Inter - Society Color Council

Quarterly Newsletter

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email: isccoffice@iscc.org
address: 7820B Wormans Mill Rd. Suite #115, Frederick MD 21701

Denali Princess Hotel, Alaska
Photo credit: Jennifer Kruschwitz, PhD

ISCC Board of Directors Corner

Jerald Dimas

Greetings, I'm Jerald (Jerry) Dimas.

I'm currently serving as ISCC Treasurer. I've had the pleasure to meet and develop relationships with many professionals in the field of color, thanks to my involvement with the ISCC over the past 35 years.

The organizational changes I've witnessed over this time has been profound, transitioning from a council of color organizations, to what has evolved into a council having Member-Bodies with interests in color and individual members who share in those interests but may not be formally associated with them. For some time now, our Individual members have made up our single largest member group.

I encourage members to "get involved." The ISCC, like most things, will give back to you what you're willing to put into it.

Hopefully your experience as a member of this professional society will be as positive as mine.
I am currently the Director of Color Science Applications for Color Communications, LLC, in Chicago, Illinois.

My responsibilities include applying color science to the manufacture and distribution of color samples for color cards, color tools, color systems, POS displays and color control programs for the paint, coatings and fabrication industries. Also, I provide technical support and oversee our Product Quality and Innovation teams.

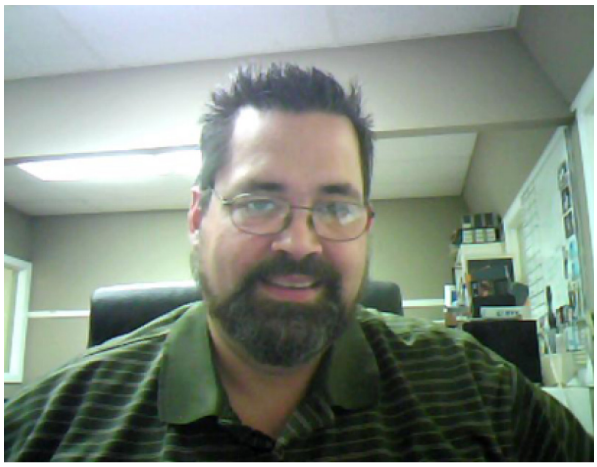
I've spent much of my career applying psychophysics to point-of-sale color sampling and color selection tools. I've helped to develop industry best practices in the area of color tolerancing and in operational protocols across various industries that require accurate color in products and sampling.

Being involved in organizations like the ISCC is vital to having access to the latest information in color research, color webinars and color meetings and color information from around the world.

I'm also a member of the Detroit Color Council, ASTM Committees E12 and D01 on Color and Appearance and Paint and Related Coatings, respectively. My other professional affiliations are with the Chicago Paint and Coatings Association and the Council for Optical Radiation Measurements. I have served the ISCC as a member of the Board of Directors from 2005-2008, as President from 2017-2018, as Past President from 2019-2020, and now as Treasurer since 2021.

I'd like to thank all the ISCC members past and present that have impacted me throughout my career both professionally and personally. I look forward to serving the ISCC as your treasurer and look forward to a bright and colorful future with you all.

Jerald Dimas
ISCC Treasurer



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Hue Angles

The Oldest Hack in Color Engineering

Michael H. Brill, Datacolor

When I was at MIT, I learned what it meant to call something "a hack." The term referred to a patch in software (or hardware) that was ad hoc but clever and fixed a problem. There are many other definitions of "hack" (the noun), but I don't use those here. To me, "hack" is not necessarily pejorative, but descriptive.

In color engineering there have been many hacks, originating even before the term "color engineering" was popular. Two rather good ones are Cal McCamy's approximation for correlated color temperature of a light given its chromaticity [1] and the CIELAB L* function as an approximate inversion of a fifth-degree polynomial that characterized the Munsell Renotation System lightness scale [2].

Just for fun, I now ask you: What is the oldest hack in color engineering? One could nominate Newton's representation of color as a closed circle. Newton must have been aware that the purples are not elementary colors that he could see with his prisms. But Newton and others may have adopted the circle as an instructive idealization, and that is not a hack.

To get the ball rolling (I expect hundreds of reader responses), I nominate the object-color tristimulus value (X, Y or Z, for any illuminant and observer you like). This quantity is defined as a specific ratio (see ASTM E-308, any edition). The numerator is the wavelength integral of the product of illuminant power density, reflectance and color-matching function (generally, xbar, ybar or zbar). The denominator is the wavelength integral of the product of the illuminant power density and the function ybar. There's also a factor of 100, but that doesn't matter.

What problem does this definition cleverly solve? In a single stroke, it renders the object-color tristimulus value dimensionless and independent of the absolute light intensity, as is its cousin – the emissive-mode tristimulus value. (This latter fact emerges from the grounding of emissive-mode tristimulus values on the emissive-mode color-matching experiments that underlie basic colorimetry. In a short paper I just submitted to Color Research and Application, I explain how the titration in a color match leads to cancelation of all dimensions.) Creating the object-mode ratio makes the tristimulus values from reflected lights appear comparable to the values from emitted lights and emissive displays. Certainly color-matching equivalence classes of reflected lights are not disturbed by the ratio. But, as many color-management experts have warned, we should be careful in asserting exact colorimetric color reproduction between emissive and reflective media. For one thing, only the reflective tristimulus space has an unambiguous white point.

How is the object-color tristimulus value a hack? It is ad hoc, solves the units problem, and is clever enough to survive generations of standards bodies like the ASTM and the CIE. The ad hoc quality manifests when we observe that the object-color tristimulus values have a distinct and asymmetric dependence on Y wrought by the denominator, yet that asymmetry was not based on color matching (as should befit a true tristimulus value). Furthermore, as the current object-color tristimulus value is a ratio between two spectrum integrals, it will have a weird illuminant-invariance such as I have found for Von Kries adapted tristimulus values [3] and band ratios [4]. If the illuminant is restricted to a finite linear function space, changing its coefficients will not alter the object-color tristimulus value if the reflectance is outside a forbidden function subspace. There's no room for such games in the emissive-mode tristimulus values.

So that is why I consider the object-color tristimulus value as a hack. My only remaining question is, how old is it? Wyszecki and Stiles [5] point to the dawn of the 1931 CIE system of colorimetry. I have not investigated further, but it's entirely possible that this hack precedes not only the term "color engineering," but also the name "tristimulus value" itself. I'll leave that subject to serious historians in our ranks.

[1] McCamy CS, Color Res Appl 17 (1992), 142-144 (with erratum in Color Res Appl 18 (1993), 150.

[2] Newhall SM, Nickerson D and Judd DB, Final report of the OSA subcommittee on spacing of the Munsell colors, J Opt Soc Am 33 (1943), 385-418.

[3] Brill MH, Minimal Von-Kries illuminant invariance, Color Res Appl 33 (2008), 320-323.

[4] Brill MH, "Can color-space transformation improve color computations other than von Kries?" in: Human Vision, Visual Processing, and Digital Display IV, J. P. Allebach and B. E. Rogowitz, Editors, Proc. SPIE 1913, 485 - 494 (1993).
[5] Wyszecki G and Stiles WS, Color Science, 1st ed. New York: Wiley, 1967, p. 279.

International Colour Day 2022 School-wide Celebration

St. Teresa RCP Irlam Manchester UK

Maggie Maggio

The four-year Colour Literacy Project (CLP) is currently half-way through the beta-testing phase at the foundational level. We worked with two elementary schools in the first phase and found that it was critical to have both a dedicated volunteer coordinator and the support of the administration to allow all teachers to participate in the training sessions. This feature article will highlight one of our partner schools, St. Teresa RCP Elementary School, Irlam in Manchester, UK.

Over the past year, the teachers at St. Teresa's participated in the first two ***21st Century Colour Literacy Workshops***. The format for each workshop with the teachers included short presentations by the Colour Literacy team accompanied by hands-on activities. The three sessions of the Eye Opener series took place last spring and the four sessions of the STEAM (Science, Technology, Engineering, Arts and Math) series were split between the Fall 2021 and Spring 2022 terms. Each two-hour session was conducted virtually during staff meetings after school on Tuesdays.

The two workshops together totaled 14 hours of professional development focused on expanding colour education as an interdisciplinary subject.

Following the final STEAM session in February 2022, the teachers voted to celebrate International Colour Day school wide by exploring variations of nine hue families in each of the classrooms on March 21, 2022.

The idea for a school-wide short course on color was inspired by an essay by W. D. Wright in *The Rays are Not Coloured*, published in 1967. Although this short essay reflects the stereotypes of the day it also includes some gems as he proposed that the topic of color should be considered a "General Studies" subject bridging sciences, arts, even philosophy and religion.

"What would be the aim of the course? … It would not be part of an examination syllabus and might, indeed, be timed to fill the post examination vacuum at the end of the term. One aim would be to help boys and girls to think both in breadth and depth on a particular subject.

Another would be to stir their imagination and sense of wonder. Yet another would be to encourage them and train them to use their creative abilities." Quote from ***A Course on Colour*** for Schools by W.D. Wright.

Rather than wait until the end of the school year as Wright suggested, International Colour Day, first proposed in 2008 and celebrated worldwide on March 21st, seemed the perfect opportunity to spend the day exploring color school-wide. Maybe the idea will catch on and even more elementary schools will honor the equinox with a celebration of color in years to come!

Activities of Each Class

Rainbow Partners! The Nursery and Reception classes each painted half the colors to make rainbow painting in spectrum order and added purple and magenta. A strip of silver foil was used to divide the spectral colors and extra-spectral colors.

In addition to painting the rainbow, the classroom workstations included, flashlights and colored filters on a multicolored parachute table cover to see how the transparent colors combined both on top of another color and with light shining through them. They experimented with natural color "potions" with water and flowers, hue family mixing with hands, building 3D constructions with bricks, and hue family painting on 3D natural forms.

Nursery Age 3-4

The other half of the Rainbow Partners! This activity introduced the magenta and purple hue families that are not visible in the rainbow but that we can see. The students also participated in a Hue Family Safari by taking a sample hue card with them to spot matching colors around the school.

Reception Ages 4-5

Many classes focused on colors plus shapes. In Year 1, they collected and organized geometric shapes made of colored card stock into hue families and then connected them to string together to make geometric hue family mobiles.

Year 1 Ages 5-6

The students each chose one hue family to explore and then used spray water-colors on four organic shapes inspired by the artist Miro. They experimented with shifting their chosen color by adding additional sprays from the hues adjacent to their chosen hue. The shapes were then turned into organic

Reception Ages 4-5

Teams of two third year students made Isamu Nocguchi inspired Cloud Mountain card sculptures to explore how color is affected by distance. After painting three progressively lighter colors in their chosen hue family, the students collaged magazine papers in the same hue family to add details and then assembled the mountain ranges.

Year 3 Ages 7-8

The fourth-year students' activity was a Hue Family Imagination Station. In teams of two. they experimented with blending chalk pastels from one hue family to make a variety of colored geometric shapes. The shapes were then cut out and built into 3D imaginative structures using only slits and slots.

Year 4 Ages 8-9

The year 5 students worked on a collaborative hue family collage. The design was inspired by a 2018 article in Arts and Activities magazine by Don Masse, which in turn was inspired by the quilt Block Party by Corinne Sovey.

Year6 Ages 9-10

Hue Family Icosahedrons! Inspired by the Kolormondo model, the year 6 students used paper plates and acrylic paint to make 3D forms that have the pale colors at the North Pole, vivid colors at the Equator and dark colors at the South Pole. Construction took some extra time during breaks, but all the students were engaged and excited to finish their "balls."



Ages 10-11

Credit for organizing this exciting, inaugural "Beyond the Rainbow" event goes to CLP partner school coordinator, Colette Harrison and head teacher, Sandra Burgess.

A special thanks to all the inspiring teachers and enthusiastic students who made the first school-wide International Colour Day 2022 celebration a huge success.

Fluorescent Fridays

Building an International Student Chapter

Luanne Stovall

The 2021-2022 Fluorescent Friday series of showcasing color research and instruction at the university level continued with two excellent events.

February Event

On February 25, 2022, the FF event celebrated our first anniversary of student presentations. North Carolina State University in Raleigh, NC presented a program on color quality that included one faculty presentation and three student presentations. The program was attended by 74 participants.

Color Quality Control: An Interdisciplinary Exploration

Former ISCC president, Renzo Shamey, introduced the presentations with a general overview. Almost all materials are colored in some way and color is among the top factors influencing consumers' decisions in material purchases. Color perception, however, is a personal experience, and its quantification for quality control purposes is influenced by a number of biological, psychological and environmental factors.

Research at the Color Science and Imaging Laboratories at North Carolina State University comprises the study of human color perception, as well as specification, quantification and reproduction of color in different media. A main theme running through nearly all of our projects is color quality control. It involves examining various parameters that have an impact on the accuracy, repeatability and reproducibility of colorimetric assessments. Our work encompasses many disciplines of learning from optics, chemistry and imaging science to physiology, psychology, and mathematics, and we often collaborate with colleagues across several colleges.

Among studies currently in progress is the examination of color difference models with a view to improving their performance by incorporating the effect of texture and background. We are also developing visual and instrumental methodologies for the color quality control of multicolored stimuli. This presentation will provide an overview of some of the current research in our labs.

Renzo Shamey is a distinguished Ciba professor at North Carolina State University and directs activities at the Color Science and Imaging Laboratory. His current research interests include color perception including multi-color stimuli, unique hues, whiteness, blackness, grayness, and color difference modelling. He is a Fellow of the Society of Dyers and Colourists (UK), Past President of the Inter-Society Color Council (US), editor in chief of the Encyclopedia of Color Science and Technology, 2nd edition, and a North Carolina State University Scholar.
rshamey@ncsu.edu

Three students presented their research. Summaries of each presentation appear in the sections that follow.

Simultaneous Contrast and its effect on perceived Color Differences

The color quality control of multicolored material is examined either visually to address the complexity of the appearance of the object or by assessing each color in isolation, which is a common instrumental color quality control method. To improve the accuracy and repeatability of this process, it is important to incorporate the effect of surrounding colors on the appearance of each color in the pattern. The focus of this study is to quantify changes in perceived color differences of multicolored stimuli that occur due to the change in the surrounding colors and incorporate these findings in suitable color difference models.

This presentation was by **Jiaying Wu**, a Ph.D. student in the Fiber and Polymer Science program in the Wilson College of Textiles at NC State University. She received her M.S. degree in Textile Chemistry from NC State. Her research interest focuses on the effect of complex backgrounds on the color difference perception of multi-colored materials.
jwu13@ncsu.edu

Color Quality Control from Polymeric Pellets to Products

Color quality control of polymeric products is carried out by measuring the color or transparency of the colored material. However, it is often necessary to relate these characteristics to the color properties of the starting ingredients. This is typically done by measuring the colorimetric and spectral properties of polymeric pellets or plaques. In this study a model based on the Kubelka-Munk theory is used to relate the transmittance of polymeric plaques and associated products to the measured reflectance of pellets. Several types of polymeric specimens are tested to improve the accuracy and applicability of such predictions especially in relation to measuring the reflectance of single pellets.

This research was presented by **Zhenhua Luo** a Ph.D. student in the Fiber and Polymer Science program at North Carolina State University. She received an M.S. degree in Textile Engineering from NC State in 2018. Her research interests include the role of color on perceived attractiveness, color measurements of polymeric products, visual color perception, and digital color imaging. Her current research focus is modeling the effect of texture on visual and instrumental color difference assessments of fabrics and polymeric materials.
zluo3@ncsu.edu

Image-based deep learning for diagnosis of Color Defects

In recent years deep learning technology has found a wide range of applications including detection of objects in images. Image-based analysis of faults can overcome several challenges in quality control of colored objects in different sectors. This research examines the applications of deep learning to diagnose color defects. Two cases are briefly reviewed: detection of psoriasis (a common skin disease) for medical applications, and diagnosis of production and coloration defects in the textile industry. Databases containing images of normal and defective specimens are used and learning algorithms are then employed to train the engine and provide a diagnosis. With suitable training these systems can provide increased diagnostic accuracy and shorten the time to address various issues.

The presenter was **Hao Cui**, a Ph.D. student in Textile Technology and Management in the Color Science and Imaging Laboratories at NC State University. Having come from an IT background, his research interest lies in deep learning and digital image processing. He has also worked in the textile's global supply chain for more than seven years. He is currently developing a web application to diagnose and troubleshoot coloration faults using deep learning technology.
hcui6@ncsu.edu

April Event

On April 29, Toronto Metropolitan University, Canada, presented the FF program. The program moved the science focus of the previous Fluorescent Friday from research at the graduate level to a design focus at the undergraduate level.

Hitting a sweet spot with color

This event included an overview of the Graphics Communication Management Department, a faculty research study on an expanded gamut, and a student and faculty presentation on reimagining Nestlé Turtles Holiday Gift Packaging. Three faculty members and two students gave presentations.

Dr. Habekost teaches courses in the areas of press, printing technologies and introductory pre-media. Professionally, he is active in the Technical Association of the Graphic Arts (TAGA) and started the RyeTAGA student chapter in 2006. Every year student chapters from other universities compete for the Helmut Kipphan Cup for the best student publication of student research. The RyeTAGA student chapter has won the cup seven times and the award for best undergraduate student research paper nine times since 2007. He is also a general member of Graphic Communications Education Association. In addition, he promotes international exchange activities at the school with our current international exchange partners in Belgium, Denmark, Germany, South Korea and Sweden. Dr. Habekost's research interests are in the areas of color measurement, the application of color differencing equations, color measurement of metallic inks, paper topography and its influence on print quality, and expanded gamut printing. He has published chapters for books, refereed journal articles, research papers in conference proceedings, and articles for PrintAction magazine.

Accuracy of spot color replacement

The faculty research study titled "Accuracy of spot colour reproduction in a 7-colour, expanded gamut, flexographic printing system" conducted by Reem El Asaleh, Martin Habekost and Abhay Sharma was presented by **Dr. Reem El Asaleh**.

Expanded gamut printing involves expanding the number of process colors by orange, green and violet colors to create many spot colors with the new fixed CMYK-OGV ink set and eliminating the need to use spot colors, since they can be achieved through the combination of CMYK-OGV.

This study focused on evaluating flexographic expanded gamut printing on a narrow web flexographic label press located at Toronto Metropolitan University. Esko Equinox and GMG OpenColor expanded gamut software solutions were used, where each system was tested with its own proprietary characterization test chart. The Idealliance ECG small v1 (2019) test target was also used in this study.

A verification test chart was created, with selected Pantone spot colors. The test chart was then processed using the characterization data from the proprietary and non-proprietary characterization press runs. The build/composition of the selected Pantone colors was analyzed and the CIEDE2000 color difference was calculated. Both software solutions performed better in color accuracy with their proprietary characterization targets than with the data gathered from the

Dr. El Asaleh is an Associate Professor in Graphic Communications Management. She holds a Master of the Digital Media Program and a Ph.D. in Media and Design Innovation Programs within The Creative School. Her multidisciplinary knowledge in computer science and graphic communication was shown in her multiple research projects elaborating on the graphic arts industry issues. Her area of Academic Interest is in Color and Imaging Science, Emerging Pre-Media Technologies, and Digital Asset Management. Currently, she is working on developing a systematic review of challenges and outlook on the impact of implementing integrated technologies in the graphic art industry for the past 10 years.

Managing color and brand identity

The design project was introduced by instructor, **Donna Abdelrazik**. She shared examples of methodology and application of managing color and brand identity within the evolving virtual production landscape.

The presentations explained how the School of Graphic Communications Management (GCM808: Package Prototyping course), and Nestlé Canada partnered to reimagine the Nestlé Turtles holiday chocolate gift packaging. Students strategized, designed and proposed a packaging system to deliver a gifting experience to the target consumers. The students shared their experience working with a global brand to develop an iconic trademark in a virtual classroom.

Donna Abdelrazik (Razik) is a Lecturer in the School of Graphic Communications Management at Toronto Metropolitan University. She holds a B.Tech. from Ryerson and an M.Sc. in Packaging Value Chain from Cal Poly. She is a leader in print innovation and a technical packaging specialist with over 20 years of development and commercialization experience in the CPG alcohol beverage

She is an award-winning instructor in the School of Graphic Communications Management at Ryerson University supporting the packaging concentration courses and other foundation curricula. Donna focuses on the experiential learning journey for her students and incorporates industry challenges into her curriculum for students to research viable solutions.
drazik@ryerson.ca

Cassandra Pascucci is a fourth-year GCM student, graduating in 2022 with a minor in Communication Design and a concentration in Packaging. She is an organized, hard-working creative with a knack for packaging and sustainability, having participated in various competitions throughout her undergraduate career.
cpascucci@ryerson.ca

Cameron Garside is a fourth-year GCM student with a concentration in Packaging. He is a self-driven designer with an interest in graphic design for packaging and a strong interest in 3D modelling and product rendering for packaging.
cameron.garside@ryerson.ca

The Fluorescent Friday team would like to congratulate all the students for their hard work, outstanding presentations and academic success. We would also like to thank the faculty members for their willingness to participate, direction to students and color leadership.

The next event will be in Fall 2022 as we continue our goal to build an ISCC International Student Chapter. Special thanks to the team members: Lina Cárdenas, Jean Hoskin, Jennifer Krushwitz, Maggie Maggio, Mike Murdoch, John Seymour, Renzo Shamey and Luanne Stovall.

COLOR RESEARCH AND APPLICATION

Color Research and Application
Volume 47, Number 2
Pages: 239 - 522

Color Research and Application has been the principal forum for the publication of research articles, reviews, and editorials on the science, technology, and application of color since its foundation in 1975. It is my honor and privilege to have become the new Editor-in-Chief (EiC) from the beginning of 2022. The founding EiC, Fred Billmeyer, edited the journal for 11 years from 1976, and Rolf Kuehni, edited it for 3 years from 1987. My immediate predecessor, the remarkable Ellen Carter, has edited, guided, nurtured, and led Color Research and Application as EiC for an extraordinary 31 years. Ellen has overseen the transition from print-only copies of the journal and postal editing to online manuscript submission, editing, and publication—a transition that has been accompanied by numerous changes of staff at the publisher. Ellen has been instrumental in expanding the journal to where it is today. She has increased the number of endorsing societies from the founding three to the thirteen we have today,and has built a vibrant network of associate editors, editorial board members, authors, reviewers, and of course, readers. This represents a huge and prolonged amount of work for which we owe Ellen an enormous debt of gratitude. Thank you, Ellen!

Ellen now becomes an Emeritus Editor of the journal—I hope she will continue to guide the journal and me.

Along with the change in EiC, we have made some changes to the journal's editorial structure. The principal change is the introduction of a group of Senior Editors, who oversee the review of submitted manuscripts and thus act as handling editors. The new structure is to be made up of:

Editor-in-Chief
The EiC acts mainly as the distributing editor. After an initial review, appropriate submissions are passed to a Senior
Editor for the assignment of referees and subsequent editing. Senior Editors then make recommendations about each submission to the EiC.

Senior Editors
Instead of the EiC acting as sole editor, we have appointed an impressive group of Senior Editors, who are subjectspecialists, to act mainly but not exclusively within their diverse areas of expertise. Senior Editors are responsible for assigning reviewers and making recommendations to the Editor-in-Chief about whether a paper should be revised, accepted, or rejected.

Editorial Board
We continue to maintain an Editorial Board. As before, members serve in an advisory capacity and will offer advice to improve the quality and visibility of the journal as well as reviewing submitted manuscripts at the invitation of Senior Editors.

International Advisory Board

The members of the International Advisory board are appointees of their endorsing color societies. They represent the interests of those societies and of the countries in which the societies are based. The Advisory Board, like the Editorial Board, provides a pool of expert referees and gives guidance and advice to the journal and the Editor - in - Chief. Advisory board members can also serve as Senior Editors.

We hope these changes will allow the journal to continue along the successful path plotted by Ellen over the past 31 years. Our goal is to continue to improve the overall quality of publications in the journal, nurture and build in our core areas within color research and application, and expand into new areas, such as in basic color and color vision research.

I look forward to working with the entire editorial and publishing team, as well as our authors and readers, on the colorful adventure ahead. The Table of Contents for the April 2002 are listed below for your reference.

Andrew Stockman

MEETING REPORT

AIC Online Conference June 13-16, 2022

Topic: Sensing Colour

Paula J. Alessi, ISCC Liaison to AIC

The next AIC Conference will be fully online June 13-17, 2022. The AIC regular member hosting this event is the Colour Research Society of Canada (CRCS). The theme of the conference is Sensing Colour. Several workshops will be held both online and in-person in Toronto. More information will be posted soon at https://www.aic2022.org.

The AIC 2022 program committee conducted a survey asking all authors of accepted abstracts whether they would attend in person in Toronto or if they would only attend online. Unfortunately, the survey showed that only 41% of authors planned to come to Toronto to participate in person. As a result, the decision has been made to hold AIC 2022 as a virtual conference with all presentations given online. Therefore, the registration fees have been adjusted.

Registration

Online registration is now open at https://www.aic2022.org/attendees/registration/. Your registration fee as an online participant includes full access to AIC 2022.

All registration fees are in **Canadian dollars**. Here are the important fees to remember:

Early bird registration fee **before April 21**	$200
Early bird registration fee for students **before April 21**	$50
Registration fee (general and students) **after April 21**	$275
CRCS Members' Rate (anytime)	$200
CRCS Student Members	FREE
One day flat fee (available after May 23)	$100/day

Here are some important registration facts to keep in mind:

1. **Full refunds** for registration (less processing fees) will be available until **May 15**.
   - **50% refunds** will be available from **May 16-31**.

2. **All presenters (Oral and Poster) must pay for the full conference by the Early Bird deadline (April 21)**. At least one author of each presentation (Oral or Poster) must register for the full conference. Make sure to register with the same email address that you used to submit your Abstract.

3. **Full papers are due Friday, May 20, 2022**. Full papers will be published in the Conference Proceedings shortly after the conference. Authors who fail to present their work (Oral or Poster) during the conference will not have their full paper published in the proceedings.

4. **All attendees who register for the full conference will have access to recordings** of oral presentations and posters for **3 weeks** following AIC 2022 (with permission of the presenter) via the online conference platform. The one-day flat fee option does not include access to lecture recordings.

5. **Accepted authors who require financial assistance can apply via an** online form to receive a reduced rate for online attendance to AIC 2022. Decisions will be based on a 150-word statement about why the author requires assistance. Deadline to submit a request for financial assistance is **April 11**.

Registration on the conference management program (Pheedloop) is by credit card. If you require another payment option (e.g. bank transfer), please complete the Registration page and check Other Method for payment, and contact sensingcolouraic2022@gmail.com .

ISCC Attendance

ISCC members are encouraged to participate. It will be very worthwhile to interact with the international colour community online! So register today for AIC 2022!

A Blast from the Past:

ISCC Newsletters 50 Years Ago – ISCC Newsletter No. 217 March-April 1972

Paula Alessi

The focus of this article will be a few tantalizing topics from the 21-page 1972 March-April Newsletter No. 217.

First Macbeth Award

The ISCC Macbeth Award was announced in 1967 to be given biennially as recognition of a recent contribution (i.e., within the past 5 to 10 years) to the field of color. "The Award was established by Norman Macbeth, past director and long-time treasurer of the Inter-Society Color Council, to honor the memory of his father, Norman Macbeth, Sr., and his pioneering contributions to the art and science of color and illumination." The January 1970 ISCC Board of Directors established a recommended practice for finding the award recipient through a Macbeth Awards Committee that was directed to present the first award in 1972. Peter Carl Goldmark had the honor of being the first recipient of the coveted ISCC Macbeth Award (Fig. 1). Dr. Goldmark received the award for his recent contributions to the invention of electronic video recording (EVR).

This invention was viewed as a milestone in the field of color because it had the potential of being as important to the public as color television or the long-playing record that was also pioneered by Dr. Goldmak. The EVR system used optics and electronic physics to transfer any film or video taped program to a special unperforated thin film, or optical tape, stored in a small cartridge which could then be placed into a player attached to the antenna system of a TV receiver and automatically played on a television screen in black and white, or color. This invention truly was revolutionary for its time. I wanted to share this with our 2022 ISCC members who may not have realized that the receipt of the Macbeth Award is a tradition that started 50 years ago!

1972 ISCC Williamsburg Conference on Fluorescence and Colorimetry of Fluorescent Materials

Fig. 2 Speakers and panelists - Standing from left to right: F.W. Billmeyer, Jr., RPI; A. R. Robertson (Canada), NRC; E. Allen, Lehigh
University; Å. Stenius (Sweden); J. Donnelly, Jr., Westvaco; H. Aach, Queens College; H. Terstiege (Germany); C. J.
Bartleson, Macbeth: J. Schanda (Hungary). Sitting from left to right: F. Grum, Eastman Kodak Company; E. Ganz (Switzerland),
Ciba-Geigy; H. Hemmendinger, HCI; A. Berger (Germany), Bayer; F. Simon, Clemson University; W. D. Wright (England),
Imperial College. Missing in the picture are two speakers: G. Wyszecki and R. A. Ward.

This was the fourth Williamsburg Conference hosted by ISCC and to put it in the words of David Wright, "…it must be regarded as the most successful of the four." Franc Grum and Eugene Allen co-chaired the conference with invaluable assistance from Milt Pearson and George Gardner. Figure 2 shows the speakers and panelists who were featured at this epic Williamsburg Conference. These prominent color science experts were the pioneers of state-of-the-art fluorescence studies in 1972! The conference was attended by practical and theoretical experts from the United States and abroad.

An alphabetical list of the speakers with the titles of their talks follows:

H. Aach - Fluorescent Pigments in Art and Design
E. Allen - Fluorescent Colorants: True Reflectance, Quantum Efficiency and Match Formulation
E. Ganz - Fluorescent Whitening Agents for Textiles and Detergents
E. Ganz - Whiteness Measurement
F. Grum - Instrumentation in Fluorescence Measurements
H. Hemmendinger - Mechanisms of Release of Absorbed Energy
G. Wyszecki - Basic Concepts of Fluorescence
Å. Stenius - Fluorescence of Paper
R. Ward – Daylight Fluorescent Pigments, Inks, Paints, and Plastics
Abstracts of these talks appear in ISCC News No. 217.

A very eloquent summary of this Williamsburg Conference was written by David Wright. Professor Eugene Allen pointed out how important it is to fundamentally understand the importance of fluorescent excitation and emission processes. Only then could people from industry make smart decisions for quick approximate evaluations and shortcut procedures. Dr. Hemmendinger's talk emphasized the challenges involved in making the leap from fundamentals of fluorescence to necessary industrial shortcuts. This spawned a lively evening discussion session including all participants that famously made Williamsburg Conferences so valuable!

Professor Wright also speculated that there would be a need for a fundamental understanding of how whiteness is perceived. As Ganz's paper pointed out, a plethora of whiteness formulae exist, and it is not always clear how one determines which formula to use. Wright pointed out that a white gate near his home illuminated by sodium lamps in the evening always looked white to him "in spite of the fact that sodium lamps reflect only monochromatic yellow light into his eyes." The formulae in Dr. Ganz's list did not cover this situation.

As measurement issues of fluorescing samples were discussed, it was obvious that there was need for a standard illuminant to simulate D65 when measuring fluorescent samples. Stenius gave some examples of problems associated with the lack of a standardized illuminant; stamps made with fluorescing inks required color preservation and how the fluorescing greased proof paper affects the color of butter. The discussion of lighting of samples naturally led Mr. Derby to raise the issue of metamerism as it relates to fluorescence. This led to discussions of whether one could define an index of metamerism in the presence of fluorescence and/or a color rendering index for illuminants with power in the ultraviolet region. In Professor Wright's words, "…these issues raise some very nice colorimetric problems which we can leave to Dr. Wyszecki since he seemed to think all the problems were solved." This comment would get an LOL in today's social media parlance.

Dr. William Thornton raised a question about optical brighteners. He asked, "Comparing watt for watt, do we want an optical brightener with a dominant wavelength of 420, 450 or 480nm?" This was another area that was ripe for discussion, but clearly required more work.

Professor Wright postulated on Dr. Grum having a more complex color mixture problem in the use of fluorescing dyes to compensate for unwanted absorptions encountered in color photography. There was little time to delve into this intriguing topic.

Finally, Professor Wright felt that Mr. Ward's paper on Daylight Fluorescent Pigments, Inks, Paints and Plastics was invigorating because it opened the door to studies that must be done to examine the new range of visual and perceptual experiences that are encountered as more fluorescing pigments, inks, paints and plastics become available.

Participants walked away with a good foundational knowledge of the issues surrounding fluorescence and with a "To Do" list of many new studies that needed to be performed to fully grasp this subject, especially for industrial applications. As has been seen from the past, the best Williamsburg Conferences were those with lively discussions that stimulated more thoughtful color studies!

What is Photogrammetric Engineering?

In 1972, Photogrammetric Engineering was the official journal of one of ISCC's Member Bodies, American Society of Photogrammetry. Today, in 2022, this journal is called Photogrammetric Engineering and Remote Sensing published by the American Society of Photogrammetry and Remote Sensing (ASPRS), which is no longer a Member Body of ISCC.

ISCC News No. 217 published the following definition of photogrammetry:

> *Photogrammetry is the art, science and technology of obtaining reliable information about physical objects and environment through processes of recording, measuring and interpreting photographic images and patterns of electromagnetic and acoustical radiant energy and magnetic phenomena.*

This very informative article goes on to say that photogrammetry derives and produces topographic maps and surveys using measurements and other information obtained from aerial photography. These aerial photographs were used in highway planning, construction, property surveys, stockpile volume determinations to name a few. Another important aspect of photogrammetry was 'photographic interpretation' to provide accurate discrete information for "forestry, soils, geology, military defense, urban area analysis, and archaeology." Other specialized areas that used photogrammetry were "X-ray technology, dentistry, laboratory deformation of construction materials, and shapes of radar telescope dishes." The article ended with the following statement:

> *Conventional aerial photogrammetry is sometimes correlated with 'remote sensing' in which various other types of data are recorded and analyzed such as infrared scanning systems, and scintillometers and magnetometers for mineral exploration.*

Today in 2022, remote sensing has become an integral part of the photogrammetry efforts as the two words have been added to the name of its national society. So remote sensing became a significant part of their mission over the past 50 years. The need for assistance from a color society like ISCC also became less important to their mission. Hence there was no longer a need for them to remain a Member Body of ISCC. Currently the ASPRS also likes to be known as the Imaging and Geospatial Information Society, as it moves its focus to be better positioned for applications in the 21st century. Here is a quote from Tom Lillesand, ASPRS President:

> *We are extremely proud of our historical roots in imaging science and technology in the form of photogrammetry and remote sensing, and we intend to maintain and build upon our emphasis in this area. However, our membership is focused on imaging not only in the sense of primary data acquisition, but also with respect to the extraction of information from image data in a decision support context. We want to make clear that ASPRS represents a scientific and professional home for a broad array of individuals whose interests span the entire spectrum of geospatial information sciences, technologies, and applications. The new tag line is an important expression of ASPRS's vision for the future.*

Britain Going Metric

This *ISCC News* No. 217 issue closed with an article extracted from British Record #3, March 2, 1972, about Britain switching over to the metric system of weights and measures. This surprised me! I thought that Britain had been on the metric system for longer than 50 years!

The metric system was first proposed in 1791. It was adopted by the French revolutionary assembly in 1795, but it did not become compulsory in France until 1837. Britain had been using the Imperial System of measurement since 1824. The move to the metric system in Britain was gradual. This article reported that 60% of the population was aware that this switch was happening in 1972.

I hope these tidbits extracted from the ISCC News No. 217 will tempt you to explore these articles and others at https://iscc.org/Newsletter.

Interdisciplinary Color:

Art, Science, Industry, and Education

Jean Hoskin, ISCC Board of Directors Secretary

Since its founding the ISCC has had "the goal of advancing the knowledge of color as it relates to art, science, and industry. Each of these fields enriches the others, furthering the general objective of color education." (iscc.org)

The founders were ahead of the times with such a collaborative statement. In 1931, the world was still in the industrial age and the method of problem solving was the Scientific Method. Since then, we have passed through the Information Age (or Digital Age or New Media Age) and on to the Experience Age (or Conceptual Age). The Design Thinking method of problem solving emerged in the 2000s.

There are similarities, differences and advantages among the different methods used by art, science, industry and education. For each of these areas, I have selected an example to summarize, since there are variations in each, as well as processes that cross over.

- Art - Artistic Process
- Science - Scientific Method
- Education - Research Methodology
- Industry - Design Thinking

The Artistic Process: subjective and individual

In her book (1957), Susanne Langer opens by stating that every age has its own preoccupation. She encourages us to look back at history and see the groupings of ideas, not by subject matter, but by technique. "It is the mode of handling problems, rather than what they are about, that assigns them to an age" (Langer, p. 3). The technique begins with a question, which limits or predisposes the answer. We can distinguish between Impressionists and Color Synchronists by the technique that they used to explore a common subject – color.

In addition to the technique or question, the artist has rules that apply to their art. It is the role of the artist to create these rules, to which the construction of the art responds. John Taylor (1964) stated that the artist can follow a precedent or nature, or neither, but Taylor emphasized that the artist must choose. I would add that the artist could also choose to tell a story or follow intuition. Continuing with Taylor, "That is the paradox of the artist's freedom: there is no rule which governs all art; yet there is no art without rule."

That the artist can create their own technique, questions and rules means that there are a variety of methods from highly subjective to analytical. The Art of Education (https://theartofeducation.edu/) posted a contemporary list of *six steps in the artistic process*, which I am merging with the *Stages in the creative process* posted by Leisa Greene. These process steps are moving along a continuum to a more objective approach.

1. Find your inspiration
2. Research ideas, methods, and techniques
3. Brainstorm and practice techniques
4. Create work
5. Reflect on and revise work
6. Present your work.

The artistic process is thought to be highly subjective, but what is interesting about this list is that there are steps for learning techniques as well as communicating meaning. The artistic process appears to cross over between the intuitive and the analytical depending on the stage in the process, the media and the style. Repeating John Taylor, "there is no rule which governs all."

The best example of the crossover between intuitive and analytical process was during the Renaissance, when Leonardo DaVinci applied his own *scientific method* to his art using three steps: observation, experimentation and repetition. He used drawing to share his research and ideas, believing that "visual representation was superior to description." (Roche, 2018, p. 15). Palmedo described DaVinci's drawings as a final product of his observations and an active part of his research, as well as an art form appreciated by others. (Palmedo, 2020, p.136). Unfortunately, after Leonardo, art and science diverged.

The Scientific Method: objective and collaborative

If you have ever taken a science class, you have learned the Scientific Method of acquiring knowledge. Scientific inquiry aims to gain knowledge through testable explanations. The empirical method is based on phenomenon which can be verified by observation or experience rather than by theory or pure logic. Nonempirical statements are assumed, editorialized, theoretical, not factual and cannot be replicated.

There were several scientific methods throughout history, but in1660, the objective basis of scientific inquiry was attributed to the Royal Society in England whose fellows chose to verify all statements by facts determined by experiment. The term Scientific Method emerged in the 19th century and achieved popular use in the 20th century thanks to John Dewey, philosopher and education reformer, who conceived of the scientific method as both an attitude and a tool important to education.

The process involves making hypotheses based on knowledge obtained while formulating the research question, testing the hypothesis, and analyzing the results. A good hypothesis provides a testable statement of a theory that can be supported or falsified. The research design can be an iterative, cyclical process applying more accuracy and precision.

There is not one single series of steps, and variation exists between experimental sciences and social sciences. Entire theories can be retested if new evidence is discovered.

- Define the question
- Research and observation
- Form a hypothesis
- Test the hypothesis through reproduceable data collection, experimentation, measurement and observation
- Analyze data
- Draw conclusions
- Report findings

Research Methodology is a term used in social sciences and education to describe "the application of scientific procedures toward acquiring answers to a wide variety of research questions" (Adams, 1985. p. 16). Like other scientists, the social scientist seeks to inform, solve prob-lems, describe situations, generate new ideas, test hypotheses and pose new questions for research. (Adams, p.16). It is important that the procedures can be repeated at a later date and also relate cur-rent studies to other research studies. The steps listed above can be emphasized or varied depending on the purpose, sample size and goal to describe, illustrate, predict or test.

Creative thinking in art and science: The comparison

Both art and science are concerned with describing the universe and asking questions about nature and culture. There is an underlying desire to create, understand and share ideas.

The difference between science and art is where the "practitioner draws their inspiration—from the external (objective reality) vs. internal (subjective reality) experience, respectively" (Roche, p. ix).

The commonalities between artists and scientists are many:

- Both are interested in reducing the infinitely complex to something simpler.
- Both strive to express that which is difficult to comprehend in a more elegant way.
- Both must observe the world closely.
- Both can have a deep and profound effect on people.
- Both endeavor to achieve the expression of fundamental truth in some form.
- Both seek to enlighten, illuminate and enable people to better comprehend themselves, their world and their relationship to it.
- In short, they attempt to promote a deeper under standing of everything (Roche, p. 2).

Recommended Reading:

Adams, Gerald R. and Schvaneveldt, Jay D. (1985). Understanding Research Methods. New York: Longman Inc.

Augustin, Sally, and Coleman, Cindy (2012). The Designer's Guide to Doing Research. Hoboken: John Wiley & Sos

Brown, Tim (2009). Change by Design. New York: Harper Collins

Curedale, Robert (2012). Design Methods 1. Topanga, CA: Design Community College, Inc.

Curedale, Robert (2012). Design Methods 2. Topanga, CA: Design Community College, Inc.

Pink, Daniel H. (2005). A Whole New Mind. New York: Riverhead Books.

Prengaman, Emily (2019) "Lessons in Process: Similarities between Scientific and Artistic Creative Practice," The STEAM Journal: Vol. 4: Iss. 1, Article 11. DOI: 10.5642/steam.20190401.11 https://scholarship.claremont.edu/steam/vol4/iss1/11/

Roche, Richard, Farina, Francesca, and Commins, Sean (2018). Why Science Needs Art. London: Routledge

Taylor, John F.A. (1964). Design and Expression in the Visual Arts. New York: Dover Publishers.

In 2014, Artist Maskull Lasserre was an artist-in-residence at the Board Institute, a joint MIT/Harvard research center in Cambridge, MA. He compared the approach of artists and scientists to their work.

- Both exist in a rich world of ideas and viewpoints.
- Both probe boundaries to discover and display new aspects of reality
- Both use intuition.
- Both use a trial-and-error process.
- Both use a process of abstraction to represent physical reality.
- Artists and scientists employ specific methods to pursue their goal (Palmedo p. 135).

Carl Sagan wrote "Science and art are ways of thinking much more than they are bodies of knowledge" (Roche, p. 120).

"Scientific and artistic process have similarities but are not the same. Both types of creativity spring from intelligent minds that make connections between ideas and synthesize information in new ways. But the artist has more room for freedom and creativity in their work. Their tools are suggestive and emotional and can be abstract. Scientists have a more rigorous path, they rely on logic, clarity, and evidence (Prengaman, 2019, p. 4)."

What happens when the two methods are merged? Design Thinking.

Design Thinking: The integration of art and science

Design Thinking is a process for innovation that emphasizes observation, collaboration, fast learning (or fast failure), visualization of ideas, rapid prototyping and concurrent business analysis. You will notice that the steps involved are a combination of the scientific method and the artist's creative process. Because of the complexity, design thinking requires an interdisciplinary team that is both analytical and creative thinking. It allows for simultaneous analysis of the environment, technology, the focus on people, global markets and the product, service or experience design. The design solutions are informed, repeatable, innovative, empathetic and future focused.

Tim Brown contrasts *linear thinking*, which is sequential, with design thinking, which is about connections. He continues with a description of innovation as a system of overlapping spaces, which is aligns with Design Thinking. The spaces for innovation are inspiration, ideation and implementation. The Design Thinking process is iterative, because it is fundamentally an exploratory process, which "will make unexpected discoveries" (Brown, 2009, p.16).

There is no one best way to execute the process, however, here are some components.

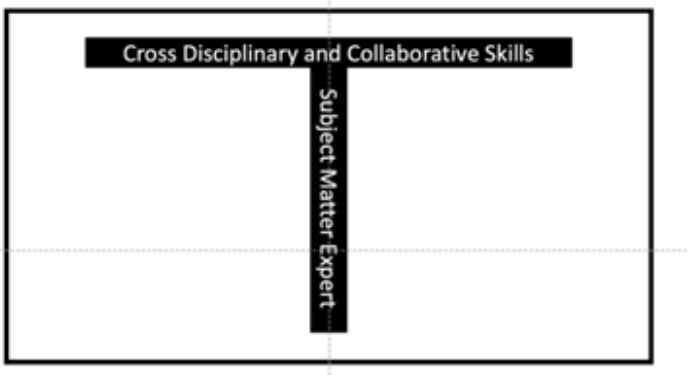
1. Define the problem
2. Brainstorm solutions
3. Research ideas
4. Establish criteria and constraints
5. Consider alternative solutions
6. Select an approach
7. Develop a design proposal

8. Make a prototype
9. Test and evaluate
10. Define the design
11. Create the solution
12. Communicate the results

Effective Design Thinking requires different skills from team members. One is a right-brain thinker, and third is a collaborative "T-type." Although the next is a left-brain thinker (sequential, literal, functional, textual, and analytical) and right-brain thinker (simultaneous, metaphorical, aesthetic, contextual, and synthesis-oriented) are both required for this multidisciplinary team, Daniel Pink in *A Whole New Mind*, emphasized the change in focus from the analytical mind of the Information Age to the creative thinker of the Conceptual Age. More interesting were the essential aptitudes listed for the R-Directed (right brain) thinker, that "will guide our lives and shape our world" (Pink, 2005, p.67). They are design, story, symphony, empathy, play and meaning. Daniel Pink devotes a chapter to each one of these aptitudes, but for us, the challenge is to determine how color applies to each one.

There are two strokes in two directions in the letter T, which are a metaphor for the T-Shaped person. To operate in an innovative interdisciplinary environment, an individual must have strength in least two dimensions. First, each team member is a subject matter expert. The vertical stroke of the T is the depth of each person's expertise that allows them to provide content to the outcome. The horizontal cross on the T represents the ability to collaborate effectively across disciplines, to work outside the core area, and to understand how their subject impacts other areas. A few examples of the other disciplines are business, technology, policy, writing or engineering. Design Thinkers "cross the T" (Brown, p. 27). The benefit of a team of T's is the skill to cross boundaries, see analogies and build creative connections. The individual benefits by adding insights to their area of expertise and making it more interesting.

ISCC is a network of people who have a deep knowledge of color in art, science, industry or education. Color is the vertical line of the T. Have you identified the skills for collaboration that you bring to your business or to the ISCC that crosses the T? If so, are you ready to apply Design Thinking to drive revolutionary innovation in the color industry and in color education? Are you ready to make color more interesting?



T- SHAPED PERSON

https://theartofeducation.edu/2018/02/15/comparing-scientific-method-artistic-process/

https://indieitpress.com/7-stages-of-the-creative-process-dreaming-and-doing/
(Leisa Greene)

https://theunstandardizedstandard.com/2020/02/06/what-is-the-difference-between-the-scientific-method-and-the-creative-process/

https://www.harvardbusiness.org/both-and-leadership-combining-the-benefits-of-i-and-t-shaped-leaders/

Spring 2022 ISCC Webinars

Ann Laidlaw

March Webinar Report

Nick Harkess and Paula Alessi presented "A Meeting of Minds – Art and Color Science" on March 1, 2022. This was a webinar featuring a conversation with Nick and Paula about his labor of love 20 years in the making known as Colour Made Simple (CMS).

We had about 60 international attendees, many from "down under." This interesting presentation took the form of a conversation between the presenters. Due to some health issues for Nick, parts of the webinar were pre-recorded. Paula and Nick spent many hours practicing, and it showed by their seamless handling of the whole event. After the formal presentation, there were many questions from a very interested crowd. Thanks Nick and Paula for your time and effort!

The ISCC webinar schedule will include Understanding and Communicating Color Rendition, presented by Mike Royer on April 26, 2022 at 2 p.m. EDT. Dr. Royer's presentation will cover recent discoveries of how light influences the color appearance of objects, and along with that the development of better metrics for quantifying and communicating these effects. The presentation will cover new color rendition metrics—including TM-30 and others—new calculation tools, new standards, and new design guidance. It will include the latest research trends and provide insight into how color rendition will change as LED technology evolves.

April 26, 2022

Dr. Michael Royer is a senior engineer at the Pacific Northwest National Laboratory (PNNL), where he works primarily on the Advanced Lighting Science and Technology Research program, sponsored by the U.S. Department of Energy. His research focus is human factors in lighting. Michael is a Fellow of the Illuminating Engineering Society (IES) and serves on the IES Vision Science Committee and the IES Color Committee. He is an associate editor for the journal Lighting Research & Technology.

May 24, 2022

Our May webinar will be High Dynamic Range Imaging - Technologies, Applications and Perceptual Considerations, presented by Dr. Timo Kunkel on May 24, 2022 at 2 p.m. EDT. High-Dynamic Range imaging, better known by its acronym HDR, has established itself as a foundational component when looking at the aspects defining today's image fidelity. HDR technology is widely supported by millions of devices covering the whole production pipeline from cameras to post-production tools, deployment systems and displays, and is embraced by content creators, providers, and consumers alike.

HDR imaging is based on several key concepts that facilitate perceptually meaningful, artistically compelling and technologically effective delivery of movies, TV shows, and video games that are more immersive and realistic than previously possible. The improvements offered by HDR imaging have required significant changes to the underlying technologies, such as increases in signal range and granularity, as well as the implementation of advanced content remapping approaches. They also brought to the forefront some visual phenomena and perceptual effects that in the past were not considered relevant to everyday viewing, making HDR content presentation qualitatively different from standard dynamic range (SDR) content consumption.

This webinar provides an overview of the key concepts enabling today's HDR ecosystem, including technological aspects, industry standards, formats, and applications, and places them into context of the unique perceptual properties HDR imaging adds to the creative presentation of content.

Timo Kunkel is Director of Image Technology & Standards in the CTO office of Dolby Labs, Inc. Over the past 15 years, he has been investigating the technical and perceptual aspects of HDR and wide color gamut imaging with focus on advanced display approaches and has been involved in developing the core concepts of what is now Dolby Vision. Timo has published and taught about HDR concepts and technologies throughout our industry for many years. He is also a member and technical expert with the CIE, ICC, SID ICDM and IEC TC100 and 110. Timo holds a PhD in Computer Science from the University of Bristol, UK, and a MSc from the University of Freiburg, Germany.

All ISCC webinar events are found on our Resources page, under Online Webinar Series. As always, registration for live events is free and open to the public. ISCC members may also access recorded webinars. https://iscc.org/SeminarSeries

Calendar 2022

2022	
May 2	AATCC Abstract submission deadline for Textile Discovery Summit https://aatcc.org/wp-content/uploads/2022/01/Call-for-Posters-2022-Summit-for-Website_fillable.pdf
May 5	CMG Monthly Color Chat https://colormarketing.org/event/colorchat-zoom-may-5/
May 8 -13	Display Week technical Symposium San Jose, CA http://www.displayweek.org/
May 10-12	AATCC Research Committee Meetings https://aatcc.org/aatcc-events/research/
May 15	IS&T CIC30 Call for Papers Journal First deadline CIC Home (imaging.org)
May 15 – 20	CLEO Conference Laser Science to Photonic Applications San Jose, CA https://www.cleoconference.org/home/program/
May 19	ASPRS 2022 Florida Region Spring Lidar Workshop https://my.asprs.org/ASPRSMember/Events/Event_Display.aspx?EventKey=FL220519&WebsiteKey=9126ee3f-e9e1-43bd-a00c-0cfa63182579
May 24	Detroit Colur Council Virtual Meeting -Augmenting Color Communication in Context and Multi-model Color-naming Systems with Deep Learning https://detroitcc.org/upcoming-events/
June 3	Geobyte WebinarUpdate of the USDol Geospacial Technology Competency Models (GTCM) https://my.asprs.org/ASPRSMember/Events/Event_Display.aspx?EventKey=GB20220603&WebsiteKey=9126ee3f-e9e1-43bd-a00c-0cfa63182579
June 6	IS&T CIC30 Call for conference papers CIC Home (imaging.org)
June 8	CMG Webinar Color, Material & Finish (CMF) 102 https://colormarketing.org/event/colorspeak-june-2022/
June 7 – 10	IS & T Archiving 2022 http://www.imaging.org/site/IST/Conferences/IST/Conferences/Industry_Calendar.aspx?hkey=4400a3cc-8e46-4fef-b2d1-797308deb907

2022	
June 9 – 10	ASTM E12 June 2022 Meeting ASTM International Headquarters, West Conshohocken, PA
June 13 - 16	AIC Midterm Meeting Toronto Canada http://www.aic2022.org/
June 14 – 15	2022 SPE ANTEC Color & Appearance Division Charlotte, NC https://specad.org/2022-spe-antec-color-and-appearance-division/
June 19 - 23	LightFair 2022 Las Vegas, NV https://www.lightfair.com/las-vegas-2022
July 6 – 8	IS & T London Imaging Meeting 2022Display Science https://www.imaging.org/site/IST/Conferences/London_Imaging_Meeting/IST/Conferences/LIM/LIM_Home.aspx
July 17 – 22	NAPIM Summer Course https://www.napim.org/napim-event-list
Aug 18 – 20	IES 2022 Annual Conference New Orleans, LA https://www.ies.org/events/annual-conference/
August 24 -25	Color Management Workshop at AATCC technical Center https://aatcc.org/workshops/
September 9-10	SCAD 2022 Annual Conference Newport Beach, CA https://scadent.org/events/newportbeach-2022
September 23	ASPRS Geobyte Webinar Allen Coral Atlas: A New Technology for Coral Reef Conservation https://my.asprs.org/ASPRSMember/Events/Event_Display.aspx?EventKey=G-B20220923&WebsiteKey=9126ee3f-e9e1-43bd-a00c-0cfa63182579

2022	
Oct 4 - 6	AATCC 2022 Textile Discovery Summit Hilton University Place Charlotte, NC https://aatcc.org/summit/
Oct 10 – 13	IES Street & Area Lighting Conference 2022 Dallas, TX https://www.ies.org/events/street-area-lighting-conference/
OCT 16 – 20	Frontiers in Optics + Laser Science Rochester, NY https://www.frontiersinoptics.com/home/
Dec. 7-8	AATCC and Printing United Alliance Digital Textile Printing Conference Durham, NC https://aatcc.org/conferences/

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.

Datacolor

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

Avian Technologies LLC

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

Radiant Vision Systems LLC

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

Konica Minolta Sensing Americas

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

NVR, INC.

Plaza America Tower I
11700 Plaza America Drive Suite 500
Reston, Virginia 20190
Contact: Susan Hackney
Email: shackney@nvrinc.com

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isccoffice@iscc.org

Editor: Madelaine Yafet

Layout and Design: Lina Cárdenas, Patricia Luna

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Newsletter Coordinator: Jodi Baker

Final Edit Reviewers: Jean Hoskins, Mike Brill and Paula Alessi

Quarterly Newsletter

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