

# Inter-Society Color Council *News*



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*Hugh Fairman, now Past-President, ISCC, passes the gavel to Ms. Paula Alessi, President, ISCC.*

## WELCOME PRESIDENT ALESSI!

**ROLAND L. CONNELLY**  
NEW PRESIDENT-ELECT

It is with great pleasure that the ISCC announces its new officers and directors. Paula Alessi of Eastman Kodak, Rochester, New York assumed the Presidency in June 1992 for a two year term. Roland Connelly will serve the same term as President-Elect. Reelected as Secretary was Danny C. Rich of Datacolor International, Lawrenceville, New Jersey, and as Treasurer - Phillip S. Hunter of Hunter Associates Laboratory, Reston, Virginia. Also, elected for three year terms, were three new directors: Michael H. Brill of Science Applications International, McLean, Virginia; Robert Chung, of Rochester Institute of Technology, Rochester, New York; and Joel Pokorny from the University of Chicago, Chicago, Illinois.

## ISCC NICKERSON SERVICE AWARD PRESENTED TO BONNIE K. SWENHOLT

President Fairman, Friends in the ISCC:

When I had the honor of receiving the first ISCC Service Award nine years ago—it wasn't known as the Nickerson Service Award then—I had no idea that so many of my dear friends would subsequently share that honor with me. Today, at the Awards Luncheon of the 61st Annual ISCC meeting, it is my pleasure to present to you the eighth and latest of these honorees, Bonnie K. Swenholt.

After receiving a B. Sc. in Physics at Florida State and a M. Sc. also in Physics at Northwestern, Bonnie Swenholt joined Eastman Kodak in 1948. There she worked with Ralph Evans in the Visual Research Studios. Later she was supervisor of the Physical Laboratories in the Photographic Technology Division. I first knew Bonnie through her outstanding papers with Ralph Evans on the perception of color and her shepherding through publication of Evans' posthumous book of the same name in 1974.

In the ISCC, Bonnie was always there,



*Nickerson Award presented to Ms. Bonnie Swenholt (center). Left, Hugh Fairman, now Past-President, ISCC; right, Dr. Fred W. Billmeyer; right front, Ms. Paula Alessi*

willing and ready to do whatever jobs had to be done and done right. In the early 1970s, Bonnie chaired the project committee on the Color Aptitude Test. She was a candidate for President- Elect

in 1979, but instead served as a Director from 1979 to 1982. During this period, she undertook the responsibility of Arrangements Committee Chairman, and did such a good job that nobody can remember exactly how many excellent meetings she was responsible for. She was chairman of the IMG Delegation in 1987, and in that same year she began her most recent service to the Council, that of Editor of the ISCC News. After four years she regretfully gave this task up when she retired from Kodak. Now she and husband Jack are enjoying retirement in Florida, and we are happy to have her here with us today.

Mr. President, it is with great pleasure that I give you Bonnie K. Swenholt as the 1992 recipient of the ISCC Nickerson Service Award.

*Dr. Fred W. Billmeyer, Jr.*



*Norm Burningham (right), receives from President Fairman (left), a Certificate of Appreciation for his service on the Board of Directors*

## MACBETH AWARD

Presented to Dr. Jozef Cohen at the 1992 Annual Meeting In Princeton, New Jersey

Every other year, in even numbered years, the ISCC recognizes a person who has made one or more outstanding contributions in the field of color by presenting to that person the Macbeth Award.

In 1972 the Macbeth Award was established in honor of Norman Macbeth Sr., a founding member of the ISCC and the founder of the Macbeth Lighting Corporation. So this is the twentieth anniversary of the presentation of that first award. The award is to recognize a member or former member of the ISCC for a recent contribution in the field of color. The contribution shall have advanced color either directly by practical development or indirectly by an outstanding dissemination of knowledge about color by writing or lecturing.

It is a pleasure for me to be allowed to introduce this year's recipient of the Macbeth Award—Jozef Cohen. Who's Who in America identified Dr. Cohen as an educator and a psychophysicist. It is true that he recently retired after teaching at the University of Illinois for over 40 years and that he is author of the Eyewitness Series in Psychology. It is also true that those of us in the color field know him as the Father of Matrix-R, a psychophysicist. However, I believe Jozef is first and foremost a scholar — interested in the discovery, understanding, and sharing of ideas— and that is a calling from which one does not retire.

My personal experience with Dr. Cohen may help illustrate what I mean. Actually, when I think about it carefully, I first met Jozef Cohen face to face just about 2 years ago when I traveled to Champaign-Urbana to join in a weekend colloquium that Jozef had organized. Each attendee informally shared something interesting that they had been studying—the fields and topics were diverse with some common threads. Everyone left with new insights; new ideas were shared and understood.

Although our actual meeting was recent, I feel as if I have known Jozef Cohen for many years. Quite some time ago I heard vague comments about something which I considered new, strange, and yet very interesting — Matrix R. So I wrote to Jozef for more information, and that began the process. Again, as is so typical of Jozef, he was willing to share information and patiently explain ideas again and again for people like me who were not prepared mathematically to grasp the concepts quickly.

The Macbeth Award is for a recent contribution to color. I would say that Matrix R was born in roughly 1975, but ideas like people must have time to grow and develop. It is just now coming of age. It started as a spectral decomposition theory applied to metamers. However, recently the number and breadth of applications has been growing. Some examples include Hugh Fairman's presentation this morning, an article on color correction of CRT displays using principle component analysis by Vrhel and Trussell soon to be published in



President Fairman (right) presents Jozef Cohen (left) with the Macbeth Award

Color Research and Application, and even applications in the field of mechanics. Matrix R is founded in basic mathematical formulations that allow communication among scientists well beyond the discipline of color. Thus the interchange of ideas and concepts through many scientific fields has been facilitated, and all those involved have gained from the exchange.

Without further ado, I present to you, Mr. President, ISCC members, and guests, the recipient to the Macbeth Award. Jozef Cohen. Let us give him a warm welcome.

*Dr. Ellen Carter*

### Jozef Cohen's Commentary on Receiving the Macbeth Award

I have enjoyed a long University career, some 45 years, and I have taught many courses other than Sensation and Perception, the standard offering for color vision. In fact, I confess that color vision has almost no appeal to the general student, and my usual enrollment was about 1.3 students each semester. This did not please the University, because it cares not what is taught but only that the instructor/student ratio is favorable—very favorable. Accordingly, I taught another course, the History of Ideas, a collection of all the wonderful things that I had found interesting in the University Library. This course was popular indeed, and I wrote a whole series of small books on many subjects, including Thinking and even one on Sigmund Freud and his psychoanalysis. This small book, and I hold a copy in my hands, sold many thousands of copies; although written twenty years ago, the Spanish edition still remains in print, published in Mexico City.

In my course on the history of ideas, we eventually dis-  
*continued next page*

## Jozef Cohen's Acceptance Speech, continued from previous page

cussed the sociology of science, and the manner by which new ideas are introduced and perhaps subsequently accepted by the scientific community. We have many volumes on this topic, but the most famous is Thomas S. Kuhn's *The Structure of Scientific Revolutions*, published by the University of Chicago Press. In Kuhn's book, we find, with exquisite documentation, the vivid descriptions of the resistance manifested by the scientific community when a new or novel construct is introduced. Scientists, wrote a distinguished Nobel Laureate, never change their intellectual postures; they just die. This resistance, of course, has been discussed by many historians of science, and Professor E. G. Boring (I knew him, and was he ever!) referred to the controlling group (at any given time) as the orthodox group, and to the external individual or external group as the unorthodox. Kuhn presented fragments of advice to the unfortunate unorthodox group — try to show that the new paradigm, the word used by Kuhn for this purpose, can solve the unsolvable, or that the paradigm is more succinct than those accepted by the orthodox group.

Examples of unorthodox individuals abound. The most interesting, I believe, was that marvelous colorimetrist of the nineteenth century — Hermann Gunther Grassmann, who is remembered, of course, for Grassmann's Laws in present-day colorimetry and well-known to all of us. Grassmann was a high school teacher, as we would say now, was trained in theology, and had studied no formal mathematics at the University level. (Grassmann, whom I so admire, was also a Sanskrit scholar and a political activist — with eleven children.) Grassmann had inspected Helmholtz' published findings concerning experiments on complementary spectral color stimuli, and had found but a single complementary pair. By mere mathematical manipulation, Grassmann concluded that Helmholtz must be wrong, that every spectral color stimulus

must have a complementary of some sort.

Helmholtz made further experimental inquiry, and indeed Helmholtz was wrong. I could speak about Grassmann for a long time, for he is one of my favorite people. I tend to identify with this sort of individual. We should note that Grassmann wrote a most advanced mathematical text, with a complex German title that may be translated as "The Theory of Extensions", which was published by Grassmann. No one, not even Gauss himself, understood the work, and no one showed even cursory interest.

After an approach by Grassmann, Gauss suggested that Grassmann review the book himself, and indeed did write his own review — probably the only instance of an author describing his own book because no one could or would understand it. Grassmann sold no copies, and the remainders were burned. Nevertheless, the book remains one of the great watersheds of scientific history, introducing such concepts as vectors themselves, the scalar and vector products between vectors, now known to thousand of students studying linear algebra each year, and who have no difficulty whatever. These vector operations are absolutely essential to the development of Matrix-R operations, those that have brought me here today.

Grassmann wrote a second edition of his great work, and it also was self-published. And no one understood or purchased that edition either. While no one accepted Grassmann's book 150 years ago, many editions have since been published and you can buy the book today, as for example, from Chelsea Publishing in New York.

Historians of science, however, have failed to discuss an aspect of behavior that makes the attrition of the unorthodox group extremely persistent. Psychologists, who are supposed to study the behavior of organisms, have few findings that, as it seems to me, are worth anything. However, B. F. Skinner, the arch-behaviorist, con-

firmed what we have always known. When a pigeon pecks at a white stimulus, the pigeon can be positively reinforced (or rewarded, as my grandmother would say — Skinner always avoided the word). For example, we have continuous reinforcement when the pigeon receives a corn-pellet following each peck peck. This gives one level of response frequency. Then we have so-called random reinforcement, where the pecks followed by corn-pellets are designated by a table of random numbers. By logic, we would conclude that the reduced random-reinforcement would produce greatly reduced frequency response. Strangely, this is not true. Random reinforcement actually produces an enormous increase in frequency response. New Jersey is a gambling state, and we have all observed people playing slot machines, in all those gambling casinos, and they play and play because they are randomly reinforced.

When I introduced Matrix-R operations, now so many years ago, my reception was precisely as predicted by Kuhn — but far more violent than I had expected. However, I had a secret weapon, because I had a series of people and events, occurring randomly, that were positively reinforcing, and this produced a far greater output than if I had been continuously reinforced.

I had been seeking a vector configuration (for color mixture data) that would remain invariant under transformation or, stated differently, was independent of the three arbitrarily selected reference primaries. I began this line of thought when I was an undergraduate, as it seems, during the Revolutionary War. I was totally dissatisfied with the arbitrary vector configurations that were the basis of each color theory; each theory brought a different vector configuration. I sought a configuration that would not rest on the whim of the investigator. By my view, the configuration had invariant and created by God (the Great Clock Maker), and it was my business to find it.

The first of my secret weapons, the first positive reinforcer, was in the

person of Clarence H. Graham, who had been offered the Headship of my Department. During his visit to Illinois, I outlined my thoughts, and he was very supportive. Eventually, Matrix-R operations solved easily a problem with which he had great difficulty, the transformation matrix transforming one set of color matching functions to another. Alas, Graham did not accept the position at Illinois, but if he had, my professional life would have been much easier. Graham is now deceased, but I do wish that he were here now.

Then came Constantine Trahiotis, a colleague at the University of Illinois, on whose blackboard I spontaneously wrote the basic equation for Matrix-R [ $A(A'A)^{-1}A' = R$ ]. I was soon able to prove that the identical Matrix-R could be derived from ANY set of linearly independent color matching functions. Although I had a proof, it was still amusing to take this or that set of color matching functions and by computer operations, derive the identical Matrix-R. Trahiotis came into my office and wrote GIMRO on the blackboard. What's GIMRO? Trahiotis replied: "Garbage In, Matrix-R OUT." Trahiotis is in the audience now, having come all the way from Connecticut to be with us on this afternoon. It all began in his office.

I then acquired a young colleague, Thomas F. Friden of the University of New Mexico, and in a story too emotional to be described here, he suffered a most untimely death — which may be traced to his interest in Matrix-R.

I was then brought to the office of Paul Guy in a suburb of Chicago. He was and is Vice-President of Research in Shawk, Inc. (then, Shawkgraphics, Inc.). Guy thought Matrix-R to be of great interest, and he arranged for me to speak at the TAGA meetings in Philadelphia. Some individuals in that audience are here today.

A preliminary paper on Matrix-R was published in the TAGA proceedings, and this has become somewhat of a collectors item. Once again printers, who have been at the very core of the advance of civilization, were ahead of

their time. There is a marvelous volume in the University Library, *Books Lethal to their Authors*. I propose to sometime do another, *Books Lethal to their Printers*; at one time, printers were required to have an imprimatur, a license to publish — the ultimate censorship. No matter, printers continued to print with or without a imprimatur.

Finally, I was able to give talks on Matrix-R at the Illinois Institute of Technology and at the University of New Hampshire. After the New Hampshire address, I met a young man who had taken a bus from MIT to hear the talk in another state. His name was and is Michael Brill, who is in the audience now. That was 17 years ago, and Brill has since published on Matrix-R operations.

Still and all, Matrix-R was going no place. It was an invariant, but so what? I knew that modern physics embraces invariants, and that was certainly of interest. I was constantly asked the question: "What good is it?" I could only recall that Gladstone, Prime Minister of England during the nineteenth century under Queen Victoria, had once visited Faraday to observe simple manifestations of electrical currents. Gladstone, as might be expected, asked "What good is this electricity?" and Faraday responded: "Sir, one day you will tax it."

There Matrix-R stood, with all its invariance, when the great moment of mental illumination stood. This moment of illumination has often been described in the literature, by Galileo and by Hamilton, for example. I was daydreaming, which I do rather well, when I realized that Matrix-R was going to solve Wyszecki's metamer problem directly.

Gunter Wyszecki, whom I consider to be the greatest colorimetrist of this century, had made a fascinating proposal — now called the Wyszecki hypothesis. Therein, he prosed that every color stimulus comprised two parts — the fundamental that was processed by the visual system and the metameric black (now called the residual) that was ignored by the visual system. All

members of a metameric suite had the same fundamental, but each had a different metameric black; this accounted for metamers. The literature did tell of methods for generating suites of metamers, but we have shown that almost all are special cases of Matrix-R. (The remaining methods are essentially iterative.)

Given two metamers, one subtracted from another gave a metameric black, and the metameric blacks so obtained, when added to any radiometric function (with its own metameric black) gave another metamer. Wyszecki had isolated metameric blacks, and he had generated metameric suites. Nevertheless, he was unable to resolve a given color stimulus into its fundamental and residual. Indeed, Wyszecki had never seen even a single isolated fundamental and therein presented the question of questions.

I believe that the essential ingredient of the scientific method is not the solution of a problem, but the statement of the right questions. While I did solve the Wyszecki problem, the true genius belongs to the individual with the insight to pose the problem.

So said Gertrude Stein, in one of her essays. Given any radiometric function, I realized that simply premultiplying Matrix-R, would "kick-out" the metameric black, and and give the fundamental directly. Here was a perfect analogy to the visual system. The metameric black might then be obtained by the subtraction of the fundamental (obtained by Matrix-R) from the radiometric function.

I carefully put Wyszecki's some of Wyszecki's favorite metamers on the computer (I was using a mainframe at the time), premultiplied by Matrix-R as required, made the appropriate subtractions, and everything was exactly as predicted. What to do with this information.

Did Wyszecki know this? Accordingly, I wrote a letter to Wyszecki asking if he knew of any mathematical process by which the fundamental might be isolated. He answered that he did not, and knew of nothing in the literature.

## Jozef Cohen's Acceptance Speech, continued from previous page

Accordingly, I tore off the last page of my printout showing the results of the resolutions, and seeming to emulate Fermat with respect to his last theorem, I wrote: "I know how to resolve ANY radiometric function into its fundamental and metameric function, but there is not enough room on the paper for me to describe the process or to give the proofs."

Soon, Wyszecki was on the phone, asking how this was done. I explained that my wife, Huguette, and I would be vacationing in Canada in about six weeks, and I would call at his office and explain. We did go to Canada, I did see Wyszecki and I did demonstrate the Matrix-R process. Alan Robertson, who was at most of this meeting, is presently seated to my right. This, ladies and gentlemen, was the turning point.

I returned to the University, and found a new colleague in William E. Kappauf, and together, we wrote two long papers in *The American Journal of Psychology*. With respect to the second paper, Kappauf used a 300x300 Matrix-R to locate three spectral orthogonal color stimuli — and these to extremely close tolerances, for both the 1931 and the 1964 data. These had not been located before, although the literature had reported intense searches. On the next morning, Kappauf died of a heart attack. I was obliged to write and illustrate the second paper by myself. That paper was translated into Chinese by Professor Dong and published in China.

I visited Dr. Wyszecki several times. Our last meeting was very strange, because I was dying of a heart attack (I kept placing nitroglycerin tablets under my tongue) and Wyszecki was dying of Leukemia, as I now know. Nevertheless, we thought that it would be appropriate if we both authored a book on Matrix-R. I returned to Urbana, for open-heart surgery, and although was extremely ill for a long time, I did recover — as you can see. I had the perhaps unscientific view that mere will-power would bring deliverance from disease, even fatal

disease, and I kept encouraging Wyszecki to beat the odds. In one instance, I did manage to get him on the phone, and when I told him that he was obliged to recover so that we could do that book together, he replied: "Try to do it yourself." Gunter Wyszecki died soon after, and therein Matrix-R suffered a catastrophic setback. I am trying to do the book myself.

Quite early on, Ellen Carter, sitting on my right, became virtually certain that Matrix-R would solve the metamer problem, and spontaneously she wrote a letter to the Committee of Metamerism of the ISCC. A copy of that letter is in my possession and quite likely, the original is still in the files of the ISCC Committee.

All of this caught the attention of Rolf Kuehni who arranged a true-blue Matrix-R conference at the Rochester Institute of Technology. Hugh Fairman read a paper that solved a hitherto insoluble problem posed by the then National Bureau of Standards, a paper that has since appeared in *Color: Research and Application*. He has published several other papers, and headed a Committee on Matrix-R standard notation and nomenclature, and this also has appeared in the literature. Michael Brill also read a paper at that meeting. I also received the most lyrical letters from William Thornton following the meeting, and those were reinforcing indeed.

Throughout all this, Fred Billmeyer always thought that there was at least something in the Matrix-R proposal. He was, as you know, the founding Editor of CR&A, and although he did not initially accept my papers, he invariably encouraged perseverance. When, finally, I wrote a long paper for CR&A he was a reader and wrote: "The author is to be congratulated on writing this paper, and the journal is to be congratulated on receiving it." That takes great courage, and Dr. Billmeyer is at this table today.

There was some publicity at the University, and when the Department of Physics had a cancellation of its

weekly speaker, they turned to me and Matrix-R. The problem had now grown to great complexity, and was not easily understood — because of great confusion between a color stimulus and a color sensation.

Nevertheless, in the vast audience, there were two staff members from the Department of General Engineering: Scott Burns and Edward Kuznetsov. Independently, and I emphasize independently, they requested semi-private discussions of Matrix-R operations. This was the beginning of a wonderful collaboration that resulted in two articles in CR&A. As I worked in the General Engineering building, with these super brains, I often wondered what I was doing there. These people were highly trained in modern mathematics, and I had not had a University course in mathematics beyond freshman algebra fifty years ago.

Throughout everything, I had a colleague in the Department of Speech and Hearing, Robert Bilger, who is a foremost expert in hearing. Bilger and his wife, Lynn, are in the audience now, having traveled all the way from Illinois for this occasion. Bilger was always encouraging. I once asked why he was so encouraging, when in truth, he was entirely unacquainted with color theory or matrix operations. He answered that he was confident because he knew me. He had many hours of conversation with me and concluded that I, who had been critical of everything including my own work, would not exaggerate. I could be trusted implicitly and explicitly. Of course, my wife Huguette S. Cohen, bore up through everything. She bore up through everything, especially during the years when I received no salary raise whatever. Nevertheless, Huguette never suggested even once that I stop work on Matrix-R and act like an ordinary professor. Clearly, I married the right person.

Now, the last point. Is it too late? After all, I am retired, and shall never again file that curse of academia, the annual progress report. I may do as I please, but additional Matrix-R contributions will not bring a salary raise nor

## 1992 REPORT

ISCC Interest Group II: Appearance, Vision, & Modeling  
Co-Chairs: Mark D. Fairchild & Paula Alessi

ISCC Interest Group II, Appearance, Vision, & Modeling met Monday morning June 22, 1992 during the AIC/ISCC joint meeting in Princeton, NJ. This year, Interest Group II held a session of contributed presentations entitled "Recent Advances in Color Appearance Specification." The goal was to take advantage of the many international guests in Princeton for the CIE and AIC

*Jozef Cohen, from previous page*

will I ever be offered a position at another University.

Here is a story that I read in *Le Monde*, a Parisian newspaper. In 1926, an early French movie maker by name of Gonce made a spectacular film concerning the life of Napoleon Bonaparte. The film was never released, for the film was silent and sound had come. The American movie maker Francis Ford Copolla found a print withering in a vault in Paris. Copolla restored the film and and his wife wrote a musical soundtrack.

Copolla exhibited the film in Radio City Music Hall to 6000 members of the community of motion picture arts and sciences. When the five-hour film was concluded, the 6000 member audience was on its feet in seemingly unending applause. As it happened, Gonce was still alive in a Parisian home for the elderly. Copolla had an overseas telephone line to Gonce. Copolla said: "Listen, 6000 people are cheering your film." Gonce listened for a while and said: "Too late! Too late!" Gonce listened for a few more minutes and said: "Well, it's NEVER too late." Yes, Monsieur Gonce, it is Never too late.

We are all familiar with Yoga Berra's contribution to American Culture: "It ain't over until its over." I shall extend that and say, "It ain't over even when it IS over."

Today I receive an honor that I considered so unlikely, that it never entered my fantasy life. I am beholden to all of you. I shall try to deserve it.

*Jozef Cohen*

meetings and provide a forum for researchers in the area of color appearance. The response to Interest Group II's call for papers was excellent — resulting in a full agenda and the need to extend the meeting an extra 1/2 hour beyond its original time allotment. Nine presentations were made on a wide variety of topics related to the specification of color appearance.

The morning began with a presentation by Fred Billmeyer on "ASTM Documentary Standards on Color and Appearance Measurement" in which the relevant current ASTM documents and their contents were reviewed. This was a good opportunity for international participants to learn about ASTM activities. Next, Uri Feldman of MIT presented "Quantifying the Experience of Color" co-authored by Nathaniel Jacobson and Walter Bender. This work was a series of psychophysical experiments aimed at quantifying observers' responses to various combinations of colored stimuli stressing the relationships between colors in the stimuli and how this analysis might be applied to color reproduction. Yan Liu of the Gemological Institute of America presented "A Non-Color-Constancy Phenomenon: The 'Alexandrite Effect' in Gemstones" with co-authors J. Shigley and E. Fritsch. This effect, caused by rather unique absorption properties in certain gemstones, results in a change in color appearance by as much as 180° in hue angle upon a change from daylight to incandescent illumination. Examples of the effect, and methods of quantifying it were presented. Actual gemstones exhibiting the effect were brought along to convince anyone doubting the photographic illustrations. Cynthia A. Brewer of San Diego State University presented "An Extension of the Hunt Model of Color Appearance to Predict Simultaneous Contrast Effects on Computer-Displayed Map Colors." This work addressed a problem in the construction of color-coded maps in which certain

colors become confused due to simultaneous contrast with neighboring colors. The Hunt color appearance model was used to produce a system whereby map makers could avoid the use of potentially confusing colors. The next presentation was "Testing Chromatic Adaptation Models" by Elizabeth Pirrotta of RIT given by Mark Fairchild since the author was unable to attend the meeting. Mathematical comparisons of the predictions of various chromatic adaptation and color appearance models were presented along with the design of a new type of haploscopic experiment that will allow a quantitative comparison of model performance.

After a coffee break, the meeting resumed for the last 4 presentations. Tarow Indow of UC-Irvine presented "Metrics in Munsell Color Space, in the Large and in the Small" reviewing his extensive work on multi-dimensional scaling of the Munsell system. Next Paul Tannenbaum of DuPont presented "Chromatic Adaptation, Metamerism Indices: Another Point of 'View'" with co-author Chuck Reilly. This presentation reviewed the development of a modified version of CIELAB to better predict the effects of chromatic adaptation and provide a more useful determination of a metamerism index. Hugh Fairman of Armorguard presented "A Proposal for an Interchange Specification" in which he suggested that it might be useful to use orthogonal tristimulus for transmitting color image information and then reconstruct fundamental spectral distributions at the receiving end. The session wrapped up with a presentation on "Rayleigh Matching and Mismatching as Related to Color Appearance" by Lucia Ronchi of the Istituto Nazionale di Ottica, Florence in which the effects of chromatic adaptation on various visual matching tasks was discussed.

This interest group meeting, made up of a variety of contributions, seemed quite successful. We are open to suggestions for other meeting topics and/or formats. Interest Group II is currently looking for a co-chair to replace Paula Alessi as she assumes her role as ISCC president. Please send any suggestions for co-chairs, topics for future meetings, or anything else to Mark Fairchild.

*Mark Fairchild*

# ISCC MEETING REVIEW

Princeton, NJ June 21-24, 1992



The AIC/ISCC conference held at Princeton June 21-24, 1992 consisted of three interest groups and a series of invited and contrib-

uted papers. The conference encompassed a spectrum of topics.

## INTEREST GROUP I: MEASUREMENT AND COLORIMETRY

contained five talks centered around measurement predictions and improvement of measurements. New ceramic color standards have been developed for testing broadband instruments. Advancements have also been made for correcting for thermochromism. Research in the areas of fluorescent dyes and predictions of substrate color from solution measurements have shown successful results.

**INTEREST GROUP II: APPEARANCE, VISION AND MODELING** included nine talks ranging from the update of the ASTM manuals to several psychophysical experiments for quantifying visual effects as well as testing and using color appearance models.

While CIELAB is still useful for predicting visual effects such as the non-color constancy of Alexandrite,<sup>1</sup> the demand for testing and using color appearance models is quite evident. Researchers involved in applications such as choosing map colors whose appearance is affected by surrounding colors are already investigating color appearance models (revised Hunt) to choose distinguishable colors.<sup>2</sup> However, there are several color appearance models to choose from which give quite different computational results.<sup>3</sup> Testing of these models should give insight to which models best predict the appearance of colors. Analysis of results for Rayleigh matching may be useful for improving some of the parameters of

color appearance models in the areas of adaptive effects and brightness-luminance discrepancies.<sup>4</sup>

**ISCC SPECIAL INTEREST GROUP III** sponsored a discussion panel (George Brainard, Michael Brill, Louis Graham, William Thornton and Wade Thompson) on specific aspects of color in art, design and psychology. Among the topics discussed was the effect of lighting on night shift or extended shift workers. Current research by George Brainard suggests that not only is the type of illumination used important, but systematic variations in the level of illumination is important. In addition, the effect of color interiors for medical environments was examined. Presently, there is a scarcity of information on this topic and further research is definitely necessary.

Another interesting and noteworthy point raised during the panel was the extremely poor consistency of the colors used in some of the available color psychology tests. Specifically, Louis Graham presented his findings for his measurements of various sets of the Lüscher Psychological Color Tests. He found that the variability of the color chips for various sets of the Lüscher Test was significant. Graham concluded that if color psychology tests are to be used as serious tools, then it is important that commercial color tolerances be used to maintain the consistency of the colors used in the test for all sets of the given test. Finally, the communications gap between the artists and scientists was considered. Some of the panelists felt that it would be useful to develop some set of common vocabulary for communication between scientists and artists.

**ISCC INTEREST GROUP IV** met to discuss various aspects of color education. A number of presentations were given on a wide range of topics but the underlying theme for the morning was how to accurately teach color to art and design students. Brian Rose began with a slide show of a Hypermedia program he had written as a tutorial on human color vision. The interactive nature of the program allowed the

student to learn at his or her own pace and also at whatever level of detail the student felt comfortable. Next, William Thornton discussed the subject of illuminant metamerism. He elucidated the topic with demonstrations using a light booth. Evelyn Stevens then reviewed the Color Index and its use. Louise Stahl followed with a discussion of her experiences in teaching color to artists. She included in her talk a slide show of color artwork produced by her students. Finally, Nancy Howard gave presentation on a scientific approach to teaching color to designers.

**THE SESSION FOR THE CONTRIBUTED PAPERS** began with Hugh Davidson<sup>5</sup> taking the participants on a walk down the memory lane of instrumental color matching. The overview began with the beginnings of the CIE standards, the work of Kubelka and Munk, and the Hardy spectrophotometer and noted highlights up to the small, low cost instruments for color measurement used today. Henry Hemmendinger<sup>6</sup> continued the discussion of the accuracy of measurement instruments. Although the newer instruments may be small and fast, none beats the original Hardy instrument for accuracy. Hemmendinger challenged the manufacturers to improve instrument accuracy.

Roy Berns<sup>7</sup> changed the tone of the morning by discussing model predictions of different systems. Berns demonstrated that although there are differences between systems, such as a CRT's, thermal printers, and textiles, an underlying generic approach can be used to mathematically model these color systems. The two-step approach is to find the additive system for mixing and then characterize the relationship between the additive description of the color stimuli and the manner in which the user controls the color stimuli.

Tibor Illés<sup>9</sup> presented a model for the color matching problem based upon the Kubelka-Munk theory. Some of the advantages of the method were it could be implemented on a personal computer and there were no theoretical restrictions on the number of pigments that could be used. After the presentation there was

some debate as to whether others have already investigated the same mathematical methods.

THE SECOND SESSION of the AIC symposium on computer color formulation consisted of five speakers. Donald Andrade<sup>9</sup> started the session with a presentation on a method to determine absolute  $k$  and  $s$  values for use in the Kubelka-Munk equations. He explained how using a wavelength dependent  $k_2$  in the Saunderson equations would yield an absolute set of  $K$  and  $S$  values.

The second speaker, N. S. Gangahedkar,<sup>10</sup> spoke about the present state of computer color matching in India. He stressed that although great progress has been made over the past few years, there are still numerous problems and shortcomings with computer color matching. Next, Brian Lewis<sup>11</sup> presented a paper on a photometric approach for measuring the refractive index of opaque plastics. Two methods were described in detail and some experimental results were also included. Danny Rich<sup>12</sup> spoke next about the current state of numerical standards. He argued that the translucent blurring effect, non-uniformity, thermochromism, and hygrochromacy of numerical standards introduces significant random and systematic errors into the measurement process. Therefore, the numerical standards must be further improved in order to have better inter-instrument agreement. Finally, Robert Hirschler<sup>13</sup> discussed the newly formed SENAI/CETIQT, a textile industry training school and research center in Brazil. He talked about the resources, goals and activities of SENAI/CETIQT.

The symposium concluded with six presentations on Wednesday morning of June 24. Roland Connelly<sup>14</sup> began the day with a discussion of some of the more difficult problems of dye and pigment formulation. He examined in detail a few of the problems and reviewed some examples. Then G. Lucido<sup>15</sup> presented a paper on evaluating dyeing strength formulae by color

matching. The different methods of calculating strength were presented and the results of some experimental comparisons of the methods were also presented. Next, Daniel Spitzer<sup>16</sup> spoke about some recent advances in the colorimetry of paints. Some of the topics he discussed were automation of color technology, specialized color matching software, and multi-angle colorimetry. The fourth speaker, James DeGross<sup>17</sup> discussed the role of computer color formulation in the point-of-purchase paint market. He gave a history of these systems and ended his talk with future improvements which are currently being planned for these systems. Leonhard Oberascher<sup>18</sup> then gave a presentation on gravure printing and computer color formulation. Presently, there are numerous problems with this technology and there is still considerable research to be done on this topic.

Overall, the conference was very interactive and filled with various activities, even into and during the evening hours.

## References

1. Y. Liu, J. Shigley, and E. Fritsch, "A Non-Color-Constancy Phenomenon: the 'Alexandrite Effect' in Gemstones."
2. C. Brewer, "An Extension of the Hunt Model of Color Appearance to Predict Simultaneous Contrast Effects on Computer-Displayed Map Colors."
3. E. Pirrotta, "Testing Chromatic Adaptation Models."
4. L. Ronchi, "Rayleigh Matching and Mismatching as Related to Color appearance."
5. H. Davidson, "The Origin and Development of Instrumental Color Matching."
6. Dr. H. Hemmendinger, "Formulation to a Numerical Color Specification."
7. Dr. R. Berns, "A Generic Approach to Mathematically Modeling color Systems."
8. Dr. T. Illés, "A Non-Linear Programming Approach to the Color Matching Problem."
9. D. Andrade, "In Pursuit of Absolute  $K$  &  $S$  Values for Use in Kubelka's Hyperbolic Equations."

10. D. N. S. Gangahedkar, "computer color Matching: The Indian Experience."

11. B. Lewis, "Measuring Refractive Index - A Photometric Approach."

12. Dr. D. Rich and J. Jalijali, "Numerical Standards: Are the Materials Ready?"

13. Dr. R. Hirschler, "Spreading the Light: A Colorimetry and Colour Matching Centre for the Brazilian Textile Industry."

14. R. Connelly, "How to make Formulation Really Work - Special Techniques for the Textile Industry."

15. G. Lucido, K. Araujo, L. Almeida and R. Araujo, "Evaluating Dyeing Strength Formulae by Colour Matching."

16. Dr. D. Spitzer, "Innovations in Industrial Colorimetry of Paints."

17. J. DeGross, "Automation of Computer Color Formulation Systems for the Paint Point-of-Purchase Market."

18. Dr. L. Oberascher, "Gravure Printing - will Computer color Formulation Be Able to Help?"

*Nathan Moroney & Amy North, R I T*

## AUDIO CASSETTE COURSE AVAILABLE

"SCIENTIFIC COLOR MEASUREMENT AND CONTROL" BY AMERICAN CHEMICAL SOCIETY AND DR. EUGENE ALLEN

The American Chemical Society (ACS), an ISCC Member Body, has an audio cassette, authored by member Dr. Eugene Allen, available for purchase.

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## FROM THE EDITOR

### Thanks For Your Contributions

I wish to thank all those that are contributing information to this newsletter. Without their efforts we would not have the quality (and quantity) of information we have!

If anyone has information for the newsletter, please see the back page for information on how to get it to the editor.

When submitting minutes or complete articles for inclusion in the newsletter, please abbreviate them as best you can before submitting them.

### Electronic Bulletin Board

To facilitate the sending of information electronically, the ISCC News now has an Electronic Bulletin Board available for your use. It is currently sharing the FAX line at the editors office, so you must call (716) 223-1823 before attempting to upload. The system must be put on line manually when it is to be used. We do not have a dedicated line at this time.

The BBS is set for 300, 1200, or 2400 BAUD with No parity, 8 Bits, 1 Stop Bit. Be sure to put your modem program in this mode before calling the BBS.

Uploads can be done by using one of the following protocols: Kermit (preferred for Mac to PC transfers), Xmodem (Preferred for PC to PC transfers) or one of the Ymodem systems.

If this system is used and enough people ask for it, we can put it on line full-time, thus permitting the uploading and downloading of ISCC and related items, 24 hours a day.

Let us know if you like the idea and will use it!

*Ed.*

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## NEW MEMBERS

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

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## NEWS FROM PROF. T.-H. DONG, PEOPLES' REPUBLIC OF CHINA

*Early last April, I received a letter from old friend and ISCC member Professor Emeritus Tai-Huo Dong, of Zhejiang University, Peoples' Republic of China. I had not heard from him for a long time, and his letter explained this in terms of a serious illness and a remarkable recovery. In subsequent correspondence I persuaded Prof. Dong to let me share his letter with his many friends in the ISCC.*

*He wrote (I have corrected his English only minimally):*

"From the autumn of 1990, I often felt asthenia, asthma, fever and anemia, but no considerable influential symptom. Until the lower December, my health was suddenly collapsed and emergency admitted into the hematology ward of Second Affiliated Hospital of the Zhejiang Medical University, because after a bone puncture, the picture of my bone-marrow was accurately diagnosed that my symptom was "acute monocytic leukemia" (a kind of cancer in blood, a low survival rate disease) which is coded "M5b" by the international FAB system of leukemia. Leukemia is the world's 4th high mortality from disease! "In the whole hospitalized time, the principal chemical medicine for me was the intramuscular injection "arabinoside cytosine" (ara-C) and in the first three months, emergency period, I had been transfused a total amount of 4,000 cc. fresh blood. I also had been injected 100 pcs of 1,000,000 u. interferon in the early six months. My remissional period was begun at fifth month while both bone-marrow picture and hemogram were normalized and no leukemic cell could be found in the microscopic specimens. In the whole treatment time I was inspecting the bone-marrow picture once every month and hemogram once every 3-day to observ-

ing and monitoring the ill situation. From 5th month, I began to drink a solution made of Chinese traditional medicines continuously to now, because according to modern pharmacology, these medicines all contain rich organogermanium (rare element Ge 132) which is effectively to increasing the WBC [white blood count] and to depressing the disintegration rate of leukemic cell. In my whole treatment, no adverse phenomena had been occurred, a rare case in leukemia curing!

"By a final and whole examination, my blood, brain and all of my internal organs (involving the hematopoietic organ) all are in good condition and all are coinciding the gerontotherapeutics's demand. They have not been infiltrated by the leukemic cell. My blood natural Killer cell (NK) activity (to against the cancer virus by one's own energy) is 61% and T-cells are all in the standard parameters. My physicians are considering it is a marvel in curing a leukemic patient old man (76)—the therapeutic effect is so good, so rapid, and so clear! Then I was discharged from the hospital at the end of January 1992—just before the Chinese new year—ending my 14 months hospital life! By God's blessing, I have won the fight to leukemia! Of course, future cautions are still important! According to my own self curing experience, both non-worry mentality and cheerful mind are the effective medicines other than chemistry to any patient.

"From this March, my chief physician allowed me to do light work 4 hours per day and suitable physical exercise to reduce my body overweight... Now I am beginning to continuous drafting 'The colour specification & notation of Chinese colour system' which is a China state standard, for it's delayed by my sick

more than one year, therefore, I must draft it hurry up!

"Almost all old persons are often like to recall their previous pleasantly events when they were young and had done or realized, as well as they are also looking forward to their intimates in Happyful living....I have meeting many famous color scientists and obtaining their warmful friendship too, thus making the closed Chinese color science is understood by outside experts. As a Chinese old proverb says: good teacher and helpful friend are a happyful event in one's life. Of course, the friendship offering to me is a remarkable and memorable event in my academic and personal life for ever.

"The China color system in drafting will be one of RGB-D65-10°-0/45, all color chips are arranging in our own form. We have made about 1000 pcs of different color chip already (trial), their color difference are within 2 delta E....

"With my family's best regards to yours."

*Subsequently, Prof. Dong wrote (May 10); "Your warmful letter is an effective encouragement for me to fight the recovered leukemia in future 5-year observational period, especially the first year 1992-1993. I am still monitoring it by bi-week hemogram and bi-month injecting "ara-C" for 10-day (a treatment range)....I am much obliged to you that you will send a news about my illness and work to the ISCC News as your proposed context. Thanks!"*

*Please note, to those wishing to write, Prof. Dong's address is in the ISCC membership list, but the postal code (310027) is missing.*

*Fred W. Billmeyer, Jr.*

# REPORT ON CIE DIVISION 1, VISION AND COLOR

Princeton, NJ, June 1992



ISCC  
President Ms.  
Paula Alessi is  
the U.S.  
Member of  
the Division.

Each country has only one official member of each of the seven CIE Divisions.

The meetings were held in the Woodrow Wilson Conference center at Princeton University. They were scheduled to precede the 61st Meeting of the Inter-Society Color Council (ISCC) and the 25th Anniversary Meeting of the International Colour Association (AIC).

In its annual booklet, dated January 1992, the United States National Committee (USNC) lists the names of 23 Technical Committees (TC's) of Division 1. One was dropped in the course of the meeting and three new ones were formed. Not all TC chairmen held meetings at Princeton. Because of the wide diversity of activity in Division 1, chaired by Prof. Dr. Mitsuo Ikeda, Dept. of Architectural Engineering, Kyoto Univ., Japan, the TC's are divided into three sections: Vision, Colour and Visual Ergonomics. There are 6 TC's in the Vision section, chaired by Dr. Ir. Pieter Walraven, TNO Inst. voor Zintuigfysiologie, Soesterberg, The Netherlands. The 12 TC's in the Colour section are chaired by Dr. Alan Robertson, Institute for National Measurement Standards, National Research Council, Ottawa, Ontario, Canada, and the 6 TC's in the Visual Ergonomics section are chaired by Mr. Tetsuji Takeuchi, Matsushita Electric Industrial Co, Ltd., Lighting Research Laboratory, Osaka, Japan.

Two new reporters were established at this meeting; so there are now nine reporters in Division 1.

VISION Section, chaired by Dr. Ken Sagawa, Industrial Products Research Institute,

Ibaraki, Japan, in the absence of Walraven.

TC 1-21, Testing of Supplementary Systems of Photometry, Sagawa, JPN. The content of the technical report that will conclude the activity of the TC was discussed.

TC 1-23, Visual Acuity, Walraven, NDL. Inactive.

TC 1-26, Individual Variation of Heterochromatic Brightness Matching, Hirohisa Yaguchi, JPN. Gathering Data.

TC 1-30, Luminous Efficiency Functions, Ikeda, JPN. Various luminous efficiency functions were identified —  $V(\lambda)$ , the original photopic function;  $V_m$ , the Judd modification (CIE Pub 86);  $V_{b2}$  and  $V_{b10}$ , the heterochromatic-brightness 2 deg and 10 deg functions (Pub 75);  $V_p$  for point sources; and  $V'$ , the scotopic function. All but the two  $V_b$ 's can be integrated over their wavelength range. The report of the committee is complete with the exception of what to do about the 10 deg color matching  $y$  bar function. Should it be adopted as  $V_{10}$ ? Would this give discrepant photometric units? These questions are still to be answered. For point sources of 5 deg or less angular subtense one can forget about  $V_p$ . When completed, the report will be submitted for adoption as a CIE/ISO standard.

TC 1-36, Fundamental Chromaticity Diagram with Physiologically Significant Axes, Mrs. Françoise Vienot, FRA. Chairman not present. This TC was established in 1991 in Melbourne. It will hold its first meeting in Pisa, Italy, September 1992.

TC 1-37, Extension of  $V_m$  Beyond 830 nm. Proposed at Melbourne meeting, but no chairman was found. The Princeton meeting produced no discussion to support extension; so the proposed TC was abandoned thereby releasing the number 37 for future use.

Newest TC, TC 1-37, Supplementary System of Photometry, Sagawa, JPN. Established at the final session of

Div. 1 at Princeton, to recommend a system of photometry to assess lights in terms of their comparative brightness relationships at any level. The TC will be expected to select exact models to be used for the  $V_{b2}$  and  $V_{b10}$  functions, presumably including tables of data.

Proposed new TC: Critical Fusion Frequency. It is to investigate fundamental parameters affecting critical fusion frequency (CFF) for the evaluation of flicker in CRT displays. The TC needs a chairman and until then a number cannot be assigned.

Mr. Takaso, JPN, Department of Defense, will be asked to serve as a reporter for R 1-08, Color Appearance in Peripheral Vision.

## COLOUR (Robertson, CAN)

TC 1-09, Standard Sources for Colorimetry, Dietrich Gundlach, DEU. In the absence of chairman Gundlach, Heinz Terstiege (DEU) reported. There are no problems specifying D65 simulators or incandescent sources for instruments. However the specification of the illumination in color-matching booths is a problem because booth manufacturers have not provided spectral power distributions of the sources in their booths. The Executive Committee of Division 1 has asked Gundlach to complete the work of this TC within the coming year. Terstiege pointed out that daylight illuminants with spectral power distributions that are easier to simulate than those of the D series are vitally needed. He recommended that a reporter be appointed to study the problem and propose terms of reference. (A reporter was subsequently appointed. See R 1-09 at end of this section.)

TC 1-13, Colour Appearance Analysis, Michael Pointer, GBR. This committee has been studying color rendering based on chromatic adaptation. The objective was to select a chromatic adaptation model. Two chromatic models have been investigated, one proposed by Hunt, another by Nayatani and colleagues. A report has been written that will be submitted shortly to committee ballot, after which the committee will be discharged. Follow up TC's have already been

established to continue the work, namely 1-27, 1-32, 1-33 and 1-34. See material reported for these numbers.

TC 1-24, Field Trials of Television Illumination Consistency Index, R. White, GBR. Inactive.

TC 1-27, Specification of Colour Appearance for Reflective Media and Self-Luminous Display Comparisons, Paula Alessi, USA. The terms of reference and time frames were modified as follows:

1. Submit draft of "Guidelines for Coordinated Research on Evaluation of Colour Appearance Models for Reflection Print and Self-Luminous Display Image Comparisons" to CIE for approval. By September 1992 submit approved guidelines to Editor, Color Res. and Appl.

2. Investigate the suitability of various color spaces, such as CIELUV and CIELAB and their modifications, as well as the colour appearance models of Hunt and Nayatani, for their suitability for specifying a colour appearance match between a print and a self-luminous display.

TC 1-28, Parameters Affecting Colour Difference Measurement, Klaus Witt, DEU. Negative votes on the draft document were resolved and constructive comments were incorporated. Chairman Witt will prepare a revised draft for approval by committee members before sending it to Division 1.

TC 1-29, Industrial Colour Difference Measurement, David Alman, USA. This active committee has conducted an extensive study of color difference equations for evaluation of industrial color differences. The committee has developed modifications of CIELAB equations that are simpler to use than CMC. It intends to publish these provisionally recommended equations so that they can be used in field trials. There is concern that colorists in the textile industry may be reluctant to try new equations because CMC has been satisfactorily used by them for some time.

TC 1-31, Colour Notations and Colour Order Systems, Calvin McCamy, USA. The work of this committee started before the 1991 CIE

meeting in Melbourne, although the committee was not approved until that meeting. At Princeton, McCamy distributed 33 documents on the subject, and the contents of the most important ones were discussed. ISO/TC 187 on Colour Order Systems had asked CIE to recommend one or more color order systems for adoption by ISO as international standards. The ISO committee requested that the CIE committee deliver a final report by February 29, 1992. Without time to do more, McCamy formulated a draft and sent it to Robertson who forwarded it to Schanda. This draft was circulated to TC members. All early responses indicated approval, but in May strong negative responses were received from Sivik and Bristow (both SWE). The committee agreed to solicit material suitable for adding new sections to the document by September 30, 1992. Billmeyer, McCamy and Sivik are to prepare a draft to be circulated for ballot before the committee meeting to be held in conjunction with the AIC meeting in Budapest, Hungary, June 1993.

TC 1-32, Prediction of Corresponding Colours, Yoshinobu Nayatani, JPN. The chairman was not present, but a draft report has been completed documenting the results of field trials of the Nayatani chromatic adaptation transforms. Comments by Berns and Robertson are being prepared.

TC 1-33, Colour Rendering, Wolfgang Walter, USA. This committee is to revise the colour rendering recommendation in Pub 13.2, basing it on the chromatic adaptation transform of Hunt or Nayatani, whichever is eventually recommended by the CIE. Meanwhile, the committee is considering a number of areas, such as new test samples, relative weighting of hue, value, and chroma, avoidance of negative indices, averaging to obtain a general index, and use of fewer reference illuminants.

TC 1-34, Testing of Colour Appearance Models, Mark Fairchild, USA. Agreement was reached on a plan of work as follows:

1. Establish models to be tested:

CIELAB, CIELUV, LABHNU, Hunt, Nayatani, RIT model RLAB.

2. Collect surface-color data sets: Use Pirotta-RIT, and Mori and Luo if permission can be obtained.

3. Perform tests of models on available data. Mori and Luo will be expected to test their proprietary data. Other members will test RIT data.

4. Prepare guidelines for additional research to begin immediately.

5. Prepare a Technical Report by 1995.

TC 1-35, Selection of Light Sources for Colour Vision Examination, Stephen Dain, AUS. Just getting organized.

TC 1-38, Compatibility of Tabular Spectral Data for Computation Purposes, Calvin McCamy, USA. The terms of reference of this new committee are as follows: To prepare guidelines for tabulating CIE spectral data to promote compatibility of sets of data for computation purposes, considering such factors as spectral range, spectral interval, bandpass functions, truncation, interpolation, extrapolation and number of digits:

R 1-04, Colour Difference Evaluation, Thomas Maier, USA. Alessi read a report from Maier in which he cited 14 literature references on color difference evaluation from July, 1991, to date. This and his Melbourne report are expected to be published as CIE Research notes.

R 1-09 (New), Practical Daylight Sources, Joanne Zwinkels, CAN. The terms of reference are to investigate and report on the feasibility of a CIE recommendation on practical daylight sources for colorimetry. See Robert Hunt's Letter to the Editor, "Standard Sources to Represent Daylight," Color Res. & Appl., v 17, n 4, August 1992, p 293.

## VISUAL ERGONOMICS (Tetsuji Takeuchi, JPN)

TC 1-14, Lighting Effects on Vision, Peter Boyce, USA. Completing final draft of committee report.

TC 1-16, Lighting Needs for the Partially Sighted, Warren Julian, AUS.

*continued next page*

## REPORT ON THE FIRST MEETING OF ISCC PROJECT COMMITTEE 49, IMPROVED COLORIMETRY

A successful first meeting of ISCC Project Committee 49 was held at the ISCC Annual Meeting on June 21, 1992, in Princeton, New Jersey. There were approximately 50 present. The meeting was directed by Dr. W. A. Thornton, chair, and Dr. F. W. Billmeyer, Jr., co-chair.

Approved only the previous day by the ISCC Board of Directors, the committee addresses the need for further work to confirm and complement recently published studies by Thornton and others relating to discrepancies between visual and computed characteristics of light. Its scope includes documenting this need, studying the discrepancies experimentally, and finding avenues for the improvement of traditional colorimetry. Its ultimate objective is to arrive at a best set of new weighting functions, and a best brightness function, defining an improved colorimetry. Together with a program of work for the

committee, these were the main topics of discussion, covered under the six headings listed below.

1. Areas where traditional colorimetry fails. Dr. Thornton took examples from the lighting field, where those dealing with strongly metameric light sources often find that two sources with the same visual appearance have widely different computed chromaticities, and those with the same chromaticities have widely different appearances. These results are symptomatic of similar problems in color graphics, television, photography, and printing, all important fields involving strong metamerism.

2. How traditional colorimetry is meant to function. Very briefly, Thornton described how traditional (or, using Wyszecki's term, basic) colorimetry works. Spectral power distributions (SPDs) are determined for viewed lights. These are multiplied by weighting functions (color-matching functions,

CMFs) and summed over wavelength to obtain tristimulus values, which should be the same for pairs of matching lights. Calculation of chromaticity coordinates, plotting them in a chromaticity diagram, and calculation of luminance follow.

3. The new experimental results.

Thornton then described new experimental results from his laboratory, amplified in a comprehensive three-part article, "Toward a More Accurate and Extensible Colorimetry," now being published in *Color Research and Application*, vol 17, 1992, No. 2, pp. 79-122; No. 3, pp. 162-186; and No. 4, pp. 240-262. CMFs have been determined by observations with a visual colorimeter. This is coupled to a spectroradiometer and the SPDs determined for every light viewed and every spectral component in each field at match. Greatly improved sensitivity over the classical colorimeters has been achieved; for example, the need for a significant blue component in maximum-saturation visual matches at longer wavelengths was shown here but not detected by Stiles and Burch in the 1950s. It demonstrates that the traditional chromaticity diagram cannot be a straight line at those wavelengths. To date, three different, disparate primary sets and six observers have been used. Large errors in chromaticity computed by the 1964 CIE standard observer, and large errors in luminance as a correlate for perceived brightness, are found. For some primary sets, the chromaticity diagram "disintegrates." Transformations of primaries and the normalization of CMFs, essential to CIE colorimetry, are not supported by the new visual data. Many more results are described in the published article.

4. Avenues for improving traditional colorimetry. Thornton proposed the use of Maxwell-type rather than maximum-saturation CMFs. He suggested use of several primary sets (never done before) and averaging CMFs to reduce errors. He proposed a new correlate to perceived brightness, and a new, truly constant-brightness, chromaticity diagram.

5. Objectives of an improved colorimetry. Dr. Thornton said that the committee's objectives are to achieve practical results in the short term, based completely on new, accurate visual data.

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### CIE Division 1, from previous page

The Chairman is the former Secretary. He has the task of completing and publishing the final report begun by the late Chairman, G. Verriest. The 200-page report may be published as a book.

TC 1-17, Contrast Metric of Visibility, A. Korn, DEU. Final report, CIE Pub 95, "Contrast and Visibility," published (1992). TC disbanded.

TC 1-18, Disability Glare, Johannas Vos, NDL. Chairman preparing final draft of report.

TC 1-19 Specification of Visibility for Real Tasks, Werner Adrian, CAN. No report, except that Adrian has replaced M. Rae, USA, as chairman.

TC 1-25, Fundamentals of Discomfort Glare, M. J. Perry, GBR. Inactive.

TC 1-39, Discomfort Glare Experienced by the Elderly, Ms. Sueko Kanaya, JPN. Committee formed at this meet-

ing. It will survey published data and recommend maximum tolerances for older persons.

### CLOSING SESSION (Mitsuo Ikeda, JPN)

No liaison reports. Liaison officers to AIC and ISO committees were confirmed. Fred Billmeyer (USA) agreed to serve as liaison officer to ISO/TC 61, Plastics, which has an interest in color.

Next meeting of Division 1 is planned to precede AIC Congress, COLOR 93, Budapest, Hungary, June, 1993.

*This report for ISCC News is a condensed version of a report written by Fred W. Billmeyer, Jr., with input from Paula Alessi and others, for publication in USNC News. Harry K. Hammond III*

These results should be tested immediately in those fields and applications struggling with strong metamerism. The use of coupled spectroradiometer-colorimeters should be promulgated, and eventually more accurate (in terms of what is seen) commercial instruments should be developed for the measurement of color and brightness.

6. Program of work for the committee. Dr. Billmeyer closed this section of the meeting by outlining the following work program and time line.

(a) Examine current documentation (the Thornton article) of why an improvement to traditional colorimetry is needed, and assess what further documentation is required. Target completion date, December, 1992.

(b) Substantiate and extend the new visual data using coupled spectroradiometer-colorimeters.

(c) Where immediately possible, test the new data and conclusions in fields struggling with strong metamerism. Target completion date for (b) and (c), concurrently, December, 1993.

(d) Arrive at a best new set of weighting functions and a new brightness function, and apply them in a recommendation for an improved colorimetry. Target completion date, December, 1994.

The final part of the meeting was devoted to discussion from the floor.

There had been a few questions to Dr. Thornton during his presentation, but the questioners were not identified. One of these asked about the nature of the surround in the colorimeter. Dr. Thornton said that the surround is always illuminated with white light to roughly 10-20% of the brightness of the viewed fields; Stiles suggests (ref. 26, Part I of the published article) that "with a large matching field the nature of the surround is probably not critical."

Another commenter suggested that the reason why earlier workers (Stiles and Burch) had not required any power from the blue primary at long wavelengths was that, due to their choice of primaries, none was needed. Dr. Thornton replied to the contrary: With a red primary in the region of 650 nm, as in the older work, as much as 0.1 watt of blue primary must be present in the field with 1 watt of variable

wavelength component as it goes between the green and red primaries, 526-645 nm. Yet the Stiles-Burch data show no blue primary content at all being required in the matches in this region. At wavelengths beyond that of such a longwave red primary it is true that little blue primary is needed for the match.

M. Brill questioned the repeatability of the observers' settings. Dr. Thornton replied that multiple repeat measurements of color-matching functions (CMFs) by single observers have not yet been made. But note the agreement among the results of the six normal observers in the 18 sets of CMFs of Figs. 18-20, Part I of the published article. Dr. Brill also asked about the source of the ellipses on some of the transparencies and article figures. They are transformed MacAdam ellipses, and the method of obtaining them is described in Appendix B, Part I of the published article.

M. Saltzman asked about the magnitude of the task of obtaining more data. Would it take years, months, or how much time? That cannot be answered in detail, but Dr. Thornton noted that the rate of obtaining the present results was such that a single long weekend sufficed to obtain the CMFs of three observers for one primary set. Thus if qualified, dedicated observers can be located, results from a single instrument are not impossibly difficult to obtain. Of course, work on other instruments is also essential.

J. Pokorny asked if rods could contribute to the results. Thornton said he was not competent to rule this out, but he did not feel it was likely to be important. The colorimetry we seek is expected to be related to the human visual response as a whole and not dependent on assumptions about what goes on in the retina.

C. S. McCamy asked about the ages of the observers. He noted that it would be preferable to have at least 30 observers all under the age of 30 to supplement the results obtained to date with older observers.

M. Fairchild reported on work in progress at RIT in which 2 $\Omega$  color matches were made by the Maxwell method on a CRT monitor (thus limiting the selection of primaries). He showed

transparencies of 20 repeat measurements of CMFs by a single observer, and the curves for 18 observers, all of college age. While the 18 were quite different, their average was very close to the CMFs of the standard observer. He warned that care must be taken when adding variances in averaging. In several other respects, Fairchild confirmed the nature of Thornton's results.

D. H. Alman asked if additivity failure is important. It certainly is, and this makes it essential to consider other ways of treating CMFs in the future.

A. R. Robertson commented that the Maxwell-type CMFs, derived from matches to white, might tend to be better for whitish matches, and use of the maximum-saturation method might have advantages for highly saturated matches. This view was offered by Wyszecki and Stiles in *Color Science*, 2nd ed. Thus it might be advantageous to continue to study both.

Stanziola asked, if what we have now is so good, how can we explain the tremendous variability in the sizes and shapes of the acceptability ellipses of the J & P Coats data in various parts of the diagram? Billmeyer pointed out that it must be remembered that uniformity of the chromaticity diagram was never meant to be a part of basic colorimetry, where it is only required to predict whether colors do or do not match to the standard observer. ~

M. Saltzman commented that, as A. Berger-Schunn has recently written, the bottom line for those of us using materials is, make a nonmetameric match whenever you can! Of course, McCamy pointed out, there are many fields in which metamerism not only cannot be avoided, but is essential, including all types of color reproduction.

It is in these fields, afflicted with strong metamerism, Thornton and Billmeyer comment, that the anticipated improved colorimetry should have the greatest impact. But significant improvements are also expected in other fields, where metamerism is weaker.

*Fred W. Billmeyer, Jr.*

*The following interesting article appeared in American Dyestuff Reporter, September 1990*

## THE GOOD, THE BAD, AND THE COLORFUL: VIDEO COLOR YOU CAN USE

Computer color control systems have, for several years, offered textile customers the option of color video display. The usefulness of displays often depends as much on the expectations of the user as on the technical ability of the system designer. Laboratory users are interested in the application of a video system to reduce the time required for tasks such as shade matching. Color stylists are interested in having the very large gamut of video colors from which to select combinations for customers. Quality control personnel may wish to review production history to make pass/fail decisions and to allocate goods to customers. Each of these tasks is very time-consuming when performed without a computer color system, and is accelerated when assisted with correct video display. All of these uses are obvious applications for video color display, but all of them have inherent limitations when the task is transferred from physical samples to display on a CRT. The degree to which these limitations are understood significantly affects the successful implementation of any video display system for textiles.

When textile samples are assessed visually, most shaders are aware that the evaluation should be performed in a light booth having a gray surround with lightness approximately equal to the lightness of the standard. A short amount of time should be allowed for the user's visual system to adapt to the illumination before the judgment is made. The samples ordinarily are large enough to allow a ten degree field of view, and the illumination/viewing

geometry is 45/0 (or 0/45). The light booth should be cleared of other samples and objects that may influence the visual assessment. The standard and sample should be viewed with similar presentations (same thickness, orientation, etc.) and with edges butted together. Reality in most textile shade booths is usually an approximation of these conditions, compromising those aspects which are considered either less important or more difficult to achieve.

The flexibility of video color display permits the rendition of colors that may never be seen in the gamut of reflected light, and may stretch the mathematical principles upon which the colorimetry of surface colors is based. This flexibility is a double-edged sword, offering the user both the freedom to view colors in a new medium, and the hazard of making color assessments under conditions which are not consistent with color theory. The evaluation of colors rendered on a video display screen requires a set of conditions similar to that described for reflection samples. The rendition and viewing of colors, however, tends to suffer from the same compromises as with physical samples, for the same reasons of difficulty and convenience. The results of such compromise are sometimes acceptable, and sometimes not. Therefore, both the designer and user need to implement the video color system with respect for the rules and conditions of classical colorimetry.

Let us now look at the work of the three applications described above. The work of a laboratory user will be accelerated by screening potential formulas using the video display in conjunction with sorting by cost, metamerism, predicted performance, etc. Viewing the colors of these potential formulas is a useful tool for selecting one or two candidates for development, but is not a substitute for laboratory dyeings. Color stylists may search through existing color standards for matches to a customer's shade, and may develop new shades more rapidly by making adjustments from existing formulas. However, creating colors on a

video display for subsequent laboratory development will always be limited by the differences in gamuts between the CRT phosphors and the colorants in use on the textile substrates. The third user outlined above, the quality control manager, should continue to make pass/fail decisions on a quantitative basis using visual assessment of the samples as a final arbiter. Once goods have been accepted, however, the QC manager may wish to taper the existing inventory and display the ordered samples on the video screen.

Each of these applications is made less time-consuming and more efficient by the use of video display. Color display hardware and software will continue to improve, much to the benefit of the user. However, the user and system designer must observe limits if video display is to be a useful companion to computer color management, rather than a technological gadget without relevance to the real tasks faced by textile manufacturers. Understanding of the strengths and limitations of tabular, graphic, and video display of colorimetric data will permit the best use of a computer color control system.

*Ann Laidlaw*

### WALSH-WESTON AWARD

The ISCC wants to congratulate two of its members: Margaret Halstead and Mike Pointer, who received the Walsh-Weston Award and a bronze medal from the Chartered Institution of Building Services Engineers. The awards were made for a series of three papers for which Margaret Halstead, Adrian Hill, David Palmer and Mike Pointer were co-authors. The papers "the Effect on clinical judgments of new types of fluorescent lamp Pts I, II, and III" were published in *Lighting Research and Technology* in 1991.

## THE 1992 ISCC POSTER PAPERS SESSION WAS THE BIGGEST SUCCESS EVER!!!

The Poster Papers Session held at the 1992 ISCC Annual Meeting was the biggest success we have ever had !!! We had an all time high of 15 papers presented, 10 of which came from foreign authors. In fact two foreign authors chose to present two papers on two different topics. The global color science interest was truly refreshing!

PAUL GREEN-ARMYTAGE of Curtin University in Perth, Australia

and a member of the AIC Executive Committee presented "A Game to Introduce the Language of Color". His examples beautifully illustrated how a game can turn into a challenge providing useful information on the power of colour as a communication tool that invokes human expressive ideas and feelings. I was fascinated to learn how my favorite colors could form my self-portrait.

HENRY HEMMENDINGER of the Hemmendinger Color Lab in Princeton presented "The Spreadsheet as a Flexible Tool in Colorimetry". Henry was reluctant to submit this paper for fear that it was too commonplace and not state-of-the-art. He quickly found out that there was a high level of interest in his use of spreadsheets to display detailed digital information alongside analog presentations of sample reflectance data, which make error checking a much easier task.

TODOR KEHLIBAROV of the Bulgarian Academy of Sciences in Sofia, Bulgaria presented two papers. The first, "Colorimetric Evaluation of Bulgarian Butter from 'Ros Demascena Mill'", was a delightful and informative illustration of the colorimetric methods, including CIELAB representations, used to characterize Bulgarian rose butter. It was exciting to learn that these colorimetric specifications will be used to prepare a Bulgarian standard. The second, "Colorimetric Investigation for Determination of Liquid Standard Scale", provided an impressive visual attempt at choosing colored paper samples of the NCS Color System to match the CIELAB differences generated for their Bulgarian liquid standard scale.

UTA-MARIA KRAPF of the University of Alabama presented "The Theory and Application of the Bezold Effect". This paper was a very clever and colorful demonstration of how the use of three specific colors (red-orange, green, and blue-violet) can be used in specific combinations and configurations viewed at specific distances and/or angles to achieve the appearance of six combinations of color pairs.

ANTAL NEMCSICS of the Technical University of Budapest in Budapest, Hungary also presented two papers. The first, "Color Space Relying on Harmony Threshold Measurements", featured an illustration of how the Coloroid color space could be arrayed according to psychometric scales developed from harmony threshold measurement tests using observers with unadapted eyes (i.e. no controlled light or dark adaptation conditions were imposed on the

*continued next page*

### W.D. WRIGHTS' AIC 25TH ANNIVERSARY REMARKS

**AIC**

*The following is the text of remarks made by David Wright on the occasion of the 25th Anniversary Banquet of the Association International de la Couleur held at the Nassau Inn in Princeton, NJ on Tuesday June 23, 1992. The remarks were delivered by video broadcast to the assembled diners during AIC President Alan Robertson's introduction of all the living past-presidents of the AIC.*

"It is with the greatest regrets that age and arthritis are keeping me at home instead of at the AIC Jubilee celebrations. I regret it because I am missing a very enjoyable event, but, more important, because I am letting down the President of the ISCC, Hugh Fairman. Not that I would have been much of an exhibit, and I only wish that Deane Judd were still with us. He certainly played a major part in establishing the AIC.

"I can take some modest responsibility for two of the AIC Presidents, namely Robert Hunt and Alan Robertson. Years ago they were PhD students of mine at Imperial College - two of my very best students, in fact - and happily they are not yet bothered with old age or arthritis, so far as I know.

"I am very glad indeed that Gunnar Tonnquist is to be the main speaker at the Jubilee Banquet, as there is no one better informed than him of the 25-year growth of the AIC. I must, though, warn you about his slides, as on one occasion he revealed that the dress my wife was wearing was the same as one he had filmed ten years earlier!

"There is no doubt that the AIC is now a well-established international body and that it is making valuable contributions to the advancement of colour science and colour technology, neither is it ignoring art and design. There seems to be no shortage of material for future conferences, but if the AIC President did run out of ideas, I would like to suggest Blackness as a subject that has been overlooked. I think it could be fascinating!

"With my greetings and best wishes to you all,"

W. David Wright,  
DSc, ARCS, DIC  
25 Craig Mount  
Radlett, Herts WD7 7LW  
United Kingdom

*Dr. Fred W. Billmeyer*

## Poster Papers, continued

observers making visual assessments). The second, "International Color Center", outlined the establishment and functioning program of an International Color Center consisting of an International Color Information and Color Education Center and a Color Museum in Budapest along the Danube River. The poster also included post-graduate student plans proposed for the building itself.

OSVALDO DA POS of the Universita Degle Studi Di Padova in Italy presented "An Experimental Contribution to the Study of Color Combination Pleasantness with Surface and Projected Colors". Observers were asked to evaluate surface and projected color combinations in the form of a six square checkerboard on the basis of their pleasantness. This poster nicely illustrated that for inverted surface colors (i.e. in which whiteness, blackness, and lightness are reversed as compared to their natural lightness ratio) pleasing results were found, whereas for vague inverted surface colors (i.e. either whiteness or blackness are reversed) unpleasant results were reported. For projected color combinations, the results were much more difficult to interpret.

In ORONZO RICCI's absence, Dr. Lucia Ronchi graciously agreed to present this paper entitled, "A Painter Faced with the Paradigm of Reality and Pictorial Reproduction". This poster featured lovely reproductions of Oronzo Ricci's paintings, which represented an expression of the following philosophy: "The color, in addition to the perception of hue, conveys a plethora of information which may lead, through an unconscious process, to the association or the completion of images as they relate to known situations."

RICHARD RIFFEL of the Monsanto Chemical Company in Springfield, Massachusetts, presented "Characterization of Dichroism and Linear Polarization Effects on Colorimetric Properties of Transparent Plastic Materials". This paper was an excellent tutorial on how a polar spectrophotometer with defined illumination and collection polarization states could be used to characterize linear-polarization-induced dichroic

effects which can lead to colorimetric mis-matches on samples made from the same transparent plastic material.

BRIAN ROSE of the Munsell Color Science Lab at Rochester Institute of Technology presented "COLOR LOGIC: Interactively Defining Color in the Context of Computer Graphics". This was a very impressive demonstration of Brian's Macintosh-based program called COLOR LOGIC. It is an interactive color science tutorial covering color vision (how color is detected by the eye), light and objects (how they interact with one another), color perception (how color is interpreted by the brain), art and design (theories and usage of color), color order (two theoretical systems used for organizing colors), and computer color models (practical systems used for selecting and editing colors).

KEN SAGAWA of the Industrial Products Research Institute in Japan presented "Individual Variation in Mesopic Luminous Efficiency Functions". This highly technical paper described how principal component analysis was used to analyze spectral luminous efficiency data gathered for 24 observers by direct brightness matching at nine retinal illuminance levels covering a mesopic range from 100 trolands to .01 trolands.

JANOS SCHANDA of the CIE Central Bureau in Vienna, Austria presented "Pilot Study of Readability of Colored Signs on a CRT Display with Small Color Differences". Preliminary results from experiments studying the  $DL^*$ ,  $Da^*$ , and  $Db^*$  color differences needed to accurately detect the opening direction of a Landolt ring presented for a short time on a CRT in front of a colored background were shown. For lightness changes resulting in  $DE^*_{ab}$  of 1.0, observer detection was almost error-free. For chroma and hue changes, larger  $DE^*_{ab}$  values (about 3.0) were needed for error-free observer detection. Landolt rings in the reddish direction were easier to detect than in the greenish direction, while ring opening detection difficulty in the yellowish and

bluish directions were about equal.

FRED SIMON of FTS Inc. in Clemson, South Carolina presented "A New Approach to Color Instrument Calibration". This paper described a standardization approach involving the measurement of molded acrylic scratch-resistant plastic samples, where a specific attribute can be varied in a systematic way allowing traceability of properties, such as reflectance or transmittance photometric and wavelength scales, to a national standardizing laboratory.

JELER SLAVA and LEGAT DUNDA of the Faculty of Technical Science at University of Maribor in Slovenia presented "Colorimetry in Slovenia". This paper was an excellent and informative accounting of how colorimetry developed in Slovenia from 1982, when it was a small research group at the Faculty of Technical Science in Maribor until the present, where it is now a research institution center for the investigation of color and computer aided color matching for textiles and polymers. The center features an interdisciplinary approach to papermaking and the production of lacquers and plastics. Experts from the fields of colorimetry, physics, mathematics, psychology, chemistry, textiles, paper, graphic technology, and architecture are actively involved in the center. We were delighted that the political situation in Slovenia was calm enough to allow these authors to visit our country and technically contribute to our Papers Session.

In summary, I am proud to say that this 1992 ISCC Poster Papers Session was a resounding success! The diversity of art, technical and design-oriented papers was a testament to the saying "Variety is the spice of life!". Finally, this international Poster Papers Session proved once again that color truly is a universal language that can be communicated to and understood by all. Many thanks to all our authors and we hope that you will decide to come back next year!

Paula J. Alessi,  
Poster Papers Committee Chair

## ISCC BOARD OF DIRECTORS MEETING SUMMARY

In the spirit of keeping the general ISCC membership informed, this article will summarize the ISCC Board of Directors Meeting that took place on Saturday, June 20, 1992, at the Nassau Inn in Princeton New Jersey. The Officers present at the meeting were Hugh Fairman; President, Paula Alessi; President-Elect, and Danny Rich; Secretary. The Directors present were Norm Burningham, Ellen Carter, Robert Chung, Richard Harold, Nancy Jo Howard, Romesh Kumar, Ann Laidlaw, Joel Pokorny, Evelyn Stephens, and Magenta Yglesias. Guests included Fred W. Billmeyer, Jr.; By-Laws Committee Chair, Roland Connelly; Interest Group Coordinator and incoming President-Elect, Allan Rodrigues; Program Chair for the 1992 Annual Meeting, Lou Graham; Planning Committee Chair, and Mike Hammel; Publications Chair.

### Report of the Officers

**REPORT OF THE PRESIDENT -** Hugh Fairman appointed Jack Ladson to the Board as New Members Chair. This position was newly created with the hopes that new members' interests could be adequately represented at the Board level and fresh new ideas could be more readily brought forth to the Board. Jack's term of office will be two years in order to coincide with the term served by all officers.

The following three new sustaining members were approved: Labsphere, Byk-Gardner, and Sharp Electronics.

**REPORT OF THE PRESIDENT-ELECT -** Paula Alessi reported that there will be a joint electronic color conference co-sponsored by the Image Science and Technology (IS&T) organization and the Society for Information and Display (SID) in the fall of 1993. Both IS&T and SID would like ISCC to be involved as a contributing society. Paula Alessi wrote a letter to Larry Tannas, the program co-chair, indicating many ways that ISCC can contribute to such a conference. *Any ISCC member wishing to become involved in*

*this electronic color conference should contact Paula Alessi.*

**REPORT OF THE TREASURER -** Phil Hunter prepared a written report since he could not be present at the meeting. As of May 30, 1992, the ISCC total income was \$63,957.11 and the total expenses were \$38,071.96. The total assets in our checking and savings accounts and our two Certificates of Deposit is \$80,612.40. The income over expenses and the total assets are overstated by approximately \$25,000 due to the fact that the 1992 Annual Meeting expenditures have not yet been taken into account.

### Report of Interest Groups

**REPORT OF THE INTEREST GROUP COORDINATOR -** Roland Connelly assured us that there were no problems to report. Since Roland will be serving as President-Elect, he must resign from his position as Interest Group Coordinator. He recommended Richard Harold to serve as the new Interest Group Coordinator. We are thankful that Richard agreed to take on this role. Roland feels that with the change of administrators, this would be a good time to reorganize the Interest Groups. Richard is enthusiastic about addressing the concerns relative to restructuring the Interest Groups to be in better alignment with ISCC member needs. He will pursue the idea of each Interest Group having its own constituency. This would be very simple to do since Ann Laidlaw, our Membership Secretary can add to the member database a listing of which Interest Group most fulfills each member's needs. *Anyone having specific thoughts on the Interest Group structure is encouraged to contact Richard Harold directly.*

### Standing Committee Reports

**REPORT OF THE FINANCE COMMITTEE -** Hugh Fairman agreed to take the responsibility of serving as a Vice Chairman to direct the Finance Committee along with Phil Hunter, the Chair-

man. Allan Rodrigues, who has been a significant help in the ISCC budgeting process, also agreed to serve on this Finance Committee. Paula Alessi must find a third member to join Hugh and Allan. *Anyone wishing to serve on the ISCC Finance Committee is encouraged to contact Paula directly.*

**REPORT OF THE SERVICE AWARD COMMITTEE -** Harry Hammond proudly reported that Bonnie Swenholdt was unanimously approved as the 1992 recipient of the Nickerson Service Award.

**REPORT OF THE 1993 GODLOVE AWARD COMMITTEE -** Michael Brill reported that his committee has been formed and they have issued a call for nominations. All those receiving the ISCC News should have seen this nominations call. *Anyone wishing to nominate someone as the 1993 Godlove Award recipient for a long term color science contribution is encouraged to contact Michael Brill.*

**REPORT OF THE MEMBER-BODIES LIAISON COMMITTEE -** In Joann Taylor's absence, Paula Alessi gave this report. All Member-Body delegates were invited to a luncheon to be held at the 1992 Annual Meeting. The personal touch that Joann's invitation letter provided successfully generated a positive response by 24 delegates. Paula reviewed the agenda to be followed at the Member-Body luncheon. The emphasis would be placed on the needs and opportunities for communication between ISCC and its Member-Bodies. *Anyone wishing to learn more about the Member-Body activities is encouraged to contact Joann Taylor or Paula Alessi.*

**REPORT OF THE MEMBERSHIP COMMITTEE -** Ann Laidlaw submitted a written report featuring the following membership statistics. As of June 19, 1992, there were 622 Individual Member Group (IMG) ISCC members, which included 24 students, 24 retirees, 13 honorary members, 72 foreign members, and 489 domestic members. Furthermore, there were 161 Member-Body delegates, liaisons, and editors and 6 sustaining members. Also, thanks to Ann and many others, the 1992 Membership Directory

*continued next page*

## Board of Directors, continued

was issued in March of 1992 and distributed to members with the May/June ISCC News mailing. To aid in the new member orientation process, Ann instituted a buddy system, where a new member is assigned to an ISCC Officer or Board member as a welcoming "buddy". It is the "buddy's" responsibility to contact the new member to provide general information about ISCC and to help the new member better assimilate into the Interest Group and Project Committee structure based on their color interests. Finally, Ann reported that her membership data base includes telephone and FAX numbers for many, but not all ISCC members. Hugh Fairman suggested that pre-addressed postcards be used to solicit ISCC membership for their telephone and FAX numbers.

**REPORT OF THE IMG MEMBER-BODY COMMITTEE** - At this year's Annual Meeting, it is hoped that Don Woelfel can get some feedback as to what we can do with the IMG to make it active and make it contributory. Norm Burningham suggested that one way is to actively solicit from the IMG group. Most often, the IMG Annual Meeting is very poorly attended. It was suggested that perhaps the personal touch is what is needed. Prior to each Annual Meeting, the IMG Delegation Chair should send a letter out to all IMG members indicating the "state of union", listing IMG minutes from the previous Annual Meeting, and informing them of the next Annual Meeting with request for input to the agenda and what they might like to see happen at the Annual Meeting.

**REPORT OF THE PUBLICATIONS COMMITTEE** - As Chair, Mike Hammel reported that the Newsletter is progressing well. Mike is always looking for more input. Mike Hammel has been taking most of the burden of Publications Committee on himself. He would prefer having a more formal committee of consistent Newsletter contributors. Paula Alessi offered to help find other members for Mike's Publications Committee. *Anyone wishing to serve on the ISCC Publications Committee is encouraged to contact Mike Hammel or Paula Alessi.*

**REPORT OF THE PUBLICITY COMMITTEE** - Ellen Carter mentioned that there are many aspects of publicity that could be better accomplished if Ellen had a formal committee. Two people with rotating responsibilities would provide the most help. Roland Connelly suggested an appointment of committee members in connection with the meeting chairman. Norm Burningham felt that a third person should act as a reviewer for press releases and other types of publicity. Romesh Kumar, the 1993 Annual Meeting Program Chair agreed to help Ellen out with publicity for the 1993 Annual Meeting. Ellen Carter and Paula Alessi will work on finding a third person to help serve on the Publicity Committee. *Anyone wishing to serve on the ISCC Publicity Committee is encouraged to contact Ellen Carter or Paula Alessi.*

**REPORT OF THE POSTER PAPERS COMMITTEE** - As Chair, Paula Alessi reported that the 1992 Poster Papers Session was likely to be the most successful one in ISCC history. The two measures of success that she used were that it featured the largest number of papers ever having been submitted and most of them were from contributors outside the United States. Due to the number of easels and poster boards required, this also turned out to be the most expensive Poster Papers Session that the ISCC has ever conducted.

**REPORT OF THE PLANNING COMMITTEE** - Lou Graham reported that the Fredericksburg meeting report has been issued by Ann Laidlaw. Ninety eight percent of the IMG survey returns, which went out in conjunction with the Fredericksburg Meeting information, have been sent to Don Woelfel. The most common aspect mentioned in a majority of the survey returns was the need for a sense of belonging to the ISCC. Lou Graham made a request for significant subjects for future study to address the IMG concerns as well as those brought forward at the Fredericksburg Meeting. The Board has been and will continue to address the issues raised at the Fredericksburg Long-Range Planning Meeting.

**REPORT OF THE PROBLEMS COMMITTEE** - Allan Rodrigues reported that there are only three active project committees. Project Committee 32, Image Technology, is turning in a closing report, which consists of their color reproduction bibliography. Project Committee 44, Uniform Color Solid, had a three hour session at the 1992 Annual Meeting in Princeton to review the history of the committee. A new scope and objectives has been submitted for Project Committee 49, Improved Colorimetry. Thus the approved scope for ISCC Project Committee 49 is:

1. To document why an improved system for colorimetry is needed.
2. To extend and confirm the results relating to problems with traditional colorimetry, to study discrepancies between visual and computed colorimetry, and to find avenues for improvement.

3. To make recommendations for consideration by standardizing organizations for such an improved colorimetry.

Bill Thorton was approved as Chair of Project Committee 49. Fred W. Billmeyer, Jr. will be the Vice-Chairman or Secretary.

## Report of Annual Meetings

1992 - PRINCETON, NEW JERSEY - Allan Rodrigues reported that all plans were going well. This meeting is a success story for ISCC as evidenced by its sell-out attendance and the large number of foreign participants. We are tremendously grateful to Allan and his organizing committee; Danny Rich, Hugh Fairman, Ralph Stanzola, and Jim Grady for doing an excellent job in planning this very successful meeting!

1993 - NEWPORT, RHODE ISLAND - Romesh Kumar reported that the theme for the symposium would be "Color, Environment, and Regulations". Here "the Environment" refers to ecological concerns rather than psychological concerns and many of the talks will involve legal presentations on dealing with the FDA, EDA, etc. A Call for Papers has gone out. There has been a good response to date. Romesh has received commitments from over one dozen speakers representing Universal

Colorants, Industrial Colorants, Plastics, Inks, Powder Coatings, Automotive and Artistic Paints. Magenta Yglesias will work with Romesh Kumar to expand the Call for Papers such that it attracts art and design-related members to this meeting. The Dry Color Manufacturer's Association (DCMA) has been contacted about co-sponsoring this symposium.

1994 - DETROIT, MICHIGAN - Romesh Kumar as Arrangements Chair for 1994 has worked with Jim Grady to find a hotel. The Detroit Color Council will co-sponsor the symposium. Paula Alessi will appoint a Chair and pursue establishing a topic.

1995 - 1996 - *Location, topics and Chairs are needed, so if you have any suggestions, please forward them to Paula Alessi.*

WILLIAMSBURG CONFERENCE - There have been two topics suggested for the 1994 Williamsburg Conference. The first was Fluorescence suggested by Richard Harold. The second was an extension of the 1992 Williamsburg Conference topic, Color Reproduction Across Different Media, suggested by Norm Burningham. Each will report to the Executive Committee before the October Board Meeting so that a topic can be chosen as soon as possible.

OLD BUSINESS - Fred W. Billmeyer, Jr. is our ISCC representative on ANSI Committee 2535, which has developed an ANSI standard for Safety Color Code. This standard covers fluorescent and non-fluorescent colors for signalling and marking as well as for safety. Many thanks to Fred and Nick Hale for their joint efforts in developing this standard.

COOPER HEWLETT MUSEUM - Some ISCC members, like Nick Hale, have some materials that they would like to have donated to this museum. Many thanks to Evelyn Stephens for serving as the contact person.

CIE - LIAISON - Paula Alessi reported that all went well at the CIE Division 1 meetings held on June 18th and 19th immediately prior to the 1992 Annual Princeton Meeting. The mule barge trip co-sponsored by ISCC and USNC for foreign guests was a very popular event.

#### EXECUTIVE STAFF POSITION

FOR ISCC - One of the suggestions coming out of the Fredericksburg Meeting was that the ISCC could benefit from having an executive office to handle some of the important ISCC organizational and professional functions. Roland Connelly has been investigating the possibility of establishing such an Executive Staff Position. He is currently working on two items:

1) Definition of duties and responsibilities. (secretary, newsletter, membership duties).

2) Location and control in this volunteer executive office. Such an office really should be close to the President's office to be effective, but do we really want the office to change location as the President changes?

Roland will submit a proposal at the October Board meeting covering staff, location requirements, function and cost as well as control procedures.

SPECIAL LETTER REGARDING ANNUAL MEETINGS - This topic was prompted by a letter from Max Saltzman about access for handicapped individuals

wishing to attend our meetings. Since we do not wish to exclude these individuals from attending our meetings, Danny Rich proposed that ISCC adopt a policy stating that it will only use meeting facilities and lodgings that meet the guidelines of the National Disability Act. This proposal was unanimously approved by the Board.

AD-HOC COMMITTEE ON ANNUAL MEETINGS - Ellen Carter was asked to Chair this Committee as a result of some discussions with regard to improving Annual Meetings at the Fredericksburg retreat. Ellen's committee has been charged with coming up with ideas on meeting locations and format possibilities, meeting dates (should they be fixed in the same month year after year?), and a policy on co-hosting meetings. *Anyone wishing to comment on meeting improvements is encouraged to contact Ellen.*

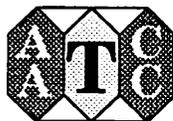
The meeting was adjourned at 2:00 pm.

Many thanks to Danny Rich and Roland Connelly for taking excellent notes from which these minutes were extracted!

*Paula J. Alessi, President*

## NEWS FROM MEMBER BODIES

### AATCC 1992 CONFERENCE



AATCC will host its 1992 International Conference & Exhibition at the Inforum in Atlanta,

Ga. October 4-7. The conference will feature a technical program, over 75 exhibits of machinery, equipment, dyes and chemicals for the wet processing industry and special events including a welcoming reception, awards luncheon, dinner party and spouse program.

The technical program for the conference will feature over 60 speakers in 17 concurrent sessions beginning at 9:00 a.m. on Monday, October 5 and ending Wednesday, October 7 at noon. Developed by AATCC's Executive Committee on Research, the program includes the Intersectional Paper Competition, the Student Paper Competition, the traditional Olney Medal Address and 14 sessions devoted to a variety of topics

of interest to the textile wet processing industry. The 14 sessions are titled: International Trade, Finishing, Analytical Techniques, Dyeing (two sessions), Environmental, Color Science, Sizing and Preparation, Managing Quality, Carpets, Garment Wet Processing, Dyeing and Finishing, Microfibers and General. The registration packet for the conference includes titles and speakers for these sessions.

The conference will be held at the Inforum. The host hotel is the Hyatt Regency Atlanta, 265 Peachtree St. NE, Atlanta, Ga. 30303. A registration packet including all forms for the conference and a request for hotel accommodations was mailed in early July. If you wish to receive a registration packet, please contact Shirley Clifton at the AATCC Technical Center; telephone 919-549-8141; fax 919-549-8933.

To take advantage of the reduced conference registration fees, the registra-

*continued next page*

## AATCC Conference, continued

tion form and remittance must reach the AATCC Technical Center by September 14. MasterCard and Visa are accepted for the registration fee and any additional function tickets ordered. After September 14, you must register on site and increased fees will apply. AATCC's room block at the hotel is valid only through September 14.

### AATCC Other News

October is also the month that AATCC sponsors its annual workshop on Color Measurement Principles and the Textile Industry. The workshop is scheduled for October 29-30 and will be conducted at the AATCC Technical Center in Research Triangle Park, N. C. Guest speakers for the workshop are all recognized authorities.

Developed for operating personnel, the workshop covers basic color theory, visual and instrumental color measurement and the practical use of the CMC equation.

Hands-on lab sessions will cover sample preparation, strength calculations, reflectance and transmittance measurements, shade sorting, shade formulation and color difference measurements.

A registration fee of \$365 (\$310 for individual and corporate AATCC members) includes lunch and refreshment breaks each day, a compilation of the papers presented and a copy of the AATCC monograph entitled *Color Technology in the Textile Industry*.

To register for the workshop or to obtain more information on it, contact Peggy J. Pickett at AATCC. Early registration is encouraged since this program fills quickly. As of press time, the 92-93 schedule for workshops and symposia was not completed. It is anticipated that it will be mailed in August.

### Membership news

Memberships recently reached a ten

year high. As of May 1, 1992, the total number of individual members was 7030. This is the first year it has exceeded 7000 since 1981 when membership was 7349 and dropped to 6789 in 1982. Corporate membership is up to 239, its highest level since 1980 when 245 corporate members were on the rolls.

There are many benefits to becoming either an individual and/or corporate member of AATCC. There are also incentives for members recruiting new members. For more information about AATCC membership, please contact Membership Services, AATCC, P. O. Box 12215, Research Triangle Park, N. C. 27709-2215; Telephone 919-549-8141.

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*The following article appeared in Photogrammetric Engineering & Remote Sensing Vol. 58: 561-567, (1992):*

## A Generalized Component Substitution Technique for Spatial Enhancement of Multispectral Images Using a Higher Resolution Data Set

A generalized Component Substitution (COS) technique is presented for enhancing spatial resolution of multispectral bands using a higher resolution data set. The process involves a simple one-step linear transformation of the combined data space, and the procedure can be used for the implementation of the popular Intensity Hue Saturation (IHS) transformation technique of data merging. In the generalized procedure the weights used in the linear transformation are scene dependent and are determined from multivariate statistical techniques. Examples of enhancement of the SPOT multispectral image and a Landsat TM image of Sydney using a SPOT panchromatic image are presented. The results are compared with that of the IHS technique. The generalized technique may be also used for filtering noise or an unwanted component from a multispectral image.

Vitala K. Shettigara

## AMERICAN SOCIETY FOR PHOTOGRAMMETRY AND REMOTE SENSING (ASPRS) Call for Papers

### 14th Biennial Workshop on Color Photography and Videography in Resource Monitoring

# ASPRS

This workshop will be held May 24 - 27, 1993 at Utah State University, Logan Utah. The workshop will address state-of-the-art applications of photographic and videographic remote sensing to:

- plant sciences
- agricultural crop monitoring
- range management
- forest resources
- fisheries habitat mapping
- water quality monitoring
- riparian vegetation mapping
- wetland delineation
- river geomorphology

One page abstracts are due by November 15, 1992. Send abstracts to:

Christopher Neale  
Department of Biological and  
Irrigation Engineering  
Utah State University  
Logan, Utah 84322-4105  
Telephone (801) 750-3689  
FAX (801) 750-1248

Acceptance letters will be mailed by December 15, 1992. Full papers are due February 15, 1993 for review. Final deadline for publication will be April 1, 1993. Blue line paper and instructions will be provided.

The following were extracted from the Color Association of the United States (CAUS) Newsletter. The CAUS is an ISCC Memberbody.



### Casablanca celebrates 50th in Black and White

When Isabella Rosselini was invited to the 50th anniversary celebration of "Casablanca" - a movie that co-stars her mother, Ingrid Bergman — and heard that Ted Turner was one of the hosts, she had just one question. "I called to see if it was black and white or colorized," she said. "If there is no movie that speaks for black and white it's Casablanca, no?"

*As reported in Women's Wear Daily, April 9, 1992*

### Veggie Color

With more and more people eating vegetables it's hardly surprising that Sunset magazine focused on color changes in cooking. Here are a few pointers from their article: Green vegetables will, upon the first blast of heat, in fact get greener (what is being seen is more chlorophyll as the gases initially escape); thereafter their color begins to fade (first to olive, then to grayish yellow as heat displaces the magnesium atoms in the chlorophyll, shifting its chemical structure and color). Also unstable are the color pigments anthocyanin (red) and betacyanin (blue) commonly found in red cabbage. The red color needs acid to fix it; otherwise it will tend to turn blue.

*As reported in Sunset, May 1992*

### FSCT ANNOUNCES AVAILABILITY OF 1991 MATTIELLO LECTURE VIDEO

**FSCT** The Federation of Societies for Coatings

Technology has recently completed the video production of the 1991 Joseph J. Mattiello Lecture. The lecture, which took place in Toronto during the 1991 FSCT Annual Meeting and Paint Show, featured a presentation by Dr. Loren Hill, Sr. Research Fellow at Monsanto Chemical Company in Springfield, MA, entitled, "Structure/Property Relationships of Thermoset Coatings."

The video, which runs one hour, includes the information presented during the lecture. It is available on a loan basis to both FSCT Constituent Societies and to individual companies. This video is ideal as both a main presentation at a meeting or for instructional purposes.

The 1991 Mattiello Lecture Video is available on a first come, first served basis. To receive a copy, contact Sorbello at FSCT Headquarters, 492 Norristown Rd., Blue Bell, PA 19422, Phone (215) 940-0777.

The Joseph J. Mattiello Lecture has been held each year since 1950 to honor the late Dr. Mattiello, former Vice-President and Technical Director at Hilo Varnish in Brooklyn, NY. Dr. Mattiello was an active member of the Federation Paint and Varnish Production Clubs (forerunner to FSCT) and participated in activities on both the local and national level, including serving as President in 1943-44, prior to his untimely death in 1948.

The Federation of Societies for Coatings Technology was founded in 1922 as the Federation of Paint and Varnish Production Clubs and has grown to consist of 26 Constituent Societies, 22 in the United States, two in Canada, and one each in the United Kingdom and Mexico. Over 2,200 companies are represented by its 7,300 members, who are involved in research and development, supervisory production and engineering, and technical sales and service regarding the formulation, testing, and manufacture of coatings. The mission of the Federation is to provide education information to its members and the industry, and it does this via seminars, publications, and as sponsor the Annual Meeting and, Paint Industries Show and publisher of the Journal of Coatings Technology.

### GEMOLOGICAL INSTITUTE OF AMERICA (GIA)

**GIA** There are two news items from the GIA: GIA has created a new

Educational Services department that will address the information needs of students, and GIA GEM Instruments Corporation now offers two kinds of spectrometers which present jewelers with one of the quickest ways for identifying gems.

The new GIA Educational Services department will be managed by Veronica Clark-Hudson, formerly an instructor of traveling classes for GIA's Gemology Education program. This new department will serve the GIA student body and the jewelry industry in general.

Measuring the absorption spectra of gemstones saves time by providing positive identification of the gemstones. Spectrometers can be critical in determining the origin of color in various gem materials. Both instruments available from GIA feature transmitted and fiber optic light sources, making them suitable for examining transparent, translucent, and opaque gem materials.

For more information about GIA activities contact GIA Headquarters, 1660 Stewart St. Santa Monica, CA 90404-4088; tel. (310) 829-2991; or FAX (310) 453-4478.

### IESNA DIRECTOR APPOINTED

**IES** Rita M. Harrold has been appointed director, Educational and Technical Development for the Illuminating Engineering Society of North America (IESNA), an ISCC Memberbody.

In this new position, which combines management responsibility for educational and technical activities, Ms. Harrold will be expanding the development of lighting education materials, administering programs for the lighting community, and producing technical materials and documents. Under Ms. Harrold's leadership, the society plans to better meet user interest by offering a full

*continued next page*

## OPTICAL SOCIETY OF AMERICA (OSA)



The OSA announces the Ophthalmic and Visual Optics Third Topical Meeting

to be held at the Doubletree Hotel, Monterey, California on February 19-20, 1993.

This topical meeting provides a forum for discussion of current research and other advances related to the optics of ophthalmic devices and of the eye. The community of involved disciplines includes those whose principal activities relate to optics, vision science, optometry, and ophthalmology. This year in recognition of the 60th Anniversary of the first publication of Stiles and Crawford on the directional sensitivity of the retina, a special session relating to photoreceptor optics will be held.

Some of the invited speakers include: Peter L. Walraven discussing the Stiles-Crawford Effect in normal and anomalous color vision, David R. Williams on cone aperture, and Howard C. Howland on the photographic and videographic refraction of eyes: past, present, and future.

## IESNA continued

range of courses from fundamentals to advanced programs. In addition, she will work closely with the numerous committees of the society to ensure timely production of ANSI standards, recommended practices, energy management and committee reports, and measurement testing and calculation guides. Ms. Harrold will be playing an active role in the revision of the IESNA Lighting Handbooks, expected to be published in Spring 1993. Ms. Harrold officially took over this position on June 1, 1992.

The IESNA was established in 1906 to establish scientific lighting recommendation and to advance knowledge on the lighted environment to the benefit of society. It is the recognized authority on lighting in North America and a leader of the world's technical lighting societies.

For more information please contact:  
Optical Society of America  
2010 Massachusetts Avenue NW  
Washington, D.C. 2—36  
(202) 223-0920

The following articles of interest to ISCC members have been published in Journal of the Optical Society recently. The abstracts are abbreviated.

1) Mark S. Drew and Brian V. Funt, "Variational approach to interreflection in color images" (JOSA A 9:1265) Interreflections affect the colors of surfaces as they appear in images. The light reflected by one surface that then impinges upon a second surface changes the color of the overall illumination that it receives and hence the color of the light that it reflects. Both the relative colors and positions of the two surfaces affect the result. We analyze the physics of the interreflection process and extract constraints on the possible surface reflectances, ambient illumination, and geometric configuration of the surfaces. Although it is more complex than some previous analyses of interreflection, the variational approach is more general and relaxes some restrictive assumptions concerning the type of illumination and the number of surfaces.

2) Ken Sagawa and Keishiro Takeichi, "System of mesopic photometry for evaluating lights in terms of comparative brightness relationships" (JOSA A 9:1246) A photometric system assessing lights in the mesopic range in terms of comparative brightness relationships is described. The system is based on a weighted geometric mean of the CIE photopic luminance modified by the brightness-to-luminance ratio (B/L) and the CIE scotopic luminance to provide an equivalent luminance that corresponds to comparative brightness relationships of lights in the mesopic range. The weighting coefficient, called the adaptation coefficient, is defined as a function of equivalent luminance, so an iterative calculation is required to obtain an appropriate equivalent luminance. Examples of how to calculate the equivalent luminance and an experimental evaluation of the system are described.

## SOCIETY FOR IMAGING SCIENCE AND TECHNOLOGY Call for Papers

# IS&T

The IS&T and the Society of Electrophotography of

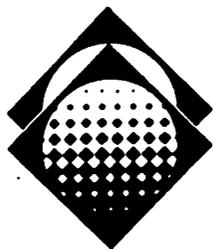
Japan (SEPJ) are co-sponsoring the 9th International Congress on Advances in Non-Impact Printing Technologies/Japan Hardcopy '93. The congress will be held October 4-8, 1993 at Pacifico Yokohama, Yokohama, Japan. Among the many topics to be covered at this congress are color science, color standards, and the psychophysics of printing and displays.

You are cordially invited to participate in the 9th International Congress on Advances in Non-Impact Printing Technologies/Japan Hardcopy '93. Original contributions related to state-of-the-art and future technologies are invited. The time allocated for the presentation of each paper should be 15 minutes plus 5 minutes for discussion. Please note that the conference language is English. Those wishing to present a paper are requested to send the application form and an abstract of approximately 150-250 words by March 10, 1993 to:

Prof. Masaaki Yokoyama,  
Program Chairman  
The Society of Electrophotography  
of Japan  
c/o Tokyo Institute of Polytechnics  
2-9-5 Honcho, Nakano-ku,  
Tokyo 164, Japan  
Tel. 81-3-3373-9576;  
Fax 81-3-3372-4414

We also ask that you designate from the proposed topic list the one most descriptive of your presentation. Please allow one week for mail delivery. Author(s) will be notified of the acceptance of their paper at the beginning of April 1993, and then asked to submit a camera-ready 4 page full paper for publication in the proceedings by July 10, 1993.

## TAGA HONORS PEARSON



Milton (Milt) Pearson, Principal Imaging Scientist of the Rochester Institute of Technology (RIT) Research Corporation, received a 1992 Honors Award at the Annual Awards Banquet of the Technical Association of the Graphic Arts (TAGA), April 7, 1992, at the Westin Bay Shore Hotel, Vancouver, British Columbia, Canada.

Pearson received the award for his almost 30 years of dedicated service to graphic arts research. He has been a distinguished color reproduction scientist at RIT, has contributed to graphic arts documentary standards, and served for some years as secretary of CIE Committee TC 2.3, Photometric Characteristics of Materials. Since 1964 he has served as TAGA member of Subcommittee on Optical Density of the American National Standards Institute (ANSI).

His most recent contribution to color was as chairman of the very successful ISCC/TAGA 1992 Williamsburg Conference on "Comparison of Color Images Presented in Different Media" at Colonial Williamsburg, Virginia, 23-26 February 1992. A brief report on the meeting appears in ISCC News. A detailed report on the meeting by Mark Fairchild appears in *Color Research and Application*, Vol. 17, No. 4, August 1992, p. 300-302.

*Harry K. Hammond III*

## ARTISTS' PAINTS AND RELATED MATERIALS

## ASTM

*Minutes of  
the Meeting  
of ASTM  
D01.57*

May 29, 1992 (Abbreviated)

ASTM D01.57 met in Las Vegas, Nevada May 29. 20 members and guests attended.

D01.57.02 Lightfastness of Pigments, Tom Vonderbrink, Chair

1. Tom reported that the proposed caveat to section 5 of D4303 passed in subcommittee level. There were a number of issues discussed. It has yet to go to the main committee.

2. ASTM subcommittee G03 requested the opportunity to comment prior to the balloting phase on any standards changes this subcommittee is contemplating relating to accelerated weathering.

3. The proposed change to D4303 was approved in subcommittee balloting.

4. More fluorescent light tests were discussed at the last meeting. There was further discussion.

5. Since some pigments darken in mass tone during lightfastness testing, Joy Luke proposed that, for new pigments, masstones be tested as well as tints.

6. Joy Luke mentioned the expense involved in contracting for xenon-arc testing services. This cost might be reduced by having the manufacturers do some of the testing.

ASTM D01.57.04. Specification for Artists' Paints, Al Spizzo, Chairman

7. Al reported on the results of balloting

8. Mark Golden presented a proposal for the revision of D5098. The revision would allow the producer to use either the Table 1 "common name" or "chemical description" on paint labels.

9. Joy Luke distributed a proposal for corrections and additions to Table 1 of D4302, D5067, and D5098.

10. Because of time, the proposal for including a test to evaluate the potential for bleeding of artist paints was not discussed.

ASTM D01.57.09. Watercolors, Tom Vonderbrink, Chairman

11. Tom reported there was no new business to discuss.

ASTM D01.57.07 Physical Properties, Robert Gamblin, Chairman

12. Mr. Gamblin was unable to attend. He did however submit an outline of a proposal for testing adhesion of oils to acrylics.

ASTM D01.57.10. Consumer Evaluation, Joy Luke, Chairwoman

13. Joy Luke led a discussion with representatives from the Pencil Manufacturers Association regarding the development of a performance standard for colored pencils.

14. Joy Luke reported on the subcommittee balloting of the Standard Practices for Visual Evaluation of the Lightfastness of Art Materials.

ASTM D-01.57.08 Toxicity Labeling and D01.57.12 Determination of Toxicity, Woodhall Stopford, M.D. Chairman

15. Dr. Stopford was unable to attend, but did submit the Draft Standard Test Method for Determining Bioavailability of Metals in Art Materials.

16. Chuck Jacobson spoke regarding the C.P.S.C and the labeling laws.

ASTM D01.57.11. Gouache Paints, Takahiro Takigawa, Chairman

17. Mr. Takigawa distributed Draft 2 of the proposed new Standard specification for Gouache Paints.

ASTM Subcommittee D01.57. Tom Vonderbrink, Vice Chairman

18. It was moved, seconded and approved to accept the minutes from the meeting of January 19 and 20, 1992.

19. Joy Luke moved that her original motion regarding the caveat to D4303-90 be amended.

20. It was decided to table the issue of correcting cadmium pigment identification in Table 1 of the performance standards until after a task group has examined the table in its entirety.

21. The motions regarding the renaming of "Cobalt Green" and the balloting of the Standard Test Method for Determining Bioavailability of Metals in Art Materials were passed unanimously.

22. The next meeting of the Subcommittee is scheduled for January, 1993 at the Crown Sterling Suites Hotel in Ft. Lauderdale, Florida.

23. Meeting was adjourned at 4:48 P.M.

*Mark Gottsegen*

*For Details of the minutes, please contact: Mr. Mark Gottsegen, Department of Art, UNC Greensboro, Greensboro, NC 27412-5001.*

## ASTM E12.02 SUBCOMMITTEE ON SPECTROPHOTOMETRY AND COLORIMETRY (ABBREVIATED)

Minutes of Meeting of June 25,  
1992

**ASTM** Chairman Hammond called the meeting to order at Princeton University, Princeton, New Jersey. The attendance sheets show that there were 17 voting members present out of 63, 3 non voting members out of 10, and 15 visitors.

1. The proposed agenda, distributed at the meeting, was approved without change or addition.

2. The detailed minutes of the meeting of January 20, 1992, were approved as circulated.

3. STATUS OF STANDARDS  
(Numbers correspond to those of agenda items).

3.1 C523 has been withdrawn as shown in 1992 Annual Book of ASTM Standards, Volume 14.02. It is being replaced by E1477-92, Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.

3.2 E259-91, Practice for Preparation of Reference White Reflectance Standards, was reported to have passed Society Ballot.

3.3 E97 is being withdrawn by E12.03; use instead E1347-90, Test Method for Color and Color-Difference Measurement by Tristimulus (Filter) Colorimetry. (E97 still appears in the 1992 Annual Book of ASTM Standards Part 14.02.)

3.4 E308-90, Test Method for Computing the Colors of Objects by Using the CIE System. Hugh Fairman reported on his work on revision of the published tables of weights for computing tristimulus values from spectral data.

3.5 E313-73 (1987), Test Method for Indexes of Whiteness and Yellowness of Near-White, Opaque Materials. Billmeyer stated that the needed revision of the Standard could not be accomplished in the desired time; so he moved that it be reaffirmed. McCamy seconded. The vote was unanimous.

3.6 E805-81 (1987), Practice for Identification of Instrumental Methods of Color or Color-Difference Measurement of Materials. Hammond indicated that this standard needs to be reaffirmed if it is desired to retain it.

3.7 E1164-91, Practice for Obtaining Spectrophotometric Data of Object Color Evaluation. Billmeyer will add a section dealing with the measurement of diffuse transmittance. Rich commented that there is a need for standards of diffuse transmittance of materials such as photographic film. Billmeyer suggested that this subject be discussed under Agenda Item 4.3.

3.8 E1247-88, Test Method for Identifying Fluorescence in Object-Color Specimens by Spectrophotometry. The revision of this standard has passed E12 Committee Ballot and is now going to Society Ballot.

### 4. OLD BUSINESS

4.1 Proposed Guide to Selection of Color Difference Equations. Roland Connelly has prepared some material to go into the new standard. Harold and Billmeyer will obtain material from Connelly and develop a first draft of the proposed guide.

4.2 Precision and Bias Statements for Test Methods Requiring Them. Billmeyer and Norbert Johnson hope to address this matter promptly.

4.3 Proposed Guide to Measurement of Transmittance of Translucent Specimens. Guidance is sought from Jack Hsia of NIST. Hsia has published a Technical Note on the subject that contains material that should be included in the guide.

4.4 Hue Difference Computation. Material from the minutes of the January 1992 meeting of the Committee was published in ISCC News No. 336 and corrected in No. 337, May/June 1992. Another method will soon be published in a paper to appear in the journal Color Research and Application. Anyone having experience with any method of computation of hue difference is requested to communicate with Hammond.

4.5 Method for Total Reflectance proposed by Jerry Popson at the January meeting. Popson revised his January draft and sent it to Hammond and Billmeyer just before the June meeting. Billmeyer wrote a somewhat further revision and sent it to Hammond. This draft meets Popson's need with only a few modifications.

The meeting was adjourned at 10:50 a.m.

*Danny Rich, Sec'y Pro Tem  
Harry K. Hammond III, Chairman*

## COLOR RESEARCH AND APPLICATION IN THIS ISSUE, October 1992

**CR&A** This issue's Talking About

Color... column tackles the problem of color-difference evaluation. Most practitioners of colorimetry use a color difference formula to numerically evaluate the variations in colors that are supposed to match. But what formula? - the CIE recommended CIELAB or CIELUV? - CMC or BDF formulae? - or any of many others? Which one do you use? Rolf Kuehni discussed what is needed before a new formula is adopted as an international standard.

In the middle ages, there were few examples of man-made objects with more striking color than the stained glass windows of the Gothic and Romanesque cathedrals. The richness of the reds and blues are especially

the reds and blues are especially impressive when viewed from the dark interiors. The art of stained glass windows in modern church architecture is considerably different with higher levels of illumination both natural and artificial.

In the medieval cathedrals the ever-changing natural illumination from outside the church produced an ebb and flow of colors as witnessed in the church interior. To understand the visual impression created with stained glass, laboratory situations designed to simulate the color experience in medieval cathedrals were constructed. In "Colour Appearance of Stained Glass Windows" Janos Schanda

reports on these experiments, which use the appearance model developed by Nayatani and his co-workers to describe the changing colored effects of the stained glass.

From color in medieval cathedrals we jump forward roughly seven centuries to consider color in electronic displays in the next three articles. Perhaps the study of color in cathedrals and electronic displays are not so far apart... changing illumination giving rise to changing color appearance is a point of concern to both. How does an observer arrive at an understanding of one constant color

for an object (or an image of an object) when there are variations in illumination caused by light sources and shadows? In "Techniques for Simulating Object Color Under Changing Illuminant Conditions on Electronic Displays," Jimmy Troost and Charles M. M. de Weert compare the characteristics and performance of several computational schemes. Particularly models using complete reflectance measurement are compared to models that use only tristimulus input.

In the second article on electronic displays, M. J. Vrihel and H. J. Trussel are concerned about the problem of producing a hard-copy reproduction that matches the image on a CRT. This problem is complex because the display is calibrated to one illuminant and often the printer to another; then the copy is

viewed under still a different light. A vector space approach using the spectral reflectance distribution in the image is described in "Color Correction Using Principal Components" and the results of this type of color correction is compared to a white point mapping method.

In the third article relating to electronic displays, Sharon McFadden asks how well the user can discriminate images on a display when the background of the display is varied and nonuniform. When electronic displays are used in medical imaging, radar or many other applications, colored symbols may be superimposed on multicolored backgrounds. This situation can cause the colors of symbols to become less discriminating and more confusable. "Discrimination of Colours Presented Against Different Coloured Backgrounds" presents characteristics of sets of colors that should be discriminating in a complex display.

Iridescent metallic colors produce a pleasing effect in jewelry. While such iridescent color arises from interference effects of thin layers of titanium oxide on smooth metal, unlike most other interference colors the hues of titanium jewelry remain relatively constant despite differences in viewing angle

when there is a fixed angle of illumination. Thus Ian Weatherall uses this characteristic to specify "The Interference Colors of Oxidised Titanium Metal" in terms of Munsell designations and CIE colorimetry.

Most people associate red with the message to stop and green with the message to go. Because newly designed lamps can result in large color shifts, it is important to ask how these lamps affect the perception of important safety colors. In "Subjective Preferences for the Red Color of Stop Signs: Implications for the Design of High-Intensity-

Discharge Headlamps" Michael Sivak, Michael Flanagan, Andrew Gellatly, and Juha Luoma address the consequences of colorimetric shifts in red sign materials. It is concluded that designers of high-intensity-discharge headlamps should try to minimize the shift of safety red towards orange.

In the Color Forum the topic of metamerism is featured. First William A. Thornton provides "A Critique of 'Recommended Terminology for Matrix R and Metamerism'", an article published in this journal [vol. 16: 337-41, 1991]. Dr. Thornton's critique is followed by a discussion by Hugh Fairman, author of the original article.

## UNIVERSITY CORNER

### UCLA EXTENSION PRESENTS SHORT COURSES ON PHOTOMETRY AND COLORIMETRY

UCLA Extension presents "Photometry and Colorimetry in Electronic Imagery and Industry," November 9- 13. This course covers photometry and colorimetry as they apply to self-luminous displays, electronic printing and illuminated images, quality control, and paint and dyes, among other applications. The instructor is displays consultant and ISCC member Lawrence Tannas, Jr., MSEE, president, Tannas Electronics.

The class meets at the UCLA Extension Building, 10995 LeConte Ave, 8 AM - 5 PM. For further information, including a brochure detailing all fall quarter engineering short courses, call (310) 825-1047, FAX (213) 206-2815, or write: UCLA Extension, Engineering Short Courses, 10995 LeConte Ave. STE. 542, Los Angeles, CA 90024.

## O T H E R N E W S

### SMS HONORS PROFESSOR FOR ACHIEVEMENTS

Wade S. Thompson, art and design professor at SMS, and Co-chair, Interest Group III (Art Design and Psychology) recently received Distinguished Scholar status from Southwest Missouri State University. This distinction is the highest honor that the school bestows upon a faculty member. Thompson, a faculty member since 1979, received an SMS Foundation Excellence in 1988. He has shown his work actively since 1971. Congratulations Wade!

*Ms. Magenta Yglesias, Co-chair, IG-III*

### MONTAGE 93:

#### International Festival of the Image

July 11 - August 7, 1993 the city of Rochester, New York will host Montage 93: International Festival of the Image. the goals of Montage 93 are to celebrate the fusion of arts and technology in contemporary image-making, and to explore the future of visual communications.

Two new works and 20 exhibitions sponsored by the festival will be unveiled during the first week of Montage 93. Symposia and lectures addressing the impacts of art and technology are scheduled for the second and third weeks of the festival, when numerous professional imaging associations will hold conferences. From July 21-25, the Riverside Convention Center will be the cite of the Arts & Technology Exposition featuring both an imaging industry trade show and media artists working with a full range of new and emerging imaging systems.

The International Student Festival will take place from July 18 - 24 to provide unique educational opportunities for graduate and undergraduate media students.

Discussion groups, demonstrations, and portfolio reviews will be central to this week-long gathering. Independent film and video screenings; performing arts events; workshops, and a wide variety of other daytime and evening events of interest to both specialists and to the general public are scheduled throughout the festival.

Media under consideration at Montage 93 include photography, video, computer imagery, electro-static imagery, laser imagery, image transmission, electronic printing, animation and holography.

Montage 93 seeks proposals for 2 hour workshops, symposia, and lectures by and for teachers, artists, and students Pre-K - Grade 12 on innovative media education programs. Submission deadline US: November 1, 1992.

Outside US: November 15, 1992. Information and submission procedures: Montage 93, 31 Prince St. Rochester, NY 14607; phone 716-442-8898; fax 716-442-8931.

### COLOUR GROUP (GREAT BRITAIN)

The 1993 Newton Medal will be awarded to Professor Semir Zeki, F.R.S. The Newton Lecture and dinner will be held on February 3, 1993 at the Royal Society.

The Colour Group announces their 1992-93 meeting schedule.

7 October Colour in Displays City University 2 PM and New Technologies

4 November Colour in the National Gallery 2 PM History of Art

2 December Colour Matching and Leeds University 10:30 AM Prediction

6 January Colour Deficiencies City University and Anomalies

3 February Newton Lecture Royal Society

3 March Colour in Architecture National Gallery, 2PM

31 March Colour in Archeology Institute of Archeology

19 May Annual Group Meeting Cambridge University

## C A L E N D A R

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

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

### 1992

#### SPE RETEC, Sep. 14-16

Society of Plastics Engineers, Color and Appearance Division/ Philadelphia Section "Measuring Up To Today's Standards", Hyatt at Cherry Hill, New Jersey. Information: Gary E. Beebe, (215) 785-8285.

#### CMG - CONFERENCE, Sep. 20-22

Color Marketing Group International Color Directions Conference, Clarion Plaza, Orlando, Florida. Information: Katie Register (703) 528-7666.

#### OSA - ANNUAL MEETING, Sep. 20-25

Optical Society of America Annual Meeting, Albuquerque, New Mexico. Information: Optical Society, (202) 223-8130.

#### ISEP, Sep. 21-22

International Symposium on Electronic Photography, Sponsored by the Society for Imaging Science and Technology and German Society of Photography, Cologne, Germany. Information: (703) 642-9090.

**IMAGING THE FUTURE, Sep. 21-25**

The Royal Photographic Society Science Committee Symposium on Imaging the Future, University of Cambridge, England. Information: Dr. M. R. Pointer, Kodak Ltd., Research Div. W-93, Harrow, Middlesex, HA1 4TY, England, tel. 44-81-427-4380 or FAX 44-81-863-4798.

**AATCC - CONFERENCE AND EXHIBITION, Oct. 4-7**

American Association of Textile Chemists and Colorists, Hyatt Regency, Atlanta, Georgia. Information: AATCC, (919) 549-8141.

**USNC/CIE ANNUAL MEETING, Oct. 11-13**

The United States National Committee of the CIE Annual Meeting, Embassy Suites Resort, Scottsdale, Arizona. Information: Dr. Ian Lewis (602) 991-9260, FAX (602) 991-0375.

**FSCT, Oct. 21-23**

Federation of Societies for Coatings Technology, 70th Annual Meeting and 57th Paint Industries Show, McCormick Place, Chicago, Illinois. Information: (215) 545-1507.

**IS&T 8th INTERNATIONAL CONGRESS, Oct. 25-30**

8th International Congress on Advances in Non-Impact Printing Technologies with Exhibit, Williamsburg Hilton, Williamsburg, Virginia. Information: (703) 642-9090.

**GIS/LIS Conference, Nov. 6-12**

Geographic Information Systems and Land Information Systems Conference sponsored by the American Society of Photogrammetry and Remote Sensing and several other organizations, San Jose Convention Center, San Jose, California. Information: Denise Cranwell, (301) 493-0200.

**IS&T E/W SYMPOSIUM III, Nov. 8-13**

The Society for Imaging Science & Technology, Maui Westin Hotel, Maui, Hawaii. Information: (703) 642-9090.

**ASTM COMMITTEE D-20 ON PLASTICS, Nov. 15-19**

Miami, Florida. Information: Katharine Schaff, (215) 299-5529.

**OPTICON, Nov. 15-20**

Optical Society of America OPTICON '92, Boston, Massachusetts. Information: Optical Society, (202) 223-8130.

**AATCC FALL MEETING, Nov. 17-19**

American Association of Textile Chemists and Colorists, The Doral Inn, New York City, New York. Information: Jerry Tew, (919) 549-8141.

**1993****ASTM COMMITTEE D-1 ON PAINT, Jan. 17-20**

Crown Sterling Suites, Ft. Lauderdale South, Florida. Information: Scott Orthey, (215) 299-5507.

**ASTM COMMITTEE E-12 ON APPEARANCE, Jan. 17-20**

Crown Sterling Suites, Ft. Lauderdale South, Florida. Information: Bode Buckley, (215) 299-5599.

**IS&T/SPIE SYMPOSIUM, Jan. 31- Feb. 5**

The Society for Imaging Science and Technology Symposium on Electronic Imaging: Science and Technology, San Jose Convention Center, San Jose, California. Information: (703) 642-9094.

**OSA TOPICAL MEETING OPHTHALMIC AND VISUAL OPTICS, Feb. 19-20**

The Optical Society of America - Third Topical Meeting on Ophthalmic and Visual Optics, Doubletree Hotel, Monterey, California. Information: Optical Society of America (202) 223-0920.

**ASTM COMMITTEE D-20 ON PLASTICS, Mar. 1-4**

Atlanta, Georgia. Information: Katharine Schaff, (215) 299-5529.

**CMG - CONFERENCE, Apr. 4-6**

Color Marketing Group International Color Directions Conference, Hyatt Crystal City, Washington, District of Columbia. Information: Katie Register (703) 528-7666.

**LUX EUROPA 1993, Apr. 4-7**

Chartered Institution of Building Services Engineers, Edinburgh, Scotland. Information: CIBSE, Delta House, 222 Balham High Rd., London SW12 9BS.

**ISCC ANNUAL MEETING, Apr. 18-20**

Color, Environment and Regulations, Newport Islander Doubletree Hotel, Newport, Rhode Island. Information: mesh Kumar (401) 823-2161.

**A ANNUAL CONFERENCE, May 2-5**

Technical Association of the Graphic Arts Annual Technical Conference, Minneapolis - St. Paul, Minnesota. Information: Karen Lawrence, (716) 272-0557.

**CORM '93, May 18-21**

National Institute for Standards and Technology, Gaithersburg, Maryland. Information: Dr. Jack Hsia (301) 975-2342.

**ASPRS WORKSHOP ON COLOR PHOTOGRAPHY AND VIDEOGRAPHY IN RESOURCE MONITORING, May 24-27**

American Society for Photogrammetry and Remote Sensing - 14th Biennial Workshop on color Photography and Videography in Resource Monitoring, Utah State University, Logan, Utah. Information: Christopher Neale (801) 750-3689.

**AIC-7TH CONGRESS, Jun. 14-18**

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

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meeting reports



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