Inter-Society Color Council *News*

Issue 463 Summer 2013

Board of Directors Corner

The Board of Directors decided to try a new feature in the ISCC News, The BOD Corner, to keep members informed about special items. Each issue you will hear from different BOD members. I, Ellen Carter, wanted to present the first column. The past couple of months have been a busy time in the color world and within the ISCC. I would like to highlight five items for you. All of them have additional details later in this issue.

Following up on the announcement in the last issue of the ISCC News, Joy Turner Luke did receive the Godlove Award during the ASTM meeting at NIST in June. As you know ASTM E-12 on Color and Appearance is a long-term member body of the ISCC. I had the honor to read the citation, which was written by Ann Laidlaw, and then to present the award to Joy during the E-12 meeting. All three delegates from ASTM E12 to the ISCC joined in the presentation. After the meeting several members of the ISCC and ASTM joined Terry Godlove, Jr. and Joy Luke for a celebratory dinner. We were delighted that members of Joy's family and Terry's family were also able to attend the dinner. Please read the citation and enjoy the pictures included in this issue.

In July the AIC Quadrennial Congress was held in Gateshead, United Kingdom with over 500 attendees from all over our colorful world. During the conference Roy Berns received the AIC's Deane B. Judd Award. Paula Alessi, one of ISCC's past presidents, gave the citation. Please see more about the AIC and Judd award from Paula later in this issue.

Dave Wyble, who officially became Editor of the ISCC News in January of 2012, but had been helping with the publication of the new letter long before that, has decided it is time to retire from the Editorship. The ISCC BOD hopes you all will join us in thanking Dave for the great job he has done with the ISCC News. We also hope you will welcome Paula Alessi, who has agreed to become Interim Editor of the ISCC News and is putting out this, her first issue, with guidance from Dave. Thank you, Paula.

This year the BOD has decided to try something new for our Annual Business Meeting. We are going electronic. It is scheduled on Monday October 21st as a teleconference so that members can attend without the need to travel. Please see the announcement with the call-in directions in this newsletter.

Finally, mark your calendars because plans are well underway for Color, Light and Appearance Week at NIST, in Gaithersburg, Maryland, June 16-20, 2014. The ISCC has invited CIE Division 1 on Color and Vision to hold their meetings on June 16 and 17. Then ISCC will have a bridge conference on Wednesday June 18th, followed by ASTM E12 meetings June 19- 20th. It should be a great time to get together with international associates interested in design, production, and appearance issues of color and lighting and their standardization. More information will follow in future newsletters. If you are interested in submitting a paper for the bridge session you can contact Michael Brill MBrill@datacolor.com.

Ellen Carter, *BOD Member*

Editor, Color Research & Application

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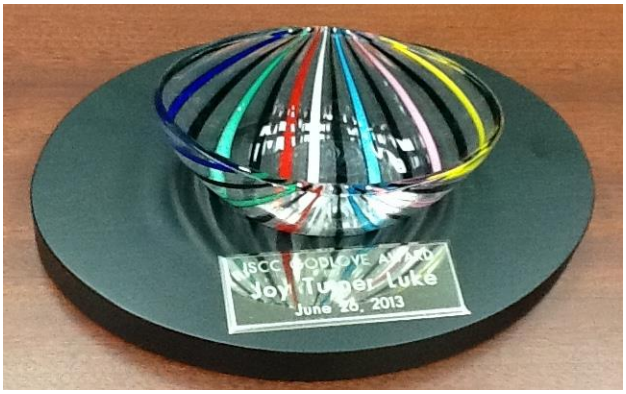
The ISCC Godlove Award Citation for Joy Turner Luke

The Godlove Award is the most prestigious award bestowed by the Inter-Society Color Council (ISCC) to honor long-term contributions in the field of color. This year the honor will go to Joy Turner Luke.



Working as an artist for over 50 years, she has participated in many exhibitions, and taught color in composition and design classes. She has authored books and articles, created software, participated in technical committees, and juried exhibitions.

Joy's career uniquely exemplifies the complementary disciplines of the ISCC. She has worked as an artist and teacher, she led work regarding the safety of artists' materials, and she has participated in research into fundamental aspects of human color vision. During the course of her lengthy and active career, Joy shared her expertise in both creative and technical aspects of color with colleagues, students, and industry. She studied at the Newman Art School, American University, Rollins College, and Southern Methodist University. She attended color science educational events at and became a trustee of the Munsell Color Foundation and an advisor to the Munsell Color Science Laboratory at the Rochester Institute of Technology.

Joy's contributions to color education are enduring. She wrote and illustrated "The Munsell Color System, A Language for Color" published by Fairchild Publications. She presented multiple invited papers at the ISCC Williamsburg Conferences and ISCC Annual Meetings, and for ten years launched the Clemson

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Godlove Citation continued

University Color Measurement Conference for the textile industry with the presentation "Color and Light: Fickle Friends", a interactive demonstration on color perception. Joy and Stephen Luke created Color Cleaver, a color software application to map colors in the Uniform Color Scales of the Optical Society of America, and to create visually harmonious bridges between different colors. The software makes the visually-uniform, three-dimensional space useful for artists, as well as the scientists for whom it was designed.

The ISCC benefited tremendously from Joy's passion and talent. She served as ISCC President from 1988 to 1990, and chaired ISCC Project Committee 37 "Artists' Materials" from its inception in 1976 to 1981 and again from 1989 until its completion 1991, as well as contributing to many other project committees. She uniquely bridged the disciplines of technical research, practical application, and aesthetics of color. Her historical knowledge of the work by Dorothy Nickerson, David MacAdam, and Albert Munsell is a terrific resource for ISCC members and others.

The ISCC and the larger community of color scientists and artists have been enriched by the breadth and depth of the work of Joy Turner Luke. It has been my pleasure to know Joy since 1988, when she recruited me to join in the ISCC's work. I've visited her home and studio, and been amazed at her projects, archives, and diverse research interests. I'm honored to participate in Joy's citation, and very sorry that I cannot celebrate the occasion in person at the meeting of ASTM E12, one of ISCC's member bodies, at NIST on June 26th, 2013. This location is especially fitting because of Joy's continuing long-time activity in both the ISCC and ASTM International. Congratulations, Joy, and thank you sharing your extraordinary career with the ISCC.

Ann Campbell Laidlaw, *ISCC Secretary*
RoLyn Group

New Email Distribution List for Communication to Members

The ISCC Board of Directors has set up an email distribution list for communications to our members. This list will allow us to send out announcements and also newsletters more easily and cheaply to those who do not opt for a printed copy. Members for whom we have an email address on file should have already received an introductory email from us. That message allows you to verify that you wish to receive messages from us, or to unsubscribe. If you wish to change the email address which we use to reach you, or if you did not receive our invitation, please send your desired address to isccoffice@iscc.org. Note that we will continue to send paper mailings to those who prefer to not utilize email.
John Conant, Aerodyne Research, Inc.

Thank you, John, for setting this up!

AIC News

Congratulations to Nancy Kwallek! She was elected to serve on the AIC Executive Committee from January 2014 - December 2015. She will be representing ISCC throughout her two years of service.

SAVE THE DATE!

ISCC Annual Business Meeting – Teleconference-Monday, October 21 from 2-3 PM EST. See page 6 for details!

The 2013 AIC Deane B. Judd Award Citation for Roy S. Berns

I am incredibly humbled and honored to be giving this citation for Dr. Roy S. Berns as he receives the 2013 AIC Deane B. Judd Award. My dear friend Roy, thank you so much from the bottom of my heart for bestowing this honor upon me.

When I was first asked to do this, I was struck with both excitement and fear. Excitement because in all my years of association with AIC, I have been involved in many Judd Award ceremonies serving many different capacities, but this one is the most special. I am excited beyond belief to be giving the citation for my best friend in the international color science world. I am scared out of my mind because I am afraid that I might get a little too carried away. So please allow me to put my fears aside as I tell you about my very good friend, Roy with the greatest sense of pride while we follow his journey from color science PhD to multi-faceted color science scholar and expert in 2013 as he receives this Award.

First it is important to remember that the AIC Deane B. Judd Award is to recognize work of international importance in the fields of color perception, color measurement, and/or color technology. The man we are honoring today, Dr. Roy S. Berns, has led a professional life in the international color community that embodies the true meaning of the prestigious Judd Award. His contributions do not just fall into one area. His situation is unique in that his contributions have international acclaim as they cover a diverse array of color science topics. We are honoring Roy today for his accomplishments in the areas of color science education, color difference formulae development, spectral-based imaging systems, total appearance measurement, and digital rejuvenation of precious works of art. All of these accomplishments have had a significant global impact.

So let's start first with his accomplishments in the area of color science education. His contributions began under the most tragic circumstances as he was appointed successor to the deceased Dr. Franc Grum at the Munsell Color Science Laboratory at the Rochester Institute of Technology (RIT). The tragic untimely loss of Franc was devastating to the entire color science community, but the person who felt it the most was Roy. I can recall a conversation with him about his fears of being thrust into this leadership role after having received his PhD before his mentorship with Franc was completed "Can I do it?" "Am I ready?" he asked. This was 1985, a time when the world was ripe for color science education, a time when very few universities offered a practical and applied education in a topic such as color science. So my answer to him for both of these questions was a resounding "YES!" "Yes you are ready!" and "Yes you most certainly can do it!" Roy immediately embraced the leadership role as he became the Richard S. Hunter Professor. So here it is 2013 and Roy is still teaching. His drive to continue as a color science educator for all these years came from the one thing that he treasures most – his students! They are all ages from all walks of life. Yes there are graduating seniors in pursuit of their master's or PhD degrees, but there are also many adults who went back to school to follow their dream or take a chance on a midlife career change. There are also adult students from Roy's applied short course programs in color science and engineering given at industrial and corporate sites around the US and in Europe, Asia and Australia. Finally a number of post-doctoral fellows have traveled to RIT from around the world to study and research their color science questions with Roy. All students were inspired by Roy to develop state-of-the-art technology that led to new color science frontiers. To summarize the success of Roy, the professor, he graduated 46 masters and doctoral degree students. Because his emphasis is on student-centric research publications and presentations, hundreds of articles have been published in such prominent journals as those shown here.

Also hundreds of presentations have been given at many of these prestigious color, imaging, optics, and art conservation conferences around the world such as AIC meetings and congresses, CIE interim and quadrennial meetings, Color Imaging and Image Archiving Conferences sponsored by IS&T and SID

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Judd Citation continued

in the USA and Europe, Optical Society of America, International Congress of Imaging Science, ICOM Committee for Conservation triennial meetings, and the American Institute of Conservation.

The topics featured in these publications and presentations cover many global aspects of color science from practical color imaging (including digital capture, measurement, perception, production and reproduction) to fundamental color principles (colorant formulation, color difference evaluation, and color appearance). The legacy of Roy's contribution to color education lives on throughout the world as his students and postdoctoral fellows are now practicing what they have learned at many of these academic, corporate and industrial institutions across the globe.

So today as we are gathered in this room together, we reach out our hearts to say, Roy, thank you for the gift of your students!

To continue with Roy's color education contributions, we must call to mind some other very sad events. Once again tragedy hit the color science world and Roy personally with the death of his two mentors, Dr. Fred W. Billmeyer,Jr. and Mr. Max Saltzman. Their iconic book, *Billmeyer and Saltzman's Principles of Color Technology,* needed revision. So once again Roy turned tragedy into triumph by admirably taking on the task of writing the third edition. The third edition expanded traditional color science aimed at quality assurance by including color imaging. Roy took a classic piece of color science educational literature from the past and revised it to a present day state-of-the-art textbook that is being used in classrooms and industries in the US, China, Taiwan and other places around the world.

Now let's move to Roy's passion for research projects. A research theme that has been present throughout his career is the development of color difference formulae. Roy has been involved in both the elucidation of important psychophysical data and in the ongoing creation and improvement of color difference equations for industrial applications. Fundamental visual color tolerance psychophysical data were collected at RIT, involving students and visiting scientists from the United States, Japan, China, Taiwan, and Germany. After recognizing the shortcomings of the CIELAB color difference formula, Roy derived the international CIE94 equations. He worked with Dupont Automotive, University of North Carolina, University of Granada, and CIE Technical Committee TC1-55 to develop the current international color difference equation known as CIEDE2000, which is now an ISO standard. This color difference research continues and has spanned nearly 30 years.

Roy was the first to establish a research program in spectral-based imaging, archiving and printing of cultural heritage. His visionary work was enabled by expertise at RIT in the areas of printing as well as image science. Roy's techniques set the example as others have followed this innovative work by doing similar research in academic laboratories found in Germany, Norway, and Taiwan.

Roy recognized that the next color science frontier is the measurement and standardization of total appearance, that is, color and spatial properties. Using principles of photometric stereo and linear light source reflectometry, imaging systems have been built that measure spectral reflectance, surface microstructure (gloss and BRDF), and surface macrostructure (surface normal). These systems have been successfully tested at the Museum of Modern Art for works of Jackson Pollack and Vincent Van Gogh. From these data, images can be rendered using computer graphics that enable the viewer to interact with the image in similar fashion to moving around that actual painting. Roy's work here has spawned so much interest that the Munsell Color Science Lab at RIT has taken on two professors to help mature the technology of total appearance measurement.

Recently, Roy has begun a new area of research, solid-state lighting for museum applications. This draws upon his expertise in color science, the physics of artist materials, and chromatic adaptation. Roy's unique color science expertise sheds new light on problems that lighting engineers and scientists have been trying to solve for quite some time.

The final area of Roy's research that I will discuss is my personal favorite and one that is of great interest to an international group such as the AIC. It is his

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Judd Citation continued

use of color and imaging science principles for digital rejuvenation of artwork. Roy has become an innovator and pioneer in this field and is paving the way for others to follow. Art restoration and preservation used to be a very time-consuming and painstaking effort done by hand. The application of Roy's revolutionary techniques has resulted in a more reliable, efficient and faithful color reproduction of the original painting. Using a combination of analytical spectroscopy, instrumental-based color matching, color-managed imaging, and image processing, Roy turns back the clock when paintings and drawings change their colors appreciably due to the ravages of time. This work has become internationally renowned as it has been applied to works of art at the Art Institute of Chicago, the National Gallery of Art in Washington D. C., the Museum of Modern Art in New York, the J. Paul Getty Museum in Los Angeles and the Van Gogh Museum in Amsterdam.

One of the biggest challenges facing AIC has always been the color communication gap between artists and scientists. The AIC is grateful to Roy for his pioneering work in the area of art conservation and preservation because it has gone a long way towards bridging this gap.

I will leave you with the following thoughts. Deane B. Judd's impact on the field of color was enormous, in part because he contributed to a wide array of applications including color differences, color appearance, color physics and lighting. To quote Dr. Judd from the Preface of his book, *Color in Business, Science and Industry*, "The key to color problems of the future is to be found in visual psychophysics mixed with a sprinkling of common sense." At the heart of the body of work that Roy has done over the years is visual psychophysics. His common sense has come from having the sense to know that color is an international concept that can unite scientists, artists, designers, educators and industrialists. The result of his common sense has been ground-breaking research findings in the areas of color education, color difference, spectral-based imaging systems, total appearance measurement, and digital rejuvenation of artwork that have globally advanced state-of-the-art color science.

Congratulations to Roy, my friend, your friend, our teacher, our researcher, our scholar and our colleague as he receives the 2013 AIC Deane B. Judd Award.

Paula J. Alessi, *AIC Past President*

From left to right: Prof. Javier Romero, AIC Vice President; Paula J. Alessi; Dr. Roy S. Berns; Mrs. Berit Bergström, AIC President.

ISCC NEEDS YOUR HELP AT OUR ANNUAL BUSINESS MEETING ON OCTOBER 21!

The ISCC is a vital organization to all those interested in color across the United States. Two great benefits of the ISCC are our national status as a color group, which makes us the U.S. representative to the International Colour Association (AIC), and the reduced rate we enjoy, as ISCC members, for the prestigious journal, *Color Research and Application*.

The ISCC has been changing over the years and we are now at a crossroads. It is time for real change in our organization and the way it serves you, our members. The Board of Directors would like to share the following concerns with you:

- Attendance at and contributions for annual meetings have been extremely low
- We are having difficulties finding members to serve as Executive Officers and Directors
- Newsletter items submitted from our members are scarce, and we need help keeping the calendar up to date with your important activities.
- The number of individual members and member bodies who either have not renewed their membership or are behind on their dues has increased.

The ISCC Board of Directors wants all of the above to change but can't do it without your help. We need to hear from you! We want ISCC to become your organization for color related activities that can better serve you and your current needs. This can happen only if you tell us what you would

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ISCC Needs Your Help continued

like from your national color organization. Significant improvement can happen only if we work together on the current problems and propose solutions that can benefit all.

Let's have an open dialog about these issues through the upcoming electronic/digital Annual Business Meeting on Monday October 21. Please call in to this important teleconference. Here is the call-in information:

Dial +1 (786) 358-5420
Access Code: 377-733-442

The time is from 2-3 PM Eastern Standard Time. Please call so that your voice can be heard and you can help shape a new ISCC that will better serve its members. If you have ideas to share but cannot join the call, please contact Ellen Carter at Ellen.Carter@alum.rpi.edu or 856-678-6444.

Change is always difficult, but also often necessary to grow! We are excited about the new ISCC as it strives to become an organization molded by you and your needs.

ISCC Board of Directors

University of Rochester Center for Visual Science Celebrates 50 Years!

I am excited to announce that the Center for Visual Science turns 50 this year! In recognition of this milestone, we will be hosting a CVS 50th Anniversary Celebration that will be held October 18-20, 2013, in Rochester, NY.

This event begins with a Welcome Reception on Friday evening, October 18, 7-9 pm, in the Flaum Eye Institute Foyer, continues with talks from current and former members of CVS and poster viewings on Saturday, October 19, in Goergen Hall on the River Campus, followed by a banquet at the Colgate Divinity School at 6:30 pm and, finally, a brunch at my home on Sunday, October 20, 10 am to 12 noon. For additional event details and to register, please click on the following link:
http://www.cvs.rochester.edu/symposium/anniversary_50.html

I look forward to seeing you in October!

With warm regards,
David Williams
Director, Center for Visual Science

Discovery of the missing link in evolution of bioluminescence

Biochemistry

With bioluminescence — the process that makes fireflies glow — now a mainstay in medical research, scientists are reporting discovery of a "missing link" of its evolution, which represents one of the deepest mysteries about bioluminescence. It paves the way toward development of new enzymes that glow in different colors and are 10, 100 or 1,000 times brighter, they say in ACS' journal *Biochemistry*.

With bioluminescence — the process that makes fireflies glow — now a mainstay in medical research, scientists are reporting discovery of a "missing link" in its evolution.
Credit: Hemera/Thinkstock

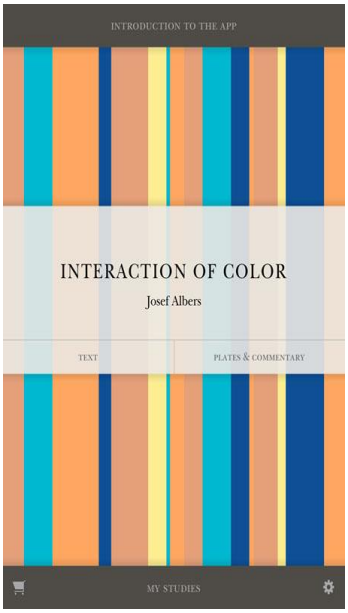
V.R. Viviani and colleagues focus on luciferases, enzymes critical in producing the bioluminescent effect in fireflies, jellyfish and other creatures. Scientists have known that bioluminescence originated 400 million years ago in jellyfish, and more recently in fireflies and other beetles. But how? That has been a mystery, the source of controversy and the key to developing more versatile bioluminescent enzymes for medicine and biology.

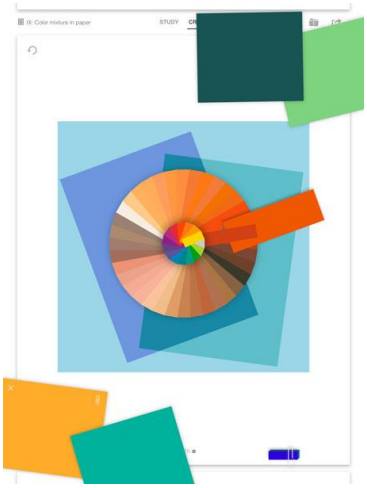
The scientists describe discovery of a "luciferase-like" enzyme in mealworm larvae that represents a missing link between the non-luminescent enzymes of the past and the "bright," modern-day luciferase enzymes in fireflies. Viviani's team discovered a structural switch that turns these kinds of "dark" enzymes into luciferases, and then used that information to develop a totally new luciferase that can produce an orange glow — the first case of development of a luciferase from other distantly related enzymes with other metabolic functions.

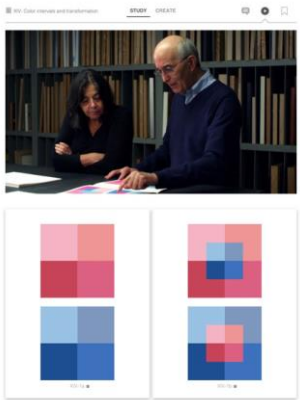
The work results open up new possibilities in biotechnology with the ability to engineer new luciferases from distantly related metabolic enzymes. It could also help scientists develop brighter luciferases with an array of new colors, they say.

Josef Albers ,"Interaction of Color"

-Experience it through an iPad App ©Yale University Press







One review of this mobile iPad application for Josef Albers masterpiece, "*Interaction of Color*" calls it "Amazing. Beyond groundbreaking…This is the example the world has been waiting for. An extraordinary piece of education and inspiration."—Debbie Millman, *Design Matters*.

The innovative features help the user understand Albers's ideas by allowing plate viewing, experimentation, creating and sharing your own designs. It is possible to read the original text, with improved features for the iPad. The plate viewing experiences are inspired by Albers's teaching methodologies. You will be amazed at how each plate is expertly designed to reproduce the experience of working with colored and cut paper. It is possible to do such things as observe how the same color can look different on different backgrounds by lifting flaps and moving pieces. Suprisingly, the paper snaps back to its original position with the lifting of your finger.

This illustration to the left shows endless possibilities for creating, sharing and saving your own studies. It is possible to pull swatches from any new color palette. Those swatches can then be placed anywhere into your design with the ability to easily change and refine your color selections. You also can collect and export your favorite color swatches and palettes along with their RGB values. This allows the ability to share your designs with others through Facebook, Twitter, or email. It is also possible to open and reuse plates or palettes in your own favorite design software.

It is easy to navigate between text, commentary and plates. Definitions of important terms can be obtained with a tap of the finger. Related plates for each chapter can be viewed. If you tap on a plate, you can study its construction and colors in detail.

This last illustration to the left shows how you can obtain a deeper understanding through the built-in commentary. There are videos of scholars, designers, and Albers's former students discussing text and plates. The most challenging principles of Josef Albers are explained and clarified. Archival video and audio of Albers allow you to talk through special exercises.

For information and a more detailed explanation of this clever and valuable app, please visit http://yupnet.org/interactionofcolor/.

HUE ANGLES

(Send contributions to mbrill@datacolor.com and see http://hueangles.blogspot.com))

Anatomy of a "Hue Angles" column

This column marks the seven-year anniversary of Hue Angles. Perhaps it is time to review the premise of the column: what is and what is not a Hue Angles. The charter defines the column as "tidbits of interesting lore shared by ISCC members in short-essay form." The task is harder than it looks, yet also intrinsically fun. Not only should there be a hint of color education, but some of the writer's personal experience is an important ingredient. Terry Benzschawel's color-science mind in the job of a Wall-Street quant was a great example. So was Hugh Fairman's essay on Henry Hemmendinger and colored M.C. Escher prints. Of course, Ralph Stanziola's personal journey in selling color-measurement instruments was such a piece. I could mention others---they're in the archives.

We need more such essays. I'm sure many readers could craft a story or two, taking off from a meeting trip or a sales foray, or even a journey to an art museum. Please let me hear from you.

Now, having reviewed what is (in my opinion) a Hue Angles column, let me talk about what is not in the charter. I was given the helpful suggestion to write about the color of fireworks, based on my having seen three separate fireworks displays simultaneously from a small island off the coast of Cape Ann in Massachusetts. As a lead off base, the person who suggested this topic provided an essay from the Konica-Minolta website (http://sensing.konicaminolta.us/a-colorful-explosion/). Upon reading that essay, I found it said all I could ever think of saying about firework color---and much that I had not known. Sparks cast by strontium salts produce red, sodium produces yellow (in moderation, please), barium produces green, and copper produces blue. Predictably, a mixture of strontium and copper produces purple. Although fireworks have been around for thousands of years, the use of metal salts to control color dates only from the 1830s.

What was missing from this piece was another sort of spark---that of originality and personal investment. This essay was already written, and not a Hue Angles waiting to be born. It might be part of someone else's testimonial, but not of mine.

So that is why I need your inputs.

Well, there is one twist to the firework story. Ever notice that firework displays that are shown in movies tend to be all washed out in color? In great part that is because the points of light saturate the photographic medium in all three channels. I wonder why movie makers aren't more attentive to this problem. Maybe they want the dark parts of the image to show up, and are willing to sacrifice the firework display. But many people ignore such effects, which is why color management has a way to go before it is used widely and enthusiastically.

John McCann could probably write a great Hue Angles on his experience with such effects and how they are remedied by high-dynamic-range images. He literally wrote the book on HDR [1].

Many of you have effectively written the book on other corners of our world. Let's explore those corners together in the next seven years.

1. J. J McCann and A. Rizzi, *The Art and Science of HDR Imaging*. Wiley, 2011.

Michael H. Brill
Datacolor

COLOR research and application

Color Research and Application

IN THIS ISSUE, August 2013

We open this issue with a colorful view of European architecture. In "Three color strategies in architectural composition," Juan Serra discusses three complimentary strategies that architects use in building design for the application of color to describe the building; to influence the perception of the visual properties of architectural shapes; and for its own intrinsic value. While he believes that the color classification system is useful in providing a rational order to analyze, understand, and create colored architecture, he agrees that this is only one way to approach the issue.

Next we move on to less colorful, but still important issues related to color measurement. Every measurement comes with its own uncertainty of the value measured. James L. Gardner discusses

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CR&A In This Issue August 2013, continued

"Tristimulus colorimeter calibration matrix uncertainties." Dr. Gardner explains that for tristimulus colorimeters reference spectral uncertainties and the colorimeter signal uncertainties during calibration are simply scaled and combined in an applied measurement. However, modeling shows that transforming x,y chromaticity and Y luminance can lead to lower chromaticity uncertainties than transforming X,Y, Z tristimulus signals themselves. This can be especially important in display applications.

After discussing instrumental measurement uncertainties, we move to testing color difference formulas. Dibakar Raj Pant and Ivar Farup compute the hue geodesics (the line made up of a series of points originating from a point representing an achromatic stimulus on a surface of constant brightness that share the same hue) and chroma contours of four color difference formulas: the CIELAB, the CIELUV, the Riemannian approximation of CIEDE2000 and the OSA-UCS based ΔE_E in the CIELAB color space, and compare the results to the Munsell Color Order System. In "Geodesic calculation of color difference formulas and comparison with the Munsell color order system" Pant and Farup discuss the comparisons of the geodesic grids of these formulas with the Munsell hues and chromas at the Munsell values 3, 5 and 7 and find that none of these four formulas can precisely fit the Munsell data. The latest color difference formulas do not perform better in predicting hue geodesics and chroma contours than the CIELAB and CIELUV color difference formulas. These findings also suggest that the distribution of hue geodesics and chroma contours of the above four color difference formulas are weak in predicting perceptual color attributes all over the color space even though their quantitative color difference measures are good.

It is well known that our vision changes as we age. These changes may be due to a change in the color of the lens in our eye, and/or a haziness forming on the lens due to cataracts. In order to understand the issues of elderly vision, Patarin Wongsompipatana, Mitsuo Ikeda, and Pichayada Katemake investigated the effect of the desaturation on brightness of objects in terms of the equivalent lightness. The mathematical expression of equivalent lightness is composed of two terms: the achromatic lightness and the chromatic lightness. Both terms can be affected by the changes in the eye upon aging. In our next article "Equivalent Lightness of Elderlies investigated by Cataract Experiencing Goggles" they report the results of an experiment to determine the relative effect of each achromatic lightness and the chromatic lightness. They concluded that the scattered environmental light due to haze compensated the decrease of chromatic lightness to keep the brightness of stimuli unchanged.

For out next two articles we move to the field of graphic arts. First, Marin Milkovic, Nikola Mrvac, and Mile Matijevic examine the influence of and correlations between retinal localized chromatic adaptation and methods of rendering on the perception of desaturated achromatic reproductions. In printing, grays are most often formed by the additive and subtractive effects of overlapped dots of the chromatic inks used in the print. Thus, checking the gray balance (to assure grays are perceived as neutral) is a commonly used control of the printing process.

Another important parameter is the gamut of the inks in the printing system and how the image is rendered to the printer gamut. In "Evaluation of the effect of retinal localized chromatic adaptation intensity on desaturated achromatic reproductions derived by standard rendering methods" the authors describe their experiment and the correlations found between these parameters.

Another parameter that is important in printing is the paper on which the print is made. In addition to the appearance effects of the gloss and texture of surface of the paper, the color (generally whiteness) of the paper is very important because it acts as an additional colorant in the printing system. In "The Effect of Paper Appearance on Printed Color of Inkjet Printers", Saeideh Gorji Kandi reports on her experiments to investigate the effect of the type of paper on print reproducibility, light fastness, color gamut and colorimetric properties of the final print. Texture features were computed using two analysis methods: co-occurrence matrix and edge frequency.

In earlier articles in this journal [2009;34:233-252 and 2011;36:394-412], Ralph Pridmore has explored the many roles or features of complementary colors. In this issue he examines the spectral power distributions (SPDs) of complementary colors and reports a, to use his word, curious double helix. In "Helical Structure of Complementary Colors' Relative Spectral Distribution Function", the SPDs are plotted in a rectilinear graph of wavelength versus wavelength with radiance vertical to the plane. In this space, the white locus representing the illuminant chromaticity is a sinusoidal curve. He then goes on to discuss the features and purpose of this structure.

continued on next page

CR&A In This Issue August 2013, continued

Colors evoke emotional responses and people have definite preferences for certain colors. Both the emotional responses and the preferences may be affected by the application of the colors, and have been studied by many researchers. Our next two articled examine these in different ways. Mitsuhiko Hanada wanted to find the independent components of the emotions that color invokes. Various factors such as happiness, impact, dynamism, warmth, elegance, and calmness, to name a few, have been identified. These factors have usually been identified with factor analysis. However, the factors may be overlapping or made up of various components. Recently a technique called independent component analysis has been developed to determine unique factors involved in a system. In "Analyses of color emotion for color pairs with independent component analysis and factor analysis", he reports on the emotions evoked by color pairs and compares the results of independent component analysis with those of factor analysis.

Red seems to have many special associations not just for people, but also in nature. In our final article of this issue, Nicolas Guéguen and Céline Jacob use a social site on the internet where personal ads of women registered on a web meeting site displayed photographs to study the effect of the color red. In a controlled experiment, they used the color of the clothing as the independent variable and the number of contacts received from men as the dependent variable. In "Color and Cyber-Attractiveness: Red Enhances Men's Attraction to Women's Internet Personal Ads", they report that they found that photographs from women's internet personal ads displayed on meeting sites received significantly more contact solicitations from men when they appeared with a red-colored clothing rather than black, white, yellow, blue or green. These results confirmed and extended previous studies that link color and women attractiveness.

In this issue, we also have a book review and a publication briefly mentioned. Dr. Peter Bodrogi reviews *Seeing: The Computational Approach to Biological Vision* by John P. Frisby and James V. Stone. Finally, a Publications Briefly Mentioned announcement tells about Rolf Kuenhi's 3rd Edition of *Color: An Introduction to Practice and Principles*.

Ellen Carter
Editor, Color Research and Application

Calendar

Oct 4-6	**OSA – 13th Annual OSA Vision Meeting**, University of Houston College of Optometry
Oct 6-10	**OSA Frontiers in Optics 2013,** Laser Science XXIX, Hilton Bonnet Creek, Orlando, FL
Oct 21	**ISCC Annual Business Meeting**, Teleconference, Dial in: 1-786- 358-5420, Access Code: 377-733-442
Oct 27-29	**IES Annual Conference**, Huntington Beach, CA
Nov 4-8	**IS&T Color Imaging Conference**, Hotel Albuquerque, Albuquerque, NM www.imaging.org/ist/conferences/cic
Dec 5-6	**AATCC Textile Testing Workshop** Research Triangle Park, N.C. aatcc.org/events/workshops/ITT.htm
Dec 12-13	**ASTM E12 Color and Appearance**, Hyatt Regency Riverfront, Jacksonville, FL
2014	
Feb 2-6	**IS&T/SPIE Conference on Human Vision and Electronic Imaging,** San Francisco, CA
Jun 16-17	**CIE Division 1 on Color and Vision**, NIST, Gaithersburg, MD
Jun 18	**ISCC Bridge Symposium,** NIST, Gaithersburg, MD
Jun 19-20	**ASTM E12 Color and Appearance,** NIST, Gaithersburg, MD
Oct 21-24	**AIC Interim Meeting, The Color and The Culture,** Hotel Misión de los Ángeles, Oaxaca, Mexico, www.aic2014.org
2015	
Jan 28-29	**ASTM E12 Color and Appearance**, Sheraton, New Orleans, LA
May 19-22	**AIC Midterm Meeting, Color and Image,** Toyko, Japan, www.aic2015.org
Jul29-Aug3	**CIE Quadrennial Meeting (including Div. 1),** Manchester, UK

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.aviantechnologies.com	603-526-2420
BYK-Gardner USA	www.byk.com/instruments	301-483-6500
CERAM Research Ltd.	www.ceram.com	+44(0)1782 764428
Datacolor	www.datacolor.com	609-895-7432
Gamma Scientific	www.gamma-sci.com	800-637-2758
Hallmark	www.hallmark.com	816-274-5111
Hunter Associates Laboratory, Inc.	www.hunterlab.com	703-471-6870
IsoColor Inc.	www.isocolor.com	201-935-4494
X-Rite Incorporated	www.xrite.com	616-803-2113

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 #463, Summer 2013

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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

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)