



# Inter-Society Color Council News

Issue 467

Summer 2014

## Board of Directors Corner

My name is Cameron Miller, and I am bringing you this issue’s Board of Director’s column. I joined the ISCC in 2006 and attended my first ISSC meeting that year in Ottawa, Canada. I am a very



technical person (lab rat), and at the time was very interested in this society that brought views and knowledge of color from my technical measurement world to the commercial production world to the artistic perception world. I served on the Board of Directors from 2007-2010 and co-chaired the 2008 Annual Meeting “The RGBs of Color” and a “Safety Color Expert Symposium” with Carl Andersen of the Federal Highway Administration. My experience demonstrates that you do not need to be an ISCC member

for several years before becoming involved in developing the future direction of the ISCC. I currently serve as the treasurer, a position I have held since 2011.

I am the group leader for the Optical Technology Group in the Physical Measurement Laboratory at the National Institute of Standards and Technology (NIST). The activities of my group cover photometry, radiometry, and optical properties of materials which includes color. Before becoming group leader, I was the Photometry Project Leader in charge of realization and dissemination of the Candela and working with industry in lighting-related activities, especially the development of solid-state lighting. My other activities include vice-president technical of the CIEUSA and the chairman of the Testing Procedures Committee for the Illumination Engineering Society. I have a Ph.D. from Cornell University in Physical Chemistry.

As many of you are aware, the ISCC has become a virtual organization. Many people have asked what happened to the non-virtual part (the office and all of its historical content). As part of my duties, along with Maria Nadal (a past-president of the ISCC), we were in charge of bringing all of the contents of the office located at HunterLab in Reston, Virginia to NIST. Once again we would like to thank HunterLab for housing the office for so many years. At NIST, Maria and I began organizing the boxes of ISCC records to minimize the storage footprint, including scanning many documents to create electronic versions in order to eliminate the paper copies.

A benefit of scanning many of the documents is that they can be posted to the website for members to review and look through what really is the history of our organization. All of the Newsletters have been scanned and are uploaded to the website storage. In the near future, all of the Newsletters starting with Number 1 published October 16, 1933 to the last Newsletter of 2013, Number 464, will be available online for download. (All 2014 Newslet-

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ISCC EXECUTIVE OFFICERS	
Terms end 2014	<p>President Mr. Scot R. Fernandez Hallmark Card Inc. 2501 McGee Kansas City MO 64141 USA 816-545-2462 fax: 816-274-7367 <a href="mailto:sferna2@hallmark.com">sferna2@hallmark.com</a></p>
	<p>Secretary Ms. Ann Laidlaw RoLyn Group 136 E. Hill St Decatur, GA 30030 336-420-1998 <a href="mailto:acl99colors@yahoo.com">acl99colors@yahoo.com</a></p>
	<p>Treasurer Dr. C. Cameron Miller Nat'l Inst. of Standards and Technology 100 Bureau Drive, Stop 8442 Gaithersburg, MD 20899 301-845-4767 fax:301-975-4713 <a href="mailto:c.miller@nist.gov">c.miller@nist.gov</a></p>
	<p>President Elect Mr. John Conant Aerodyne Research, Inc. 45 Manning Road Billerica MA 01821-3976 USA 978-663-9500 fax: 978-663-4918 <a href="mailto:jconant@aerodyne.com">jconant@aerodyne.com</a></p>
	<p>Past President Dr. Francis X. O'Donnell The Sherwin Williams Company 610 Canal Road Cleveland, OH 44113 216-515-4810 fax: 216-515-4694 <a href="mailto:fxodonnell@sherwin.com">fxodonnell@sherwin.com</a></p>
ISCC BOARD OF DIRECTORS	
Terms end 2014	<p>Dr. Ellen C. Carter Editor, Color Research and Application 21 Castle Drive Pennsville, NJ 08070 856-678-6444 <a href="mailto:ellen.carter@alum.rpi.edu">ellen.carter@alum.rpi.edu</a></p>
	<p>Dr. Michael H. Brill Datacolor 5 Princess Road Lawrenceville, NJ 08648 USA 609-895-7432 fax:609-895-7461 <a href="mailto:mbrill@datacolor.com">mbrill@datacolor.com</a></p>
	<p>Dr. Romesh Kumar Clariant Corporation 74 Elmira Heights Putnam, CT 06260 401-823-2161 fax: 401-823-2750 <a href="mailto:romesh.kumar@clariant.com">romesh.kumar@clariant.com</a></p>
Term ends 2015	<p>Dr. Art Springsteen Avian Technologies LLC P.O. Box 716 Sunapee NH 03782-0716 USA 603-526-2420 fax: 603-526-2729 <a href="mailto:arts@aviantechnologies.com">arts@aviantechnologies.com</a></p>
Terms end 2016	<p>Ms. Paula J. Alessi Color Scientist 126 Gnage Lane Rochester, NY 14612 585-225-4614 <a href="mailto:geinhaus@frontiernet.net">geinhaus@frontiernet.net</a></p>
	<p>Mr. Kim Vlaun Artist/Educator</p>

*Board of Directors Corner continued*

ters are sent electronically to paid members and will not be posted on the website until 2015.) As we were scanning the documents, it was kind of magical to read through the Newsletters. The Newsletters represent a primary source that chronic the development of modern colorimetry as we use it today. I hope you will take advantage of downloading a past Newsletter once in a while and reading the developments taking place at that time in history.

One difference that is noticeable between the historical Newsletters and the Newsletters published today is the number of contributions from the ISCC membership. Historically, the Newsletter contributions from the ISCC membership were much greater than they are now. However, there were more ISCC total members in the past than there are now. So this result may be expected, but not necessarily desired.

I have been asked what is the role of the ISCC? The ISCC has always been a source of information about what is happening in the broad area of color. In the past, it was a focal point of tidbits that would lead the average reader to articles expanding upon a newly developing area or concept. With the development of the internet and search engines, some members have been wondering if the ISCC has been replaced by automated technology. What we are finding out is that the internet is a vast sea of information and we need knowledgeable individuals (instead of search engines) to help sort the valuable information. The Newsletter is a place where members can once again be directed to the most valuable information, but it requires the membership to make contributions guiding the other members to this information. I reiterate. As members of our Council, please contribute technical, administrative, and creative ideas to help shape the future of the ISCC, whether it is through the Newsletter, volunteering to serve in a leadership position, or participating in our fall teleconference meeting (see page of this Newsletter). The future of the ISCC is in our hands.

Cameron Miller  
*NIST, ISCC Treasurer*

## 2014 ISCC Annual Business Meeting and Awards Luncheon

One of the highlights of the Color, Light and Appearance Week held from June 16-20 at NIST was the 2014 ISCC Annual Business Meeting and

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*2014 ISCC Annual Business Meeting continued*

Awards Luncheon held on Wednesday, June 18<sup>th</sup>. The Annual Business Meeting consisted of the Secretary's Report, the Treasurer's Report and the President's Report. The Awards portion of the luncheon consisted of the Nickerson Award presentation and an Honorary Membership presentation.

### 2014 Secretary's Report

The Board of Directors, including Officers, meet by teleconference most months. A committee on Social Media, chaired by John Conant, meets via teleconference on a monthly basis for most of the year. We have successfully balloted changes to the ISCC By-Laws to reflect updated practices, such as electronic voting and reduced participation by Member Bodies. The dues have been reduced for individual members, reflecting the efficiency of electronic communication and the elimination of our office staff position. Member Bodies are no longer charged for membership. The ISCC Secretary asks Member Bodies to provide current liaison contact information. This will allow us to keep informed about each Member Bodies' activities, so that we may promote them in the ISCC Newsletter and on our website. We also ask Member Bodies to promote ISCC activities that may be of interest to their Member Body general membership. ISCC asks former Member Body delegates to join ISCC as Individual Members and update their contact information. This may be done by visiting our website at <http://www.iscc.org/>.

The ISCC currently has about 100 Individual Members. This includes 73 regular members, 24 student or retired members and 9 honorary members. We currently have 4 Sustaining Members. They are Avian Technologies, Datacolor, Hallmark, and Hunter Associates Laboratory, Inc..

The 2013 Annual Business Meeting, as required in the By-Laws, was held by teleconference on October 21, 2013. The 2014 Annual Business Meeting was held in conjunction with the day-long technical symposium as part of the Color, Light and Appearance Week at NIST.

*Respectfully submitted,  
Ann Laidlaw, ISCC Secretary, RoLyn Group*

### 2014 Treasurer's Report

The following are our Assets and Income:

#### Current Balances

- SunTrust \$62,739

- Paypal \$3,264

#### 2014 Dues Collected

- Individual \$4,210
- Member Bodies \$0
- Sustaining Members \$0 (Invoices sent out late July)

So far, the liabilities for 2014 are \$5000 for the 2014 Meeting expenses. The 2014 annual expenses are:

- Banking Fees
  - Credit card capabilities \$360
  - Credit card fees \$140
- AIC Membership Fees \$100 AUD
- Newsletter publication \$1000
- Mailbox \$160
- Webpage \$240
- Phone line \$303.

Thus the total 2014 annual expenses will be about \$2300. It is also important to note that we are current on all federal and state taxes to date.

The financial health of the ISCC is very good. Our income currently exceeds the outgoing fees. A MasterCard has been obtained through the SunTrust account in the name of the treasurer.

The invoices for the 2015 membership will be sent out in November, 2014.

*Respectfully submitted,  
C. Cameron Miller, ISCC Treasurer, NIST*

### 2014 President's Report

It is recruiting time. ISCC needs help from members as we search for new leadership in some Officer and Board of Director positions. Specifically, we are searching for candidates to fill the President-Elect Officer position and three Board of Director positions. Please consider nominating a fellow ISCC member who is a strong leader or consider volunteering yourself, if you care to become more involved in the activities of our national color organization. Nominations to fill these positions can be taken by Frank O'Donnell, our Past-President ([fxodonnell@sherwin.com](mailto:fxodonnell@sherwin.com)). All terms will begin in January of 2015. The term of office for a Board of Director is 3 years. The term of office for the President-Elect is two years, then as President, another two years and then as Past-President, another 2 years.

Special thanks were given to our outgoing leadership, whose duties will end December 31, 2014. First, Frank O'Donnell was recognized for his

*continued on next page*



*2014 President's Report continued*

contributions as Past President. Then Ellen Carter and Mike Brill were recognized for their contributions as members of the Board of Directors. Romesh Kumar, who was unable to attend the meeting, was also recognized for his service as a member of the Board of Directors.



The President, Scot Fernandez, closed his report with the Awards Ceremony, which will be covered in the following articles of this Newsletter.

*Respectfully submitted,  
Scot Fernandez, ISCC President, Hallmark*

### **2014 ISCC Nickerson Service Award Citation**

Scot Fernandez gave this 2014 ISCC Nickerson Service Award Citation for Dr. Cameron Miller at the 2014 Annual Business Meeting and Awards Luncheon. The Nickerson Service Award is presented by the ISCC Board of Directors for outstanding, long-term contributions towards the advancement of the Council and its aims and purposes.

Dr. Miller has served in a leadership role for the ISCC since 2007, holding two leadership positions first as a member of the Board of Directors (2007-2010), and then as the Treasurer of the Council (2011 – present). As a Board member, Cameron was always proactive to take on responsibility and provide strong thought leadership for the organization. One of the many activities he coordinated for the organiza-

tion was the 2008 ISCC Annual Meeting and Conference held in Baltimore, MD. The Conference was a stand-alone meeting that had an excellent collection of presentations and participation.

In 2011 when Dr. Miller's Board term expired, he stepped up to join the Executive Officers of the organization, and took over the responsibility of the Council's Treasurer. When Cameron took on this responsibility, the ISCC was challenged to re-evaluate the entire budget, and membership processing system. This came at a time when we had to let go of our administrative office. So Cameron became kind of a "membership secretary" by creating a very detailed database that tracks membership currently and historically back to 1996. This has been invaluable to the Council for not only keeping track of individual members but also of Member Bodies, Sustaining Members, Honorary Members, student members and deceased members. Cameron is also responsible for generating the mailing envelopes for all the members who receive the hardcopy newsletters. He helped ease the ISCC successfully through its transition from holding down an administrative office to being a self-sustaining organization. Cameron worked through these issues on his own, which represents a significant personal time investment into the organization. His commitment and dedication has set a blueprint

for our financial future, and is a foundational requirement for the future success of the organization.

In a broader sense, Cameron has also upheld the goals of the ISCC through his work at NIST and his activities in ASTM E12.

So on behalf of the ISCC Board of Directors, it is an honor to give Dr. Cameron Miller the



2014 Nickerson Service Award.

## ISCC Honorary Membership Awarded

Also during the Awards Ceremony, Scot Fernandez awarded Dr. Stephen Bergen an Honorary Membership for his lengthy service to the ISCC Awards Committee. Steve houses the awards, prepares them for the recipients and sends them for presentation at the ceremonies. Steve's dedication to the task for many years has made it easy for the ISCC to execute our Awards Ceremonies year to year. Steve was very surprised to receive this honor!



Steve was very surprised to receive this honor!

## Finished but Not Forgotten!

Color, Light, and Appearance Week at NIST was a great success! We exceeded our goals in content, attendance, and activities. There were 75 attendees registered for the meetings.

The CIE Division 1 Meetings Monday and Tuesday were attended by 59 people from 18 different countries, with additional people calling-in to either technical committee meetings Monday or the main Division meeting Tuesday. Holding the Division 1 meetings here in the USA allowed much more North American participation. There were 27 attendees registered for the Division 1 meetings from the USA, and 3 from Canada. In addition to the activities of the 13 Technical Committees (TCs) on Monday, all Division 1 Technical Committees and Reporterships were reviewed at the Tuesday Division main meeting, and several new TCs or Reporterships were proposed relating to equivalent luminance, source whiteness metric, typical LED spectra, and metrics for consistent color appearance with different color gamuts, etc.

The Tuesday Evening Soiree, held at the Dogfish Head Alehouse and sponsored by Konica Minolta, Datacolor, and BYK Gardner, provided the attendees and their guests the opportunity to become acquainted with new colleagues in an informal setting for networking and discussion. This event set the stage for the ISCC's day on Wednesday.

The ISCC held two events Wednesday. First, covering most of the day was the Bridge Symposium with 14 papers presented in five different sessions: Computations, Color Appearance, Instrumental Assessment of Color Appearance, Color Render-

ing, and New Directions. Currently all the extended abstracts are posted on the ISCC website, and we are pleased to announce that shortly all the presentations will also be posted there. The second event was the ISCC Luncheon including the 2014 Annual Business and Awards Meeting. Elsewhere in this newsletter you can see pictures and read about Cameron Miller, who received the Nickerson Service Award and Stephen Bergen who became an Honorary Member of the ISCC.

The Thursday and Friday ASTM E-12 meetings also had increased attendance. The presence of more than the usual number of international E12 members provided a special time for discussing topics of common interest such as how to share information about standards from organizations around the world, and in particular with DIN in Germany. Several new projects were proposed and task groups were begun. Some examples include new fluorescence terminology, the use of uncertainty-based color tolerances in compliance statements, and new materials for possible use as standards for the measurement of appearance and color attributes. All left the week inspired by novel ideas and impressed with the exciting applications involving the use of color and light throughout the world.

NIST is always a special place to hold a meeting. The week's activities were further enriched by two opportunities for attendees to visit selected NIST laboratories and see the fine research that is being carried out related to Color and Lighting. We give a special thank you to our hosts, Maria Nadal, Cameron Miller and Yoshi Ohno, at NIST.

The intense week of color, technology, activities, and challenging discussions in both a conference and social setting was memorable for all those who participated from around the world. Although Color, Light and Appearance Week finished on Friday, June 20<sup>th</sup>, the week will not be forgotten in the minds of any of the attendees.

## Meet Your Fellow ISCC Members



Meet the Fehrmans (Cherie and Kenneth)

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*Meet Your Fellow ISCC Members continued*

Dr. Kenneth Fehrman and Cherie Fehrman are a husband and wife design team who have worked together for more than twenty-five years in the fields of Color Consulting and Interior Design. They have worked on both residential and commercial projects including residences, boutique hotels, educational facilities, medical facilities, and restaurants.

Kenneth earned his doctoral degree from the University of San Francisco, specializing in color and its effects. He is a Professor of Interior Design at San Francisco State University and has been a color consultant and interior designer for the past twenty-five years. He has also taught at the University of California, the Rudolph Schaeffer School of Design, San Francisco City College, and Canada College in the areas of graphic design, environmental design, textiles and aesthetics and fashion. Kenneth is a member of the International Interior Design Association (IIDA), the Interior Design Educators Council (IDEC) and the Inter-Society Color Council (ISCC).

Cherie is an interior designer, color consultant and writer. She is Kenneth's color research assistant and co-author. She has taught color and design courses at San Francisco State University, the Rudolph Schaeffer School of Design, and Western Design Institute. She also designs a line of pillows featuring antique textiles and a jewelry collection featuring antique stones and carvings. She is a member of the Inter-Society Color Council (ISCC) and The Authors Guild.

The Fehrmans founded PRISM (Photochromatic Research Institute for Science and Marketing) in 1990 to disseminate accurate information about color/light. Separately and together, they have written seven books and several hundred articles. Their books include *Color: The Secret Influence* (Prentice Hall 2000 & 2004) which is used as a text at major universities; *Postwar Interior Design 1945-1960* (Van Nostrand Reinhold); *Interior Design Innovators*, which is also used as a university text; and *Home Decorating Q & A* intended to provide some color and design help to consumers working on their own residential projects. Currently, they offer seminars on the effects of color/light to design professionals and the public.

In 2012, Cherie opened an e-Commerce site for her antiques, jewelry and pillow designs, *Elegant Artifacts* - [www.ElegantArtifacts.etsy.com](http://www.ElegantArtifacts.etsy.com). For additional information about the Fehrmans, you can visit their website - [www.ColorTheSecretInfluence.com](http://www.ColorTheSecretInfluence.com).

## Harry Krewson Hammond, III Obituary

### January 11, 1917 – May 29, 2014



Harry K. Hammond was born on January 11, 1917 in Mount Penn, Pennsylvania, a suburb of Reading. His parents were Mary Ellen Schoenburger Hammond and Harry K. Hammond, Jr. Harry's father was a long-time employee of the local electrical utility there. Harry grew up in Mount Penn and graduated in 1934 from Mount Penn High School, where he was known as "Einstein" by his classmates. He went on to Lehigh University, Bethlehem, PA, where in June 1938 he received a BS in Engineering Physics and a commission as a 2nd Lieutenant in the Infantry, US Army Reserve. In those days, it was possible to be an active reservist without going on active duty. Harry opted for this course of action, and went to work for the Bowers Battery Manufacturing, Co. and later the Pennsylvania Electric Co.'s meter department before he received in 1939 an appointment to the National Bureau of Standards (NBS) Photometry Section. At the NBS, then in Washington, DC, he worked on aircraft lighting problems primarily for the Bureau of Aeronautics, Navy Department. Harry realized nearly immediately that no one in the group had any actual flying experience, and so to understand the requirements for lighting on both planes and airports better, he took up pilot training at Congressional Field in Rockville, MD. In a year and a half he had a pilot's license.

Two months after Pearl Harbor, Harry was called to active duty with the Army Signal Corps at its radar training school and headquarters of the Army Air Corps at Fort Monmouth, NJ. There at a Saturday night dance at the Officer's Club, Harry

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*Harry K. Hammond, III Obituary continued*

met a young lady whose name was Pauline Mae Knott of Long Branch, NJ. He invited her the next day to take an airplane ride with him. As a private pilot, but a member of the military, he could borrow a plane from the Army. At 2000 feet the engine died, Pauline spotted the airfield and pointed it out to Harry, and Harry was able to make a dead stick landing. Pauline never forgot Harry. They were married on May 4, 1946 in the Presbyterian Church in Long Branch, NJ.

Harry meanwhile spent four years in England, France, and later in Germany with the US Army Signal Corps commanding groups whose duties were the maintenance, repair and distribution of AM and FM tactical radio receivers and transmitters, carrier telephone equipment and ultimately microwave radio links. All the time in Europe he was corresponding with Pauline.

In 1946 Harry returned to the Photometry Section of the NBS, and retained his position in the active Army Reserve from which he retired in 1966 as a Lieutenant Colonel. Harry retired from the Bureau in 1977. During this active employment at the Bureau, Harry participated in activities having mostly to do with object color and gloss evaluation for industries working with paint, plastics, rubber, paper, and textiles. Also during this time, he participated with organizations such as American Society for Testing and Materials (now ASTM International), Optical Society of America, Illuminating Engineering Society, Technical Association of the Pulp and Paper Industry, Inter-Society Color Council, and the CIE. In 1948 Harry was a founding member of ASTM Committee E12 on Color and Appearance. Probably the most forward thinking of the contributions he made to these organizations was his participation, with Pauline accompanying him, on a People-to-People Delegation from IES that went to China, October 25, 1984, for three weeks. In 1984 hardly anyone from the United States but government officials had been to China since the end of the Second World War about forty years earlier.

During this same period, after the Second World War, Harry and Pauline were fortunate enough to have two sons. H. Krewson Hammond, IV was born in 1947 and Leon Paul Hammond in 1952. Harry owned and played an electronic musical instrument, known as a theremin. The theremin was invented in 1920 in Russia and was marketed in the United States during the thirties and forties. Its distinguishing feature was that it was unnecessary to come into physical contact with the instrument to

play it. Rather the player waved his hands near each of two antennas. One controlled the volume and the other the pitch by inducing hand capacitance in the antenna. The inventor's name was Leon Theremin. While it is easy to imagine how Harry and Pauline arrived at the name for their first son, it is only a slight stretch to imagine how they arrived at the name for the second.

When Harry retired from the Bureau, he immediately joined Gardner Laboratory, then in Bethesda, MD. Harry remained with Gardner until well into his eighties, working fewer hours perhaps in the later years, but always representing their interests in societies and associations by travelling with Pauline to the trade group's meetings.

Throughout his life, Harry had interests outside of work in both social and religious activities. His involvement in Freemasonry dates back to at least 1947, when he was raised to the Sublime Degree of Master Mason in Chevy Chase Lodge. He was, for a number of years, a member of the Investment Committee for the Masonic and Eastern Star Home in Washington, DC. He was also active with his wife in Chevy Chase Chapter No. 39 of the Order of the Eastern Star (OES), and was a member of the Scottish Rite. At the time of his death he was the oldest member of Hiram Takoma Lodge No. 10.

When he and Pauline purchased a house in Chevy Chase, MD in 1951, they became members of the Chevy Chase Presbyterian Church, where Harry served as a deacon. In 1965 he and Pauline joined the Fourth Presbyterian Church in Bethesda, Maryland, where he served as a deacon and of which he was a member at the time of his death.

Harry, who was predeceased by Pauline, passed away on May 29, 2014 at the age of 97.

*Jack Ladson, Color Science Consultancy*

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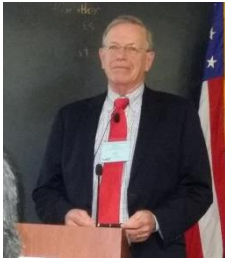
## AIC 2014 Interim Meeting Update



Don't miss this opportunity to register for this meeting on Colors, culture and identity: past, present and future from October 21-24 in Oaxaca, Mexico. For more details, please visit [www.aic2014.org](http://www.aic2014.org).

## Speakers for ISCC Bridge Symposium – June 18, 2014

### Computations



**Jack Ladson et al.**  
Evaluating Spectrophotometric  
Uncertainty

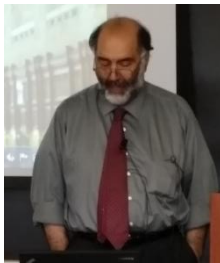


**Changjun Li et al.**  
Toward a Unified Method for  
Computing Tristimulus Values



**Jan Henrik Wold et al.**  
Age- and Field-Size-Parameterized  
Calculations of Physiologically Signif-  
icant XYZ Colour-Matching Functions

### Color Appearance



**Mojtaba Navvab**  
Virtual Reality as a Surrogate  
Sensory Environment for Evalu-  
ation of Human Luminous Envi-  
ronment

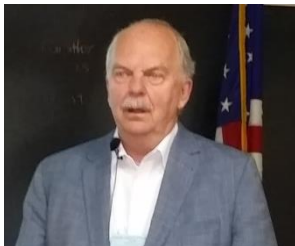


**Sophie Jost**  
Review on One Aspect of Colour  
Quality: Visual Appreciation



**Robert C. Carter**  
Slope of the Self-Luminous Gray  
Scale: Independent Converging Evi-  
dence

### Instrumental Assessment of Color Appearance



**Walter Franz**  
How to Control Color appear-  
ance Within the Interior Auto-  
motive Supply Chain

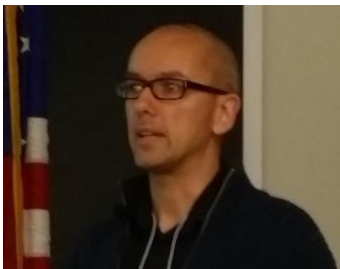


**Larry Steenhoek**  
Specification of Gonioapparent  
Color and Appearance



**Gaël Obien**  
XDReflect, a European Joint  
Research Project Devoted to the  
Metrology of the Appearance of  
Surfaces

### Color Rendering



**Kevin Smet et al.**  
Chromaticity of White



**Lorne Whitehead**  
Assessing Color Rendering  
Without Test Samples



**János Schanda**  
Color Rendering and Museum Lighting:  
Field Study Based on Refurbishing the  
Lighting of the Sistine Chapel

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## Metameric Blacks: A Color Curious Column

Ever wonder ... "How do fireworks make light and color?"

First, light and color are not two separate things. All light produces some color perception. So light and color in fireworks are made exactly the same way. There are two sources of light in fireworks. The first is simple incandescence, or light and color that is produced just because material is heated to very high temperatures. This can be considered the "fire" in fireworks. Just like a campfire emits light with yellow, orange, and red colors simply due to the high temperature of the material being burned, fireworks can produce similar colors due to the very hot explosion and burning of the explosive charge. These reds, oranges, yellows, and whites due to incandescence are the dominant colors in most fireworks even though they are often the colors we pay least attention to.

You might wonder what the pictured neon signs have to do with fireworks. Neon lights produce their color by having gases in the tubes excited by electrical energy. Once the gas atoms or molecules are excited, they release that energy as very specific colors of light. Pure neon produces glowing orange or red signs. Other gases such as argon, helium, krypton, and xenon can be used alone, in combination with each other, or in combination with other gases to produce differently colored "neon" signs.



Some tubes are also coated with phosphors that absorb energy of one type and emit different colors; this is also how fluorescent lights work. Fireworks also produce various colors by using the incandescent energy from the explosion (the fire part of the fireworks) to excite various atoms or molecules that, in turn, emit various colors when they release that energy.

A variety of atoms and molecules are used to produce colors in fireworks. Some examples include sodium for yellow, calcium chloride for orange, strontium chloride for red, barium chloride for

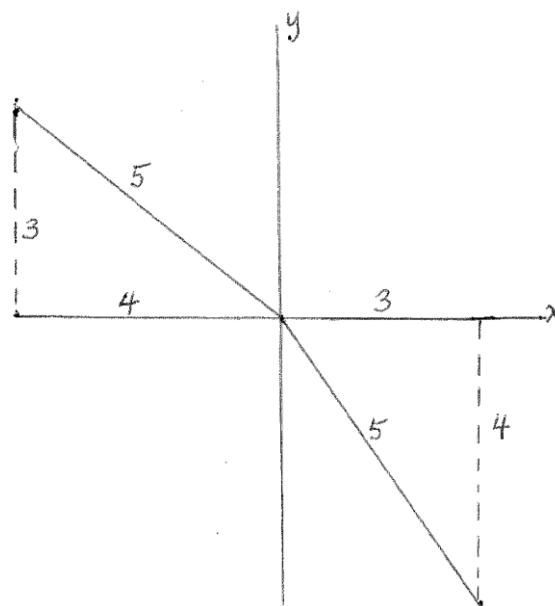
green, and copper chloride for blue. Think about all these atoms and molecules being heated up by incandescent explosions and then emitting their beautiful colors next time you see a fireworks display!

Content of this column is derived from The Color Curiosity Shop, an interactive website, also available as both English-language and Spanish-language books, allowing curious students from preschool to grad-school to explore color and perhaps become interested in pursuing a science education along the way. Please send any comments or suggestions on either the column or the webpage to me at <mark.fairchild@rit.edu> or use the feedback form at <whyiscolor.org>. This specific topic can be found at <<http://whyiscolor.org/Questions/1-5.html>>.

Mark D. Fairchild

Rochester Institute of Technology

### Puzzle: Media Madness



In the figure above, the horizontal line  $x$  is the boundary between two media. The vertical line  $y$  is perpendicular to  $x$ . The diagonal lines form a light path refracting from one medium to the other. The  $x$  and  $y$  relative lengths along the ray path make 3-4-5 right triangles, as indicated. The light's wavelength is 589nm, the temperature is 20C, the relation is good to 3 decimal places.

Name the media! (Answer in next issue)

## HUE ANGLES

(Send contributions to [mbrill@datacolor.com](mailto:mbrill@datacolor.com) and see <http://hueangles.blogspot.com> )

### Battle of the senses

Rolf Kuehni just alerted me to an article in *Science* [1] that says we perceive a trillion different odors. To compute such a limit, one must count just-noticeable differences (JNDs) within a physically constrained stimulus space, as is familiar for color discrimination. This led me to ask two questions. First, how does this number compare with the number of distinct odors sensed by, say, a grizzly bear, whose sense of smell is said to be 100,000 times that of humans [2]? Secondly, how does this number compare with the number of colors sensed by a human being?



<http://www.animalstown.com/animals/g/grizzly-bear/wallpapers/grizzly-bear-wallpaper-02.php>

I'll attempt to answer the second of these questions first. Since most of us consider vision to be our primary sense, the comparison with olfaction is distressing, and perhaps a bit controversial. Despite the fact that some display mavens say we see 16 million colors (on the basis of eight bits times three channels of color), cynics add "most of which are black." The problem of counting discriminable object colors is a bit tricky, as many have noted. In general one counts colors by finding a perceptually uniform color space, delimiting the object-color solid in this space, and finding the volume of the object-color solid as the number of 1-JND cubes that can be packed therein. One number that seems to bear some authority is 2 million colors [3], but note that even the title of the article [3] attests to the trickiness of the assessment. For one thing the assessment is done in CIECAM02 space, which is arguably not perceptually uniform.

The number 2 million is paltry compared with a trillion, so either we are under-using our noses or we are counting wrong. I subscribe to the latter idea. When comparing the senses, you have to make sure you are counting the same kind of thing. For one thing we have binocular vision, but when you denote a trillion odors, you haven't got other odor sensors that give you other dimensions (such as, say, two noses that give "bi-nasal olfaction"). More importantly, spatial vision has no counterpart in olfaction. So to be fairer to vision, you have to multiply the number of object colors (say 2 million) by the number of LMS cone triplets, which is about 2 million [4]. This may give too much advantage to vision, because the number of fibers in the optic nerve is only about 1 million [5], which reduces the spatial address number to only about 300,000. Assuming each of these spatial addresses sees 2 million possible colors, the estimated total number of visual inputs is 600 billion---comparable to olfaction, but not exceeding it.

It appears that vision loses to olfaction by more than just "a nose". And (returning to the first question) beware of the grizzly bear.

#### References:

1. Bushdid, C, Magnasco, MO, Vosshall, LB, Keller, A. Humans can discriminate more than 1 trillion olfactory stimuli. *Science* 21, 343, 6177 pp 1370-72 (March 21, 2014).
2. <http://www.grizzlybay.org/LearnMore/GrizzlyBearNose/GrizzlyBearNose.htm>, accessed 27 Jun 2014.
3. Masaoka, K, Berns, RS, Fairchild, MD, Abed, FM. Number of discernible object colors is a conundrum. *Journal of the Optical Society A* 30 (2) 264-277 (2013).
4. <http://www.wdv.com/Various/Eye/EyeBandwidth/index.html>, accessed 27 Jun 2014.
5. <http://faculty.washington.edu/chudler/facts.html#sensory>, accessed 27 Jun 2014.

Michael H. Brill  
*Datacolor*



## IN THIS ISSUE, August 2014

We open this issue with an article by Roy S. Berns, in which he introduces three new terms to enhance our communications of color changes using the CIELAB color space. Early after the adoption of rectangular coordinate system  $L^*$ ,  $a^*$ , and  $b^*$ , CIELAB in 1976, the cylindrical system using  $L^*$ ,  $C^*_{ab}$  and  $h_{ab}$ , was also adopted. These variables, while based on the same CIELAB color space, related more directly to common ideas of lightness, chroma, and hue. Now Prof. Berns suggests two additional coordinates: vividness and depth, that more directly describe color changes that occur in both lightness and chroma. He adds an additional dimension, clarity, to describe the effect of a color change as related to its background. The article, “Vividness,  $V^*_{ab}$ , Depth,  $D^*_{ab}$ , and Clarity,  $T^*_{ab}$  provides the mathematical expressions for these new terms as well as visualizations to demonstrate how changes in these variables led to color changes more representative of our daily experiences .

Our next article, “Color reproduction of authentic luminescent backlit transmissive color images”, aims at producing faithful full color images under luminescent backlighting. Luminescent backlit color images are used as high anti-counterfeiting security to verify the authenticity of documents because they are not easily reproduced. The authors, Julien Andres and Roger David Hersch, propose a new approach for creating color halftone images to be viewed under UV excitation light that incorporates printing an invisible luminescent white emissive ink layer on the back side of a transmissive substrate and a classical *cmy* image on the front side of the substrate.

While we are talking about the color we see, let us take a step back to see colors at a distance. Although we are not usually aware of it, the scattering and absorption of the atmosphere affects the colors we see. Raul Luzon, Sergio M.C. Nascimento, Osamu Masuda, and Javier Romero discuss the “Chromatic losses in natural scenes with viewing distance.” Based on their study of color changes in real atmospheres, they propose simple exponential models to determine the chromatic loss that then can be applied to make realistic visual simulations, such as those used when training pilots.

Our next article reports on a series of studies in-

vestigating whether the presence of a familiar object in a scene helps the visual system stabilize the color appearance of other objects with respect to changes in illumination. In natural daylight, the actual spectrum of light is ever changing. Yet our perception of the color of objects stays fairly constant. The degree to which an object color percept is relatively stable across changes of illumination is called color constancy. Yet in their studies, Erika Kanematsu and David Brainard found very little or “No Effect of Familiar Contextual Object on Color Constancy,” although it might reasonably have been hypothesized to have an effect.

Next we have a two part series on “Use of Basic Color Terms by red-green dichromats” by the same four authors. Julio Lillo is the first author of “Part 1. General description,” and he is joined by Humberto Moreira, Leticia Álvaro, and Ian Davies. Humberto Moreira leads “Part 2. Models.” Part 1 describes a study involving trichromats, protanopes, and deuteranopes, which revealed that dichromats differ from trichromats in the number and nature of the dimensions needed for describing the basic color terms. In Part 2, two alternative models of the mechanisms underlying the use of Basic Color Terms are described and compared. This series of articles provides a comprehensive and detailed overview of how R-G dichromats use basic color terms to categorize surface colors. The results can integrate some of the results of and explain some of the conclusions obtained in earlier research.

Last December Part 7 of the series “Experimental determination of laws of color harmony” was published. Now Professors Antal Nemcsics and Jenő Takács are presenting “Part 8: Harmony content versus relative surface coverage.” Whether a color composition appears harmonious to an observer depends not only on the colors included in the composition, but also on the relative amounts of the different colors. Previous research on this topic has been based on two different principles: color vision mechanisms and analysis of coverage area of the different colors in the composition. In this article, harmony based on the relative surface area was studied. Nemcsics and Takács found that the primary factor in the measure of harmony content is the relative surface coverage of the highly saturated colors present.

Moving on to the field of architecture, Juan Serra discusses the “Color Composition Features in Postmodern Architecture.” Following the formal classification developed by JA. Ramírez, Dr. Serra

*continued on next page*



*CR&A In This Issue August 2014 continued*

discusses four trends: 1) the new utopias of the 1960s, 2) the neo-illuminist rationalism of the 1970s, 3) 1980's figurative postmodernity, and 4) deconstructivism in the 1990s. For each of these trends, he examines the color composition features and analyzes a case study building. Then he reflects on how these influences lead us to the contemporary colored architecture.

In the modern world, increasingly enjoying music can be a personal event listening with earphones, rather than the communal event at a concert. Music evokes different moods, and different colors can be associated with different moods. Chang Bae Moon, HyunSoo Kim, Hyun Ah Lee, and Byeong Man Kim explain that listening to music with colored illumination can provide a deeper appreciation of the music than listening without the added color experience, but there are questions. How does one choose the illuminating color? Do different listeners agree with the mood and color evoked by the musical piece? And does this depend on the listener's preference for that musical genre? In our concluding article the authors above discuss their study "Analyzing relation between mood and color for different musical preference."

We also have two book reviews plus some publications briefly mentioned in this issue. In the review entitled "When Color Meets Computer Vision, Alessandro Rizzi reviews the book *Color in Computer Vision: Fundamentals and Applications* by Theo Gevers, Arjan Gijsenij, Joost van de Weijer, and Jan-Mark Geusebroek. Then *Value Metrics for Better Lighting* by Mark S.Rea is reviewed by János Schanda. The publications are: ISO/CIE 11664-6:2014 Colorimetry – Part 6 CIEDE2000; CIE 207:2014 The Effect of Spectral Power Distribution on Lighting for Urban and Pedestrian Areas; and CIE 207:2014 Sensitivity of Human Skin to Ultra-violet Radiation.

Ellen Carter  
Editor, *Color Research and Application*

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## Problems with Yahoo Mail!

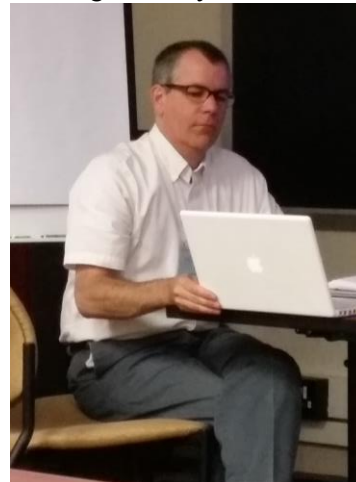
If there are any ISCC members who have yahoo as their mail provider or have yahoo power their mail provider (such as frontiernet.net), those members will have difficulties receiving ISCC News electronically or any other electronic messages that ISCC sends to the general membership. Electronic messages from the service that ISCC uses, including

the Newsletter, will get **blocked** to any email address that contains yahoo.com or is powered by yahoo.com, like frontiernet.net. One possible solution to this problem is to whitelist [isccoffice@iscc.org](mailto:isccoffice@iscc.org). If whitelisting does not work or you know of anyone who has been having troubles receiving the Newsletter electronically, please contact our President-Elect, John Conant, at [jconant@aerodyne.com](mailto:jconant@aerodyne.com) or by phone at 978-663-9500. Thank you!

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## Online Meeting Experiment

Technology has opened up new possibilities for the professional interactions the ISCC relies upon. There are a variety of online meeting approaches available that permit the sharing of conference audio and video across the internet to any number of remote sites. During the ISCC Bridge Symposium at NIST on June 18, we tried one such option, sharing speaker and audience audio as well as the presentation slides. Two online participants attended the meeting virtually from their offices.



*Dave Wyble implementing online meeting test*

The technology relies on a *smart* conference room in which the various audio and video components are routed through a local computer and then relayed to the remote participants via the website of a paid service. (In June we used a free trial.) Participants

with limited network bandwidth can use a telephone for audio and the website for presentation slides. There are many options and different services, but most look to be adequate for a typical ISCC meeting.

In general the participants were satisfied with the service. They were able to see and hear the presentations well, and saved the cost and time of travel. They also have some freedom to come and go during the day, much like those attending the meeting in person. However, there are aspects of the meeting that are not captured in this process, such as useful (but informal) discussions during breaks, meals, and evenings.

We would welcome your opinion on how you see these technologies playing out for future ISCC

*continued on next page*

*Online Meeting Experiment continued*

meetings. What is such a service worth? Is the trade-off between travel time and cost worth the loss in the personal interactions? What participants does this bring to a meeting that would never otherwise get the opportunity to attend? If you have any feedback on these issues, please contact the following members of the Social Media Committee: Dave Wyble at [drwyble@gmail.com](mailto:drwyble@gmail.com) or the Chair, John Conant, at [jconant@aerodyne.com](mailto:jconant@aerodyne.com). We appreciate your help as the ISCC explores this and other options as we move the organization forward into the 21<sup>st</sup> century.

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### Call for Nominations for the 2014 ISCC Macbeth Award

The Macbeth Award was established by Mr. Norman Macbeth, Jr. in honor of the memory of his father, Mr. Norman Macbeth. The award is usually, but not necessarily, presented biennially in even-numbered years, when deserving candidates have been nominated.

The Macbeth Award is given for one or more **recent** outstanding contributions in the field of color. **It is to be presented to a member, or former member, of the Council.** The contributions shall have advanced the field of color, interpreted broadly as in the objectives of the Council as defined in Article II of the Constitution. The merit of a candidate shall be judged by his or her **recent** contributions to any of the fields of interest related to color whether or not it is represented by a Member-Body. The **recent** contribution to color may be direct, it may be in the active practical stimulation of the application of color, or it may be an outstanding dissemination of knowledge of color by writing or lecturing. **The candidates for the Macbeth Award need not have been active in the affairs of the Council.**

Nominations should include the following information:

1. The name and full address of the nominee.
2. A sentence or two giving the specific reason for the award's bestowal. This will normally form the basis for the citation presented to the successful nominee.
3. A narrative (up to one-page) of the nominee's contribution and its significance.
4. A curriculum vitae or the nominee, as well as any other material deemed useful.
5. The name of the person or Member Body or Award Committee who prepared the nomination with appropriate contact information.

*Note: Confidentiality of the nomination is of the utmost importance. The nominating individual/group must ensure that the nomination is not disclosed to the proposed nominee. If any of the above information cannot be obtained without risking disclosure, then the information should be omitted from the nominating letter.*

Nominations should be submitted using the form found at <http://www.iscc.org/UniversalNominationForm.pdf>. This form can be filled out, scanned and emailed to [isccoffice@iscc.org](mailto:isccoffice@iscc.org) or printed, completed and sent to:  
ISCC Secretary  
7820B Wormans Mill Rd. Suite #115  
Frederick, MD 21701

**The deadline for receipt of nominations is September 15, 2014.**

**Note: Nominations received after September 15, 2014 will be retained for future consideration.**

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### Rolling Nominations for all ISCC Awards

As most of you know, ISCC has three significant awards that are given out to deserving recipients. The Nickerson Service Award is presented as the occasion arises for outstanding, long-term contributions towards the advancement of the Council and its aims and purposes. The most recent recipient of the Nickerson Service Award was Cameron Miller in 2014 (see page 4 of this newsletter). The Macbeth Award is described in detail in the left column of this page. The last recipient of the Macbeth Award was Joanne Zwinkels in 2010. The Godlove Award is the most prestigious award bestowed by ISCC because it honors long-term contributions in the field of color. The award is usually, but not necessarily, presented biennially in odd-numbered years, when deserving candidates have been nominated. The last recipient of the Godlove Award was Joy Turner Luke in 2013. For a more detailed description of all awards and a listing of past recipients, please visit

<http://www.iscc.org/functions/awards.php>.

Each Award has an Award Committee associated with it. Each Award Committee convenes when nominations of deserving candidates are received.

The Board of Directors has gone to a rolling submission process for all Awards. This means that Award Committees are always receiving nominations. Each selection process will then be based on the nominations in hand at the appropriate time when each committee convenes. To accommodate

*continued on next page*

*Rolling Nominations for Awards continued*

the rolling submission process, there is one common nomination form for all Awards. It can be found at <http://www.iscc.org/UniversalNominationForm.pdf>. Instructions for filling out the form and submitting it are clearly outlined on the form.

Please consider submitting a nomination for any Award based on the candidate's qualifications.

## **ISCC 2<sup>nd</sup> Teleconference Meeting – Wednesday October 22, 2014**

After the success of our first teleconference meeting in 2013, the ISCC Board of Directors decided to hold a second one. Please mark your calendars. It will take place on October 22, 2014 from 2-3PM EST.

Our first teleconference meeting marked a significant change in our dues structure and the formation of a Social Media Committee. Individual member dues were reduced in 2014 and Member Bodies are no longer required to pay any dues meaning they no longer have voting rights. This dues change recognizes that we are now more an organization of active individual members than Member Bodies. The ISCC continues to support the activities of our Member Bodies through publicizing meetings and other activities like co-location of meetings. In addition, we hope that Member Bodies with share information pertaining to ISCC with their members. The Social Media Committee is chaired by our President-Elect, John Conant. It is responsible for making all newsletters from the first through those of 2013 available on our website. The idea of piloting remote access to our NIST ISCC Bridge Symposium using GoToMeeting was made possible by members of this important committee. Future plans of this committee include making an electronic directory available to all members, completing a Wikipedia page on ISCC, and forming a Members-only section of [iscc.org](http://iscc.org). If you are interested in the work of the Social Media Committee, please contact John Conant at [jconant@aerodyne.com](mailto:jconant@aerodyne.com).

There were many other suggestions that resulted from that first meeting that we did not have a chance to explore. The development of a code of conduct at meetings and in forums was mentioned for consideration. Also the idea of giving other awards for such things as leadership within the organization was discussed. The two biggest items that were left open were:

1. Can the ISCC still cover such a wide group of interests – art, science, industry, education or should it narrow its focus?

2. Are the aims, as outlined in our By-Laws, still appropriate?

Here is a reminder of what the aims and purposes of the ISCC are:

The council shall operate solely and exclusively as a non-profit organization with the aims and purposes:

- To stimulate and coordinate the work being done by the various members leading to the description and specification of color by those members.
- To promote the practical application of this work to the color problems arising in science, art, history, and industry, for the benefit of the public at large.
- To promote communications between technically oriented specialists in color and creative workers in art, design, and education, so as to facilitate more effective use of color by the public through dissemination of information about color in both scientific and artistic applications.
- To promote educational activities and the interchange of ideas on the subject of color and appearance among its members and the public generally.
- To cooperate with other organizations, both public and private, to accomplish these objectives for the direct and indirect enjoyment and benefit of the public at large.

Besides discussing the initiatives of the Social Media Committee, our second teleconference will hold an open forum to discuss these two questions leftover from our first virtual meeting. Please consider joining us so that your voice can be heard.

A complete agenda and call-in information will be distributed to members via email. Call-in details will also be available on our office phone (866-876-4816) after October 1, 2014.

If you have any questions regarding our second virtual meeting, please email them to [isccoffice@iscc.org](mailto:isccoffice@iscc.org) or call 866-876-4816 and someone will help you.

The ISCC can be shaped by you, the members. Now is your time to help define how the ISCC can best function in 2014 and beyond.

*Paula J. Alessi*  
*BoD member, Newsletter Editor*



## Speakers for ISCC Bridge Symposium – June 18, 2014 (continued)

### New Directions



**Jim Leland et al.**  
Toward a Unified Nomenclature  
in Fluorescence Spectropho-  
tometry



**Hong Wei et al.**  
Evaluation of Targets for Color  
Calibrating Digital Color Imag-  
es from Optical Bright-Field  
Transmission Microscope

### Calendar

- Aug 8-9** ACM Symposium on Applied Perception , Vancouver, Canada, <http://sap2014.cs.mtu.edu>
- Aug 22-24** Center for Visual Science's 29<sup>th</sup> Symposium: Engineering the Eye IV: Restoring Vision, University of Rochester, Rochester, NY, <http://www.cvs.rochester.edu/symposium/index.html>
- Aug 23-24** 2<sup>nd</sup> Visual Science of Art Conference (VSAC), Belgrade, Serbia, <http://ecvp2014.org/vsac/>
- Aug 24-28** ECVP 2014 Symposia, Belgrade, Serbia, <http://ecvp2014.org>
- Sep 7-11** IS&T NIP30, Sheraton Philadelphia Downtown, Philadelphia, PA, [www.NIP\\_DF@imaging.org](http://www.NIP_DF@imaging.org)
- Sep 11-12** X Conferenza del Colore, Università di Genova, Genoa, Italy, <http://www.gruppodelcolore.it>
- Sep 14-16** SPE CAD RETEC 2014 Conference, New Orleans Marriott, New Orleans, LA  
<http://www.specad.org>
- Oct 2-4** SCAD Annual Session of the Society for Color and Appearance in Dentistry, Chicago, IL,  
<http://www.scadent.org/events/Chicago-2014>
- Oct 10-12** 2014 OSA Vision Meeting, Philadelphia, PA, <http://www.osavisionmeeting.org/2014/conf>
- Oct 21-24** AIC Interim Meeting, The Color and The Culture, Hotel Misión de los Ángeles, Oaxaca, Mexico, [www.aic2014.org](http://www.aic2014.org)
- Nov 2-4** 2014 IES Annual Conference Art Science and Practice of Illumination, Pittsburgh, PA,  
<http://www.ies.org/ac>
- Nov 3-7** IS&T Color and Imaging Conference, Boston, MA, <http://www.imaging.org/ist/conferences/cic>
- Nov 20** 22<sup>nd</sup> Annual Workshop on Object Perception, Attention, and Memory, Hyatt Regency, Long Beach, CA, <http://www.opam.net/>
- 2015**
- Jan 28-29** ASTM E12 Color and Appearance, Sheraton, New Orleans, LA
- Feb 8-12** SPIE/IS&T Electronic Imaging Symposium, San Francisco, CA, <http://spie.org/electronic-imaging.xml>
- Feb 9-12** Human, Vision, and Electronic Imaging Conference: Research at the Intersection between Perception/Cognition, Imaging Technologies, and Art, San Francisco Union Square Hilton,  
<http://hvei.eecs.northwestern.edu/>
- Mar 24-26** AATCC International Conference, Hilton Desoto, Savannah, GA,  
[http://www.aatcc.org/ic/gen\\_info2015.cfm](http://www.aatcc.org/ic/gen_info2015.cfm)
- May 19-22** AIC Midterm Meeting Color and Image, Toyko, Japan, [www.aic2015.org](http://www.aic2015.org)
- Jun 24-25** ASTM E12 Color and Appearance, Harbor Beach Marriott, Ft. Lauderdale, FL (D2)
- Jun 28-Jul 3** 28<sup>th</sup> Session of the CIE, 2015, Manchester, UK, [website coming soon](#)
- Sep 9-11** The Eye, The Brain, & The Auto International Conference, Dearborn, MI, Info: Carolyn Barth, [clbarth@dioeyes.org](mailto:clbarth@dioeyes.org)
- Oct 4-6** SPE/CAD RETEC, Show Your Colors, Westin Hotel, Indianapolis, IN, Info: Betty Puckerin, [betty.puckerin@ampacet.com](mailto:betty.puckerin@ampacet.com)
- 2016**
- Jan 27-28** ASTM E12 Color and Appearance, Grand Hyatt, San Antonio, TX
- Oct 18-22** AIC Interim Meeting Color in Urban Life, Santiago Chile, [www.aic2016.org](http://www.aic2016.org)

### ISCC 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	www.avianttechnologies.com	603-526-2420
Datacolor	www.datacolor.com	609-895-7432
Hallmark	www.hallmark.com	816-274-5111
Hunter Associates Laboratory, Inc.	www.hunterlab.com	703-471-6870

#### We could still use your help!

ISCC has positions in the organization that need filling including Directors and others. We can help identify a place for you depending on your skills and desires. Contact Nomination Chair Frank O'Donnell, fxodonnell@sherwin.com

#### ISCC News Issue #467, Summer 2014

**Editor: Paula J. Alessi**

(585)225-4614 [geinhaus@frontiernet.net](mailto:geinhaus@frontiernet.net)

**Editor Emeritus: Prof. Gultekin Celikiz**

(215)836-5729 [gcelikiz@yahoo.com](mailto:gcelikiz@yahoo.com)

### ISCC Member Bodies

*At its foundation, the ISCC is composed of many related societies. These societies, our Member Bodies, help the ISCC through small annual dues as well as maintaining a relationship with each organization's individual members. We frequently hold joint meetings to further the technical cross-pollination between the organizations.*

*If you belong to one of our member body organizations, we encourage you to work with ISCC and your society to further the connection. Contacting the ISCC President is a good place to start. If your organization is not on this list and you think it should be, the ISCC office can provide you with details about membership.*

*Or use our new online application: [www.iscc.org/applicationForm.php](http://www.iscc.org/applicationForm.php)*

American Association of Textile Chemists and Colorists (AATCC)  
 American Society for Testing and Materials International (ASTM)  
 American Society for Photogrammetry & Remote Sensing (ASPRS)  
 The Color Association of the United States, Inc. (CAUS)  
 Color Marketing Group (CMG)  
 Color Pigments Manufacturing Association (CPMA)  
 Council on Optical Radiation Measurements (CORM)  
 Detroit Colour Council (DCC)  
 Gemological Institute of America (GIA)  
 Illumination Engineering Society of North America (IESNA)  
 International Color Consortium (ICC)  
 National Association of Printing Ink Manufacturers (NAPIM)  
 Optical Society of America (OSA)  
 The Society for Color and Appearance in Dentistry (SCAD)  
 Society for Information Display (SID)  
 Society for Imaging Science and Technology (IS&T)  
 Society of Plastics Engineers Color and Appearance Division (SPE/CAD)