Margaret M. Balcom

INTER-SOCIETY COLOR COUNCIL
NEWS LETTER

NUMBER 174 January-February 1965

34TH ANNUAL MEETING Once again it's time to schedule and plan your annual trek to New York City for the Annual Meeting of the Inter-Society Color Council. Again this year there is a triple attraction: a day of Problems Subcommittee activity, a symposium on "Colorants for Industry and Design," and the New York World's Fair.

Some of the Problems Subcommittees will hold open meetings. There never is a problem in getting people to attend these sessions. Enough controversy remains to occupy ISCCers for at least another year. No one has clearly shown whether this controversy is a tribute to our success in solving problems or an indication of our failure. We only know that sessions are too well attended, and the discussions are lively.

Only ISCC brings together so many diverse users, producers, and studiers of color. We use a spectrophotometer, an anomaloscope, and a paint brush with equal skill and ease. Our dexterity is demonstrated in the symposium scheduled for Tuesday, April 27. Manufacturers and designers will tell us what they want in colors. Producers will tell us what we can expect and how they plan to achieve it. In the mid 1960's we apparently assume that if we can state clearly what we want, someone will probably make it for us.

The speakers are:

Mr. Robert S. Foster, Columbus Coated Fabrics Corporation, Columbus, Ohio, "Colorant Needs in Industry."

Mr. Bruce Unwin, Kenyon and Eckart Advertising Agency, Detroit, Michigan, "Perspective on Colorant Problems in Advertising."

Mr. William Huckle, Imperial Color Division, Hercules Powder Co., Glens Falls, New York, "Prospects for Improved Inorganic Pigments."

Dr. Julian J. Leavitt, Organic Chemicals Division, American Cyanamid Co., Bound Brook, New Jersey, "Advances in Organic Colorants."

The pièce de résistance and grand finale are scheduled Tuesday evening. The Godlove Award is the highest honor of the color world. To receive the award is to sit beside men (and women) of great achievement and to be assured a

position of fame in history. The award is presented every two years if a suitable recipient can be identified. This year Dr. Isay Balinkin will receive the Godlove Award. (See the following item in this Newsletter.)

The names "Corning" and "Steuben" have special meaning for many of us. At one time we thought that glass was a cheap, common, fragile material with limited usefulness. Corning and Steuben have demonstrated that each of our adjectives can be grossly in error. The banquet speaker, Dr. Robert H. Brill is Director of Scientific Research at the Corning Museum of Glass. The aura of Corning rings in his topic, "Color, Archeology and Ancient Glass."

After all this, if your curiosity or spirit of adventure has not been spent, you might try the World's Fair.

ISAY BALINKIN TO RECEIVE GODLOVE AWARD

One of the highlights of the session will be the presentation at the banquet meeting of the Godlove Award. This award, established in memory of the late Dr. I. H. Godlove, is given biennially for contributions to the subject of color. It will be presented this year to Dr. Isay Balinkin, Professor of Experimental Physics at the University of Cincinnati, and Director of Research for the Cambridge Tile Company of Cincinnati, where he has been consulting physicist since 1936.

Dr. Balinkin's contributions to the subject of color started with his interest in uniform color scales and the expression of color tolerances, sparked by his work in studying the control of color uniformity in ceramic tile. But in color it is perhaps as a teacher and educator, for his development of teaching aids, and for his skill as a lecturer in demonstrating many of the technical facts of color so clearly, that he is best known. His development of a three-dimensional space model of color from which to select color schemes for application to commercial problems, was but one of his early color interests. One of his latest is the Interchemical Color Center exhibit at the New York World's Fair for which he served as color consultant. He is a fellow of the Optical Society of America, a member of Sigma Xi, and a fellow of the American Ceramic Society which he has ably represented in the Inter-Society Color Council for many years. He has served the ISCC in many capacities, as its chairman in 1950-51. No ISCC meeting is quite complete without him!

COLOR MARKETING GROUP A NEW MEMBER BODY

On January 18 ballots marked by voting delegates of ISCC were counted. Seventy-one of the eighty-seven eligible cast ballots. Seventy were affirmative. With this action the Color Marketing Group became the 30th Member Body of the Inter-Society Color Council.

Founded in the spring of 1962 by six members of the Inter-Society Color Council, the Color Marketing Group now has more than 225 individual members throughout the United States. It has been incorporated as a non-profit, educational organization. Its purposes are to promote more knowledgeable use of color in marketing; to provide a forum for the exchange of ideas and the solving of color problems, and to offer education and training in the complete application of color. Membership now includes corporate as well as individual members. The three voting delegates are Kenneth Kelly, Martha Jungerman, and Louis Graham.

A more detailed story of the Color Marketing Group will appear in a later Newsletter.

NEW MEMBERS The following applications for individual membership were accepted at the last meeting of the Board of Directors held in Philadelphia on January 11, 1965.

Individual Members	Particular Interests
Mrs. R. J. Abruzzi (E1) 12 South 12th Street Philadelphia, Pennsylvania 19107	Color of home furnishings, color psychology, correlation, color of home promotion.
Mr. R. J. Abruzzi 12 South 12th Street Philadelphia, Pennsylvania 19107	The printed page typographically and in illustration of educational books and advertising or promotional material.
Miss Evelyn D. Adams Dan River Mills, Inc. 111 West 40th Street New York, New York 10018	Every aspect of color as related to textile design and styling.
Miss Jo Anne Albert 210 East 36th Street New York, New York 10016	The knowledge of color for a mass market and the plotting and prediction of trends.
Mrs. Pauline G. Anastasi 1491 Metropolitan Avenue Bronx, New York	Particular use in designing and styling for cotton textiles and/or synthetic fibers used in textiles.
Mr. Takashi Azuma Central Research Laboratory Tokyo Shibaura Electric Co., Ltd. 1 Komukai Toshibacho Kawasaki, Japan	Color rendering, measurement of color, color psychology and color conditioning.
Mr. Seymour Commanday CIBA Chemical & Dye Co. Route 208 Fair Lawn, New Jersey 07410	Instrumental color measurement and matching, fastness testing, instrumental control of color of company products.
Mrs. Thomas L. Croft 5 Kingsbury Place St. Louis, Missouri 63112	To understand human behavior as it is determined, influenced by, made more pleasant or unpleasant by color and in its uses in fashion, interior decorating, theater, merchandising, architecture, etc.

Individual Members	Particular Interests
Miss Elizabeth N. Davis % Lillian Murr Shop P. O. Box 438 Chester, South Carolina	Some phase of research with color. What research is being done with color and extrasensory perception?
Mr. Arthur H. Groth, Jr. E. I. duPont de Nemours & Co. Marshall Laboratory 3500 Grays Ferry Avenue Philadelphia, Pennsylvania 19146	
Mr. L. James Halberstadt Prophylactic Brush Co. 221 Pine Street Florence, Massachusetts 01062	Its application to household articles and personal brushes.
Mr. C. James Hewlett 11209 Lake Avenue Cleveland, Ohio 44102	Its use in interior design.
Mr. Donald E. Landry 327 Auburn Drive Daytona Beach, Florida 32018	Specification, education, control systems.
Mr. Richard A. Lewis, Pres. Corporate Annual Reports, Inc. 114 East 32nd Street New York, New York 10016	Graphic arts, communication.
Mr. Per Sten Stensby Geigy Industrial Chemicals P. O. Box 430 Ardsley, New York	Evaluation of optical brighteners (visually and instrumentally).
Mr. Luke Thorington Duro-Test Corporation 2321 Kennedy Boulevard North Bergen, New Jersey	Light sources, color rendition, spectroradiometry.
Mr. H. W. Zussman Geigy Chemical Company Ardsley, New York	Instrumentation vs. consumer preference, characterization.

NEW SINGLE DESIGN SOCIETY IN U. S. A new single industrial design society, ASID/IDI, has just been formed through the merger of the American Society of Industrial Designers and the Industrial Designers Institute. Both societies are members of Inter-Society Color Council. John Vassos of Norwalk, Connecticut, a founding member and

first President of the Industrial Designers Institute was named Chairman of the Board; and Henry Dreyfuss of New York City and South Pasadena, California, a founding member and former President of the American Society of Industrial Designers was made President.

ASID/IDI represents approximately five hundred industrial designers. It maintains the standards of the profession in its relations not only with business and industry, but also with government and international designers. It will continue and will enlarge on such programs heretofore sponsored on an individual basis, such as the Design Awards Program which gives recognition to designs of excellence done each year for American industry, and the Student Merit Awards Program and the Walter Dorwin Teague Scholarships for students of Industrial Design. The directors of the new society are confident that a united effort in the field will accomplish even greater recognition of the industrial designer.

FRANCIS SCOFIELD RECEIVES ARMIN J. BRUNING AWARD

This award--"for the most outstanding contribution to the science of color in the field of coatings technology"--was established in 1962 by John W. Masury & Sons, Inc., Baltimore, Md. The award commemorates the name of Armin "Joe" Bruning, who headed the Color Control Department servicing both the Masury and H. B. Davis Companies.

The 1964 Armin J. Bruning Award plaque was presented to Francis Scofield, Director of the Technical Division of the National Paint, Varnish and Lacquer Association, Washington, D. C. Mr. Scofield has been associated with the NPVLA since 1936, serving first in the Scientific Section which has since been expanded into the Technical Division.

SOCIETY OF PLASTICS ENGINEERS RETEC

The Society of Plastics Engineers has scheduled a Regional Technical Conference at the Manger Hotel in Rochester, New York, May 12, 1965. The subject of the RETEC is "Coloring of Plastics II." Eight papers are scheduled in the one-day program:

"Rapid Color Measurement of Light," Stewart Sease and Paul Fisher, Rohm and Haas

"Some Unsolved Problems in Color Matching," George Ingle, Monsanto

"Use of U. V. Absorbers in Stabilizing Plastics Colorants," J. A. Weicksel, American Cyanamid

"Coloring Plastics through Surface Decoration," R. E. Dunning, Bee Chemical

"Stylist Looks at Color," Dudley Smart, Chrysler Styling

"Yellowness Measurement of Plastics for Lighting Use," Fred Billmeyer, Jr., Rensselaer Polytechnic Institute

"Relationship of Chemistry to the Application Properties of Azo Colors in Plastics," S. Zukerman and M. J. Dunn, H. Kohnstamm

Informal Panel Discussion on Color Problems

Registration fee including preprint and luncheon is $13 for S. P. E. members or $15 for non-members in advance. Tickets are $2 higher at the door. For advance registration or other information write Richard Melville, Vogt Manufacturing, 100 Fernwood Avenue, Rochester, New York 14621.

HARRIET J. TAYLOR DIES For the number of ISCC members who knew her, it will be sad news to hear of the death, on January 4, 1965, of Miss Harriet J. Taylor, 90, in Hinsdale, Illinois, where for many years following her retirement she was very happy to be a resident of the King-Breuwart House. The news comes from an item in the Chicago Tribune of January 6, forwarded by Walter Granville, with the comment that "She certainly was one of the pioneers in promoting a better understanding of color in the midwest."

In the days when Miss Taylor was active in color she worked for Favor, Ruhl and Company of Chicago, handlers of artist and school supplies. She was an early proponent of the Munsell system in teaching color to children and was a Favor, Ruhl representative at many an Eastern and Western Arts Association meeting where supplies for teaching the system were exhibited by her company. She was close to the early group that included Arthur S. Allen, T. M. Cleland, and Emory C. Andrews.

Many of us knew her, a few quite well -- Walter Granville, Carl Foss, C. R. Conquergood, Harold Lloyd, Blanche Bellamy, Genevieve Becker Gorman, I believe Faber Birren also. Undoubtedly there are others.

One of my early memories of Miss Taylor was her delight at the sign she found left for her on the door of the Munsell school she was visiting in Meredith, N. H., in 1926; it said, "Gone to measure the sunset." This was true; the entire group had gone to sketch a sunset and to fill in color notations that would be followed later in completing the sketch. She knew exactly what we meant, and in later years reminded me of this sign many times.

I remember, too, that it was in the company of Miss Taylor, at the color meeting held at the Willard Hotel in Washington in 1939, that I first met Mr. C. R. Conquergood. With Carl Foss and a Mr. Organ (I never forgot his name), we five hired a car and went sightseeing together, leaving a quartet of us as fast color friends since that early day.

As for Harold Lloyd, he overcame my skepticism about his long-standing interest in color when I met him at the philatelic color meeting back in 1947, by quoting the length of time he had already known Miss Harriet! She provided a bond that made her friends feel immediately closer than if they had met in another more usual manner.

Her blue eyes had a sparkle that showed her enjoyment of life. And her interest in color, during the years that she worked, was one of her great satisfactions. After her retirement from business, her color friends continued to mean much to her. Those of us who knew her well smile at such memories as we pause for a bit to recall such happy incidents. Memories live, though time marches on---D. N.

QUESTIONNAIRE ON COLOR BOOK

Included with this Newsletter is a questionnaire and a return envelope. The purpose of the questionnaire is to discover what additional work, if any, Problem Subcommittee 20 should undertake. Question 5 is the most important. Be sure to answer this one. We want to keep this excellent committee working.

THE COLOUR GROUP GREAT BRITAIN

"Some Classic Books of Colour" was the topic of the 23rd Science Meeting of the Colour Group. Members, each an author, selected a book, and each presented a review. The books reviewed were:

Six Lectures on Light, J. Tyndall, New York, 1873; London, 1875.

Principles of Light and Color, Edwin D. Babbitt, East Orange, 1878.

Color-Vision and Color-Blindness, J. E. Jennings, Philadelphia, 1896.

A Color Notation, A. H. Munsell, Baltimore, 1905.

An Introduction to the Study of Colour Vision, J. H. Parsons, Cambridge, 1915.

Light and Colour in the Open Air, M. Minnaert, London, 1940.

An Introduction to Color, R. M. Evans, New York, 1948.

At the January meeting three speakers discussed "Computers and Colorimetry." The speakers were A. W. S. Tarrant, Spectroscopy Department, Battersea College of Technology; Dr. E. Atherton, I. C. I. Dyestuffs Division; and Mr. J. L. R. Landry, Davidson and Hemmendinger, Brussels.

"Colour Rendering" was the topic of the February meeting. The three speakers were Dr. J. L. Ouweltjes, "CIE Test Colour Method"; Dr. B. H. Crawford, "The Band Method"; and Dr. D. A. Palmer, National Physical Laboratory, "Experiments Predicting Colour Shift Using the Band System." The Colour Group plans to develop a comprehensive annotated book list on the subject of color. Members have been invited to suggest books to be included.

DOROTHY NICKERSON RETIRES (?)

Our long-time Secretary and Past President of the Inter-Society Color Council retired on December 31, 1964, from the U. S. Department of Agriculture where she was leader, Color Research Laboratory, Market Quality Research Division. Miss Nickerson had been associated with the Department of Agriculture for over thirty years and prior to that with the Munsell Company. Her life has been devoted to color and to the grading of agricultural products where color is an important favor.

On December 16th, Miss Nickerson was surprised by her co-workers at the Department of Agriculture where a party in her honor was given. She was also presented with a leather-bound book filled with letters of congratulations and good wishes for her future which we all know will be a very active one. She was also presented with a television set.

In commenting on the party and presentations, referred to above, Miss Nickerson said that this was one of the first times her associates at the Department of Agriculture and her "color friends" were together and she was anxious for them to meet. There were nearly 100 people there and many of Miss Nickerson's friends came from far away just to attend her retirement party.

Some of those who have been actively working with her and are known as her "color friends" who attended her retirement party were Deane B. Judd, Kenneth Kelly, Isadore Nimeroff, Lou Barbrow from the National Bureau of Standards; Frank Scofield and Everett Call from the National Paint, Varnish and Lacquer Association; and Mrs. Margaret Godlove. Walter Scott, former Director of the Southern U. S. D. A. Regional Laboratory and one of the original counselors of the ISCC and Vice Chairman in 1942, was also present and many others.

Where Miss Nickerson has been only recently associated with the Color Research Laboratory of the Market Quality Research Division, the party was jointly sponsored by them and also by the group with whom she was long associated -- Cotton Division, Agricultural Marketing Service.

To say that Dorothy Nickerson has retired is certainly a misnomer. All of her friends who have known of her vitality know that she has tremendous plans for the future and that she is now devoting her full time to her avocation rather than her vocation. One of many new plans she now has is to provide color definitions for a new dictionary to be published. It is probable that her greatest problem will be to keep herself free enough to take an occasional vacation and to do some traveling which she has planned for such a long time.

Miss Nickerson, having contributed an enormous amount to the field of color, will now be spending all of her free time in this area and in other special interests which leaves us only to hope that we, in color, will receive a proportionate share of her attention.

Congratulations, Dorothy, on the completion of the first phase of your life and best wishes for phase two which should be most enjoyable for you and most productive in the field of science and education.

Norman Macbeth

INTERNATIONAL COLOUR MEETING

Lucerna, meaning lamp in Latin, will shine bright with light and color when the colorists from many countries are assembled to discuss scientific and practical aspects of color in Lucerne, Switzerland on June 1-4, 1965.

The international color meetings in Europe are taking place every year--the previous meeting was held in Strassburg during 1954. Many Americans were in attendance at the time of such meeting in Düsseldorf in 1961. It is expected that there will be a large representation from the United States in 1965.

These meetings are widely diversified in their subject matter centered around color. The exchange of knowledge and experience should profit not only physiologists, psychologists, physicists, and chemists, but also artists, architects, dye manufacturers, and educationalists.

The broad spectrum of subjects as shown in the presently available program covers eight main headings: color physiology, colorimetrics, color systems, color measurement, reproduction, mixing, color conditioning, and education. These main themes will be assigned half a day which means that many sessions will have to run concurrently.

An introductory invited lecture of about half an hour will create the proper climate for the shorter contributed papers.

At the opening ceremony on Tuesday, June 1, Dr. Judd (USA) will present the latest views on one of the least known and most important aspects dealing with "Color Appearance." The session on color measurement will have Professor Richter (G) as the main speaker, while the physiology of color will be introduced by Professor Le Grand (F).

Next day the broad views on the philosophy of color will be presented by Professor Wright (GB) to be followed by colorimetry with Dr. Wyszecki (CND) and Déribéré on color conditioning.

On Thursday, June 3, two morning sessions will introduce the subject of calculating dye mixtures by Dr. Brockes (G) and color in art by Mr. Wilson (GB).

Final day will be devoted to reproduction of colors by Dr. Friele (ND) and color in education by Professor Balinkin (USA).

The Swiss Organizing Committee which includes our own Ralph E. Pike has done a neat job in arranging the program, not forgetting several pleasant social events. We can be assured of a warm welcome at this International Color Meeting in Lucerne in 1965.

Those who are interested to be informed about complete program should write to:

Secretary of the Swiss Organizing Committee
International Color Meeting 1965
Seefeldstrasse 301
8008 Zurich, Switzerland

Isay Balinkin

ISCC PLEDGES $2,000 TO COOPER UNION MUSEUM FOR THE ARTS OF DECORATION

Many members and member bodies of the Inter-Society Color Council have had close association with the Cooper Union Museum for the Arts of Decoration. An open house and reception was held at the museum during the 1964 ISCC Annual Meeting. Those who attended saw at first hand their magnificent contribution to the decorative arts. The ISCC Newsletter No. 168 (November-December 1963) told of the attempt by the Cooper Union Trustees to close this museum and of the formation of a "Committee to Save the Cooper Union Museum," and in the ISCC Newsletter No. 169 (January-February 1964) the desire of this committee to prepare for eventual financial support of the museum was discussed.

ISCC recently received a letter from Henry F. duPont, Chairman of the Committee to Save the Cooper Union Museum, in which the present status of the museum was reviewed.

After prolonged efforts to stir the interest of a suitable institution to accept responsibility for the future of the museum, the committee believes that they have found the ideal recipient in the Smithsonian Institution. Mr. Dillon Ripley, the Chief Executive Officer of the Smithsonian, presented to his Board of Regents in January a positive proposal for assumption by the Smithsonian of responsibility for the Cooper Union Museum. The proposal expressly involves the retention of the museum in the City of New York and its continuance as an entity in its present character and with its present resources and services with plans for vitalization and development.

A requisite element in the success of this proposal, and its chance of acceptance by the Board of Regents of the Smithsonian, will be a demonstration on the part of the committee of evidence of independent financial support here in New York, from foundations and individuals interested in this preservation and prepared to contribute toward its accomplishment. The Smithsonian budgets are reviewed and approved at least two years in advance, and for that reason, as well as for the reason of assurance to the Smithsonian that there is substantial local support on which to build their ultimate responsibility, operating funds for a 4-year period are required.

The committee has already received conditional pledges totalling approximately $53,000 per year for four years or $212,000 in all. They now require additional pledges from among members of the committee and their sources of approximately $47,000 per year over four years. This would make a total of $100,000 per year for four years. At the same time the committee is making submissions to some important foundations to provide the remaining $100,000 per year for four years in matching funds.

During the January 12, 1965, meeting of the ISCC Board of Directors, it was agreed that the council would pledge the sum of $500 per year for the next four years for the support of the museum if the proposal for acceptance is agreeable to the Board of Regents of the Smithsonian Institute. We know that you will be pleased to hear of the support of the council for this worthy cause. Individual members or member bodies who wish to add their support, may write to the Committee Chairman, Mr. Henry F. duPont, Winterthur, Delaware.

RENSSELAER OFFERS COLOR PROGRAM

Rensselaer Polytechnic Institute has announced a short color course for June 21-25, 1965. The program, "Principles of Color Technology," will be held on the Rensselaer campus, Troy, New York. The Director of the course is Dr. Fred W. Billmeyer. A brochure describing the course and an application form are enclosed with this Newsletter.

HUNTERLAB WORK SHOP

The third Hunter Associates Laboratory Workshop on Measurement and Specification of Appearance of Materials was held at the Park Arlington Motel, Arlington, Virginia, during the week of January 11, 1965.

The five-day lecture and laboratory session was intended for customers, technical representatives, and other interested persons from all industries: food, paint, paper, plastics, textiles, etc. Richard S. Hunter, Hunterlab President, a recognized expert with 35 years in the field, presented most of the lectures.

Areas covered included: (1) Underlying scientific facts from physics and psychology, (2) Visual dimensions of appearance, (3) Measurement scales for description and specification of color, gloss, etc., (4) Instrument use, design, and construction, (5) Applications by industry, (6) Specimen handling.

Lecture outlines and reprints were furnished by Hunterlab. Registration was limited to 30 students; fee, $150. It is expected that Hunterlab will offer a similar course in August. For information write to Hunterlab, 5421 Brier Ridge Road, McLean, Virginia.

BOOK REVIEW
COLOUR MEASUREMENT IN THE TEXTILE INDUSTRY

Colour Measurement in the Textile Industry, by Dr. Anni Berger and Dr. Andreas Brockes. Co-authored in the translation from the German Farbmessung in der Textilindustrie by Dr. N. Dalal. Published by Farbenfabriken Bayer AG, Leverkusen, Germany, as a special edition of the Bayer Farben Revue, February 1964. Sixty-four pages, 6 x 8 inches, liberally illustrated. Copies may be obtained free of charge by writing to Verona Dyestuffs, Springfield Road, Union, New Jersey.

Written by two of the foremost European experts in the field, this beautifully illustrated booklet should be in the hands of everyone concerned with or interested in color measurement, no matter what industry is involved. The major topics covered are outlined by the headings of the Table of Contents:

Fundamentals (of the physical aspects of color and the CIE system)

Technique of Measurement (specimen preparation, principles of instrumental color measurement, descriptions of instruments by type and commercial availability)

Color Formulation (relating concentration of colorants to reflectance, spectrophotometric and colorimetric matching)

Color Difference Calculation

Special Problems (fluorescence, whiteness, etc.)

Appendix (contains both tables of data and examples of various calculations)

Bibliography (lists references cited in the text)

As the reviewer knows only too well, it is far from easy to write about color measurement in simple, readily understood language. Dr. Brockes and Frau Dr. Berger have done substantially better than average in this respect, especially when one considers their double handicap of space limitations and translation into a different langauge. Concepts are, on the whole, presented clearly and accurately, and if the longer sentences customary in the German tongue don't yield on the first reading, a second attempt usually suffices.

The authors are especially to be congratulated for including numerical examples of the calculations involved in color matching and in obtaining color differences. Nothing serves to illustrate these arithmetical chores as well as actual examples, and far too few of these are available elsewhere in the literature on color measurement.

Occasionally, a difference in usage carries over from the German which may prove confusing to the uninitiated reader, for whom this booklet is intended. We would say "colorimetry," for example, instead of "color metric," and "standard and sample" instead of "sample and matching." Similarly (page 5), it is by international usage rather than agreement that most color measurement uses just two standard light sources, CIE Illuminants A and C. In another case (pages 6, 8, 10), it is the lack of accepted specific terms in English that leads to the confusion: we have no better word than "brightness" to use for describing three concepts well differentiated in the original German-luminance, purity, and the combination of the two known as dyers' brightness.

In several other instances, the discussion in Color Measurement could be improved by slight amplification. Thus (page 6) the concept of the CIE system can usefully be derived from the three-receptor model of color vision, but this bypasses the basis of the system in the additive mixing of colored lights, so helpful in setting the stage for later discussion of colorimetry and colorimeters.

On page 16, it is not made clear that most colorimeters do not have separate filters converting the spectral energy distribution of their tungsten light sources to that of Ill. C. Likewise, the statement that the reproducibility of measurement of colorimeters corresponds to (and in the reviewer's opinion, usually exceeds) that of spectrophotometers must refer to differential measurements only. It may also be mentioned that while, as stated, the short wave-length secondary maximum in the $\bar{x}$ curve is usually obtained by computation (as a fraction of the Z reading), there are now some 4-filter colorimeters on the market in which this component is separately obtained, with a significant improvement in absolute accuracy.

On page 39 it should be pointed out that whenever color differences are expressed, the exact method of computation should be specified, since it has been demonstrated many times that different equations do not lead to the same results even if "normalization" factors have been applied. For this reason, the designation "NBS unit" should not be applied unless the NBS formula is used.

Despite these minor objections it must be emphasized that this is a highly useful as well as beautifully prepared booklet. In few if any places has so much clear, concise information on color measurement been presented in one compact, well-illustrated volume. An understanding of the content of Color Measurement will take the reader far towards the mastery of this complex field.

Fred W. Billmeyer, Jr.

"PHYSIOLOGICAL BASIS OF COLORIMETRY"

"Physiological Basis of Colorimetry," Prof. Yves LeGrand, Couleurs, 1st Quarter, p. 11, 1964. (Translated by Deane B. Judd.)

For today's technician it appears plain that colorimetry belongs to physics, since the color of an object does nothing but translate subjectively the variations of its spectral reflectance in the visible, but the modalities cannot be explained except by going into physiology. This evidence goes back scarcely more than one century: although since 1801 Thomas Young had correctly stated that trichromatism, known throughout all antiquity by painters, resides in the retina and not in the nature of light, it was necessary to wait for Helmholtz, Maxwell, and Grassmann to make this notion become incontestable. If there remains now no more doubt on this point, there remains nevertheless much to be determined about the exact nature of the biological mechanisms that explain colorimetry, and I wish to summarize some progress made recently in this domain.

The Rods

For man, just as for many animals, the retina is double: the retinal cells called cones function at high levels of light and make possible chromatic discrimination, while the rods possess a greater sensitivity to weak lights, but do not give rise to anything but achromatic sensations. Cones and rods differ in their spectral sensitivities which pass through a maximum at about 0.56 and 0.51 microns, respectively, from which results the celebrated Purkinje phenomenon.

It was thought formerly that the rods have no role to play in chromatic vision, but this is perhaps not rigorously correct, as we will see later on. But in any case, the study of the rods is useful to fix our ideas on the mechanism of sensitivity to light of the visual receptors, since they are better known than the cones.

It is known, in fact, that the rods contain a photosensitive pigment, retinal purple or rhodopsin; the absorption of light by this substance modifies its chemical structure, whence comes an electric disequilibrium in the rod and birth of a nerve discharge which, after various relays, will provoke in the brain the luminous sensation. Vision thus commences in the rod by a photochemical phenomenon, but photochemistry is not enough to give an account of all the peculiarities of night vision; for example, dark adaptation is not uniquely a function of the concentration of rhodopsin in the rods as Hecht formerly imagined, and even in this simple case some phenomena of nerve physiology arise to complicate the scheme.

The Cones

Our knowledge of the cones is much less advanced; by analogy it is admitted that we still have to deal with a photochemical phenomenon, rapidly complicated by nerve effects. But up to now no one has ever been able to isolate the substance present in the cones and which will play a role analogous to the retinal purple of the rods. The only experimental proof of the existence in the cones of at least two photosensitive pigments has been furnished by Rushton (1958) thanks to the spectrophotometric analysis of the light diffused by the

not up-to-date see Wald and Marks Science, Spring '64

1- 1,000 ft Lamberts

choroid and which escapes from the eye after a double traverse of the retina; these experiments have been made on the fovea of the living human eye, a region which contains only cones. The absorption maxima of these pigments, thus also of the corresponding spectral sensitivity, are located at about 0.54 and 0.59 microns. According to Weale (1959), the second value would be more nearly 0.60 microns. Some relative indications of a third substance whose maximum is in the neighborhood of 0.44 microns, have been obtained by Brown and Wald (1963) on the retinas of enucleated eyes.

It appears thus that we have, if not identified, at least detected the three photosensitive substances of the cones that furnish the basis of trichromatism. A more economical hypothesis would be the existence of a single pigment (iodopsin) with the interposition of three types of filters, interferential for example, as is suggested by the layered structure of the cones such as can be observed with the electron microscope; but this appears to be highly improbable, since the color depends very little on the angle at which light strikes the retina, as can be tested by diffusion from the blind spot. We can thus take as proven the existence of three distinct pigments in the cones.

One question then arises: does each cone contain a mixture of three substances, or rather a single one? The best way to reply would be to measure by the "microspectrophotometer" the absorption of an isolated cone, a task which is difficult for a specimen of only a few microns. Marks (1963), however, has come upon a fish whose cones are large (the golden cyprin), and it appears that each cone contains but one of the three pigments (Figure 1). Evidently it is premature to extend this conclusion to man, but it gains all the same in probability.

Transitive relation (Dict) - If A has this relation to B, and B has this relation to C, then A has this relation to C.

Königs - transitivity

Linear Colorimetry

After trichromatism, the second essential fact in colorimetry is the linear character of the relations of additivity, transitivity, and so forth, and, in particular the reduction of luminous efficiency V_λ to a weighted sum of the three fundamental color responses.

It is classic to state that the explanation of these linear visual relations is not possible except at the photochemical stage, because after the first nerve relay (bipolar cells) which follow the cones the flow phenomena follow complex mathematical laws much closer to the logarithmic law of Fechner than to a relation of the first degree. If it be admitted that there is a sufficient dilution of the visual pigments in the cones to make the absorption remain lower than 10 per cent (which appears likely), the linear character of visual relations follows directly from the classic Beer's law of absorption. The reason why V_λ would be a linear combination of the fundamental responses is usually looked for along the same line of argument: it can be supposed, for example, that certain cones might contain a mixture of three pigments and might constitute the luminosity receptor, as in the Piéron scheme of "receptor triad."

These ideas commence to be explored for exceptions. In particular a recent study by Clarke (1963) on extrafoveal colorimetry has shown important departures from the laws of chromatic additivity. For example, if on a diagram RGB

1- 1,000 ft. Lamberts additivity holds

(Figure 2) whose primaries are spectrum lights 0.65, 0.50, and 0.45 microns there are plotted the additive mixtures of lights 0.43 and 0.53 on the one hand (solid curve) and of 0.48 and 0.65 microns on the other (dotted curve), curves are found which depart definitely from the classic straight lines; the fields to be equalized are juxtaposed rectangles each subtending about 40 by 80 minutes of arc, viewed at 10° from the fixation point. It is poorly understood why the sole fact of departing from the fovea is enough to destroy additivity if this only depends on the dilution of the pigments. It appears, therefore, that this additivity must be above all the result of nerve connections which differ in the fovea from those outside the fovea. For example, it is possible that the rods, which according to Aguilar and Stiles (1954) retain activity up to high levels (5,000 scotopic trolands, that is to say, a scotopic luminance of 5,000 candelas per square meter viewed through a pupil of 1 square millimeter), interfere with cone vision, the "color" belonging to rods being represented by the point S (Figure 2). It is possible also that we have to do here with local effects of adaptation (Troxler effect). In every way this breakdown of the linear laws outside the fovea is annoying for practice because it compromises the hopes that have been placed in the adoption of a test field of 10° diameter to define a new standard observer better adapted to the usual conditions of industrial inspection than the classic CIE observer whose test field subtends only 2°.

The hypothesis of an independent luminosity receptor is also losing ground. Thus Rushton has recently studied the deviations of V_λ, measured by flicker, between the real observer used by him and the standard observer, and their connection with the relative richness of the retina of the real observer in the pigments 0.54 and 0.59 microns. The correlation is very close, a result that would be in favor of the hypothesis of a V_λ obtained by mixture of responses of cones each containing a pigment, and not by mixture of pigments in one cone. That this mixture of responses could, at least to a first approximation, be linear seems to prove that, contrary to the classic ideas, one can speak of the additivity of nerve responses themselves at the level of the first retinal relay at least. Certain neuro-physiologists would furthermore be in favor of this new conception, additivity becoming in sum a physiological phenomenon and no longer photochemical.

Neural Transmission

We will say a few words in conclusion about certain studies of visual physiology that light up a new day not only for colorimetry alone, but also for chromatic vision. The latter differs from the former by two principal characters: on the one hand, instead of additivity, chromatic vision exhibits a neutralization since saturation diminishes always in a mixture and even cancels itself in the case of complementaries; on the other hand yellow poses a difficult problem because it does not appear to be the sum of red and green, but rather as a new color, distinct from the three fundamental colors.

The first phenomenon, that of neutralization, shows itself after the first relay of the bipolars: the records of potentials by micro-electrodes yield in fact three different types of variation with wavelength, the one always with the same sign with a central maximum (luminosity), the two others presenting responses of opposite sign according to the spectral region and furnishing in this way the two antagonistic pairs red-green and yellow-blue of the Hering theory.

On the other hand, the electrical responses of the relays (ganglions and geniculate body) following furnish still different results of "modulator" type with narrow spectral response corresponding to many "simple" colors, one of which is yellow. It thus appears that visual coding is built up in three successive stages. First the photochemical stage with the three cone pigments that are the base of colorimetric trichromatism and whose best mathematical representation is given by the tristimulus values R, G, B. Then a retinal nerve stage furnishing on the one hand the luminosity and on the other two pairs of antagonistic colors, those which in short explain the distinction between the luminous and chromatic attributes and the decrease of saturation by mixture; at this level the best mathematical formulation would be the triad: luminance, dominant wavelength and purity. Finally, a third "psychological" stage, that is to say, simply situated at the ganglion level, or a level further on, and which would be responsible for "simple" colors, contrast effects, and so forth.

This description is still very qualitative, but we are approaching the goal, and it appears likely that in a few years we will finally possess, after a century and a half of fumbling, a satisfactory model of this gift so simple in appearance, so complex in reality: color.

MORE ON "OP ART"

Interesting, puzzling, and startling effects of certain geometric and color combinations have fascinated people for eons. They seem to be in a class with optical illusions. Time may have coined the word "Op Art" in their October 23rd issue, 1964. It was apparently adopted from a comment by Carl J. Weinrath, Jr., Director of Manhattan's Gallery of Modern Art. He said, "Optical art is this year's dress length." Although I do not know what the statement means, it did lead to an interesting and descriptive neologism. I like it better than my invention, "opticolor illusions."

It is a courageous magazine which attempts to reproduce art using a high speed magazine press, magazine paper and inks. It is a step beyond daring to attempt to illustrate effects which depend on subtle colors for the effects, such as "Op Art." I must say that the ganble paid off exceptionally well. Many of the reproductions are striking and interesting. They make me want to see the original "paintings."

"SURVEY OF INDUSTRIAL NEEDS FOR MEASUREMENT OF COLOUR"

This survey has been carried out to investigate the needs of various sectors of industry for color measurement, their particular problems and their current research and development work directed towards solving these. Some twenty research associations and other research organizations have been approached for their views. This report has been prepared by the Scientific Instrument Research Association on behalf of the Research and Development Panel of the United Kingdom Automation Council and edited for publication in the Journal of the Colour Group. The U. K. A. C. is indebted to the various contributors for their ready cooperation in producing very detailed statements.

The object of the report is to summarize the information obtained to present a picture of industrial needs with clarification of common problems so that an assessment may be made of the possibility of joint action in research and development in color measurement technology.

The first part of this edited version of the report will deal with the problems under general headings. Most of the problems listed in the replies to the survey were of interest to more than one of the research associations.

Existing colorimeters came in for a considerable amount of criticism. The filter/photocell spectral response is not sufficiently close to the C. I. E. functions in most instruments. This results in discrepancies between instruments of different makes and even between those of the same make. Differences in viewing geometry also give rise to discrepancies. This criticism is linked with the need for a calibration service which will provide permanent substandards of known color so that differential rather than absolute measurements can be made. There is also need for further control in the preparation of magnesium oxide standards. Calibrated secondary white standards would increase the ease of making measurements with some instruments.

A further criticism was the difficulty of deriving the required parameters from the instrument readings. This applied to both the derivation C. I. E. coordinates and to the figures needed for input to computers. The derivation of tolerance specifications from colorimetric measurements is particularly difficult and there was a call for both simple methods of fixing tolerances and also for a simple explanation of the C. I. E. system.

The survey also showed the need for an evaluation and comparison of the colorimeters at present available.

Additional problems concerned with colorimeters were the difficulty of measuring non-uniform samples, such as wood grains, and the need was also expressed for colorimeters calibrated in terms of the new C. I. E. 10° field data.

The main interest in the specification of fluorescent colors was among the research associations working with near white materials containing fluorescent bleaching agents. At present there is no C. I. E. standard for an illuminant in a colorimeter suitable for measuring fluorescent colors. Allied to this requirement was the need for an agreed method of measuring "whiteness." One-dimensional color scales were also required in association with ageing tests. Research associations dealing with natural materials were particularly interested in this problem.

There was wide interest in methods of expressing color tolerance and in the relation of instrumental measurement and visual experience. Evaluation of the uniform color systems was required in connection with this.

The application of colorimetric measurements to formulation is linked to the derivation of suitable parameters from the instrument readings. The need to predict a color match is important in many industries in addition to the paint and dye industries where considerable research has already been carried out. Metameric color matches introduce special problems and examples where given of the inevitability of metameric matches in sanitary ware and in colored telephones with matching cords. Simple spectrophotometers for making measurements on metameric samples are needed.

The problems of visual matching also receive comment in the replies to the survey. There is need for an equivalent to natural daylight which includes the ultra-violet content and also need for a survey of the color rendering properties of lamps.

The next section of this summary will deal with the research in progress at the various research institutions, but it can be pointed out now that many of the problems that have been listed in the replies to the survey have already been investigated. In particular, the National Physical Laboratory has carried out a considerable amount of work in the color rendering properties of light sources.

The Glass Industry Research Association is working on instrumental methods of measurement of colorlessness of glass and making tests on the Colormaster colorimeter.

The Ceramic Research Association is making an assessment of colorimeters for use in the ceramic industry. They are including the Colormaster, the Hilger J40 and the Colorcord and are using crystal glasses and pastel wall tiles as samples. (These samples are available to any interested laboratory.) The application of the Colormaster to batch matching of glazes and to research into causes of color variation in ceramic bodies and glazes is being investigated. Work on visual assessment of color includes the comparison of the color differences readily identifiable with those which can be reliably measured. Specifications of tolerances and the color rendering properties of lamps are also being investigated. Future research will include measurement of metameric colors and measurement of whiteness. It is also hoped to establish color standards. If permanent standards can be made these may be of interest to many other industries.

The Rubber and Plastics Research Association is correlating accelerated tests using Xenotest with normal service ageing.

The reply from the Leather Manufacturers Research Association said that the Colour Committee of the Society of Leather Trades Chemists is considering a revision of the system suggested by Wyszecki at the 1963 C. I. E. Conference in connection with an official test method for determination of color tolerances.

The Wool Industries Research Association is connected with the proposal by the Society of Dyers and Colourists to consider problems of evaluation of different instruments and techniques.

The Hosiery and Allied Trades Research Association is carrying out research on the color measurement of knitted fabrics. They are interested in the correlation between visual assessments and the different transformations of the C. I. E. system and also to increase the precision of visual judgements.

The Launderers Research Association is developing a simple battery-operated portable reflectometer.

Imperial Chemical Industries have carried out a considerable amount of research over a number of years on color measurement techniques and their correlation with visual discrimination, on the specification of parameters and the accuracy of the match attainable. Much of the work has been directed towards the setting up of the Instrumental Match Prediction service to dyers which allows a dyer to send in C. I. E. coordinates of a sample and to have computed the recipe for a match to the sample.

Recent work by the Printing, Packaging, and Allied Trades Research Association has included a comparison of the results given by different colorimeters under industrial conditions and also on the effect of the optical geometry of a reflectometer on the measurements obtained. The association has recently published a description of a simple transmission measuring instrument which can be built and used in schools. Surveys have been made of the factors to be taken into account when assessing primary colors for 3-color subtractive reproductions processes and of methods of measuring whiteness. The spectrophotometry of fluorescent near-whites is also being considered.

A literary survey on measurements of color of wood is being prepared by the Furniture Industry Research Association. They are using color measurements in connection with ageing tests and also working on the problem of making measurements on non-uniform colors.

The main recent work by the Paint, Colour and Varnish Manufacturers Research Association is on the instrumental formulation of mixtures of pigments or tinting pastes. At present they are working with a Davidson and Hemmendinger Colorant Mixture Computer. They are also studying the application of analogue and digital methods to color formulation. (Digital methods are more suitable for working from colorimetric measurements while analogue methods can produce a non-metameric match.) Future work at the Paint Research Station will include a study of the effects of variation in the type of medium and the study of dispersion of the pigment on color strength and the extension of the color matching theory to partly transparent films, such as printing inks. A color formulation service might be made available to member paint manufacturers. Studies of simple tristimulus colorimeters and simple methods of calculating correction additions to mixtures are being made.

The Technical Optics Department of Imperial College under Professor W. D. Wright listed the following research projects already carried out or in progress:

1) The development of a tristimulus colorimeter using spectrum templates instead of filters.

2) The development of a differential spectrophotometer.

3) The development of a visual differential colorimeter.

4) The calibration of a series of gray tiles and an inter-laboratory comparison of these.

Future work is likely to include an extension of the calibration of the gray tiles to a study of mat gray and colored tiles and their use as sub-standards.

The National Physical Laboratory also has several projects in their current research program:

1) Measurement of absolute spectral luminance factor of primary standards surfaces of the highest possible permanence and also of secondary standard surfaces for industrial use.

2) To increase by a factor of at least ten the accuracy of spectrophotometry by the use of time-ratio photometry and by the building of a high precision double monocromator of suitable design.

3) A close investigation of the visual factors involved in setting up the color matching functions to define a mean standard observer; this involves particular difficulties with large fields of view.

4) Design of a prototype template colorimeter for commercial production.

5) The study of variation of differential color sensitivity with luminance and adaptation and other aspects of subjective color measurement.

The N. P. L. also pointed out that a very considerable amount of work has been carried out over the last few years on the color rendering properties of light sources and the associated problems of visual tolerance.

The U. K. A. C. survey did not cover instrument manufacturers but a copy of the request for comments was passed to Joyce, Loebl and Company Limited who replied that they have been developing a set of gelatine mosaic filters for use in their colorimeter.

J. M. Adams,
Colour Group
Great Britain

"VARIABLES OF PERCEIVED COLOR"

In this issue of the Newsletter we run the risk of including too many "goodies." There is one enclosure to which the Newsletter would like to call your special attention. It is "Variables of Perceived Color," by Ralph M. Evans, Journal of the Optical Society of America, Vol. 54, No. 12, 1467-74, December 1964. This work is an important addition to Mr. Evans' significant contributions to the understanding of color.

CENTER FOR VISUAL SCIENCE

The recently established Center for Visual Science at the University of Rochester, Rochester, New York, has conducted a series of lectures by scientists in the field of visual research. Symposia and colloqua have been conducted by visiting scientists and by the staff of the University. Dr. F. J. J. Clarke, visiting Assistant Professor of Optics on leave of absence from the National Physical Laboratory, England, conducted a series on Troxler's Effect and other extra-foveal mechanisms. The series of five lectures was held from October through December. Dr. Olof Bryngdahl of the University of Stockholm lectured on "Spatial Modulation Transfer of the Human Visual System." Dr. M. G. F. Fourtes, Ophthalmology Branch National Institute of Health, spoke on "Interpretation of Visual Responses in Limulus."

The center has also brought many other distinguished scientists to the University, and has shared them with the Rochester community. This promises to be a very important contribution to the scientific community.

"THE SCIENCE OF COLOR" A new color filmstrip and teacher's manual entitled "The Science of Color" is being made available for use in chemistry, general science and vocational guidance classes by CIBA Chemical & Dye Company.

The filmstrip tells the inspiring story of how the discovery of chemical dyes by an 18-year-old youth brought a new range of colors to the world.

Full-color photographs and drawings trace the history of dyes from ancient times to the present. Simple schematic drawings explain the chemistry involved in the dyeing process. Photographs and illustrations acquaint the student with the dye industry.

"The Science of Color" not only shows how scientific principles are applied in industry, but also opens up new career horizons for science students.

CIBA Chemical & Dye Company designed this filmstrip to provide secondary school teachers with a visual aid in teaching the story of natural dyes, the discovery of chemical dyes, and how the development of the dye industry has affected many other industries.

Teachers may obtain a free copy of this filmstrip by writing Audio-Visual School Service, 120 Fulton Avenue, Garden City Park, New York.

In the Olden Days
(Pre-IBM)
Pay day depended
On mortal men;
And every month
Upon the First,
We'd afford to eat
And "suage our thirst."
Then came the Age
Of Automation,
Spreading blight
Upon the Nation:
"Efficiency,"
Or so we heard,
Caused us to wait
Until the Third.
But now it's stretched
Until the Fifth,
And I for one
Am slightly miffed.
I'd gladly scrap
The damn machines
In favor of
Us human bein's!

R. von Uhlit

Taken from Adult Leadership December 1964

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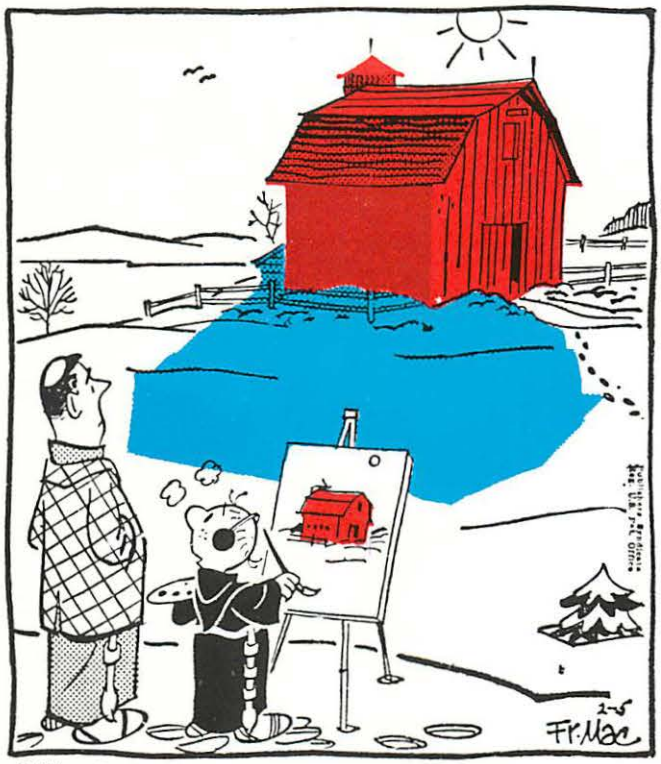
BROTHER JUNIPER—



"Why God lets a red barn cast a blue shadow, I'll never know!"