same wavelength (no pun intended) when it comes to color issues. Does this sound familiar? It should because many such differences still exist today! Evans always believed in visual learning, which is why this book features 304 drawings and illustrations! Evans loved to be a teacher, so he went to great lengths to explain each graph and diagram that he used in this book. Upon completion of this book, the reader has a working knowledge of some difficult concepts in physics and sensory psychology, such as color temperature, CIE chromaticity diagrams and perceptual constancy.



In 1959, Ralph Evans published a book entitled Eye, Film, and Camera in Color Photography. The purpose of this book was to teach readers about the psychology of color vision as they set out to create color photographs. This was done by highlighting human perception theories, optical image formation fundamentals, lighting control techniques, and some photographic aesthetic approaches. These concepts are quite often very difficult to grasp, but Evans's book simplifies things by specifying what the photographic medium is capable of and what viewers see when they look at a finished color photograph. After reading this, you will have a new appreciation for how accurately a photographic reproduction can represent reality.



In 1974, Ralph Evans's book, The Perception of Color, was finally published after a five-year labor of love to complete it. Thankfully, it was completed before his death and published shortly after his passing. This book represents an orderly compilation of twenty years of Evans's color perception work. In October of 1973, Evans gave a presentation to ISCC members entitled "Trichromatism and Color Perception." This talk was a glimpse into the contents of his book.

The presentation featured very effective live demonstrations of a variety of perceptual phenomena that prompted Evans to question generally accepted color perception assumptions. Sadly, the perceptual effects and discussion of their inter-relationships could not be reproduced in the book. So, the ISCC audience had a visualization advantage if they read the published book after his death. If Evans had published in 2023, it probably would have been possible to reproduce his demonstrations in this book. Evans described the perceptual effects and their inter-relationships in great detail to make up for the lack of visual demonstrations. The most significant assertion that Evans reached in this book is that five variables are required for color perception. He defined those five variables as hue, saturation, lightness, brightness and brilliance. Evans's work accounted for these five variables by adding a "chromatic strength" function to the usual luminous efficiency and color-matching functions. In Evans's own words the "chromatic strength" function "has been found to be dependent on the relationship of the psychophysical variables of the stimulus to those of the surround, but the perceptions that it mediates are perceived as caused by the stimulus itself." These ideas were found to be very controversial back in the day. So, it made for some heated discussions. Evans admitted that his five perceptual variables needed to be further developed in order to achieve sufficient precision and reliability. It was Evans's hope that this book would bring on debate and that his colleagues would explore some of its ideas to the point where those explorations would advance the knowledge of color perception.

Faber Birren's Collection Gifted To Yale University

ISCC Newsletter No. 228 announced that Faber Birren's Collection of books and other treasures on color and color theory were gifted to the Art Library at Yale University. At the time, Birren's private library collection was considered one of the best in the world. Here are some of the gems contained in Birren's collection:

- Original works of Robert Boyle and Isaac Newton.
- Simultaneous contrast by M. E. Chevreul, including a memorial edition printed by the French Government.
- Charles Henry's Cercle chromatique and Rapporteur esthètique, both of 1888, which were central documents in the evolution of Seurat's and Signac's Neo-Impressionism.
- Moses Harris' extremely rare Natural System of Colours (ca. 1776), distinguished by a beautiful hand-tinted color wheel over engraving.
- J. B. Corneille's Les premiers èlèments de la peinture pratique (Paris, 1684), from which a series of palettes bringing sense and order to color compositions was adopted by most of the leading artists.
- About 250 photographs from his archive of international museum and private photography collections, accompanied by verifications of the colors on the represented palettes according to a standard color scale.

Status of Problem Subcommittee on Determination on Strength of Colorants (Pigments) – 25P

This is worthy of note because this subcommittee completed an extensive literature search on procedures for strength evaluations of colorants, both dyestuffs and pigments. This is significant because the work took years to complete and it was, at the time, the most extensive reference that could be found on the subject. The report was several hundred pages long and ISCC members could purchase it for $25.

Report On 2nd Aic Congress 1973 In York, England

This second AIC Congress featured over 100 lectures and paper presentations. It is instructive to look at a quick summary of some of the presentations by author and topic:

- Peter Gibson – stained glass
- Robert W. G. Hunt – color reproduction
- Lythgoe – colors underwater
- Marre – acquired color deficiencies
- Dorothy Nickerson and David Wright – tributes to the late Deane B. Judd
- Tarow Indow – color atlases
- P. W. Trezona – color vision
- Moreland – anomaloscope to detect color deficiencies
- Hasegawa - new technique for binocular fusion of white and colored lights
- Cavonius - improvement of wavelength discrimination by luminance differences
- Palmer - effect of green light on the red droplet cones in the pigeon retina
- Walraven – adaptive hue shifts

Color Difference Papers

- C. J. Bartleson – observers fall into four categories in brightness scaling
- Michael R. Pointer – colour discrimination found to be independent of white light adaptation
- Rolf Kuehni - significance of 495 and 570 nm in colour vision
- Fred W. Billmeyer, Jr. – fractionation of Munsell chroma steps down to commercial tolerance sizes
- Eastwood – linear change on V* for possible color space modifications
- Kowaliski – logarithmic luminance scale for UCS
- Klaus Witt – recalculated data for DIN 6164 color samples from illuminant C to D65
- Cichowski, McLaren, Richter, Coates et al, and Morley, Munn and Billmeyer – use of Adams-Nickerson formula
- Jaeckel et al – consistency of assessors' judgements of commercial matches.

Color Scaling Papers

- C. A. Padgham and Rowe – hue and saturation scaling
- Zollinger – naming of colors
- C. J. Bartleson – observers fall into four categories in brightness scaling
- Mattiello and Guirao – dependence of saturation and luminance
- McConnell – revised neutral axis in Glasser cube root space to help assessments of near white paper samples
- Lakowski – relation of age on color memory performance
- Battersby – acute memory for flower colors, assisted by color names
- Robert Seve – better terminology needed for description of gloss

Color Formulation and Whiteness Papers

- Bridgeman & Fairbrother – pharmaceutical industry requires anomalies in K and S constants to be solve
- McDougall – K and S constants for meat industry
- Dinsdale and Malkin – K and S constants for ceramics
- Eugene Allen – computer color matching of printing inks using 2-layer method
- St. John – computer color matching challenges for multi-component fabrics
- Thompson and Waller – methods to control color in batches of pigment
- Seltzer and Janes – wool as a substrate in a predictability study
- Coates et al – measurement of Z useful for classifying the whiteness of wool
- Blakey – undertone in white pigments
- Franc Grum – “white space” defined experimentally

Color-Rendering Papers

- Ouweltjes – optimistic view of the CIE method
- Walter – interpolation tables for reference illuminants
- Margaret Halstead et al – use of a dual index
- Morley – difficulty in correlating visual assessments and index when using mercury lamps
- Garrett – colour rendering requirements in dental hospitals

Colorimetry Papers

- F. J. J. Clarke and P. W. Trezona – large field tetrachromacy
- Coates et al – systematic errors in fluorescence measurements in textiles
- Annie Berger – broad band irradiance with monochromatic view adequate for fluorescence measurements in textiles
- Baba and Sengoku – 2-mode method, with one monochromator and broad band and monochromatic illumination, required for fluorescence measurements
- Erb – white standards
- Gunther Terstiege – white standards
- Bentley – standardizing system for use with digital-incremental spectrophotometers
- Christie – diagnostic reflectance standards to eliminate systematic errors in colorimetry
- Malkin – unacceptable spread of measurements obtained in international comparison of instruments

B. K. A. Battersby discussed the following color applications

- Little's model for relating color perception to colorimetry
- Lakowski's inconclusive study of Luscher personality test
- Deribere's views on possible relations between the perception of color, sound, taste and smell

- Wildblood – the need for an international institute of color
- Gerritsen – a new colour circle to be used for colour education
- Verity – a new series of colour teaching charts for colour education
- Granger – colour harmony and discord vary with time
- Walker – slide show on the use of colour by artists in the last 100 years prior to 1974

More information can be obtained on all of the AIC York presentations by going to the ISCC newsletter at http://www.iscc-archive.org/Newsletters/ISCCNews228.pdf . It is also possible to obtain the full published text of each presentation by going to the AIC website at: https://aic-color.org/publications-proceedings.

Report on CIE International Meetings 1973 in London

Three CIE international meetings were held in London, England at the conclusion of the AIC Congress in York. The first was CIE TC 1.3 on Colorimetry. This meeting lasted for two days and was led by R. W. G. Hunt. The two days were dedicated to discussions of work on color difference formulae. It was agreed that deriving a simple formula based on the x,y,z system was not possible. The simple formula derived based on the 1964 U* V* W* system was rejected by the colorants industries because it did not have the accuracy required for all colors. The ANLAB 40 formula (where AN stood for Adams Nickerson) was proposed as an international standard much to the disappointment of the CIE. The CIE was not fond of the use of ANLAB 40 because it incorporated complex functions of X, Y and Z. The CIE preferred investigation of a set of equations that look like the following:

$$L^* = k_1 \left(\frac{Y}{Y_w}\right)^{\frac{1}{3}} - k_2$$

$$a^* = k_a \left[\left(\frac{X}{X_w}\right)^{\frac{1}{3}} - \left(\frac{Y}{Y_w}\right)^{\frac{1}{3}}\right]$$

$$b^* = k_b \left[\left(\frac{Y}{Y_w}\right)^{\frac{1}{3}} - \left(\frac{Z}{Z_w}\right)^{\frac{1}{3}}\right]$$

CIE was in the process of doing work to define values of k1, k2, ka, and kb so that these equations would yield numerical values that would be close to those obtained from the ANLAB 40 equations.

Here, in 1973, are the beginnings of the 1976 CIELAB equations that we have all come to know and love! Hunt emphasized that color difference users could plot a* against b* obtaining a type of “chromaticity diagram” not a color mixture diagram as existed for u,v coordinates from the U* V* W* equations.

The second CIE meeting was for CIE TC 3.2 on Colour Rendering. Margaret Halstead conducted this meeting. The main emphasis of their work was establishing an international sub-committee to study the colour reproduction properties of colour printing, colour photography and colour television light sources. The colour photography work began first. They also looked to the TC 1.3 Colorimetry Committee for advice on adaptation, when different light sources were involved. It was also decided to explore defining a colour preference index similar to the colour rendering index. Finally, there was some interest in extending the colour rendering sample set to include fluorescent colours and use of a new colour difference formula.

The third CIE meeting was for CIE TC 2.3 on Photometric Characteristics of Materials. They met for two days and spent a majority of their time discussing their draft document on “The Radiometric and Photometric Characteristics of Materials and their Measurement.” Then they broke out into sub-committee work on fluorescence (led by Franc Grum), polarization, turbid media, and gloss.

Color is a blessing to the world

I love what Midge Wilson* said about chromatic energy when compared to the divisiveness of countries around the world trying to develop new sources of energy. So, I have reproduced her article here:

Chromatic Energy

There is urgency in developing new sources of energy. Some talk of solar energy; others of geothermal energy. Few consider the wonders of chromatic energy.

Color is like a smile on a friendly face. It can enliven the spirit and inspire the soul. Beautiful colors impart special appeal to the most ordinary objects. They spark a myriad of fascinating combinations.

What a marvelous source of energy! It can transform a moody mood, make a dull spot bright and bring spring to a hibernating room. Color can make your spirits dance and your heart sing. Color surmounts language barriers. It reveals the treasures of the ages and the mysteries of ancient pasts; yet it is as fresh and as contemporary as the moment which it accompanies. It adjusts to changing times as nothing else we know. Color is indeed wondrous. It gives us hope and inspiration and with its many variations enables stylists to compensate for material limitations and restrictions by interpreting basic items in endless variations.

Color is one of our greatest blessings. It surrounds us in abundance. It is available to everyone to possess and to appreciate. It is not something which one country can hold and deny another. No one needs to worry about governments sharing their supply or depending upon international agreements to make it available. So long as the sun rises each day, to bring us light to see, we will be able to enjoy color. It is one of nature's finest gifts. How the heart sings, with the joy that color brings!

***Note: Midge Wilson, Executive Director of the Color Association of the United States, received the 1974 ISCC Macbeth Award for her work on selection and production of forecast colors for industry.**

My heart sang after reading this and I hope that yours does too. In the year of 2024, let's all forget about what divides us and relish in what unites us! Color is one of those things that unites us. It surrounds us in every aspect of our daily lives. We can all rejoice in the beautiful experience that color brings to humanity!
If you would like to see more colorful and breathtaking sunrises and sunsets, check out this YouTube link, https://www.youtube.com/watch?app=desktop&v=vBJ2-75ZUFc

You won't be sorry. Enjoy!

Color Research and Application Highlights

Michael J. Murdoch

In this column, I highlight articles by ISCC authors in Color Research & Application. The most recent issue 48(6), includes one Research Article by ISCC members.

Fundamental scales of hue appearance and discrimination

Saeedeh Abasi, Mark D. Fairchild
https://doi.org/10.1002/col.22895

Can you put a number on hue? Scaling of perceptual attributes has long been a core topic in color science, bringing together intuition about color appearance, psychophysical methods, and mathematical modeling. In this article, authors Saeedeh Abasi and Mark Fairchild describe two new models for hue scaling, both starting from cone fundamentals; one a scale of hue appearance and the other a scale of hue discrimination. The difference between these is subtle but important, and it is explained well in the paper. Their appearance-based hue scale is based on unique hue (UH) cardinal axes, similar in character to the NCS color order system, while their discrimination-based hue scale is based on equal visual differences around the hue circle, much like the Munsell color order system. These two ways of describing hue persist because neither can replace the other, not because of indecision or competition.

Abasi and Fairchild present a series of plots showing modeled hue spacing results utilizing NCS color samples as well as those used by Ebner and Fairchild in the development of IPT color space, which is known for its excellent hue linearity (Ebner F, Fairchild MD. Development and testing of a colorspace (IPT) with improved hue uniformity. Color Imaging Conference 1998). The paper develops two models, called Fundamental Hue Scales (FHS). The FHS_H scale, with H for hue-quadrature, is best for appearance-based scaling in which judgements correspond to interpolations between unique hues. The FHS_h scale, with h for hue angle like in CIELAB and CIECAMXX, is best for discrimination-based scaling in which the perceptual distance between hues is important. The two scales differ in the spacing of hues around the hue circle, with FHS_H squeezed and stretched a bit compared to FHS_h in order to present the unique hues at the cardinal directions. Interestingly, they leave open the opportunity to tune the FHS_H model with the unique hues of an individual observer, because it is known that UHs do vary between people. That's part of the reason why some people insist a tennis ball is yellow, while others know for sure it is green!

This article on hue scales is part of a broader effort led by Professor Fairchild to focus on one-dimensional scales for color appearance modeling, rather than try to squeeze and contort multiple scales into a supposedly-uniform three-dimensional color appearance space. Note that I work with both authors at RIT, but I have not been involved in any of the work except on occasion as an observer in visual experiments.

ISCC Webinars Report

Ann Laidlaw

November Webinar

The ISCC webinar program included a presentation in November on The Power of Color, Changing Perceptions, by Judith van Vliet. Judith has an extensive background at companies as varied as Kawasaki Motors, Avient ColorWorks, and ColorForward. She also serves as Vice President of Membership at the Color Marketing Group, holding various leadership positions for over fifteen years. Her presentation reviewed the way that understanding the psychology of color helps us understand its power in branding and in architecture. It can even determine our productivity. ISCC members can access the recorded webinar at https://register.gotowebinar.com/recording/5864915304365914543.

January Webinar

The next webinar was January 23, 2024 at 2 p.m. EST. The topic was Exploring Dye Histories in Bold: Color from Test Tube to Textile, and the presenter was Elisabeth (Lisa) Berry Drago, Curator and Director of Visitor Engagement at the Science History Institute. In this talk, Bold's curator, Elisabeth Berry Drago, takes you behind the scenes to share interesting collections, highlights and stories of how the exhibit came together. Berry Drago examines the accidental origins of synthetic dyes, shows how fashionable 19th century buyers caught the "mauve measles," unpacks the complicated (and sometimes toxic) legacies of color—and takes a look ahead at how contemporary artisans and manufacturers are working towards a more sustainable future for fashion.

Elisabeth Berry Drago

Fluorescent Fridays

Luanne Stovall

Upcoming Event

The Fluorescent Friday team is currently working on the Spring schedule. Stay tuned for the next color-focused event!

Recent Event

Lighting the Way: 21st Century Tools for Digital Color Design
In October, Fluorescent Friday spotlighted the Rueff School of Design, Art, and Performance, Purdue University.
Check out the video on the ISCC YouTube channel:
https://youtu.be/1AzdkbVMFc?si=SM1UN1xuTGTlgB8u

Speakers:

- Dr. Petronio Bendito, Associate Professor, Rueff School of Design, Art, and Performance, Purdue University
- Stevi Eggers, 2023 MFA candidate, Rueff School of Design, Art, and Performance, Purdue University
- Félicia Barrett, (MFA 2022), Rueff School of Design, Art,and Performance, Purdue University

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.

Dr. Lina Cardenas, Fluorescent Friday host, introduced the program. Petronio Bendito provided an overview of his color-related curriculum at Purdue University along with his presentation titled, *Color Design Education in the RGB Environment: Tools and Insights*. He emphasized that color literacy education is vital to students in a broad range of fields, from digital art, TV, video, photography and web design to interactive apps, 3D productions, augmented reality, motion graphics, and games design.

FLUOR-
ESCENT
FRIDAYS

Dr. Bendito explained his conviction that 21st century color literacy at the university level needs to be based not only on experience and intuition but must also include familiarity with the fundamental physics of light, the science of color perception and science-based tools to navigate the digital environment that we interact with every day via cell phones and computers. Based on 21st century color literacy competencies, the classroom exercises, research and projects are designed to investigate practical applications related to creating engaging color stories, color naming strategies, color topologies, and color communication techniques.

Next, MFA candidate Stevi Eggers presented *Rooted in Friendship*, her award-winning color story project developed as part of the coursework for *AD 61200 – Color Aesthetic and Research*, an interdisciplinary graduate-level course taught by Professor Bendito. She submitted the project for the Inaugural Color Design Scholarship Competition held by the International Association of Color Consultants/Designers and was selected as the competition winner.

The process began with a mood board collage of inspirational images followed by in-class exercises and research designed to develop color palette relationships, analyze HSB color typology, map out a color model, and investigate the social, historical and cultural context that inform an overall color story. Final steps included open class presentations and peer feedback that informed her revisions and provided an interface between the methodology and practical applications.

Félicia Barret's talk focused on the color component of her MFA Project, titled *MOTIV Brand Identity*, which won the Graphis New Talent Annual Silver Award in 2023.This project included the development of a mobile application and involved an extensive investigation into sustainable solutions in visual communication design developed with research methodologies explored in Professor Bendito's *Color Aesthetic and Research* course. Barret explained that MOTIV was intended to motivate consumers to adopt sustainable habits and to identify true motives behind brand packaging that can reveal signs of greenwash marketing, which she defined as deceptive tactics used to promote false solutions to the climate crisis that distracts from and delays concrete and credible action (United Nations 2023).

She detailed the project background, research overview and methodology, data collection, analysis, development of the MOTIV brand color palette, and explained how the color palette choices were applied to multiple touchpoints of the brand identity. Her background research on sustainability communication included a "Color Field Study" designed to see which colors were chosen for natural and sustainable products sold in grocery stores and determine how brand colors are perceived in marketing color choices. Approximately 50 products were chosen for the study. Methodologies included using HSB analytics to locate groupings of color strategies, and identify the hue, value and chroma attributes of the color relationships.

After determining trends in existing sustainable product marketing, Barret applied the research findings across multiple touchpoints in her MOTIV brand identity project, concentrating on implications for sustainable design practices for screen usage, as well as the physical presence on printed surfaces and non-treated materials. Finally, she developed an exhibition to share her findings and provoke conversation about innovative ways that research-backed sustainability practices can be applied in graphic design practices to mitigate waste consumption for products, minimize waste for clients, and inform consumers. She noted that her research has implications and practical applications for digital color literacy and sustainability pertaining to energy and waste consumption.

Coming soon: Keep an eye out this spring for Petronio Bendito's new book, *RGB / CMY Digital Color Wheel* from Davis Publications, with teaching resources that includes practical lessons, digital color mixing tutorials, and video instructions!

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.

Journal of the International Colour Association

Special Edition

Luanne Stovall

As we kick off the New Year, I'm delighted to share the special edition articles (https://aic-color.org/journal-issues) by the Colour Literacy Project (https://colourliteracy.org) team, printed in Volume 33 of JAIC, the Journal of the International Colour Association (JAIC). Also, see https://colourliteracy.org/colour-talks-lectures for a list of the talks on the Colour Literacy Project YouTube channel. Before diving into the content, here's a brief overview of the participating organizations.

The AIC was founded in 1967 and serves as a kind of "Mothership" for color-focused organizations around the world from Argentina, Australia and Belgium through Italy, Japan and Korea to Thailand, Taiwan and the United States. Items featured in AIC newsletters include publications, research highlights, student awards, notices of upcoming conferences and events, updates from member organizations, and reports from the five study groups. See AIC newsletter articles at https://aic-color.org/journal-issues. As a joint educational initiative of the AIC and the ISCC, the Colour Literacy Project (CLP) is housed under the AIC Study Group on Colour Education and is focused on strengthening the bridge between the arts and the sciences in 21st century colour education. The primary objective is to provide state-of-the-art resources for all educational levels –– from preschool to university students to industry professionals and the public at large.

21st Century Color Revolution

The timing feels right. At this moment in history, we find ourselves on the cusp of a fundamental paradigm shift in the way we perceive "reality" and understand our relationship to light, material matter, and everything in the world we inhabit. Color is the face of the world. But how does it really work? Why is color literacy important, and how does this knowledge help us to navigate the challenges and opportunities of these uncertain times? The articles in this special edition explore diverse facets of these fundamental questions.

JAIC Articles

Robert Hirschler (Budapest, Hungary) introduces the papers in the opening editorial. He describes the Colour Literacy Project's support for an inclusive 21st century educational framework aligned with state-of-the-art developments in the sciences, and also with the deeply ingrained cultural, psychological, and aesthetic factors woven into the fabric of our daily lives. Robert shares the team's foundational tenets that include a core belief in the direct experience of color phenomenon through multiple lenses and an openness to the best available peer-reviewed research.

Luanne Stovall (Houston, Texas), ***Prologue: One Artist's Journey from Traditional Colour Theory to the Colour Literacy Project.*** As a painter, educator and daughter of a high school art teacher, Luanne experienced color education through an isolated "art silo," largely removed from the ebb and flow of new advances in science, technology, and cultural studies. Inspired by historical paradigm shifts in color education (think Bauhaus), she realized that a new historic moment is upon us. 21st Century Color Literacy connects the dots between disciplines and serves as a powerful conduit between the arts and the sciences. These vital connections reveal how deeply we are woven into the fabric of the world.

Robin Kingsburgh (Toronto, Canada), ***The Colour Literacy Project: Revitalising Colour Education Foundations***. In the introductory article, Robin provides an overview of the CLP's approach to a top-down/bottom-up color education and identifies the "basic concepts that are fundamental to learning across all disciplines" from preschool through college and university levels to industry professionals. She describes the CLP approach to "teach the teachers" through experiential and inquiry-based exercises, and highlights the foundational "Eye-opener" and "STEAM" series (Science, Technology, Engineering, Arts, Math) that are the focus of beta-testing with partner schools.

Ingrid Calvo Ivanovic (Santiago, Chile), ***Rethinking colour in Design Education Through the Human and Social Perspectives.*** Ingrid addresses the role of color literacy in contemporary design disciplines and offers a forward-thinking approach to 21st century color education. This new model requires a fundamental shift from 20th century color theory to a more holistic practice where all stakeholders are included in a human-centered paradigm. She articulates six key themes that are vital to implementing successful design solutions: Color Design for Sustainability, Color Design for Health and Wellbeing, Color Design for Behavioral Change, Color Design for Emotion, Color Design for the Majority, and Culture-Sensitive Color Design.

Stephen Westland (Leeds, England) with Marjan Vazirian and WenWen Song, *Contemporary Axioms for Colour Reproduction.* This paper defines color as a complex multidisciplinary and transdisciplinary subject, and focuses on the widespread misunderstandings of color science in color education that are perpetuated not only through social media, but also in university-level materials. The authors point out that these common misunderstandings are represented by four axioms that are not supported by peer-reviewed data. In response, four new axioms are proposed as foundational cornerstones in an updated color curriculum.

Paul Green-Armitage (Perth, Australia), Maggie Maggio (Portland, Oregon), *Before Colour Theory –– Learning to Discriminate, Describe, and Order Colours.* By teaching the teachers new ways to open eyes and inspire minds, Paul and Maggie make the case for transformational change in color education at the foundational level. In this 21st century model, participants are encouraged to develop their ability to recognize subtle differences in color relationships, rather than relying on an entrenched bias toward bright colors and primary hues. The authors argue that "a well-developed awareness, combined with a framework for ordering and describing colors, should be in place before the introduction of more formal aspects of colour theory."

David J. C. Briggs (Sydney, Australia). *The Elements of Colour I: Colour perceptions, colour stimuli,* and ***colour measurement; The Elements of Colour II: the Attributes of Perceived Colour***. David's two-part article covers basic concepts related to the ways that we perceive, experience, describe and measure colors. His in-depth explanations are fundamental to the 21st century color paradigm that is firmly aligned with peer-reviewed color science research. Pointing to the ubiquitous red, yellow, blue color wheel as a prime example, he stresses the need for traditional art and design education to recognize erroneous misconceptions, adopt new tools, technologies, and resources, and transform color education curricula into the 21st century color education framework.

Harald Arnkil (Helsinki, Finland), Andreas Schwarz (Essen, Germany). *Colour Harmony in the Context of Teaching.* Arnkil and Schwarz define the concept of color harmony as rooted in notions of beautiful or pleasing color combinations that reach back to early roots of antiquity. A brief historical overview of a selection of diverse theories is provided, along with examples of alternative viewpoints. The authors state their intention to provide colleagues with guidance on how color harmony can be addressed in art and design curricula and conclude that "most theories of colour harmony are restrictive and normative and therefore questionable in the field of art and design pedagogy."

Robert Hirshler, Andreas Schwarz. Itten's Seven Colour Contrasts –– a Review: Part I. Early Contrast Theories and the Road to Itten's Contrast Theory Part II. The Seven Contrasts as Described in Kunst der Farbe (The Art of Color) Part III. The Influence of Itten's Contrast Theory on Colour Education
In the first part of this three-part article, Robert and Andreas recount the origins of Johannes Itten's well-known contrast theory and the road leading up to the seven contrasts that were published in Kunst der Farbe (The Art of Color). Part II addresses details of Itten's seven contrasts and identifies the concepts that have led to misconceptions over the course of many decades. The third and final paper presents the pitfalls caused by generations of teachers and students who have interpreted Itten's color contrast canon "without consideration for the core concepts which underlie it."

Andreas Schwarz. Josef Albers Put into Perspective. The stated aim of this article is to evaluate the achievements of Josef Albers and his *Interaction of Color* within the framework of a contemporary didactic approach to color education, with its emphasis on color perception and the importance of subjective experience. In the process, Andreas recognizes Albers' significant contributions, but urges readers to critically examine the relevance of his achievements and not to "lose sight of the fact that Albers also had his predecessors and that his work is by no means as original as it is often portrayed."

Universal Color Design:
Creating Rich Experiences for a Color-vision Diverse Population.

Bill Fischer

As I write this, there are at least 2 billion individual persons, worldwide, intermittently experiencing a quiet physical discomfort, a quiet barrier to access to the social fabric of their culture and society, at the hands of designers and artists and their color choices. They think it's their fault. They believe their vision deficiencies are to blame, that their clouded sight, their sensitivity to light, their color acuity plight is responsible. That they are ill-fitted to the human-built world. And, indeed, society reinforces that notion with the label "disabled."

This plight is particularly pronounced within the employment restrictions imposed on the 11 million job opportunities denied to individuals who cannot pass a color-blind test. [(1)] The affected occupations include air traffic controller, anesthesiologist, automotive technician, commercial driver, electrician, flight attendant, medical assistant, pilot, railroad engineer, and some military jobs. These occupations are reliant on color coding to facilitate the effective use of control panels, safety signage, instruction manuals, signals, graphic user interfaces, and more. These color-coded barriers are not a product of the natural world. They are human created.

Every one of these so-called disabled and deficient persons possesses some form of color-sight ability. If we can identify the junctions where these diverse abilities intersect, we can create a new, universal, color model that is responsive to the full spectrum of color-sightedness and create rich color experiences for everyone.

So, what are these vision disabilities that, surprisingly, constitute 40% of the general population, with an additional 23% being affected by additional age-related deficiencies?

1% Low vision: Defined as 20/40 or worse vision with best possible correction (via eyeglasses). [(2)]

4.5% Color blindness: .5% of women and 8% (1 in 12) of men worldwide. 99.99% of colorblindness is colloquially known as red-green and clinically denoted as deuteranope and Protanope. For these individuals, all hues are perceived entirely or mostly as either yellow, blue, or gray. [(3)]

14.5% Scotopic sensitivity syndrome: A problem with the brain's ability to process visual information. It's often referred to as Irlen Syndrome and encompasses sensory overload caused by surface reflection, patterns, and high contrast color combinations resulting in fatigue that can interrupt reading and math comprehension, as well as deter computer usage [4]

20% Photophobia: A sensitivity to light and highly saturated color that can be debilitating and is reported in most forms of migraine and many neuro-ophthalmic disorders. Women are 2-3 times more likely to experience it. [5]

23% Age-related deficiencies: The percentages listed below are for persons between the ages of 40 and 74.

> **19.5% Cataracts:** Clouded vision, light sensitivity, and faded colors.[6]
>
> **1.8% Glaucoma:** Peripheral vision loss, blind spots, and blindness. [7]
>
> **1.0% AMD:** An acronym for "age-related macular degeneration." Symptoms include center blind spots, blurred vision, and faded colors. [8]

That is a broad and complex spectrum of partial color-sight abilities. Developing design methods that will provide universally rich experiences for each of them will require envisioning a new rubric for how we assess color efficacy. For this, I'll define color as information, and fall back on two fundamental metrics of information theory put forward in 1948 by Claude Shannon: *signal and noise*.

Color Signal efficacy will be assessed using four metrics:

Differentiation: The degree to which a color can be distinguished from its neighbors.

Attention: The place in a visual hierarchy that a color occupies in a composition.

Association: The shared understanding of cultural meaning or brand that a color carries.

Emotion: A shared sentiment that is prescribed by a specific color wrapped in a particular context.

Color Noise efficacy will be assessed using two metrics:

Weak or lacking signal: It does not proficiently carry one or more of the above signals.

Decorative: It serves primarily as decoration (it's beautiful noise, hopefully).

To begin to verify this proposed model, let's delve into four case studies, one for each signal type. Within these studies I will include what I call a "visual proof."

Case Study #1: Differentiation And The Bar Graph

In our current data-driven world, information is a fundamental facilitator of societal membership. When access is unattainable, full participation is compromised.

The chart at the top of *Figure 1* employs pleasing and pleasant colors, which are all too common in information graphics. It seems that in contemporary information design, "pretty" is the rule of the design day, no matter the subject, even if it's death or taxes. This emotional-dissidence between the topic and the color palette can undermine the impact, the importance, and the compelling data-story that could otherwise have informed or even swayed audiences.

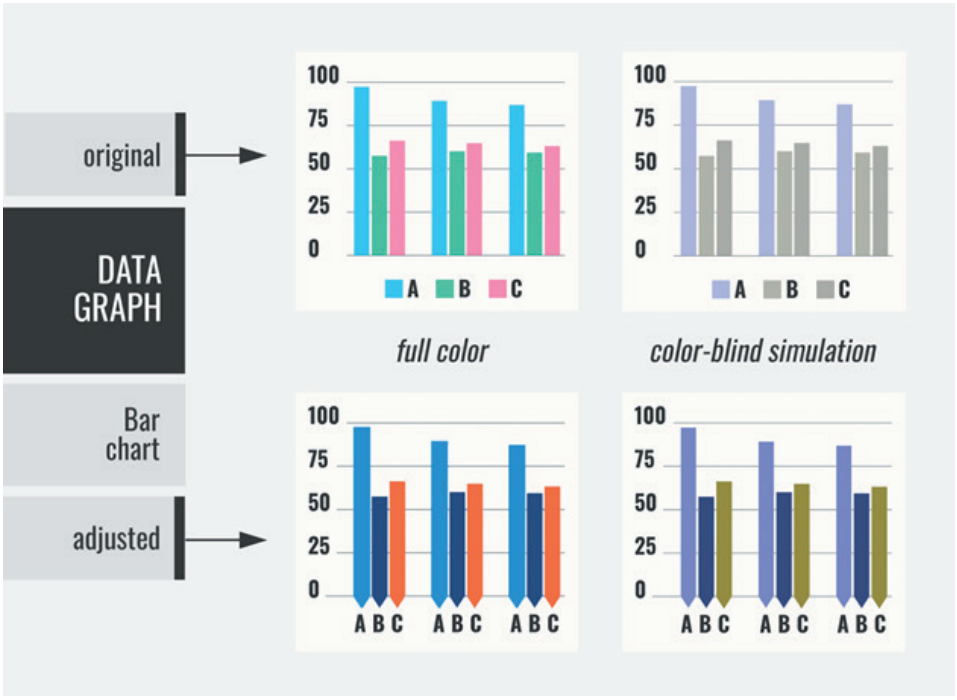


Figure 1

Beyond this emotional dissidence lies the subpar execution of the fundamental function of providing access to the data. In the case of the original color selections, a color-bind person will likely be unable to differentiate between bars A and B, rendering the key useless. For someone with low vision, the graphical contrast may be too muted to easily differentiate the bars from each other and the background.

The adjusted image resolves these issues by utilizing higher contrast and maintaining the color differentiations for color-blind individuals. The key is replaced with data labels directly adjacent to their corresponding bars. The graph is now accessible for the color-blind because the bars maintain their saturation levels even though the hues are different; the richness of the chroma is preserved, and that creates an experience that is universal.

Case Study #2: Attention And Fashion

There are few situations where many of us feel comfortable wearing brightly colored clothing - sports uniforms, pajamas, Halloween costumes, and swimwear, among others, come to mind. These opportunities can be important aspects of our cultural participation. They are the opportunities where we can let our color flags fly.
But what about color-blind persons? What advice do we have for them: just wear neutral colors. Translation: your life should be color-neutral because we don't know how to design for you.

Figure 2

In *Figure 2*, the original design for a color-block fashion ensemble employs a carefully balanced and highly saturated color theme. This is for women that want to make an entrance, be seen, and really, just enjoy being colorful. However, for color-blind persons, the feng shui, the gestalt, the visual hierarchy, the delicate balance of hue, lightness and saturation devolves into chaos. The pink and green become gray, the peach and red-orange translate to dull yellow. For low-vision and some elderly, the modular-ness that is at the heart of the color block aesthetic is lost due to the low contrast between the pant and shirt on the right model, and the skirt and large color shape in the center model.

I revised the color palette to respond to all color-sight-abilities while still maintaining ten different hues – the same number as in the original design. The yellow-blue translation provides an equally colorful and balanced experience, albeit with two hues. That's universal design, providing the full spectrum of color-abled-persons with the opportunity to let their color flags fly along with everyone else.

Case Study #3: Association And Barbie Pink

The Barbie universe is a dull and colorless dystopia...if you happen to be color-blind.

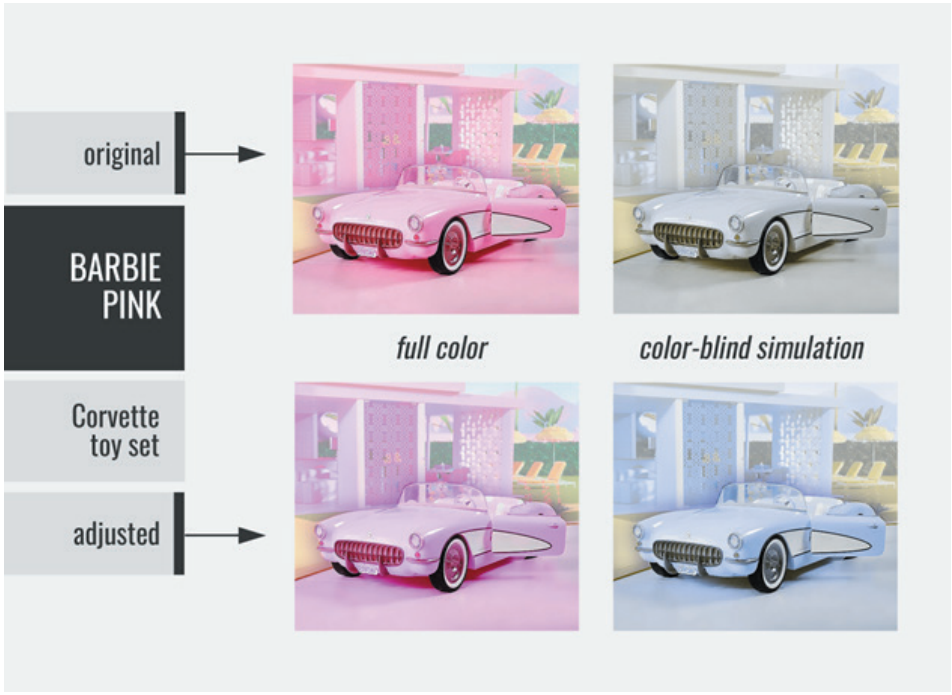


Figure 3

Execute a Google image search with the word Barbie and you will witness remarkable consistency in hue for the pink applied to the sets, props, and clothing used in the recent film and associated toys. No surprise, Mattel calls this hue Barbie pink. Mattel may have arrived at this precise hue with a comprehensive scientific study of the sociological, psychological, and physiological factors influencing color preference in a large sampling of likely consumers enveloping a wide range of ethnic, cultural, gender and racial profiles. Or, perhaps, the lead color designer picked it out of a swatch book, declaring: "This...this is the pink little girls love!"

In either case, there is one subset of the population that was likely not considered in the calculation: color-blind persons. But let's imagine that they did consider color-blind persons and performed a simulation like the one in Figure 3. What might be some reasons they elected to keep that hue exactly as it is: Pantone: 219C?

- Well, only .5% of the female population is color-blind.
- Boys, even though their color-blind percentage is 8%, don't buy Barbie products.
- Color-blind persons are accustomed to seeing pink this way.
- It would be too expensive to change.
- We've been using this hue for decades. Barbie Pink is the indelible brand.

That's right. Barbie pink is an indelible part of the Barbie brand, and that pink hue is copied by nearly every other toy in the, stereotypically gendered, girl's toy aisle. It is the color brand of the girl's toy aisle. When many little girls enter that long, narrow passage of sensory nirvana, they know, because the toy industry tells them, they're home. That pink is a universal bond that says, "This is your aisle." Unless you are one of the 700,000+ color-blind girls in the U.S. [9] and many, many more throughout the world. I believe those girls might feel more at home with a nice periwinkle. All it would take is a modest hue shift from that Barbie pink, and all the other toys would follow, and the girls toy aisle could feel like home for many more girls.

Case Study #4: Emotion and Ferrari

Caltech professor and author of the book Emotional: How Feelings Shape Our Thinking Leonard Mlodinow will tell you "Thousands of years ago, when wild humans roamed the plains and savannas, they were far from the fastest or strongest animals. Alone, they couldn't survive, so they banded together. And emotions, like empathy, guilt, and shame, evolved to glue these packs together and encourage cooperation." [10] If you want to move populations beyond mere reaction and toward action (such as purchasing your product out of a sense of belonging-longing), there is an important role for emotion to play. And when it comes to the personification of the renegade, live fast, live rich, and be noticed; male sub-tribe – there can be few products that better personify that on an emotional level than a red Ferrari.

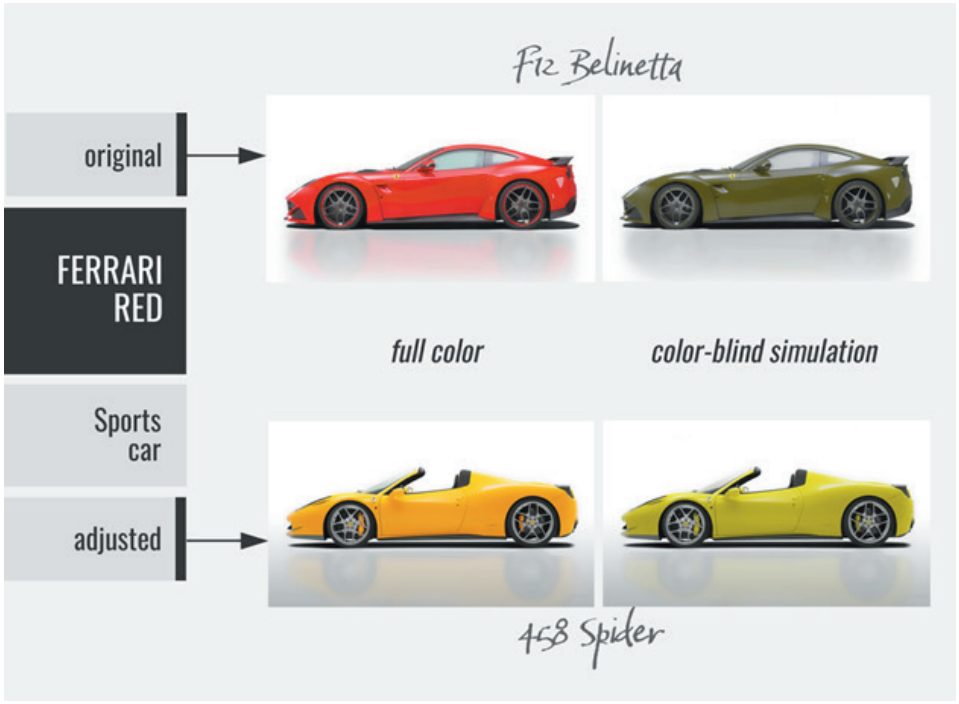


Figure 4

According to color practitioners and some solid research, red can personify a plethora of different emotions: excitement, energy, daring, love, desire, passion, urgency, danger, anger, hatred, rage, aggression and…speed. Clearly, some psychologically contextual packaging is a prerequisite for us humans to know how to feel about any red that happens to appear before us. And, oh, what a package is the red Ferrari. We know it's red. We know it's a Ferrari. And culturally, we know Red + Ferrari = renegade, live fast, live rich, and be noticed, male sub-tribe. We don't even need to see it. But when we do, regardless of color, the sexualized body lines, the audio tone of the engine, the rarity, the price tag, all conspire to reinforce what we already know about the red Ferrari. And if you are color-blind, the color is not important. Because the color, for you, is not daring, not dangerous, not exciting, not passionate. But it is red, so you're told, and you know what that means in this particular package, even if you can't see it.

Fortunately, for color-blind individuals, only about half of Ferraris are red. They come in a wide range of colors in fact. The most chromatic for a color-blind person being yellow, the main color of the coat of arms of Modena, Italy, Ferrari's home. Which is also the official color of the Ferrari Corporation as epitomized by the primary color in the scheme of their famous dancing horse badging. I like to think that this is the Ferrari of choice for the color-blind, renegade, live fast, live rich, and be noticed, male sub-tribe.

So now what? Your introduction to accessible and universal color is complete, say I, and your journey can end here. There are few laws (and weak ones at that) requiring you to employ universal color design. Persons that would benefit from it live largely in the shadows, owning the problem so you don't have to. Your clients, your boss, your company or organization likely don't hold it top of mind. You can walk away right now. But if you choose to pursue what I like to characterize as design citizenship, a journey lies ahead for you – one that I have traveled over the past eight years, encompassing all manner of design disciplines. Yes, it is a sort of hero's journey and there are five challenges that you will encounter along the way:

First Challenge: Gaining Awareness: That's what this article was about: Introducing the two-billion-person problem. So, now you know.

Second Challenge: Finding Empathy: This is on you. Explore how connected you are personally to color and sight deficiencies. Ask yourself, do you or someone you know experience:

- Color-blindness.
- Severe low vision (near-sightedness) (far-sightedness) (double vision).
- Cataracts, glaucoma, or macular degeneration.
- Migraines accompanied by light sensitivity.
- Scotopic sensitivity (vibrating high-contrast text or patterned graphics).
- Inability to pursue, or difficulty excelling at, a profession due to color-blindness.
- Temporary deficiencies: screen glare causing difficulty seeing text and graphics on a phone. Dim room light causing difficulty navigating a built environment or seeing text and graphics on a product (like button controls).

Now think about how that affects your life. Their life. Have conversations. Shine some of your own light on these invisible deficiencies and disabilities.

Third Challenge: Acquiring Knowledge: My goal is to arm you with the tools and methods you need to integrate universal color into your design practice, whether that is built environments, physical products, AR, VR, print or digital media. I'm currently developing a universal color design system along with tools, methods, and examples designed to facilitate its application. These resources will be distributed through an online course, downloadable color swatches and themes, and…maybe a book.

Fourth Challenge: Taking Action: With this knowledge, you will be enabled to explore universal color solutions that work for you, your organization and your industry. You will find opportunities that make sense for certain target audiences, users, or clients and provide opportunities for increased market share, job performance and personalized experiences for a variety of sight-abilities.

Fifth Challenge: The Full Embrace: Becoming one with universal design requires a commitment to creating equally rich shared experiences for all persons across the broad spectrum of their collective abilities, at every possible turn.

Thank you, dear reader, for making it all the way to the bottom of this article, and to Maggi Maggio for giving me the opportunity to include it in this newsletter. If you would like to receive free updates on the course release date and more case studies and thoughts centered around universal design, please subscribe to my free Substack newsletter:
BillFischer.substack.com/
(I post about twice per month).

Bill Fischer is an author, educator, consultant, designer, professor emeritus, and purveyor of Inclusive, Socio-Emotional, Entertaining, and Universal Design (i-see-u.info).

References:

(1) Federal Aviation Administration | Electrical Training Alliance | American Railway Engineering and Maintenance-of-Way Association American Medical Association American Society of Anesthesiologists | National Institute of Standards and Technology | Federal Motor Carrier Safety Administration | U.S. Department of Defense

(2) National Institute of Health: Visual impairment, blindness cases in U.S. expected to double by 2050: https://www.nih.gov/news-events/news-releases/visual-impairment-blindness-cases-us-expected-double-2050

(3) Colorbindguide.com: Colorblind People Population! Statistics: https://www.colorblindguide.com/post/colorblind-people-population-live-counter#:~:text=What%20Percentage%20of%20the%20Population,colorblind%20people%20in%20the%20world

(4) Irlen.com: Irlen and the Brain: https://irlen.com/brain-research

(5) National Institute of Health: Sex and Gender Differences in Migraines: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9176156/#:~:text=The%20pathology%, and Shedding Light on Photophobia: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3485070

(6) National Institute of Health: Cataract Tables: https://www.nei.nih.gov/learn-about-eye-health/eye-health-data-and-statistics/cataract-data-and-statistics/cataract-tables

(7) National Institute of Health: Glaucoma Tables: https://www.nei.nih.gov/learn-about-eye-health/eye-health-data-and-statistics/glaucoma-data-and-statistics/glaucoma-tables

(8) National Institute of Health: AMD Tables: https://www.nei.nih.gov/learn-about-eye-health/eye-health-data-and-statistics/age-related-macular-degeneration-amd-data-and-statistics/age-related-macular-degeneration-amd-tables

(9) Office of Juvenile Justice and Delinquency Prevention: Statistical Briefing Room: https://www.ojjdp.gov/ojstatbb/population/qa01104.asp (Data was multiplied by .05 to calculate the number of colorblind girls).

(10) The Harvard Gazette: Logic or emotion: Which is more valuable?: https://news.harvard.edu/gazette/story/2022/01/logic-or-emotion-which-is-more-valuable/

AIC 15th Congress

Chiang Rai, Thailand, November 28 - December 2, 2023

Leslie Harrington & Paula J. Alessi

As ISCC liaison to AIC, it is my responsibility to provide the latest AIC news to our ISCC quarterly newsletter. But since I did not attend the AIC 15th Congress, I asked my colleague and dear friend Leslie Harrington to write a short summary for us all to enjoy. Many thanks to Leslie, who presided over the Congress as AIC President.

The AIC 15th Congress was held in the enchanting city of Chiang Rai, Thailand, from November 28 to December 2, 2023. The event was hosted by the Color Society of Thailand (CST) and led by Congress Chairman Associate Professor Pichayada Katemake, Ph.D.

Congress Chairman, Associate Professor Pichayada Katemake, Ph.D.

By all reports this was an exciting Congress with higher-than-expected attendance, totaling 223 attendees from 29 countries, with 84 oral and 82 poster presentations making for a full, immersive schedule.

The Congress opened with a colorful and exciting performance from a Thai dance troop.

Opening Ceremony performance by traditional Thai drummers and dancers

The performance was followed by a lecture, "What Color Is Thai?" by Piyanan Prasarnrajkit, setting the tone for the coming days. The excursion held a few days later continued to entrance the attendees with visits to Wat Phra Kaew, the original home of the Emerald Buddha, Wat Rong Suea Ten, the Blue Temple, recognized for its shade of rich sapphire, Wat Huay Pal Kang, known for its unique white architecture and finishing at Wat Rong Khun, better known as the White Temple, featuring the White Buddha.

Wat Rong Suea Ten, the Blue Temple

Wat Huay Pal Kang

As the day ended and the sun began to set, it was hard not to fall in love with this country's rich history and vivid colors, highlighted by this final image of the majestic dragons.

Majestic Dragons at Sunset

The highlight of the five-day event was the Judd Award, presented to Professor Rolf Georg Kuehni, and the CADE (Color in Art Design and Environment) Award, presented to Clino Trini Castelli, for his presentation entitled, The "Color Fever" Chroma Survey 1973. Both citations are included in the Congress proceedings.

The Congress featured two pre-meeting workshops: "Cultivating Calm and Focus" by Petronio Bendito and "Water Color Painting" by Suphawat Hiranthanawiwat.

Oral paper presentations were given throughout the week. The nine session titles for these oral presentations included Color Technology and Applications, Color in Nature, Color in Art and Design, BAGIS Session (Sponsored by JSPS), Color Vision, Color Psychology, Color Naming, Color in Art and Design, Color and Beauty, and Color Technology.

Thirteen keynote lectures included Piyanan Prasarnrajkit's "What Color Is Thai?," Vien Cheung's "Color and Culture," Alessandro Rizzi's "Color Technology and Applications," Ming Ronnier Luo's "Color Technology and Applications," Petronio Bendito's "Digital Color Literacy, Media Arts and Design Education," Andrew Stockman's "Color Vision," Takahiko Horiuchi's "Color Technology and Applications," Berit Bergstrom's "Color and Education," Nicole Tse's "Color Applications," Alain Tremeau's "Color Appearance," Tien Rien Lee's "Color Designs," Jose Caivano's "Color Appearance" and Stephen Westland's "Colour, Machine Learning and Creativity."

The Congress closed with the traditional banner passing to the AIC 2024 host, Assoçiacão ProCor do Brasil at ESPM College, to be held September 16 - 19, 2024, in São Paulo, Brazil.

If you could not attend the Congress and are interested in more details on the papers shared, you can download the proceedings free of charge from the AIC website at https://aic-color.org/publications-proceedings.

Election Results

The ISCC Board of Directors is pleased to announce the results from the December election. The three new Board of Director members are:

Congratulations and thanks to our new directors. Contact information for all board members is on page 3 of this newsletter. The newly elected Board members serve a three-year term, ending in December 2026.

We would like to express our sincere gratitude for the work and service of our colleagues: outgoing Directors Shoshana Burgett, Ellen Divers, and Kate Edwards (all with a term of service of 2021- 2023). We wish them success and hope to have their continued support, counsel and assistance.

Sandra Sampson

Robin Kingsburgh

Justin Laird

Calendar 2024

March 4 - 7	SPE ANTEC Conference St. Louis, MO https://www.4spe.org/i4a/pages/index.cfm?pageID=8330&utm_source=social_share&utm_medium=website&utm_campaign=ANTEC_2024&utm_id=ANTE_2024_Social_Share
March 12	Detroit Colour Council Presentation by John Tasca "LED Daylight for Color Matching" Livonia, MI 48152 https://detroitcc.org/upcoming-events/
March 24 - 27	OFC Technical Conference and Exhibition, San Diego, CA In-person and virtual https://www.ofcconference.org/en-us/home/
March 28	IES Educational Webinar Series Museum Lighting Controls: Striking a Balance 12 pm –1 pm ET https://www.ies.org/event/museum-lighting-controls-striking-a-balance/
March 31	Call for Papers Abstracts Due for AIC 2024 Midterm Meeting https://aic2024.org/home/call-for-papers/
April 1	2024 AATCC Textile Discovery Summit Poster Abstract Submission deadline https://www.aatcc.org/summit/
April 9 - 12	IS & T Archiving 2024 Science, Sustainability, Security Washington, DC https://imaging.org/IST/Conferences/Archiving/Archiving2024/Archiving2024_Home.aspx?WebsiteKey=6d978a6f-475d-46cc-bcf2-7a9e3d5f8f82&hkey=5bd7c069-e1ed-41f9-8dfd-a508f485ee47&46c611a9cb64=1#46c611a9cb64
April 9	Call for papers Submission Deadline Optica Advanced Photonics Congress https://www.optica.org/events/congress/advanced_photonics_congress/submit_papers/
April 22	CMG 2024 Cleveland Forecasting Virtual Event 11 am – 2 pm ET https://colormarketing.org/event/2024-chromazone-cleveland/
April 25, 26	CMG 2024 Cleveland ChromaZone+ In-person Forecasting Event https://app.glueup.com/event/2024-cleveland-chromazone-94961/
May 2	CPMA Spring Meeting (American Coating Show & Conference) Indianapolis, IN https://www.pigments.org/news-resources/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 14 - 17	SID International Symposium, Seminar & Exhibition Display Week 2024 San Jose, CA https://www.displayweek.org/

June 11	ASPRS ISPRS Technical Symposium II, Las Vegas, NV In-person and virtually via ZOOM https://my.asprs.org/ASPRSMember/Events/Event_Display.aspx?EventKey=ISPRS2024&WebsiteKey=9126ee3f-e9e1-43bd-a00c-0cfa63182579
June 12, 13	ASTM E12 Color and Appearance June 2024 Committee Meeting, Philadelphia Marriott Downtown 1201 Market Street https://member.astm.org/meeting/event
June 26 - 28	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
July 10 - 12	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 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/
Sept 17 - 19	AIC 2024 Midterm Meeting Color Design, Communication and Marketing Sao Paulo, Brazil https://aic2024.org/
Sept 22 - 25	IES Street and Area Lighting Conference Atlanta, GA https://www.ies.org/events/street-area-lighting-conference/
Sept 23 - 25	SPE CAD RETEC Sail Away with Color Technical Conference Tampa, FL https://specad.org/2024-cad-retectm-homepage/
Sept 25	CMPA Fall Meeting (CAD RETEC) Tampa, FL
Sept 29 - Oct 4	2024 NAPIM Annual Convention/Technical Conference, Milwaukee, WI https://www.napim.org/aws/NAPIM/pt/sd/calendar/352795/_PARENT/layout_details/false
Oct 6 - 8	AATCC Textile Discovery Summit, The Westin Savannah Harbor, Savannah, Georgia https://www.aatcc.org/summit/
Oct 29 - Nov 1	Illuminating Engineering Society Street & Area Lighting Conference (IES) Indianapolis, Indiana https://www.ies.org/events/street-area-lighting-conference/

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

Radiant Vision Systems LLC

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

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

ISCC Newsletter Issue #505, Winter 2024

isccoffice@iscc.org

Editor: Madelaine Yafet

Layout and Design: Lina Cárdenas, Josefina Rojas D.

Printing: Thanks to Konica Minolta in Ramsey, NJ

Newsletter Coordinator: Jodi Baker

Final Edit Reviewers: Mike Brill and Paula Alessi

Quarterly Newsletter

Winter 2024 - Issue #505