

# Inter-Society Color Council *News*

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## PRESIDENT'S COLUMN

On January 26, the board of directors held its winter 1997 meeting in Ft. Lauderdale, FL. In this month's column, I would like to highlight two activities resulting from the meeting.

First, Joy Luke who is co-chair of the History committee with Harry Hammond, reported on some of that committee's work, her contact with the Cooper Hewett Museum and the writing she has been doing for the history committee. Joy has completed a short history of the Inter-Society Color Council. At this time, this history brochure is being printed and will shortly be available in the ISCC office. The brochure is designed to acquaint others with the activities of ISCC through a historical perspective. If your member body is having a meeting and would like copies of the history brochure, other promotional materials, or membership application forms, please contact Cynthia Sturke at the ISCC Office, and she will supply the materials to you in time for your meetings.

Before I get to my second item, I would like to pause and remind readers of the ideals upon which the ISCC was founded as they are given in the membership directory. Article II of the ISCC Constitution describes the Aims and Purposes of the Council. I quote: "The Council shall operate solely and exclusively as a non-profit organization with the following aims and purposes:

A. To stimulate and coordinate the work being carried out by the various members leading to the uniformity of description and specification of color by these members.

B. To promote the practical application of this work to color problems arising in science, art, and industry, for the benefit of the public at large.

C. To promote communication 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.

D. To promote educational activities and the interchange of ideas on the subjects of color and appearance among its members and the public generally.

E. 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." All the ISCC activities are focused toward these goals. I believe most individual members or member body delegates, whether

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they have consciously focused on the ISCC aims or not, are committed to these ideals. However, there is another type of membership; sustaining members, that provide special opportunities to contribute to the goals of the ISCC.

According to the by-laws "Any person, society, association or organization, interested in color and desirous of participating in the activities of the Council for the furtherance of its aims and purposes as set forth in Article II of the Constitution, shall be eligible for the membership as a sustaining member." Either now or in the past, both companies and individuals have chosen to become sustaining members. Some who have chosen to do so, either now or in the past, include: Pantone, the Fine Arts Department of Montclair State College, Technical Associates, Inc., Mr. Donald R. Hall, Ms Isabel R. Manetti of Sharp Electronics, Mr. Thomas J. Keane of BYK-Gardner, Dr. Art Springstein of Labsphere, BYK-Gardner, and Color and Appearance Technology.

Sustaining membership brings with it certain benefits, although many readers may not be familiar with them because they are not identified in the bylaws. These benefits include both useful materials, such as the ISCC Directory and 10 copies of each issue of the ISCC News for use by the sustaining member, and recognition of their support on each newsletter, on promotional brochures, and at annual meetings. Now there is an additional benefit, a hot link from the ISCC home page (<http://www.iscc.org>) to the web page of any sustaining member.

This brings me to the second item from the board of directors meeting. We think that sustaining membership has not been given enough attention, thus we are forming an ad-hoc committee on sustaining membership to try to promote an increasing awareness of the value of sustaining membership during this calendar year 1997. We already have a couple of committee members, but we could always use more help. **Anyone**


**interested in participating on the Ad Hoc Committee for Sustaining Members, please contact me.** Or if you have ideas that should be brought to the committee, please forward them to the Ad-Hoc Committee on Sustaining Members at my address. Also, whether you join the committee or not, I want to ask every member of the ISCC to consider encouraging your company or organization to become a sustaining member.

I will close by saying that the next ISCC Board of Directors meeting will be held on April 12, 1997 at the Airport Hilton, Philadelphia, PA. If you have items you think should be discussed, please contact me or pass them on to your favorite director. You can find all the Board of Director's addresses on the back of this News. *Ellen C. Carter*

*President  
ISCC*

## VIRTUAL COLOR EXHIBITION AT THE NEW YORK SCHOOL OF INTERIOR DESIGN

**Michael H. Brill**

 On February 19, I attended the opening of *Virtual Color*, at the New York School of Interior Design. Shashi Caan, the curator of the exhibit, is also Chair of the ISCC Interest Group on Art, Design and Psychology. Ms. Caan's vision was "to assemble a group of practicing designers, architects, and artists with the task of creating three dimensional experiences in color." These creations extend beyond artificial confines to include the whole exhibit environment: The venue of the exhibition (which had previously been austere white) was repainted with colors that were vivid enough to highlight the show without competing with it. Illumination, ranging from indirect fluorescents to track lights, enhanced

the interactions of these colors. The repainting was permanent, but prompted by the exhibit and executed only two weeks ahead of time. I was impressed by the extent to which the New York School of Design was willing to put the exhibitors' views into practice.

The exhibition itself contains eight displays. Theodore Prudon offers an historical perspective on the current return to architectural color after the stark neutral colors of the modernist style. He views the Bauhaus bias toward neutrals not only as affecting contemporary architecture, but also as leading to a uniformitarian idea that medieval cathedrals were white. Prudon offers pictorial evidence that only post-Reformation cathedrals were white, and that color was at other times a principal design ingredient.

Another display with historical flavor is Joe Roberts' interactive CD-ROM on Josef Albers. This display shows how spatial interaction of colors from even flat patches can powerfully suggest lighting and three-dimensional relationships.

Lois Swirloff has a programmed slide show, and also a true-3D optical illusion to show that lights and painted colors can have interchangeable perceptual roles. The illusion consists of a three-dimensional corrugated surface whose zigs are painted differently than its zags so as to give the strong impression of two differently colored lights from different directions. (Sasha Petrov, eat your heart out!)

Two displays showing interaction of light and objects are presented by Donald Kaufman and Matthew Tanteri. Kaufman leads a viewer to look at two rooms that are painted different colors, each through a window in the other. Tanteri leads a viewer on an exotic journey through a metallic tunnel illuminated dazzlingly (but indirectly) by low-pressure sodium vapor lamps. The afterimage effects are remarkable. From the outside, Tanteri's exhibit is an interesting visual pun: sodium light leaking upward through the tunnel roof appears to be incident from the outside,

and an external blue light appears to suffuse the tunnel from within.

Shashi Caan's own display is a set of working examples of how she uses color palettes in color selection. In this selection, she uses color relationships in harmony with three-dimensional forms. The display consists of a series of "stop-action" shots of color patches arranged in various relationships that resemble those encountered in a particular piece of architecture for which an interior design is required. I find this experimental approach to color combinatorics preferable to certain systems that try to enumerate all the combinations. Joseph R. McMahon (the exhibition designer) remarks, "Caan's .... is a provocative disassembling of built work into bar-code-like arrays of color, which are then reassembled as three-dimensional objects that serve as a wake-up call, revealing that color is not the thing our environment wears but *is* our environment."

Finally, displays of completed architectural works in two different traditions are offered by Gwathmey Siegel (using color sparingly for accent), and by Ricardo Legorreta (using color extravagantly for viewer involvement). One of Legorreta's photographs shows a red veranda on a hotel porch overlooking a blue ocean—good colors for a vacation.

After an evening of discussing the interaction of design and color with participants and guests, I could better appreciate the view that, indeed, "color is not the thing our environment wears but *is* our environment." [A collection of essays available at the exhibit contains all the quotes I have made in this report.]

This exhibition continues from,  
February 20 to May 2, 1997  
Monday-Friday, 10am - 5pm  
Saturday, noon - 5pm  
170 East 70th Street  
New York, NY

## COLOR RESEARCH AND APPLICATION In This Issue, April 1997

**T**he ability to formulate paints, plastics, and dyed textiles to the specific shade that the designer or consumer wants, has long been an important task in the field of color science. This task is closely related to problems of being able to produce batch after batch of the same colored material. It is likely that many people became color scientists just because their company had a need for such color control problems to be solved. With the increased use of computers, these problems have been approached mathematically. Our first two articles this month deal with the theory and mathematics of computer formulation and batch shading. In "Radiative Transfer Theory Solid Color Matching Calculations" Percy Pierce and Robert Marcus review the concepts of color matching calculations. They compare the Kubelka-Munk, two flux approximate radiative transfer, and exact radiative transfer color calculations. These theories provide the theoretical basis for much color formulation software.

Using a modern computer with appropriate software and a database of the characteristics of the available materials, one can input a set of object color tristimulus values of a reflectance (or transmittance) curve and have the computer predict possible formulations for producing batches of colored material that match the desired color. In the second article, "The Colour Correctability of a Colour Matching Recipe," Boris Sluban and James Nobbs examine why it is easier to reproduce certain color formulations to the same color tolerances batch after batch than other recipes. Computer color formulation programs will often produce multiple possible recipes for the same desired product. Advanced knowledge of how correctable a batch would be, would help the developer to select the most desirable formulation.

For the next article, we move from

the production of colored materials to the reproduction of colored scenes, either in photography, printing, or on computer displays. Just as a batch is judged by how well it reproduces the color of the original standard, a color reproduction is judged by how faithfully it reproduces the original. However, the situation involves much more complex perception of appearance. One must remember that with a photo, slide, or computer display, a reproduction is almost never viewed under the same conditions as the original scene. Thus, photographers have long known that an exact reproduction of the colorimetric values may not be judged as the most desirable reproduction; but what is? In the next article, "Chroma Variations and Perceived Quality of Color Images of Natural Scenes," a naturalness criterion is suggested. That is, the image should conform as much as possible to the ideas and expectation that the observers have about the original scene at the time the picture is taken. In this article, Elena Fedorovskaya, Huib de Ridder, and Frans Blommaert, using the media of computer displays, find that colorfulness is the main perceptual attribute underlying image quality and that the perceptual quality of the images was found to be closely related to the naturalness of the images.

So far in this issue, articles on colored materials, we have been concerned with color production, and reproduction. For our next article, we go to the field of preservation and restoration of colored materials, in this case, granite on buildings. A.C. Iñigo, S. Vicente-Tavera, V. Rives, and M.A. Vicente examine the "Color Changes in Granitic Materials Surface by Consolidated and/or Water Repellent Treatment." Color is an important aspect of many historical buildings or even collections of buildings in one town or area. Perceived changes in color often adversely affect an observer's impression of the building and its physical condition, even when color of the edifice is that of the natural building material. Thus while it might be desirable to protect the building

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with chemical coatings, one wants to preserve and maintain the original appearance unchanged.

In the December 1995 issue of this journal, N. Kwallek, C. M. Lewis, J.W.D. Lin-Hsiao, and H. Woodson reported on a study to investigate the relationships among the qualities of the color (hue, saturation, value, and coolness or warmth of the colors) on human performance, mood, and color preference in the office environment. Now Kwallek, Woodson and Lewis team with C. Salese examine the "Impact of Three Interior Color Schemes on Worker Mood and Performance Relative to Individual Environmental Sensitivity." In this study, three office schemes (red, blue-green, and white)

were used. When examining the effects of interior color on office worker performance and mood, few researchers consider individual differences. One important variable may be how individuals screen out irrelevant stimuli within their environment. Some individuals are stimulated or excited by their environment, while others may be distracted. It was found in this study that only when individual differences in the ability to screen irrelevant environmental stimuli are taken into account did the color schemes exhibit a differential impact on productivity.

Over the past 7 years, Neville Smith has compared and contrasted many of the color order systems in modern use.

Specifically he has reported on the Color Curve, Coloroid, DIN, Munsell, Natural Color System, and Optical Society of America-Uniform Color System (OSA-UCS), often using one of the systems as a grid to compare other systems. In this issue, he joins with Fred Billmeyer in examining the "Interrelation of the Swiss Colour Atlas (SCA-2541) and Munsell Colour Order System." Also included in this article are the similarities and differences between the Swiss Colour Atlas and the Natural Color System. Both systems are comprised of double cones forming equilateral triangular constant hue planes.

Ellen C. Carter  
Editor

*Color Research and Application*

## SID 97 INTERNATIONAL SYMPOSIUM, SEMINAR & EXHIBITION

**Hynes Convention Center  
May 11-16, 1997  
Boston, Massachusetts, USA**

**T**echnical courses and seminars, technical sessions, product engineering/applications sessions, panel discussions, poster session, and a major exhibition of the latest components equipment, and systems.

### **Student Travel Grants:**

A limited number of travel grants up to \$1,000 each will be available to student authors of accepted papers. Please call Jay Morreale at 212-620-3371 (fax -3379).

e-mail: jmorreal@newyork.palises.org.

### **Symposium Topics:**

The Society for Information Display (SID) encourages the submission of original papers on all aspects of research, engineering, application,

evaluation, and utilization of displays. SID 97 will feature topical sessions which focus specifically on selected issues or key developments. Paper submissions are welcome for any of the general symposium topics.

## WORLD-CLASS COMMITTEE SELECTS TECHNICAL PROGRAM FOR SID-97

**I**n February 26, 1997 - On two days late in January, 80 of the world's leading display scientists and engineers gathered and selected 220 papers that will make up the technical program of the Society for Information Display's 1997 Symposium, Seminar and Exhibition (SID 97). This annual SID event will take place at the Hynes Convention Center in Boston, MA, from May 11 to May 16, 1997. It has become the leading international forum for advances in electronic-display products, technol-

ogy, systems, applications, manufacturing, testing, and human factors.

Keynote addresses by Peter Brody and Shinji Morozumi will commemorate the 25th anniversary of Brody's fabrication of the first active-matrix liquid-crystal display (AMLCD), and a gala exhibit of historical displays and products in the lobby of the Hynes Convention Center will celebrate the 100th anniversary of Karl Ferdinand Braun's invention of the first modern cathode-ray tube (crt).

In addition to the technical program and keynote addresses, SID 97 will include Sunday short courses, a by-invitation-only Monday investor's forum sponsored by ILR, Monday and Friday seminars, application seminars, an exhibition with over 330 booths, 2 receptions, an awards banquet, evening panel sessions, and the Wednesday luncheon, which will include the formal presentation of *Information Display* magazine's Display of the Year Awards.

For SID 97 registration and hotel information, call Mark Goldfarb, Palisades Institute for Research Services, 1745 Jefferson Davis Highway, Suite 500, Arlington, VA 22202. Tel: 703-413-3891; Fax: 703-413-1315.


The Society for Information Display is an international society devoted to

the advancement of display technology, manufacturing, and applications, with headquarters at 1526 Brookhollow Drive, Suite 82, Santa Ana, CA 92705-5421

*Dr. Karen Braun  
Xerox Corp.*

## CORM 97 WORKSHOPS

### April 28, 1997: The need for NIST Appearance Measure- ments and Standards

 On the Monday preceding the CORM '97 annual meeting, April 28, 1997, from 1:00 pm until 5:00 pm, a CORM workshop will be held, at no cost, on the Need for NIST Appearance Measurements and Standards at the Gaithersburg Marriot Washingtonian Center Hotel, 9751 Washingtonian Blvd., Gaithersburg, Maryland, 20878 (301-590-0044).

The workshop will provide attendees the opportunity to help define and prioritize the color and appearance standards needed in their industries. The workshop is open to participants. Travel, hotel accommodations, and incidentals are the responsibility of each attendee. The workshop will include a panel of experts and an open discussion.

A previous workshop (20 May, 1996) was sponsored by four NIST labs to help NIST researchers better understand industrial needs in color and appearance.

Subsequently, funding for a NIST competence project was granted to the four participating laboratories to advance the science and capability of appearance measurements. The NIST objective is to develop measurement services and standard reference materials for appearance attributes such as: color, gloss, translucency, luster, sheen, texture, orange peel, distinctness of image, and contrast. It is necessary to establish the desired physical properties and ranges of measurement quantities for these reference materials.


For more information and suggestions, please contact:

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### May 1, 1997: Retroreflectance Measurements Workshop

CORM Subcommittee OP-4 and NIST will be sponsoring a workshop at NIST, at no cost, on Retroreflectance. The workshop will review and discuss the calibration and metrology aspects of measuring the retroreflectance of road signs, pavement markings, and other retroreflectance devices. Your participation is invited.

## CIE SYMPOSIUM AND WORKSHOP: STANDARD METHODS FOR SPECIFYING AND MEASURING LED CHARACTERISTICS

 On 22-25 October 1997, the CIE or Commission International De L'éclairage, or International Commission on Illumination, Central Bureau, Vienna, Austria, will conduct a workshop and symposium on Standard Methods of Specifying and Measuring LED Characteristics.

Currently there is considerable effort

within the LED industry and the community who use LEDs to standardize on LED characterization and measurement. CIE TC 2-S4 on LED Measurements will deal with the underlying radiometric, photometric, and colorimetric measurements. Health aspects of LED radiation will also be discussed. The Workshop will contain a tutorial part and a symposium where new results can be discussed. An instrument exhibition and hands on demonstrations will also be organized.

### Call for Symposium Contributed Papers and Posters

Prospective authors are invited to submit two page extended abstracts of their proposed contributions in English no later than 30 April, 1997 to: CIE Central Bureau, Kegelstrasse 27, A-1030 Vienna, Austria, or via email to cieb@ping.at. Please do not fax, as accepted extended abstracts will be printed in an Extended Abstracts Booklets.

Authors will be notified of acceptance of their abstract by 1 June, 1997. Instructions for preparing camera-ready copy of papers will be forwarded to accepted authors. Final camera ready copy of the papers will be due at the Symposium.

### Registration

Registrations are accepted for:

LED measurements tutorials, 22-23 Oct., 1997. Several CIE publications and lecture notes will serve as background material for the tutorials. Registration fee: US\$600,

And:

LED Symposium, 24-25 Oct., 1997. Registration fee: US\$200.

For participants of both parts a reduced registration fee of US\$700, holds. Deadline for registration is 30 April, 1997.

# ACTIVITY SUMMARY OF CIE DIVISION 1 MEETING IN GÖTEBURG, SWEDEN

This article summarizes important color activities within CIE Division 1, Vision and Light, that occurred at the meeting in Göteborg, on Thursday, June 13, 1996 and Friday, June 14, 1996.

The three main sections within CIE Division 1 are Vision, Color and Visual Ergonomics. Only the Vision and Color sections will be summarized here. Anyone wishing details on the Visual Ergonomics Section is welcome to contact the author of this article.

**Vision Section** - There are 9 Technical Committees (TC) and two Reporters within the Vision Section.

## Technical Committee Summary

### TC 1-21 Testing of Supplementary System of Photometry

Chairman: K. Sagawa (JP)

**Terms of Reference:** To test existing methods of photometry to evaluate lights for assessing comparative brightness relationships.

**Status:** A fourth draft report has been written, which discusses the scaling of equivalent luminance based on different reference stimuli. This fourth draft was circulated to members in May and was discussed at a TC meeting at this session. There seems to be considerable disagreement on the equivalent luminance scaling method.

### TC 1-26 Individual Variation of Heterochromatic Brightness Matching

Chairman: H. Yaguchi (JP)

#### Terms of Reference:

1. To analyze existing data on heterochromatic brightness matching in terms of individual variation.

2. To develop a simple set of

individual characteristics for brightness matching.

**Status:** Data has been collected by the chairman. The variations between observers can be described by a model using only two eigenvectors. It is not clear what the physiological basis is for the variations. Differences in absorption within each observer's lens is a most likely cause. A draft report should be available in 1997 at the next Division 1 meeting, which will be held in Kyoto, Japan prior to the AIC Quadrennial Meeting.

### TC 1-30 Luminous Efficiency Functions

Chairman: M. Ikeda (JP)

**Terms of Reference:** To prepare an ISO/CIE Standard on luminous efficiency functions which classifies and specifies the existing functions,  $V_p(\lambda)$ ,  $V_b(\lambda)$ ,  $V_m(\lambda)$ , and  $V_{b,10}(\lambda)$ , and the color-matching function,  $y_{10}(\lambda)$ , if appropriate, in their photometric use.

**Status:** A draft report, entitled "Guide to Use of Spectral Luminous Efficiency Functions", has been produced. It describes the following seven luminous efficiency functions and how they should be used:  $V(\lambda)$ ,  $V_m(\lambda)$ ,  $V_{10}(\lambda)$ ,  $V_{b,p}(\lambda)$ ,  $V_{b,2}(\lambda)$ ,  $V_{b,10}(\lambda)$ , and  $V'(\lambda)$ . All existing data are summarized in the report. Ikeda wants to leave the data at 10nm because there has been no agreed interpolation method for generating the 1nm data. If this is only a guide, then 10nm data should suffice. Also CIE TC2-35 is publishing a  $V(l)$  standard that will be specified at 1nm intervals. Therefore it was voted and approved to change the terms of reference for this TC to read "To prepare a CIE Technical Report" and not an ISO/CIE standard. If 1nm data were available, an ISO/CIE Standard would be warranted. Normalization of the data was also discussed. The  $V_{b,2}(\lambda)$  and  $V_{b,10}(\lambda)$  functions were normalized to 1.0 at 570nm. Normalization of the other functions will not be done for this guide. Trezona and Kinney recommended dropping  $V_{b,2}(\lambda)$  because it is equivalent to  $V_m(\lambda)$ . Other comments pointed out that the  $K_m$  reference should be included and the explanation of  $V_{10}(\lambda)$  should be explained.

### TC 1-36 Fundamental Chromaticity Diagram with Physiologically Significant Axes

Chairman: F. Vienot (FR)

**Terms of Reference:** Establish a chromaticity diagram of which the coordinates correspond to physiologically significant axes.

**Status:** Work is ongoing to derive a continuous observer from 1 degree and 10 degrees. The approach starts from the CIE 1964 10 degree observer, employs the König fundamentals and then involves the continuous addition of varying parameters, such as field size taking into account the macular pigment, the ocular media, and the photopigment optical densities. A seventh draft has been prepared and will soon be circulated. Progress of the TC was presented at the CIE Experts Symposium on Image Technology in Vienna (March, 1996) and a seven page report is included in the published Proceedings.

### TC 1-37 Supplementary System of Photometry

Chairman: K. Sagawa (JP)

**Terms of Reference:** To recommend a system of photometry to assess lights in terms of their comparative brightness relationships.

**Working Program:**

1. To list items on which photometric systems based on brightness matching are evaluated, such as the reference stimulus, linkage to the current CIE photometric and colorimetric systems, practical simplicity and the physiological basis of the system structure, etc. The numerical testing results from TC 1-21 will be included.

2. To evaluate the proposed systems according to the items listed above.

3. To find a system for recommendation by selection from the proposed systems, or by some combination of them.

**Status:** This TC will follow from the completion of TC 1-21 work. They are considering the requirements for a CIE model for a supplementary system of photometry. This TC met in Göteborg. It was agreed that the new system should account for a chromatic effect as it

relates to brightness, be based on a 10 degree field, and be normalized at 555nm but the real reference is 540THz. The chairman proposed a draft system for recommendation, but agreement within the TC has not yet been reached. A request to do a qualitative evaluation of the proposed systems was raised by members.

#### TC 1-40, Critical Flicker Fusion Frequency

Chairman: K. H. Ruddock (GB)

Terms of Reference: To investigate fundamental parameters affecting critical flicker fusion frequency (CFF) for the evaluation of flicker in CRT displays.

Status: There has been no progress made by this committee since its formation in Melbourne 1992. This committee is very important because ISO is looking to the CIE for guidance on the evaluation of flicker of self-luminous displays. Dr. Vienot, as Associate Director, will try to drive this TC. She will inform the Chair of the urgency of this work and request that he respond with some type of action within 6 months. If no action ensues, this TC will be disbanded.

#### TC 1-41, Extension of $V_m(\lambda)$ Beyond 830nm

Chairman: P. L. Walraven (NL)

Terms of Reference: To write a report on the feasibility of extending the  $V_m(\lambda)$  function beyond 830nm.

Status: The report is ready, but it will be modified based on some results of TC 1-36. Therefore, the final report will be ready before the 1997 meeting.

#### TC 1-42, Color Appearance in Peripheral Vision

Chairman: M. Takase (JP)

Terms of Reference: To prepare a technical report on color appearance zones for colored lights in terms of unique hues in peripheral vision.

Status: They have collected data for highly saturated colors. They need data for colors of low and medium saturation levels. They will prepare a color zone map by the 1997 meeting.

#### TC 1-46, Equivalent Luminance

Chairman: S. Kokoschka (DE)

USA members: none

Terms of Reference: To write a technical report describing the fundamental concept of equivalent luminance and to provide guidelines on how to apply these concepts.

Status: This new TC was established in New Delhi. Currently Kokoschka is the only member. Dr. Vienot, as Associate Director, will contact him about getting more TC members. So far Kokoschka has outlined two parts to the programme of work. The first is to summarize the experimental results for equivalent luminance according to the literature. The second is to consider the work of TC 1-21 and TC 1-37 when considering methods for calculating and measuring equivalent luminance.

#### Reporter Summary

##### R1-02-Brightness-Luminance

Relation: F. J. Blommaert (NL) Reporter

Status: Nothing has been heard from this reporter. Dr. Vienot will follow-up to see if there has been any activity.

R1-12 - Visual Acuity: P. Waraven (NL) Reporter

Status: No report

**Color Section** - There are 8 TCs and 5 Reporters within the Color Section.

#### Technical Committee Summary

##### TC 1-27 Specification of Color Appearance for Reflective Media and Self-Luminous Display Comparisons

Chairman: P. J. Alessi (US)

Terms of Reference: To study and make recommendations for the specification of a color appearance match between a reflective image and a self-luminous display image.

Status: A preliminary report has been written and published in the CIE Experts' Symposium Proceedings on the findings of six research groups that each independently responded to the published guidelines (CIE Publication No. 118 Paper No. 4). Their results show inconsistencies. Plans are to

collate all raw data, subject them to the same analysis, and report results on more common ground during the next quadrennium.

#### TC 1-31 Color Notations - Color Order Systems

Chairman: C. McCamy (US)

Terms of Reference: To study and report on color order systems in response to a request from ISO for preparatory and background work which must be accomplished before an ISO Standard in the field of color notation can be drafted.

Status: The sixth draft report submitted to the Division at the New Delhi meeting was distributed to all TC members for ballot. All members voted approval. Two members did not return their ballots. The report does not recommend use of any one color order system as a standard. The report describes existing color order systems and summarizes how each can and should be used. The Division Editor is reviewing the report and the Division and Board of Administration ballots will be handled by the Central Bureau.

#### TC 1-33 Color Rendering

Chairman: J. Schanda (HUN)

Terms of Reference: 1. Study indices for the evaluation of color rendering properties of light sources based on a color appearance model.

2. Prepare a report on a proposed method that will replace CIE Publication No. 13.2 (this report has the potential to become a standard).

Status: The fourth draft was discussed at a TC meeting in Göteborg. Based on comments received, a final TC voting draft will be prepared and the report will be published before the end of the year.

#### TC 1-34 Testing of Color Appearance Models

Chairman: Mark Fairchild (US)

Terms of Reference: Investigate the performance of models based on their ability to predict the color appearance of surface colors in simple and complex scenes under various illumination conditions.

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**Status:** As a result of the CIE Color Experts' Symposium, it had been agreed that an interim color appearance model should be recommended by the CIE, CIE97. This model is being put together by Ronnie Luo with help from Mark Fairchild, Robert Hunt and Yoshinobu Nayatani. This model is being constructed by pulling together the strong features of all the current color appearance models. It should be ready for presentation at the Kyoto meeting. This new direction required a change in the Terms of Reference.

**Addition of Terms of Reference:** To recommend one color appearance model for interim use. This model should give due consideration to the findings of other relevant Technical Committees. The final Technical Report should include summary details of all analyses carried out and all models investigated.

**Additions to the working program:**

1. Establish one color appearance model.
2. Prepare a Technical Report.

#### TC 1-35 Selection of Light Sources for Color Vision Examination

**TC Chairman:** S. Dain (AU)

**Terms of Reference:** To provide a procedure and criteria for the identification of appropriate light sources for color vision examination using reflecting samples.

**Status:** Because of inactivity since it was formed in 1991, this TC was disbanded.

#### TC 1-38 Compatibility of Tabular Data for Computational Purposes

**TC Chairman:** C. McCamy (US)

**Terms of Reference:** To prepare guidelines for tabulating CIE spectral data to provide compatibility of sets of data for computational purposes, considering such factors as spectral range, spectral interval, bandpass function, truncation, interpolation and number of digits.

**Status:** A report of the discussions in New Delhi, members' comments and Schanda's suggestions for a new interpolation approach, as described in a manuscript by Schanda and

Kranicz, is being distributed for consideration and further comment. Based on the responses, the Chairman will prepare another draft technical report on recommended practices for tabulating spectral data. The importance of this committee's work was emphasized. The work of many other TCs is looking to this TC for guidance before proceeding.

#### TC 1-43 Rod Intrusion in Metameric Matches

**Chairman:** R. Berns (US)

**Terms of Reference:** 1. To write a report giving a step by step procedure for calculating the effect of rod intrusion on trichromatic color matches;

2. To use the procedure to calculate the effect of rod intrusion on typical industrial color matches.

**Status:** The work of this TC has been stalled because they are still trying to settle on the calculational procedure for pupil diameter. Alan Robertson mentioned that the calculation should be done for a pupil diameter of 5mm rather than the worst case scenarios of 2 and 7mm.

#### TC 1-44 Practical Daylight Sources for Colorimetry

**Chairman:** R. Hirschler (BR)

**Terms of Reference:** 1. To intercompare existing daylight simulators for color measuring instruments and color-matching booths;

2. On the basis of this intercomparison, to recommend practical methods for simulating daylight sources.

**Working Program:**

1. Obtain spectral irradiance data on existing simulators for both color-matching booths and color measuring instruments, either directly from the manufacturer or from spectroradiometric measurements performed by the committee members, under standardized conditions.

2. Evaluate the performance of these existing simulators according to various criteria, including: (a) quality of simulation based on CIE Publication No. 51; (b) integrity of simulation (e.g. stability, insensitivity to instrument

geometry and polarization effects, optical throughput); (c) practicality of implementation (e.g. simplicity of fabrication, economy, compatibility with existing instrumentation)

3. Prepare a CIE technical report on these findings and provide recommendations for practical methods of simulating daylight sources for different applications (e.g. based on allowable color-difference errors). It is expected that more than one method will be required to satisfy practical considerations (e.g. it is not possible to have as stable or reproducible a daylight simulation with pulsed lamps as continuum lamps, but they are preferred for on-line measurements; so this reality must be accommodated in the recommendations).

**Status:** it was requested that the following terms of reference be added: 3. Confirm by extensive field trials the practical applicability of the currently recommended method for assessing the quality of daylight simulators for colorimetry (CIE Publication No. 51). After much discussion, it was decided to reject this addition to the terms of reference. It was felt that such an addition to the terms would slow down the work, which is already considered very urgent, of this TC. Furthermore, revision of CIE Publication No. 51 is an issue for TC 1-45 to handle and not TC 1-44. Thus TC 1-44 is urged to move forward with their work so that it can be completed as soon as possible.

#### TC 1-45 Revision of CIE Publication 51 to include D50 Simulators

**Chairman:** C. S. McCamy (US)

**Terms of Reference:** To prepare a revision of CIE Publication 51-1981 "Method of Assessing Daylight Simulators for Colorimetry" to include the assessment of D50 simulators.

**Status:** The Chairman requested that the terms of reference be modified to include in the revision an extension of the spectral range of the method. In Publication No. 51, all metamers are defined and computations performed from 400 to 700nm. This spectral range is inadequate for color-matching applications adding long wavelength



red light. The spectral range must be extended to 760nm to fairly assess all visual effects. Extension of the spectral range would be consistent with the current consensus in TC 1-38. This addition to the terms of reference was rejected because it was felt that it would slow down the progress of this committee. Extension of the spectral range should be treated as a separate issue.

#### Reporter Summary

##### R1-04- Color Difference Evaluation:

K. Witt (DE), Reporter

Status: No report

##### R1-11 - Cognitive Aspects of Color:

G. Derefeldt (SE), Reporter

Status: Derefeldt has completed a study which has been published in SPIE proceedings. It will also be published in the CIE Collection. It is still not time to form a TC. Derefeldt will continue as Reporter paying special attention to the literature with regard to spatial and motion issue of color. A final report will be ready in one to years.

##### R1-13 - Revision of Wyszecki and

Stiles: P. Walraven (NL), Reporter

Status: After CIE encouragement, Wiley wants to publish a third revision. Wiley agreed to provide funding and would like the project completed in two years. The revision would be about 1100 pages. Peter sent a letter to potential authors. Many authors will contribute by each writing a chapter according to their expertise. Alan Robertson mentioned that he had much of the original material from the book and he would be happy to contribute it.

##### R1-14 - Visual Observation of Blood Oxygen Levels:

W. Julian (AU), Reporter

Status: Experiments and research are ongoing.

##### R1-15 - Lighting Terminology:

M. Pointer (GB), Reporter

Status: This reportership was formed upon request of TC 7-06. Mike Pointer

is working on the effort to produce a new CIE lighting vocabulary in electronic form so that it can be updated periodically. Twenty six people from Division 1 have agreed to help. Work is organized into three categories:

1. terms that require no change
2. terms that require new definition
3. new terms.

This vocabulary will incorporate terms from ISO TC 187. AIC will also be invited for input. Many of the ASTM E284 definitions are being considered. The concept of grouping terms according to subject matter (i.e. imaging, technology, colorimetry, etc.) is being considered.

No new Technical Committees were formed, but the following new reporters were formed.

#### Vision Section

There is a need to establish the practical uses of the new photometric system designed by TC 1-21 and TC 1-37. Design of visual environments is very important. Thus the following Reporter proposal was put forth:

Title: Visual Adaptation to Complex Luminance Distribution

Terms of Reference: To survey state-of-the-art research on visual adaptation to complex luminance distribution and to judge whether CIE should establish a new Technical Committee on this issue.

Reporter: Dr. Itiroyuki Shinoda (JP)

The title, terms of reference and Chairman were approved by unanimous vote. It was given a number of R1-16.

#### Color Section

A. William Thornton has published three papers in Color Research and Application outlining work that he has done to point out that there are certain situations existing where visually matching lights do not lead to identical chromaticity coordinates. These results suggest that there can be breakdowns in traditional colorimetry that should be

addressed and hopefully solved. A reportership has been established to try bring together all knowledge on breakdowns in colorimetry.

Title: Improved Colorimetry

Terms of Reference: 1. To inform Division 1 of work carried out by researchers in the area of additive color matching, breakdown of trichromatic generalization, and improved systems of colorimetry and to report progress at division 1 meetings; 2. To advise on the feasibility of establishing a Technical Committee.

Reporter: J. Schanda (HUN)

The title, terms of reference and Chairman were approved by unanimous vote. It was given a number of R 1-17.

B. Not all color names are possible or present at all illuminance levels. A new reportership was formed to address the presence of different color names depending on illuminance level.

Title: The Use of Color Identification Under Various Illuminance Levels.

Terms of Reference: 1. To survey the state-of-the-art of color codes under various illuminance levels; 2. To judge whether the CIE should establish a Technical Committee on the topic; 3. To establish liaisons with CIE Division 3 and 4.

Reporter: Taiichiro Ishida (JP)

The title, terms of reference and Chairman were approved by unanimous vote. It was given a number of R 1-18.

#### **TC 2-33 "CIE Standard Colorimetric Illuminants"**

Schanda requested that CIE Division 1, discuss the following with regard to the above TC in Division 2:

The original  $S_0(\lambda)$ ,  $S_1(\lambda)$  and  $S_2(\lambda)$  tables were defined at 10nm intervals. In CIE 15.2-1986, they were linearly interpolated to 5nm intervals with the recommendation to use linear interpolation to obtain 1nm tables or to find intermediate values. The question now is whether the interpolation of

(Continued→)

$S_0(\lambda)$ ,  $S_1(\lambda)$  and  $S_2(\lambda)$  tables using a non-linear method should be evaluated as part of the work of TC 1-38? It was pointed out that only the D65 table represents original fixed point data at 10nm intervals and it should remain so. Therefore it was decided that the S functions should become part of the TC 1-38 work.

Schanda also asked if Illuminant B could be eliminated. The answer was yes.

It was agreed to support the use of normal script in describing illuminants rather than subscripts; (i.e. D65 rather than  $D_{65}$ ).

#### Meeting Schedule

The next Division One meeting will be held in Kyoto on May 23-24, 1997 prior to the AIC Quadrennial Session.

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## MUNSELL COLOR SCIENCE LABORATORY Overview & History

Gultekin Celikiz

**D**id you ever wonder what the Munsell Color Science Laboratory is doing and what is its involvement at Rochester Institute of Technology. Well I wondered and I guess by mental telepathy I received a copy of their yearly report from RIT, and this is what I learned:

The Munsell Color Science Laboratory (MCSL) was established in 1983 after the dissolution of the Munsell Color Foundation, Inc. The aims and

purposes of the Munsell Foundation as stated in its bylaws were "...to further the scientific and practical advancement of color knowledge and, in particular, knowledge relating to standardization, nomenclature and specification of color, and to promote the practical application of these results to color problems arising in science art and industry."

The following four basic objectives guide the activities of the Munsell Color Science Laboratory:

- 1) To provide undergraduate and graduate education in color science,
- 2) To carry on research and development in color and appearance,
- 3) To maintain the facility to perform spectrophotometric, colorimetric, and geometric measurements at the state of the art, and
- 4) To provide an essential ingredient for the success of the first three - namely, liaison with industry.

Mark D. Fairchild has been the Director of the MSCL since 1996.

**Richard S. Hunter Professorship:** The R. S. Hunter Professorship in Color Science, Appearance, and Technology was established in 1983 by a gift from Richard and Elizabeth Hunter. They recognized a need for perpetual education and research in this critical area.

Franc Grum was the first R. S. Hunter Professor and Director of MCSL from 1983 until his untimely death in 1985. Roy S. Berns has been the R. S. Hunter Professor since 1987 and Director of MCSL from 1986 until 1996.

In 1984 there were two faculty members, Drs. Franc Grum and Roy Berns, a secretary and two students. At the close of academic year 1995, there were still two faculty members, Roy Berns and a newcomer, Mark Fairchild. In addition, there were three staff members, three visiting scientists, six full time graduate students, thirteen part-time graduate students, two seniors, and four new students.

The Munsell Color Science Laboratory is now made up of four faculty members, three staff, and

approximately 20 graduate students and visiting professors. Research in the laboratory falls into the general areas of appearance modeling and psychophysics, fundamental color science, color measurement, and image reproduction. MCSL is made up of six main laboratories devoted to research and education in these areas and housed in RIT's Chester F. Carlson Center for Imaging Science. During 1996 the laboratory almost doubled its personnel; the number of faculty increasing from 2 to 5 and the total number of people working in the lab from 25 to about 40. In addition, the research funding had increased ten fold during the first decade of operation. In July 1996, Dr. Mark Fairchild was appointed as the new director of MCSL leaving more time for Dr. Berns to teach and do research with graduate students. The aim of this plan is to better fulfill the objectives of the laboratory defined above.

Let us next look at some of the activities of the faculty and staff that make the MSCL.

**R. S. Hunter Professor, Dr. Roy S. Berns:** Dr. Berns received his BS and MS degrees from UC Davis and his PhD in Chemistry from Rensselaer Polytechnic Institute. His research activities are in the fields of "Color Tolerances", "Multi-Spectral Image Acquisition", and "Color Modeling".

Color tolerance research is supported through the MSCL Industrial Color Tolerance Consortium. Currently there are nine members. The research, carried out by a graduate student, resulted in a database of hue discrimination data showing that CIELAB does not have visual uniformity as a function of hue angle. Of interest was that the lack of uniformity was not well described by either CMC or BFD equations. Articles are in preparations for submission to *Color Research and Application* and to the *AIC Quadrennium* in Kyoto. There have been collaboration with Professor Manuel Melgosa at University of Granada in Spain. The goal is that vision researchers will use these

population results rather than single-observer results such as the MacAdam ellipses.

With Multi-Spectral Image Acquisition research is to develop practical methods of color printing that minimize metamerism between original objects and their printed reproductions. One component of this research is to have spectral images rather than trichromatic images. There are various techniques to estimate spectral scene data rather than make direct measurements every 10nm or 20nm throughout the visible spectrum. The results of the research results this year were presented both at Optical Society of America's annual meeting and the Scottsdale Color Imaging Conference. A paper was also presented to *Color Research and Application* for publication.

Recently there was an interest in halftone printers, particularly ink jet. Hewlett-Packard's Barcelona Division is supporting a two year research effort on this project. Koichi Iino, Visiting scientist from Toppan Printing Co. Ltd., has developed spectral models of halftone printing and incorporated them into color management modules for desk top publishing and conventional printing. A two-part article on this subject is being completed for submission for the *Journal of Electronic Imaging*. The second visiting scientist, Tsuneo Kusunoki from Sony performed a visual experiment where observers scaled differences in image quality between displays with different surface reflection properties. This research will be submitted to the *Society for Information Display*.

This year an article on the theory and practice of deriving instrumental tolerances from visual and colorimetric data was submitted to *Color Research and Application* and the article has recently appeared in that Journal.

Dr. Berns attended four conferences; CIE sponsored symposium on color standards for image technology where he presented a paper on colorimetry for imaging and led a roundtable discussion on calibration, characterization and test targets, ISCC

Annual Meeting in Orlando where he gave a paper describing an abridged technique to diagnose spectrophotometric errors. An article on this subject will soon be published in *Color Research and Application*. In May 1996 University of Rochester and RIT jointly sponsored a conference honoring Dr. David MacAdam where Dr. Berns was invited to give a paper on the history and current status of color difference equations. In November, in Scottsdale IS&T/SID Color Imaging Conference Dr. Berns spoke about the new CIE technical report on CRT colorimetry. It must be added here that all his research activities were performed with his graduate students.

**Director of MCSL, Dr. Mark Fairchild:** Mark received his BS and MS degrees from Rochester Institute of Technology and his PhD in Vision Science from University of Rochester. In July 1, 1996, Dr. Fairchild became the Director of MCSL with responsibility for the facilities and research program. Two new faculty joined the MCSL family; Jon Arney and Ethan Montag. More about them later on. It is anticipated that a third position, the Xerox Distinguished Professorship in Imaging Science, will be filled by a candidate with expertise in digital color imaging systems.

Colleen Desimone remains as the MCSL secretary. Lisa Reniff has returned from maternity leave on a half-time basis as a Color Scientist. Dave Wyble joined the MCSL as a full-time Color Scientist beginning Jan. 1997. Dave with a background in computer science will be completing an MS program in Color Science that he undertook on a part-time basis.

Dr. Fairchild's research activities are centered around "Color Imaging and Perception" and includes topics such as color-appearance modeling, color-gamut mapping, image preference, image perception, and computer graphics.

Dr. Fairchild shares his research activities with ten of his graduate students that he advises. Here is a list of topics that his graduate students

have worked or are working at this time:

"On the influence of print size on color appearance in large-format ink-jet printing with the aim of developing algorithms that can be used to generate consistent color for various size prints."

"The development and testing of general purpose gamut-mapping algorithms to deal with the colors that cannot be produced on a given imaging device."

"Testing of color appearance models in CRT-to-print image reproduction."

"A psychophysical evaluation of preferred color reproduction for low-end ink-jet prints to help develop better printer driver software."

"The influence of surround relative luminance on the perceived contrast of black and white images."

"Measuring perceptual preference for gamut mapping and making detailed measurements of constant-hue contours in the CIELAB color space."

"Development SGI Iris Explorer modules for color reproduction and color appearance research and education."

"Cross-media image matching experiment and a computer graphics project aimed at the development of colorimetrically accurate, full spectral, synthetic images that can be used in the evaluation and development of color imaging systems."

"Evaluating and revising the Nayatani *et. al.* color appearance model."

"Psychophysical measurement of the tradeoff between dots-per-inch and bits-per-pixel in printed images."

"Monte Carlo simulation of color matching in order to derive more reliable estimates of the variation in color matching functions."

"Computer graphics rendering of sampling of various color spaces and color order systems."

In the remaining time Mark is authoring his forthcoming book, "Color Appearance Models."

Further detail of his research can be obtained from his world wide web site: <http://www.cis.rit.edu/people/faculty/fairchild>.

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**Jonathan S. Arney, Associate Professor:** Dr. Arney has a BS from Wake Forest and a PhD in Chemistry from University of NC, Chapel Hill. His research activities deal with "the Optics of Papers: MTF Analysis", "Modeling Halftone Imaging: The Yule-Nielsen Effect", and "Image Microstructure". Paper remains a major medium for non-impact printing, and the optical properties of paper have a significant impact on tone and color reproduction. Most printing processes use some form of halftone to control tone and color reproduction, and the way light scatters within paper governs the probability that the light will be absorbed by the halftone dots. This lateral scattering acts as an optical blurring of the halftone dots and results in an overall darkening of the image. Few reports had been published on the lateral scatter properties of paper, so a project was initiated to carry out a systematic study of the scattering characteristics of a series of papers and other substrates commonly found in non-impact printing applications.

Tone reproduction in halftone images has long been modeled empirically with the so called Yule-Nielsen equation. The thrust of current research was to develop a mechanistic understanding and quantitative model of the microstructure of halftone images and the microscopic interaction between light, ink, and paper. Published reports of this work are "An Expanded Murray-Davies Model of Tone Reproduction," and "Modeling the Yule-Nielsen Effect."

The current focus of research in image microstructure is on the impact of different halftone patterns (clustered dots, disperse dots, error diffusion, etc.) on tone and color microstructure and on the characteristics of ink jet and laser jet technologies. These projects will move from the experimental analysis of tone reproduction into the area of color microstructure analysis. The results are expected to lead to improved understanding of the physical and optical limits and potentials of non-impact printing.

**Ethan D. Montag, Research Assistant Professor:** Dr. Montag has a BS from University of Pennsylvania, and an MS and a PhD in Experimental Psychology from UC San Diego. Before becoming a Research Assistant Professor Dr. Montag was a Postdoctoral Fellow at University of Rochester. As a faculty member he taught *Vision and Psychophysics* and the *Color Science Seminar*. During the past year Dr. Montag completed the first part of an extended research project dealing with color gamut mapping funded under the auspices of the NYF-NYS/IUCRC and NYSSTF-CAT Center for Electronic Imaging. This part of the project dealt with the evaluation of gamut mapping algorithms in which only one color attribute, lightness or chroma, of the image was mapped at a time. These results were presented at the IS&T/SPIE Symposium on Electronic Image in San Jose.

Based on these results, Dr. Montag has been developing the next series of experiments in which simultaneous gamut mapping of chroma and lightness will be studied with gamuts more similar to those found in real devices. He has been working on new images to use as stimuli that will push the algorithms to their limits. Another focus of this research is whether gamut mapping algorithms can be used globally on an image as opposed to using different algorithms for different regions of color space.

During last summer, Dr. Montag finished writing up a project studying the relationship between form and color. This work has been accepted for publication in the *Journal of the Optical Society of America, A*. This study involved the measurement of the changes in thresholds for chromatic stimuli due to the influence of boundary information. Dr. Montag found that sensitivity to color can be enhanced or degraded depending on how close the color to be detected is to a superimposed grating.

Dr. Montag is also involved with Dr. Berns and Lisa Reniff with the measurement of color differences. This

project is part of a work being done for the MCSL Industrial Color Difference Consortium.

The MCSL is very fortunate to be one of the world's most well-equipped laboratories for color science research and education. The equipment is housed in six large (and several smaller) laboratories within RIT's Chester F. Carlson Center for Imaging Science. A complete list of MCSL facilities is available upon request.

Further information can be found by visiting the world wide web site at <http://www.cis.rit.edu/research.mcsl>.

or

contact:

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## RIT ANNOUNCES UPCOMING SHORT COURSES

Rochester Institute of Technology, Munsell Color Science Laboratory announces its annual courses on color; "**Principles of Industrial Color Measurement**," June 16 -18, 1997, "**Industrial Instrumental Color Matching**," June 19, 1997, and "**Foundations of Color Management Systems**," June 23 -27, 1997.

• "Principles of Industrial Color Measurement," will focus on the applications of colorimetry for industrial color control. Key topics include spectrophotometry; principles,

geometry selection and methods of characterizing precision and accuracy; CIE colorimetry; derivation of colorimetry from tristimulus values through CIELAB and tolerancing: CMC & CIE94 equations, deriving visual tolerances from historical, pass/fail data additional topics include color vision; color order systems and metamerism. This course is taught by Drs. R. Berns and M. Fairchild of RIT.

••“Industrial Color Matching” will be taught by Ralph Stanziola, co-founder of Applied Color Systems and current President of Industrial Color Technology. His topics will include colorant identification via spectral analysis, additive functions of reflectance (K/S) and transmittance (Beer-Lambert), semi-quantitative production batch adjustments, computer colorant formulation, methods to get the most out of your system, and a problem solving session.

••“Foundations of Color Management Systems,” is a five-day intensive course to teach the underlying principles for implementing color management. The course is divided into three sections: colorimetry, modeling imaging peripherals for device profiles, and color appearance models. Participants can participate in any or all of the sections.

For further information on any of the courses, contact: Colleen M. Desimone, Munsell Color Science Laboratory, Rochester Institute of Technology, Chester F. Carlson Center for Imaging Science, 54 Lomb Memorial Drive, Rochester, NY 14623-5604; Telephone 716-475-7189, FAX 716 475-5988; e-mail cmd9553@rit.edu. Visit our WebSite at:

<http://www.cis.rit.edu/research/mcsl/courses.html>.

## THIRD OXFORD CONFERENCE: “OPTICAL SPECTROMETRY”

A three day conference focusing on Optical Spectrometry is to be held at the Royal Holloway, University of London, Egham, Surrey from 28 June to 2 July 1998. It is jointly organized by the Council for Optical Radiation Measurement (US) and the Ultra Violet Spectrometry Group (UK).

The conference will address optical spectrometry in the UV, visible, NIR and IR regions, including reflectance, fluorescence, and luminescence techniques. Particular emphasis will be placed on analytical applications, instrumentation, validation, and standards. The conference targets chemists, biochemists, QA officers, standards institutions and instrument manufacturers needing to keep abreast of current advances in standards and applications of optical spectroscopic techniques.

International speakers have been invited to give keynote lectures opening sessions containing submitted papers. Topics are as follows:

- Analytical applications in quality control, colour, structural analysis and biomedical characterization.
- Instrumentation
- Compliance, validation, and traceability
- Advances in standards and metrology
- Novel techniques
- Training

Authors should submit a 200 word abstract together with a completed reply form to the primary contact for the conference. For further information, contact in the US:

Dr. Art Springsteen, c/o Labsphere Inc., P.O. Box 70, N. Sutton, NH 03260; tel: 603-927-4266, fax: 603-927-4694; e-mail: arfty1166@aol.com

Outside of the US:

Dr. Mary Barnard, The Pines, Larch Avenue, Ascot, SL5 0AW UK; tel: 01344 21485

*Optical Radiation News, #66, Fall 1996*

## COLOR DISPLAY CALIBRATION STANDARD

NIST and the American Society for Testing and Materials (ASTM) have completed revision of ASTM Standard E 1455, on the color measurement of displays. When compatible tristimulus colorimeters, as defined in the standard, are calibrated and used according to the standard, these relatively simple and inexpensive instruments achieve an accuracy comparable to that of more complicated and expensive spectroradiometers. Standard E 1455 thereby allows the wider and more consistent use of color calibration instruments. The improvement is achieved by the computation and the application of a calibration matrix that allows each detector to contribute in the appropriate proportion to all of the color coordinates.

*Optical Radiation News, #66, Fall 1996*

## NEWS FROM THE COLOR MARKETING GROUP (CMG)

**Melanie C. Wood, CMG\***, President of CMG has announced the results of the election of officers: **Hall S. Dillon, CMG**, Dorn Color, Inc., Cleveland, OH, Executive Vice President; **Allen Ferrell, CMG**, The Creatice Edge, Denver, CO., Vice President, Strategic Planning; **Jay de Sibour, CMG**, Pantone, Inc., Carlstadt, NJ., Treasurer; **Sue Ross,**

(Continued→)



**IIDA, CMG**, Monterey Carpets, Inc., Santa Ana, CA., Secretary; and **Laraine Turner, CMG**, The Jolley/Turner Group Inc., Long Beach, CA, Immediate Past President.

## APPLE COMPUTER RECEIVES

### CMG'S DIMMICK AWARD

Apple Computer of Cupertino, CA is the 1996 recipient of CMG's prestigious Dr. Forrest L. Dimmick Award for Excellence in Color Marketing. The Dimmick Award is the highest honor bestowed by CMG, having been presented just nine times since its inception in 1969. The award is named after Dr. Forrest L. Dimmick, an early member of CMG, who was professor of psychology at Hobart College, Geneva, NY, from 1925 to 47. He later headed the Vision Bureau at the US Naval Research Laboratory in New London, Ct.

"The award recognizes the outstanding accomplishments of those who exemplify the best use of color as a fundamental marketing tool," said Laraine Turner, CMG\*, who presented the award to Apple's Jennifer Bossin, Senior Marketing Manager. "It is designed to honor the people who develop, and companies that provide resources for, marketing programs in which color is used to benefit their customers, society at large or the environment."

According to CMG Treasurer Jay de Sibour, CMG, of Pantone Inc., Apple has long been an innovator in the use of digital color on the desktop, and has been a pioneer in providing user-friendly color solutions for both professionals and consumers. "Apple Computer, the choice of the graphic design marketplace, has literally revolutionized the world of digital color."

For further information contact:  
Mary Ann Miller  
Desbrow & Associates  
tel: 412-471-5700

## NEW CORM COMMITTEE FORMS

The new subcommittee **OP4** on Retroreflectance held its first meeting during the CORM 96 conference on May 20, 1996. During this 1st official meeting the subcommittee title of simply "Retroreflectance" was agreed to. The mission statement was formulated that stated the subcommittee will be: "To advise on the national measurement system for retroreflectance. This will include advice on capabilities at the national standards laboratory level and methods of distributing and certifying the distribution of this scale at the secondary laboratory level and at the measuring instrument user level."

A discussion of the working program for the committee resulted in the following list of items to be addressed: 1) Advice on national laboratory needs; 2) Reference documents; 3) Work-shop and survey; 4) traceability and secondary laboratory testing; and 5) accreditation issues.

The committee decided to proceed with the Retroreflectance Workshop in conjunction with the CORM 97 annual meeting, as described in the Jan-Feb 1997 issue ISCC News.

## THE FIFTH COLOR IMAGING CONFERENCE OF IS&T & SID

The Color Imaging Conference has become the premier technical conference for scientists, technologists and engineers working in the areas of color science and systems and their

application to color imaging. 1997 marks the fifth year of this topical, annual conference with a significant growth in overall participation as well as an increase in the professional disciplines represented.

As the Color Imaging Conference has grown and matured, the focal areas have expanded dramatically. Professional disciplines represented range from psychophysics, optical physics, image processing, color science, graphic arts, systems engineering and applications as well as hardware and software development. The focus is color - color as a critical element of the research and application efforts of this segment of the professional community.

Beyond representing all areas of color imaging, this year's conference will expand into the areas of color on the web and color in motion imaging in particular and computer science in general.

With this call for papers we are urging you, the members of the color imaging profession, to submit a paper to the technical program committee. All submitted papers will be refereed by the technical committee in order to ensure that the conference continues to provide significant and timely information on color imaging to its participants.

Please submit a 2-3 page abstract (1,000+ words), indicative of the final paper content, and a short biography by April 4, 1997 to:

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Please indicate your preference for either oral or poster presentation. Upon acceptance of your abstract, you will be sent an author's kit with instructions for the preparation of the paper to be published in the conference proceedings. Papers are due by Sept. 5, 1997 and are preferred in electronic form; camera-ready copy can also be accepted.

Inter-Society Color Council is one of the cooperating societies.

## FSCT CELEBRATES 75TH ANNIVERSARY

The Federation of Societies for Coatings Technology reported its plan for the 1997 International Coatings Expo and Technology Conference, to be held Nov. 3-5 at the Georgia World Congress Center, in Atlanta, GA.

Steve Hodges, Program Chair, announced that the theme for the 1997 event, which celebrates the FSCT's 75th Anniversary, will be "75 Years: Tradition - Discovery - Opportunity." Several events are now in the planning stages which will focus on the FSCT's successes of the past, its present efforts in strategic planning, and its vision for the future.

The International Coatings Expo (*the new "Paint Show"*) experienced record-setting numbers in 1996 with over 330 exhibiting companies and 8,772 attendees. Last held in Atlanta in 1993, ICE will return to America's "Olympic City," bigger and better than ever.

Accompanying ICE'97 will be the Federation's International Coatings Technology Conference, a focused series of one and two day seminars on various aspects of the development, formulation, manufacture, and application techniques for today's coatings, inks, adhesives, and other related technologies. The highly successful conference was first featured

last year and attracted 525 industry professionals in many "sold-out" sessions.

For exhibiting information, please contact Steve Kettelkamp at 314-994-9640.

## SOCIETY FOR INFORMATION DISPLAY

## FINAL CALL FOR PAPERS

### 1997 INTERNATIONAL DISPLAY RESEARCH CONFERENCE and WORKSHOPS

The 17th Annual International Display Research Conference (IDRC 97) will be held at the Sheraton Centre Hotel in Toronto, Canada on September 15-19, 1997. IDRC rotates triennially between the United States, Asia, and Europe. Recent IDRCs were held in Monterey, CA (IDRC 94), Hamamatsu, Japan (Asia Display 95), and Birmingham England (Eurodisplay 96).

This Conference emphasizes research and fundamental development activities in display technology and related human interfaces. Display researchers and other interested individuals are encouraged to attend for an intensive exchange of ideas through formal and informal discussions. These will be facilitated by topical evening discussions, by minimization of parallel presentations, and by author interview sessions where demonstrations are encouraged. Workshops will be included to focus on active-matrix displays and technology, passing LCDs and technology, field-emitter displays, and organic electroluminescent devices. In keeping with the conference emphasis

and tradition, there will be no commercial exhibition of equipment.

Keynote Speaker

James M. Hurd, President & CEO, Planar Systems, Inc.

*Translating Display Research into Display Business Opportunities*

Papers that are relevant to the advancement of the state of the art of electronic displays are solicited for the main Conference (Sept. 16-18). Contributed papers for the Workshops will be presented in joint sessions with the main conference. Accepted papers will be of interest to contributors to the field of display research, will describe new results or concepts, and will be previously unpublished. Areas of interest include but are not limited to:

Display Materials, Display Devices, Display Processing, Display Addressing and Circuits, Display Systems and Human Interfaces.

*New phenomena and concepts are distinguished features of this Conference. IDRC is an ideal forum for presenting new concepts in display technology and discussing their potential impact.*

THE DEADLINE FOR PROPOSED PAPER SUMMARIES IS APRIL 1, 1997.

Workshop participants may also register for the remainder of the IDRC's contributed papers (on Sept. 16-18) at a reduced rate.

For further information, contact Ralph Nadell at 212-620-3341.

## CORRECTION

There is a saying in the Middle East, "Eye is blind to what the mind does not see." In the Presidents column in the last newsletter, I misspelled Charles W. Jerome and Roland Connellys' names. I thought Jerome was spelled with a G, and Connelly was spelled with an A. My apologies to both persons and to Dr. Ellen Carter.

Gultekin Celikiz-Editor

(Continued→)

## DEFINITELY THE LAST CALL! FROM THE ISCC OFFICE

A SECOND BILLING HAS GONE OUT FOR ISCC MEMBERSHIP RENEWALS. IN ORDER TO INSURE YOUR INCLUSION IN THE UPCOMING 1997 DIRECTORY, PLEASE RETURN YOUR RENEWAL PROMPTLY. IF YOU HAVE ALREADY RENEWED, PLEASE BE SURE TO LET CYNTHIA STURKE AT THE ISCC OFFICE KNOW OF ANY CHANGES TO YOUR MAILING ADDRESS AND CONTACT INFORMATION.

CYNTHIA

## GENTLE REMINDER!

All appropriate information submitted to this *NEWS* publication is the full and complete responsibility of the sender.

This publication and the ISCC assumes no responsibility for information changes and inaccuracies.

Thanks,

The Editor

## C A L E N D A R

Please send information on Member Body and other organization meetings involving color and appearance functions with dates, places, and information source to:

Cynthia Sturke

ISCC Office Manager  
11491 Sunset Hills Rd.  
Reston, VA 20190

tel: 703-318-0263

fax: 703-318-0514

email: [iscc@compuserve.com](mailto:iscc@compuserve.com)

## 1997

CMG, *Color Marketing Group*, SPRING INTERNATIONAL CONFERENCE, Apr. 27-29, Innisbrook Hilton Resort, Tarpon Springs, FL Information: CMG Headquarters 5904 Richmond Hwy, Suite 408, Alexandria, VA 22303, tel: 703-329-8500, fax: 703-329-0155 email: [colorcmg@erols.com](mailto:colorcmg@erols.com)

CORM 97/ 25TH ANNIVERSARY MEETING: *Council for Optical Radiation Measurements*; April 29 - May 1, 1997, NIST, Gaithersburg, MD; Info: Jim Butler, NASA/ GSFS; tel: 301-286-4606; fax: 301-286-1616

16th ASPRS, *American Society for Photogrammetry and Remote Sensing*, Workshop on Color Photography & Videography in Resource Assessment, April 29 - May 2, 1997, Weslaco, TX. Contact: tel: 210-969-4824; fax: 210-969-4893; email: [jveritt@tamu.edu](mailto:jveritt@tamu.edu).

TAGA ANNUAL CONFERENCE, May 4 - 7, *Technical Association of the Graphic Arts* Québec City, Le Chateau Frontenac, P.Q., Canada, Information: Karen Lawrence; tel: 716-475-7470

AATCC *American Association of Textile Chemists and Colorists*, Committee Meetings, May 6-8, 1997, Warwick, RI; info: tel: 919-549-8141

FSCT *Federation of Societies for Coatings Technology*, May 17-18 Spring Board Meeting, Birmingham Hyatt Regency, Birmingham, England, info: FSCT tel: 610-940-0777

SID 97, *Society for Information Display* May 12-16, Boston, MA, Information: Lauren Kinsey, SID, 1526 Brookhollow Dr., Suite 82, Santa Ana, CA 92705, tel: 714-545-1526, fax: 714-545-1547, email: [socforinfodisplay@mcimail.com](mailto:socforinfodisplay@mcimail.com)

DETROIT COLOUR COUNCIL ANNUAL SYMPOSIUM June 10, 1997, Title: "Color Control and Instrumentation", Dearborn Inn, Dearborn, MI, Information: Jim Keiser, tel: 810-583-8345

IS&T 50th ANNUAL CONFERENCE, May 18-23, Hyatt Regency Cambridge Hotel, Cambridge, MA Info: IS&T Conference Mgr., 7003 Kilworth Lane, Springfield, VA 22151, tel: 703-642-9090, fax: 703-642-9094, email: [info@imaging.org](mailto:info@imaging.org), internet: <http://www.imaging.org>

COLOUR 97, May 26-30, 8th AIC Quadrennial Meeting Colour 97 Executive Committee Meeting May 25, Kyoto International Conference Hall, Kyoto, Japan, Info: Paula Alessi, Eastman Kodak Co. tel: 716-477-7673, fax: 716-722-1116, email: [pjalessi@kodak.com](mailto:pjalessi@kodak.com)

ISCC ANNUAL MEETING, Sept. 14-17, *Inter-Society Color Council and Appearance Division of Society of Plastics Engineers*, Marriot Inner Harbor Hotel, Baltimore MD, Info: Gary Beebe, tel: 215-785-8497

HFES 41st ANNUAL MEETING, Sept: 22-26, *Human Factors and Ergonomic Society*, Albuquerque, NM, Info: HFES, PO Box 1369, Santa Monica CA 90406-1369, tel: 310-394-1811, fax: 310-394-2410, email: [72133.147@compuserve.com](mailto:72133.147@compuserve.com) internet: <http://hfes.org>

**AATCC INTERNATIONAL CONFERENCE AND EXHIBITION** Sept. 28-Oct 1, *American Association of Textile Chemists and Colorists*, Marriot Marquis, Atlanta, GA, info: AATCC, tel: 919-549-8141

**OSA ANNUAL MEETING**, Oct. 11- 19, *Optical Society of America*, Long Beach Convention Center, Long Beach, CA Info: OSA, tel: 202-223-0920; fax: 202-416-6100

**IS&T 13TH INTERNATIONAL CONGRESS**; Nov. 2-7 *Society for Imaging Science and Technology*, Advances in Non-Impact Printing Technologies, Sheraton Seattle Hotel, Seattle, WA. Info: IS&T Conference Manager, 7003 Kilworth Lane, Springfield, VA 22151, tel: 703-642-9090; fax: 703-642-9094; email: info@imaging.org

**INTERNATIONAL COATINGS EXPO (ICE)**, *Federation of Societies for Coatings Technology*, Nov. 3 - 5, Georgia World Convention Center, Atlanta, GA Info: FSCT tel: 610-940-6777; fax: 610-940-0292

**CMG, Color Marketing Group**, FALL INTERNATIONAL CONFERENCE, Nov. 9 - 11, St. Francis Westin Hotel, San Francisco, CA , info: CMG , 5904 Richmond Highway, Suite 408, Alexandria, VA 22303, tel: 703-329-8500 email: colorcmg@erols.com

**IS&T/SID FIFTH COLOR IMAGING CONFERENCE** *Society for Imaging Science and Technology / Society for Information Display*, Nov. 16 - 19, Transforms and Transportability of Color, Radisson Resort, Scottsdale, AZ, info: IS&T Conference Manager, 7003 Kilworth Lane, Springfield, VA 22151, tel: 703-642-9090, fax: 703-642-9094, email: info@imaging.org internet: <http://www.imaging.org>

## 1998

**CMG, Color Marketing Group**, SPRING INTERNATIONAL CONFERENCE, The Broadmoor, Colorado Springs, CO info: CMG, 5904 Richmond Hwy Suite 408, Alexandria, VA tel: 703-329-8500; fax: 703-329-0155, email: colorcmg@erols.com

**ISCC WILLIAMSBURG CONFERENCE** (Feb. 22-24), Color and Design: 21st Century Technology and Creativity, Inter-Society Color Council, info: Wade Thompson tel: 417-882-2553

**TAGA 98 - 50TH ANNIVERSARY CELEBRATION**, Apr. 26 - 29, 1998, *Technical Association of the Graphic Arts*, Marriot Lincolnshire Resort, Chicago IL info: Karen Lawrence, tel: 716-475-7470

**SID 98, Society for Information Display**, May 17 - 22, Anaheim, CA, info: Lauren Kinsey, SID, 1526 Brookhollow Drive, Suite 82, Santa Ana, CA 92705 tel: 714-545-1526; fax: 714-545-1547 email: socforinfodisplay@mcimail.com

**ASTM COMMITTEE E-12 ON APPEARANCE**, June 16-18 St. Louis, MO , info: Bode Bradley, tel: 610-832-9740 fax: 610-832-1547

**AATCC INTERNATIONAL CONFERENCE AND EXHIBITION** Sept. 22-25, *American Association of Textile Chemists and Colorists*, Marriott, Philadelphia, PA Info: AATCC tel: 919-549-8141

**ISCC ANNUAL MEETING** (Oct. 2-4) *Inter-Society Color Council* and OSA ANNUAL MEETING (Oct. 3 - 8), *Optical Society of America* Baltimore Convention Center, Baltimore, MD Info: OSA, tel: 202-223-0920, fax: 202-416-6100

**COLOR MARKETING GROUP (CMG) FALL INTERNATIONAL CONFERENCE**, Oct. 4 -6, Le Centre Sheraton Hotel Montreal, Montreal, Quebec, Canada, Info. CMG 5904 Richmond Hwy., Suite 408, Alexandria, VA 22303 tel: 703-329-8500, fax: 703-329-0155 email: colorcmg@erols.com

## 1999

**ISCC ANNUAL MEETING** (MAY 5-7) *Inter-Society Color Council* and TAGA ANNUAL CONFERENCE, May 2 -5, *Technical Association of the Graphic Arts*, Technical conference, Philadelphia, Pa. Info: Karen Lawrence, tel: 716-475- 7470

**ISCC WILLIAMSBURG CONFERENCE (FEB.)**, 2nd Panchromatic Conference-Color in its surround, info: Dr. Cynthia Brewer; tel: 814-865-5072

**SID '99 (May) California**  
Information: Lauren Kinsey SID, 1526 Brookhollow Drive, Suite 82, Santa Ana, CA 92705  
Tel: 714-545-1526, Fax: 714-545-1547  
email: socforinfodisplay@mcimail.com

**AATCC, INTERNATIONAL CONFERENCE AND EXHIBITION**, October 12-15, *American Association of Textile Chemists and Colorists*, Convention Center, Charlotte, NC, info: AATCC, tel: 919-549-8141

## 2000

**SID 2000 (May) Toronto, Ontario Canada**, Information: Lauren Kinsey SID , 1526 Brookhollow Drive, Suite 82 Santa Ana, CA 92705, Tel: 714-545-1526, Fax: 714-545-1547 email: socforinfodisplay@mcimail.com

**AATCC CONFERENCE AND EXHIBITION** (Oct. 1-4)

# HELP WANTED

## XEROX PROFESSORSHIP IN DIGITAL COLOR IMAGING SYSTEMS

The Rochester Institute of Technology invites applications and nominations to fill the newly established Xerox Professorship in Digital Color Imaging Systems within the Chester F. Carlson Center for Imaging Science. This senior-level, tenure-track faculty position will enhance and expand the strong color imaging activities of the Center (see <http://www.cis.rit.edu>) focusing on digital color imaging systems integration (image capture, display, storage, transmission, retrieval, and output) and data management and connectivity.

The successful candidate is expected to develop new avenues of funded research as well as expand upon ongoing research (e.g. within the Munsell Color Science Laboratory). The Xerox Professor will be responsible for teaching a course in color imaging systems and other appropriate undergraduate or graduate imaging courses. The Xerox Professor should have a strong interest in providing leadership within the color imaging community.

Candidates must be recognized experts in digital color imaging with experience or a strong interest in pursuing research in systems integration. They should have a record of research productivity and teaching proficiency. Candidates are sought from academia, industry, and government.

Applications, nominations, and inquiries should be sent to Dr. Roy S. Berns; Chair, Xerox Professorship Search Committee; Munsell Color Science Laboratory, RIT Chester F. Carlson Center for Imaging Science; 54 Lomb Memorial Drive; Rochester, New York, 14634-5604; USA; tel: 716-475-2230; fax: 716-475-5988; internet: [rsbpsh@rit.edu](mailto:rsbpsh@rit.edu). Confidentiality will be maintained until campus interviews.

RIT is an affirmative action, equal opportunity employer.

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## IMAGE SCIENTISTS WANTED AT POLAROID

Polaroid Corporation seeks to hire several Image Scientists at various levels of experience. These positions require creative, self-starters who can solve difficult imaging problems while keeping within schedules and budgets. The positions will be located in the Boston/Cambridge area.

Successful candidates will provide image science support to different programs in the corporation. The support will take the form of:

- Performing image quality simulations of future systems
- Modeling components or devices
- Developing and optimizing imaging device color and spatial responses
- Setting component/device/system requirements and specifications
- Conducting assessments of competitive technologies
- Evaluating technical developments with and eye toward commercialization
- Representing customer image quality concerns on design teams
- Acting as a liaison with the marketing organization in setting new product requirements

### Qualifications:

- Imaging, Physical Science, or Engineering degree (B.S., M.S., Ph.D)
- Highly skilled in either Mac, Windows, or UNIX operating systems
- Programming experience in C and/or some imaging environment
- Solid, demonstrated, image analysis skills required
- Strong written and verbal communication abilities
- Knowledge of color science and color management a plus

Confidential Inquiries are welcomed  
Please mail, email, or fax your resumé to:

Dr. Jay Thornton  
Image Science Laboratory, Polaroid Corporation  
750 Main St. -3J Cambridge, MA 02172  
[thorntj@polaroid.com](mailto:thorntj@polaroid.com)  
617-386-9700 (Fax)

# Polaroid

Polaroid is an equal opportunity employer and it is our policy to support non-discriminatory practices and policies based upon race, color, religion, national origin, veteran status, handicap, marital status, sexual orientation, age or sex.



# J O B S W A N T E D !



This Section is intended to help ISCC members that are in need of, and are looking for employment. Here is an opportunity to use the resources at hand. There is no charge for this service. However the restrictions are as follows:

1. This service is for ISCC members' use only.
2. No more than 50 words may be used to describe yourself.  
(Not including name address and/or telephone number).
3. If you are using a P.O. Box, you must supply a complete address.
4. No Agency representing member(s) is allowed.
5. Neither the ISCC News nor the editors are responsible for any errors.
6. You must advise us in writing when you have obtained employment.

We hope this new section will be of value to you, the ISCC member. If you have any suggestions/criticisms, please send them to the editor. Let's make this work!

## SEEKING EMPLOYMENT IN R&D POSITION IN COLOR

PhD (expected, 1997) Color Vision, MS Biophysics, BS Biomedical Engineering. Highly motivated, adaptable and dependable individual seeking R&D position. Interdisciplinary background and research experience in color color vision, biomedical instrumentation, colorimetry, photometry and reflectometry. Working knowledge of computer graphics, image analysis/processing, mathematical modelling. Computer and statistics skills include Pascal, C C++, Matlab, Assembly, S, SAS, Steplt.

Jun Xu

The University of Chicago, Visual Science Center  
939 E. 57th Street, Chicago IL 60637  
Tel: 773-702-1987, Fax: 773-702-4442  
email: junxu@midway.uchicago.edu

## SEEKING EMPLOYMENT IN COLOR REPRODUCTION INDUSTRY OR HUMAN FACTORS.

PhD in visual psychophysics. Detailed knowledge of color vision, colorimetry, human psychophysics, color testing and calibration procedures, and statistics. Broad knowledge of pattern recognition and image processing. Familiarity with signal processing and systems analysis. Knowledge of optics, electronics, and mathematical modeling.

SHUANG WU

Schepens Eye Research Institute  
20 Staniford Street  
Boston, MA 02114

TEL: 617/ 723-6078 Ext.590

FAX: 617/ 523-3463

e-mail: shuangwu@vision.eri.harvard.edu

## SEEKING EMPLOYMENT RELATED TO COLORATION

Noted Bulgarian color and light expert, returning from visiting scholarship in Japan, seeks short or long term employment in the West. Thirty years' extensive and varied experience in visual and instrumental color measurement in many systems. Capable in research, teaching, program development, quality control. Multilingual.

Assoc. Prof. Dr. Todor Kehlbarov  
BG-1000 Sofia, P.O. Box 1089  
Bulgaria

Phone/Fax 011 359 2 88 05 97

US Contact: Dr. F. W. Billmeyer, Jr.

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Please note: the deadline for submission of material is the 1st of each even numbered month. Material received after the 1st may not be printed until the following issue.

All submissions must be in English.

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President	Dr. Ellen C. Carter	2509 N. Utah Street, Arlington, VA 22207	ecarter@capaccess.org	703-527-6003	
Pres. Elect	Dr. Michael H. Brill	David Sarnoff Research Ctr, CN 5300, Princeton, NJ 08543	mbrill@sarnoff.com	609-734-3037	609-734-2662
Secretary	Dr. Danny C. Rich	Datacolor Int., 5 Princess Rd., Lawrenceville, NJ 08648	dannyrich@compuserve.com	609-895-7427	609-895-7461
Treasurer	Mr. Hugh S. Fairman	334 Springbrook Trail, Sparta, NJ 07871		201-729-7278	201-729-7278
Past-Pres.	Mr. Roland L. Connelly	ShelLyn, Inc., 1108 Greccade Street, Greensboro, NC 27408	roland@shelLyn.com	910-274-1963	910-274-1971

**LIST OF DIRECTORS****1994-1997**

Mr. Michael A. Hammel	Hammel and Company 3782 Bonny Rigg Trail Roswell, GA 30075	<a href="http://www.colorpro.com/hammel">http://www.colorpro.com/hammel</a> mahammel@mindspring.com	770-587-5120	770-587-5128
Mr. Richard W. Riffel	950 W. First St., Elmira, NY 14905	rriffel@compuserve.com	607-733-0115	
Mr. William S. Vogel	204 Four Lakes Drive, Easley, SC 29642		864-277-8977	

**1995-1998**

Dr. Cynthia A. Brewer	PSU Dept. of Geography, University Park, PA 16802	cbrewer@essc.psu.edu	814-865-5072	814-863-7943
Dr. Mark Fairchild	RIT Munsell C.S. Lab., P.O. Box 9887 Rochester, NY 14623	mdfpph@grace.rit.edu	716-475-2784	716-475-5988
Prof. Wade Thompson	1910 East Cardinal St., Springfield, MO 65804	wst255f@nic.smsu.edu	417-882-2553	417-883-5830

**1996-1999**

Dr. Helen H. Epps	University of Georgia, 300 Dawson Hall, Athens GA 30602	hepps@hestia.fes.uga.edu	706-542-4913	706-542-4862
Mr. James R. Keiser	DuPont Automotive Products, Detroit Colour Council 945 Stephenson Hwy, Troy MI 48007-2802	keiserjr@sptv4.dnet.dupont.com	810-583-8345	810-583-8316
Mr. Jack Ladson	17329 Mc Duff Ave., Olney MD 20832	jaladson@bell.atlantic.net	301-774-7464	301-774-5260

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**ISCC MEMBER-BODIES**

American Association of Textile Chemists and Colorists (AATCC)	Graphic Arts Technical Foundation (GATF)
American Society for Testing and Materials (ASTM)	Human Factors & Ergonomics Society (HFES)
American Society for Photogrammetry and Remote Sensing (ASPRS)	Illuminating Engineering Society of North America (IESNA)
The Color Association of the United States, Inc. (CAUS)	National Association of Printing Ink Manufacturers (NAPIM)
Color Marketing Group (CMG)	Optical Society of America (OSA)
Color Pigments Manufacturers Association (CPMA)	Society for Information Display (SID)
Council on Optical Radiation Measurements (CORM)	Society of Plastics Engineers, Color & Appearance Division
Detroit Colour Council (DCC)	Society for Imaging Science and Technology (IS&T)
Federation of Societies for Coatings Technology (FSCT)	Technical Association of the Graphic Arts (TAGA)
Gemological Institute of America (GIA)	Technical Association of the Pulp and Paper Industry (TAPPI)

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