Inter-Society Color Council *News*

Issue 446 July - August 2010

Recipe for the Standard Sandwich

In Princeton NJ there is a shop that is famous world-wide for its sandwiches, the Hoagie Haven. This June on the campus of Princeton University, another international sandwich was on the menu for color scientists—the Standards Sandwich. What is the recipe for the unique Standards Sandwich? Take one slice of ASTM International's Committee E12 on Color and Appearance. Next, spread on it a juicy day of talks from the ISCC Special Topical Meeting (Standards: What they are - What will they be? - What should they be?). Top it off with a thick slice of the International Commission on Illumination (CIE) Division 1 on Vision and Color. All in all, you have a very satisfying sandwich. While this report is primarily on the meat of the sandwich, I will give a little bit of the flavor of the bread also.

Seriously, on June 14th the ASTM group of color scientists began the usual semiannual meeting of E12. This time they were joined by many of their friends. The E12 meeting convened nine subcommittees: Terminology, Geometry, Instrumentation, Color Analysis, Fluorescence, Image-based Color Measurement, Color Spaces, Visual Methods, and Precision and Bias. However, our guests gave an extra flair. For example, the terminology subcommittee had a lively discussion of the differences and appropriate applications of the terms background and surround. Osvaldo DaPos, from the University of Padua in Italy, contributed interesting illustrations of optical illusions using gray or colored patches on a black background with different surrounds. Adding to the discussion Michael Pointer from England showed the nesting of an image and its background, in a surround and ambient field. Carl Andersen from the Federal Highway Administration discussed the conspicuity of a pedestrian with various backgrounds. Through these discussions we members all got a better understanding of vocabulary used across disciplines. These insights will lead to better definitions of the terms we use sometimes too casually in color.

The topics in the two days of ASTM meetings were as varied as the subcommittee names implied. In the fluorescence subcommittee, Richard Harold gave a presentation on Fluorescent Coatings: Inspection, Optical Safety and Visual Effectiveness. He reported on a study of eye strain which occurred when using blue LED lights for coatings inspections and how this strain could be mitigated. Spectral integration was the focus of the subcommittee on color analysis. This topic came up again and again throughout the week's activities. The ASTM section of the week closed with the Main E12 Meeting

Continued on page 2

Contents

ISCC EXECUTIVE OFFICERS

ISCC BOARD OF DIRECTORS

Continued from page 1

and the awarding of a plaque to Hugh Fairman for his leading role in standards development.

On Wednesday the ISCC took center stage with its Special Topical meeting, *Standards: What they are - What will they be? What should they be?* The chairs were Jack Ladson, Michael Brill and Hugh Fairman. The meeting consisted of six sessions. M. Ronnier Luo, from Leeds University and Director of CIE Division 1, opened the session on the standards process by describing the work of the CIE Division 1 on color and vision. Phil Wychorski, Orion Standards LLC, followed with an explanation of the standards review process within the United States National Committee of the CIE and an invitation to all to come join and see how the CIE/USA is addressing these important issues. Finally Danny Rich used documentary standards in graphic reproduction as examples to describe the good, the bad and the ugly of standardization. He ended with the following admonitions about what makes a good standard and why:

- International standards are used as regulatory tools for commerce in many parts of the world.
- Standards should be written with full knowledge of the commercial implications of the requirements
- A process, procedure or technology should be standardized only when:

  - It is already in wide use
  - The document will aid in uniformity of practice
  - The document defines the critical commercial or technical parameters that must be met or controlled.
- The latest formula for computing color differences, color-matches, color tolerances, product attributes, appearance attributes, or other object or image property modeling should not ever be standardized.
- Any technology that distinguishes one product over others should not be standardized.
- Standards should always make it easier to know when a process or technology has been performed correctly.

The next session, on Fundamental Colorimetry, highlighted three topics on which the CIE Division 1

Continued on page 9

HUE ANGLES

(send contributions to mbrill@datacolor.com)

Here are some notes from a most unconventional convention. Perhaps they will make the ISCC blog light up…

Notes from the NPA: New Platonic solids, new visions of Doppler shift

The Natural Philosophy Alliance is even more diverse than the ISCC. Its members—artists, lawyers, physicians, chemists, physicists and mathematicians—all give voice via their own expertise to challenge current scientific theories. They agree with each other less often than ISCC members. (Yes, that's possible.) I attended their meeting (NPA17) [1] in Long Beach, CA the week after ISCC met in Princeton. Two NPA nuggets might intrigue ISCC members: a geometrical shape with interesting optical properties, and a thought experiment to clarify the Doppler effect.

Artist Michael R. Evans [2] dubs the "atom" out of which he builds his creations the Trion-Re'. Realizable in paper or clear acrylic plastic, the Trion-Re' looks like a shortened weaving-shuttle. You can make one by cutting out the 60°-arc-limited parts in the figure below. Assemble the parts so A is preserved, the three B vertices coincide, edge 1 meets 1', 2 meets 2', and 3 meets 3'. [Exercise for the reader: Is this construction mathematically possible or must it be forced? See "Trion Re'dux" below.]

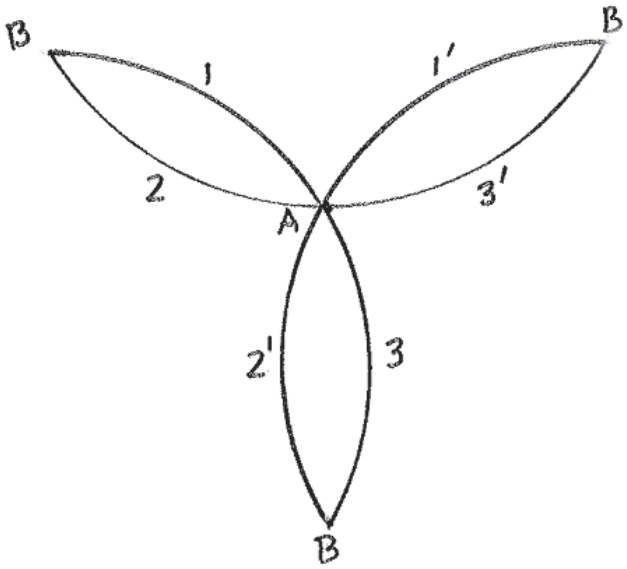

Figure to aid in constructing a Trion-Re'

A curious optical effect: When you shine a laser at any of a variety of angles into a Plexiglas Trion-Re', you see only a glow from its two ends (vertices), and no light from elsewhere. Could the Trion-Re' have optical light-trap applications?

On a mathematical note, the Trion-Re' has the minimum number of faces (F), vertices (V) and edges (E) that satisfies Euler's formula V + F - E = 2 for polyhedra. Although the Trion-Re's faces are not flat when assembled, given the above construction they start out flat and are never stretched (i.e., have zero Gaussian curvature).

Another NPA nugget was Physicist Francisco J. Müller's paper [3] asking, if we think we understand Doppler red-shifts of light, then how do shifts of non-light happen (e.g, for a Fraunhofer absorption line incurred by an interstellar cloud)? Let a stationary Earth E look at a star S (possibly receding) through a cloud C (possibly receding). Say the recession red-shifts 656 nm to 670 nm. (I will speak of shift rather than scaling because the wavelengths here are not very different from each other.) There are three cases.

Case I: **If S and C recede together from E, then the S's spectrum and C's absorption line are red-shifted together (the latter to 670 nm).** C receives 656 nm light from S with no Doppler shift (because C and S are not in relative motion). The cloud absorber stops that radiation, and the rest of the light is passed Doppler-free. The lengthening path from C to E then shifts the entire spectrum including the absorption line.

Case II: **If S recedes while C and E are stationary, then S's spectrum is red-shifted but not C's absorption line.** Now C is in the same frame as E. S's light is already red-shifted upon reaching C, and in particular 642 nm light is shifted to 656 nm and is stopped by the absorber. The absorption is at 656nm, but the rest of the spectrum is shifted 14 nm higher.

Continued on page 4

Continued from page 3

Case III: **If S is stationary relative to E and C recedes, then C's absorption line is red-shifted but S's spectrum is not.** Light received through C outside C's absorption band has no interaction with C. For these wavelengths, the cloud does not exist, so S and E are static and have a vacant path between them—incurring no Doppler shift. But light emitted at 670 nm is blocked by C (at 656 nm), and that line is Doppler-shifted back to 670 nm due to the recession C from E.

Müller and I seem to agree on the results of these three cases, but whereas I model Doppler shifts based on how the whole optical path stretches in time [4], Müller has a different view. I thought this problem would be interesting for ISCC thinkers. In a sense the assumptions are simpler than the ones we take for granted in color science. At first I saw the cloud as a filter, but Müller correctly noted that even a transparent filter interacts with the light at all wavelengths, unlike in parts of the Doppler example.

Oh, by the way, much is said in NPA about Einstein's relativity theories, and I added to that this year [5]. Back to normal stuff next issue!

Michael H. Brill

References

1. http://conf17.worldnpa.org/ and click Abstracts to read any paper.

2. M. R. Evans, The geometry of light, *Proc Nat. Philos.Alliance*, **7**, 149-153 (2010).

3. F. J. Müller, The Doppler effect of absorption spectral lines in moving astronomic bodies (How can it happen?) *Proc Nat. Philos.Alliance*, **7**, 336-342 (2010).

4. M. H. Brill, Doppler effect: surprises from the time domain, *J. Nanophotonics* **4**, 041520 (4 Feb 2010).

5. M. H. Brill, Cochetkov's speeding bola—yet another entanglement for special relativity, *Proc Nat. Philos.Alliance*, **7**, 62-63 (2010).

P. S. Trion-Re'dux

My Trion-Re' puzzle (above) has several levels of answer—so I won't wait for the next issue to clue you in. Can the three flat leaves be rolled up into a 3D convex figure with three-fold symmetry about the axis AB? Yes, but….

Examined along the AB axis, any cross-section of the Trion-Re' is an equilateral triangle, and the triangles are all centered on the axis and have the same orientation. Any progression of triangle sizes (as a function of position on the AB axis) is enforced by the shape of the unrolled leaf (whether or not limited by 60° arcs). Since the corresponding triangle sides are straight and parallel, each face rolls and unrolls between 3D and flat. So the answer to my puzzle is "Yes."

A this point, it bothered me that the lining-up of the triangles implies that the edges of the Trion-Re' are plane curves in 3D. They are also plane curves when unrolled flat. So how do you roll a planar 60° arc out of its plane so it becomes again a plane curve? I was able to show this is not possible if you use a circular cylinder as a "curling iron". But I still don't know the cross-sectional shape of the cylinder that makes it work. Maybe some ISCC geometer can find it.

Then I heard from artist Michael Evans (through physicist Greg Volk): The faces of the acrylic Trion Re' are not Gaussian-flat, but are closer to being parts of spheres! So we have two distinct constructions, folks, the paper-folding one (with its neat math problem) and the acryllic one (with its neat optical property). They may be "artistically equivalent," a matter to be decided by Interest Group 3!

Member News

David McDowell Awarded IS&T Honorary Membership

The Society for Imaging Science and Technology awarded David McDowell with Honorary Membership for his energetic and tireless support of standards in the graphic arts and imaging industries. The award was announced in April 2010. Honorary Membership is the highest award of the Society, for outstanding contribution to the advancement of imaging science and engineering. David Q. McDowell graduated with a BSc in engineering physics from the University of Rhode Island (1957), and retired in 1999 from the Professional Imaging Division of Eastman Kodak Company, where he worked for 42 years.

Hugh R. Davidson 1918-2010

Hugh R. Davidson died on April 2, 2010 after a long illness following a stroke. Hugh was born in York, Pennsylvania in 1918. After graduating from high school in York, Hugh took a year off and toured the far West of the United States returning to the East to attend Lehigh University in the fall of 1937. He graduated from Lehigh in 1941 with a Bachelor of Science in Electrical Engineering, and joined the Office of Naval Research for the duration of the War where he was involved in development of automatic gunfire control and targeting for submarines.

Around 1954, Hugh Davidson developed the first automatic tristimulus integrator and attached it to the GE-Hardy spectrophotometer. This provided for the first time a quick way of obtaining tristimulus values, which until that time had been obtained by counting squares under a plotted curve.

Hugh R. Davidson
1918 --2010

With Henry Hemmendinger, at Davidson and Hemmendinger, he painted the first glossy edition of the Munsell Book of Color and supplied it to the Munsell Color Company. There also he developed COMIC, an analog computer, which proved to be the first computer dedicated to making computer assisted color-matches. The COMIC utilized an oscilloscope as a display. On the oscilloscope appeared 16 dots that represented the standard spectral curve to be matched. The pigments to be used were characterized by resistances at each of the 16 wavelengths by a plug-board that was inserted in the machine to provide the absorption characteristics of the formula for matching. The user adjusted the concentrations of the ingredients with knobs until a match was made, and then the concentrations were read from the knobs.

Later the COMIC II accomplished the same task digitally using Kubelka-Munk two-constant theory. A COMIC machine presently resides in the Smithsonian Institution in Washington, DC as an example of a special-purpose computer from the earliest days of electronic computation.

Shortly after introducing COMIC II, Hugh and Henry published the first paper fully explaining two-constant Kubelka-Munk color-matching theory. This was some eight years before Eugene Allen's now well-known two-constant paper.

Also at Davidson and Hemmendinger, Hugh developed the first color rule that used painted panels to display the series of metamers in the rule. About this time, Hugh undertook, with E. Friele, a very large study of the relative accuracy of the various color-difference equations then in use.

Now on his own at Davidson Colleagues, Hugh developed digital software for computer color-matching to run on mini-computers and later personal computers. Hugh developed the pigment plan for and painted the samples of the Optical Society of America's Uniform Color Scales when an OSA committee chaired by David MacAdam produced that atlas.

Hugh has had over 40 papers published in such various journals as *Journal of the Optical Society of America*, *American Dyestuff Reporter*, *Color Engineering*, *Journal of Chemical Education*, *Industrial and Engineering Chemistry*, *Journal of Coatings Technology*, and *Color Research and Application*. From the early 1950's until around 2001, Hugh held weeklong seminars in color education, directed mostly to the subject of computer color-matching. He is estimated to have taught 2500 students in this period, and must therefore be somewhere near the top of the list of color-science educators who have the largest number of student-classroom hours.

In 1966 Hugh won the Bruning Award of the Federation of Societies for Coating Technology. In 1988 Hugh won the Millson Award of the American Association of Textile Chemists and Colorists, and in 1977 he won the Inter-Society Color Council's most prestigious award, the Godlove Award. Hugh was made an Honorary Member of the Inter-Society Color Council at our meeting in Rochester in 2001.

Hugh was predeceased by his wife Nancy in 1995, and he is now survived by his daughter Pem Buck, and two sons Willie and Jonathan. To his family and colleagues, the Inter-Society Color Council offers its deepest sympathy and condolences.

Hugh Fairman

Metameric Blacks: A Color Curious Column

Ever wonder ... "why are eyes different colors?"

Our skin, hair, and eyes come in many different colors. Amazingly all those different colors are made from exactly the same stuff! That stuff is a pigment, or colored material, called melanin.

The color of our hair and skin is caused mainly by the amount of melanin there (and the underlying blood and body tissue for our skin color). The more melanin, the darker our hair or skin. Black hair has lots of melanin. Blonde hair has a little bit. And gray hair has none at all.

The same is true for eyes. The amount of melanin in our irises (the colored part of our eyes) helps determine its color. But since melanin itself is black or very dark brown, how can we get blue eyes? Eye colors like blue and green are produced by small amounts of melanin in our eyes in the form of tiny particles that scatter light, just as particles in the sky scatter light to make it look blue. It is also interesting that the pattern in any iris is considered absolutely unique. The chances of finding an identical iris are so low, that you would have to check far more people than are currently living on Earth to find one!

This image shows the variety of eye colors. Included are the blue eye of a young child, a fairly rare gray eye, and a hazel eye, which has several colors. (Note: These three irises come from a single family, a mother and two daughters!) Interestingly, some people wear colored contact lenses to change their eye color.

Image showing the variety of eye colors

Content of this column is derived from *The Color Curiosity Shop*, an interactive website allowing students from pre-school to grad-school to explore color and perhaps pursue a science education. Please send any comments to me at <*mdf@cis.rit.edu*> or use the feedback form at <*whyiscolor.org*>.

Mark D. Fairchild

Inter-Society Color Council's 2010 Annual Meeting

The Inter-Society Color Council will hold its 2010 Annual Meeting at the College of Textiles at North Carolina State University's Centennial Campus on October 7 and 8, 2010. The preliminary program for the meeting is on page 7 of this newsletter.

Who Should Attend: This meeting is open to everyone with an interest in promoting the interchange of ideas on the subject of color and appearance. This conference is designed to promote communications between technically oriented specialists in color and creative workers in art, design, and education.

Registration: A registration form is included with this newsletter and also can be found at www.iscc.org/meetings/AM2010/. Please note that except for students, the registration cost increases after Sept. 6, 2010.

Hotel Information: We have reserved a block of rooms at a special rate of $74 per night at the Fairfield Inn & Suites in Raleigh's Crabtree Valley. To receive this rate, state the promotional code, "ISCC", and make your reservation by September 6, 2010 by calling the hotel at: 919-881-8000. The hotel does not offer a shuttle service. A taxi from Raleigh-Durham Airport (RDU) costs about $30. A NCSU mini-bus will be made available from the hotel to NC State's Centennial Campus, which is about 7 miles from the hotel.

More Information: Contact David Hinks for questions, concerns, or if you want to help.

PRELIMINARY PROGRAM, 2010 ISCC ANNUAL MEETING

The Colors of Multi-Colored Things:

Understanding and Controlling Multi-Color Technology

This meeting will confront the hottest issue in color today: Precise, accurate control of the colors of multi-colored objects. Markets today demand much tighter color tolerances than ever before, and color-production technology (including new colorants, new textures, and advanced gonio-apparent surfaces) challenges these tolerances. Our speakers will address the issues of the day, so you too can be on the forefront. We'll meet at North Carolina State University in Raleigh, NC on **October 7-8**. Here is the preliminary program for the four non-concurrent sessions:

- **Interest Group 1 Basic and Applied Color Research.**

  Michael H. Brill (Datacolor), "The Feynman paint-mixing problem, redux"

  Renzo Shamey (N C State), "The effect of texture on perception and measurement of whiteness"

  Carol Tomasino Revels, "Describing color differences: How good are your color comments?"

  Renzo Shamey (NC State), "Instrumental assessment of complex multicolored patterns"

- **Interest Group 2 Industrial Applications of Color .**

  Ann Laidlaw (XRite): "Color tolerances in black and white"

  Daniel B. Gazda (Wyle Integrated Science), *et al.*, "Colorimetric solid phase extraction (CSPE): Using color to monitor spacecraft water quality"

  Gabriele Kigle-Böckler (BYK-Gardner GmbH), "Objective mottling control at the line with new and innovative testing technologies"

- **Interest Group 3 Art, Design and Psychology.**

  Roy Berns (RIT), "Reconstructing the original colors of Vincent Van Gogh's *The Bedroom*, part of the permanent collection of the Van Gogh Museum, Amsterdam"

  Rolf G. Kuehni, "A brief history of the idea of yellow, red, and blue as chromatic primaries in painting"

  Rolf G. Kuehni, "A brief history of the color circle"

  Carl Jennings (University of Hawai'i), "Revisioning Color"

- **The Education session will feature two one-hour tutorials:**

  David Hinks and TBD designer (NC State), "Color Management of Textiles"

  Allan Rodrigues and Larry Steenhoek (Dupont Performance Coatings), "Measurement and specification of gonioapparent color"

Please contact Ann Laidlaw (ALaidlaw@XRite.com) with any questions about the meeting.

Color Research and Application IN THIS ISSUE, August 2010

We open this issue with the article, ''The Development of Roof Color in Ancient China.'' With advances in tile making, the choice of the color of tiles used for roofs in China changed from a gray to colorful. However, the color usage in ancient architecture was regulated by hierarchy and the theory of five colors and five essences. Those regulations made clear the allowed roof colors in different zones and classes of structures. Aiping Gou and Jiangbo Wang report on research about the characters of the roof colors in different periods, finding the turning points and reasons of roof color changes in crucial periods. They examined specific color samples of different dynasties (tested on site), the related laws and documentations, as well as applying the theory of five colors and five essences.

As we move through the centuries from our 1st article, which dealt with color starting about 4000 years ago, we will stop on the way for Zena O'Connor to examine early and more recent theories and definitions of color harmony. After examining the paradigms and assumptions embedded within these theories and the validity of harmony predictions, Dr. O'Connor proposes an updated definition of color harmony in her article ''Colour Harmony Revisited.'' She also proposes a conceptual model that represents an attempt to revise color harmony to fit with the current theoretical paradigms. Her model is contingent on factors that influence the relationship between color and aesthetic response such as individual and cultural differences as well as perceptual, contextual, and temporal factors.

Our next article takes a new look at the Rochester Institute of Technology RIT-Dupont dataset, which was created in the 1980s primarily for the development and testing of color difference metrics. These data were published as 156 median tolerances. These tolerances were derived using probit analysis, where 50 observers judged the total color difference of 958 color-difference pairs in comparison to a near-neutral anchor pair. There has been an interest in making the complete visual data available, which was accomplished as described in this article, ''RIT-Dupont Supra-Threshold Color-Tolerance Individual Color Difference Pair Dataset.'' However, having this dataset available, there was a concern that it could be used improperly by assigning uniform uncertainty when by definition, visual stimuli different than the median tolerance have greater uncertainty. Therefore, in this article, Roy S. Berns and Bingxin Huo describe a method to assign a weight for each color-difference pair. It is recommended that these weights be used for both performance evaluation, such as an F-test on WSTRESS values, and for formula development where weighted regression or nonlinear optimization is used.

Talking about color differences, Kaida Xiao, M. Ronnier Luo, Changjun Li, and Guowei Hong describe psychophysical experiments to investigate the color appearance changes between the color perceived from small patches and real rooms. In ''Colour Appearance of Room Colours,'' they report that colors appear lighter and more colorful for room colors than for patches that subtended about 10° of visual field. They also state that the size change from a small patch to room size has a large effect on lightness and chroma attributes, but little effect on the hue attribute. In addition, the results show that the wall color has a considerable effect on the overall illuminant in a room, and that these effects are independent of the light source used. Then, the authors proposed a method for predicting the appearance of room colors by combining the illuminant prediction, color appearance model (CIECAM02), and a size effect correction.

Naming colors is an important communication skill, learned as a child but used throughout life. It is useful to have a computational technique for identifying stimuli (materials or images) with the names for colors that people would commonly use and understand. In our next article, ''Colour Category Foci of Munsell Colour Spectra Revealed by Two Computational Methods,'' Elina Raisanen and Markku Hauta-Kasari examine to what extent certain computational methods provide results that match those of psychophysical research. They compare two methods, non-negative matrix factorization and self-organizing maps, to find computationally how Munsell color spectra actually correlate with their corresponding color names reported in psychophysical experiments. That the result remains consistent across the studies and different sample sets is particularly significant.

Color has been used as a clue in many computer vision applications such as object recognition and tracking, scene understanding, image reproduction, and photography. Our brain has the ability to assign a constant color to an object although the actual stimuli vary. Actually, the color depends on the scene illumination, the content of the scene, and the characteristics of the sensor. Many color constancy algorithms of increasing complexity have been developed to help computers do

In this Issue, Continued

Continued from page 2

this task which our brains do easily. However, the gray world algorithm based on the assumption that everything in a scene averages to a gray is still widely used. In our next article, Bing Li, De Xu, Weihua Xiong, and Songhe Feng present a novel iteration method to identify achromatic surface for illumination estimation and introduce the local grey-edge method to optimize the initial condition of the iteration so as to improve the accuracy of the proposed algorithm. In ''Color Constancy Using Achromatic Surface,'' they show how gray surfaces can be detected in an image using an illumination-independent descriptor. The color of these surfaces is then used to compute a color-corrected image. The experiment results on different image datasets show that their algorithm is effective and works as well or better than existing competitive methods.

For our final article, we go to the textile industry, where the color of most fabrics is a result of a combination of two or more dyes. One of the issues that must be considered when developing the formulation of the color is the compatibility of the dyes. Haleh Khalili and Seyed Hossein Amirshahi present "A Novel Method for Determination of Compatibility of Dyes by Means of Principal Component Analysis." In their method, the reflectance spectra of samples dyed with the classical dip-test method were converted to the traditional Kubelka-Munk absorption and scattering (K/S) data, and the dimensional properties of dataset were evaluated by the eigenvalues of each matrix. The percentage variance and residual percentage variance of the distribution of data around the first eigenvector were used for quantitative evaluation of binary mixtures. They found that the K/S data of the fully compatible mixtures scattered around one dimension and are proportional to the degree of deviation from compatibility. According to results, dyes with a percentage of variance value greater than 99.5% lead to excellent compatibility.

We end with a short note on ''Whiteness, Chromaticness, and Blackness Symmetries for CIELAB'' and a book review. In an extension of his earlier article, ''Using symmetry to understand the attributes of color,'' [Vol. 33, pp 27– 44, 2008], Lou Adams describes an interesting concept. Defining whiteness, blackness, and chromaticness in CIELAB can connect visual perception and color language to CIELAB coordinates in a simpler way. Then, we close this issue with Rod Heckaman's review of Fundamentals of Digital Imaging by H.J. Trussell and M.J. Vrhel.

Ellen Carter
Editor, Color Research and Application

Henrik Wold, University of Oslo and Buskerud University, posed the question, *Is XYZ colorimetry still a relevant concept for a colorimetric standard?* He described the work of CIE Technical Committee on Fundamental Chromaticity Diagram with Physiologically Significant Axes. This TC's report includes adjustments for observer age and field size. When these functions are used to define XYZ coordinates, a possible multiplicity of standard observers arises, so is the current usage still relevant for color technology? Then Rolf Kuehni discussed *Mensurating a Perceptual Object Color Solid*. While the study and analysis of color difference evaluation has a long history, there is still much to be done. Kuehni proposed that the psychological object color solid, its internal differences, and their relationship to stimuli have yet to be systematically investigated. He pointed out that the detection of thresholds and the evaluation of color differences are two different cognitive processes. He listed ten issues (too many to quote here) that remain insufficiently resolved. Wendy Davis, National Institute of Standards and Tech. (NIST), closed the morning with *Color quality: Where we are; what's next?* She focused her comments on the activities of CIE TC 1.69 on the Color Rendition by White Light Sources, which she chairs. This very active TC, which met also this week, brings to light many issues that are more imperative with the advent and increased usage of solid state lighting.

The first afternoon session focused on two areas where activities in E12 and CIE intersect. First, on the topic of Tristimulus Integration, Hugh Fairman of Resource III, presented *Some Recent Improvements in ASTM Standards on Colorimetry*. The ASTM is providing the applied standards for industrial colorimetry. Precision of description is being enhanced (e.g., for the elusive hue angle), and numerical methods are becoming more accurate (e.g., for bandpass corrected reflectance and tristimulus integration). Then Changjun Li, chair of TC 1.71, in *Tristimulus integration* described the various ways to derive weight sets for computing discretely sampled tristimulus integrals. CIE TC1.71 is studying which way is most accurate, and then seeking to promote uniformity of practice.

The second topic was multi-angle spectrophotometry. Dave Wyble, Munsell Color Science Laboratory of RIT, led off with a discussion of the *Repeatability Analysis of Multiangle Spectropho-*

Continued on page 10

Continued from page 9

tometers. He described studies which used the ASTM standard practices to evaluate inter-instrument comparison between three commercial multi-angle spectrophotometers. Maria Nadal, of NIST, explained that appearance is a main driver of commerce, and control of appearance across national borders depends on standardizing laboratories such as NIST. She then described the *NIST Appearance Metrology Program*.

The final afternoon session was Printing. Klaus Richter, Berlin University of Technology won the prize for the longest-titled talk, *ISOCIE trend for color output of equally spaced color series and elementary hues IRJGB on displays for eight ambient reflections of ISO 9241306:2008*. He spoke about the color management standards, which have the intersecting goals of equally spaced color scales, elementary colors that are aligned with device-independent scales, coding efficiency and insensitivity to such factors as quantization error and veiling reflection. He described how the ISO, CIE, DIN and ICC are developing a common RGB profile-connection space to meet these requirements. Ann L. McCarthy, Lexmark International Inc, in *Balancing 'automatic color' and artistic intent: The role of color standards,* provided a bridge from standards to the reality of the common user. She reminded us that in the early years of photography the promise to users was "you push the button we do the rest." And now today, automation in digital color management is taking a similar approach and as a result is falling short with users who want control over their color results. Can new color interoperability standards enable support for these users?

A special evening session capped off this Special Topical Conference on Standards after the Networking Reception at the Triumph Brewery. It was planned that Hiroyasu Ujike, from AIST in Tokyo Japan and chair of CIE TC 1.67, would give the evening presentation based on a TC report. However, due to an unfortunate circumstance, he had to leave early and his associate Hiroshi Watanabe gave the presentation, *The Effects of Dynamic and Stereo Visual Images on Human Health*. This talk with its many short movies proved to be a fine post-reception talk and provided a unique visual challenge for the audience, while educating us on the issues of rapid motion, bright fields and stereo images on an observer's health and feeling of comfort.

Thursday and Friday were devoted to the Division 1 of the CIE. They held technical committee meetings one day and a Division 1 meeting the final day. Technical committees that met were TC 1.69 Color rendition by white light sources (chaired by Wendy Davis, US), TC1.63 Validity of the range of CIEDE2000 (chaired by Klaus Richter, Germany), TC 1.71 Tristimulus Integration (chaired by Changjun Li, China), TC 1.74 Methods for Re-defining CIE D-Illuminants (chaired by Janos Schanda, Hungary), and TC 1.56 Improved Color-matching functions (chaired by Michael Brill, US). During the Division 1 meeting the work of each of the technical committees and reporterships was reviewed as well as Liaison reports given from the International Colour Association and several ISO committees.

Two new technical committees and two new reporterships were proposed. The first committee, Validity of Formulae for Predicting Small Color Differences, plans to evaluate available formulae for small color differences (<~2.0 CIELAB) and to define a visual threshold color difference relevant for industrial applications. The second TC concerns the calculation of color matching functions as a function of age and field size. Following on from CIE Technical Report Publ. 170, they plan to recommend a procedure for calculating XYZ-like color matching functions from cone fundamentals, as a function of age and field size, and to deliver a computer program for the calculations. Michael Brill is one of the two new reporters. He is tasked with reconciling Maxwell vs Maximum Saturation color matches by examining: 1) the CIE Publ. 185 rod-cone model; 2) the viability of the uniqueness of stimulus C for a Maxwell match; 3) the hypothesis of pigment-bleaching distinction between the matching methods, and 4) in u'v' space the Wyszecki & Stiles reported discrepancy of the spectrum loci to assess the significance of the difference, and finally 5) considering whether to recommend a new TC to carry out further study. Also, he is to consider whether to recommend a new TC to carry out further study. Hugh Fairman, the other new reporter, will examine spectral data interpolation by reviewing methods, and make a recommendation for the interpolation of existing, highly structured source spectra, including the FL illuminants, for colorimetric calculations.

We left the week excited about the continuing work and new projects for ASTM and CIE Division 1.

Ellen C. Carter

CALENDAR

Please send any information on Member-Body and other organization meetings involving color and appearance functions to:

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2010

Sep 13-16	**2010 CAD RETEC,** Society of Plastic Engineers, Color and Appearance Division, Nashville, Tennessee, www.specad.org/index.php?navid=127
Sep 19-23	**NIP26, International Conference on Digital Printing Technologies,** Austin, Texas, Society for Imaging Science and Technology Society for Imaging Science and Technology, www.imaging.org/IST/conferences/nip/
Sep 24-25	**Bridging the Gap, Pioneering the Future,** The Society for Color and Appearance in Dentistry (SCAD), Newport Beach, California, www.scadent.org
Oct 7-8	**Annual Meeting of the ISCC,** College of Textile, North Carolina State University, isccoffice@cs.com
Oct 19-21	**2010 NPIRI Conference**, National Association of Printing Ink Manufacturers, Sanibel Harbour Resort, Ft. Myers, Florida, http://74.0.252.227/publicarea/techconf2010/techconf10CFP.aspx
Nov 7-9	**IES Annual Conference,** Illuminating Engineering Society, Fairmont Royal York Hotel, Toronto, Canada, www.iesna.org/ac/index.cfm
Nov 8	**ICC-DevCon 2010**, Sheraton Gunter Hotel, 205 E. Houston Street, San Antonio, Texas, www.color.org/DevCon/devcon10.xalter
Nov 8-12	**CIC18, 18th Color Imaging Conference**, Society for Imaging Science and Technology, San Antonio, TX, 703/642-9090, www.imaging.org/ist/Conferences/cic/index.cfm

2011

Feb 2-3	**ASTM E12, Color and Appearance,** Baltimore Marriott Waterfront, Baltimore, MD www.astm.org/COMMIT/COMMITTEE/E12.htm
Mar 22-24	**2011 AATCC International Conference,** American Association of Textile Chemists and Colorists, Charleston, S.C., www.aatcc.org/ic/2011/index.cfm
May 16-19	**Archiving 2011,** Society for Imaging Science and Technology, Salt Lake City, Utah, www.imaging.org/IST/conferences/archiving/
May 15-20	**50th International Symposium, Seminar, and Exhibition,** Society for Information Display, Los Angeles Convention Center, Los Angeles, CA, www.sid.org/conf/sid2011/sid2011.html
Jun 7-10	**2011 AIC Midterm Meeting, Interaction of Color and Light**, Zurich, Switzerland, Organizer: Pro/colore, www.aic2011.org

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American Society for Photogrammetry & Remote Sensing (ASPRS)
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Color Marketing Group (CMG)
Color Pigments Manufacturing Association (CPMA)
Council on Optical Radiation Measurements (CORM)
Detroit Colour Council (DCC)
Gemological Institute of America (GIA)
Graphic Arts Technical Foundation (GATF)
Illumination Engineering Society of N. 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 of Plastics Engineers, Color & Appearance Div. (SPE)
Society for Imaging Science and Technology (IS&T)

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ISCC 2010 Annual Meeting

October 7-8, 2010

College of Textiles, North Carolina State University, Raleigh, NC

Details at <www.iscc.org/meetings/AM2010/>

Last Name/First Name _____

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	$300 ☐	$350 ☐	$325 ☐	$375 ☐

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