

Inter-Society Color Council *News*



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REPORT ON FIRST ISCC PAN-CHROMATIC CONFERENCE

People involved with color have the good fortune to find that their interests emerge in many places. Not only are the ways color occurs in nature numerous, but almost every man-made technology involving seeing or being seen requires the art and science of color. Indeed, the pan-chromatic nature of color suggests the need for a forum of the same name. While different disciplines have different questions, they have a strong prospect of learning from each other's solutions to color problems. This was exactly the purpose and result of the first Pan-Chromatic Conference in Williamsburg VA from Feb. 12-15, 1995, chaired by Michael Brill (David Sarnoff Research Center) and Steven Shafer (Carnegie Mellon University).

Right now, virtual reality and intelligent machines are about to make their way into our living rooms and workplaces. In and of themselves, these are fascinating topics with broad appeal; they were brought together at this first Conference.

The following encapsulations of the talks reveal the state of the art of color science, and foretell how this and future Pan-Chromatic Conferences will contribute to progress in color. Each section is prefaced with text, presented in the introduction to the conference, which eloquently states premises the conference sought to explore.

HUMAN COLOR VISION

"Quantification of color relies largely on quantifying light that is seen by humans. It will be a surprise that no model now exists for predicting even the amount of light reaching the retina given a general light stimulus seen through our natural pupils. Furthermore, trichromatic color matches, idealized as being subject to simple linear algebra, escape in certain cases from this comfortable confinement."

Peter Lennie: Mechanisms of Color Vision

The first talk of the conference was a tutorial examining the structure and function of those parts of the visual system that analyze information about color. Beginning with light absorbed by the photoreceptors, Lennie discussed the transformation of signals that occurs at different stages in the retina and in central visual pathways through the thalamus

LOOK FOR A COMPLETE REPORT
OF 1995'S ANNUAL MEETING IN
YOUR NEXT ISSUE OF ISCC NEWS

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and visual cortex. This talk served as a basis for the subsequent talks and their relation to color and vision.

R. Munger, A. R. Robertson, G.H. Fielder: Hue-dependence of Hue Discrimination in CIELAB Space

This talk reported on experimental work testing the effectiveness of the most recent CIELAB equations versus CMC equations with respect to hue discrimination. Reference hues were chosen to have the same chroma and lightness while spanning the complete hue circle. Initial results suggested that hue discrimination is better approximated by the CMC formula than by the newly proposed CIE formula.

Hugh Fairman: Calculating Rod Participation in Object Color Matching

Color researchers often need to know whether or not rods are participating in a color match. Calculations concerning directional sensitivity, pupil diameter (for photopic luminance) and rod threshold (for scotopic retinal illuminance) can indicate the probability that rods are or are not participating in a match, and if so, to what degree. Fairman presented a working example which showed how various components of the calculations are brought together to estimate rod participation.

Arthur G. Shapiro, Joel Pokorny, and Vivianne C. Smith: Defining Rod-Photoreceptor Spaces

In 1979 MacLeod and Boynton designed a color space that expressed lights in terms of L, M, and S cone excitations. Shapiro et al presented a similar color space for rod excitation, and applied its methodology to radiance levels of a typical color CRT video display. Rod-photoreceptor spaces provide an easy-to-use conceptual framework in which to design experiments on the rod system, and

can also be used to estimate whether or not rods are participating in measurements presumed to be the result of cone activity.

Ronald Oldchurch: Homage to the Flag

Often, the visual system interprets the visual plane as having three dimensions. When this happens, contrast and spreading effects depart dramatically from conventional notions. In honor of Josef Albers' paintings entitled "Homage to the Square," this computerized slide show explored three-dimensional contrast and spreading effects with a variety of patterns. The slide show is now available on the Internet in both Macintosh and DOS versions, and can be downloaded with a Web tool such as Mosaic. Readers are invited to visit this site at <ftp://ftp.cts.com/pub/ronald/>

COLORIMETRY

"Because colorimetry must be based on visual perception, some attention must be paid to the extent nature forgives us for our mathematical simplifications and compromises. Then, usefulness demands the compromises — observer-independence of color specification, linearity of color matches, uniform color spaces, and the like."

Danny C. Rich: Color and Light: More than Meets the Eye

This tutorial offered a brief but complete overview of the measurement of color, serving as a basis for measurement issues central to the conference. Rich's talk covered the basis of colorimetry, photometry, scotometry and radiometry and the instrumentation required to produce objective assessments of the color and appearance of lights and objects. The talk also reviewed various standards for the measurement of light and color, and showed why each is important and how each might differ from or complement other standards.

Henry Hemmendinger:

Advances in the Industrial Applications of Colorimetry: Is the Computer the Enemy?

In its desire to make color equipment user-friendly, Hemmendinger observed that vendors often do not make software that can be adapted by availing the user of the theory and data on which the software is based. Computer programs as well as program manuals commonly fail to include references to relevant assumptions and equations solved by the computer programs. While some loss of competitive edge comes with publication of these elements, revealing them also offers vendors and their customers adaptability and features from which both can profit.

Richard L. Alfvén: Observer Metamerism: Precision of Color Matches and Accuracy of Color Matching Functions

Alfvén reported on a cross-media color matching experiment he performed. Most significantly, the range of color mismatches predicted by current recommendations on observer metamerism is significantly smaller than the experimentally established range. Very little variation in luminance is predicted for the range of color-mismatches predicted by the CIE method. The lack of luminance variation predicted by the CIE method results from the use of Stiles-Burch color matching functions to determine the four deviation functions which define the range of color mis-matches for the Standard Deviate Observer.

Ron Henry: Colorimetry in the Natural Atmosphere

Because of the Clean Air Act, the effects of the atmosphere on the color and brightness of objects has become of interest. The natural environment offers many challenges not found in the usual controlled laboratory setting. One goal of the research discussed in this talk is to give accurate assessments of color appearance given the semi-

transparent nature of haze. Henry's findings suggest that the visual system substantially discounts the effects of haze in a way that can be modeled with color scission.

COLOR MACHINE VISION

"...(this) session focuses on on the artificial extraction of information from the visual field. Some problems that beset machine vision also beset human vision; machine vision is a laboratory from which the study of human vision can benefit, and machine vision can also benefit from human vision's solution to these problems."

Steven A. Shafer: Color in Machine Vision

For both humans and machines, color vision is helpful in object recognition. This tutorial introduced elements involved color machine vision, including image segmentation, machine color constancy, and color texture analysis. Shafer also enumerated color variations caused by physics-based effects, such as optical highlights, shadows, and interreflection, and described advanced work in this area of physics-based image segmentation.

Brian V. Funt and Graham D. Finlayson: The State of Computational Color Constancy

Funt et al's work with computational machine vision models similar to those found in humans represents the kind of crossover this conference set out to encourage. He reviewed and tested several models of color constancy, including various grey-world models, Land/McCann's retinex/reset model, as well as those which assume probable illuminants and reflectances, or those which extract hints of illumination from specularities and interreflections. While these models work well on average, all can be easily made to fail by designing scenes in which the assumptions are not met. However, recent methods of color-based object recognition that do

not require color constancy can be used to develop a successful model (see Finlayson's talk on page 4).

Ningyan Liu and Hong Yan: Segmentation of Color Drawing and Map Images

Liu et al also echoed the conference theme by adapting properties of human vision to machine vision. Misregistrations in images can cause problems during computerized image segmentation. However, the human visual system processes color information (similar to that caused by misregistration) with low resolution, while luminance information is processed with high resolution. As a result, misregistrations are often invisible to human observers. By constructing an algorithm that operates similarly to the human system, segmentation errors due to misregistration are shown to be significantly reduced.

Michael Swain and Viktoria Zanko: Finding Color Textures in Image Databases

Color information is valuable for differentiating textures in computational environments. Using scale as well as color information, Swain et al developed a neural net classifier to efficiently match textures to a database of 120 color texture photographs. Their strategy also enabled them to recognize the same texture from different viewpoints using steerable (orientation-sensitive) filters across multiple scales.

Glenn Healey and Lizhi Wang: Illumination-Invariant Recognition of Color Textures

Following a time-honored tradition of using image statistics to classify achromatic textures, Glenn Healey talked about using the correlation matrix between spectral bands to perform illuminant-invariant recognition of planar color textures (as in a photograph). When the spectral reflectances in the texture are linear

combinations of as many basis functions as there are photoreceptor types, the correlation matrix transforms linearly under change of illumination. Using this fact, Healey constructed an illuminant-invariant distance function between textures under the same illumination, and showed its effectiveness in classifying textures.

Carol W. Wong: A Real-Time View-Invariant Color Recognition Technique

This talk demonstrated a successful, real-time application of color machine vision. Wong described a view/illumination invariant color recognition technique. In a video demonstration, a mobile robot testbed equipped with corresponding color image processing hardware and software successfully identified and tracked a moving human subject through changing conditions.

COLOR COMPUTER GRAPHICS

"Computer graphics... in one sense performs the inverse of computer vision; rendering a given world, rather than inferring the properties of a world from renderings of it. But human vision enters into graphics, so it is not quite the inverse of computer vision. Humans are satisfied with certain graphical shortcuts that deviate markedly from each other and from real-world images. Developing metrics for image quality is a task for image science in general, and for graphics in particular."

Gary Meyer: Color Synthesis in Computer Graphics

This tutorial began with a brief introduction of the major research topics in color computer graphics. Meyer then discussed the contributions of spatial and spectral distribution to object properties such as gloss, haze, luster and translucency, as well as hue and brightness. Meyer then outlined a local illumination model that simulated these properties. In slide demonstrations

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accompanying his talk, he simulated perlescence and other spatially dependent colored surface textures.

Jianping, Jiang, Elizabeth Murphy, Leslie Carter, Walter Truskowski: A New Tool for Rule-Based Evaluation of Color in Graphical User Interfaces.

In a graphical user interface, optimization of color usage can require expensive human factors expertise. Jiang reviewed some existing systems which are too complex to be used efficiently. In order to simplify the color selection process, Jiang et al developed a proprietary color space with a manageable set of color names and parameters, and rule set for the evaluation of color usage in this color space. This was then wedded to the common RGB video representation for actual implementation.

Robert Geist and Stephen Junkins: Color Representation in Virtual Environments

In this talk, Junkins et al modeled two visual effects. A diffuse reflection, such as Tiffany lamp onto an adjacent surface, was simulated using thermal energy transfer ("radiosity") equations and texture mapping. Moving specular highlights were simulated using hypothetical eye position, illuminant angle of incidence, and wavelength-dependent interaction with surfaces. These effects were effectively demonstrated in a video walk-through of a virtual environment.

Mark Percy: Linear Color Representation for Efficient Image Synthesis

Percy discuss the importance of full spectral information instead of the RGB model to reduce inaccuracies in virtual environment rendering. Incoming light, scattering media, and outgoing light are represented as coefficient vectors, matrices, and sensor vectors respectively, and scattering takes the form of matrix multiplication.

These elements are chosen to fully capture spectral information, and to tailor it to the application if, for example, non-visible (e.g., infrared) light proves useful. A video then demonstrated the effects of illumination changes on a walk-through environment.

INTERDISCIPLINARY SESSION

"... computer vision and human vision (must be) brought overtly together. A particular focus is color constancy, the estimation of reflectances from reflected lights independent of the particular illuminant spectrum. Another focus is object-based segmentation—to determine whether an image boundary is due to reflectance change or is just a shadow or illuminant artifact."

Shoji Tominaga: Surface Reflectance by the Dichromatic Model

Usually, reflections are described with only two components, one for the interface and one for the body. Tominaga described an algorithm for object surfaces with multiple highlights and interreflections. Using a spherical chromaticity space, he estimated reflectance functions for two interreflecting surfaces. He concluded with a successful slide demonstration of simulated interreflection of two curved surfaces.

Graham D. Finlayson and Brian V. Funt: Optimal Spectral Sharpening

Finlayson's presentation may one day represent one of the more remarkable examples of crossover discussed at this conference. When using a Von Kries model, spectrally sharpened (nearly monochromatic) sensors best discount the illuminant and support the most complete adaptation. Assuming that all possible color signal spectra are equally likely, Finlayson demonstrated an analytic technique for finding the best single-wavelength intervals for spectral

sharpening for machine vision. Similar wavelengths and curves result from real-life color matching experiments; both indicate optimum wavelengths near 450, 540 and 610 nm.

Alan N. Gove: Neural Processing of Multi-Spectral IR Imagery

Gove et al described biologically motivated processing techniques to aid visualization and enhance target detection. They used two types of input: 1) computed reflectance in the visible spectrum, and 2) emissivity differences from infrared sources. This information was fed to networks which enhance contrast using center-surround relations analogous to those found in single-opponent and double-opponent channels of the visual system, again exhibiting the kind of crossover highlighted by the meeting. The resulting system provides improved target detection.

A. P. Petrov: Resolving the Color Image Irradiance Equation

Petrov's talk (delivered by M. Brill in Petrov's absence) dealt with the extraction of the shape of a 3D uniformly colored matte object from a single 2D color image of it. The key to the extraction was the fact that there is a linear transformation that relates the color of each pixel with the surface direction associated with that pixel. The matrix of transformation can be determined from the fact that the surface directions in a neighborhood are also subject to an integrability condition. Petrov showed some experimental evidence that his algorithm (which has ideas in common with those of R. Woodham and B. Horn) works quite well.

BARTLESON LECTURE

To recognize work of international significance, Gertrude Bartleson established the C. James Bartleson Award. Dr. (Mark) Fairchild received

the Award for his "wide ranging and important contributions to the science of color vision, spectrophotometry, colorimetry, and color reproduction." After the Award Dinner, Robert Hunt recounted his meories of the many personal and practical contributions of C. James Bartleson. Fairchild followed with his gracious acceptance.

Mark D. Fairchild: Considering the Surround in Device-Independent Color Imaging

Fairchild then recounted recent research in an area that had interested Bartleson. Photographic images intended for projection in a darkened room are produced with higher contrast than those intended for viewing as illuminated prints. The dark surround of projected images causes image elements to appear lighter. This effect is stronger for darker colors, resulting in a loss in perceived contrast. He described related research of the past, by Bartleson and others, as well as present research addressing device-independent color imaging. He then predicted and compensated these effects with the RLAB color-appearance model.

CONCLUSION

The meeting concluded with a panel discussion on the future direction and ways of improving Pan-Chromatic conferences. This included possible topics which might be addressed in the future. One of the conference's tenets, "to confront empirics rather than reinforcing conventions" is likely to remain, as it is the basis of the kind of creativity key to breakthroughs. The benefits of future Pan-Chromatic Conferences should be clear.

In the view of this reporter, future conferences might endeavor to attain greater attendance and to foster increased communication between disciplines.

This conference departs from the

conventional conference structure. The conventional short question and answer periods just provide time for authors to answer a few specific questions and do not provide time for extended interaction. Break times could be prefaced with open-ended questions from the session chairs of each category, designed to encourage conversations between attendees. Right after the breaks, attendees could be asked to share their insights. In order to obtain greater attendance, some the conference material might be more accessible to a more general audience, while maintaining the high standards for research presented; interest in these areas is very high, and parallels the joint presentation of these areas of interest in one conference.

There was also a suggestion of holding an ongoing Pan-Chromatic Conference on the Internet.

Private conversations often reflected the meeting's mission; for only one example, color measurement expert Danny Rich could be seen sharing his experiences with complex properties of certain surfaces with virtual graphics expert Gary Meyer. This is the kind of discussion that will one day make virtual realities and the objects in them seem more real.

Many of the more public interactions will be remembered by all who attended. After one talk, Robert Hunt suggested that color correction schemes used in image reproduction might be useful for robots needing to recognize colors in changing environments. The response was even more interesting; techniques for achieving color constancy in machine vision may one day play a role in faithful image reproduction. At another point Steven Shafer, chair of the Machine Vision Session, made the observation that current approaches to color object synthesis require complex, time intensive mathematics. In his own field, real-time machine vision requires efficient processing, which may prove useful to high-level graphics and the

synthesis of reality. Many questions are waiting for enterprising researchers to solve. The results will surely involve a broad range of interesting approaches.

Congratulations to Mike Brill, Steven Shafer and all of the Conference team who helped organize and orchestrate this successful conference.

Reported by Ronald Oldchurch

NEW EDITION OF JAPANESE COLOR APTITUDE TEST

Recently, the need for an aptitude to estimate color and color difference has been increasingly required of visual observers in the fields of business, science, industry and education. The Japan Color Research Institute (JCRI) has responded to these demands by developing a new edition of its Japanese Color Aptitude Test (JCAT).

An earlier edition of this test had been in demand by some students who participated in learning sessions at the JCRI, and by some instructors in color education, including in the U. S. Dr. Fred W. Billmeyer, Jr., at The Rensselaer Color Measurement Laboratory. But the test had been out of print for many years, largely because of the difficulty in mass producing its sample cards with tight color tolerances.

In the early summer of 1993, Dr. Billmeyer asked the JCRI if the test, then called the Japanese Color Discrimination Test, was still available for purchase, so that it could be discussed and recommended in a new ASTM Standard Guide to the Selection, Evaluation and Training of Observers, since issued as ASTM standard E 1499.

The JCRI decided to produce a new version of the test, and held a project meeting in August, 1993. After about a year, a prototype set of color cards was produced with high accuracy. Testing began in the summer of 1994.

Using the prototype sets, the JCRI cooperated with the Tokyo Institute of Polytechnics for trial testing, and confirmed the usefulness of the test by comparing the visual results with the specifications developed by the JCRI in 1993. Production of the JCAT (New Edition) began in October, 1994, and distribution is now proceeding smoothly.

TYPES OF TESTS IN THE JCAT

TRIANGLE TEST

When a color specification is first established, color differences judgements are often carried out visually. But since this evaluation is subjective, the results may be ambiguous. To remove the ambiguity, a test for the selection of candidates for observers engaged in visual testing is provided in the JCAT.

The candidate observers are shown a series of 24 cards, each of which contains three color chips, two identical and the third slightly different. The observer is asked which one is different. If the differences are small enough there is considerable uncertainty in the judgement. An observer candidate whose score is lower than average in this test is not qualified to identify small color differences. Two sets of cards are supplied, one for use by beginners and a second, with smaller differences, for use by senior workers with some previous experience.

COLOR-ATTRIBUTE DISCRIMINATION TEST

It is important that the observer can distinguish whether a given color difference results from a difference in hue, value, or chroma.

The candidate observers are shown a set of 30 cards, each of which has two colored chips, differing by only one of the three above attributes. The observer is asked which of the attributes (hue, value, or chroma) differs between the two chips. Again, two sets of cards are supplied, for beginners and seniors, respectively.

Magnitude Scaling Test

Many kinds of color atlases or books of color chips are available on the market, but it is not always easy to locate a color from among the chips. Only those chips with specified notations, based on some color order system, are in the collection. For example, in the Munsell collections colors are displayed on constant-hue charts, and the hue of the specimen often falls between two of them. The notation of a sample must be found in such cases by interpolation or extrapolation among the standards on the charts. A skilled observer can estimate each of the attributes of a sample's color to within about a tenth of a step between the two nearest levels of that attribute.

The magnitude scaling test was developed to assess the candidate observer's feel for the type of judgement required in magnitude scaling of an appearance attribute. The test consists of 81 cards (27 for each of the attributes hue, value, and chroma), each consisting of three color chips in a horizontal row. The left-hand chip is identified with the scale value 1 for the attribute being tested, and the right-hand chip with the scale value 10. The observer's task is to assign an integral scale value between 1 and 10 to the center chip. For each attribute, there is a set of 9 cards for each of three colors, red, green, and blue.

FEATURES OF THE JCAT

1. The sets of cards may be used for evaluating the potential capability of the observer, and also for training the observer under the actual experimental conditions.
2. The test is easy to administer, since the cards are about the size of business cards and no holders or easels are required.
3. The illumination level should be about 1000 lux (about that of a typical color viewing booth) and its spectral quality should be near to that of north-sky daylight.

4. The sets are useful and effective for assessing the observers' basic knowledge of color and for testing their levels of discrimination of small differences in color or another appearance attribute.

5. Two levels of difficulty, beginner and senior, are provided.

6. The three tests in the JCAT are independent and can be taken simultaneously by three different observers.

7. As colorimetric data are specified for each color chip in all three tests, the basis for correlating visual and instrumental test results is provided.

8. The answer to the test question is printed on the reverse side of each card. In addition, color charts are provided illustrating the scales for the three colors and three attributes in the Magnitude Scaling Test.

TEST PROGRAM IN THE U. S.

The JCRI has generously made a copy of the JCAT available to ASTM Committee E-12 on Appearance, Subcommittee E12.11 on Visual Methods. This group, chaired by Nick Hale, Hale Color Consultants, 147 Caribbean Court, Naples, FL 33942 (phone and fax 01-813-591-1501), will undertake a trial of the JCAT, probably in the summer and fall of 1995. Interested persons should contact Mr. Hale.

COMPONENTS OF THE JCAT

COLOR CARDS

Triangle Test, 24 cards for beginners; 24 cards for seniors.

Color-Attribute Discrimination Test, 30 cards for beginners; 30 cards for seniors.

Magnitude Scaling Test, 81 cards plus 3 color charts.

AUXILIARIES

Brochure, manual of procedures, pad of data sheets, carrying case (small briefcase size).

FURTHER INFORMATION

Technical information: Japan Color Research Institute, Iwatsuki Studio, 6-23, Ueno 4 chome, Iwatsuki-shi, Saitama 413, Japan; phone 81-48-794-3831; fax 81-48-794-3901.

Sales information: Japanese Standards Association, Overseas Sales Division, 1-24 Akasaka 4 chome, Minato-ku, Tokyo 107, Japan; phone 81-3-3583-8003; fax 81-3-3586-2029.

ASTM Standards on Color and Appearance: ASTM, 1916 Race Street, Philadelphia, PA 19103, attn. Bode Buckley; phone 01-215-299-5599; fax 01-215-299-2630.

*Fred W. Billmeyer, Jr.
Genro Kawakami*

MOLECULAR BIOLOGY OF HUMAN COLOR VISION REVISITED

A news item in the May-June, 1986, issue of the ISCC News (No. 301, p. 5) described the molecular genetics of human color vision by abstracting two articles on this subject appearing in the AAAS weekly journal *Science*. Now, in its 17 February issue, that journal provides new information on the subject. A headline item on the "This Week in Science" page notes that the long-wavelength and middle-wavelength cone pigments of men are encoded by a cluster of genes on the X chromosome. In men with normal color vision the number of genes in the cluster ranged from two to nine, more than had been supposed. This multiplicity may help explain individual variations in normal color vision. [Maureen Neitz and Jay Neitz, "Numbers and Ratios of Visual Pigment Genes for Normal Red-Green Color Vision," *Science* 267, 1013-1016 (17 February, 1995).]

The news note from "This Week in Science" goes on to describe another article in this same issue [David M. Hunt, Kanwaljit S. Dulai, James K.

Bowmaker, and John D. Mollon, "The Chemistry of John Dalton's Color Blindness," *Science* 267, 984-988 (17 February, 1995)], noting the 1986 result that when either or both of the long- and middle-wavelength gene classes are completely absent, color blindness results. The chemist John Dalton (1766-1844), celebrated for developing the atomic theory of chemistry, and his brother suffered from this defect. Dalton gave as his first scientific paper, just 200 years ago, an account of how his color perceptions differed from those of other people. Color blindness is still called daltonism world wide.

Dalton had supposed that his vitreous humor was tinted blue, accounting for his confusion of scarlet with green and pink with blue. But this was disproved immediately after his death by examination of his eyes. Fortunately his physician scrupulously preserved Dalton's eye tissues and now, 150 years later, they have been examined after amplification of the genes by the polymerase chain reaction. The results show that his middle-wavelength photopigment was missing. Thus, Dalton was a deuteranope.

This conclusion differs from that of no less an expert than Thomas Young, who believed Dalton to be a protanope, with the long-wavelength pigment missing. Young was critically influenced by Dalton's observation that in the solar spectrum "that part of the image which others call red, appears to me to be little more than a shade, or defect of light." But Hunt and coworkers note that, when questioned by eminent scientists of his day, Dalton never stated that the spectrum he saw was shorter than those seen by others. His other observations, analysed by Hunt through spectrophotometry of contemporary materials and use of the CIE system, are compatible with both deuteranopia and protanopia. The molecular biological evidence is, however, conclusive.

The cover of this issue of *Science* is an 1836 engraving of Dalton.

Fred W. Billmeyer, Jr.

RIT'S MUNSELL COLOR SCIENCE LABORATORY OFFERS INDUSTRIAL SHORT COURSES IN COLOR MEASUREMENT AND FORMULATION

Rochester Institute of Technology's Munsell Color Science Laboratory will present its annual course, "Principles of Industrial Color Measurement," June 5 - 7, 1995 and a new course, "Industrial Instrumental Color Matching" June 8, 1995.

"Principles of Industrial Color Measurement," will focus on the applications of colorimetry for industrial color control. Key topics include spectrophotometry: principles, geometry selection, and methods of characterizing precision and accuracy; CIE colorimetry: derivation of colorimetry from XYZ through CIELAB; and tolerancing: CMC and TC1-29 equations, deriving visual tolerances from historical pass/fail data, and optimizing l:c ratios. Additional topics include: terminology, color vision, color order systems, illuminant and observer metamerism, and color TQM concepts. This course is taught by Dr. Roy S. Berns, Director of the Munsell Color Science Laboratory and R. S. Hunter Professor of Color Science, Appearance, and Technology, and Dr. Mark Fairchild, Associate Professor of Color Science.

"Industrial Instrumental Color Matching" will present techniques to successfully use computer colorant formulation systems in an industrial
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environment. This course will be taught by Ralph Stanziola, co-founder of Applied Color Systems and current President of Industrial Color Technology. Topics include colorant identification via spectral analyses, additive functions of reflectance (Kubelka-Munk) and transmittance (Beer-Lambert), semi-quantitative production batch adjustments, principles of computer colorant formulation, methods to get the most out of your system, and a problem solving session. This is a great opportunity to benefit from Stanziola's extensive industrial experience.

These courses are highly beneficial to persons involved in the coloration of natural and synthetic materials such as coatings, textiles, and polymers. For further information, contact Colleen M. Desimone, Munsell Color Science Laboratory, Rochester Institute of Technology, Chester F. Carlson Center for Imaging Science, 54 Lomb Memorial Drive, Rochester, NY 14623-5604;

Telephone (716)475-7189;

FAX (716)475-5988;

E-mail: CMD9553@rit.edu.

COLOR ME CRAZY

Want to lose weight? set the table with black place mats. Got a boss with a bad temper? Wear green, a placid color. Need to calm a hyperactive child? Decorate his or her room with brown accents, for stability. So urges Lin Yun in his book *Living Color*, a guide to using hues to change your life. Countless others have made cases for the power of color, but Yun takes his to the limit. He suggests painting your home to match your neighbor's for friendlier coexistence, driving a two-toned car that has both your and your spouse's favorite colors for a more harmonious marriage, even planting white flowers (they're lucky) on your lawn to attract reliable babysitters. Whatever happened to trying for a personality match?

NEW BOARD MEMBERS

ISCC Secretary Danny Rich announced at the meeting of the Board of Directors at Williamsburg, Virginia, February 12, 1995, that the voting delegates had elected Mark Fairchild, Ron Oldchurch and Wade Thompson to serve a three-year term from 1995 to 1998. Their biographies are published in ISCC NEWS No. 353, January/February 1995. They will replace Brill, Chung and Pokorny whose three-year term expires at the end of the Annual Meeting in Greensboro, North Carolina, April 25, 1995.

Harry K. Hammond III

COLORING ON COLOR@INFI.NET - THE ART, SCIENCE, AND INDUSTRY

COLORING is a moderated discussion list intended to serve those interested in the coloring of paints, plastics, fabrics, inks, ceramics, and other materials.

Discussions may include, but are not limited to lighting and filters; vision and perception; instruments, measurement, standards and calibration; color difference metrics and tolerances; color order systems, color naming; pigments, dyes, color stability, and colorant calibration; color matching, software, and lab procedures.

Employment opportunities for, and resumes from color specialists and consultants are welcome. Member and company profiles will be solicited and published.

Announcements of technical meetings for color societies, such as those found in the Inter Society Color Council newsletter may be posted.

Announcements of Web pages by individuals and companies serving the color industry are encouraged.

To subscribe, send the following message to COLOR@INFI.NET:

SUBSCRIBE [title] full name - nickname <e-mail address>

For example:

SUBSCRIBE Dr. Roy G. Biv - Roy <roygbiv@heaven.com>

Postings intended for the multiple recipients of the COLORING list should be directed to COLOR@INFI.NET. It is not necessary to be a subscriber. This is a hand operated list; the editor will decide what is appropriate for general distribution.

The group will attempt to create archives of messages, important public domain spectra, other data and software deemed to be of value to the art or industry. These will be posted on the COLORING Web pages, planned for May or June, 1995, at: <http://www.infi.net/~wmdawes/coloring/index.html>

You may address special requests for member list or sample digests to the editor.

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COLORING List COLOR@INFI.NET - The Art, Science, and Industry

- Owner Bill Dawes <wmdawes@infi.net>

Under construction:

- COLORING Web Pages- Send URL's and other info

- COLORING Ventures, Inc. - Looking for Associates

(Continued→)

Coming eventually:

- Newsgroup sci.engr.color-Working with net.god mentor now
- Sci.Color.Zine - Net magazine looking for contributors
- Color data and spectra CD-ROM - Send your ideas, data, or samples

Bill Dawes, an ISCC member for 30 years, has recently started an Internet mailing list. If you have E-Mail access to the net, and the topics interest you, you are invited to join. Subscriptions are free. If you're not connected yet but want to know more, printed information is available by 'snail mail'; contributions to defray printing and postage costs will not be refused.

NEWS FROM MEMBER BODIES

COLOR WATCHING IN NEW YORK CITY



I enjoy sitting in Bryant Park (42nd Street between Fifth Avenue & Sixth), and watching the people go by."

-Gwen Messing, FlyntFabrics, Inc.

The Royalton Hotel (44th Street between Fifth Avenue and Sixth), is one of my favorite places in New York City. Although I have never stayed there, I've gone for drinks. I love the lobby's modern decor (Philippe Starck), a combination of art deco and futuristic design colored in lime green and royal blue, unconventional colors for a hotel lobby. A lot of silver is used, even the bathroom has large silver doors. I like the modern looking white furniture (slipcovered) and the fish bowls with fake fish.

-Christine Da Rocha, A CAUS intern, currently studying at F.I.T.

The nicest and quietest place to view color and a place where you really can find decent light in New York is the courtyard with little chairs at the Garden Court (architectural design, Voorsanger & Associates) at the Morgan (36th street and Madison). Now for seeing colors on view, go down Broadway south of Astor (8th Street) on any afternoon when school (New York University) is in session and you'll really see weird, fun stuff. Now that is really color!

-James Siewert, Hoechst Celanese, chair of CAUS Men's forecast committee

The 104 bus. Its Broadway route from the tip of Manhattan to the Upper West Side gives you all kinds of people ... mothers, children, actors. I'm a people watcher.

-Gayle Portnow, photographer

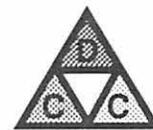
The best place in New York where I am always sure to see color action is on the front steps of my school. I attend LaGuardia High School of Music and Art and the Performing Arts, a school which is supposedly made up of the creative souls of the future. There is always sure to be one lost soul standing on the front steps thinking she is at a fashion exhibition... some girl in hot pink pattern leather 5 inch platforms, silver leggings, a huge, gaudy belt, and chaotic shirt straight from the pages of "Teen Bopper Magazine." While this get-up may sound ridiculously tacky and it is, it's nice to be able to count on laughing before opening the door to a full day at school." (Sound like any ISCC Meeting you've ever attended?? Ed.)

*Maia Halperin, student at LaGuardia High School of Music and Art
Excerpted from CAUS March News*



DETROIT COLOUR COUNCIL

March 16 Meeting



The topic of the DCC program for March was, "Procedure for Visual Evaluation of Interior and Exterior Automotive Trim." This is also the title of the DCC's Bulletin #3. Three speakers, Tom Fetner (GM), Terry Muscat (Chrysler), and Lisa Nicol (Ford), each described different sections of the bulletin, as well as the history and purpose of forming the Artificial Lighting Task Group. Definitions of Standards, Equipment, Color Temperature, Maintenance, and the proper way to hold and view panels were reviewed. A lively question and answer session with the speakers followed. Copies of the Bulletin are available from any Detroit Colour Council board member.

Submitted by J.R. Keiser

GATF CENTER FOR IMAGING EXCELLENCE



The
Graphic
Arts
Technical
Foundation

(GATF) will unveil a new Center for Imaging Excellence on April 24, 1995 at its Pittsburgh headquarters. GATF board members, VIPs, and industry experts have been invited to attend the opening ceremony. This state-of-the-art prepress center was designed to provide graphic communications firms with technical training and advice as they reinvest in digital equipment. Supported by Power Macintosh workstations, the Center for Imaging Excellence will enable printing firms to become more adept at handling client-

supplied files, crucial to the success of printing companies today. In addition to Power Macs, the center will be supported by PC workstations and a cluster of networked peripherals. GATF instructors will teach prepublishing concepts through hands-on exercises on desktop workstations. Special emphasis will be placed on teaching workshop attendees how to accept, manage, manipulate, and output digital data. Instructors will emphasize the concepts and procedures to improve quality, productivity, and profitability. Ten new workshop programs have been designed for the Center. The three- and four-day programs will run continuously from April 1995 through March 1996. For additional information and a listing of workshop dates and times, contact:

Flo Queen
GATF
Phone: (412) 621-6941
Fax: (412) 621-6598

*Excerpt from GATF News Release,
February 24, 1995*

GATF COLOR BAR PACKAGE

A new Digital Sheetfed Color Control Bar package is available from Graphic Arts Technical Foundation (GATF). The package contains five color control bars (two four-color bars and three six-color bars) supplied on a floppy disk in Encapsulated PostScript (EPS) file format for either the Macintosh or IBM operating systems. Digital color bars are unique in that the files can be used indefinitely. They are easily adapted to different press sizes. The consistent number of color patches in each repeat ensures that multiple lengths of a bar can extend across the press sheet at a constant repeat interval. Also, since the bars for scanning densitometers lend themselves to automated density reading, production time is reduced. The digital color bars also include

elements for measuring ink densities, overprint ink densities, dot gain, ink film trapping, gray balance, ink coverage, and print contrast. Additionally, the color control bars contain elements that can help the press operator visually evaluate slur, doubling, and dot gain. The package also includes a detailed User's Guide. Price to members is \$750.00, non-members \$950.00. Printers who have previously purchased GATF digital color bar products are offered the package at a discounted price of \$495.00. For further details contact:

GATF Order Department
Phone: (412) 621-6941
Fax: (412) 621-6598

*Excerpted from GATF News Release,
February 28, 1995.*

1995 COLOR PAPER ABSTRACTS FROM JOSA, A

**Smith, Vivianne C. and
Pokorny, Joel (1995).
Chromatic-discrimination
axes, CRT phosphor spectra,
and individual variation in
color vision. JOSA, A., 12, 27.**



of cone-excitation space to define stimuli and to report data. Color specification in monitor systems is accomplished by combination of the phosphor chromaticities. The effect of interobserver variation on color specification is highly dependent on the spectroradiometric properties of the primaries. We review potential sources of biologic variability and its effect on the nominal axes in a cone-excitation diagram for a color monitor system.

Variation in preretinal pigment (lens and macular pigment), in the effective optical density and the spectral sensitivity of the visual photopigments, and in the cone weighting used to derive the spectral luminosity function are considered. The consequences of such biological variability are rotation and translation of the axes for a given observer relative to the nominal axes that the observer used for color specification. The importance of such rotations can be viewed within the framework of a particular experimental paradigm.

**Wei, Jianping and Shevell,
Steven K. (1995). Color
appearance under chromatic
adaptation varied along
theoretically significant axes in
color space. JOSA, A, 12, 36.**

Changes in color appearance caused by chromatic adaptation were measured with a wide range of adapting fields. Observers viewed a 39- 55 minute annular test field composed of an additive mixture of lights from red phosphor and the green phosphor of a CRT. The annular mixture field was centered and superimposed upon a 4.7 degree steady, circular background field. After the observer was completely adapted to the background, the luminance of the red phosphor in the test was held fixed while the observer adjusted the luminance of the green phosphor until the test appeared neither reddish nor greenish. Twenty-two equiluminant backgrounds (4.5 cd/m², approx. 50 Td) were systematically selected along two axes in Judd chromaticity space. One axis was along tritanopic confusion lines, with middle-wavelength- sensitive (M-) and long-wavelength-sensitive- (L-) cone stimulation held constant. The other axis maintained constant short-wavelength- sensitive- (S-) cone stimulation. The results show that adapting backgrounds that were varied along tritanopic confusion lines do not have a differential effect on color appearance at high test levels (well above adapting level). At lower test levels there is a systematic change in

(Continued→)

color appearance of the test light, which is quantitatively described by additive redness. Along constant S-cone-stimulation lines, adapting backgrounds differentially affect color appearance in a systematic way, reflecting changes in receptor gain and the additive contribution. The measurements taken with adapting fields throughout color space are described by the two-process model of chromatic adaptation.

Smith, Vivianne C., Pokorny, Joel, Davis, Monica, and Yeh, Tsaiyao (1995). Mechanisms subserving temporal modulation sensitivity in silent-cone substitution. *JOSA, A, 12, 241.*

Temporal contrast sensitivity data were collected with sine-wave-modulated lights for achromatic, chromatic, and silent-cone-substitution stimuli. Achromatic (556- and 624-nm lights in phase) and chromatic (556- and 642-nm lights in counterphase) modulation sensitivities were measured at a constant time-average retinal illuminance of 1256 trolands (Td) and chromaticity of 595 nm. These data were considered to represent isolated temporal responses of luminance and red-green chromatic channels, respectively. Silent cone substitution was achieved with counterphase modulation of the 556- and 642-nm lights and by suitable adjustment of the modulations or the radiances of the two lights. (1) The peak modulation depth of the 642-nm light was reduced to silence the long-wavelength-sensitive (LWS) cone, and the peak modulation depth of the 556-nm light was reduced to silence the middle-wavelength-sensitive (MWS) cone. These protocols maintained the time-average retinal illuminance and chromaticity as for the control conditions. (2) The luminance of the 642-nm light was decreased to silence the LWS cone and was increased to silence the MWS cone. In this procedure the time-average retinal illuminance and chromaticity differ for the silenced-LWS-cone (1047 Td and 589.5 nm) and the silenced-MWS-cone

(4358 Td and 622 nm) conditions. The response modulation of the achromatic and the chromatic channels was calculated for the silent-substitution conditions. The chromatic channel is more sensitive at low frequencies, with a transition to greater achromatic channel sensitivity near 13 Hz for the silenced-LWS-cone condition and near 6 Hz for the silenced-MWS-cone condition. Thus the postreceptoral channels postulated to mediate sensitivity under silent-substitution conditions change with temporal frequency, and the transition frequency from chromatic to luminance processing differs between two silenced-cone conditions.

Losada, M. Angeles, and Mullen, Kathy T. (1995). Color and luminance spatial tuning estimated by noise masking in the absence of off-frequency looking. *JOSA, A, 12, 250.*

We assessed the contribution of off-frequency looking for pattern detection and obtained bandwidths for chromatic and luminance mechanisms in conditions free from this effect. We used a simultaneous spatial masking technique with Gaussian enveloped sinusoidal test stimuli (0.5 cycle/deg) and filtered one-dimensional static noise masks whose spectral power was uniformly distributed per octave. Stimuli were modulated in the chromatic (isoluminant red-green) or luminance (yellow-black) domain. Color and luminance detection thresholds were compared for low-pass, high-pass, and notch- (band- stopped) filtered noise. We obtained the following results: (1) at high-noise spectral densities, masking by notched noise is greater than the summed masking of the high- and low-pass noise, indicating the presence of off-frequency looking for both color and luminance detection. There is no evidence for off-frequency looking at lower power densities. (2) Using notch-filtered noise, which avoids the problem of off-frequency looking, we found that color processing is subserved by bandpass

channels with bandwidths similar to those revealed for luminance processing. (3) Both color and luminance mechanisms appear to have bandwidths proportional to their center frequency (constant in octaves). (4) The lower and upper sides of the color and luminance tuning functions were estimated individually by use of high-pass and low-pass noise of a low power density and are revealed to be asymmetric, with the lower side declining more steeply than the upper side.

Bauml, Karl-Heinz (1995). Illuminant changes under different surface collections: examining some principles of color appearance. *JOSA, A, 12, 261.*

I report the results of a set of experiments designed to study whether the visual system's adjustments to illuminant changes vary with the surface collection in a scene. Simulations of flat matte surfaces rendered under diffuse illumination were presented on a CRT monitor. Under several surface collections subjects set asymmetric color matches between a standard surface and a test surface that was rendered under illuminants with different spectral power distributions. The three subjects' data span 28 different illuminant x surface collection conditions. Five different standard surfaces were used. Two results stand out. First, a change in surface collection did not induce a substantial change in the effect of illuminant changes on the subjects' settings. In this sense the results are consistent with the hypothesis that the visual system's adjustments to illuminant changes do not depend on the surface collection. Second, the illuminant-induced changes in the subjects' settings for a given surface collection were well approximated by a von Kries model, in which the change in the von Kries coefficients is a linear function of the illuminant change. In addition, I tested the hypothesis that the gain of the signal from each cone class is regulated by the photopigment

absorptions originating entirely within that cone class. I found some clear deviations from this hypothesis, which indicates interactions among the cone stimulating the eye to change its focus than are black-white (broadband) targets. The present study investigates the influence of target spectral bandwidth on the dynamic accommodation response in eight subjects. The fixation target was a 3.5-cycle/deg square-wave grating illuminated by midspectral light of various bandwidths (10, 40, and 80 nm and white (CIE Illuminant B)). The target was moved sinusoidally toward and away from the eye, and accommodation responses were recorded and Fourier analyzed. Accommodative gain increases, and phase lag decreases, with increasing spectral bandwidth. Thus the eye focuses more accurately on targets of wider spectral bandwidth. The visual system appears to have the ability to analyze polychromatic blur to determine the state of focus of the eye for the purpose of guiding the accommodation response.

Yeh, T., Lee, B.B., and Kremers, J. (1995). Temporal response of ganglion cells of the macaque retina to cone-specific modulation. JOSA, A., 12, 456.

The temporal response of cone inputs to macaque retinal ganglion cells were compared with cone-specific sinusoidal modulation used to isolate each cone type. For all cell types of the parvocellular (PC) pathway, temporal responsivity was similar for short (S)-, middle (M)-, and long (L)-wavelength-sensitive cones inputs, apart from small latency differences between inputs to center and surround. The temporal response resembled that expected from receptor physiology. Responses of cells of the magnocellular pathway to M- or L-cone modulation showed more complex properties indicative of postreceptor processing. Human psychophysical temporal-sensitivity-functions were acquired with S-cone modulation under conditions similar

to those for the physiological measurements. Ratios of psychophysical to physiological data from S-cone cells (the only cells that respond to this stimulus) yielded an estimate of the central filter acting upon PC-pathway signals. The filter characteristics could be described by a four-stage low-pass filter with corner frequency 3-5 Hz.

HIGH TECH IS HIGH DRAMA AT SID '95

SID International manufacturers struggle to make liquid-crystal displays (LCDs) larger - and smaller. Researchers rush to prepare papers announcing technical developments that will change the way people watch television. In industrial and university laboratories, engineers race to develop crisp, reflective displays that will hold the image of a fax or newspaper page without electrical power. These are just three of the exciting issues that will be the focus of the Society for Information Display's International Symposium, Seminar, and Exhibition (SID '95), North America's only conference and trade show devoted exclusively to display technology, components, products, systems, and manufacturing. The conference will be held at the Walt Disney World Dolphin outside of Orlando, Florida, from May 21 to May 26.

The Society's Press Relations Office identified a few of the questions that may be answered at SID '95: - How is LCD power consumption being reduced so laptop battery life can be extended to six or more hours between charges? - Where are the large, flexible, power-efficient displays suitable for the long-sought "electronic newspaper"? - What new products will be demonstrated to the press by Fujitsu, the first manufacturer of commercial color plasma display panels — the

favorite pick for hang-on-the-wall TV? - What is ARPA doing to continue its support of dual-use display technologies despite an unsympathetic Congress? - What is the ideal display for a mobile communications device? - How large can direct-view LCDs get?

Early in February in Santa Clara, California, a committee consisting of dozens of the world's leading display scientists and engineers selected the 200-plus papers that will be presented at SID '95. Some of these papers announce developments that could be far-reaching, including:

A paper from Allied Signal Micro-Optic Devices describing an optical system for dramatically increasing the viewing angle of both passive-matrix and active-matrix liquid-crystal displays (LCDs).

A paper from Kent State University and Kent Display Systems introducing a method for speeding up the addressing of bistable cholesteric displays by 20 times. These displays can be large, can be fabricated on a flexible plastic substrate so they can be rolled up, and consume no power once the data has been written to the display. The speed enhancement finally allows systems developers to think seriously about a long-postponed dream: the electronic newspaper.

Separate papers from Uchia and Philips describing new projection bulbs with small arc lengths and much longer lifetimes. Such bulbs are needed to implement the next generation of projection displays based on polysilicon LCD light valves and digital micromirror devices.

With the new leadership of the U.S. Congress casting a jaundiced eye on cooperative government-industry programs, people in the display community are thinking about the future of programs supporting advanced display manufacturing. Some of these issues will be addressed by Lance Glasser of ARPA when he describes the current status of ARPA's display initiative in a keynote address.

With 2 keynote addresses, 4 Sunday short courses, 16 Monday and Friday seminars, 6 How-To Seminars, 63

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technical sessions, a Wednesday luncheon, an evening panel session, and a special evening event, all in the dazzling Walt Disney World Dolphin, SID '95 is the international display community's richest annual event.

For SID '95 registration and hotel information, call Mark Goldfarb, Palisades Institute for Research Services, 1745 Jefferson Davis Highway, Suite 500, Arlington, VA 22202.

Phone (800) 787-7477, (703) 413-3891, Fax (703) 413-1315.

OTHER NEWS

TWO NEW CIE TECHNICAL COMMITTEES

Division 2 of the CIE has agreed to establish two new Technical Committees: TC 2-39: Geometric Tolerances for Colorimetry, as it seems that the guidelines described in CIE 15.2-1986 are insufficient to perform measurements with adequate accuracy, Dr. Rich, USA, was suggested to become TC Chair.

TC 2-40: CIE Standard on characterizing the Performance of luminance and illuminance meters, based on the Technical Report CIE 69-1987 to foster international agreement on describing photometer characterization. Dr. Rattunde, Germany, was suggested to become Technical Committee Chair. Interested persons should contact Dr. Rattunde and Dr. Rich respectively to get further details.



CIE EXPERT SYMPOSIUM '96 ON COLOUR STANDARDS FOR IMAGE TECHNOLOGY

Currently there is considerable effort within the imaging industry and the imaging standards community to move forward in the area of colour image definition and exchange. This has, in part, been enabled by the recent rapid increases in both computer power and data storage technologies. Whilst the basic fundamentals of colour technology are well laid out by the work of the CIE there has been little co-ordination of the options selected by the various activities for use in formal or defacto standards.

Based on this situation, CIE, ISO, IEC and ITU decided to co-sponsor an expert meeting organized by the CIE.

The goals of the meeting are: 1) to share information on the technical content and status of projects involving the characterization of definition of the colour of images, 2) to identify areas where existing/proposed directions are divergent and to initiate discussion towards resolution, and 3) to identify areas requiring new technology or knowledge and to recommend needed activities of CIE, industry, and other standards groups to provide the necessary solutions.

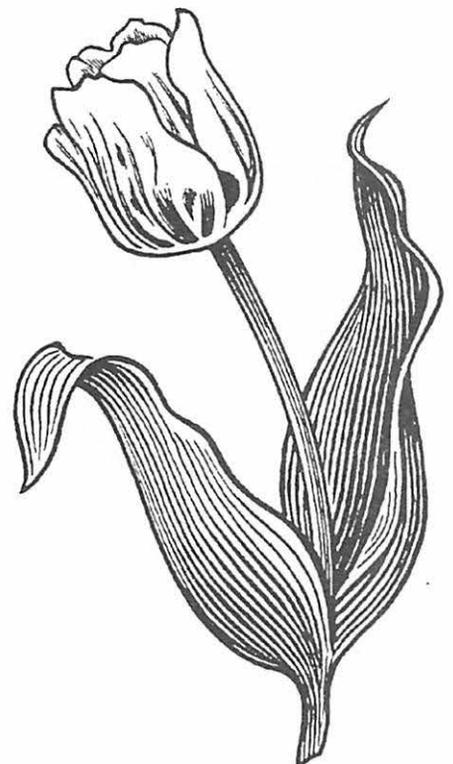
The main agenda items are: 1. Colour space definitions and selections. 2. Colorimetric specification (what to choose out of the CIE recommendations). 3. Colour appearance models. 4. Viewing conditions (should viewing conditions and colorimetric conditions match?). 5. Standardization of colour test targets - scanner input, internal data, output characterization. 6. Colour "profile definition" as used in the exchange of data between colour

management systems.

Open roundtable discussions will be held on the following issues, and others that may be identified in earlier parts of the meetings, with the goal of identifying appropriate paths forward leading to usable solutions:

1. Appearance comparisons across divergent media/display technologies.
2. Soft display viewing environment.
3. Soft display calibration/characterization.
4. Cross media gamut mapping (compression and expansion).

This meeting is open to all participants. To insure adequate space and support, and to allow distribution and adequate review of relevant documents, prior registration is required. The following individuals are specifically encouraged to attend: nominated representatives of ISO/IEC/ITU/CIE committees and of industry groups involved in the development or use of standards for colour specification, representatives of companies that "own" or are developing defacto colour standards specification, colour science and vision experts who are willing to provide help in these areas.



IS&T ELEVENTH INTERNATIONAL CONGRESS - ADVANCES IN NON-IMPACT PRINTING TECHNOLOGIES ANNOUNCEMENT AND CALL FOR PAPERS

The Congress will provide a broad overview of key technology areas as well as leading developments that result in tomorrow's breakthrough products. The Congress will be organized into two parallel sessions of oral presentations. A general interest Keynote paper will be given at the start of each day. Session Focal papers will provide either an in-depth overview or report on a major advance. At the day's end, Poster papers will be presented on sub-

jects relevant to the day's session topics. Proposed topics include:

Electrography, Magnetography, Ink Jet Printing, Thermal Printing, Halftone Imaging, Print & Image Quality, Input & Output Scanners, Novel Printing Technologies, Media For Non-Impact Printing, Electrostatic Marking Materials, Electrostatic Marking Processes, Image Acquisition & Processing, Liquid Toners & Printing Systems, Electrophotographic Photoreceptors, Ionography, Electron Beam Imaging, New Applications Of NIP Technology, Color Reproduction, Science & Standards.

The committee has issued a call for papers on these and related topics. Those wishing to submit a paper should contact:

Dr. Jeff Anderson
Publications Chair
Tektronix
P.O.Box 1000 (M.S. 63-131)
Wilsonville, Oregon
97070
Phone: (503) 685-3407
Fax: (503) 685-3717
email: Jeffrey.j.anderson@tek.com

*Excerpted from IS&T News Release,
March 4, 1995*

NPL SPECTROPHOTOMETRY AND COLORIMETRY CLUB & RHOPPOINT INSTRUMENTATION LTD

GLOSS - Standards, Application and Measurement

14 February 1995
National Physical Laboratory
Teddington Middx TW11 0LW

ABSTRACTS

Specular Gloss Measurement Services at the National Research Council of Canada
Dr Joanne Zwinkels, National Research Council of Canada, Ottawa
K1A 0R6, Canada.

The National Research Council of Canada provides a primary calibration service for specular gloss at 20°, 60° and 85° geometries in accordance with international standards (ISO 2813, ASTM D523). This paper will discuss the

important factors affecting the accuracy of specular gloss measurements, such as the spectral and geometric characteristics of the measuring instrument. The features of the NRC Reference Glossmeter and the NRC quartz wedge primary gloss standards will be described in detail. The design concepts for the NRC reference goniospectrophotometer, currently under development, will be briefly discussed. This new facility will provide calibrations of specular gloss, as well as bi-directional reflected radiance factors.

Gloss Characterization by Indicatrix Parameters Dr. Wolf Czepluch, BAM, 12200 Berlin, Germany.

One of the main remedies for characterizing the gloss of surfaces is the so called reflection indicatrix, which describes the angular dependence of the reflected light. Condensing the indicatrix shape to important parameters results in three, now more or less (inter-)national standardized gloss components:

-specular gloss: average over a small angular region centered in the indicatrix maximum

-haze: average over a small angular area situated near the angular region for specular gloss measurement

-clarity of image: measure for the (maximal) indicatrix gradient, often related to the half value angle of the indicatrix.

A general comparison of the three parameters will be given including a presentation of their standardized versions. As a special problem newer investigations about the influence of aperture tolerances on specular gloss values will be discussed, which may be responsible for unexplained differences even between standardized instruments.

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Practical Aspects of Specular Reflectance Measurements on Metals
A.J. Dowell, Ano-Coil Ltd., Chippenham Drive, Kingston, Milton Keynes MK10 0AN, UK.

The paper draws on the practical experiences of measuring specular reflectance on mirror finished pre-anodized aluminium coil. It compares the results of reflectance measurements made using the various different instruments commercially available, including the British 45° instrument, the German multi-angle 20°, 60° and 85° instrument and the American Dorigon unit. The advantages and disadvantages of these are discussed and specular reflectance results are considered in relation to the findings from goniphotometer measurements and diffuse reflectance measurements from an integrating sphere.

Paper Gloss
Dr. L. F. Gate, ECC International R&D, John Key House, St. Austell, Cornwall PL25 4DJ, U.K.

The relationship between the surface structure and the reflection of coated paper is examined experimentally using a gloss goniphotometer built with a polarised light source and a detector with a reception angle resolution of 0.5 degrees. It demonstrated that the reflected intensity from coated paper is sensitive to the polarisation state of the incident light and this is then used to show that the surface can be modelled as an array of microfacets which all have the same refractive index and have a normal angular distribution about the mean plane of the surface. The refractive index of the microfacets in the surface of a coating can be increased by means of the calendaring operation which is used commercially to increase the gloss of a coating. The increase in refractive index of the surface layer of the coating arises through compaction and the consequent reduction in void volume of the layer.

It is postulated that the microfacets

are not specularly smooth but have a structure (microroughness) related to the dimensions of the colloidal mineral particles which compose the bulk of the surface. The scale of the microroughness can be estimated from the change in reflected intensity when the specular angle is moved by one degree. A typical value of 0.15 micrometers is found from these optical measurements.

The Effect of Gloss Defects on Measurement of Colour in Multi-Angle Measurement of Paints
Dr. Judith Hardy, ICI Paints, Wexham Road, Slough, Berks SL2 5DS, U.K.

Modern automotive coatings often contain a varied selection of special effect pigments such as aluminium and pearlescent flake pigments which show strongly angle-dependent colour effects. The range and complexity of these pigments available to colour stylists in the automotive industry is increasing rapidly as suppliers develop new production routes to change the chemical composition and structure of flake pigments.

Suppliers and users of effect pigments are turning towards the use of goniospectrophotometers for the characterization of these novel colour effects. The nature of these pigments is such that their full colour effect becomes apparent at or very near the specular angle, necessitating the development of instruments which are capable of measuring colour close to specular, but still able to discriminate a gloss component from the reflected light containing the information about the pigmented coating. The quality of the surface coating and any gloss defects present will affect the measurements taken, and the choice of geometry chosen for multi-angle measurements is a compromise between the need to characterize full colour development while avoiding the effects of surface defects on near specular measurements.

This paper will provide some examples of the effects of gloss defects

on colour measurement of automotive coatings, and show how this in turn influences the choice of measurement geometry.

Measuring the Gloss of Curved Surfaces
Bruce C. Duncan, National Physical Laboratory, Teddington TW11 0LW, U.K.

The measurement of surface gloss is important in coatings and injection moulding technology and quality control. Standard reflectometer gloss meters can reliably measure flat surfaces. When measuring the gloss of curved surfaces the reflected light diverges from the axis of the meter and a proportion of the light may not be incident on the detector leading to erroneous low gloss measurements. By modelling the reflection of light from cylindrical surfaces, the fraction of the reflected beam collected by the detector can be calculated and the measured value corrected to give the true gloss. Such models can identify the critical radius of curvature, dependent on the radius of the illuminating light beam, at which corrections become necessary. The reduced size of the illuminating beam in small area gloss meters gives better performance than standard meters on most curved surfaces. The performance of real gloss meters has been compared with that predicted by the models. Differences between the two are explained by the differences between real and model meters. Recommendations are made on how to measure and interpret curved surface gloss.

COLOR RESEARCH AND APPLICATION IN THIS ISSUE, June 1995

We begin this issue with two articles about the Nayatani Color Appearance Model. Yoshinobu Nayatani first presented the formulation of a nonlinear model of chromatic adaptation in 1980. From this beginning, over the succeeding fifteen years

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the Nayatani model to predict the color appearance has been developed and refined with applications in many areas. Now in "Revision of Chroma and Hue Scales of a Nonlinear Color-Appearance Model," Dr. Nayatani reports on a new coefficient, $ES(\theta)$, that corresponds to the chromatic strength of spectral colors (and those colors on the red-purple locus). Using this new coefficient in place of the eccentricity function, $eS(\theta)$, the nonlinear color appearance model can predict the hue and chroma scales of the Munsell and Natural Color System (NCS) very well.

In a follow-up article, Hiroaki Sobagaki, Kenjiro Hashimoto, and Tadashi Yano join with Yoshinobu Nayatani to report on the "Lightness Dependency of Chroma Scales of a Nonlinear Color-Appearance Model and its Latest Formulation." A new chroma CN (which is the old chroma, C, multiplied by a lightness correction, LA) is proposed. CN improves the agreement between the model predictions, Munsell Chroma and NCS chromaticness. For those researchers wishing to use the nonlinear color appearance model, the step-by-step procedure for making calculations is given and explained in an Appendix including the resulting numbers for four examples.

When the Commission Internationale de l'Eclairage (CIE) defined the spectral power distributions of various phases of daylight illumination, no artificial sources were available with the defined distributions. Since then there has been a continuing search for sources that can serve as suitable daylight simulators. For some additional discussion on this problem readers may want to refer to Dr. Hunt's Letter to the Editor of August, 1992 [Vol. 17, 293-4, 1992]. The CIE has recommended two methods that can be used for computation of the color differences introduced by a change from a reference to a test illuminant. One method measures the color rendering properties of a light source in terms of a General Color rendering Index Ra. The second method is intended specifically for testing the quality of

daylight simulators by assessing the performance over the visible region in terms of a Metamerism Index MIvis. Bjarne Hisdal examines these two methods in "Colorimetric Evaluation of Daylight Simulator Sources" and concludes that both methods evaluate daylight simulators in the same way and that disagreement between the two methods in detailed rank may often be due to visually insignificant color differences.

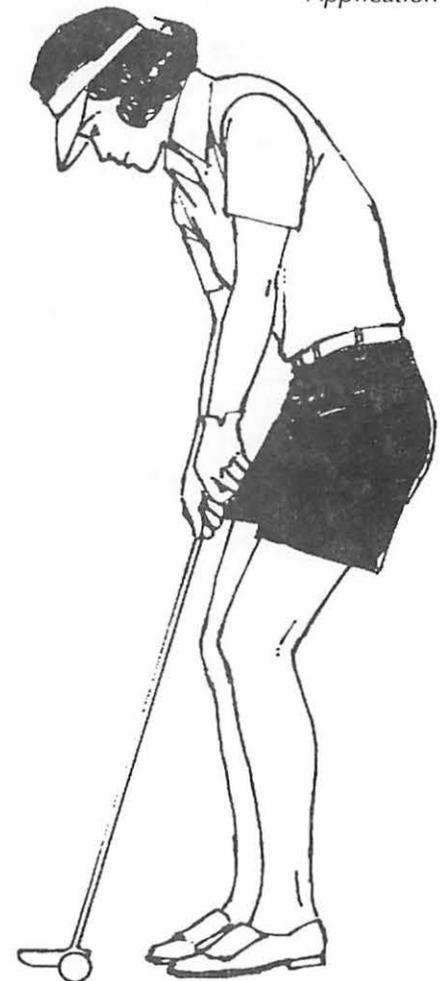
Another search that has gone on for years is the one for the ideal color difference formula. In "A General Form of Color Difference Formula Based on Color Discrimination Ellipsoid Parameters," Chengwu Cui and Jeffery K. Hovis derive a general color difference formula based on the color discrimination ellipsoids in the CIELAB color space. They show the link among the current popular color difference formulae and suggest a framework for modifying the CIELAB color difference formula in the future.

We take for granted the way in which the two-dimensional visual information we receive through our eyes is interpreted into our understanding of the surroundings made up of three-dimensional objects. That is, we take it for granted until we try to teach a machine to see and interpret things the way that we do. What laws have we internalized? Are there visual cues that we use? The understanding takes on degrees of complexity as we add depth, shadows, and transparent objects. In computer vision the researcher tries to transform the two-dimensional image to three-dimensional object perception by using natural constraints. In "Depth and Orientation Through Surface Transparency" only E. M. Gerritsen, Charles M. M. de Weert and Johan Wagemans report on investigations to determine if people use the physical constraints of additive color mixture in their interpretations of depth or orientation.

It is well known that color attracts attention and sells products. Therefore the proper selection of color is an important consideration in the product design process. In "A Systematic

Method for Color Planning in Product Design" Shih-Wen Hsiao describes how to incorporate the results of market surveys into a systematic methodology for color selection in the design process. Thus the color image that the customer has of a product is translated into the product design. The tools that the designer uses in this process are 1) the Hue and Tone system and the Color Image Scale to translate words to color or color to words, 2) the composite operation for fuzzy set theory to get semantic equivalence of words and colors, and 3) a computer program to calculate the membership functions and present to results to the designer. In this way, the psychology of the customer can be presented to the designer increasing the efficiency of the design process or to help train new designers.

Ellen C. Carter
Editor, Color Research and
Application



(Continued→)

C A L E N D A R

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

Harry K. Hammond, III
or
John Peterson
BYK-Gardner, USA
2435 Linden Lane
Silver Spring, MD 20910
Phone: 301-495-7150
Fax: 301-585-4067

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

Harry K. Hammond, III
or
John Peterson
BYK-Gardner, USA
2435 Linden Lane
Silver Spring, MD 20910
Phone: (301) 495-7150
Fax: (301) 585-4067

1995

IS&T 48th ANNUAL CONFERENCE

May 7 - 11
Imaging On the Information Superhighway
Omni Shoreham Hotel
Washington, D.C.
Information: IS&T
7003 Kilworth Lane
Springfield, VA 22151
Phone: (703) 642-9090
Fax: (703) 642-9094
email: imagesoc@us.net

CMG SPRING CONFERENCE

May 14 - 16
Color Marketing Group International Color Directions Conference
Fairmont Hotel
Dallas, TX
Information: Katie Register
Phone: (703) 329-0155

CORM 95, ANNUAL MEETING

May 15 - 17
Council for Optical Radiation Measurement
Ottawa, Ontario, Canada
Information: Norbert Johnson
Phone: (612) 733-5939
Fax: (612) 733-6211

ASTM COMMITTEE E-12 ON APPEARANCE

June 21 - 23
Denver, Colorado
Information: Bode Buckley
Phone: (215) 299-5599

June 26 - 30
Virtual Reality and its Applications
Leeds, UK
Information: Mrs. F. Johnson
Conference Office
University of Leeds
Leeds LS2 9JT
Phone: (011) 44 0532 336100

5th INTERNATIONAL CONFERENCE ON IMAGE PROCESSING

July 3 - 6
Information: IAP95 Secretariat
IEE Conference Services
Savoy Place
London WC2 0BL

ASTM COMMITTEE D-1 ON PAINT

July 9 - 13
Atlanta, Georgia
Information: Scott Orthey
Phone: (215) 299-5507

ASTM COMMITTEE D-20 ON PLASTICS

July 9 - 13
Lake Como, Wisconsin
Information: Mrs. Katherine Morgan
Phone: (215) 299-5529

1995 IESNA ANNUAL CONFERENCE

July 29 - Aug. 3
Marriott Marquis
New York City, NY
Information: Valerie Landers
IESNA
Phone: (212) 248-5000 ext. 117

AIC INTERIM MEETING '95

Colorimetry
 Sep. 4 - 6
 Berlin, Germany
 Information: Prof. Dr. Heinz Terstiege
 c/o BAM
 Unter den Eichen 87
 12205 Berlin, Germany
 Fax: (011) 49-30-812-10-83

IMAGING SCIENCE & TECHNOLOGY GROUP OF THE ROYAL PHOTOGRAPHIC SOCIETY

Sept. 4 - 8
 Silver Halide and Electronic Imaging
 Robinson College
 Cambridge, England UK
 Information: Dr. M. R. Pointer
 Kodak Ltd.
 Research Division W93
 Headstone Drive
 Harrow
 Middlesex HA1 4TY
 England
 Phone: (011) 44 0181 424 3750
 Fax: (011) 44 0181 424 3750

OSA ANNUAL MEETING

Sep. 10 - 15
 Optical Society of America Annual Meeting
 Portland, OR
 Information: OSA Meeting Department
 Phone: (202) 416-1980

"COLOR AND CULTURAL HERITAGE" CONFERENCE '95

Sept. 12 - 15
 Color Group - Bulgaria
 "St. Constantine" Resort
 "F. J. Curie" Scientists' House
 Varna, Bulgaria
 Information: M.F.A Krasimir Krustev
 Color Group - Bulgaria
 P.O.B. 431
 BG-1000
 Sofia Bulgaria
 Phone: (011) 359-2-88-4075
 Fax: (011) 359-2-87-9360

SPE RETEC 95

Sep. 25 - 26
 Color & Appearance Division & Carolinas Section of the
 Society of Plastics Engineers (SPE)
 "Coloring Properties and Effects of Colorants on Processing
 and Polymer Properties"
 Isle of Palms, Wild Dunes Resort
 Information: Johnny F. Suthers
 Phone: (615) 229-3263

AATCC CONFERENCE AND EXHIBITION

Oct. 8 - 11
 American Association of Textile Chemists and Colorists
 Hyatt Regency
 Atlanta, GA
 Information: AATCC
 Phone: (919) 549-8141

IS&T 4th TECHNICAL SYMPOSIUM WITH GRAPH EXPO '95

Oct. 8 - 12
 Prepress, Proofing, & Printing
 Chicago, IL
 Information: IS&T
 7003 Kilworth Lane
 Springfield, VA 22151
 Phone: (703) 642-9090
 Fax: (703) 642-9094
 email: Imagesoc@us.net

Oct. 9 - 11
 Biological Effects of Light
 Hotel Nikko
 Atlanta, GA
 information: Scott Bowen
 (404) 252-7913

FSCT Annual Meeting & Paint Industries Show

Oct. 9 - 11
 Saint Louis, MO
 Information: Robert Ziegler
 Federation of Societies for Coating Technology
 492 Norristown Rd.
 Blue Bell, PA 19422-2350
 Phone: (610) 940-0777
 Fax: (610) 940-0292

SID

Asia Display '95
 October 16-18
 International Research Conference
 Act City,
 Hamamatsu, Japan
 Information: Lauren Kinsey
 Phone: (714) 545-1526

IS&T 11th ANNUAL INTERNATIONAL CONGRESS

Oct. 29 - Nov. 3

Advances In Non-Impact Printing Technology

Hyatt Regency Hilton Head

Hilton Head Island, SC

Information: IS&T

7003 Kilworth Lane

Springfield, VA 22151

Phone: (703) 642-9090

Fax: (703) 642-9094

email: imagesoc@us.net

CIE 23rd QUADRENNIAL MEETING

Nov. 1 - 3 Division Meetings: Nov. 6 - 8

International Commission on Illumination

Vigyan Bhavan Conference Complex

New Delhi, India

Information: Jonathan Hardis

Secretary USNC/CIE

Phone: (301) 975-2373

Fax: (301) 840-8551

E-mail: hardis@onyx.nist.gov

CMG FALL CONFERENCE

Nov. 5 - 7

Color Marketing Group International Color Directions Conference

The Pointe Hilton Resort at Squaw Peak

Phoenix, AZ

Information: Katie Register

Phone: (703) 329-8500

Fax: (703) 329-0155

IS&T & SID 3rd COLOR IMAGING CONFERENCE

Nov. 7 - 10

Color Science, Systems, and Applications

Radisson Resort

Scottsdale, AZ

Information: IS&T

7003 Kilworth Lane

Springfield, VA 22151

Phone: (703) 642-9090

Fax: (703) 642-9094

email: imagesoc@us.net

- or -

Lauren Kinsey

SID

1526 Brookhollow Drive, Suite 82

Santa Ana, CA 92705

Phone: (714) 545-1526

Fax: (714) 545-1547

email: socforinfodisplay@mcimail.com

ASTM COMMITTEE D-20 ON PLASTICS

Nov. 13 - 16

Norfolk, VA

Information: Mrs. Katherine Morgan

Phone: (215) 299-5529

1996**ASTM COMMITTEE D-1 ON PAINT**

Jan. 21 - 24

Fort Lauderdale, FL

Information: Scott Orthey

Phone: (215) 299-5507

ASTM COMMITTEE E-12 ON APPEARANCE

Jan. 22 - 24

Fort Lauderdale, FL

Information: Bode Buckley

Phone: (215) 299-5599

USNC/CIE "1995" ANNUAL MEETING

Jan. 27-29

United States National Committee of CIE

Orlando, FL

Information: Jonathan Hardis

Secretary USNC/CIE

Phone: (301) 975-2373

Fax: (301) 840-8551

E-mail: hardis@onyx.nist.gov

IS&T/SPIE

Feb. 4 - 9

Electronic Imaging: Science and Technology

San Jose Convention Center

San Jose, CA

Information: IS&T Conference Manager

7003 Kilworth Lane

Springfield, VA 22151

Phone: (703) 642-9090

Fax: (703) 642-9094

email: imagesoc@us.net

SID

Feb. 6-8

Display Works '96

Information Lauren Kinsey

Phone: (714) 545-1526

IS&T 9th INTERNATIONAL SYMPOSIUM

Feb. 18 - 21
 Photofinishing Technology
 Co-located with PMA Show (Feb. 22 - 25)
 Las Vegas, NV
 Information: IS&T Conference Manager
 7003 Kilworth Lane
 Springfield, VA 22151
 Phone: (703) 642-9090
 Fax: (703) 642-9094

ASTM COMMITTEE D-20 ON PLASTICS

Mar. 18 - 21
 Orlando, FL
 Information: Mrs. Katherine Morgan
 Phone: (215) 299-5529

TAGA ANNUAL CONFERENCE

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

ISCC ANNUAL MEETING WITH ASTM

May 5 - 7
 Orlando, FL
 Information: Danny Rich
 Phone: (609) 895-7427
 Fax: (609) 895-7461

CMG SPRING CONFERENCE

May 5 - 7
 Color Marketing Group Conference
 Sheraton New Orleans Hotel & Towers
 New Orleans, LA
 Information: Katie Register
 Phone: (703) 329-8500
 Fax: (703) 329-0155

ASTM COMMITTEE E-12 ON APPEARANCE

May 8 - 10
 Orlando, FL
 Information: Bode Buckley
 Phone: (215) 299-5599

EXPO 96

May 11 - Oct. 4
 Color and Light in Communication
 Information: Gabor David
 3 Tukory u.
 Budapest
 H-1054
 Hungary

SID '96

May 13 - 17
 San Diego, CA
 Information: Lauren Kinsey
 SID
 1526 Brookhollow Drive, Suite 82
 Santa Ana, CA 92705
 Phone: (714) 545-1526
 Fax: (714) 545-1547
 email: socforinfodisplay@mcimail.com

IS&T 49th ANNUAL CONFERENCE

May 18 - 24
 Minneapolis Marriott City Center
 Minneapolis, MN
 Information: IS&T Conference Manager
 7003 Kilworth Lane
 Springfield, VA 22151
 Phone: (703) 642-9090
 Fax: (703) 642-9094

AIC - '96 INTERIM MEETING

June 16 - 18
 Color Psychology Beyond Psychophysics
 Gothenburg, Sweden
 Information: Lars Sivik
 Kullaviks Skogsväg 4
 S-429 35 Kullavik, Sweden
 Phone: (011) 46-31-933347
 Fax: (011) 46-31-431012
 email: sivik@psy.gu.se

ASTM COMMITTEE D-1 ON PAINT

June 23 - 26
 San Francisco, CA
 Information: Scott Orthey
 Phone: (215) 299-5507

ASTM COMMITTEE E-12 ON APPEARANCE

June 24 - 26
 San Francisco, CA
 Information: Bode Buckley
 Phone: (215) 299-5599

AATCC CONFERENCE AND EXHIBITION

Oct. 8 - 11
 American Association of Textile Chemists and Colorists
 Opryland Hotel
 Nashville, TN
 Information: AATCC
 Phone: (919) 549-8141

IS&T 12th INTERNATIONAL CONGRESS

Oct. 27 - Nov. 1

Advances In Non-Impact Printing Technologies

Hyatt Regency San Antonio

San Antonio, TX

Information: IS&T Conference Manager

7003 Kilworth Lane

Springfield, VA 22151

Phone: (703) 642-9090

Fax: (703) 642-9094

email: imagesoc@us.net

CMG FALL CONFERENCE

Nov. 3 - 5

Color Marketing Group Conference

Sheraton Seattle Hotel & Towers

Seattle, WA

Information: Katie Register

Phone: (703) 329-8500

Fax: (703) 329-0155

IS&T FOURTH COLOR IMAGING CONFERENCE

Nov. 16 - 23

Color Science, Systems & Applications

Radisson Resort

Scottsdale, AZ

Information: IS&T Conference Manager

7003 Kilworth Lane

Springfield, VA 22151

Phone: (703) 642-9090

Fax: (703) 642-9094

ASTM COMMITTEE D-20 ON PLASTICS

Nov. 18 - 21

New Orleans, LA

Information: Mrs. Katherine Morgan

Phone: (215) 299-5529

1997**ASTM COMMITTEE D-1 ON PAINT**

Jan. 26 - 29

Fort Lauderdale, FL

Information: Scott Orthey

Phone: (215) 299-5507

ASTM COMMITTEE E-12 ON APPEARANCE

Jan. 26 - 29

Fort Lauderdale, Florida

Information: Bode Buckley

Phone: (215) 299-5599

Fax: (215) 299-2630

TAGA ANNUAL CONFERENCE

May 4 - 7

Technical Association of the Graphic Arts Annual Technical Conference

Montreal or Quebec City, Canada

Information: Karen Lawrence

Phone: (716) 475-7470

SID '97

May 12 - 16

Boston, MA

Information: Lauren Kinsey

SID

1526 Brookhollow Drive, Suite 82

Santa Ana, CA 92705

Phone: (714) 545-1526

Fax: (714) 545-1547

email: socforinfodisplay

@mcimail.com

COLOUR '97

May 26 - 30

8th AIC Quadrennial Meeting

Colour '97 Executive Committee Meeting

May 25

Kyoto International Conference Hall (KICH)

Kyoto, Japan

ISCC ANNUAL MEETING

Sep. 14 - 17

Inter-Society Color Council Annual Meeting with Color and Appearance Division of Society of Plastics Engineers

Newport, RI

Information: Gary Beebe

Phone: (215) 785-8497

AATCC CONFERENCE AND EXHIBITION

Sep. 28 - Oct. 1

American Association of Textile Chemists and Colorists

Marriot Marquis

Atlanta, GA

Information: AATCC

Phone: (919) 549-8141

1998**TAGA ANNUAL CONFERENCE**

May 3 - 6

Technical Association of the Graphic Arts Annual Technical Conference

Chicago, IL

Information: Karen Lawrence

Phone: (716) 475-7470

SID '98

May 17 - 22

Anaheim, CA

Information: Lauren Kinsey

SID

1526 Brookhollow Drive, Suite 82

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Fax: (714) 545-1547

email: socforinfodisplay@mcimail.com

AATCC CONFERENCE AND EXHIBITION

Oct. 12 - 15

American Association of Textile Chemists and Colorists

Convention Center

Charlotte, NC

Information: AATCC

Phone: (919) 549-8141

2000**SID 2000**

May

Toronto, Ontario

Canada

Information: Lauren Kinsey

SID

1526 Brookhollow Drive, Suite 82

Santa Ana, CA 92705

Phone: (714) 545-1526

Fax: (714) 545-1547

email: socforinfodisplay@mcimail.com

ASTM COMMITTEE E-12 ON APPEARANCE

Jun. 16 - 18

Saint Louis, MO

Information: Bode Buckley

Phone: (215) 299-5599

Fax: (215) 299-2630

AATCC CONFERENCE AND EXHIBITION

Oct. 4 - 7

American Association of Textile Chemists and Colorists

Convention Center

Philadelphia, PA

Information: AATCC

Phone: (919) 549-8141

1999**TAGA ANNUAL CONFERENCE**

May 2 - 5

Technical Association of the Graphic Arts Annual Technical

Conference

Philadelphia, PA

Information: Karen Lawrence

Phone: (716) 475-7470

SID '99

May

California

Information: Lauren Kinsey

SID

1526 Brookhollow Drive, Suite 82

Santa Ana, CA 92705

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J O B S W A N T E D !

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

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

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

WE EXTEND OUR
CONGRATULATIONS TO
JASON GIBSON
ON HIS NEW
JOB WITH
HEWLETT
PACKARD!



JOB WANTED

Phil Q. Jin,
The University of Chicago, 939 East 57th Street, Chicago, IL
60637
ph.: (312)702-1987 (lab) or (312)363-7919 (home)
fax: (312)702-4442
e-mail: jinq@midway.uchicago.edu

Ph.D. in Color Vision (03/95), MS in Color Science/Optics,
interested in obtaining a professional position doing re-
search, development, or marketing in color science and/or
optics. Fluent in Chinese and English. Experienced in color
vision, psychophysics, colorimetry, photometry, statistics,
UNIX, C, image display programming. Permanent resident of
USA.

ISCC NEWS EDITOR Michael A. Hammel

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

Editor, ISCC News • Michael A. Hammel • 3782 Bonny Rigg Trail, Roswell, GA 30075

Please send all other materials on diskette as follows to the above address:

MS DOS-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).

E-mail:

Internet: hammel@gvu.gatech.edu (or) MCSL@rit.edu

CompuServe: 75664,1567

If necessary, fax material to (404) 587-5128

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



meeting reports



photos



contributions from members

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Pres. Elect	Dr. Ellen C. Carter	2509 N. Utah Street, Arlington, VA 22207	(703) 527-6003	
Secretary	Dr. Danny C. Rich	Datacolor International, 5 Princess Rd., Lawrenceville, NJ 08648	(609) 895-7427	(609) 895-7461
Treasurer	Mr. Daniel S. Walton	Color and Appearance Technology P.O. Box 3709, Princeton, NJ 08543	(609) 734-0300	(609) 734-0245
Past-Pres.	Ms. Paula J. Alessi	Eastman Kodak Company, Rochester, NY 14650	(716) 477-7673	(716) 722-1116

LIST OF DIRECTORS

1993-1996

Mr. Gary E. Beebe	Ato Hass North America Inc., P.O. Box 219, Bristol, PA 19007	(215) 785-8497	(215) 785-4315
Mr. Joseph F. Campbell	DuPont Marshall Laboratory, 3401 Grays Ferry Ave., Philadelphia, PA 19146	(215) 339-6039	(215) 339-6008
Dr. Robert T. Marcus	Pantone Inc., 590 Commerce Blvd., Carlstadt, NJ 07072	(201) 935-5500	(201) 896-0242

1994-1997

Mr. Michael A. Hammel	3782 Bonny Rigg Trail Roswell, GA 30075	(404) 587-5120	(404) 587-5128
Mr. Richard W. Riffel	ColorTec Associates, Inc., P.O. Box 386 Lebanon, NJ 08833	(908) 236-2311	(908) 236-7865
Mr. William S. Vogel	10013 Sagefield Dr., Baton Rouge, LA 70818	(504) 261-7107	

1995-1998

Dr. Mark Fairchild	RIT Munsell Color Science Laboratory, P.O. Box 9887 Rochester, NY 14623	716 475 2784	716 475 5988
Mr. Ronald Oldchurch	1680 N. Hwy 101, #11 Leucadia, CA 92024	619 943 7029	619 943 7029
Prof. Wade Thompson	1910 East Cardinal St., Springfield, MO 65804	417 836 6694	417 883 5830

ISCC MEMBER-BODIES

American Association of Textile Chemists and Colorists (AATCC)	Graphic Arts Technical Foundation (GATF)
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American Society for Testing and Materials (ASTM)	Illuminating Engineering Society of North America (IESNA)
American Society of Interior Designers (ASID)	National Artists Equity Association (NAEA)
American Society for Photogrammetry and Remote Sensing (ASPRS)	National Association of Printing Ink Manufacturers (NAPIM)
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Color Marketing Group (CMG)	Society for Information Display (SID)
Color Pigments Manufacturers Association (CPMA)	Society of Plastics Engineers, Color & Appearance Division
Detroit Colour Council (DCC)	Society for Imaging Science and Technology (IS&T)
Federation of Societies for Coatings Technology (FSCT)	Technical Association of the Graphic Arts (TAGA)
Gemological Institute of America (GIA)	Technical Association of the Pulp and Paper Industry (TAPPI)

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Pantone Color Institute
Color and Appearance Technology

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