M. Balcom

Inter-Society Color Council *Newsletter*

NUMBER 204
January-February 1970

39TH ANNUAL MEETING

The 39th Annual Meeting of the Inter-Society Color Council will be held at the Statler Hilton Hotel, New York, New York, on Monday and Tuesday, April 13-14, 1970. The general theme will be "The Use of Color in Art and Science."

On Monday morning and early afternoon, April 13, meetings of the problems subcommittees will be held. At 3 P.M. on Monday, there will be a presentation by Dr. John Ott, Chairman of the Board of Trustees of the Environmental Health and Light Research Institute at Sarasota, Florida. His topic will be "Physiological Aspects of Psychological Responses to Color," and he will use slides and movies to illustrate his talk. We can expect to see examples of his work in time-lapse photography.

On Tuesday, April 14, there will be a short business meeting followed by a research report by Professor Harry Helson, who was presented the Godlove Award last year. Dr. Helson's presentation will be concerned with his recent research on "Factors Affecting the Pleasantness of Object-Background Color Combinations." Dr. Robert Burnham, as Chairman, has invited several speakers to participate in the symposium on Tuesday afternoon. They will present individual viewpoints and discuss the subject "The Use of Color in Art and Science."

The reception and banquet are Tuesday evening. Dr. Burnham will present an illustrated lecture entitled "More to Color than Meets the Eye."

For advance registration blanks write:

Mr. Ralph M. Evans, Secretary
Inter-Society Color Council
Eastman Kodak Company
Photographic Technology Division, Building 69
Rochester, New York 14650

REPRINT ENCLOSED WITH THIS ISSUE

Dorothy Nickerson, History of the Munsell Color System, Color Engineering, Vol. 7, No. 5, Sept.-Oct. 1969, pp. 42-51. According to the author this is "a history of perhaps the most famous name in the color field and of the development of the Munsell foundation, and also the story of many other color pioneers and their contributions to color technology and color communications."

FROM THE NEW EDITOR

This issue is the first by your new editor. It is experimental in the sense that an attempt has been made to achieve more visual appeal, better and faster legibility, easier scanning capability, and at the same cost. Research on human vision reveals that certain principles can be invoked to achieve the above aims most efficiently. Pages 2 and 3 have been printed from the same text in the previous and the experimental formats respectively, to help you in making a judgment. For guidance, and to help your Board of Directors decide whether these aims have been achieved, will you, as readers, indicate a preference in the box below. Clip the box, and send it to the Secretary whose name and address appear on the last page of the issue. Your response will be helpful and greatly appreciated.

Inter-Society Color Council News Letter

I prefer the previous format, as on page 2. ☐

I prefer the experimental format used in the rest of this issue. ☐

Comments: _____

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Name: _____

Address: _____

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Affiliated with ISCC through _____

THE THREAT OF CONFORMITY

We move into the seventies dazed and bewildered, having struggled through the sixties decade of bad taste, moral unshackling, bombardment of the senses and a frantic search for heightened experiences. Our environment is now machine-dominated paced by over-emphasis on play and perpetual youth -- both escape mechanisms. Much of the progress which was good was overshadowed by the less desirable. Many of the changes were too rapid or too radical to be easily assimilated. Having survived the explosion, we need time to reconnoiter and assess the situation.

Under this pressure for progress, man is surrendering his status as a human being. On every side there is increasing depersonalization. In this mass-oriented world, the individual becomes a lost soul. Our synthetic environment affords only dwindling opportunities for personal expression. Before it is too late, let us stop trying to make all of the world alike -- living and acting as a single body. The differences make this world wonderful. If we continue to squeeze everything from the same tight mold, we will soon destroy all of the excitement, the wonder, the curiosity which our world now holds. It is a blessing that the climates, vegetations, customs, emotions and tastes are different, but technological domination is rapidly eradicating this. We even seek to control the whims of nature!

Fortunately, no one will ever be able to leash color. Each of us sees it differently. We react individually. Our preferences are unique. The more science, technology and merchandising pressures tend to drive the world into a single channel, the more we must look to color to break the chain; to serve as the resistant element and the bold challenger. For color, like music, knows no barrier. It reaches all alike, always evoking individual responses. Indeed COLOR MAKES THE DIFFERENCE!

From the Color Association of the United States, Inc.

ISCC ANNUAL MEETING SYMPOSIUM
"The Use of Color in Art and Science"

The symposium at the April meeting brings together a group of experts in various color fields. Each has a unique background on which to draw, and the individual interpretations of the symposium title can be expected to be provocatively varied, indeed. Six speakers will be called upon to express opinions for brief periods of time and three others will respond to their comments. We can then expect comment from the floor.

The Chairman is Dr. Robert W. Burnham, who recently rejoined the Council after a long absence. Dr. Burnham is a Research Associate with the Eastman Kodak Company where he has done research in the psychophysics of color vision for a number of years. He was formerly Chairman of Delegates from the American Psychological Association, and Chairman of Problem Subcommittee 20: Basic Elements of Color Education. The final report of that subcommittee was published in 1963 by Wiley under the title, "Color: A Guide to Basic Facts and Concepts" with co-authors Dr. Randall M. Hanes, incoming President of the Council, and C. James Bartleson, Vice-President of the Association Internationale de Couleur.

The six speakers on the panel will be Walter C. Granville, Professor Harry Helson, Professor Dorothea Jameson Hurvich, the Reverend Alfred A. Juliano, Calvin S. McCamy, and Frank C. Wright. The respondents will be C. James Bartleson, Dr. JoAnn S. Kinney, and Raymond Spilman.

Walter Granville is well known to many as a past President of the ISCC. He is an independent color consultant from Libertyville, Ill., was formerly with Container Corporation of America and the Inter-Chemical Research Laboratories, and is presently concerned with the color styling of consumer products and the color planning, lighting, and furnishing of schools and hospitals. He planned and supervised the production of the third edition of the Container Corporation's Color Harmony Manual, now widely used for color selection and specification. He is a trustee of the Munsell Color Foundation. Mr. Granville has lectured extensively on color systems and color usage.

Professor Helson has had a long and distinguished career in the academic world, and is currently Professor of Psychology at the University of Massachusetts. He served as a delegate to the ISCC from the American Psychological Association and received the ISCC Godlove award in 1969. He has published a large number of articles, principally in the areas of color and vision, published two books, and edited two others. He is well known for has adaptation-level theory which has been extended broadly from color to a wide variety of human behavior. His current research interests in color concern the role of stimulus factors in asthetic responses to color, the importance of content, color, dynamic quality, and other characteristics in classical and abstract paintings, and the role of color in encoding information in psychophysical judgments.

Professor Hurvich has a highly distinguished background as one half of a research team with her husband, Professor Leo M. Hurvich, which dates back to the early forties. She is, at the present time, Research Professor of Psychology and a member of the Institute of Neurological Sciences at the University of Pennsylvania. Her interests

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are broad in the sense that they are concerned with sensory mechanisms in general (but with vision in particular, and color vision as a subparticular). She is interested in art, in a serious and thought-provoking way, and can be expected to reflect a scientific background in her consideration of the use of color in the artistic arena. She and her husband have published prolifically in the scientific literature and have been instrumental in the quantitative implementation of Hering's theory of color vision which appears to have broad explanatory possibilities.

The Reverend Alfred A. Juliano, a relative newcomer to the ISCC, has been seriously concerned with color for some time. He is an artist-inventor, writer and lecturer, and, incidentally, a pioneer in automotive safety dating back to the thirties. Born in Pennsylvania, he studied for and was ordained a Catholic priest in Connecticut (1946). His technical background has been broad and varied. He has spent many years in his studio and laboratory working on experiments related to his broad humanitarian interests. He is presently devoted to the establishment of an independent research laboratory for special studies in color production and the development of visual systems for educational and other uses.

Calvin S. McCamy is not a member of the ISCC, but his background is full of color. He is Chief of the Image Optics and Photography Section of the National Bureau of Standards. He is basically a physicist and mathematician, and has taught both subjects at the university level. His publications range through flame physics, radiometry, theory of color filters, color vision, photometry, densitometry, and photographic image evaluation, to the preservation of photographic records. He is a consultant to all agencies of government and a member of the National Research Council. He is a member or fellow of a sizable number of national and international technical organizations. He will discuss the growing uses of aerial color photography as applied to many human endeavors and the application of the science of color photography beyond the visible spectrum.

Frank C. Wright is an artist. He is well known to many members of the ISCC as President of the American Artists Professional League. He is also President of the Council of American Artist Societies. His earlier years were spent in marketing, public relations and advertising. During the war, he served as Economic Advisor to General Lucius Clay. Art was a hobby which came to full bloom in 1956. He has studied with such artistic greats as Eugene Savage, Edmund Graecen, Dean Cornwall, and Dimitri Romanovsky. His paintings and drawings appear in such famous collections as those of Victor DuPont, Edward Cabot, Gordon Rust, Louis Tiffany Rusk, Mrs. Angell McAlpin, and Edward Pennel Brooks. He paints murals, landscapes, marine, still life, sporting dogs, horses, sailboats, and portraits. He will bring invaluable experience, plus exuberant enthusiasm to bear in interpreting the use of color in art.

So much for the speakers, and now for the respondents.

C. James Bartleson has been involved in color, color vision, and color reproduction work for nearly twenty years. He is presently Director of Research for the Macbeth Color and Photometry Group of the Kollmorgen Corporation. He has published a sizable number of articles on color and vision and is a member of a number of technical societies. His background ranges widely on both the artistic and technical sides of color. You may expect him to be profound as well as provocative.

Dr. JoAnn S. Kinney is a research psychologist who heads the Vision Research Branch of the Naval Submarine Medical Center at Groton, Connecticut. She directs Navy research studies on underwater, night, and color vision. She, too, has published prolifically and holds a patent for a night vision test. She and a colleague contributed significantly to the ISCC Williamsburg Conference on Color Perception. As a sideline, she lectures in Physiological Psychology and Sensory Perception at the University of Connecticut. She was recently presented the Federal Woman's Award which honors career women in the Federal government for outstanding contributions to major government programs and for personal qualities of leadership, judgment, integrity, and dedication. Beside all that, she is a charming raconteur and should make a real contribution to the symposium.

Last, but certainly not least (the speakers were alphabetically arranged, as well as the respondents), Raymond Spilman is also well known to many ISCC members as the Chairman of Delegates from the Industrial Designers Society of America. He is a highly recognized Industrial Designer (par excellence) who has progressed from General Motors to his own organization in giant steps. He has been internationally recognized with numerous design citations and has been involved in a variety of educational activities which include lecturing at Columbia, MIT, Rhode Island School of Design, Lehigh, Peabody, Syracuse and North Carolina State. He is a fellow of IDSA, and is a past President and Board Chairman of the American Society of Industrial Designers. He was Chairman of the Education Committee for a number of years. Professionally, and in color, he made an extensive training film for U.S. Gypsum, entitled "Color, Texture, Lighting and Design," which was a treatise primarily for laymen on the use of color and how texture and lighting affect the use of color in

design. He has been highly active in ISCC activities. He brings a different slant to the panel which crosses both the lines of art and science.

Well, these are the people, and we hope your interest has been stimulated. They will make the program vibrate.

KODAK PLUGS THE ISCC MEETING

Because of a vital interest in the activities of the ISCC, the Eastman Kodak Company devoted a full page ad describing the kinds of people that are interested in the Council, specifically referring to the annual meeting on April 13 and 14. The activities described ranged from the psychophysics of color, through fashion coordination, the graphic arts, display design, and advertising art. The ad was slated for appearance in Science, December 26, 1969; Scientific Research, December 22, 1969; Scientific American, January, 1970; Harper's Magazine, March, 1970; The Atlantic, April, 1970; and the New York Times Magazine, March 8, 1970. The ad is the latest version of Kodak's series "We want to be useful. . .and even interesting." The ad is reproduced on page 6.

NEW MEMBERS

The following applications for individual membership were accepted at the meeting of the Board of Directors held in New York City on January 15, 1970.

Individual Members and their Particular Interests

Mr. Antonio P. De Andrade e Silva
514 47th Street
Brooklyn, N.Y. 11220
The influences of color in all all aspects of the human behaviour. The color as an important element in the selling market. The color as important element in the hospitals and industries, etc.

Mr. Albert J. Blanc
Dogwood Lane
Balmville, N.Y. 12550
Colorimetric and formulation development, and manufacturing of equipment for industrial measurement and control application.

Mr. Michael A. Caggiano
710 N. Myers St.
Burbank, Calif. 91506
Research in the application of color in environmental design are my primary interests in color.

Mr. Michael Ferrell
Marbon Chemical Division
Borg-Warner Corporation
Washington, W.Va. 26181
Color matching as a science.

Mr. Matthew Foley
6040 Bonny Doon Rd.
Santa Cruz, Calif. 95060
Color with respect to time.

Dr. Iyad I. Ismail
30 Springhill
Dundee, Scotland
Color stability of plastics materials used in dentistry.

Mr. Ronald A. MacLean
123 Walmer Road
Toronto 4, Ontario, Canada
Colour-interiors. Colour-psychology and emotional factors. Colour-form related to industrial design. Colour as subjective and sensory response, etc.

Mr. Donald A. Pahl
Hewlett Packard
1501 Page Mill Road
Palo Alto, Calif. 94304
Physiology, psychology and biology and their effects on living organisms.

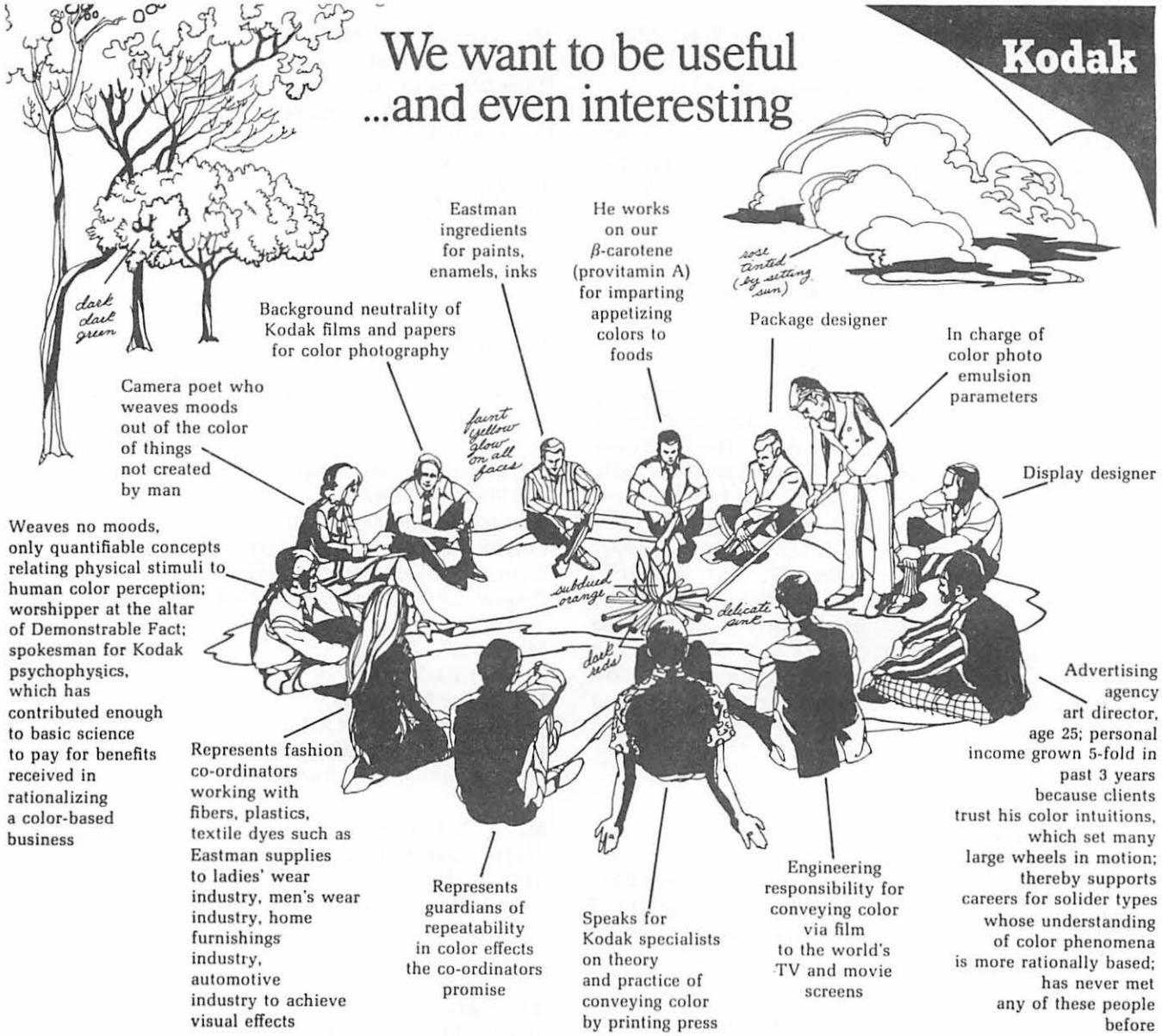
Mr. S. J. Popson
Martin-Sweets Company Inc.
3131 W. Market St.
Louisville, Ky. 40212
Color instrumentation.

Mr. Louis Port
434 Wadsworth Ave.
Plainfield, N.J. 07060
Computer dye standardization and correlation of instrumental and computer analyses with visual observations.

Mr. Eric G. Ratcliffe
Chas. Pfizer & Co. Inc.
640 N. 13th St.
Easton, Pa. 18042
Quality control of dry colors.

Mr. Herbert J. Sanborn
3541 Forest Dr.
Alexandria, Va. 22302
In my professional work and in my own right as an active printmaker (color lithographer) and artist.

Mr. George R. Spears
Sylvania Electric Products
100 Endicott St.
Danvers, Mass. 01923
Measurement and control of product.



We take counsel in preparation for the annual meeting
of the Inter-Society Color Council
in New York on April 13 and 14.

This ad isn't trying to sell you anything in particular. Why not just be informative? Thought you should know that such a thing as the Inter-Society Color Council exists and has existed since 1931. We don't endorse ISCC; ISCC doesn't endorse us. ISCC helps us; we help ISCC.

Some 99.5% of human females and 92% of males are believed capable of seeing color the same way. So widely shared a sensation makes a broad base for a business. To a large extent it is the base of ours.

You can object to objectivity. You have a right to regard the interplay between your psyche and a tulip as no business of physicists, chemists, psychologists, psychophysicists, etc. Be advised that numerous societies of such worthies constitute one side of the 29-member house in the Inter-Society Color Council. The other side consists of societies of professionals in the *use* of color.

Primitive man may have been starved for color. You are sated with it. No matter. Your economic behavior suggests you demand it. Thereby hang vast numbers of jobs. Therefore rivalries and disputes can arise. Objectivity is required. To supply objectivity and renew it, the Inter-Society Color Council meets again. Our people will be right up there on the speaker's platform.

EASTMAN KODAK COMPANY An equal-opportunity employer

Mr. Carl D. Thome
College of Optometry
Pacific University
Forest Grove, Oregon 97116
Testing and researching various illuminants as they pertain to color vision aptitude and its evaluation in the individual. This work is being carried out in a special projects program of post-graduate training in partial fulfillment of the requirements for a master of science degree in Clinical Optometry.

Mr. Masaomi Unagami
Color Planning Center
2-1 Nihonbashi Bakurocho Chuo-ku
Tokyo, Japan 103
Color planning, color coordination of industrial product and information of color problems.

KOLLMORGEN SUPPORTS EDUCATION

Mr. W. B. Reese, Vice President of the Kollmorgen Corporation and President of its Macbeth Color and Photometry Group, has announced the company's policy to support accredited educational institutions qualified to offer courses on color technology. Kollmorgen wishes to encourage the expansion and availability of color courses for the benefit of industry and management in an academic rather than commercial environment. The company believes that such support represents the most effective means of advancing the state of color practice and attaining a desirable level of technical understanding throughout industry. Kollmorgen plans to provide support in three ways: financial grants in aid, invited lecturers from its technical and research staffs, and demonstration materials and equipment for use in laboratory workshops.

The company will also offer training programs devoted to the operation, application, and maintenance of Kollmorgen equipment as a service separate and distinct from its support of the educational courses in color technology referred to above.

A one-week course on "The Principles of Color Technology" will be offered by the Rensselaer Color Measurement Laboratory at Rensselaer Polytechnic Institute in Troy, New York under the direction of Professor Fred W. Billmeyer, Jr. This course, including laboratory workshops enabling participants to reduce to practice the principles elucidated in the lectures, will be held in the week of March 30th through April 3rd. Details may be found in a brochure which has been enclosed with this News Letter.

Another one-week course on "Application of Computers to Color Science" will be held at Clemson University in Clemson, South Carolina, under the direction of Professor Frederick T. Simon. This course will be held in the week of April 27th through May 1st and will be repeated June 8th through June 12th. Details may be obtained from William C. Laffoday, Office of Professional Development, Clemson University, Clemson, South Carolina 29631.

KOLLMORGEN ANNOUNCES NEW SERVICE

A new service for color measurement which will furnish accurate spectrophotometric data for close color control has been announced by the Kollmorgen Corporation. Measurements will be furnished in both graph and tabular form and are available over the standard range of wavelengths for color (380 to 700 nanometers). CIE tristimulus specifications are available with respect to either CIE source A or source C. Details may be obtained from: Kollmorgen Color Measurement Service, Box C, Newburgh, New York 12550.

EXPANSION OF PROBLEM 10

The program of the ISCC Subcommittee for Problem 10, Color Aptitude Test, has been expanded to include a comprehensive study of various commercially available color discrimination tests. The expansion was announced recently by Mrs. Angela C. Little, Cochairman with Carl Foss, in a letter circulated to all known users of the Farnsworth-Munsell 100 Hue Test. The subcommittee had been interested earlier only in improvements of the ISCC Color Aptitude Test.

Mrs. Little says the subcommittee is interested in studying the effects of age, sex, and experience on test scores, and to compare the distribution of scores on the CAT with those on the FM test.

If there is anyone in (or not in) the Council who has been actively involved in a testing program with either or both tests, and who has not been contacted, please notify Mrs. Little at the University of California at Berkeley, 94720, in the Department of Nutritional Sciences, 313 Hilgard Hall.

Information is needed regarding sex, age, score obtained, re-test scores (in chronological order), and training and experience with color discrimination or inspection problems. If any of the testers were color defective or anomalous, copies of the test diagrams on the FM test, as well as scores, would be appreciated, plus any more diagnostic information that may be available.

REPORT OF SUBCOMMITTEE 30, ISCC — SPECIAL WORKSHOP MEETING SEPTEMBER 69

Surface Properties

Carleton Spencer led a lively discussion on surface properties which had been under consideration by the Building Color Committee as a basis for a specification of color and its attributes.

Surface finish has always been a problem for definition and no solution has been found. With the establishment of the Universal Color Language (UCL) it is now opportune to establish a standard for surface properties. Spencer presented a set of gloss standards in acetate as produced for the Detroit Paint Production Club. Samples of various materials were presented to show the problems of identical colors having various glosses and textures. It was shown how some definition or standard is necessary when using colors and textures.

Dick Hunter presented copies of his paper "Gloss Evaluation of Materials" published in 1952 and dealt with the reflectance factors and methods of measuring gloss characteristics. He pointed out that ASTM D523 represents a basis for gloss measurements which is best to date. The use of the 60° viewing angle (from vertical) gave best viewing aspect, however, problems exist in the instrumentation. The 85° angle for sheen observation has also been established making an ASTM standard using three angles, 60° for general observation, 85° for sheen and 20° for high gloss. A D1471 Tuperameter is also used but is not generally accepted. Hunter explained that the greater the accuracy of the measurement, the flatter the surface must be.

Martin (Aluminum Association) asked about the 45° angle used by the Porcelain Enamel Industry; Hunter explained that this was a satisfactory angle for general observation but was not a good angle for inspection for appearance factors. Gloss is infinitely variable and more difficult to measure than color. Spencer suggested some standard general visual classification of gloss, named "apparent gloss."

Hunter feels that more activity on the subject of general appearance is important for future ISCC activity. Martin showed problems of reflectance of textured surfaces. Hanes asked if there were not already some basic categories for measurements of textures; he felt acceptance to be the problem.

Call asked if we could not establish some general areas of texture and gloss.

Hale felt that ASTM already does have some standards.

Scheffler asked for a simple sample arrangement for use of the design trades.

Call reminded of the Kelly "Universal Appearance Factor."

Spencer suggested a general "apparent" range of gloss specification related to the specific trade for each product.

Hunter listed the factors: Shinyness, Haze, Image Quality, Texture (coarseness, embossing which are degrees of texture). Kelly mentions appearance attributes and suggested the Committee establish a working list of factors. Spencer suggests a standard vocabulary giving finish (rather than gloss with high, low and medium as specification for gloss), color by UCL, texture and surface. There was an expressed need for clarification of vocabularity and Hunter offered to establish this for next meeting.

All members present felt that the discussion was very worthwhile and should be continued and expanded. A problem area was designated as: to explain to the building industry the factors of appearance which can be specified and to set some guide lines and tolerances.

Color Tolerances

Nick Hale was chairman of this session and opened with the statement that all proposals were based on the Munsell NBS-ISCC-Centroids system. He presented a tolerance schedule from A to AAAA based on the Nickerson color difference formula: $I = (C/5)(2AH) + 6AV + 3AC$. In this formula values can be altered for each factor. Following is the table of Munsell Color Foundation tolerances:

Designation of the closeness of Color Match	Munsell Hue	Munsell Value	Munsell Chroma
AAAA*	1.5/C	0.03/	/0.1
AAA	2/C	0.05/	/0.2
AA	3/C	0.10/	/0.4
A	4/C	0.20/	/0.6

*AAA is the standard most commonly used but many industries use the AAAA.

Call explains there is a cost factor in specifying tolerances depending on product and the manufacturer, therefore we have a commercial tolerance and a specification tolerance. Olson says the paint industry would enjoy a tolerance spec.

Martin says they use the Hunter lab. spec. with AAA bracket.

Hanes pleads for an acceptability tolerance rather than a formula.

Hale contends that the chart does this.

Hale mentions fade factor or tolerance as basis for Nickerson formula. Kelly refers to Judd table 19 in NBS-ISCC Catalog and shows that color differences are dependent to some extent on the lighting, both type and intensity.

Hunter feels that the color tolerance chart is a good starting place for future committee activity. Hale enquired as to what direction should we go; members felt that we should look at each product area and suggest tolerances applicable. Members are to bring examples of tolerance charts of actual situations, especially areas of argument. The committee will then survey the industry to see if there are some bases for recommendation. Hunter was requested to bring the color tolerance problems, with which he is familiar, due to his area of expertise.

It was felt that the committee should undertake three areas of study and various members offered to work in these areas (non-color).

A — Surface Properties — gloss, haze, distinctiveness of Image, Reflection.

B — Texture — Irregularities of Surface.

C — Within the film — pearlescence, metallics, translucence, transparence.

Milo D. Folley, AIA
Chairman, Subcommittee 30
Color in the Building Industry

JULIAN GARNSEY, 82, COLOR CONSULTANT

Julian Ellsworth Garnsey, beloved and venerated member of the ISCC since 1939, died on December 16, 1969, at his home in Princeton, New Jersey. He was 82 years old.

Mr. Garnsey was a colorist and mural painter who was responsible for the color design of the 1939-40 New York World's Fair. He was also a color consultant for such projects as the Goodhue Library of the University of California at Los Angeles, the Texas Centennial Exposition, and five of the Metropolitan Life Insurance Company's housing projects. From 1942 to 1945 he was associate professor of architecture at Princeton University.

He graduated from Harvard University, Phi Beta Kappa, in 1909. He was a captain in the First Division of the American Expeditionary Forces in World War I and received the French Croix de Guerre.

Grover A. Whalen, president of the 1939 World's Fair, called the prismatic scheme evolved by Mr. Garnsey a "revelation of what can be done with color in architecture. Nothing like it has ever been done before."

He will be greatly missed by members of the Council because of his charming, almost cherubic, manner. His wonderful sense of whimsy will long be remembered, especially as it appeared in his dinner talk at the Washington meeting in 1958.

D. R. DUNCAN

A notice of the Colour Group (Great Britain) reports the death of Dr. D. R. Duncan, of the Paint Research Station, Teddington, Middlesex, England, on Christmas Eve, 1969. Dr. Duncan was internationally known for his pioneer work on calculation of the colors of mixtures of pigments and paints, which is the basis of modern computer color matching in the paint and other industries. He started this work in the late 1930's and published his first paper on it in the Proceedings of the Physical Society for 1940. In 1965 he was honored by receiving the Armin J. Bruning Award of the Federation of Societies for Paint Technology, for which the citation reads "For the most outstanding contribution to the science of color in the field of surface coatings." He was the first recipient of this Award outside the USA.

Dr. Duncan had been a Member of the Paint Research Station Staff since 1932 and during most of that period was Editor of the "Review of Current Literature on the Paint and Allied Industries," now "World Surface Coatings Abstracts," which in its present form covers 350 journals in some 30 different countries.

F. W. Billmeyer, Jr.

37 YEARS AGO

The first issue of the Inter-Society Color Council News Letter was published on October 16, 1933, by M. Rea Paul, as Secretary of the Society. We shall quote his opening statement because most of what he said is as appropriate today as it was then.

"Here is the first News Letter issued by the Inter-Society Color Council to its official delegates and cooperating associates. It is, as you will see, very informal, and designed expressly to acquaint our membership with activities that are being carried on in the field of color. No attempt has been made

to group the following information under special subjects, or to provide headings for the brief abstracts on each. At the same time, it is your Secretary's wish to present this material in the most convenient and usable form, since some of the members will undoubtedly wish to place on file, certain portions of it. Perhaps subjects carried in future News Letters could be grouped under such headings as Art, Science and Industry, or Reports, Abstracts and Notices. Perhaps the pages should be punched for binding in loose leaf form. We would like your opinion on these points, together with any additional ideas that would increase the value of this communication to you.

"The response to the recent request for items of color interest was overwhelmingly gratifying. In fact, it was necessary to hold some of the information for future letters. To be successful in disseminating information, these News Letters must look to you for further contributions from month to month. It will continue to be furnished you as long as you continue to furnish the necessary material of which it is composed."

FROM THE COLOUR GROUP (GREAT BRITAIN)

Report of the Sixty-fourth Science Meeting Held on December 3rd, 1969, at Imperial College

The meeting was entirely on the subject of the Ceramic Colour Standards now available from the British Ceramic Tile Council. The work leading to their production was carried out jointly by an informal group from the National Physical Laboratory, The British Ceramic Research Association and three tile manufacturers following enquiries from I.C.I. dyestuffs division and the Society of Dyers and Colourists.

The inter-linking parts of the work were described by three speakers most concerned with measurements and the organisation of the production of the tiles. Dr. F. J. J. Clarke and Mr. G. E. V. Lambert (N.P.L.) and Mr. F. Malkin (B.C.R.A.) spoke on the relevant parts of their subjects.

Mr. Malkin summarised the history of the project, felt to be necessary to provide precisely made standards to test the consistency and accuracy of colorimeters and spectroradiometers. Nineteen varieties of ceramic wall tiles were considered as prototypes in the first place, including four grey types which had already been examined in some detail by Prof. W. D. Wright of Imperial College as part of a previous collaborative effort.

The first set were repeatedly measured at BCRA (using a special jig to position them on their Colormaster) over a period of about two years, up till the early part of 1969, and the measurements analysed. The meeting was shown slides showing the variations for some of the tiles, which were generally within half a MacAdam ellipse, the same order of difference as that caused by 100°K difference in the lamp or 0.02 in R, G, B readings — the calibration interval on the Colormaster dials. The effects of changing the lamp and of dirt in the colorimeter were shown to be three or four times as serious, and great care was taken that the colorimeter was maintained in perfect condition.

Dr. Clarke outlined the initial measurements on the prototypes and the necessity of carrying out measurements beyond the visible spectrum, down to 200nm in the ultra-violet and up to 2000nm in the infra-red. This arose because of the sensitivity of some photodetectors whose infra-red sensitivity, in particular, becomes a problem due to the inadequate cut-off characteristics of most filters outside the visible spectrum. Generally, the infra-red reflectance could not be predicted from the visible, and therefore spurious measurements might arise from a large infra-red 'leak' when the visible reflectance was low.

He described the NPL use of the Cary 14 spectrophotometer with its reflectance attachment, which had been shown to be reliable within the variance of the instrument. By using two modes of operation, dispersing the light (1) before or (2) after illuminating the tiles, it was found possible to identify fluorescent and thermochromic samples and thus reduce the number of tiles suitable as standards to twelve.

Mr. Malkin then continued the account, explaining how at this stage BCRA chose twelve tile varieties, distributing the colours as well as possible. Three grey tiles allow five linearity checks to be made with the standards.

It was intended to supply a complete calibration check system, 50 sets of tiles with NPL calibrations and the remaining 950 uncalibrated sets supplied with information on their probable constants to a high degree of accuracy, sufficient for all except the most critical work. It had been possible to produce a thousand of each variety, except yellow, in single production batches with consequent advantage for purchasers of uncalibrated sets. The central 2-1/2" of the 4" square tiles was the most uniform, and it was expected that the tiles would prove extremely reliable. Even in the case of the second batch of yellow, the distribution of colours was only just different from the first batch, although these tiles would be given separate calibrations. Most of the tiles could be expected to lie within 1/2 MacAdam unit, although some pink and yellow samples might be found 2 units away from NPL master set figures: variations in lightness

were equally small. Sixty sets had been selected for NPL calibration, on the basis of their flatness and surface finish, and a master set selected from these. Details of the differences of individuals from the master set were presented in comprehensive form. A preliminary test on a number of instruments at I.C.I. showed that the sample repeatability was substantially better than agreement between instruments.

Mr. Lambert then described the careful, detailed measurements now being completed at NPL on the 50 sets to be calibrated with three geometries. These had already necessitated the calculation of 20,000 chromaticities.

The reference white used at NPL is pressed Analar magnesium oxide and results are at present relative to this, which is found reproducible to 0.1%, with a working standard of the Russial opal M14 glass.

The Cary double monochromator used for this work has a quartz prism and a grating, and was used with a bandwidth of about 0.1nm and a similar wavelength scale accuracy over most of the spectrum: photometric accuracy is about 0.2% of full scale. Some measurements were also made with the NPL manual Hilger-Müller spectrophotometer dispersing the light after reflection from the sample. Comparisons were shown between the instruments and with measurements on the prototype tiles, usually within 2% of the new batches.

Dr. Clarke described a method of dealing with certain deficiencies in integrating spheres and concluded the saga by promising a revised summary of all the data in the near future for use with the uncalibrated sets. It is also intended to give absolute figures when the use of the ideal diffuser comes about in a year or two. He acknowledged the great degree of help and co-operation between the many people and organisations involved in the work.

The prototype measurements are described fully in NPL Metrology Centre report MC2, and further publications are to be expected shortly.

Colour Group's Report of the Sixty-fifth Science Meeting Held on January 7th, 1970 at Imperial College

The subject under discussion at the meeting was the relation between visual and instrumental methods of colour matching with particular reference to the plastics and textile industries.

The first paper was given by Mr. R. Best and Miss S. Williams who presented a lively account of the difficulties encountered in colour control in the field of plastics. The plant and processes used in this industry are such that it is essential to operate a four shift system for seven days a week. This means that during any one day visual decisions are made by four different people and everyone knows that the colour used on a previous shift needs a slight adjustment! The result can be a progressive colour drift and the situation is not improved by the variations from day to day in the ability of the matchers to make decisions. The number of wrong decisions made is about 25% of the total number of decisions.

An instrumental control system operating with tolerance limits overcomes these difficulties but colorimeters have to be used in a meaningful way to give tolerances which tie up with visual assessments, and, in the plastics industry, the visual assessment is the final arbiter.

Miss Williams reviewed a number of instruments, both colorimeters and spectrophotometers, which are used for colour control and pointed out the difficulties involved in the measurement of samples with textured or imperfect surfaces.

Any control system which is to be used on a production line has to be simple and rapid e.g. a method which takes 30 seconds is preferred to one which takes 45 seconds. For this reason, professional colorists dislike tolerances and colour difference formulae involving chromaticity co-ordinates and prefer a system based on tristimulus values. It is possible to produce tolerance ellipses for any sample based on Δx and Δy, and these may turn out to be lopsided, but the drawback is that a terrific amount of information on past batches is necessary before the tolerance area can be generated. The method which was found to be most satisfactory involved plotting

$(Y_{Test}/Y_{Standard} - Z_{Test}/Z_{Standard})$ against $(Y_{Test}/Y_{Standard} - X_{Test}/X_{Standard})$ on a Robert Foster chart on which concentric rings corresponding to 1, 2, 3, etc. MacAdam differences had been drawn. The difference between the test and standard samples in terms of MacAdam units, ΔC, was read off this chart and replotted versus $Y_{Test}/Y_{Standard}$. These two charts ensured that the test sample was checked for both colour and lightness acceptability. The number of MacAdam units acceptable could be determined for each particular colour. This method proved to be a quick and easy to operate system of colour control.

The second paper was given by Mr. McLaren and, in spite of travelling difficulties which prevented his attendance at the start of the meeting, he presented a most lucid and interesting account of

the relative merits of visual and instrumental methods of shade passing in the textile industry.

If a range of standard shades only is being dyed, it is feasible to plot the chromaticity co-ordinates of acceptable samples and to draw a curve to enclose them — it will invariabley resemble an ellipse — and to cover lightness differences, ΔY, in a similar fashion so that future production is only accepted if it falls within these tolerances. This approach is impossible in most cases, however, particularly in commission dyehouses which may be asked at any time to match any one of several hundred thousand shades.

In this situation, if an instrumental system of colour control is to be used, reliance has to be placed on colour difference formulae. The criterion for judging such a formula is will it result in more wrong decisions than those of a skilled observer, bearing in mind that in the textile industry the decision to accept or reject is taken by one individual alone. It has been shown that even the most highly skilled observers reject 25% of acceptable samples. However, wrong rejections are not so serious as wrong acceptances because the rejects are corrected. Wrong acceptances may result in goods, which are impossible to reprocess, being rejected by the customer and this usually means that the dyer works to a tighter tolerance than his customer. The replacement of the vague notion implied in the term "good commercial match" by a more precise measured value must obviously have much to commend it, if only that it takes the strain off the visual shade passers.

Several investigations have been carried out to determine which of the several colour difference formulae available is best in a given situation, the criterion adopted being the comparison of ΔE with true visual difference. These have invariably concluded that even with the best of the formulae, the agreement is not good enough to make instrumental shade passing a viable alternative to the visual method. Statistical analysis of the results from six colour difference formulae including 1964 C.I.E., Adams Chromatic Value, Cube Root, Munsell Renotation and Friele-MacAdam-Chickering 2 has shown that no formula is better than another.

However, a more realistic approach would be to compare the number of wrong decisions made by both methods and Mr. McLaren reported on the work he had carried out on this approach. The results of Davidson and Friede had been treated in this way and although there was little difference between the number of wrong rejections for the different formulae, the number of wrong acceptances was lowest for the Friele-MacAdam-Chickering 2 formula. The instrumental results showed an increase of 14% in the number of wrong decisions, but the increase was confined to wrong rejections.

By using an instrumental method of colour control, the dyer can safely assume that his customer will not be conscious of any deterioration in the quality of future matches.

Colour Group — Sixty-sixth Science Meeting

The fifth Science Meeting of the Group for the 1969-70 season was held on February 4th, 1970 at Imperial College.

PROGRAM

Colour in Situ

Mrs. Psyche Pirie (Editor, Homes and Gardens)

Mrs. Pauline Brooke (Ministry of Public Building and Works)

M. J. Thomas (Crest Hotels)

Derek Phillips (Derek Phillips Associates)

Why 'In Situ'? — to distinguish the occasion from those on which colour is considered purely as a matter of science or of art. If this meeting dealt with any 'ology' it was psychology. There was discussion of colour as it is experienced at the receiving end by people who are the purchasers of finishes and furnishings, and those who are meant to enjoy, or at least accept the results of colour scheming.

To open the discussion the following speakers stated their points of view:

Psyche Pirie has had long experience of the reactions of housewives to what is made available for the decoration and furnishing of homes.

Pauline Brooke is an architect with a flair for colour and she works in the Interior Design Unit of the Ministry of Public Building and Works. Her varied experience for the decoration of premises ranges from the private offices of Ministers of the Crown to Mental Hospitals.

M. J. Thomas was concerned with the tastes and responses of people who frequent hotels, restaurants and pubs.

Derek Phillips is an expert on all such requirements in terms of lighting, which is the too-often neglected item essential to a satisfactory colour scheme.

COMPUTERS IN COLOR MEASUREMENT

Guest speaker at recent meetings of the New York and Philadelphia Printing Ink Clubs was Robert Hoban, Sandoz, Inc., East Hanover, New Jersey. He is a delegate to the Council from AATCC. He is responsible for the optical instrumentation laboratories of Sandoz where he has helped to develop computerized color matching systems.

In his talks, he stressed the role of instrumentation today, saying that colorimeters and spectrophotometers have become more useful because of increased data handling capabilities.

A number of different data handling computers can be used in conjunction with optical measuring instruments. Sandoz currently uses an IBM 360, with five tape drives storing information on 2800 different colorants referred to many substrates and concentrations, the speaker said. It took some five years of collecting data to build up this library of standards.

It is not necessary, Mr. Hoban added, for a company to own or lease its own computer. It can use time-sharing systems via teletype where it is possible for fifty or more users to run their problems simultaneously into, and receive answers from, one computer.

CONFERENCE

The British I.E.S. National Lighting Conference will be held at the University of York from April 12-15th 1970. The title of the Conference is "Interior Lighting in the Total Environment" and one of the subjects for discussion is "Light Sources and Surface Colours." Further details can be obtained from the Secretary, Mr. G. F. Cole, The Illuminating Engineering Society, York House, Westminster Bridge Road, London. S.E.1.

HENRY H. REICHHOLD PRI FELLOWSHIP ESTABLISHED AT SYRACUSE UNIVERSITY

Dr. Herbert L. Fenburr, President of PRI, has announced that the Paint Research Institute Fellowship at the State University of New York College of Forestry at Syracuse University has been named the "Henry H. Reichhold PRI Fellowship" with Prof. W. A. Cote, Jr. as the principal investigator.

Dr. Fenburr said that Mr. Reichhold has supported the Paint Research Institute financially for the past four years and in recognition of his interest in PRI activities, the PRI Board of Trustees have expressed their appreciation to Mr. Reichhold by naming a Fellowship in his name. There are now seven named PRI Fellowships.

In referring to Prof. Cote's work (Fellowship #25 — "Interactions at the Wood-Coating Interface") Dr. Raymond R. Myers, Research Director of PRI, stated: "A comparative study of incident and transmitted fluorescent microscopy of uralkyd coatings was published in the October 1968 Journal of Paint Technology. Meanwhile, Reichhold Chemicals of Canada Ltd. provided an alkyd system in the form of individual components of which only the alkyd component fluoresced. Migration into basswood of the solventless alkyd and into white pine of a solution is being studied. Fluorescence intensity is non-uniformly depressed at the interface, possibly because the non-fluorescent pigment concentrates at the wood surface.

"If pigment enrichment at the interface can be proved by a combination of fluorescence and electron microscopy, the technique would lead to a suitable project for the Federation's Research Applications Committee, for it would be valuable in quality control in coatings manufacture."

Dr. Myers continued, "Previous reports have stated that the Syracuse Fellowship is one of our more colorful offerings. The papers in the Journal of Paint Technology have been published in full color and transparencies are available for oral presentations. Also, the Research Applications Committee has a traveling display case on the Fellowship."

OPTICAL METHODS

The Optical Methods Committee of TAPPI held its annual meeting in New York in February. During the past year, the committee worked on 36 assignments, a considerable number of which have resulted in standard procedures that were published or are about to be published. These included a method for determining paper opacity using the Carl Zeiss Elrepho as the master instrument, a standard light source (CIE D65) for the visual color matching of fluorescent papers, a terminology of optical terms, as well as informational publications on common instrumental and visual light sources used for evaluating fluorescent materials, and spectrophotometers with available reversal optics for the same purpose.

PAINT RESEARCH INSTITUTE SYMPOSIUM IN MAY

"Paint Phenomena Influenced by Acid-Base Interactions" is the title of the Paint Research Institute Symposium to be presented at the Holiday Inn East, Columbus, Ohio, on May 19 and 20. This is the second annual meeting arranged by PRI to provide personal contact between coatings research and development personnel and representatives from PRI Fellowship programs.

Featured speaker will be Prof. Russell S. Drago, of the University of Illinois. He will present a four-session lecture on the fundamentals of these interactions based on a short course he is developing for ACS sponsorship. Other speakers will be Dr. David M. Gans, of the Coatings Research Group, Inc., and Harry Burrell, of Inmont Corp. They will relate the acid-base reactions specifically to coatings technology.

The symposium has been arranged by the President of PRI, Herb Fenburr, of Hanna Chemical Coatings Co. Herb stated that nearly all primary coatings phenomena can be influenced decisively by acid-base type interaction, including pigment dispersion, resin solubility, chemical resistance, and adhesion. This year's symposium, he continued, offers the opportunity for paint chemists to obtain a fresh approach to such everyday problems.

Assisting Herb with program arrangements are Lew Larson, of American Zinc Sales Co., and Bill Mirick, of Battelle Memorial Institute. Complete information is available from Bill at 505 King Ave., Columbus 24320 (614) 299-3151.

HONOR AWARD

The architectural firm of Faulkner, Stenhouse, Fryer & Faulkner was recently given an Honor Award in a competition held by the Middle Atlantic Regional Conference of the American Institute of Architects for their remodeling of the Fine Arts-Portrait Gallery of the Smithsonian Institution.

This building was built originally for the U.S. Patent Office and was later used by the Civil Service Commission. It was begun in 1840 and was designed to be one of the first fire-resistive buildings in this country. After the Smithsonian acquired it, the firm was retained to make it into galleries for the National Collection of Fine Arts and the National Portrait Gallery. This alteration took seven years to complete and was the last project for which Waldron Faulkner was the partner-in-charge before his retirement from active practice. It is now one of the main show places in Washington.

LAW ON TAXI COLOR TAKES EFFECT

The police in New York City are ticketing taxis not painted the proper color in accordance with a local law that went into effect with the New Year.

City-licensed cabs must be painted yellow. All others may no longer be yellow or even part yellow. The new law is meant to provide the public with an easy means of distinguishing between the city-licensed cabs and the non-city-licensed private liveries, since the services provided and rates charged by the two types may vary considerably.

The Black Pearl livery in Brooklyn had red and yellow cabs, which are now being painted all red. Other Brooklyn owners, whose cabs are a variety of colors, will also eliminate yellow.

THE PERCEPTION AND APPLICATION OF FLASHING LIGHTS

An International Symposium to be held in the Physics Department, Imperial College, London 19-22 April, 1971.

This Symposium is being arranged under the joint auspices of the National Illumination Committee of Great Britain and of the Applied Optics Section, Imperial College, and under the chairmanship of Mr. J. G. Holmes. The proposal to hold the Symposium has grown out of the program of research on flashing lights at the College and the idea of a Symposium has already been welcomed by a number of government and industrial organizations concerned with flashing lights in various parts of the world.

The main aim of the Symposium will be to promote the exchange of ideas and experience between those engaged in academic research on the perception of flashing lights and those who are designers and users of systems of flashing light signals. Flashing lights are now being used for many different signalling purposes and the Symposium will discuss the planning of future programs of research and development, and the design of new systems.

Provisional Program

The program will consist of six 3-hour Sessions and the subjects to be covered are shown below. The final arrangement of the program will, however, be adjusted according to the number of papers received on each topic.

Monday, 19 April, Afternoon Session

General Theme: The visual perception of flashing lights.

Tuesday, 20 April and Wednesday, 21 April, Morning and Afternoon Sessions

General Theme: The application of flashing lights.

Marine: navigational aids, land and ship signals.

Road Transport: vehicles, traffic control, warning lights.

Aviation: aircraft recognition, ground lights.

Railways: level crossings, signals on trains, underground systems.

Medical, clinical, vision research.

Industrial: equipment, computers and telephones, mimic displays, other uses.

Thursday, 22 April, Morning Session

General Theme: Design and research.

The design of flashing signals and signalling systems.

Future programs of research and development.

Invited Papers

The Sessions will be opened by introductory lectures and the following speakers have accepted invitations to give survey papers covering the main topics of the Symposium:

Dr. J. J. Vos (Institute of Perception, Soesterberg, Netherlands), "The visual process involved in the perception of flashing lights."

Mr. J. G. Holmes (Holophane Ltd., Bletchley, England), "The general application of flashing lights."

Mr. C. A. Douglas (National Bureau of Standards, Washington, U.S.A.), "A survey on the use of flashing lights in aviation."

Mr. R. A. Hargroves (Joseph Lucas (Electrical) Ltd., Birmingham, England), "A survey on the use of flashing lights on roads and road vehicles."

Dr. P. Jainski (Bundesverkehrsministerium, Bonn, Germany), "A survey on the use of flashing lights for marine signalling."

Submission of Papers

Offers of contributed papers must be submitted by 31 March, 1970 giving the title, author's name and place of work, and a short abstract. It is hoped to accept all the papers which are offered, but if the number of papers received is excessive, some will have to be read in title only. All the papers will, however, be open to discussion. The final manuscripts must be received by 30 September, 1970 in order to allow time for preprints to be prepared.

Publication of the Proceedings

Adam Hilger Ltd., have agreed to publish the Proceedings of the Symposium and preprints of the papers will be circulated approximately one month before the date of the Symposium.

Exhibition

It is hoped to organize a small exhibition of flashing light equipment and of demonstrations of flashing light systems.

Registration Fee and Accommodation

The registration fee for the Symposium will be £13 including the cost of a copy of the Proceedings. The numbers attending the Symposium will be limited to 250 and accommodation for 100 participants has been reserved in the College Halls of Residence for three nights from 19-22 April. The cost of accommodation and breakfast will be £2 per night. Arrangements will also be made for the provision of lunches and for a Symposium Dinner, for which additional charges will be made. Participants wishing to stay in hotels must make their own reservations directly with a hotel or through a travel agency.

Acceptance of accommodation in the Halls of Residence and for participation in the Symposium will be taken in the order in which the applications are received after a circular has been sent out in October, 1970.

Preliminary Registration

Preliminary registration for the Symposium may be made, but as soon as possible. This is not a binding registration, but a circular giving further details of the Symposium will only be sent to those who have submitted a preliminary request for registration.

Correspondence

All correspondence should be addressed to:

Professor W. D. Wright
(Flashing Lights Symposium)
Applied Optics Section
Imperial College
LONDON sw7
England

WHAT COLOR IS A TELEPHONE CALL?

The color may be blue, orange, green, brown or slate. Or it may be one of these used in combination with white, red, black, yellow or violet.

When you make a telephone call, it travels over a brightly colored pair of wires. The color doesn't affect your phone calls. But it sure makes life a lot easier for the men who install your phones.

You see, the wires run from your house to a cable. And through the cable to your telephone central office. This cable may contain as many as 900 different wire-pairs.

Imagine the job an installer or cable splicer would have picking out your particular pair of wires if they were all the same color! But with all the different color combinations, the job is easier and installation goes faster.

So when you see a cable splicer or installer at work, you'll know one thing about him for sure. He's not color blind! You should also know that he's part of the biggest cable-placing program in telephone history.

Last year, some 10.6 billion conductor-feet of wire, all kinds of wire, were added in metropolitan New York. Another 12.5 billion conductor feet are planned for 1970.

All this cable won't change the color of anyone's phone calls. But it will help make sure that your calls go through as quickly and speedily as possible.

NEW COLOR INSTRUMENTATION COMPANY FOUNDED BY FORMER KOLLMORGEN/IDL EXECUTIVES

A new company, DIANO CORPORATION, of Norwood, Mass., has been formed by several former executives of the IDL Division of the Kollmorgen Corporation. According to Mr. C. Harris, President, the company plans to offer automated instrumentation and data acquisition systems compatible with present day high speed digital computers and data transmission systems. These automated systems will be designed for use with a variety of scientific instruments including spectrophotometers, spectroradiometers, colorimeters, tensile testers, and other instruments where the acquisition and reduction of data into a useful form is both time consuming and difficult.

Other products and services will include schools in color technology and its applications in industry; consulting for industry in the application of color instrumentation and computers; field service of spectrophotometers and colorimeters including the GERS, B&L 505, COLOR-EYE; computer programming; color measurements; and the preparation and calibration of color standards.

The staff of DIANO includes:

C. Harris — President: Formerly Executive V.P. of IDL

L. C. Noyes — Executive Vice President: Formerly V.P. of Engineering of IDL

W. A. Coppock — Vice President of Marketing: Formerly manager of Application Engineering of IDL

C. Brederson — Manager of Product Service: Formerly a field service engineer at IDL

R. Cavanaugh — Manager Computer Services: Formerly a scientific programmer at IDL

J. Gill — Manager Product Engineering: Formerly an R&D engineer at IDL

NEW COURSE IN COLOR TECHNOLOGY

DIANO CORPORATION has announced its schedule of color courses for the first half of 1970. These two day courses are to aid the colorist in the performance of his color control activities. According to the instructors, Chet Harris and Wes Coppock, the course will cover areas of interest to both technical and management personnel. The course begins with a detailed treatment of basic theory and thus no previous training in the science of color is required.

Through the use of visual aids and a concentration on useful practical concepts only, the instruction offered in this two day course is equivalent to most one week courses being offered by others. Course content includes basic color theory, colorimetry, spectrophotometry, standard light sources, the Munsell system, the CIE system, the L,a,b, system, color difference equations, with detailed discussion of both graphical and computer solution techniques, color matching using computers, preparation, and use of reference standards; radiometry, spectroradiometry, measurement of fluorescent materials, instrumental design concepts, selection of and recommended procedures for establishing a successful color control program. Solution of practical problems in workshop sessions enhances the students understanding of concepts presented in the preceding lecture.

Courses scheduled for the rest of the first half of 1970 are:

April 6, 7 — Cleveland, Ohio
April 9, 10 — Detroit, Mich.
May 4, 5 — Greenville, S.C.
May 7, 8 — Raleigh, N.C.
June 9, 10 — Montreal, Canada

Persons interested in any of these courses should apply at the earliest convenience as the number of participants per class is limited.

A tuition fee of $100 includes textbook, workshop materials, lunches for both days. For more information contact:

DIANO CORPORATION
Box 920, 506 Washington St.
Norwood, Mass. 02062
Tel. (617) 762-8400

RESEARCH TEAM AT LEHIGH STUDIES COLOR PHENOMENA

Now an interdisciplinary research team at Lehigh University is endeavoring to solve mathematically the problems of both the color specialist and the ink maker. Color, with all of its physical, physiological, chemical, and psychological phenomena, is the subject of two investigations being carried on at Lehigh under the direction of Dr. Eugene M. Allen, research professor of chemistry.

The projects, one of which is sponsored by the National Printing Ink Research Institute (NPIRI), are the first to be undertaken within the University's new Color Research Laboratory, which was established recently with a grant from the Pennsylvania Science and Engineering Foundation (PSEF). The new laboratory is an education and research facility within Lehigh's Center for Surface and Coatings Research.

Dr. Allen and his associates are attempting to develop mathematical formulas to simplify and speed up the mixing of dyes which will remain constant under any illumination. Beyond this, they are probing the physical, physiological, and psychological factors involved, in an attempt to reach conclusions about the many phenomena of color not adequately explained by current theory.

Combining the interests of these different disciplines, the Lehigh research team is trying to determine the physical basis for color — that is, how light imparts color to an object and how the object modifies the light. It is also studying the response of the human nervous system to light that stimulates color, and examining the ways people perceive color.

The second phase of the research, that phase sponsored by NPIRI, will aid the printing ink industry. The project is aimed at achieving mathematically a new standard of efficiency in color matching. By reducing to mathematical formulas the many variables associated with color — the chemical properties of dyes and pigments, effect of different light sources, and response of the human optical system to light that stimulates color — color physicists have been able to computerize the color matching process insofar as it applies to textile dyeing, colored plastics, and paints.

However, color matching of printed ink films presents different problems. Computerization has so far proved impossible for two reasons. The color of the printed page, unlike that of a textile, is a complex function of the structure of the paper and the distribution of the ink film within the surface layers of the paper. And there is literally an infinite number of types of paper for the ink to act upon.

The research team is also examining the structure of printed paper in an attempt to work out an optical theory so that a practical computer color-matching program can be written.

Working with Dr. Allen in these investigations are research assistants Paul H. Hoffenberg and Daniel J. Gallagher.

From Tappi

1970 ANNUAL MEETING AND PAINT SHOW TO BE HELD IN BOSTON, MASSACHUSETTS

The 48th Annual Meeting and 35th Paint Industries' Show of the Federation of Societies for Paint Technology will be held in Boston, Mass., from October 28-30, 1970.

The Paint Show will be in the War Memorial Auditorium on Wednesday, Thursday, and Friday (October 28-30).

The headquarters hotels will be the Sheraton Boston and the Statler Hilton. Annual Meeting program sessions will be in the Sheraton as it is located adjacent to the auditorium.

The Program Committee Chairman is Loren B. Odell, of Napko Paint Corp., P.O. Box 14509, Houston, Tex. 77021.

Howard Jerome, of Cadilac Paint & Varnish Co., 156 Western Avenue, Allston, Mass. 02134, is the Host Committee Chairman.

Robert W. Matlack, Federation Executive Secretary, is Manager of the Paint Show.

ELECTRONIC COLOR PRODUCING METHOD

A patent on a new method of producing color electronically has been filed by the Atomic Energy Commission in the names of two Sandia Laboratories engineers, Cecil E. Land of the Ferroelectric Research Division and Donald G. Schueler, now on leave from the Microelectronics Division. The electrooptical system converts white light into colored light by application of electrical voltage pulses to precise points on a thin plate of ferroelectric ceramic. The voltages cause each of the points or color cells to transmit a desired color

of light, depending on the particular combination of pulses. Essentially a solid state color filter, the ceramic system provides an all-electronic means of generating an image in color. In its present state of development, the device has two prime areas of application: as a rapidly changeable color display screen for means of storing visual information, like an erasable, reusable color slide.

From Applied Optics

RED, WHITE AND BLUE

Boy Scout Troop 18 of Cazenovia, New York, forgot to take an American flag along on a recent camping trip. The troop was stymied when the time came for the Pledge of Allegience at a campfire ceremony. Then the brightly shining moon reminded the scouts of the flag left there by the Apollo 11 astronauts. Troop 18 faced the moon and recited the pledge.

THE METROPOLITAN MUSEUM OF ART

"The Year 1200." A Centennial Exhibition at The Metropolitan Museum of Art: February 12, 1970, to May 10, 1970

The exhibition explores the concentrated period in medieval art between 1180 and 1220. It was the time of the reign of Philip Augustus in France, when the cathedrals of Chartres, Notre Dame and Reims were all under construction and the first palace of the Louvre was built. During this period the Gothic style emerged from the Romanesque. It is sometimes called Transitional, but so distinguished are its styles and so recognizable its masterpieces that it would seem to call for a label of its own.

The exhibition includes over 300 works of art — enamelwork, metalwork, ivory, gems, manuscripts, stained glass, textiles and sculpture. Church, state and private collections from 14 countries, including the United States, are contributing their finest treasures to this exhibition.

Many of the objects have never before been seen in the United States, and numerous national monuments are leaving the country of their origin for the first time.

One of the high points of the exhibition is a group of three enamel plaques from the great altarpiece of the Abbey of Klosterneuburg, near Vienna, executed by Nicholas of Verdun, one of the most influential artists of the period. The exhibition will include an extraordinary group of manuscripts borrowed from collections throughout Europe, including the "Devil's Bible" from Stockholm, which was created on skins from 121 mules. The dazzling color and splendor of medieval stained glass windows are represented by panels from Chartres, Bourges, Rouen, Canterbury and other cathedrals and churches.

The exhibition is mounted in the Harry Payne Bingham Special Exhibition Galleries, which cover an area of 18,000 square feet in the second floor, south end of the building, opposite the 81st Street elevators. The installation is designed by Stuart Silver, Manager of the Museum's Exhibition Design Department.

Dr. Florens Deuchler, Chairman of the Department of Medieval art and The Cloisters, and Dr. Konrad Hoffmann and Michael Botwinick of the Museum staff, are responsible for the exhibition.

The Year 1200, the exhibition catalogue, contains twelve color plates and over 350 black and white plates. The foreword is written by Thomas P. F. Hoving, and the text by a leading medieval scholar, Dr. Konrad Hoffmann. The catalogue presents complete entries for all objects. Price: $12.95, clothbound; $5.95, paperbound.

The Year 1200: A Background Volume, comprising eleven essays by leading medievalists on the period of the year 1200. Extensive illustrations with notes cover a wide range of material that does not appear in the exhibition. The introduction is by Dr. Florens Deuchler. Price: $12.95, clothbound; $5.95, paperbound.

Samson and the Lion, a detail from the Klosterneuburg Altarpiece by Nicholas of Verdun, available for purchase. Price: $5.00. Postcards and slides will be available for purchase.

Walter Piston has composed "Ceremonial Fanfare" for the opening. This fanfare is one of five which have been commissioned by the Metropolitan Museum for the openings of its Centennial Exhibitions. The other composers participating are Virgil Thomson, William Schuman, Leonard Bernstein and Aaron Copland.

Francis Thompson, who produced the acclaimed film "To Be Alive" for the Johnson's Wax Pavilion at the New York World's Fair in 1964, has been commissioned to produce a 35mm film on Chartres Cathedral for "The Year 1200." The purpose of the film is to bring to the exhibition one of the central monuments of the period around the year 1200. The color presentation, using motion picture and still photography, explores all aspects of the cathedral's architecture, its sculptural decoration and stained glass windows.

A series of concerts and lectures have been planned to relate to the exhibition.

Leading medievalists from the United States and Europe will meet at the Museum to discuss the year 1200 during the week of March 23.

Thomas P. F. Hoving has narrated a tour of the exhibition, which is available at the entrance to the exhibition galleries.

The Museum's Department of Education has planned extensive and comprehensive services and activities built around the exhibition.

Adults — $1.00
Students — .50
Monday — free
Members — free at all times
School groups — Please call extension 425 for appointment.

Monday-Saturday — 10 a.m. to 5 p.m.
Sunday — 1 p.m. to 5 p.m.
Tuesday — 10 a.m. to 10 p.m.

Note: Entrance to "The Year 1200" closes one hour before regular Museum closing time.

Telephones: Museum — TR 9-5500; Museum Information — 736-2211.

SPECIAL CENTENNIAL EXHIBITIONS TO COME:

"19th-Century America" — April 16, 1970 to September 7, 1970

"Before Cortes: Sculpture of Middle America" — September 30, 1970 to January 3, 1971

"Masterpieces of Fifty Centuries" — November 17, 1970 to February 14, 1971

OFFICIAL BIRTHDAY CELEBRATION — April 13, 1970

Members of ISCC have been cordially invited to attend since that date coincides with our Annual Meeting time. Admission is free on Monday and $1.00 on other days.

PRINCIPLES OF COLOR REPRODUCTION

JOHN A. C. YULE. JOHN WILEY and Sons, Inc., New York, 1967. 411 pages. $15.

This is a book in the WILEY series concerning "Photographic Science and Technology and Graphic Art," which deals with the principles of color reproduction, including specific problems of color photography, printing inks, and paper. It was written by a famous specialist who himself has been, and continues to be creatively active in the field of the theory of color reproduction and masking methods. He is also a voting delegate to the ISCC from TAGA.

The book, probably the first of its kind, dispenses with a detailed treatment of color photography and color theory, but is based on the work of EVANS, HANSON, and BREWER "The Principles of Color Photography" brought out in 1953 by the same publishers. Color reproduction is presented primarily diagrammatically without presuming too much mathematical knowledge. The use of stepped neutral and color wedges is an indispensable aid to obtaining information on the reproduction process. Analogously, photographic sensitometry, a "Sensitometry of Color Reproduction" is arrived at. Everyone who wishes to deal scientifically with color photography should benefit from the unique presentation of this subject matter. The book should appeal equally to technicians, scientists, and students. The two final sections of each of the 13 chapters contribute toward clarification of the subject matter; a brief summary and a number of problems intended to stimulate further thought are included.

The introductory principles — including consideration of correction by masking methods — are followed by discussions of color and brightness reproduction, spectral sensitivity, dyestuffs and paper, and especially the notion of reflectance from printed paper. The chapters of the third part present graphically and mathematically the principles of reproduction, particularly additivity and proportionality rules, black prints, color scanning using point-by-point scanning, correction by computer, and the influence of raster-induced moiré effects. Of special interest are the application of the color chart published around 1930 by the German cameraman v. LAGORIO, and the equations illustrating color printing by Hans E. J. NEUGEBAUER. The literature in this field, which is widely known, is quoted only to a limited extent, confining itself to the most important things. Conversion tables, color transformation equations, and NEUGEBAUER equations are presented in the appendix. Excellent examples of color reproductions, from a printing technology standpoint, complete the excellent design of this valuable production.

Anonymous contribution

COLORIMETRY

I. NIMEROFF. National Bureau of Standards Monograph 104, January, 1968. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, 47 pages, 35 cents.

This monograph is a revision of NBS Circular 478, 1950, by DEANE B. JUDD. Corresponding to similar publications, the National Bureau of

Standards has also here combined principles with practical applications: the first three sections deal in a very concise manner with definitions of the physical and physiological principles of colorimetry, the CIE 1931 system, and the 1964 supplement for a visual field of 10°. D_{5500}, D_{6500} and D_{7500} are listed under standard light sources. Details are given of color differences and the USC system. The second part deals with reference standards: color glasses (especially LOVIBOND glasses) and Arny solutions for transparent specimens, and color atlases for opaque test samples. Color atlases most widely used in the United States are the Color Dictionary of MAERZ and PAUL, the Container Corporation Color Harmony Manual, the Munsell Book of Color, and the ISCC-NBS system. One Dimensional color scales for color temperature, petroleum derivatives, oils, and sugar products, follow ASTM standards. A concluding section, followed by 163 literature references, outlines the limits of the measuring methods.

Anonymous contribution

PHILOSOPHY OF COLOR

The Rays are not Coloured: Essays on the Science of Vision and Colour. By W. D. Wright, 154 pp. American Elsevier, New York, 1967. $5.95

Color is present in everything we see, be it for practical or aesthetic purposes. Since 1931, when the Standard Observer for Colorimetry was recommended for international use in color measurement and specification, color science has advanced greatly. This book is a collection of invited talks given by the author, which surveys the contributions he had made in the light of his forerunners, Isaac Newton, Thomas Young, H. von Helmholtz, James C. Maxwell, and Ewald Herring and his contemporaries, David L. MacAdam, Deane B. Judd, William S. Stiles, John Guild, W. E. Knowles Middleton, Manfred Richter and Yves LeGrand. *William David* Wright surveys the science of color with a philosophical slant, and his book ranges in depth through such subjects as color blindness, color measurement and color vision. Very practical problems such as material texture, color television, night driving and color teaching are also treated adequately. Wright is eminently qualified to have published a collection of his lectures. His contributions to the science of color are legendary, and his students extol his virtues.

The lectures are written with a clarity and sensitivity not to be found in many scientific writings. Two passages quoted from his dissertation on the texture of a rose will illustrate his fine artistic brush. On page 109 he writes: "But wait a moment. The lamp is in fact ejacting millions of photons or light quanta per second and subjecting the rose to an intense random bombardment by their minute particles of energy. What happens when they batter themselves against the petals? Some bounce off, some penetrate a little way into the petal and are scattered back again, some penetrate so far that they escape on the other side. All this will depend on the molecular and atomic dimensions of the structures they encounter and on their own particular energies and frequencies. And out of this chaos emerges a pattern of photons reproducing not merely the overall shape of the flower but the minute structure and translucence of each petal in all its infinite details. This is pure physics, statistical physics at that, yet it is nature at work in all her dynamic profusion and miraculous artistry."

Two pages later Wright states: "Let us take another look at our rose. What is it that makes the flower so attractive? It may be the sheer richness or depth or vividness of the overall colour, but the most fascinating aspect is surely the fine texture of the petals. This is a compound of many different elements: the detailed structure that we see both over the surface and within the petal; the sheen of the top surface reflection; the penetration of the light into and through the petal and its diffusion within the fibrous structure; the subtle gradation of colour along the length of the petal; the shading folds of the petal and the delicate tracery of its edges."

It is with enthusiastic pleasure that I commend the reading of this scientific gem to all who have interests, ranging from casual to penetrating, in color.

Isadore Nimeroff

(Isadore Nimeroff is chief of the Colorimetry and Spectrophotometry Section of the National Bureau of Standards.)

Reprinted from Physics Today, July, 1969

COLORIMETERS — A CONCISE TREATISE

Rudolph Kingslake's comprehensive 5 volume treatise on Applied Optics and Optical Engineering has recently been completed with the publication of Volume V, Optical Instruments: Part 2. *Chapter* 5 on Colorimeters by Harry K. Hammond *III will* interest anyone seeking a concise (27 page) dissertation on the subject. The chapter includes sections on principles of color measurement, visual colorimeters, photoelectric tristimulus colorimeters, specialized colorimeters, and color temperature meters. The material is documented with 64 references, and each one is placed at the bottom of the page on which the reference occurs. Each reference includes the title of the article as

well as the author and journal. Perhaps the most interesting feature of the chapter is the table summarizing the characteristics of 26 commercially available photoelectric tristimulus colorimeters for laboratory measurement of reflecting specimens. Applied Optics and Optical Engineering is published by Academic Press, New York and London.

Harry K. Hammond III

NOMENCLATURE AND DEFINITIONS AVAILABLE TO RADIOMETRIC AND PHOTOMETRIC CHARACTERISTICS OF MATTER

Special Technical Publication 475. 30 pages, 8-1/2 X 11, Soft Cover, Price: $3.00 plus handling and shipping charges.

This book, recently published by the American Society for Testing and Materials, contains a brief discussion of basic considerations governing development of terminology as well as terms, symbols, and definitions for use wherever photometric or radiometric concepts applicable to the characteristics of materials are involved.

No attempt was made to correlate the material in this book with ASTM Standard E 284 on Definitions of Terms Relating to Appearance of Materials, or with ASTM Standard E 349 on Definitions of Terms Relating to Space Simulation.

This publication supplements the American National Standard Z 7.1 — 1967 on Nomenclature and Definitions for Illuminating Engineering. The nomenclature, symbols, and definitions in this book are consistent with those in the ANS Standard Z 7.1 — 1967 as well as those in the (forthcoming) Third Edition of the International Lighting Vocabulary.

Contents: radiometric and photometric characteristics of matter, emission, reflection, absorption, transmission, diffusion, and refraction.

Copies of this publication are available from ASTM, 1916 Race St., Philadelphia, Pa. 19103.

FARBENLEHRE UND FARBENMESSUNG

By Werner Schultz. Springer-Verlag, Berlin, 1966. 83 pp. DM 21.

This small volume presents an admirable summary of the concepts of color measurement and a brief discussion of some of its applications in industry. In view particularly of the fact that a number of the most important treatises on the subject have appeared in English, this book can be enthusiastically recommended as an introduction for those to whom the more detailed English language treatises would on first reading be excessively arduous.

The presentation starts with a discussion of the nature of color and of its physical and subjective aspects. Following the definition and description of the CIE system, the concept of numerical color differences is introduced, and the most important color-order systems are described. The methods of instrumental color measurement are very lucidly presented, followed by a discussion of some of the implications of the relation between spectral specifications, colorimetry, and the perception of color. The final chapter is devoted to a brief exposition of some of the industrial applications of color tolerances, color description, and the uses of colorimetry and spectrophotometry in colorant formulation and color control. The volume is well printed, effectively illustrated, and is substantially free of misprints; it contains a moderate number of color prints.

One might lament various omissions, but the volume is so brief, and is so succinctly effective, that it would be inappropriate for a reviewer to single out particular topics as ones deserving additional detail. There is, however, one limitation that the reader will perceive, not only in this volume but in almost every book on a similar topic of the past decade. It is, of course, made clear throughout the book that any color specification must be based not only on the reflectance (or transmittance) of the sample, but also on the characteristics of the illuminant and of the observer. Appropriate mention is also made of the fact that standard illuminants and standard observers are defined and are used in determining any color specification, but that a true standard illuminant and a true standard observer are not in fact encountered in normal life. Even though these facts are pointed out, the author, in the enthusiasm of his personal commitment as a colorimetrist, frequently draws conclusions which would require that standard observing conditions be rigorously observed if these conclusions were to stand without reservation. Thus, for instance, on page 57 he states that "A color judgment will vary somewhat, as a result of the structure of the eye, if colors subtend an angle greater than about 1.5°. One should therefore conform to this viewing angle in precise evaluations." This statement would seem to imply that, since a color measurement of slightly metameric samples based on the 1931 CIE observer can be confidently expected to lead to conclusions consistent with the observations of a color-normal observer — in the appropriate illuminant — with a 2° field of view, the observer should restrict his observations to this condition so that one can effectively apply the very precise results of colorimetry. Unfortunately, life is not that simple. If

observations of these same samples by the same observer under the same illuminant with a 5° or 10° or 15° field of view would lead to a conclusion different from those at 1.5°, the conclusions drawn from colorimetry with the 1931 CIE observer are not applicable. This might suggest the need for colorimetry with wide range viewing conditions. The tendency to treat colorimetry as an absolute specification, and to lose sight of the hypotheses underlying any given specification, is a common failing of devoted colorimetrists. Just as the past decade has seen major advances — well summarized in this volume — in the industrial application of colorimetry, the next decade can confidently be expected to lead to substantial improvements in the conditions permitting reliable application of color measurements and of numerical color specifications to visual judgments. The availability of the volume will help achieve this goal by providing a sound introduction.

Henry Hemmendinger

From Applied Optics, April 1969

COLOUR MEASUREMENT

By Hans Arens. The Focal Press, New York, 1967. 88 pp. $14.50.

This book is a current English translation, by K. H. Ruddock (Imperial College, London) of the book Farbmetrik which has been revised and rewritten by the author. Farbmetrik was originally written in 1956. The author states that the purpose of the book is to familiarize workers in the field of color photography with the science of color measurement in a general way. The translation is very readable.

The first chapter deals with the general properties of color. Numerous examples are given to develop the difference between judgments of colors from the psychological viewpoint and judgment in terms of the stimulus reaching the eye. A brief description of the psychological approach to color is given considering the classification of color, brightness, and appearance modes. The author then considers color, in detail, as the stimulus reaching the eye. The development in this portion of the book is directed towards a fuller understanding of the Ostwald specification of color.

The second chapter is on color measurement and the author deals extensively with the geometrical representation and computation of the tristimulus values of a color. The treatment starts with the center of gravity construction and logically leads to the development of the CIE specification of color. A development is then given leading to the Ostwald specification of color. A brief discussion follows on color difference and uniform chromaticity scale diagrams.

The remainder of the book contains a brief description of the DIN Color Chart, references, and a conclusion, together with a rather complete table of common colorimetric terms. The table lists the term, symbol, and definition and is further referenced by page number to the fuller discussion earlier in the book. In addition, there is a subject index.

The weakest point in the book is, understandably, the lack of references to American work. Unless access to the German publications were available, the reader would have difficulty in investigating further some of the portions of the book which the author considers to be adequately covered in references which he gives, and therefore gives minimal coverage to in his book.

J. C. Schleter

From Applied Optics, April 1969

COLOR SCIENCE: CONCEPTS AND METHODS, QUANTITATIVE DATA AND FORMULAS

By Gunter Wyszecki and W. S. Stiles. Published by John Wiley & Sons, Inc., New York. 1967.

Color Science is a large 7" by 10" book of 628 pages filled with graphs, charts, tables and formulas, but absolutely no color. (I have always felt that even a book on science could be more colorful and ought to be when its subject is color.) Nevertheless, there are those who work with color whose response to it is less emotional and more intellectual. This book will probably appeal to those who like mathematics and scientific detail.

The book is divided into seven sections. Section one deals with light sources, filters, reflecting surfaces, and detectors of radiant energy; Section two is about the eye; Section three, Colorimetry; Section four, Photometry; Section five, Color and Brightness matching; Section six includes color-order systems and analysis of scaling methods; Section seven includes miscellaneous visual concepts.

The 628 pages are filled with 231 graphs, charts and diagrams of which 90 pages alone are devoted to filter transmission curves; plus 226 pages of tables. Undoubtedly, this book is a gold mine of facts and figures for those who need this material.

In its seven sections are paragraphs or subsections totalling 59, which constitute the reading material in the book, and this is rather discontinuous with the constant insertion of pages of tables as well

as mathematics which the serious scientist would have to follow in detail, taking time out to do so. I read what little was given to read and found almost nothing I have not found in other books where it was presented much more interestingly. The single exception to this was the DIN or German Color System developed by M. Richter and his associates, which I have heard about but have not had the opportunity of examining till now. Consequently, my review must be rather negative, although I imagine that there are those who need the facts, figures, tables, and the like, who will find the book invaluable. I am not in a position to be the judge of such figures.

I noticed something under a paragraph or subsection 3.6 COMPLEMENTARY COLORS, which I feel I ought to say something about from a purely personal point of view. Apparently, the OSA Committee on Colorimetry 1963 decided to attach this name to pairs of spectrum colors whose proportions will produce an achromatic sample matching another of different proportions. It was said that "Complementary pairs of colors are not to be confused with the complementary or the dominent wavelengths of a given color." Since such ambiguous use of the term is bound to result and cause certain confusion, I cannot imagine why a better term was not chosen by the committee. We have enough confusion in the world without deliberately contributing to it. Why not call these "neutralizing pairs" or something better if someone can think of it? How about "achromagenic pairs."?

Don F. Hill

DRY COLOR MANUFACTURERS' ASSOCIATION

Our speaker at one of the recent meetings covered new developments in printing ink. Mr. Robert Bassemir, Manager of the Graphic Arts Laboratories of the Sun Chemical Corporation, indicated a number of future problems of his and the graphic arts industry regarding pollution, the profit squeeze, and new refinements required in vehicles, in addition to the increasing importance of water based flexographic inks, and the extremely dynamic field of offset lithography with its special requirements.

On January 7, Mr. Harry P. Locklin, Manager of the Radiant Color Division, Imperial Color — Hercules, spoke on the subject of fluorescent pigments. His comments on the history, the technical aspects of fluorescence, and in general the chemical and physical properties of the finished pigments and their applications, provided a most interesting and informative review about this rapidly growing segment of the pigment industry.

The Board of Governors of DCMA has approved as recipients of grants-in-aid in the field of color science and education, Rensselaer Polytechnic Institute Color Measurement Laboratory and Clemson University School of Industrial Management and Textile Science. Previously a similar grant had been awarded to the Physics Department of the University of Cincinnati to assist their work in the field of light and color.

In addition, a gift to Lehigh University Center of Surface and Coatings Research has been made as a memorial to Seymour L. Karpeles, Imperial-Hercules and ex-President of DCMA, for his untiring efforts in DCMA programs.

Approval of recommendations from the DCMA Technical Committee has been granted for an award to be given to a member of SPE for the best paper relating to color pigments in the field of plastics.

MEASURING COLOR

How Do You Know Blue Is Really Blue?

By J. F. Reilly (NBS), U.S. Department of Commerce

How many different colors do you think there are? Unless you are unusually familiar with the subject, your estimate will probably be ridiculously low. The human eye can distinguish over 10 million different colors, according to the experts at the U.S. Department of Commerce's National Bureau of Standards.

That vast color-seeing capability of yours makes your world an enormously more beautiful and interesting place in which to live. But for you to get the maximum benefit from color in all its many forms and uses, the work of those Commerce Department scientists is vital.

How does the National Bureau of Standards, the Nation's central measurement laboratory, get involved in the color field? Simply because color is a property that can be measured and stated in numbers. And because of this, colors can be specified and reproduced. On this principle rest the mix-and-match fashions, touch-up paints and actually every planned, purposeful use of color.

The specification and reproduction of color are also important to the many companies which use distinctive color packaging that can be recognized at a distance on a crowded shelf. Those companies would almost rather lose their trademark than end up with an off-color on the package. They must be able to measure, specify and reproduce that color.

Complex Process

This measurement and specification is a fairly complex operation. To determine what color a bathroom tile is, for example, the scientist first finds out how strongly it reflects various colors of light (various "wavelengths," the scientist would say). A blue tile, of course, would reflect blue light very strongly. It might reflect red or green light to a much lesser degree. Still, the amount of red or green it reflects will affect what shade of blue the blue tile is. A little more red and it begins to move toward purple; a little more green and it moves toward aqua.

So the scientist's first job is to measure exactly how much of each color the tile reflects. He does this by creating a rainbow in a black box by using a prism or other optical device to break up the light from a lamp into colors. He then lets the colors out one at a time onto the tile or object to be measured to see how much of each color it reflects.

Next he must calculate lighting conditions. Any object may be a different color when viewed in daylight than under artificial light indoors. Also, he must figure in a mathematical factor for the average human color vision. All people see colors slightly differently. To take this into account, scientists specify colors in terms of a hypothetical person known as "the standard observer." Your particular color vision will not be exactly the same as the imaginary "standard observer's" but it will be fairly close unless you are color blind.

By the time all these factors and measurements are calculated, the NBS scientists end up running the information through a computer to come up with a numerical expression of what "color" the sample really is.

Endless Problems

The problems of color measurement are seemingly endless. The 10 million separate colors the human eye can distinguish can each occur in many forms. For example, the color of a piece of glass is based on the proportion of each color of light that it lets *through* rather than the proportion it reflects. Then there are problems related to the degree of glossiness of the object. These and many other variations must be considered, along with the specific problems of the industry being aided. Color specification in foods is a different task from color specification in textiles or in road signs and so forth.

The Commerce Department entered the color research field in 1912 when manufacturers of cottonseed oil, butter and oleomargarine asked for help in color grading their products. Within a few years, there were requests for aid in such diverse areas as glass in signal lights, protective eyeglasses, headlights, petroleum, turpentine, rosin, paper, textiles, flour, eggshells, dyes and numerous other materials. From this beginning, Commerce has contributed widely to the science of color measurement.

The colors used in road signs and traffic lights are largely those determined by the National Bureau of Standards to be least confusing to the color blind. One of the most common forms of color blindness is the inability to differentiate red from green. The red in a traffic light must be just enough on the yellow side and the green must be just enough on the blue side that the color blind can tell them apart. But they must still be red and green to those with normal color vision.

Many other colors in safety uses are based on Commerce research — railroad signal colors, standard colors used in marine navigation, highway traffic control and aeronautics, for example. NBS participated in the first National Conference on School Bus Standards in 1922. The Bureau's recommendations were instrumental in the early adoption by all states of the now familiar bright yellow known officially as National School Bus Chrome.

With such a history of color measurement research, the Commerce Department continues to be a main center for color measurement, designation and standardization. The traditional work to make even more precise the measurement and standardization techniques on which science and industry depend continues. And new areas of research reflect the growing complexity of our national technology.

One current project, for example, is to determine how well people can discriminate among colors of objects which are relatively small and relatively dim. The results will be vitally important in designing new traffic signal systems, aircraft runway markings and marine navigation beacons.

From: The Evening Star, Washington, D.C., Saturday, December 27, 1969

SIMILAR COLORS RULED BASIS FOR INFRINGEMENT BAN

Although he found a substantial difference in the designs, Federal Judge John M. Cannella ruled that a Boutique Loungewear fabric infringed Loomskill pattern "#1 23543-R.T.W." because the colors were similar.

In the unusual copyright decision, Judge Cannella said that because of the "marked dissimilarity of

the two designs," he would limit a preliminary injunction to those Boutique fabrics with color schemes substantially the same.

The Boutique design "from its general outlay down to its minute details is substantially dissimilar to Loomskill's," he said. But the colors generate "an over-all aesthetic impression substantially similar to that created by petitioners' copyrighted design using the same color."

Copying the expression of an idea, not the idea itself, constitutes infringement, the decision noted.

PORTABLE SCANNING TELERADIOMETER

The Naval Ship Research and Development Laboratory at Annapolis, Maryland, has developed an instrument which has possible applications to a variety of problems.

The instrument might best be described as a portable scanning (tele)radiometer which has a programmable wavelength response.

As currently developed, the instrument scans the spectral band from about 400 to 700 nm, uses a photomultiplier as a detector, and electronically operates on the resultant spectral sweep in such a way that the effective spectral sensitivity is any desired function of wavelength.

The programming of the spectral response is straightforward and deviations from the desired function can easily be held to within several percent throughout the spectral range — even for complicated and discontinuous response functions.

When operating, the instrument can integrate the spectral scan to give a number proportional to the luminance of a target, or read the value of the spectral scan at discrete wavelength points distributed evenly along its spectral range.

EXPERIMENTS IN ART AND TECHNOLOGY

Today the contemporary artist is asking the scientist and engineer to collaborate and participate in the activity of making art. This unique development in art represents a challenging invitation to which the technical and scientific community has responded with increasing interest and activity. The establishment of the Center for Advanced Visual Studies at M.I.T., the sessions at the annual meetings of the AAAS devoted to science and art, and the two-part survey of art and technology in the April and May issues of IEEE SPECTRUM, are examples of this.

Experiments in Art and Technology was established to catalyze a realistic interaction between the contemporary artist and the technical and scientific community. It is based on the recognition that a working collaboration between artist and scientist yields results which are not the preconception of either but are arrived at through the interaction between them. E.A.T. is evolving into an international network open to artists, scientists, engineers and individuals in other occupations and professions who wish to explore the possibilities of the new technology.

You may become a Participating Member of E.A.T. to collaborate with or give technical information to artists. There is no membership fee for Participating Members. If you would like to support and be informed of E.A.T.'s activities rather than participate, you are invited to become a Subscribing Member of E.A.T. at an annual membership fee of $20. One may also become a Sponsoring Member at $100 per year. Contributions are tax deductible.

For information write to:

Experiments In Art And Technology
235 Park Avenue South
New York, N.Y. 10003
(212) 677-3750

WRONG OFFICE DYED BLUE; COLOR PAINTER'S FACE RED

Old-time Federal workers know there are two specialized groups that nobody in Government dares argue with: Civil Service inspectors and painters.

So last week, when a group of painters marched unannounced into a downtown office, nobody argued. The lawyer who worked in the office just shrugged and tiptoed away. His furniture was shoved into the hall and drop cloths were placed over his work.

There was a mild disagreement — not really an argument — at the start. The lawyer cautiously commented that nobody had told him his office was to be painted robin's egg blue.

Orders are orders, said the painter's chief. He had an official-looking document to back him up. It said the office walls would be robin's egg blue. Nobody argued.

The painter and company brushed along. The attorney went back under his protective drop cloth, and continued doing whatever Government lawyers are supposed to do.

Over the next couple of days, several of his coworkers dropped by to congratulate him on his

good fortune. Not everybody has robin's egg blue walls, they noted. He agreed he was lucky to be singled out for the honor. The painters stroked on.

But the day of reckoning was at hand. The painter leader checked his orders one last time as he was applying the last brush strokes. Was his face red!

The orders clearly spelled out that a ninth-floor office was supposed to be painted robin's egg blue. But the office specified was across town — not at 811 Vermont ave. nw.

The painters apologized. The lawyer asked if he could keep his new walls. They said that there wasn't much they could do about it and that he could keep them. He thanked the painters. They said it was nothing and got back in their truck to get some more robin's egg blue paint and try again.

Mike Causey

From the Washington Post

COMPUTER MATCHING

Computerized matching of textiles, paints and plastics is practical and growing. Off-hand, it would seem the methods being used could be adapted to printing inks. They can. However, only to wet samples and fully opaque inks, which constitute a small fraction of the matching done by the industry. The difficulty is that the bulk of inks are matched to dry samples and that they are transparent films varying in reflectance and other properties with the stocks to which they are applied. None of the theories now being used more or less successfully in computer color matching apply to transparent films. Does this mean computer matching is out the window as far as inks are concerned? No. It shows it is not just around the corner.

Automated color matching requires converting color quantities into basic units. Two widely used are the CIE and Munsell systems. The CIE system employs three elements to define color, represented by the letters X, Y, and Z, and called tristimulus values. The three values represent the amounts of the three primary colors, red, green and cyan. A specific color is pin-pointed by plotting the figures on the familiar triangular chromaticity diagram. The Munsell system defines color by a three-dimensional diamond-shaped configuration. With this method, a specific color is pin-pointed by sectioning the diamond and giving the number of steps to be taken horizontally and vertically. It is exemplified by the Interchemical Color Tree. Tristimulus integrators and spectrophotometers can define color of inks quickly in terms of these systems. However, matching is another problem.

Present approaches to computer color matching are based on the Kubelka-Munk theory. In essence, this supposes light from a color sample scatters backward only. For opaque substances it works sufficiently well for a computer to designate a match that puts the color in the ball park. Slight adjustments by color matchers produces a commercial match. Pigment particle size and vehicle properties are other factors, but because the stock shows through in varying degrees, this principle cannot be applied to printing inks at present.

Reduction of computer color matching to inks requires investigation of factors not explored fully. These include pin-pointing how pigments scatter light when dispersed in vehicles, what effect degree of vehicle penetration into paper has, influence of thickness of ink films, and contributions of the stock. Following elucidation of these and other factors, they must be reduced to fundamental terms for computer digestion. Present techniques and new instruments, such as the ellipsometer, put such evaluations by a group, such as the National Printing Ink Research Institute, within the realm of possibility, but at high cost.

At the present stage of knowledge of computer technology, matching inks may not be feasible. At best, like with paints and plastics at present, in the early stages only approximate matches likely will be possible. Final refinement still would have to be made by color matchers. However, it would increase the number of matches that could be made in a day manyfold as well as reduce materially training of color matchers.

Cost of computers would not be a problem even for small manufacturers since centers for renting computer time and services already are common and costs are becoming increasingly nominal. The pace of technology, especially in computers, indicates sooner or later automated color matching will come to the industry. How soon will depend to what extent ink manufacturers are willing to commit the considerable sums needed for assessment and development of the required techniques.

American Ink Maker

AN EXPERT SHEDS LESS LIGHT ON ARTS

Last week, Dr. Robert L. Feller told the Phillips Memorial Gallery in Washington not to worry about a blister forming on a Renoir. Moisten with petroleum solvent, he advised.

He also sent the Israel Museum in Jerusalem his writings on lighting and varnish problems; helped design new showcases for the Princeton University Art Museum — he recommended the use of ultraviolet filters to lessen the chance of fading of paintings — and told a library in Toronto to turn down the intensity of light in its rare-book room.

Increasingly, Dr. Feller is attracting international attention as museums and libraries are finding that they are no longer as safe behind their window panes as they had believed. And they are bringing their problems to Dr. Feller's laboratory on the eighth floor of the Mellon Institute here.

As senior fellow of the National Gallery of Art Research Project in Artists' Materials, Dr. Feller, a 48-year-old soft-spoken man, has become one of the leading authorities on varnish for painting and the effect of light on art objects. Dr. Feller is a voting delegate to ISCC from the AAPL, and is slated to become a member of the Board of Directors.

"He has done more than anyone to alert museums to the great danger in too much light falling on museum objects and in working out formulas for their protection," Joseph V. Noble, vice director for administration of the Metropolitan Museum of Art, said.

"For example, at one time in museums the normal thing was to keep prints on exhibition for years. Now, because of Dr. Feller's researches, we keep them on display for four to six weeks. We rotate the prints. Otherwise they'd become brown and brittle because of the light."

Created by Mellons

The project was established at the suggestion of John Walker, director of the National Gallery, in 1950. It is supported by the Old Dominion and Avalon Foundations, which were created, respectively, by Paul Mellon and his sister, Mrs. Ailsa Mellon Bruce. Their father, Andrew Mellon, founded the gallery. Paul Mellon is now its president.

"When we first started doing tests, we found that one of the most popular varnishes being used could become completely insoluble," Dr. Feller said. "It has since been dropped. We began experimenting with synthetic resins. Our research has helped define how the varnishes differ and on what paintings they can best be applied.

"We recommend a synthetic varnish," he said, "that will last for many years — we don't know when it will ever go brittle. Traditional varnishes have to be removed and their effectiveness varies from 15 to 100 years."

His book, "On Picture Varnishes and Their Solvents," written with Dr. Nathan Stolow and Elizabeth Jones in 1959, is considered the definitive work in the field. The book grew out of a week-long conference on the subject. "Someone asked me, 'How can you talk about varnishes for a week?' " He smiled and added: "Well, we did."

Dr. Feller, who received a bachelor's degree in chemistry, studied art at Dartmouth. He received a Ph.D in physical-organic chemistry at Rutgers University.

More Brightly Illuminated

His study of light grew out of the varnish research. "This is a world of all-glass buildings," he said, "and natural light is suffused through glass walls. Museums are more brightly illuminated than ever. This is causing problems."

Dr. Feller started to find the answers to such questions as: How much of the ultraviolet radiation is filtered out by ordinary glass? How much ultraviolet is present under different conditions of natural illumination, how much on cloudy days compared to clear days or at different times of day? How much ultraviolet is given off by the fluorescent lamps now increasingly used by museums?

"Although ordinary glass filters some of the ultraviolet radiation in daylight and in fluorescent light, a trace passes through," Dr. Feller said. "This can noticeably accelerate the fading of various pigments, the embrittlement of cloth and the deterioration of varnishes and paint."

Among the museums that have installed special filters are the National Gallery and the Metropolitan. Three years ago, filters were installed at the Metropolitan's Blumenthal Patio to filter out sunlight. However, one problem developed. What was good for art, had a deteriorating effect on plants. The Metropolitan now rotates the plants.

Milton Esterow

The New York Times

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Note: In Patents first date is that of publication, second that of original (foreign) application.

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