Inter-Society Color Council *News*

Number 344 July/August 1993

IN THIS ISSUE 344

PRESIDENT'S COLUMN

PA

I'd like to begin my column by extending sincere thanks to Dr. Romesh Kumar for putting forth a fantastic effort to insure that the 1993 ISCC Annual Meeting held from April 18th-21st in Newport, Rhode Island was a smashing success!!! The Newport Islander Doubletree Hotel was a sellout! The ISCC portion of the meeting was enjoyed by 120 participants. The joint ISCC/ CPMA symposium on "Color Pigments, Regulations and the Environment" was filled to capacity at 200 participants. It is also my pleasure to thank Larry Robinson and Mary Dwyer of CPMA for their enormous amount of help in organizing all aspects of this meeting, especially the registration process. It is gratifying when cooperation between our members and those of one of our member-bodies leads to a valuable color information exchange. A success story like this is one, is one of the benefits of belonging to an organization like the ISCC.

This year, 1993, marks an ISCC milestone of which we should all be proud. With the help of one of our Board members, Bob Chung, and a group of enthusiastic students at the Rochester Institute of Technology, the first ISCC student chapter was formed. The goals of the chapter are to become more involved in the world of color outside the classroom, to increase interaction between students and the national ISCC organization and hopefully to have some fun. Chapter members prepared a very impressive poster presentation for the 1993 Annual Meeting. This poster described more details of the chapter, including how it formed in hopes that other groups of university students may find the desire to follow the RIT example in forming their own ISCC student chapters. On behalf of all the ISCC Board of Directors, I would like to formally recognize and honor Bob Chung and all RIT student chapter members for your admirable efforts in forming the ISCC charter student chapter!

There are only a few highlights of the April 17, 1993 ISCC Board of Directors Meeting that I plan to address in my column. First, it was a pleasure to welcome the new incoming Directors, Gary Beebe, Joe Campbell, and Bob Marcus. Although their terms do not officially begin until after the 1993 Annual Meeting, it was gracious of them to accept our invitation to their first Board Meeting and for them to show such an active interest in the activities of the ISCC.

Many thanks to Bob Marcus for accepting the Chairperson position for the Nickerson Service Award. He is replacing Harry Hammond, who was honored at the 1993 Business and Awards Luncheon with an ISCC certificate for three years of serving as the Nickerson Service Awards Chairperson. Anyone with suggestions of individuals deserving this coveted ISCC award are encouraged to contact Bob Marcus.

Our member-body liaison, Joann Taylor, reported that we have 44 new delegates and 5 new delegation chairs. Many thanks to Joann for her major effort in revising the member-body delegation status.

As By-Laws Committee Chairperson, Fred Billmeyer drafted the following Section 5 for Article IV on Proxy: "A member of the Board may delegate in writing, to the President, another member of the Board of Directors to serve as proxy, but no member, may hold or exercise proxies for more than one member." This new section was voted upon for approval and passed by unanimous vote. Next, creation of the

President's Column, continued

Education Standing Committee required addition of text to the Standing Committee section of the Standing Rules. The following text was agreed upon by unanimous vote:

"o.) Education Committee. The Education Committee shall preferably be chaired by a member of the Board of Directors. Its membership shall include but not be limited to the vice-chairperson of each ISCC Interest Group. The responsibilities of the Education Committee are to address the color education needs of the ISCC membership and to educate the general public, through the efforts of the ISCC membership, to help de-mystify various aspects of color. The following are the specific duties of the Education Committee:

(1) Organize some event with an emphasis on education for presentation at each annual meeting of the Council. Such an event could take the form of a workshop, a questionnaire, a discussion forum, a mini-symposium, or a joint session with an Interest Group, among others.

(2) Be responsible for the organization of, and oversee the operation of, ISCC Student Chapters formalizing the relationships between the Council and colleges and universities with color and color-related programs."

Bob Chung, our first Education Committee Chairperson, has done an excellent job by holding the first Education Committee Meeting at the 1993 ISCC Annual Meeting and helping the first student chapter to form! Many thanks to Bob for all his hard work!

The Board spent quite a long time discussing the last issue of the scheduling of simultaneous sessions at the Annual Meeting. At the January Board of Directors Meeting, it was decided that there would be no simultaneous sessions at the 1993 Annual Meeting. However, given the 1 1/2 day time slot for the ISCC-only portion of the meetings, there was no choice but to schedule one half day of simultaneous sessions. Our sincere apologies go out to Magenta Yglesias and Wade Thompson for scheduling Project Committee Meetings simultaneous to their Interest Group III session on "Human Wellness through Color and Environmental Design". As President, I am willing to go on the record saying "I promise that next year there will be no simultaneous sessions scheduled during the 1994 Annual Meeting in Detroit." This may mean that we will have to extend the meeting length by one half day. I welcome comments from members on whether they would prefer to hold meetings Sunday mornings or extend the sessions one half day during the week, meaning we may have to end on Wednesday at noon. Please feel free to contact me with suggestions!

Paula J. Alessi
ISCC President

REVIEW OF THE 1993 ISCC/CPMA CONFERENCE

The Inter-Society Color Council (ISCC) jointly sponsored a conference on April 20 and 21, 1993 with the Color Pigments Manufacturers Association (CPMA) on "Color Pigments, Regulations, and the Environment." This conference faced head-on a parameter which is increasingly important in color selection, the regulatory requirements and environmental friendliness of pigments. Conference attendees heard from many speakers about their efforts to reduce the regulatory requirements of color formulations by selecting more environmentally friendly pigments.

The well-attended conference had two major themes. The first was a general introduction to the federal and international regulatory climate and the second was a discussion of current trends in the pigment user community.

The conference opened with seven talks that summarized the regulations on pigments in Canada, Europe, Japan, Mexico, and the United States. This session was packed with valuable information about the regulatory requirements in these countries and served as a springboard to later presentations of the formulation changes that were being made.

Mr. Alan Gray started this session with an update of the Canadian Environmental Protection Act (CEPA). CEPA will go into effect later this year and will require for the first time that

Fred Billmeyer receives the newly designed Godlove Award from ISCC president Paula Alessi at the ISCC Annual Luncheon in Newport, RI, April 19, 1993.

photo by Harry K. Hammond III

Hugh Davidson receives a commemorative gift, a kaleidoscope, from John O'Brien, president of Colorgen at a banquet sponsored by Colorgen in Newport, RI, April 19, 1993.

photo by Harry K. Hammond III

importers and manufactures of new chemicals, including pigments, resins, and additives, to register those chemicals with Canadian authorities. The United States, Europe, and Japan already have similar laws. CEPA will represent a major hurdle for the introduction of new products into the Canadian market.

Dr. Klaus Hunger discussed environmental trends in Europe affecting color pigments. He focused on consumer goods regulations which differ considerably from corresponding regulations in the United States. An area of current concern to European pigment manufacturers is the fate of a colorant after the material in which it was used is recycled, for example, ink, paint, and plastic. European pigment manufacturers are recommending that recycling temperatures not exceed 240°C for plastics which contain organic pigments.

Mr. Michael Ueda summarized the pigment market in Japan and current environmental trends. He explained that many environmental regulations in Japan stem from the implication of hazardous chemicals in various outbreaks of disease. He also explained a unique Fire Safety Law which regulates some Nitro-substituted Azo pigments, including CI Pigment Orange 1, 5, Red 3, 4, Yellow 1, 5, 73, 74, and 75. These products require special handling and storage as defined by the Japanese law. Japanese companies and trade associations prefer self-regulation over government intervention and, since the 1970's, have instituted several self-regulations including one concerning food packaging materials.

Ms. Alicia Lozano gave an overview of environmental regulations in Mexico. She explained that although environmental regulations are new to Mexico, they are comprehensive and violators are subject to severe penalties.

Mr. Brian Cook, of the Environmental Protection Agency (EPA), described the EPA's current activities concerning lead and lead-based pigments. It appears that additional restrictions on lead-based pigments may be coming from the EPA in the future.

Mr. Harold F. Fitzpatrick, Esq. discussed the topic of negotiated rulemaking. This involves having the regulators and those who will be regulated write the regulation together. If done properly, better regulations result. The color pigment industry has recently experienced both good and poor rulemaking, and Mr. Fitzpatrick challenged the regulators present at the conference to use more negotiated rulemaking.

Mr. Fitzpatrick also gave the final talk in this session which discussed NAFTA (the North American Free Trade Agreement). Mr. Fitzpatrick pointed out that if the NAFTA's goal of removing trade barriers between Canada, Mexico, and the United States is to be realized then a harmonization of the environmental regulations must be effected. Mr. Fitzpatrick compared some environmental laws in the three countries and discussed the difficulties involved with harmonization.

In the afternoon session of the first day, an interesting debate emerged between the speakers representing the pigment user community and the inorganic pigment suppliers. This debate continued throughout the conference. The pigment user community gave talks about their efforts to remove heavy metals from their formulations. At this conference, the term "heavy metal-based pigment" was typically used to refer to inorganic pigments containing lead, mercury, cadmium, or chromium. They explained that, in many cases, heavy metal-based pigments could be replaced in formulations with organic pigments. Although often resulting in a loss of performance, a cost increase, or both, this was an acceptable solution to the problem. The inorganic pigment suppliers representing heavy metal-based pigments argued that heavy metals cannot be replaced and that there is no reason to do so. It was the impression of this writer that the trend is accelerating away from heavy metal-based pigments, and that the pigment user community did not seem swayed by arguments made by the inorganic pigment manufacturers.

This debate began during the first two talks. The first speaker, Dr. Hartmut Endriss, stated that not only can no organic pigment be a one-for-one replacement for an inorganic pigment, but inorganic pigments are not harmful to people and should not be replaced. In fact, he said, traces of heavy metals are essential for living organisms.

Ms. Joann Bednar, the next speaker, gave an entertaining account of the requirements that her customers from the plastic industry placed upon her color matches, including color, performance, and formulations free of heavy metal-based pigments. Her customers, in many cases, decided to move away from heavy metals and the regulatory compliance issues they raise. Although Dr. Endriss felt that heavy metal based-pigments are safe

(con't ➡)

Conference Review, from previous page

and do not enter the body because of their extremely low solubility, many of Ms. Bednar's customers feel that heavy metal-based pigments should no longer be used.

Mr. William E. Rusterholz discussed trace heavy metal contamination in organic pigments and inks, explaining that "heavy metal free" is not attainable. While levels of heavy metals less than 100 ppm exist in organic pigments and inks, there are analytical problems in determining the exact level in a given sample. The very low levels of heavy metals being guaranteed in the ink industry may be based on bad assumptions about the sources of heavy metals and their batch-to-batch variability. Mr. Rusterholz's talk clearly indicates that more work is needed in this area.

The theme of eliminating heavy metal-based pigments from formulations surfaced again in Mr. Dave Lennert's presentation concerning "Regulatory and Waste Recovery Trends Affecting Packaging Design." Mr. Lennert discussed CONEG and suggested that, with this regulation now adopted by 14 states, it was widespread enough to effectively eliminate the use of lead, mercury, cadmium, and chromium-based pigments from use in packaging. Mr. Lennert discussed a test program to recover cereal boxes by Proctor & Gamble for recycling.

The final talk on the theme of replacing heavy-metal-based pigments was a presentation by Mr. James G. King. Mr. King gave several examples of formulation changes made for the automotive coating industry to replace heavy metal-based pigments. Although these changes usually resulted in a loss of chroma and an increase in price for the user, in all cases the formulation changes were accepted because of the strong desire to eliminate the use of heavy metal-based pigments. The heavy metal debate seems to be over for the automotive coating industry, and automotive coating formulations will no longer contain heavy metal-based pigments.

The final arguments in the heavy metal-based pigment debate were given by Mr. Leonard Ulicny and Mr. David Waldron on the morning of the second day of the conference. Mr. Ulicny's presentation analyzed the life cycle of cadmium pigments, from its mining to its conversion to a cadmium pigment, and finally to its use and disposal. Mr. Ulicny argued that, because cadmium is obtained as a by-product in the mining of zinc, its use in pigments can be viewed as waste reduction.

Mr. Waldron's presentation focused on the lack of bioavailability of lead based pigments. He presented data showing the lack of lead leachate from both lead chromate and incinerator ash obtained from products containing lead chromate. He seemed to ask — If lead chromate is not a safe use of lead then what heavy metal can be used safely?

Of the many other interesting talks, three reported on a major advancement. Dr. Janos Schulze reported that the Hazard Communications Subcommittee of CPMA had just finished preparing a booklet entitled *Safe Handling of Color Pigments*. The booklet contains regulatory compliance information for the various classes of pigments and advice from pigment manufacturers on pigment storage and handling. This booklet is not intended to replace an MSDS but is a useful quick reference for pigment users.

Mr. Reinhold W. Bartsch, Jr. reported on a study he performed to determine if organic pigments would maintain their color appearance in a plastic matrix through seven recycling cycles. Mr. Bartsch found that, in general, the organic pigments tested performed well under the multiple recycling conditions. The important parameters were found to be pigment type, pigment concentration, and processing temperature.

Finally, Mr. E. Thomas Vonderbrink gave a historical review of the self-regulation of the artist colors industry, when the industry faced tremendous negative public opinion in the early 1980's. Mr. Vonderbrink's story was an encouraging one, as it is valuable to know actions can be taken to reverse public opinion. Today the artist colors industry enjoys an excellent reputation because of their work in the 1980's.

The conference showed that there is a great deal of creative work taking place in color formulation, improvement of the environmental friendliness of products, and cooperation with regulators to insure that our industry retains its good reputation. Our industry is meeting the dual challenge to produce products which perform well and which do not hurt the environment. Perhaps the quote from John Ruskin, shared by Mr. James King at the conference, is true: "The purest and most thoughtful minds are those who love color the most."

Dr. Frank P. Lavieri

ISCC INTEREST GROUP I: FUNDAMENTAL AND APPLIED COLOR RESEARCH Newport, RI 1993

Interest Group I, Fundamental and Applied Color Research, held a contributed papers session at the 1993 ISCC Annual Meeting in Newport, RI. Submission of papers was very good for this session. Several that were received after the deadline were referred to other interest groups or the poster session. Seven papers were scheduled for presentation.

The first was "Contrary Changes of Color Appearance and Hue Angle of Tanzanite between Daylight and Incandescent Light" by Y. Liu, J. Shigley, E. Fritsch, and S. Hemphill of GIA Research. Liu presented data illustrating the change in color appearance of the gemstone tanzanite upon change in illumination. The prediction of the hue angle given by the CIELAB color space was contradictory to the change observed visually. An explanation was proposed based on the design of CIELAB with von Kries-type adaptation being computed with CIE tristimulus values rather than fundamental tristimulus values that have more physiological significance.

The second presentation, "New Tests to Validate the Visual Models of Color Appearance using the Natural Color

(con't ➡)

System Album" by S. Derbal of C.N.A.M. in Paris, was canceled since the speaker was unable to make the trip to the USA at the last minute.

The third presentation was entitled "The Relationship of Color Relationships" by Uri Feldman, Nathaniel Jacobson, and Walter Bender of the MIT Media Laboratory. This was a summary of Feldman's Ph.D. dissertation research that has been discussed in previous interest group meetings. The work illustrates the consistency of psychophysical response to various combinations of color and how this knowledge can be applied to applications such as graphic design and color reproduction.

The next talk was "Color Gamut Mapping" by Gaurav Govil of the RIT Research Corporation. This presentation outlined a technique for mapping colors that can be produced in one medium into appropriate colors that can be reproduced in a second medium. This is an important issue for applications such as the printing of colored images produced on computer CRT displays.

"A Method of Reducing Metamerism and Increasing Gamut of Halftone Printing through the Use of Five or More Colored Inks" was presented by Tim Kohler, a graduate student with the RIT Munsell Color Science Laboratory. Kohler illustrated how processes of multiple-ink printing could be used to minimize metamerism and maximize the gamut of reproducible colors in high-quality applications such as reproductions of artwork.

Nathan Moroney, also a graduate student in the RIT Munsell Color Science Laboratory, presented the results of his M.S. thesis, "Color Space Selection for JPEG Image Compression." JPEG is a standard technique for compressing digital images. However, no color space is recommended for this application. Moroney psychophysically evaluated several color spaces and found that nonlinear spaces, such as CIELAB, performed best.

Lastly, Michael Brill of SAI Corporation presented "Generalized Transformation of Primaries: Two Theories to Accommodate Challenges to Grassmann Additivity." Brill analyzed Thornton's recent color matching data in various attempts to explain the apparent failure of additivity and concluded that Grassmann's laws explain the data as well as any other potential theory.

The meeting ended with a request for suggestions for future Interest Group I meetings. Suggestions can still be forwarded to either the chair, Mark Fairchild, or the vice-chair, Joanne Zwinkels. Feedback thus far has indicated that there is a strong preference for a contributed papers session with no particular topic at future meetings. This provides an opportunity each year for all members of ISCC to present current research. Comments were also made that no sessions should be scheduled parallel with any of the interest group meetings in future years. The plan for the 1994 is to have a contributed papers session with no particular topic. It will likely be called "Topics in Fundamental and Applied Color Research" again and all ISCC members are encouraged to submit presentations on their research.

Mark D. Fairchild
Chair, ISCC Interest Group I

ISCC INTEREST GROUP III: ART, DESIGN, AND PSYCHOLOGY "Color in the Human Environment"

Interest Group III presented a dynamic, informative program at the ISCC Annual Meeting which was designed to promote communication between technically oriented specialists in color and creative practitioners in art, design, and psychology. The program represented an on-going effort to facilitate more effective use of color by the public through the dissemination of information concerning color in artistic and creative applications.

Mr. Carl Fasano, from the University of Massachusetts at Dartmouth and the College of Architecture, Rhode Island School of Design, Providence, demonstrated how color and light in architecture play a crucial role in determining human wellness. The sense of season, time of day, and temperature are among the many important cues which serve to orient the individual. These all share the common factors of color and light. Unfortunately, the considerations of color and light are not stressed in the education of architecture students. Instead, the emphasis is placed upon "hard line" black-and-white drafted representation and achromatic models of architectural design ideas.

The pedagogical attitude is not conducive to the creation of environments which relate coloristically to the site or internally - vis a vis the architecture. The practice of architectural design resulting from such a dearth of color considerations is apt to produce a sense of disintegration (at worst) of the individual from the surrounding environment.

An understanding of color and light in its various modes and material manifestations will facilitate the creation of architecture which promotes a sense of integration within the individual. Effective color and material usage would lead to an alteration of architectural ideas. These ideas would relate more sensitivity to the visual needs of the individual, thus producing a sense of wellness and connectedness.

Ms. Shashi B. Caan, associate professor, New York School of Interior Design, stated that in architecture today, little consideration is given to colors, patterns, and textures. The standard practice of beginning with form to achieve architectural expression has placed color as a last consideration. Our current design education, emphasizing form over color and light, significantly contributes to this.

Recent design history, especially the Bauhaus and its Modernist legacy, has produced a design education which, on the one hand, is characterized by fragmentation rather than integration,

(con't ➡)

Interest Group III, from previous page

and, on the other hand, focuses on the purity of line and form and denies the saliency of color as a visual stimulus, This focus has resulted in much of our built environment to become a world of tonal grays, ensuing sensory deprivation leading to human discomfort. The neglect of color in architecture is partially camouflaged with theoretical justification, but primarily indicates the lack of visual literacy imparted to architects and designers during their basic education.

Therefore, to breathe fresh life into stagnant built environments, designers must be taught a greater visual awareness of the interrelationships between light, color, and form, and their skillful manipulation. The issue is not so much about a better architecture, but a different approach which explores the influence of color on form, and aims towards a more exciting visual experience which nourishes the human sensory needs.

Ms. Caan proposed that a more comprehensive color analysis of the environment be executed at the outset of the design process: a simple and effective procedure is implemented, allowing the designer to comprehend and evaluate the qualities of hue, value, chroma, proportions, scale, etc. This procedure is based on the perceptual and phenomenon related color explorations of Goethe, Albers, and Itten, with the emphasis of taking color into the third dimension. It is a step-by-step process integrating the elements of light, color, and form which inverts the customary emphasis on form and begins instead with color to generate visual harmony and balance.

Ronald Oldchurch presented "Color, Mind, and Body: A Glimpse at Symmetries in Nature." Nature provides a wealth of examples of beautiful and complex symmetries. Symmetry has a long history beginning in Taoist thought and Chinese medicine; now it serves to inform modern research on many health issues, including studies of complementary patterns in the body and brain, and of personality types. In its most developed form, symmetry provides the conceptual engine for modern theoretical physics.

The visual system constantly seeks and maintains balance in a changing visual environment. These efforts result in the perception of the external symmetry we know as color. Because the symmetry in color appearance is clearly the byproduct of a mathematical pattern, color could provide a valuable touchstone for physiological and psychological patterns in which mathematical order is now only barely recognizable.

Mr. Oldchurch's presentation provided a graphic history of complementary symmetries, ranging from the most primitive to the most advanced. The hue circle was described as a simple and profound mathematical pattern, providing a window to a precise and lucid phenomenology of color.

The Interest Group III program was concluded by a lively interactive session among the presenters and the audience. This discussion centered around issues concerning the difficulties and great challenges of using qualitative color organization within the visual realm of the artist or designer. Much of the discussion addressed visual problem-solving strategies used by artists and designers and the difficulty of establishing a useful, flexible approach to color usage that would not sacrifice creativity and intuitive processes. There were many strong and differing opinions on how far a systematic approach to color usage can be used before it begins to invade and deteriorate the experiential and subjective realm of the artist or designer.

Additionally, the program included a special meeting involving Dr. Billy Wooten of the Department of Psychology at Brown University, Providence, Rhode Island, Chair Magenta Yglesias, and Vice-Chair Professor Wade Thompson. Dr. Wooten presented an outline of the initial stages of a new research project which he is supervising in color psychology at Brown University which involves human subjective color response. According to Dr. Wooten, very little published research exists within this realm of color psychology which is the product of rigorous and accountable research procedures. Interest Group III anticipates project reports of Dr. Wooten's research as this particular project progresses.

Magenta Yglesias
ASID, Chair

SUPERB 1993 POSTER SESSION!

The ISCC would like to thank the poster paper contributors for their exceptional and attractive presentations at the Poster Paper session at the Annual Meeting in Newport. These excellent papers received a great deal of attention and opened opportunities for authors and attendees to cover important new ground. The poster session consisted of five papers, covering a wide range of topics.

Two were related to the featured theme of the meeting, the CMC equation. Dr. Tak Ming Man, in collaboration with S.K. Ku, and K.M. Sin, evaluated the CMC equation for its accuracy in shade passing decisions. They assembled an extensive database from nineteen Hong Kong companies, consisting of nearly two thousand pass/fail decisions. They then compared the reliability of three equations in predicting a shade match. Of the CMC, JPC (79) and CIELAB equations, the coefficient of correlation was best (0.80) for the CMC equation. At 50% acceptance, the average wrong decision caused by using CMC(2:1) is 12.5%, whereas shade passers on average show a 14.5% wrong decision. Man et al. also introduced a new way to identify behavior of observers towards failing a shade (bias to fail) and a new way to express the pass rate (merit pass rate). (T. M. Man, Ortech International, Ontario, Canada, with

S.K. Ku, and K.M. Sin; "Shade Passing.")

Mr. Darko Golob, in collaboration with Dr. Slava Jeler and Ms. Vera Golob, evaluated the influence of the semiaxis coefficients S_L, S_C, S_H on the CMC equation. Chiefly, this paper illustrated the differences between the CMC(2:1) equation and CIELAB, showing when and where CMC(2:1) coefficients give higher acceptable values than CIELAB coefficients, and vice versa. For example, the CMC coefficient $DL^*/2S_L$ is lower than CIELAB lightness coefficient L^*. As a result, for a target and match of a very light specimen near $L^* = 100$, the CMC lightness coefficient $DL^*/2S_L$ describes an acceptable lightness difference three times greater than that described by CIELAB lightness coefficient DL^*.

Golob et al. exhaustively described the differences between the coefficients S_L, S_C, S_H of CMC (2:1) with corresponding CIELAB coefficients L^*, C^*, H^* in this way. Then they graphed the size of acceptable differences for several levels of S_L, S_C, S_H. When these differences are graphed at several S_L, S_C, S_H levels, one is able to immediately and clearly spot cases where divergences are systematic. As a result, one becomes aware of how CMC tolerances compare to CIELAB tolerances in various regions of color space. (Darko Golob, Slava Jeler and Vera Golob, University of Maribor, Faculty of Technical Services, Maribor, Slovenia; "The Influence of the Coefficients S_L, S_C, S_H on Color Difference Equation CMC (l:c).")

Two posters came by way of RIT's Munsell Color Science Laboratory. One, entitled "How to Start an ISCC Student Chapter", is aimed at helping the growing color industry accommodate those who are interested in learning more about color. This poster provided a series of helpful steps for those who are interested in forming ISCC student chapters in their own geographical areas, including affiliating with local universities and with the central ISCC organization. There were also suggestions for tours, demonstrations, forming pools for psychophysical experiments, hosting guest lecturers, and establishing a career network. This kind of attractively done presentation should spark interest in creating future student chapters in different parts of the world. (Joseph Tusinski and Sarah Tregay, Rochester Institute of Technology; "How to Start an ISCC Student Chapter")

Dr. Roy Berns, Lisa Reniff, and Toru Hoshino supplied a poster/demonstration describing a means of achieving accurate color art reproduction. Berns et al. began with a series of six black and white images, each exposed through one of six color filters of known spectral transmittance, spaced evenly through the visible spectrum. This provided a colorimetric capture of the image. In this way, they achieved an advance over the usual trichromatic process, in which image capture is not colorimetric. These six black and white images were then assembled and interpreted using Macintosh software and a Macbeth Color Checker. The final result was sent to a calibrated diffusion dye printer. When compared with a trichromatic proof, the RIT imaging/printing process gave demonstrably more faithful color reproduction. The average actual DE^*_{ab} for the conventional photograph was 14.8%, while the average actual DE^*_{ab} for the RIT process was an improved 8.4%. Given the availability of the materials used in the RIT process, this technique could be implemented in the near future for quality art reproduction. (Roy S. Berns, Lisa Reniff, and Toru Hoshino, Rochester Institute of Technology; "Accurate Color Art Reproduction: A Not Too Distant Reality")

Finally, David Spooner presented a poster describing a low-cost spectrocolorimeter sensor. This sensor made use of a holographic mirror with narrowband rejection. The output from the detector array placed on the other side of this mirror is essentially an inverse sampling of the spectrum of the light source. Therefore, data on power content for one waveband involves a deconvolution. This is a math-intensive process, but it is easily taken care of by low-cost fast computer chips which are now readily available. This done, the problem now is to assess not just one waveband, but the entire visible spectrum. To do this, the above technology is combined with a photopolymeric method for gradually shifting the rejection wavelength over the length of the holographic mirror. This color tuning technique allows the assessment of the complete spectral power distribution with a continuous wedge holographic mirror. The simplicity of this process could result in cost reductions of an order of magnitude or more, enabling the production and use of spectrocolorimeters on a wide scale. Mr. Spooner supplied several holograms, making for a presentation that generated a lot of discussion and interest. (David Spooner, Dupont, Inc., Wilmington, Delaware; "A Low-cost Spectrocolorimeter Sensor")

We would like to thank the authors for sharing their interests with ISCC members. They enlivened an already exciting and energetic conference. We invite and encourage all members to share their varied interests in color in the open forum of the poster sessions.

Ronald Oldchurch
Poster Papers Committee Chair

THE NEWS GOES ELECTRONIC

An e-mail account has been set up to receive news items, articles, and ideas for the ISCC News. This will save the editors from having to retype articles which are undoubtedly already in soft-copy form. If you would like to submit news items electronically, please send them to:

MCSL@RITVAX.ISC.RIT.EDU

All material is also welcome on 3.5" diskette (Macintosh or MSDOS) or by mail to Editor, ISCC News, 98 Grand View Drive, Fairport, NY 14450, or by fax to (716) 425-2411.

UNIVERSITY CORNER

Our First Impressions of ISCC

This April, we attended our first ISCC meeting in Providence, Rhode Island. What a worthwhile experience! The friendliness among the attendees was striking. It was easy to start up a conversation since everyone was very willing to discuss their interest in color. The Sunday afternoon reception and Monday night dinner at the Rosecliff Mansion were great opportunities to meet scientists, businessmen, and vendors. (The food was delicious too!)

On Sunday, Paula Alessi, ISCC president, welcomed the ISCC newcomers and described the organization and mission of ISCC. We witnessed Dr. Billmeyer (our professor's professor) receive the Godlove award at the business lunch on Monday. We enjoyed the "Black Cat" demonstration by James Wiberley on subtractive color mixing during the Education Committee meeting on Monday afternoon.

Talking with speakers about their presentations and examining the latest spectrophotometer/color-matching software was much more educational than just reading papers or promotional literature.

Most importantly, we were able to cheer on our fellow students, Tim Kohler and Nathan Moroney, who presented their research to their first professional audience.

We wish to thank our sponsors at the Munsell Laboratory for providing the funding to make this experience possible.

Audrey Lester and Jim Shyu
Munsell Color Science Laboratory
Rochester Institute of Technology

COLOR QUANTIFICATION INDUSTRY PERSPECTIVE AND APPLICATIONS

Measuring and quantifying color have been regular parts of quality assurance in the textile and apparel industries for years. Describing the visual color difference between a sample and a standard, however has often been a source of confusion. Standard methods and equations have helped deal with this problem for the last fifteen years or so. In practice are the 1976 CIE L*a*b* equations as well as the CIE L*C*h values to describe lightness, chroma, and hue. Many users prefer using the color difference values dL*, dC*, dH*, since the descriptions agree better with visual assessments.

With the advent of the CMC equations (Color Measurement Committee of the Society of Dyers and Colourists), dE^*_{cmc} has proved to be a credible tool in determining pass/fail specifications. With this single number, textile QC managers and apparel manufacturers can agree on pass/fail limits beyond which goods cannot be shipped. In this manner, the single pass/fail number which typically applies to the customer or to the product line itself, applies for all shades, and is therefore easier to manage than discrete tolerances for each shade.

Several techniques are in use in the textile industry to group goods by shade so that the apparel manufacturer can know how to utilize incoming fabric. One method uses the 555 shade sorting system. This method uses three-digit codes to describe how the samples differ from the standard in terms of a three-dimensional fixed grid system around the standard. The standard block is called 555. By moving away from the standard, the sample can be described as lighter, duller, redder, and so on, simply by assigning its proper code, for example 634. While this system is easy to apply, the misunderstanding of its principles has created confusion. In an effort to make all samples be 555 or within an acceptable range of sort blocks, a textile manufacturer might increase tolerances such that the blocks are large enough to hold most of the sample population. Another manufacturer who uses smaller tolerance, and therefore smaller sort blocks, is being more critical and risks more rejection of goods. It is extremely important that the apparel manufacturer, in cooperation with the textile manufacturer, communicate the tolerances that are appropriate, so that each supplier sends goods to the apparel manufacturer that have been judged with the same yardstick. Acceptability may not be determined by using 555 alone. Coupling CMC with shade sorting is the best way first to determine acceptability, and then to automatically generate 555 tolerances. The smaller the tolerances, the more sort blocks it takes to cover a population of acceptable samples. Because of this problem, other grouping techniques have been developed.

Clustering provides another method of grouping goods. This method eliminates the need for a fixed-grid block system and effectively groups a given population into a minimum number of clusters. Within a cluster, the color difference is more uniform than color difference within a sort block, because corners no longer exist. Clustering can be effective when trying to allocate an entire inventory, or when grouping a single shipment. Clusters from previous shipments do not necessarily have any relationship to clusters from future shipments, as no reference standard is maintained.

Shade tapering provides another approach to grouping goods. Tapering sequences the pieces by color difference, so that when the pieces are laid out, the color difference appears to be a gradual change. Tapering can take two approaches, linear tapering or "minimum path" tapering. Linear

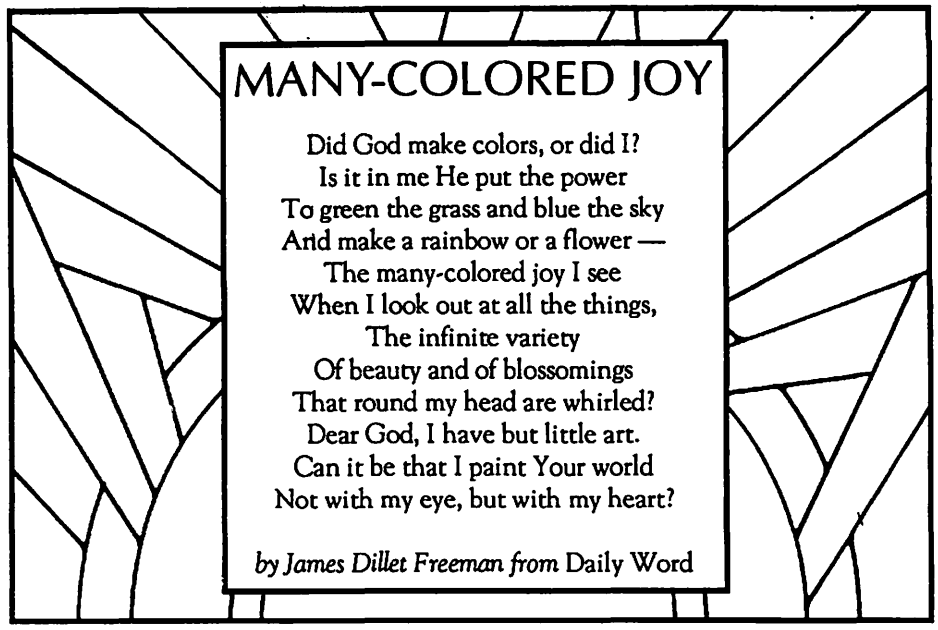
tapering works well with a sample distribution that is elongated, or more linear around the standard. By applying a line of best fit to the distribution, a taper sequence begins at one end and works through to the other end. Typically, if the first piece in the taper sequence were laid adjacent to the last piece in the sequence, maximum color difference would be observed. Minimum path tapering works well with a sample population that has a more spherical distribution around the standard. No single line of best fit applies to a spherical distribution, so a different mathematical approach finds the best starting point, then works through the sample population to find an appropriate sequence.

Tapered data can be sent to a company's mainframe computer as part of its inventory allocation system. For example, if the apparel manufacturer needs a cut of 2400 yards, the textile manufacturer can select the required yardage from the taper sequence, then transmit the information as part of EDI (Electronic Data Interchange). The remaining inventory can be re-tapered as needed for another shipment.

The advent of EDI for customer linkage allows the color difference data from the textile manufacturer to be sent via modem to the apparel manufacturer. At this point, the apparel manufacturer can use these delta values to shade sort, cluster, or taper, as desired. With this approach, the textile mill makes all the measurements, eliminating any off-shade goods and leaving the sorting, clustering, or tapering of the acceptable goods to the apparel manufacturer. Customer linkage requires trust to allow increased speed of handling the goods from shipping to cutting.

Quality requirements of the future require increased understanding between textile and apparel manufacturers as to what information is most reliable and useful. The textile mill has the ability to pull any seconds and to ship exactly what the apparel manufacturer needs for each order. The apparel manufacturer must also decide if it is a task to perform in-house, or if it is a task the textile manufacturer should perform before shipment as part of EDI. Software is available to analyze color difference, track histories of shade performance, and group inventory by shade sorting, clustering, or shade tapering. As color technology developers work with the manufacturers to discover future needs, software packages can be developed to provide the vehicles for new information.

Carol Tomasino Revels
excerpted from Color Byte



MANY-COLORED JOY

Did God make colors, or did I?
Is it in me He put the power
To green the grass and blue the sky
And make a rainbow or a flower —
The many-colored joy I see
When I look out at all the things,
The infinite variety
Of beauty and of blossomings
That round my head are whirled?
Dear God, I have but little art.
Can it be that I paint Your world
Not with my eye, but with my heart?

by James Dillet Freeman from Daily Word

CALL FOR POSTERS AND DEMONSTRATIONS FOR WILLIAMBURG: FLUORESCENCE

The theme of this year's annual conference in Williamsburg, Virginia is "The Colorimetry of Fluorescent Materials."

Because of the exciting graphic nature of the subject, many presentations lend themselves well to a demonstration or poster format. Therefore, the ISCC will offer a special poster/demo paper session this year. This conference will be held February 21-23, 1994.

Topics should be related to the colorimetry of fluorescent materials, for example:

- Computer colorant formulation
- Fluorescent samples
- Illlumination sources
- General measurement devices
- Applications

Presenters are encouraged to take advantage of the visual impact a demonstration format could provide.

Please submit a title and abstract no later than September 1, 1993 to:

Ron Oldchurch
1680 N. Hwy. 101 #11
Leucadia, CA 92024
Phone: (619) 943-7029
Fax: (619) 943-8665
E-mail:
Internet bsa @ mcl. Saic.com

NEW MEMBERS

We are pleased to list the latest members to the ISCC. Welcome!

Mr. Dan Axelrad
RIT
219 Union Street
Kingston ON K7L 2P8
Canada

Dr. Gordon P. Bierwagen
North Dakota State Univ
Dept Polymers & Coatings
Dunbar 54-B
Fargo ND 58105
USA

Ms. Lara L. Bottone
J.M. Huber Corporation
Pershing Avenue
Raritan Center
Edison NJ 08818
USA

Mrs. Karen Rybarczyk Braun
RIT
302 Robert Quigley Drive
Scottsville NY 14546
USA

Mr. Dave Brown
The New Cherokee Corporation
10 Spindale Street
Spindale NC 28160
USA

Mr. Donald Criscione
Colorgen, Inc.
One Federal Street
Billerica MA 01821
USA

Ms. Cathleen M. Daniels
Eastman Kodak
14 Bellmawr Drive
Rochester NY 14624
USA

Mr. Stuart Gallup
RIT
426 Fairwood Circle
Rochester NY 14623
USA

Mr. Jason Gibson
RIT
247 Kimball Drive
Rochester NY 14623
USA

Dr. Mary K. Killoran
PPG Industries
3800 W. 143rd Street
Cleveland OH 44111
USA

Ms. Mei-chun Lo
Dept. of Computer Studies
Loughborough Univ. Tech.
Loughborough
Leics., England LE11 3TU
United Kingdom

Mr. Harold Marcus
Munsell Color
405 Little Britain Road
New Windsor NY 12553-6148
USA

Mr. Juanillo Miel
McCorquodale Color Card Ltd.
30 Tempo Street
Willowdale ON M2H 2N8
Canada

Mr. Eric L. Neumann
RIT - Electronic Color Imaging
146 Laburnam Cresent
Rochester NY 14620-1836
USA

Ms. Betty Pavloski
Boise Cascade R&D
4435 N. Channel Avenue
Portland OR 97219
USA

Dr. Raymond J. Pohl
E.I. DuPont Polymers
Box 88
Buffalo NY 14207
USA

Ms. Cori Rolland
Graphics Technology International
28 Gaylord Street
South Hadley MA 01075
USA

Ms. Deborah Schneider
H.B. Fuller Co.
Industrial Coatings Div.
3200 LaBore Road
Vadnais Heights MN 55110-5130
USA

Ms. Kim Sutter
Lancer Dispersions, Inc.
1680 East Market Street
Akron OH 44305
USA

Mr. Robert D. Teicher
Colorgen, Inc.
One Federal Street
Billerica MA 01821
USA

Ms. Sarah B. Tregay
RIT
25 Andrews Memorial Dr.
CPU 1179
Rochester NY 14623
USA

Mr. Joseph Tusinski
RIT Center for Imaging Science
PO Box 9887
Rochester NY 14623-0887
USA

NEWS FROM MEMBER BODIES

INTERNATIONAL CONFERENCE & EXHIBITION 1992 ANOTHER AATCC SUCCESS!

Over 220 attendees descended upon Atlanta, Georgia for the 20th annual AATCC International Conference and Exhibition (AATCC-ICE). The October 4-7 conference and exhibition was held in the Inforum with the host hotel being the Hyatt Regency.

The technical sessions were well received. In Session 9: Color Science, Richard Gibson, of Tomen, America, Inc., presented a paper on "New Concepts in Color Computer Matching: The Neural Approach." Frederick T. Simon, of F.T. Simon, Inc. spoke on "Color Control of Carpet Dyeing." Samir Hussamy discussed "The Coloration of High Modulus, High-Tenacity, Low-Shrinkage Polyamide Fabrics with Acid Dyes by a New Continuous Dyeing Process." Roland Connelly and Robert Willis of SheLyn, Patrick Chong of Spartan Mills, and Sy Commanday of Hercules were members of a panel on "What is New in Color Science."

Student attendees were enthusiastic about the AATCC-ICE. "These technical sessions are great. I wish we had courses that are as good as the sessions." "The exhibitors were wonderful. I really appreciate the time they took with me." "I don't know which I enjoyed most, the technical sessions or the exhibition." "I have learned more here in two days than in many semester long classes."

The AATCC International Conference and Exhibition - 1993 will be held in Montreal, Canada, October 3-6.

Excerpted from Color Byte

SPECIAL CHINESE ISSUE OF ASTM *STANDARDIZATION NEWS*

ASTM and the Chinese Association for Standardization (CAS) will jointly publish the second Chinese-language edition of ASTM's monthly magazine, *Standardization News (SN)*. *Biao Zhun Hua Xin Wen* is scheduled for distribution in China by the end of this year.

This issue will provide CAS members with accurate, timely, and valuable information on ASTM standards and pertinent American scientific and technical activities that will benefit their professional development. It will also serve as a medium for educational institutions, research organizations, and industrial companies to make direct contact with one another.

Feature articles for the second Chinese issue include: "Lite" Products Come of Age — New Developments in Geosynthetics; Computerization of Composites Material Data; Accelerated Microelectronic Contamination Standards; An Interview with ISO Secretary General Lawrence D. Eicher; The Value of ASTM to the Commercial Fatigue Testing Laboratory and Its Customers; The Global Standards Architecture for Analytical Data Interchange and Storage; The American Council of Independent Laboratories (ACIL); Standard Terminology: An ASTM Central Resource.

In addition to these featured articles, ASTM and CAS will cooperate in selecting technical news of interest to China. This will include upcoming meetings, conferences, symposia, state-of-the-art technology, ASTM Standards Technology Training Courses, listings and abstracts of new and revised ASTM standards, and new ASTM and CAS publications.

ASTM is accepting advertising for this edition, which will be distributed by CAS to approximately 10,000 CAS members and other interested professionals. Advertisers will also be given complimentary space to describe their products and technology commensurate with the advertising space which they buy. For more information, contact Ellen McGlinchey, ASTM, 1916 Race Street, Philadelphia, PA 19103-1187, (215)299-5418.

ASTM News Release

ASPRS REPORT OF ACTIVITIES

ASPRS During the past year, the American Society for Photogrammetry and Remote Sensing (ASPRS) has been engaged in several color-related activities. The ASPRS/ACSM Convention was held in Washington, D.C. in conjunction with the XVII International Society of Photogrammetry and Remote Sensing (ISPRS) Congress, from August 3-14, 1992. This conference featured many talks on multispectral remote sensing and machine vision.

Optical Engineering (OE) Aerospace Sensing 93, co-sponsored by SPIE, was held in Orlanda, Florida, April 12-16, 1993. Highlights of the Symposium included the Conference on Imaging Spectrometry of the Terrestrial Environment, chaired by G. Vane of the Jet Propulsion Lab, and a short course on Multispectral Image Processing taught by R. Schoengerdt from the University of Arizona at Tucson.

The 14th Biennial Workshop on Color Photography and Videography in Resource Monitoring was held from May 24-27, 1993 in Logan, Utah.

This year the communication between the ISCC and ASPRS has been quite good, as evidenced by the inclusion of color meetings in the ASPRS calendar and vice versa.

Mike Brill, SAIC

PAINT VOLATILE ORGANIC COMPOUNDS FOCUS OF TRAINING COURSE

ASTM "Paint Volatile Organic Compounds (VOC)", a two-day Standards Technology Training (STT) course presented by ASTM, will focus on how to obtain precise, meaningful Volatile Organic Compound data from laboratory tests on paints and related coatings. The course will be held November 3-4, 1993 in San Bernadino, California. It includes laboratory demonstrations on the use of gas chromatography, the Karl Fischer Titration Method, paint density, and other test methods needed to determine the VOC of coatings. The instructive demonstration will be sponsored by and held at the South Coast Air Quality Management District Laboratories.

In addition to a discussion on the latest VOC technologies and changes in VOC measurements (for example, multicomponent paints and VOC aerosols), the basic principles of the ASTM test methods used to measure VOC in the U.S. Environmental Protection Agency's New Source Performance Standard will be covered. This course is designed for chemists and others who use U.S. EPA tests to determine if paints or coatings meet VOC requirements. Individuals from the paint industry, government regulatory bodies, commercial laboratories, and paint users can also benefit from the course.

A $535 fee includes ASTM's *Manual on Determination of VOC in Paints, Inks, and Related Coatings*, copies of all referenced ASTM standards covered in the course, lecture notes, visual aids, coffee and soda breaks, lunches, and transportation to and from demonstration sites. The registration deadlines are four weeks prior to each course. Class size is limited, so register early. For a free brochure, including registration information, contact Tina Falkenstein, ASTM, 1916 Race Street, Philadelphia, PA 19103, (215) 299-5480, FAX (215) 299-2610.

ASTM News Release

COLOR MARKETING GROUP (CMG)

Have You Seen Pebble, Purple Haze, Plummit or Espresso?

Be on the lookout for consumer goods in colors such as Pebble, Purple Haze, Plummit and Espresso. They are just a few of the 41 exciting new colors forecast by the Color Marketing Group (CMG) in its new Consumer Color Directions™ Palette for 1995. These colors are a result of the Consumer Color Directions Forecast Workshop held at Color Marketing Group's Spring International Conference in Washington, D.C., April 4-6, 1993.

"The new palette places the accent on softer, more natural colors, which will be a continuation of the trends from last year toward colors which are inspired by nature, the earth, the waters, and the sky," says CMG 1995 Consumer Color Directions Co-Chairman Leslie Harrington of Benjamin Moore & Company Ltd., Toronto, Canada.

Six hundred color and design professionals representing a wide range of industries, including interior home, transportation, communications/graphics, fashion, action/recreation, and building products, brought their cumulative experience in color forecasting and trend tracking to these "hands-on" workshops for a collaborative exchange of high quality information.

Some of the consumer/residential forecast colors for 1995 include gray moss, manatee, cornmeal, chargreen, and H-blue-O. Colors that will appear in 1994 and continue to be evident in 1995, known as emerging colors, are sandal wood, cumin, aloe, grunge, denim, dried apricot, and winestain.

In addition to the forecast and emerging CMG colors, eight catalyst colors are introduced. These colors accent and extend the regular palette. The first of these is *parrot*, an almost iridescent yellow-green taken out of the brilliant plumage of the parrot. The warm glow of the noonday sun has inspired *sun*, a clean, brilliant mid-range yellow. *Tangelo*, a mid-range citrus orange, is even brighter than its namesake and cleaner than last year's Solar Orange. *Tropical punch*, carried over from last year's palette, is a brilliant scarlet representing a yellowing of red, a deepening of coral. *Azalea*, a hot new magenta, is a cleaner, slightly bluer evolution of last year's New Geranium. Clean and vibrant, reddish-blue *flutterby blue*, hints at the iridescence in the wings of a passing butterfly. *Purple passion* is an electric mid-range purple. *Ocean reef*, carried over from CMG's 1994 Consumer Palette, is a bright turquoise-green which evokes the waters which surround a tropical isle.

Color Marketing Group News Release

GEMOLOGICAL INSTITUTE OF AMERICA

Corundum Treatment, Tucson Report in Gems & Gemology

GIA The Spring 1993 Issue of *Gems & Gemology*, the quarterly journal of the Gemological Institute of America, features an update on the diffusion treatment of corundum, focusing on the production of red and pink to purple colors.

At the request of a treater, authors Shane F. McClure, Robert C. Kammerling, and Emmanuel Fritsch examined faceted specimens in a range of colors to document gemological properties and determine identification

30 IMAGING RESEARCHERS AWARDED

IS&T Thirty imaging scientists and engineers, including the first ever recipient of the Edwin H. Land Medal for pioneering research and technological creativity, were honored with the industry's most prestigious awards by the Society of Imaging Science and Technology (IS&T) at its 46th Annual Conference in Boston, Massachusetts.

Henry B. Washburn, Jr., Honorary Director for Life of the Boston Museum of Science, was made an Honorary Member of the Society, its highest award. Dr. Washburn developed photographic techniques and innovations in precision imaging and cartography of rugged terrain that revolutionized the documentation of mountain and glacier detail. He led the project that used ultra-high-altitude photo mapping flights to create the first precise, large-scale map of Mount Everest. He also led the team of scientists and mountaineers that made the first laser measurements to the top of Mt. Everest, enabling precise calculations of the rate of formation of the Himalayas. Dr. Washburn was the Director of the Museum of Science from 1939 to 1980 and Chairman of the Museum Corporation from 19480 to 1985.

Howard G. Rogers, the retired Director of Research for Polaroid Corporation and holder of 146 patents in optics, photographic chemistry and polymer science, was awarded the first Edwin H. Land Medal for pioneering entrepreneurial creativity that has had major public impact. The medal carries with it a cash award of $10,000, endowed by Polaroid. Soon after Land's 1947 introduction of one-step photography, Rogers undertook the development of an instant color process, which resulted in the introduction of Polacolor instant film in 1963. Polacolor was based on Rogers' concept of dye developers, bifunctional molecules that are both image dyes and developing agents. Rogers also led research towards Polaroid's first integral color film, SX-70, in 1972, and later invented silver-assisted dye release processes, which are utilized in present Polaroid instant color films.

The Lieven-Gevaert Award, sponsored by Agfa-Gevaert for an outstanding contribution in the field of silver halide photography, was given to Joe Maskasky for his research on silver halide crystals, including tabular grains, and his microphotographic illustrations of that work. Maskasky is a Senior Research Associate of the Eastman Kodak Company.

The Chester F. Carlson Award, sponsored by Xerox Corporation, Webster Research Center, for outstanding work in electrophotography, was bestowed on Lawrence B. Schein for his pioneering contributions to the advancement of knowledge in the entire field of electrophotography. Schein currently manages IBM Corporation's electrophotographic physics project.

The Kosar Memorial Award, sponsored by the New York Chapter of the IS&T, for a significant contribution to an innovative imaging system, was presented to Osamu Majima for his contributions to the development of sublimation dye transfer color hard copy printing technology. Majima is general manager of a new printer project team of Sony Corporation.

The Raymond C. Bowman Award, sponsored by the New York Chapter, to an individual for fostering careers in imaging, went to Leslie Stroebel for his longstanding contributions as an educator in the science, technology, and applications of photography. Stroebel is a Professor Emeritus in the Rochester Institute of Technology.

Fellowship in the IS&T was awarded to Sanford H. Ehrlich, Eastman Kodak, for his fundamental work towards an understanding of the mechanisms of dopants and dye sensitization of silver halides; Joseph Gaynor, Innovative Technology Associates, for his contributions in many fields of imaging science and technology; Warren L. Rhodes, Chromatech Corporation, for his many contributions in the fields of graphics arts imaging and color printing; Shin Ohno, Sony Corporation, for his contributions to the fields of electronic photography and video printing; and James C. Owens, Eastman Kodak, for his contributions to the technologies of laser scanning and color hard copy output.

Pam Fornes
Conference Manager, IS&T

GIA, from previous page

criteria prior to commercial release. "Diffusion-treated corundum in the form of blue sapphires was a curiosity in the late 1970's," said Alice Keller, editor of Gems & Gemology, "and is now widely available in the trade. It appears that diffusion-treated corundum in different colors, including red, will also be a commercially reality in the near future."

The issue also includes a special Tucson '93 Gem News section with an overview of interesting gem materials available at the show, such as star diamonds, Mexican red quartz, and a new spessartine garnet from Africa. Other articles include reports on Queensland boulder opal, gem beryl from Luumaki, Finland, and an examination of De Beers experimental near colorless-to-blue gem-quality synthetic diamonds.

This issue features the popular annual "Gems & Gemology Challenge," allowing readers to test their knowledge of recent developments in gemology. A perfect score merits a GIA Continuing Education certificate, suitable for framing. Gemological Abstracts and Book Reviews round out the issue.

For more information on Gems & Gemology, contact the Gems & Gemology Subscriptions Department, Dept. PR36E, P.O. Box 2110, Santa Monica, California 90407-2110. Or call (800) 421-7250 ext. 201. in the U.S., (310) 829-2991 outside the U.S.

SOCIETY OF PLASTICS ENGINEERS

Dr. Fred Billmeyer, Jr., Elected Fellow of the Society

Dr. Fred W. Billmeyer has been elected Fellow of the Society of Plastics Engineers in recognition of his outstanding contributions to the plastics industry. Dr. Billmeyer was one of five SPE Senior Members to receive this honor at the Society's 51st Annual Technical Conference (ANTEC), held at the Ernest N. Morial Conventional Center in New Orleans. Since 1984, only 97 of the current 37,000 members have achieved this status.

A member of the Society since 1961, Dr. Billmeyer has been a member of the Hudson-Mohawk Section and the Color & Appearance Division. In 1964, he founded The Rensselaer Color Measurement Laboratory, the principal center of color activity in the United States for 20 years. Dr. Billmeyer has authored 13 books and over 275 articles on color measurement and polymer characterization and has drafted more than a dozen significant ASTM standards in the field of color science and polymer molecular weight measurement. In addition, he founded and for 11 years edited *Color Research and Application*, the pre-eminent color journal in the world.

Society of Plastics Engineers News Release

O T H E R N E W S

RIT'S PRINT QUALITY '93 CONFERENCE

Conference to Showcase Quality Success Stories, Live Press Run of GTO-DI

The quality success story of Xerox Corporation, winner of the 1989 Malcolm Baldrige National Quality Award, was the focus of the opening keynote address at Print Quality '93, Rochester Institute of Technology's annual conference on quality and productivity in the printing industry.

Print Quality '93 took place June 15-18 in Rochester, N.Y. A pre-conference introduction to Total Quality in scheduled for June 14.

In his keynote address, Richard Leo, vice president and general manager of Xerox Business Services, described how his company applies the techniques of Total Quality Management on an international basis.

In the second keynote address, Bryon Ramseyer, president and owner of Gamma One, discussed the successes and challenges his company has experienced with TQM. Gamma One is a color separation house serving the fashion catalog, sales promotion, trading card, and FSI markets.

The third keynote address, given by John Compton, conference chairman and director of RIT's Laboratory for Quality and Productivity in the Graphic Arts, focused on making sure that Total Quality is really *total*. "In the past few years, many printing companies have tried to implement some form of quality improvement program under the banner of Total Quality Management," Compton said. "But in many cases, these efforts have been incomplete because they focused almost exclusively on production. In reality, these approaches can be best described as *partial* quality management."

Another highlight of Print Quality '93 was a presentation entitled "The Seven Habits of Highly Effective People by Stephen R. Covey," based on the best-selling book of the same title. Bruce Rognan, an authorized Covey associate, examined the leadership principles and management skills that were pioneered by Covey and successfully adopted by thousands of individuals and organizations.

One of the most popular features of each Print Quality conference is a "live action experiment that is broadcast on closed-circuit TV for all participants to watch. This year, the live component of the conference was a workshop entitled "Cycle Time Reduction in the Pressroom."

The day-long workshop, highlighted by a press run on the Heidelberg GTO-DI, demonstrated the impact of innovative technologies such as direct-to-plate imaging on cycle time. The GTO-DI, made available for the conference through a partnership with Heidelberg, features a new technology that enables plates to be electronically imaged directly on the press cylinder, completely eliminating the need for mechanical production, film processing, stripping, even conventional platemaking. The workshop also showed how cycle time can be shortened by using waterless lithography and SMED, a technique for simplifying work processes.

RIT News Release

INTERNATIONAL COMMISSION ON ILLUMINATION

Seminar '92 on Computer Programs for Light and Lighting

CIE Publication X005 - Proceedings of the CIE Seminar '92 on Computer Programs for Light and Lighting is now available. The 1992 CIE Seminar took place at the CIE Central Bureau and the Bundesamt für Eich- und Bermessungswesen, Vienna on October 5-8, 1992.

The Seminar was set up to serve as a clearing-house among developers, vendors, and users of lighting calculation software. The meeting encompassed five invited papers and many research papers, demonstrations and workshops. The Seminar closed with a round table

(con't ➡)

CIE, continued

discussion focusing on the state of the art in lighting software tools - opportunities for future work; conventions, assumptions and accuracy in lighting design tools; and tolerances in lighting design.

The present volume, 113 pages, contains the written version of the invited and research papers and short descriptions of the lighting calculation software shown during the demonstrations and workshops. It also summarizes the Round Table Discussions.

Ellen Carter

CORM 94

Optical Metrology and Accreditation

CORM

The 1994 annual meeting and conference of the Council for Optical Radiation Measurements (CORM 94) will be held at the National Institute of Standards and Technology (NIST) in Gaithersburg, Maryland on Tuesday and Wednesday, May 24-25, 1994. This conference will feature sessions on Laboratory Accreditation, Optical Metrology, and recent activities of CORM.

The session on Laboratory Accreditation will include invited papers from the National Voluntary Laboratory Accreditation Program (NVLAP) and papers from United States laboratories seeking accreditation in the field of Optical Radiation Measurements. The Advanced Optical Metrology session will feature recent advancements at NIST in the areas of Cryogenic and Infrared Radiometry, Detector Based Photometry, and Spectrophotometry. The CORM session will begin with a report on the findings of the CORM SIXTH Report Committee and will also include a report from the Directories Committee, Radiometry and Optical Properties of Materials Committees. For further information about attending or participating in this conference, please contact one of the conference coordinators:

Philip Wychorski, Eastman Kodak Company, Corporate Metrology Center, 1669 Lake Ave., Rochester, NY 14662-4237 USA, (716) 588-6344, FAX (716) 477-0569, email PFW86344@KODAK.COM.

Chris Cromer, NIST - National Institute for Standards and Technology, Room A207/Bldg. 221, Gaithersburg, MD 20899 USA, (301) 975-3216, FAX (301) 840-8551, email CROMER@GARNET.NIST.GOV.

Bob Low, OSRAM Sylvania, 100 Endicott Street, Danvers, MA 01923 USA, (508) 750-2890, FAX (508) 750-2152.

COLOUR GROUP (GREAT BRITAIN)

CG

AIC 1994 INTERIM MEETING
CALL FOR PAPERS
IMAGES IN COLOUR

The Colour Group (Great Britain) announces a residential Symposium to be held at Robinson College, Cambridge from April 10-12. The Colour Group is organizing the meeting on behalf of the International Colour Association and with the cooperation of the IS&T Group of the Royal Photographic Society. The overall theme of the Symposium is *Images in Colour* which may be interpreted in its broadest sense to include photographic, graphic arts, television, and visual display imaging technologies. Papers are invited that cover aspects of colour reproduction that, for example, describe methodologies, discuss measurement, and present new ideas. The Symposium will incorporate the third Bartleson Lecture.

A title and short abstract (200 words) should be submitted as soon as possible. If accepted, authors will be asked to produce a short paper (1000 words + 3 Figures) for the Conference Proceedings.

Abstracts or enquiries should be sent as soon as possible to:

Dr. M. R. Pointer
Kodak Limited - Research Division
Headstone Drive, Harrow, Middlesex HA1 4TY, England

GROWING NUMBER OF VEHICLES GREEN, WHITE STILL NUMBER ONE

While the number one vehicle color choice in 1992 continued to be white, dark and medium greens made significant gains in North America, according to DuPont's annual survey of vehicle color popularity.

"Green, on average, jumped to the top five consumer color selections for all four vehicle categories, [luxury, full/intermediate, sport/compact, light trucks/vans]," said Robert S. Daily, finishes color marketing manager for DuPont Automotive. "This is a significant increase. Last year, green was only a small percentage of the full/intermediate and truck/van categories. It didn't even make the luxury or sport/compact lists."

Last popular in the late '60s and early '70s, the greens of 20 years ago were yellow green. Daily said today rich, dark blue greens are the color of choice. "Green symbolizes harmony and counteracts emotional stress," said Roseann Forde, fashion director of women's apparel for DuPont Fibers.

Based on his research, Daily predicts that greens will retain their popular position for several years, and dark, rich purples and mid to reddish yellows will emerge in the next three to five years.

Excerpted from DuPont News

Color Research and Application
IN THIS ISSUE

Color in the art of Henri Matisse is the topic for "Talking About Color..." this month. Rolf G. Kuehni describes the two approaches to coloration that Matisse used in developing his own style: the filling in of contours with uniform blends of colorants and the separate application of high chroma colorants in streaks, dashes, or dots. Although he never followed a color theory, Matisse showed great intuitive mastery of color.

What do we think of when the term color constancy is used...keeping the same color impression of the fruit in a bowl when a living room lamp is turned on at dusk...perceiving the object as having the same color even when different brightly colored objects are added to or removed from the surroundings? Looking at a curved uniformly colored surface is a more basic case than these. Consider a ripe banana. How do we recognize that we are looking at a particular colored surface, the banana, as opposed to two or more separate objects? Although much use has been made of color and much studied about the human visual system, many truly fundamental questions have not been resolved. To answer basic questions such as "Why do we see color?" and "What is the definition of color?", Alexander Petrov's research set out to describe perceived colors as a space, but ended up doing a thorough investigation of the relationship between illumination, shape, and color. In "Surface Color and Color Constancy," Dr. Petrov describes the attributes that the visual system produces as a result of processing "surface color." He shows that the set of color matrices represents all perceived colors quite adequately.

Robert Säve summarizes recent thinking about gloss. In "Problems Connected with the Concept of Gloss," he reviews the methods to characterize gloss, discusses the physics of gloss, and proposes that measured gloss be related to luminance factor in the specular direction. Dr. Säve concludes this article by calling for international cooperation and agreement in developing gloss terminology and measurement practices.

Neural networks is a relatively new computer programming technique that has been used to solve diverse problems. However, there have been relatively few applications in the field of color science. In "Color Notation Conversion by Neural Networks," Shoji Tominaga uses this technique to convert between Munsell notation and CIE notation in either direction. One of the advantages is that a special database is not necessary, only a small set of weighting parameters in the network.

It takes a talented artist or designer to produce works of beauty, although we all have our opinions about what is beautiful. Several researchers have attempted to estimate color harmony quantitatively. However, the results are usually limited to the specific combination of the colors used. In "Objective Evaluation of Color Design (II)," Naoki Kawamoto and Toshiichi Soen report on an evaluation method applicable to various real color designs. They analyzed color patterns in terms of Fourier transforms. The psychological experiment that they studied used random color patterns as visual stimuli and 13 rating scales such as "beautiful-ugly" or "heavy-light". The resulting evaluation method was tested on fabric designs.

Occasionally color constancy and color rendering are confused. Petrov's article discussed color constancy, and in the next article He Xu discusses color rendering. The CIE Color Rendering Index provides a metric to evaluate how much change occurs in the appearance of color specimens relative to a reference specimen under a test illuminant when compared to the standard illuminant. However, there is another aspect of the color rendering properties of illuminants. In "The Color Rendering Capacity of Light," He Xu examines how many different colors will appear when a set of specimens is illuminated by a certain illuminant. As an extreme example, one could imagine a set of paint chips of various colors under two conditions of illumination, first illuminated by a monochromatic red source, then illuminated by daylight. Obviously the samples illluminated by daylight exhibit a greater range of colors, or the daylight source has a greater capacity to render color than a monochromatic red source. Xu derives a new measure, the color rendering capacity, shows its calculation, and discusses its implications.

A New Feature: Reprinting Classical Articles on Color

A new feature is inaugurated in this issue. It is the reprinting of Classical Articles on Color. The article featured first is "On the Theory of Compound Colours, and the Relations of Colours in the Spectrum" by James Clerk Maxwell. Maxwell lived from 1831 to 1878, and this article was originally published in *Philosophical Transactions* in 1860. Yet after more than 130 years, the article remains amazingly insightful. Dr. Qasim Zaidi of the Department of Psychology at Columbia University, New York City, has written a commentary highlighting many of the contributions from this article. The commentary precedes the article.

Dr. Ellen Carter
Editor, Color Research and Application

C A L E N D A R

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

Harry K. Hammond, III
BYK-Gardner, Inc.
2435 Linden Lane
Silver Spring, MD 20910
301-495-7150 FAX 301-585-4067

1993

IS&T ANNUAL CONFERENCE, May 9-14
The Society for Imaging Science and Technology 46th Annual Conference, Boston Marriott Cambridge Hotel, Cambridge, Massachusetts. Information: IS&T (703) 642-9090.

CORM '93, May 18-21
Council for Optical Radiation Measurements Annual Meeting, National Institute for Standards and Technology, Gaithersburg, Maryland. Information: Dr. Jack Hsia (301) 975-2342.

ASPRS WORKSHOP ON COLOR PHOTOGRAPHY AND VIDEOGRAPHY IN RESOURCE MONITORING, May 24-27
American Society for Photogrammetry and Remote Sensing - 14th Biennial Workshop on Color Photography and Videography in Resource Monitoring, Utah State University, Logan, Utah. Information: Christopher Neale (801) 750-3689.

CIE SYMPOSIUM '93, Jun. 8-10
CIE Symposium '93, Colorimetry, Central Bureau of the CIE, Vienna, Austria. Information: Dr. J. Schanda (fax +43 1 713 0838).

AIC-7TH CONGRESS, Jun. 14-18
International Colour Association - 7th Congress, Technical University of Budapest, Budapest, Hungary. Information:Prof. Antal Nemcsics, Technical University of Budapest, Conference Office, Building Z, Room 101/b, H-1521 Budapest, Muegyetem rkp.3-9, Hungary, Phone and FAX (36-1) 185-2218.

LIGHT AND COLOR IN THE OPEN AIR, Jun. 16-18
Optical Society of America Second Topical Meeting on Light and Color in the Open Air, The Pennsylvania State University State College, Pennsylvania. Information: OSA Office (202) 223-0920.

IS&T INTERNATIONAL SYMPOSIUM, Jun 21-25
International Symposium on Electronic Imaging Device Engineering, Munich Fairgrounds South, Munich, Germany. Information: IS&T (703) 642-9090.

ASTM COMMITTEE E-12 ON APPEARANCE, Jun. 23-25
Atlanta, Georgia. Information: Bode Buckley, (215) 299-5599.

ASTM COMMITTEE D-1 ON PAINT, Jun. 27-30
Wyndham Franklin Hotel, Philadelphia, Pennsylvania. Information: Scott Orthey, (215) 299-5507.

MONTAGE 93, Jul.11-Aug.7
Montage 93: International Festival of the Image, Rochester, New York. Information: Montage 93 (716) 442-8898.

COLOR VISION DEFICIENCIES XII, Jul. 18-22
Symposium of the International Research Group on Colour Vision Deficiencies, University of Tübingen, Germany. Information: J. D. Moreland FAX 0782 613847.

IESNA ANNUAL CONFERENCE, Aug. 8-12
Illuminating Engineering Society of North America, 87th Annual Conference, Houston, Texas. Information: Valerie Landers, (212) 705-7269.

EUROPEAN CONFERENCE ON VISUAL PERCEPTION, Aug. 25-29
Edinburgh, Scotland. Information: Michael Morgan: 44-31-650 3511.

CMG - CONFERENCE, Sep. 12-14
Color Marketing Group International Color Directions Conference, Hotel del Coronado, San Diego, California. Information: Katie Register (703) 528-7666.

DCC MEETING, Sep. 23
Detroit Colour Council New Pigments for Automotive Applications, Michigan State Management Education Center, Troy, Michigan. Information: James Hall (313) 947-5428

USNC/CIE, Oct. 3-5
The United States National Committee of the CIE, Annual Meeting, Hawthorne Hotel, Salem, Massachusetts. Information: Dr. Jack Hsia (301) 975-2342.

AATCC - CONFERENCE AND EXHIBITION, Oct. 3-6
American Association of Textile Chemists and Colorists, Montreal, Quebec, Canada. Information: AATCC, (919) 549-8141.

OSA - ANNUAL MEETING, Oct. 3-8
Optical Society of America Annual Meeting, Toronto, Canada. Information: OSA (202) 223-0920.

IS&T 9th INTERNATIONAL CONGRESS, Oct. 4-8
The Society for Imaging Science & Technology, 9th International Congress on Advances in Non-Impact Printing Technologies with Exhibit, Pacific Convention Plaza, Yokohama, Japan. Information: IS&T (703) 642-9090.

FSCT - 71st ANNUAL MEETING, Oct. 27-29
Federation of Societies for Coatings Technology 71st Annual Meeting and 58th Paint Industries' Show, Georgia World Congress Center, Atlanta, Georgia. Information: FSCT Office, (215) 940-0777.

COLOR IMAGING SYSTEMS, Nov. 7-10
Color Imaging Systems co-sponsored by the Society for Imaging Science and Technology and Society for Information Display, The Pointe Hilton Resort at Squaw Peak, Phoenix, Arizona. Information: IS&T (703) 642-9090.

ASTM COMMITTEE D-20 ON PLASTICS, Nov. 15-18
Fort Worth, Texas. Information: Katharine Schaff, (215) 299-5529.

LONG RANGE CALENDAR

1994

ASTM COMMITTEE D-1 ON PAINT, Jan. 23-26
Crown Sterling Suites, Fort Lauderdale South, Florida. Information: Scott Orthey, (215) 299-5507.

ASTM COMMITTEE E-12 ON APPEARANCE, Jan. 23-26
Crown Sterling Suites, Fort Lauderdale South, Florida. Information: Bode Buckley, (215) 299-5599.

WILLIAMSBURG CONFERENCE, Feb.
Inter-Society Color Council Williamsburg Conference on Fluorescence, Williamsburg, Virginia. Information: Richard Harold (703) 471-6870.

BARTLESON SYMPOSIUM, April 11
Cambridge, England.

ISCC - ANNUAL MEETING, Apr. 24-26, 1994
Inter-Society Color Council Annual Meeting & Joint Symposium with Detroit Colour Council, Troy Marriott, Detroit, Michigan. Information: Jim Kaiser

TAGA ANNUAL CONFERENCE, May 1-4
Technical Association of the Graphic Arts Annual Technical Conference, Baltimore, Maryland. Information: Karen Lawrence, (716) 475-7470.

CMG - CONFERENCE, May 8-10
Color Marketing Group International Color Directions Conference, Sheraton New York Hotel & Towers, New York, New York. Information: Katie Register (703) 528-7666.

ASTM COMMITTEE D-1 ON PAINT, Jun. 26-29
Marriott Crab Tree Valley, Raleigh, North Carolina. Information: Scott Orthey, (215) 299-5507.

ASTM COMMITTEE E-12 ON APPEARANCE, Jun. 19-23
Montreal, Canada. Information: Bode Buckley, (215) 299-5599.

IESNA ANNUAL CONFERENCE, Aug. 7-11
Illuminating Engineering Society of North America, 88th Annual Conference, Maimi, Florida. Information: Valerie Landers, (212) 705-7269.

CMG - CONFERENCE, Sep. 25-27
Color Marketing Group International Color Directions Conference, Sheraton Bal Harbour, Miami, Florida. Information: Katie Register (703) 528-7666.

AATCC - CONFERENCE AND EXHIBITION, Oct. 11-14
American Asssociation of Textile Chemists and Colorists, Convention Center, Charlotte, North Carolina. Information: AATCC (919) 549-8141.

1995

ASTM COMMITTEE E-12 ON APPEARANCE, Jan. 22-26
San Antonio, Texas. Information: Bode Buckley, (215) 299-5599.

ISCC PANCHROMATIC CONFERENCE, Feb. 5-7
Inter-Society Color Council Pan-Chromatic Conference, Reston, Virginia. Information: Michael Brill (703) 734-4027.

TAGA ANNUAL CONFERENCE, Apr. 2-5
Technical Association of the Graphic Arts Annual Technical Conference, Orlando, Florida. Information: Karen Lawrence, (716) 475-7470.

ISCC ANNUAL MEETING, Apr. 23-25

CMG - CONFERENCE, May 14-16
Color Marketing Group International Color Directions Conference, Dallas Texas. Information: Katie Register (703) 528-7666.

CIE, Sept.
New Delhi, India

AATCC - CONFERENCE AND EXHIBITION, Oct. 8-11
American Asssociation of Textile Chemists and Colorists, Hyatt Regency, Atlanta, Georgia. Information: AATCC, (919) 549-8141.

1996

ISCC ANNUAL MEETING, Apr. 21-23

TAGA ANNUAL CONFERENCE, Apr 28-May 1
Technical Association of the Graphic Arts Annual Technical Conference, Dallas, Texas. Information: Karen Lawrence, (716) 475-7470.

AATCC - CONFERENCE AND EXHIBITION, Oct. 8-11
American Asssociation of Textile Chemists and Colorists, Oprtkabd Hotel, Nashville, Tennessee. Information: AATCC, (919) 549-8141.

1997

TAGA ANNUAL CONFERENCE, May 4-7
Technical Association of the Graphic Arts Annual Technica Conference, Montreal or Quebec City, Canada. Information: Karen Lawrence, (716) 475-7470.

AATCC - CONFERENCE AND EXHIBITION, Sep. 28- Oct. 1
American Asssociation of Textile Chemists and Colorists, Marriot Marquis, Atlanta, Georgia. Information: AATCC, (919) 549-8141.

1998

TAGA ANNUAL CONFERENCE, May 3-6
Technical Association of the Graphic Arts Annual Technical Conference, Chicago, Illinois. Information: Karen Lawrence, (716) 475-7470.

AATCC - CONFERENCE AND EXHIBITION, Oct. 4-7
American Asssociation of Textile Chemists and Colorists, Philadelphia, Pennsylvania. Information: AATCC, (919) 549-8141.

1999

TAGA ANNUAL CONFERENCE, May 2-5
Technical Association of the Graphic Arts Annual Technical Conference, Philadelphia, Pennsylvania. Information: Karen Lawrence, (716) 475-7470

AATCC - CONFERENCE AND EXHIBITION, Oct. 12-15
American Asssociation of Textile Chemists and Colorists, Convention Center, Charlotte, North Carolina. Information: AATCC, (919) 549-8141.

NEWSLETTER EDITOR Michael A. Hammel

Send photo material (black and white if possible) to:

Editor, ISCC News • 98 Grand View Drive • Fairport, NY 14450 • Tel. (716) 223-1823

If at all possible, please send all other materials ON DISKETTE as follows:

MSDOS–ASCII, Q&A, Word Star, Word Perfect (5.25"–1.2 Meg, or 360K)
(3.5"–1.44 Meg, or 730K).

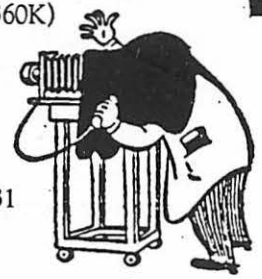
Macintosh–Word, Macwrite, MS Works
(3.5"–1.44 Meg, 800K, or 400K)

For hard copy transmission, FAX to (716) 425-2411.

Or send to: Dr. Ellen C. Carter • 2509 N. Utah St. • Arlington, VA 22207-4031

Please note: the deadline for submission of material is the 1st of even numbered months.

meeting reports



photos

contributions from members

OFFICERS 1990-1992

Position	Name	Address	Telephone	FAX
President	Ms. Paula J. Alessi	Eastman Kodak Company, Rochester, NY 14650	(716) 477-7673	(716) 722-1116
Pres.-Elect	Mr. Roland L. Connelly, Sr.	SheLyn, Inc., 1108 Grecade Street, Greensboro, NC 27408	(919) 274-1963	(919) 274-1971
Secretary	Dr. Danny C. Rich	Datacolor International, 5 Princess Rd., Lawrenceville, NJ 08648	(609) 924-2189	(609) 895-7461
Treasurer	Mr. Philip Hunter	Hunterlab, 11491 Sunset Hills Rd., Reston,VA 22090	(703) 471-6870	(703) 471-4237
Past-Pres.	Mr. Hugh S. Fairman	334 Springbrook Trail, Sparta, NJ 07871	(201) 729-9402	(201) 729-7278

LIST OF DIRECTORS

1990-1993			
Ms. Ann Laidlaw	SheLyn, Inc., 1108 Grecade St., Greensboro, NC 27408	(919) 274-1963	(919) 274-1971
Dr. Nancy Jo Howard	Phil. Coll. of Textiles & Sci., Henry Av. & Schoolhouse Lane, Phila., PA 19144	(215) 951-2888	
Dr. Romesh Kumar	Hoechst Celanese Corporation, 500 Washington St., Coventry, RI 02816	(401) 823-2161	(401) 823-2750
1991-1994			
Dr. Joanne M. Taylor	17890 NW Deercreek Court, Portland, OR 97229-3060	(503) 645-5129	(503) 645-5129
Dr. Ellen C. Carter	2509 N. Utah St., Arlington, VA 22207	(703) 527-6003	
Ms. Magenta Yglesias	JI, Inc., 1827 23rd St. NW, Washington, DC 20008-4030	(202) 328-2120	(202) 232-5602
1992-1995			
Dr. Michael H. Brill	Science Applications, Int'l Corp., 1710 Goodridge Dr., MS-1-11-1, McLean, VA 22102	(703) 734-4027	(703) 821-3576
Prof. Robert Chung	Rochester Inst. of Tech., School of Printing, One Lomb Memorial Dr., PO Box 9887, Rochester, NY 14623-0887	(716) 475-2722	(716) 465-7063
Dr. Joel Pokorny	939 East 59th Street, Chicago, IL 60637	(312) 702-1983	

ISCC MEMBER-BODIES

American Association of Textile Chemists and Colorists (AATCC)
American Chemical Society (ACS)
American College of Prosthodontists (ACP)
American Psychological Association (APA)
American Society for Testing and Materials (ASTM)
American Society of Interior Designers (ASID)
American Society for Photogrammetry and Remote Sensing (ASPRS)
The Color Association of the United States, Inc. (CAUS)
Color Marketing Group (CMG)
Color Pigments Manufacturers Association (CPMA)
Detroit Colour Council (DCC)
Federation of Societies for Coatings Technology (FSCT)
Gemological Institute of America (GIA)
Graphic Arts Technical Foundation (GATF)
The Human Factors & Ergonomics Society
Illuminating Engineering Society of North America (IESNA)
National Artists Equity Association (NAEA)
National Association of Printing Ink Manufacturers (NAPIM)
National Paint and Coatings Association, Inc. (NPCA)
Optical Society of America (OSA)
Society for Information Display (SID)
Society of Motion Picture and Television Engineers (SMPTE)
Society of Plastics Engineers, Color & Appearance Division
Society for Imaging Science and Technology (IS&T)
Technical Association of the Graphic Arts (TAGA)
Technical Association of the Pulp and Paper Industry (TAPPI)

SUSTAINING MEMBERS

Pantone Color Institute
Fine Arts Department, Montclair State College
Mr. Donald R. Hall, Color and Appearance Technology
Mr. Thomas J. Keane, BYK-Gardner
Ms. Isabel R. Manetti, Sharp Electronics
Dr. Art Springsteen, Labsphere