

Inter-Society Color Council News



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July/August 1989

RIT'S MUNSELL COLOR SCIENCE LAB RECEIVES NEW COLOR SOFTWARE

The donation of computer software by Applied Color Systems, Inc., will upgrade the computer colorant formation systems in the Munsell Color Science Laboratory at R.I.T.

The contribution consists of a complete set of CHROMA-CALC software as well as software to extract data in ASCII. The software will be used to support both graduate and undergraduate research projects in color science using the ACS-1800 Color Matching and Batch Correction System.

"There is a high industry demand, in such fields as textiles, coatings, polymers and printing, for students with knowledge of the science and technology of computer color matching," said Dr. Berns. "This is also valuable to the industrial short courses that are offered at the Munsell Laboratory." Applied Color Systems, based in Princeton, N.J. is a subsidiary of Armstrong World Industries. A leader in computer color control technology, the company has offices throughout the world.

The Munsell Color Science Laboratory is part of RIT's internationally renowned Center for Imaging Science, which offers degree programs in both imaging science and color science.

The Center is part of RIT's College of Graphic Arts and Photography. RIT is a private university in upstate New York with more than 13,000 students enrolled in more than 230 degree programs. RIT has been ranked as having the best science and technology programs among comprehensive universities in the East, according to a survey of college presidents in *U.S. News & World Report*.

News release from Rochester Institute of Technology, May 26, 1989

ANNUAL REPORT OF INTEREST GROUP I MEASUREMENT AND COLORIMETRY —SYMPOSIUM ON TRACEABILITY

During the annual meeting of the ISCC, Interest Group I held a symposium on instrumental standards and traceability. More than 70 people attended the symposium. There were eight speakers representing five instrument makers and three standards laboratories. The speakers were Richard Harold from Hunter Associates Laboratories, Cal McCamy from Macbeth, C.J. McCarthy from Milton Roy, Nick Hale representing Minolta, and Harry K. Hammond, III representing Pacific Scientific. Representing standards laboratories were Ken Eckerle from the National Institute of Standards and Technology, Dr. Alan Robertson from the National Research Council,



Dr. Danny Rich (left), Manager of Research for Applied Color Systems Inc., recently visited Rochester Institute of Technology to present a software donation to Dr. Roy S. Berns (right), director of RIT's Munsell Color Science Laboratory and the R.S. Hunter Professor of Color Science, Appearance and Technology.

Canada, and Dr. Henry Hemmendinger for Hemmendinger Color Laboratory.

Some very interesting information was exchanged during the presentations and discussions following. Most of the instrument makers used multiple sources of calibration materials, though one was usually chosen as the primary source.

Cal McCamy helped to clear up some confusion by carefully defining the difference between a documentary standard, which describes "how to make measurements", and physical standards which are used to transfer an accepted scale of measurement. He indicated that intercomparison of laboratories is the best way to establish an empirical scale when no objective standard is available from absolute methods.

Richard Harold noted the difficulties calibrating instruments when standards obtained from different sources are based on different scales. He also complained about the lack of good documentary standards on the geometry of illuminating and viewing conditions. He felt certain that instrument makers would eventually comply with whatever standards were in place. Currently, those standards are rather vague and loose. He also discussed proper sample handling procedures. He recommended the use of laboratory grade detergent, nylon brush, and lint free, non-whitened cloth for cleaning durable standards, such as porcelain on steel and glass.

Mickey McCarthy gave an excellent presentation on the development of manufacturing tolerances. He indicated that he did not believe that absolute color measurement was available yet. He described the procedures that were necessary to reduce the variability in production from 10 CIELAB units to 0.25 units. He felt that the most significant operating variable yet to be fully controlled was stray light.

Nick Hale indicated that Minolta uses standards and procedures developed at the Japan Color Research Institute. He stated that the JCRI is the Japanese equivalent of the US National Institute of Standards and Technology.

Harry Hammond indicated that Byk-Gardner uses opal glass standard, a Russian MS20 and Japanese *Everwhite* both with calibrations from NIST. He indicated that the wavelength scale is set using low pressure arc lamp lines and laser lines. The quality of the calibration is checked against BCRA tile with calibration from either Hemmendinger Color Laboratory or NIST.

The standardizing laboratories also had some interesting things to share. Ken Eckerle very carefully described the reference instruments at NIST. He gave a detailed discussion of the various sources of systematic and random errors and the way in which each contributes to statements about accuracy and uncertainty. Apparently, the single largest factor in the uncertainty is the random error associated with specimen presentation and preparation.

Dr. Robertson described the instruments at the NRC and how absolute standards are prepared on their reference instrument and then used to transfer that scale to their working instruments. The NRC is currently adding a new reference instrument for high accuracy transmittance work and eventually reflectance work. The NRC uses NIST standards in the UV and NIR regions, yet maintains close agreement with the European

standards labs (NPL and PTB) as well.

Dr. Hemmendinger described how he has monitored the effects of operating variables on the accuracy of his measurements. He has nearly 15 years of data on the inter-comparison of his General Electric Hardy instrument relative to the NIST on a set of BCRA tiles. He indicated that a 0.1% error in the zero line due to stray light causes a 0.17 CIELAB color difference on the chromatic BCRA I tiles. A 0.2 nm wavelength error will produce a 0.20 CIELAB color difference on the chromatic BCRA II tiles. A temperature shift of $\pm 1^\circ\text{C}$ results in an average CIELAB color difference of 0.2 for all twelve BCRA II tiles. He also described a situation where the absolute tristimulus errors were no larger than 0.01 in magnitude yet with the right combination of signs could result in an average CIELAB color difference of 0.12 units.

The short discussion session that followed the presentations was most disappointing. When asked if an absolute accuracy of 0.75 CIELAB unit color difference was objectionable almost no one in the audience responded. The few participants who did object to such large differences were users who are involved in national and international standards organizations. It is the conclusion of this symposium that American industry, which was reasonably well cross-sectioned in this symposium, is not concerned about setting and maintaining color difference specifications on their products smaller than about 2 or 3 CIELAB units. *anonymous*

ANNUAL REPORT OF INTEREST GROUP II APPEARANCE, VISION, AND MODELING

The objective of Interest Group II is to gather participants from both academic and industrial environments who are in the forefront of research in the areas of appearance, vision and modeling into stimulating communication sessions. In the field of our interest, one of the most dynamic current topics concerns color appearance models and their relation to the physiology of the human visual system. Therefore, Paula Alessi and Norman Burningham, acting as co-chairs of the interest group, determined to assemble a program which would address this important topic as part of the ISCC Annual meeting in Chicago. The positive response of leading researchers in this area, who were invited to participate, made it possible to extend the interest group session to a full day symposium on appearance and vision. The more than 120 ISCC members who attended enjoyed a rare treat through the thoughtful and informative presentations. The panel discussions sparked excitement among all those who chose to participate in the technical interchange.

Two of the leading models of appearance are those proposed by Dr. Roshinobu Nayatani and Dr. Robert Hunt. Both of these researchers agreed to present the concepts of their models which draw insights from current color vision understanding. In addition, Dr. Joel Pokorny, a leading researcher in human vision, agreed to be on the same program to bring us up to date on modern understanding of human vision and to provide a foundation for appreciating the relationships between physiology and the appearance models. Additional papers

focusing on the application of appearance models were invited from Dr. Michael Pointer and Dr. Ronnier Luo. As the final element of an exceptional program, Dr. David Wright, certainly the intellectual fountainhead of many of the concepts being discussed at the meeting, planned to set the stage for the symposium by providing the historical perspective of appearance issues. Unfortunately, after the program was organized, a family health problem prevented David Wright from participating.

Paula Alessi began the program by reviewing the principal scope of Interest Group II, emphasizing the inter-relationship of Appearance, Vision and Modeling in many problems currently of great interest. Paula summarized some of the outstanding questions in each area. For example, in the appearance field the adequacy of measurement techniques to fully characterize appearance, the translation of appearance through several imaging stages, and the application of the newer appearance models such as those of Nayatani and Hunt are all areas needing additional work. In the modeling field the large and expanding number of imaging systems which may be interconnected requires precise understanding and description of the systems to accomplish accurate reproduction. Underlying each of the other areas is an understanding of the mechanisms of vision which can give insight and direction for modeling.

Dr. Nayatani next presented an overview of his appearance model including the formulation of the descriptive equations and the psychophysical basis for the model found in the published data of Hunt, Breneman, Boynton and others. He also discussed several appearance phenomena appropriately explained by the model. Dr. Hunt then shared the conceptual development of his model pointing out the necessity of simplifying the physiological details if a workable model is to result. He further showed corroborative data from other researchers supporting the form of several of the defining equations and also showed application to some well known appearance phenomena. Even though a number of the major points of the two models are similar, some significant differences in emphasis and content were also clarified by having both speakers present on the same program. A more detailed technical summary of the presentations will be included in the description of the annual meeting to be published.

A panel discussion including the speakers moderated by Hugh Fairman permitted clarification of questions from the audience and further opportunity for the speakers to comment on ideas the others had raised. Norm Burningham introduced the afternoon session during which the emphasis was placed on the results obtained from the application of the appearance models. Dr. Hunt presented a paper by Pointer which proposed an approach to defining color quality based on the utilization of Hunt's appearance model. Dr. Nayatani then presented the work he did jointly with two sets of coworkers in which they successfully used the Nayatani model to describe their field trial data. The final speaker was Dr. Ronnier Luo, who showed an extensive amount of data gathered using both the Hunt and Nayatani models along with others. His data suggest that the model which works best may depend upon the luminance level in which the test samples are viewed. It was also apparent from

all of the papers presented that there is a need for extensive additional data to clarify and refine the ideas which were presented. Following a closing panel discussion moderated by Allan Rodrigues, this stimulating and informative symposium was closed.

This meeting of ISCC Interest Group II was particularly memorable because of the gracious participation of researchers on the leading edge of our knowledge. It provided a view of how our interest group meetings in coming years can provide a valuable forum for sharing ideas and encouraging ongoing work in the fields of our common interest.

Norm Burningham and Paula Alessi

PROJECT COMMITTEE REPORTS

PROJECT COMMITTEE #22—MATERIALS FOR INSTRUMENT CALIBRATION

Project Committee 22 met April 9th at the annual meeting in Chicago. Chairman Rich reported that the revision to the committee document *A Guide to Material Standards and Their Use In Color Measurement* had completed a 1st review by the Board of Directors. A few editorial comments and changes were requested and will be made. The document will go back to the Board of Directors for a final approval and should be issued later this year. This will be ISCC Technical Report 89-1 and will be the final report for Project Committee #22. The April meeting was thus the last meeting of the committee. Committee members were encouraged to attend the Interest Group I meeting on the 10th and express any interests that may remain in standards and standardization. If there is sufficient interest a new Project Committee could be set up to investigate the proposed topic.

Chairman Rich then took input from the floor on news about advances on materials for standardization. NIST reported that they have completed all measurements for two new SRMs based on sintered PTFE, a white and a gray scale. The office of SRMs has given these materials a very low priority and NIST is not certain when the SRMs will be released. Anyone interested in such materials is encouraged to write directly to the Office of Standards Reference Materials about releasing these two SRMs. NIST also reported that they are developing a new black diffuse reflectance standard. They are also in the process of restocking their supply of gold and aluminum mirrors. Hemmendinger Color Laboratory reported that he has some 1 inch circles of the old Corning dydymium glass available. The NRC in Canada reported that the new reference spectrophotometer is still under development. Progress has been slow but very rewarding. Final testing of the transmission capabilities is currently being carried out. CORM is preparing to issue its 5th report on pressing needs and will emphasize material standards for radiometric characterization and materials for use as reflectance standards, both achromatic and chromatic with colorimetric calibration similar to the old 2100 filter set. Other needs included the measurement of optical densities as large as 6.0 and standard reference materials for whiteness evaluation. RIT Munsell Color Lab continues to be the only domestic

secondary lab providing 45/0 reflectance factor calibrations. They are not as enthusiastic about sintered PTFE for use as a transfer standard as they once were. They are now suggesting the use of PTFE for BRDF/multiangle use with principle component analysis to model the non-Lambertian behavior. Fred Simon reported that he has optically brightened plastic tiles for use with flash lamp based instruments. The white tiles are somewhat photochromic and cannot be used as transfer or diagnostic standards on instruments with continuous sources. The NRC reported that they have had good success with a glazed ceramic tile whose surface has been ground off to leave a matte finish. The reflectance is only about 80% but is fairly durable and inexpensive. It is used routinely by the Canadian paper industry. It was noted that the two main reasons for poor reproducibility of matte standards are soiling (dust and oil deposits deep in the surface) and water adsorption. Applied Color Systems reported that they have found both MS-20 glass and sintered PTFE to be moderately to very translucent, and thus they cannot be used to accurately transfer a scale of reflectance factor across different areas of illumination and view. Max Saltzman commented that PTFE is not manufactured as an optical standard, as is Eastman White Reflectance Standard, and one can expect moderate to large variations in the optical properties from batch to batch or manufacturer to manufacturer.

One final reminder was shared with the committee concerning the current Schott and Hoya formulations for didymium based multiband wavelength calibration filters. The band shapes and absorption positions are not the same for the two different glasses, nor do either of them match the old Corning formulation that was used in NIST SRMs. The newer formulations lack the doublet at 585 nm and tend to be better suited for broadband spectrophotometers since the bandshapes are less sensitive to bandpass differences. It was also reported that when exposed to sunlight the filter can fade, irreversibly affecting both the bandshapes and positions. *author unknown*

PROJECT COMMITTEE #27—INDICES OF METAMERISM

Over the past several years, this Committee has been concerned about the confusion arising from loosely applying the term "metamerism" to related but not identical phenomena. The CIE definition of metamerism requires metameric colors to have "identical tristimulus values for a given reference observer and reference illuminant". Recognizing the necessity for strict adherence to this definition, the Committee in 1986 recommended the term "paramerism" for cases where tristimulus identity or a match was not obtained. While the Committee clearly defined the term and the reasons for it, many colorists still lack a clear understanding of paramerism and its application. The Committee has now completed a computer program to convert a parameric color difference to a metameric component and a simple color difference. A program diskette for IBM compatible PCs has been prepared, including practical examples illustrating the use of the concept.

The Committee also continues activities defending the use

of this term. It has corresponded with AATCC Committee RA36, who vote to drop the term. It is hoped that the computer program will convince that committee to reconsider. A response to a *Color Research & Application* "letter to the editor" has also been prepared reiterating the importance of the concept and use of the term "paramerism".

The main Committee objective over the near term is dissemination of the computer program to educate colorists on the importance of this concept.

Allan B.J. Rodrigues, Chairman

PROJECT COMMITTEE #37—ARTISTS' MATERIALS AND CONTEMPORARY ART

ISCC Project Committee #37, Artists' Materials and Contemporary Art, met on Sunday, April 9, 1989 at the annual meeting held in Chicago. Due to the absence of Project Chair Hilton Brown, the meeting was chaired by ISCC President Joy Turner Luke. Twelve persons signed the attendance sheet.

Mrs. Luke reported that Mr. Brown had defined two new projects at the ISCC annual meeting held in Baltimore in 1988. These projects had been approved by the ISCC Board of Directors. The first was a project to develop recommendations for studio lighting for artists and a second was the development of a limited palette for painters. Mr. Brown had taken the responsibility for preparing a draft of the first project and Mrs. Luke the second.

Mrs. Luke announced that Mr. Brown had completed a literature and correspondence search for information in preparation for writing the first draft for the artists' studio lighting recommendations. Since Brown had not been able to prepare a draft for the Chicago meeting due to unforeseen circumstances and professional commitments, a draft of lighting recommendations for artists' studios will be prepared by Brown and presented to the project committee for discussion at the next annual meeting to be held in Cleveland in 1990.

Mrs. Luke presented her "Report on a Study for an Artists' Palette, Phase 1". She said that it is common practice for art educators, writers of art instruction literature, and art material manufacturers to recommend a "limited palette" for beginners and students. A "limited palette" is a selection of a small number of paints—an introductory set usually contains six to twelve tubes, jars, or pans of paint—for the beginning student to purchase. Many professional artists also use a limited palette due to economy, ease of transportation, artistic preference, and so on. She stated that "frequently these limited palettes contain paints made with pigments that will fade in a comparatively short time".

Mrs. Luke announced that the goal of this study is "to recommend a specific set of pigments that have a lightfastness rating of I or II that is found in Table I of ASTM D 4302 'Standard Specification for Artists' Oil, Resin-Oil, and Alkyd Paints'". She continued that "a second less restricted palette can also be recommended for painters who want to extend the color gamut, add the iron oxides for economy, or include pigments with special characteristics".

For Phase I of this study, Mrs. Luke examined acrylic emulsion artists' paints containing 26 pigments. Drawdowns were made for each paint at mass tone, reduced one to one with white, and reduced 5% with black. These specimens were plotted on a Munsell color wheel to give an overview of the hue spacing of the mass color of the paints and the direction of color change as white and black were added. These drawdowns were then measured and converted from CIELAB notation to Munsell notation.

The placement of the 26 pigments on the Munsell color wheel illustrated that there are more pigments marketed to artists in the red through yellow sector of color space than in any other section. Luke found that many "fall on or come close to 7.5R".

Mrs. Luke announced that the next step is to decide what paints require further study before recommendations for a limited lightfast artists' palette with a wide color gamut can be defined. Furthermore, she hopes that this study can be continued to cover oil and alkyd paints since these paint systems contain pigments not found in acrylic emulsion paints.
Hilton Brown, Chair

PROJECT COMMITTEE #44—UNIFORM COLOR SOLID

The committee is working toward the possible development of a color order system whose spacing is improved in uniformity over presently existing systems. To do this the committee collects information on presently existing systems, and identifies where improvement could be made in the existing systems. The committee will then define the anticipated requirements for an improved solid with an eye toward developing a specification so that such a solid could be produced by others.

During the past year the committee analyzed the results of the visual experiment conducted at the annual meeting a year ago. This experiment was designed to test the implementation of the Sanders-Wyszecki effect in the Uniform Color Scales of the Optical Society of America. There is the appearance in the OSA-UCS equations that the arithmetic sign has been implemented with the wrong sense for samples which are lighter than a 30% reflectance gray. The results of the experiment confirmed that there was some problem with the implementation of this effect in the OSA-UCS but were unable to quantify or describe it due to the limited amount of data available.

David Alman and Roy Berns jointly studied the effect of this implementation on the assessment of small color differences and found the likely error of no effect in assessing these differences. Inasmuch as the coefficients of best fit of the equations were determined with the sign error in place, it is likely that the coefficients serve to mask the error to a great extent.

David Alman presented his results to us at our annual meeting in the form of a verbal presentation, and Hugh Fairman presented a talk on the OSA Uniform Color Scales themselves. Hugh covered the equation utilized to generate the scales, the scales and planes which are generated, and uses to which the

scales may be put.

The committee now undertakes a new experiment designed to test the uniformity of the OSA scales from the near neutral to the saturation limit. Data were collected at the annual meeting and additional data are in the process of being obtained at this writing. *author unknown*

PROJECT COMMITTEE #45—PHYSIOLOGICAL RESPONSE TO COLOR

Dr. Brainard reported on the communications network now established between Washington, D.C. and Jefferson Medical College in Philadelphia. All members are welcome and encouraged to participate in this system in order to send and receive information pertinent to the work of the Committee.

Magenta Yglesias presented a compilation of contributions of articles and information concerning the Project that had been collected during 1987, '88 and '89. These materials were reviewed by those present and requests for copies will be forthcoming in June 1989. The Co-Chair invites and urges all Committee members to contribute articles and information relevant to our Project.

It was requested by Magenta Yglesias that any interested ISCC member who was unable to attend the Project Committee #45 Meeting in Chicago please contact her in writing for: 1. Information, 2. Modern Instructions, 3. To continue or request placement on the Workshop #45 Mailing List, 4. The list and/or copies of materials concerning our Project already collected.

Dr. Brainard reported on the status of the experiment on the PHYSIOLOGICAL EFFECTS OF COLOR ON NORMAL HUMANS currently being conducted under the auspices of the Department of Neurology and Psychiatry, Jefferson Medical College, Philadelphia, PA; Designare, Ltd., Washington, D.C. and Prime Color, Inc., Cranford, N.J.

The primary aim of this research is to formulate and conduct a scientific experiment to test the physiological effects of color on normal human subjects. Our goal is to perform a study on a statistically significant number of subjects under controlled laboratory conditions which can be repeated independently at other laboratories or research facilities.

The color stimuli will be produced by monochromatic light systems. These stimuli will be specifically characterized for spectral power distribution, radiometric energy, chromaticity, and illuminance.

In the preliminary approach, subjects will be exposed to specific color stimuli while being monitored for changes in heart rate, respiration, blood pressure, muscle tension, eye movements, electrical skin potentials and electrical activity of the brain. All physiological parameters will be measured objectively with surface electrodes and transducers attached to physiographic recording equipment and data storage computers.

The authors feel that input from the scientists, designers, architects, artists and interested members of the ISCC can strengthen the project and help us design and conduct experiments on the physiological effects of color which are most appropriate and useful to the color industry specifically and society in general.

The research team is specifically interested in suggestions or comments pertaining to: 1. Subject selection, 2. Color vision testing, 3. Psychological testing, 4. Color stimulus production, 5. Color stimulus measurement, 6. Position of subject during tests, 7. Initial test wavelength/irradiance, 8. Duration of color stimulus exposures, 9. Physiological measurements/techniques, 10. Statistical reduction of data, 11. Pertinent literature, 12. All other comments or suggestions.

Magenta Yglesias ASID, Designage, Ltd., 1820 Kalorama Square, Washington, D.C. 20008, (202) 328-2120 and George C. Brainard, Ph.D., Department of Neurology, Jefferson Medical College, Philadelphia, PA, 19170, (215) 928-7644.

PROJECT COMMITTEE #46—EDUCATION SPEAKERS' BUREAU

Because of frequent requests for names of individuals willing to speak to groups on various topics in the field of color, a speakers' bureau was compiled several years ago by the Educational Resources Committee #40. During the last year's revision of the ISCC operating procedures, the Speaker's Bureau became Project Committee #46.

The chairmanship of this committee has been turned over to Dr. Stephen Bergen. All prior records were given to him and are being updated and transferred to a computer data base. Information about the Speaker's Bureau will be made available through the ISCC NEWS after the 1990 ISCC annual meeting, and updates with additional names and corrections will appear as necessary. Until then, further information can be obtained from either Evelyn Stephens or Stephen Bergen.

FROM THE PRESIDENT

Louis A. Graham, Chairman of the Member-Body Committee, suggested to the ISCC Board of Directors and the Board agreed that handsome framed certificates be prepared to present to those member-bodies of the ISCC that would like to have one for display in their office. The certificate background will be a beautiful reproduction of the spectrum printed from plates made at Rochester Institute of Technology and given to the Council. Individual certificates are being designed for each member-body that requests one. The certificates express the Council's appreciation for the support these national societies have given to the ISCC and its goals. The logos of each of these organizations and the date that they became a member of the Council will be on the certificate, as well as the ISCC logo.

So far eleven member-bodies have requested the certificates. They are being prepared for the American Association of Textile Chemists and Colorists, the Color Association of the United States, the American Society of Interior Designers, the Illuminating Engineering Society, the Optical Society of America, the Society of Photographic Scientists and Engineers, the Dry Color Manufacturers Association, The Graphic Arts

Technical Foundation, the American College of Prosthodontists, the Technical Association of the Graphic Arts and the Detroit Colour Council. The work has proceeded more slowly than Lou and I hoped, but most of these should be ready for framing by the time you read this.

Lou also contacted each member-body to see which ones are especially interested in the 1991 Williamsburg Conference on lightfastness and would like to have input toward the program. The American Association of Textile Chemists and Colorists agreed at once to co-sponsor the program and the Technical Association of the Graphic Arts, the Technical Association of the Pulp and Paper Industry, the Illuminating Engineering Society, the American Society for Interior Design and the American Society for Testing and Materials have all indicated that they are interested in active participation in the conference. Their interest and participation will assure an excellent program.

The Chairwoman of the conference is Jacqueline Welker working closely with Raymond A. Kinmonth, Jr. Both Ruth Johnston-Feller and Robert Feller have offered encouragement and advice. As usual with Williamsburg Conferences, the ISCC will be responsible for the arrangements and expenses of the conference, but the strong interest of so many member-bodies indicates that this will be an important conference. Lightfastness and colorfastness studies have a very long history; however, many of the most fundamental questions still need to be resolved. For instance, there is a notable lack of reliable information on appropriate methods for accelerated exposure to judge the lightfastness of colors and products that will be kept indoors in offices, homes and museums.

The participation of so many member-bodies in these activities is the direct result of an active, innovative Member-Body Chairman. Lou Graham is an outstanding chairman and I hope all ISCC member-bodies will keep in touch with him and assist in keeping ties to the Council strong and the Council aware of color problems and interests in their societies. Lou is a past president of the Council and continues to contribute his time and leadership.

In addition to the standing committees and their chairpersons described in earlier columns, there are two additional important individuals who report directly to the ISCC Board of Directors. One of these is the AIC Liaison who is the ISCC representative to the International Colour Association. This position is held by every other president of the ISCC. The AIC changes officers every four years; therefore, in order to have the same person represent the ISCC through one AIC term, it is necessary that he or she serve four years, while the president of the ISCC serves only two years. Past-President Allan Rodrigues became our AIC representative when he assumed office as ISCC President in 1986 and he will continue in that position until 1990. He has also been recently elected to the AIC Executive Committee and so will help to guide the organization that promotes knowledge about color worldwide.

David H. Alman serves as Liaison to the journal *Color Research and Application*. Dave represents the interests of ISCC members in this journal, which publishes the outstanding articles on color from around the world. He also keeps the

ISCC Board informed about the condition of the journal and important decisions made by the Editor-in-Chief, Associate Editors and Editorial Board. Rolf G. Kuehni is the current Editor-in Chief and he has led the journal during the transition from a quarterly to bimonthly publication, maintaining the high standards set by Founding Editor, Fred W. Billmeyer, Jr. Due to the press of other obligations, Rolf will turn over the chief editor's position to Ellen C. Carter the first of the year. Ellen's background, interests and skills make her a welcome choice. For the past year and a half she has been volunteering time to the Council by assisting Editor Bonnie K. Swenholz in the publication of this newsletter. *Joy Turner Luke*

NEWS FROM MEMBER BODIES

ASTM'S APPEARANCE TERMINOLOGY STANDARD EXPANDED

ASTM standards-writing Committee E-12 on Appearance of Materials, and its Subcommittee E12.01 on Definitions and Terminology, announce the expansion of ASTM Standard E 284, Definitions of Terms Relating to Appearance of Materials.

Until this expansion, E 284 contained some 209 terms. The standard now includes 443 terms, with another 22 terms being balloted for consensus approval. E 284 is widely used when definitions are required for terms relating to color, gloss, opacity, texture, fluorescence, retroreflection, and other geometric and spectral aspects of appearance.

For a copy of the expanded standard, contact ASTM Customer Services at 1916 Race Street, Philadelphia, PA 19103, 215/299-5585. Committee E-12 welcomes comments and suggestions for new terms or revised definitions that will allow E 284 to better serve the appearance field. Comments should be addressed to Sharon Kauffman, ASTM, (215) 299-5599. More information is available from Subcommittee Chairman Fred W. Billmeyer, Jr., 2121 Union Street, Schenectady, NY 12309, (518) 377-9511.

Committee E-12 is one of 134 ASTM technical standards-writing committees. Organized in 1898, ASTM (American Society for Testing and Materials) is one of the largest voluntary standards development systems in the world.

ASTM News Release, 1989 May 23

COLOR ASSOCIATION OF THE U.S.

CAUS announces that the COLOR COMPENDIUM, an A to Z dictionary written by Augustine Hope and Margaret Walch, will soon be ready for distribution. For more information contact CAUS, 343 Lexington Ave., New York, NY 10016, USA or telephone (212) 683-9531.

SOCIETY FOR IMAGING SCIENCE AND TECHNOLOGY

SPSE/SPIE Symposium on Electronic Imaging Santa Clara Marriott Hotel, February 11-16, 1990

Perceiving, Measuring and Using Color

The visual system did not evolve three kinds of cones as a luxury. Color is useful information, allowing us (for example) to estimate the spectral reflectance of objects independent of the spectrum of illumination, and to follow color-coded wires through a tangle. Furthermore, color in an image costs far less than the threefold increase one might first expect. Therefore, this Conference will ask, "Why color?" and examine relevant cost/benefit analysis. This question will highlight—not overshadow—other presentation issues concerning how color is perceived, measured, and encoded.

Topics:

- * Measurement and Colorimetry
- * Enhancement and Coding
- * Perception and Psychophysics
- * Pseudocolor
- * Color Selection
- * Color in Machine Vision

Send 200-word abstract to:

Vision and Visual Processing Program
SPIE Symposium on Electronic Imaging 1990
P. O. Box 10
Bellingham, WA 98225
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Abstract Deadline: August 11, 1989

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

Symposium on Color and Appearance Instrumentation

Ralph Stanziola of Industrial Color Technology, Neshanic Station, NJ, and Chairman of the Federation's Inter-Society Color Council Committee announced that a symposium on instrumentation for measuring color and appearance in the coatings industry will be held April 25-26, 1990 at the Cleveland Airport Marriott, Cleveland, Ohio. The 2-day event will be sponsored jointly by the Federation of Societies for Coatings Technology and the Inter-Society Color Council.

The Symposium on Color and Appearance Instrumentation (SCAI) will immediately follow the Inter-Society Color Council's Annual Meeting, also being held at the Cleveland

Airport Marriott, April 23-24, and will have as its theme "Combining Appearance and Color". A special "bridge" session on April 24 will serve to tie in the back-to-back events.

The tools of colorimetry and spectrophotometry are used to describe, formulate, and set tolerances for colored objects. Color, however, is only one attribute of appearance, and these tools do not adequately describe the specific effects of gloss, texture, orange peel, and other surface characteristics on the overall appearance of an object.

The Symposium will focus on the development of new instruments, optical models, and computer simulation techniques which are opening the door to a better understanding of this complex appearance phenomenon.

The program will be divided between general lectures and "hands-on" workshop sessions, designed to offer a working meeting environment, and registrants will be invited to bring samples with them.

General program sessions are under the direction of Dr. Romesh Kumar, of Hoechst Celanese Corp., Coventry, RI.

Arrangements for the workshops and instrumentation displays are being handled by Charles Leete of Collaborative Testing Services, Inc., Herndon, VA.

James Grady of CIBA-GEIGY Corp., Madison Heights, MI, and Jacqui Welker, of PPG Industries, Inc., Cleveland, Ohio, are in charge of programming of the ISCC Annual Meeting and the "bridge" session.

"Marine Coatings"—13th Monograph in FSCT Series Published

Marine Coatings is the topic covered in the 13th monograph in the FSCT series. Authors Henry B. Bleile and Stephen Rodgers focus on coatings which are primarily used by the marine industry, such as in shipbuilding and repair, oil drilling platforms, etc. This 28-page monograph is intended for those who have a need to understand marine coatings (but are not coatings technologists), as well as coatings technologists who become involved in the marine industry.

The other titles thus far published in the series are:

- 1) Film Formation, 2) Introduction to Polymers and Resins, 3) Radiation Cured Coatings, 4) Solvents, 5) Coil Coatings, 6) Corrosion Protection by Coatings, 7) Mechanical Properties of Coatings, 8) Automotive Coatings, 9) Coating Film Defects, 10) Application of Paints and Coatings, 11) Organic Pigments, and 12) Inorganic Primer Pigments.

The Series is expected to contain approximately 35 booklets when completed, and should serve as a valuable teaching and training resource for the industry. Development of the Series is under overall direction of an Advisory Board, whose members assist in selection of authors and review of manuscripts. Dr. Thomas J. Miranda and Dr. Darlene R. Brezinski are editors of the Series. The Series booklets, which are prepared in an 8 1/2 x 11 inch format, designed to fit in a three-ring binder, sell for \$5.00 each. Monographs may be ordered by contacting Meryl Cohen, FSCT, 1315 Walnut St., Suite 832, Philadelphia, PA 19107, (215) 545-1506.

Marco Wismer to Present 1989 Mattiello Lecture

The FSCT announced April 28, 1989 that Dr. Marco Wismer, formerly Vice President, Science and Technology, of PPG Industries, Inc., will present the Joseph J. Mattiello Lecture during the 67th Annual Meeting of the Federation, to be held at the New Orleans Hilton, New Orleans, LA, on November 8-10, 1989.

Dr. Wismer's presentation, entitled "Learning to Leap: Rising to the Technical Challenge of Today's Coatings Industry", will be given on Friday, November 10.

The lecture commemorates the contributions of Dr. Mattiello, who was instrumental in expanding the application of the sciences in the decorative and protective coatings fields. Dr. Mattiello, who served as President of the Federation in 1943-44, was Vice President and Technical Director of Hilo Varnish Corp., Brooklyn, New York, when he died in 1948.

The lecturer is chosen from among those who have made outstanding contributions to science, and is selected to present a paper on a phase of chemistry, engineering, human relationships, or other sciences fundamental to paint, varnish, lacquer, or related protective or decorative coatings.

GATF PRESENTS COLOR ELECTRONIC PREPRESS SYSTEMS, CHICAGO, ILLINOIS, AUGUST 13-15, 1989

Conference Moderator: Frank E. Benham, Vice President, Marketing & Research, American Color

"Integrating with Color Electronic Prepress Systems", GATF's three-day August conference, will provide printers, prepress firms, designers, publishers and advertising agencies with an in-depth analysis of the new directions in color prepress technology. You will hear developers and users of these "new" systems talk about how the color systems of tomorrow function, and how they are changing the needs and desires of each participant in the prepress process.

The advent of new options for inputting copy into electronic prepress systems, and the trend of customers to operate design and layout stations, will result in more and more digital data flowing into the data bases of the prepress companies.

The need for moving and storing digital data, as well as retrieving it at rapid rates, has taken on new significance. Optical disks, fiber optics, satellites, etc., have all become part of the graphic arts world.

Using data base management to store, manipulate, transfer, input and output data may well be the area that spells success or failure for companies in the future.

Discover which systems will affect traditional color printing markets and what the lower-resolution desktop "mini-systems" have to offer. Attendees at the conference will gain the necessary insight to assess their companies' application of prepress technologies as we move into the 1990s.

To register call (800) 433-8785 Debbie Huenefeld. Special Discount Airfares are available for those attending this conference. *News Release from GATF*

GEMOLOGICAL INSTITUTE OF AMERICA

Colored Diamonds Project

Gemologists from the GIA Gem Trade Laboratory recently examined the Hope Diamond in Washington, DC, and the Dresden Green Diamond in Dresden, German Democratic Republic. The Dresden diamond is important as it is one of the few verifiably natural green diamonds in the world. Tom Yonelunas, Gem Trade Lab CEO, said that everyone was impressed with the Hope's red fluorescence, and the fact that it continued to phosphoresce for a good 20 seconds after the ultraviolet lamp was shut off.

Gems & Gemology Honored

The GIA's quarterly journal *Gems & Gemology* has won its fourth printing award in the last five years. Printing Industries of Maryland, the state printing association, gave a Print Quality Competition award of merit to Waverly Press, Inc., of Easton, Maryland, for "printing adjudged to be of superior quality" in the category of large-press process color magazines.

The Spring issue of the magazine has just been released. The journal includes articles on the Sinkankas library, dark bluish green stones found in an important new emerald deposit in Pakistan, gem nodules in species other than tourmaline in Brazil, and "Opalite".

Subscription information is available by calling (800) 421-7250 ext. 201 in the US or (213) 829-2991 ext. 201 from outside the US, or writing to *Gems & Gemology* Subscription Manager, Dept. PRO6, 1660 Stewart Street, Santa Monica, CA 90404.

Pahuja and Monachino win Schuetz Design Contest

The 14th Annual Schuetz Design Contest sponsored by the GIA honors designers of men's and women's jewelry featuring colored stone. The contest was established in memory of George A. Schuetz, Sr., who served for years as the president of Larter and Sons, a jewelry manufacturing company on the East Coast.

The two winners each received \$500 scholarships for jewelry-related training at the institution of their choice. Melinda Monachino, G.G., of Burlingame, California, won in the men's jewelry category with her design for a ring that features a square cut tanzanite surrounded by a geometric design in white and yellow gold. Lakshman Ragmunath Pahuja of Sobhraj Jewellers in Bombay, India, won in the women's jewelry category with his design for a pair of swirling gold earrings that are inlaid with diamonds and black onyx.

Information and entry blanks for the 1990 contest are available from GIA's Jewelry Manufacturing Arts Department. The postmark deadline for the contest is Feb 28, 1990.

Gemfest '89

The Alumni Association of the Gemological Institute of America will be hosting the GIA's Gemfest '89 in Santa Monica, California, August 17-18 immediately prior to the Pacific Jewelry Show. This allows the attendees to combine the

two-day learning event with the show. GIA staff will present 48 seminars in gemology; new trends and technology; business, sales & management and jewelry manufacturing arts.

NEWS FROM OTHER ORGANIZATIONS

COUNCIL FOR OPTICAL RADIATION MEASUREMENTS (CORM)

CORM announces the CORM90 meeting to be held at Rochester Institute of Technology, Rochester, New York on May 8-10, 1990. The theme of the meeting will be "Quality! The Key to Optical Radiation Measurements".

In addition to the three sessions of papers, CORM90 will include the Franc Grum Memorial Lecture, annual banquet, tour of the Rochester Institute of Technology's Munsell Color Science Laboratory Standards facility, new Center for Imaging Science, and Microelectronics engineering facility, and the International Museum of Photography (George Eastman House) in Rochester, New York.

Call For Papers: CORM 90

The Council for Optical Radiation Measurements (CORM) solicits contributed papers on the general topic of quality in optical radiation measurements for the May 8-10, 1990 meeting at Rochester Institute of Technology, Rochester, New York. Three sessions are planned. The first session will include general principles of measurement accuracy, precision, traceability, uncertainty, and measurement assurance. The second and third sessions will present papers in the disciplines of "Radiometry" and "Optical Properties of Materials" as they relate to the topics in the first session.

Papers are anticipated from national standards laboratories, academia, and industry. Emphasis should be placed on the need and practice for making "Quality" measurements in the field of optical radiation measurements.

Those wishing to present a paper or in need of additional information should contact the program coordinators at the following addresses:

Dr. Roy Berns
Munsell Color Science Lab
Rochester Inst. of Technology
P.O. Box 9887
Rochester, NY 14623-0887
(716) 475-2230

Dr. Philip Wychorski
Eastman Kodak Company
Corporate Metrology Ctr.
1700 Dewey Ave., Bldg. 69
Rochester, NY 14650-1911
(716) 588-6344

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

The new NIST Calibration Services Users Guide 1989-1990 (NIST SP 250) lists the calibration services, special test services, and measurement assurance programs (MAPs) available from NIST. The calibrations and special tests include NIST services that check, adjust, or characterize instruments, devices, and sets of standards. The MAPs are quality control

programs for calibrating a customer's entire measurement system. The guide also lists NIST technical experts who may be contacted for information on services and measurement problems. For information on the NIST measurement services program, or to obtain a copy of SP 250, contact the Office of Physical Measurement Services, NIST, Room B362 Physics Building, Gaithersburg, MD 20899; telephone: (301) 975-2005.

THE COLOUR GROUP (GREAT BRITAIN)

221st Meeting - 19th Century Pigments

The 221st Meeting of the Color Group was held on November 2, 1988. Two reports were given at that meeting.

Leslie Carlyle of Canadian Conservation Institute, but currently at the Courthauld Institute of Art, reported on Research into British Nineteenth Century Oil Painting Techniques. The research is being carried out via books published in Britain throughout the nineteenth century which deal with painting in oils. The first half of the talk outlined the sources being used, their characteristics, and cited examples from three basic categories: Artists' Instruction Books, Handbooks on Materials, such as pigments and varnishes, and Compendiums on Art having chapters on oil painting techniques. The second half of the talk concentrated on the history and ingredients of the Artists' vehicle "Megilp", and on another variation, "Gumption".

The second talk by Sarah Cove of Courthauld Institute of Art described the Constable Research Project: Materials and techniques 1811-12, with new information about Flatford Lock and Mill.

224th Meeting - Displays

The 224th Meeting of the Colour Group was held on March 8, 1989 at City University. Two talks were given at this meeting.

The first talk, entitled "The Spectrophotometry of Mosaic Colour Filters for Liquid Crystal Television Displays", was given by A. J. Jenkins of Philips Research Laboratories, Redhill. Jenkins described the potential for new flat television displays, the liquid crystal display, the factors on which quality of the colour of the displays depend, and the Philips Research Laboratory single beam micro-spectrophotometer.

The colorimetry of displays at NPL was described by A.R. Hanson of the National Physical Laboratory. The NPL display programme has been running now for three years. It has two distinct aims: to provide a colorimetric calibration facility dedicated to all types of displays, and to look into the use of displays, specifically a computer controlled CRT, in colour vision research. At NPL, a telespectroradiometer made by Bentham has been dedicated to the measurement of displays. The instrument and measuring techniques used have been developed after much consideration of the problems associated with CRTs and LCDs. A calibration service is now available to customers, giving spectral power distributions at 5 or 2 nm intervals for self-luminous displays and reflectance values for reflective displays. Colorimetric data for both cases can be calculated and services can then be extended to more involved

investigations. In the future, NPL plans to look at environmental factors and match facilities with the needs of British Industry. Standardisation of measurement techniques and the provision of transfer standards will follow.

Reflectance Measurements: Basic concepts, developments and uses

A joint meeting of UV Spectroscopy Group and the Colour Group was held at the National Physical Laboratory (NPL) on April 5, 1989. At this meeting ten papers were given. They included: "The Physics of Reflectance Measurements" by D. Irish, Philips Scientific; "Reflectance Measuring Instruments" by J. F. Verrill of NPL; "On-line Measurement of Gloss" by M. Coulthard of Surface Inspection; "Effects of Structured Materials in Integrating Sphere Measurements" by A. Roos, Uppsala University; "Visible and NIR Reflection and Scatter Properties of Paper" by R. Edgar of IR Engineering; "The Uses of NIR Reflectance Measurements in the Pharmaceutical Industry" by B. Davies and E. Scorer of Glaxo; "The Use of UV Reflectance to Study Dyes Adsorbed on Clays" by R. Brown of Lancashire Polytechnic; "Colour Measurement in Reflectance and Transmittance and Applications" By E. Scorer of Glaxo; "Practical Difficulties in Relating Reflectance Measurements of Translucent Foods to their Visual Appraisal" By D. MacDougall of AFRC; and "Reflectance and Colour Measurements at NPL, Standards and Instrumentation" By J. A. F. Taylor.

COLORCURVE SYSTEM FOR COLOR COMMUNICATION INTRODUCED TO DESIGN AND MANUFACTURING INDUSTRIES —January, 1989

Colorcurve Systems Inc., Minneapolis introduced the COLORCURVE System, calling it the world's most precise color communication system. The COLORCURVE System is a universal tool for color selection, communication and control that includes color atlases, swatch libraries and special color services for design professionals and for manufacturers.

"Every color has a curve," said Robert Dillon, president of Colorcurve Systems Inc., about the system. "These curves are not subjective interpretations of color, but actual physical 'facts'. The COLORCURVE system uses these curves to establish objective and universal descriptions of virtually any color in the world."

Reference tools in the COLORCURVE System are the COLORCURVE Master Atlas and the COLORCURVE Gray and Pastel Atlas. Together, the two atlases display 2,185 unique color samples, all in fade-resistant lacquer. Samples are arranged at regular visual intervals according to three properties of color —hue, saturation and lightness. Each color sample also is described by its unique physical property, called a reflectance curve, which allows the color to be matched with mathematical precision. These and other features of the COLORCURVE System, according to the company, make it a powerful creative

tool for color specifiers, as well as a scientific system that gives manufacturers of colored products superior color matches faster.

For manufacturers, Colorcurve Systems Inc. announced the first of a series of major licensees in various industries. Its first licensee is Applied Color Systems, Inc. (ACS), Princeton, NJ, a leading manufacturer of computerized color matching and quality control equipment. ACS will begin in early 1989 to offer a COLORCURVE software upgrade to its customers. *Extracted from a News Release from Colorcurve Systems, Inc., a Colwell Industries Company*

Additionally, according to Mr. Robert L. Dillon, "Virtually any color can be identified in Colorcurve terms and color changes made objectively using our nomenclature. This system is possible because of a software program that generates reflectance values in the $L^*a^*b^*$ color space. These reflectance values can be generated in any increment that the user calls for allowing for this flexibility. This whole concept was developed by Ralph Stanziola in conjunction with Colwell/General, a manufacturer of color cards for the paint, coatings and automotive industries."

CALENDAR

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 (301) 495-7150
Silver Spring, MD 20910 FAX (301) 585-4067

1989

WORK WITH DISPLAY UNITS, Sept. 11-14

Second International Scientific Conference, Queen Elizabeth Hotel, Montreal, Canada. Information: Diane Berthelette, (514) 288-1551.

ROYAL PHOTOGRAPHIC SOCIETY, Sept. 18-22

Symposium on the Quantification of Images, Clare College, University of Cambridge. Information: Dr. M. R. Pointer, Kodak Ltd, Harrow Middlesex, HA1 4TY England, Tel. 01 427 4380.

COLOR MARKETING GROUP FALL MEETING, Sep. 23-27

The Phoenician, Scottsdale, Arizona. Information: Nancy Burns, (703) 528-7666.

DCC - HUMAN RESPONSE TO COLOR, Sep. 28

Detroit Colour Council. Carlton Wagner, Director, Wagner Institute for Color Research. Information: William Longley, (313) 337-5234.

CIE INTERIM MEETING, Oct. 2-3

Information: Dr. J. D. Schanda, Central Bureau, A-1030 Vienna, Kegelgasse 27 Austria, or Dr. Jack Hsia, (301) 975-2342.

LUX EUROPA, Oct 3-5

Budapest, Hungary. Information: Gabor Debreczeni, the Lighting Committee of the Hungarian Electrotechnical Association (MEE) H-1372 Budapest, PF. 451, Hungary. Telephone 225-049.

TAPPI OPTICAL PROPERTIES COMMITTEE, Oct. 4

New Orleans Marriott, New Orleans, Louisiana. Information: S. J. Popson, (812) 948-2884.

COLOUR GROUP (G.B.), Oct. 4

Bartleson Symposium on Colour hAppearance, The Royal Institution, 21 Harlbermarle, London, England. Information: Dr. Carol Wood, Crosfield Electronics, Ltd., 0442-230000, ext. 3360

SYMPOSIUM ON DAYLIGHT AND SOLAR RADIATION MEASUREMENT, Oct. 9-11

Technische Universität Berlin (West), Germany. Information: Herrn Prof. Dr. H. Kaase, Institut für Lichttechnik der Technischen Universität Berlin, Einsteinufer 19, D-1000 Berlin 10 GERMANY. (030) 314 224 01.

OPTICS 89, Oct. 15-20

Optical Society of America Annual Meeting, Orlando, Florida. Information: OSA, 1816 Jefferson Place, N.W., Washington, D.C. 20036, (202) 223-0920.

GRAPH-EXPO and SPSE SYMPOSIUM, Oct. 15-20

Electronic Pre-Press Technology and Color Proofing Symposium, Holiday Inn - Mart Plaza, Chicago, Illinois. Information: Pam Forness, (703) 642-9090.

USNC/CIE ANNUAL MEETING, Oct. 29-31

U. S. National Committee of the CIE, Hyatt San Jose, 1740 N. 1st St., San Jose, California. Information: Jack Hsia, (301) 975-2342.

FSCT, Nov. 8-10

Federation of Societies for Coating Technology 67th Annual Meeting and 54th Paint Industries' Show, The Rivergate, New Orleans, Louisiana. Information: (215) 545-1506.

SPSE 5TH INTERNATIONAL CONGRESS, Nov. 12-17

Advances in Non-Impact Printing Technologies with Exhibit, Holiday Inn at the Embarcadero, San Diego, California. Information: Pam Forness, (703) 642-9090.

AATCC NAT'L COMMITTEE MEETING, Nov. 14-16

The Doral Inn, New York, New York, Information: Jerry Tew, (919) 549-8141.

ISCC WILLIAMSBURG CONFERENCE, Nov. 28-Dec. 1

"Color Discrimination Psychophysics", Colonial Williamsburg, Virginia. Information: Dr. Roy Berns, (716) 475-2784.

ISO/TC 187 COLOR ORDER SYSTEMS, Dec. 4-6

Baltimore, Maryland. Information: Nick Hale, (301) 472-4850.

1990

ASTM E-12 ON APPEARANCE, Jan. 21-24

Embassy Suites Hotel, Ft. Lauderdale South, Florida. Information: Sharon Kauffman, (215) 299-5599.

ASTM COMMITTEE D-1 ON PAINT, Jan 21-25

Embassy Suites Hotel, Ft. Lauderdale South, Florida. Information: David Bradley, (215) 299-5504.

SPSE 6TH INTERNATIONAL SYMPOSIUM, Feb. 19-21

Photofinishing Technology and Marketing, Las Vegas, Nevada. Information: Pam Forness, (703) 642-9090.

INTERNATIONAL SYMPOSIUM AND EXPOSITION,

Feb. 25- Mar. 2

SPSE & SPIE Symposium on Electronic Imaging Devices and Systems '89, Santa Clara Convention Center, Santa Clara, California. Information: Pam Forness, (703) 642-9090.

ISCC ANNUAL MEETING/SCAI CONFERENCE,

Apr. 22-26

Airport Marriot, Cleveland, Ohio. Information: James Grady (313) 855-2353, Jaqui Welker (216) 671-0050 ext. 2404, Romesh Kumar, (401) 823-2161.

COLOR MARKETING GROUP SPRING MEETING,

Apr. 29- May 1

Royal York Hotel, Toronto, Ontario, Canada. Information: Nancy Burns, (703) 528-7666.

CORM 90, May 8-10

Rochester Institute of Technology Rochester, New York. Information: Dr. Roy Berns, Munsell Color Science Lab., RIT, P.O. Box 9887, Rochester, New York. (716) 475-2230.

SPSE 43RD ANNUAL CONFERENCE, May 20-25

Rochester Institute of Technology Center for Imaging Science, with housing at the Holiday Inn-Rochester South, Rochester, New York. Information: Pat Forness, (703)642-9090.

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American Society for Testing and Materials (ASTM)
American Society of Interior Designers (ASID)
American Society for Photogrammetry and Remote Sensing (ASPRS)
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Detroit Colour Council (DCC)
Dry Color Manufacturers Association (DCMA)
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Society for Information Display (SID)
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