Inter-Society Color Council *Newsletter*

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THE SUPERFLUOUS COLOR

If technology, with its practical laws of efficiency, were in charge of everything we would have to dispense with the autumn color in our woodlands. Not with the trees, which are models of efficiency in most of their processes, but with the color itself, which apparently has no purpose whatever. People may think it is beautiful, but it isn't needed for the trees' health, growth or fruitfulness.

In technical terms, the color is waste, sheer excess and leftover. When the leaves have passed their peak of brilliance and fallen from the trees, they molder into humus that eventually will feed parent tree as well as lesser plants. But the color adds nothing to the humus. Leaves that wither and turn brown make the same kind of humus as those most dazzling red or brilliant yellow. There is no difference between the leafmold under a ruby-red swamp maple and that under an upland rock maple that was sun-gold.

Fortunately, there is no technology among trees. Especially in October, when those useless pigments and that leftover sugar and acid flare into all this superfluous color. Whether the trees need it or not, it is magnificent.

Ed. note. Realizing that there is more involved here than meets the eye, namely, that different chemical compounds are involved, and furthermore, thinking that nature is not likely to waste perfectly good chemicals, I hastened to consult the encyclopedias. I felt sure that the different trees must make at least some different use of the various chemicals associated with the autumn colors. (I knew, of course, that the trees didn't use the colors, for trees are color blind.)

I think I was wrong--but I'm not sure. According to an article entitled "Plant Coloration", by Edwin B. Matzke, in the 1963 edition of the Encyclopedia Americana, carotenes, xanthophylls, and anthocyanins, along with co-pigments such as tannins, are the compounds that become exposed as the chlorophylls in the leaves break down and are not re-formed. These colorful compounds are the same ones that are significant in making flowers conspicuous, in serving as guides for birds and insects that effect pollination, and in facilitating the dissemination of fruits by birds and other animals. However, it is the leaves, of course, and not the flowers and fruits that are involved in the fall finery. The role of carotenes, xanthophylls, and anthocyanins is not so clear in the case of leaves. Buds and young leaves unfolding in spring, such as those of maple and oak, show the same coloration that can be seen in autumn, and it is thought that, during development, the pigments may serve to screen out harmful radiation. No such explanation serves for autumn, however, and Matzke reports that no one has ventured a functional explanation of the great fall show. He points out that the same trees that star in the autumn display in the eastern U.S. may grow perfectly well in other regions without reacting the same way in the fall. Matzke finds "consolation in realizing that something as beautiful as this is entirely free of ulterior motives".

Incidentally, Matzke reports that there are only three large areas of deciduous forests on earth--eastern North America, eastern Asia, and northern Europe. He says that the forests of eastern Asia are much like those of eastern North America, with many common genera, and that the climate is also similar. "Brilliant colors" develop there, as they do in North America. But in Europe, except in parts of the Danube Valley and in the Alps, the coloration is not comparable.

NEW MEMBERS

The following applications for individual membership were accepted at the last meeting of the Board of Directors held in New York City on September 23, 1968.

Mr. Carl J. Allen
Large Lamp Dept., General Electric Co., Nela Park
E. Cleveland, Ohio 44112
Interests: Improving color rendering aspects of light sources.

Mrs. Lillian Barber
522 Allen Road, Woodmere, L.I., N.Y. 11598
Interests: Projects involved in interior design and lighting design.

Mr. Ralph Besnoy
140-55 Burden Crescent, Briarwood,

Queens, New York 11435
Interests: To acquire further knowledge in the field of computer color matching.

Miss Jacqueline Cadovius
310 West 72nd Street, Apt. 1B, New York, N.Y. 10023
Interests: To create attractive and balanced color lines for the volume apparel market in dacron/cotton fabrics business-wise and to dabble in color schemes for the home furnishings field personal-wise.

Mr. Edward T. Connor
Instrument Development Laboratories
67 Mechanic Street, Attleboro, Mass. 02703
Interests: Instrumental measurements. Interpretation and control.

Mr. Richard K. Diamond
E.I. du Pont de Nemours & Co. Inc.
Station B, Drawer L, Buffalo, New York 14207
Interests: Color matching of Tedler PUF film by instrumental methods. Standardization of color measuring equipment and the preparation and maintaining of color standards.

Mr. Bruce A. Evans
E.I. du Pont de Nemours & Co. Inc.
Dyes and Chemicals Tech. Lab.
P.O. Box 386, Wilmington, Delaware 19899
Interests: Color matching.

Mrs. Marguerita Hindle
RFD #1, Shore Road, Westerly, Rhode Island 02891
Interests: Color formulation, color correction, color matching, instrumentation - measurement computation.

Mr. Donald E. Kropp
Castle Company, 1777 E. Henrietta Road
Rochester, N. Y. 14623
Interests: Surgical lighting. Industrial design factors in products.

Mr. Benjamin L. Meyers
P.O. Box 24, West Point, Pa. 19486
Interests: Variations in color due to fading, and adjusting formulations to conform with standards. Also determining perceptible and acceptable color tolerances.

Mr. John V. Mumford
Simpsons Sears Ltd., Dept. 817
108 Mutual Street, Toronto, Ontario, Canada
Interests: Package design - visual merchandising.

Mr. L. Norris Post
18500 West 10 Mile Road, Southfield, Michigan 48075
Interests: Painting, visual appreciative, and vinyl coated fabrics.

Mr. Charles E. Pugh
64 Prospect St., Demarest, N.J. 07627
Interests: Interiors, wallcoverings, carpet, plastic laminates, products packaging, architectural materials, psychological effects of color on human beings.

Mrs. Millicent P. Russell
Colorado State University, Dept. of Consumer Sciences
Fort Collins, Colorado 80521
Interests: Application of color to interiors. Constant search for reasons why color behaves as it does.

Mr. R.C. Sharbaugh
Ethyl Corp., P.O. Box 341, Baton Rouge, La. 70821
Interests: Quality control on oil-soluble dyes and dyed fuels and lubricants. Specifications on the same. Evaluating new dyes for these uses. Dye formulations based on color matching. Technical service on miscellaneous dye problems.

Dr. Rosslyn Suchman
Institute of Human Development, 1203 Tolman Hall
University of California, Berkeley, California 94720
Interests: Discriminative skill in small variations in hue, value, chroma - also relation of this skill to other behavioral variables.

Dr. Lawrence H.M. Vineburgh
Neotec Corporation
640 Lofstrand Lane, Rockville, Maryland 20850
Interests: Development of a color coding device.

Mr. Leonard A. Weiner
900 W. 190 Street, New York, N.Y. 10040
Interests: Colorant R&D, instrumentation, in charge of color engineering at Atlantic Chem. Corp.

Dr. Harvey Yablonsky
9 Templeton Arms, Elizabeth, New Jersey 07208
Interests: Hair color evaluation, coatings.

GEORGE INGLE TO BE LIAISON MANAGER OF MONSANTO'S D.C. OFFICE

George W. Ingle, a delegate from both ASTM and OSA, has been appointed manager, technical liaison, of Monsanto's Washington, D.C., office, effective October 1.

In his new assignment, Mr. Ingle will provide guidance and communication in technical matters of concern to all divisions (except the Agricultural Division), central departments and subsidiary companies, and to all federal departments and agencies.

Mr. Ingle, who was formerly manager, research, for the Hydrocarbons & Polymers Division, received an A.B. degree in chemistry from Colgate University in 1938, and an M.S. degree in pulp and paper technology from the Institute of Paper Chemistry, Appleton, Wis., in 1940. He joined Monsanto in the latter year as a chemist in the former Plastics Division.

Mr. Ingle's new address is 1101 - 17th St., N.W., Suite 604, Washington, D.C.

CHARLES R. CONQUERGOOD DIES

It is with real sorrow that we report the death of Honorary ISCC member Charles R. Conquergood at Toronto, Ontario on August 16, 1968, at the age of 87. He was probably the first member of the Council from Canada. His was a familiar face at many annual meetings and he served as vice chairman in 1952-53. He joined the Canada Printing Ink Company Ltd., in 1902 and after a continuous series of advances was elected Chairman of the Board in 1956. He was very well known in the graphic arts field.

Charlie, as he was affectionately known by his friends, had a major interest in color education and arranged many opportunities for lecturers to visit his country. He was a founding member and first president of the Colour Council of Toronto.

Many people may not know that Mr. Conquergood was very active in the entire educational picture in the Toronto area. From 1938 to 1950 he was a member of the Toronto Board of Education, and its chairman in 1942. During this period he also served on the Royal Commission on Education in Ontario, and among his many awards were the Lamp of Learning, in 1950, by the Ontario Secondary Schoolteachers Association, and the H.J. Friedman Gold Medal, in 1951, for service in the advancement of education in the graphic arts. The list of his achievements and awards goes on and on, including the Ault Medal in 1957, awarded by the National Association of Printing Ink Makers, of which he was president during 1930-1932.

Five of his six sons and one daughter are living as are 21 grandchildren and 2 great grandchildren. My friendship and admiration for Charlie began in 1935 when I went to Toronto and found him interested and able to find time for youngsters who wanted to learn more about color.

Walter C. Granville

REPORT FROM THE DRY COLOR MANUFACTURERS' ASSOCIATION, RAYMOND THORNTON, CHAIRMAN

The Technical Committee was actively engaged in undertaking several projects during the past year.

The Committee met with Dr. Floyd Green, a member of the Technical Committee of the National Paint, Varnish and Lacquer Association, who is undertaking changing and improving the format of the Raw Materials Index. Ten suggested changes were submitted by the DCMA Technical Committee after polling all members of DCMA for consideration by NPVLA.

Requests were made for individual member company testing procedures for yellow, orange, and green pigments used in printing inks. These procedures were tabulated and a suggested method submitted to all members for approval. It appears from the replies received so far that these suggested methods will be approved and adopted.

A similar program is under way for red, violet, and blue pigments used in the printing ink industry.

A suggested name change of Benzidine Yellow to Diarylide Yellow, in order to clarify the situation which existed between the toxicity of the pigment and the intermediates used to produce the pigment, has received favorable acceptance. The editors of the COLOUR INDEX will be so advised so that this change can be made in the new edition of the COLOUR INDEX if it should meet with their approval.

A recent ruling passed by the Pennsylvania Health Department concerning the handling of Benzidine and Dichlorobenzidine is being investigated by the DCMA Technical Committee, and further action will be undertaken.

A joint meeting with the chairman of the technical committee of the National Association of Printing Ink Makers and the National Printing Ink Research Institute was held during the past year to discuss mutual problems and to gain closer cooperation between the three organizations.

An Industrial Arts Education program will be coordinated with a similar one being undertaken by the ISCC, as well as cooperation with their Problem 25 Committee, concerning the determination of the strength of colorants.

NEW ASTM PUBLICATIONS

In their September 1968 list of publications we find that ASTM includes the following three new reports on sensory evaluation. While these refer more to odor and taste than they do to color, nevertheless the methods may be of interest to a number of our News Letter readers.

Basic Principles of Sensory Evaluation -- STP 433, 110 pp, publ. 1968, heavy paper cover, $5.75.

Correlation of Subjective-Objective Methods in the Study of Odors and Taste -- STP 440, 112 pp, publ. 1968, heavy paper cover, $5.75.

Manual on Sensory Testing Methods -- STP 434, 82 pp, publ. 1968, heavy paper cover, $4.25.

An Index to ASTM Standards, issued September 1968, price $1, 234 pp., gives complete references to pub-

lications where standards or tentatives appear in their latest form. It also tells at a glance whether the Society has issued standards on a specific subject.

Dorothy Nickerson

FSPT ACTIVITIES

At the 46th Annual Meeting of the Federation of Societies for Paint Technology on October 24, 1968, Martin E. Schleicher, Vice President of Bisonite Co., Inc., became the 47th President of the Federation; Willard W. Vasterling, of Davis Paint Co., was named President-Elect, and S. Leonard Davidson, of National Lead Co., was elected Treasurer.

GATF DEVELOPMENTS IN COLOR

The Graphic Arts Technical Foundation has announced the development of a Standard Offset Color Control Bar (Research Progress, No. 76) and a Compact Color Test Strip (Research Progress, No. 79) for use in offset lithography.

The Color Control Bar was developed in cooperation with the American Association of Advertising Agencies and the Magazine Publishers Association to fill industry's need for a quality control device suitable for actual production control and specially designed for evaluating magazine four-color web offset proofing procedures. Control bars are available to GATF members at $8.00 and to non-members at $15.50. Copies of the Research Report are also available: GATF members, 30 cents each, and non-members, $1.00 each.

The Compact Color Test Strip was developed to provide maximum information within a minimum of space. It provides for densitometric measurement or visual judgment of printing ink strength, hues of secondary colors, trapping, gray balance of tints, dot gain, slur and dot doubling. The price of the Test Strips is $12.80 for GATF members and $25.50 for non-members.

Further information can be obtained from GATF, 4615 Forbes Avenue, Pittsburgh, Pa., 15213.

IDSA MEETING FEATURES "CONTRADICTIONS"

The Fourth Annual Meeting of the Industrial Designers Society of America was held at Lake Geneva, Wis., Oct. 10-12, 1968, on the subject "Contradictions". The program speakers were selected to present "a potpourri of the contradictory facets of everyday life that influence" design. The purpose of discussion at the speakers' sessions was "to encourage healthy controversy no matter how contradictory".

One particularly interesting feature of the program was an "exciting paper" by Jack Andrews and Keith Vreeland. According to an IDSA news release, "what distinguishes this particular paper from thousands of others presented to professional societies in America, is the curious fact that it is on celluloid and is an audio-visual experience substantially experimenting and researching the potentials of multi-media as a means of real and emotional communication."

Attendees were also treated to a private U.S. preview of the Beatles' "The Yellow Submarine", described by The Observer (London) as "an exhilarating crash course in today's visual tactics and equipment -- it packs more stimulation, sly art references and pure joy into 90 minutes than a mile of exhibitions of op, pop, and all the mod cons."

Demonstrations of the use of lasers in reconstructing a three-dimensional image were also provided, as well as exhibits of vehicles, materials, objects, and visual experiences, "all expressing their contradictory nature".

QUESTIONNAIRE ON FOOD COLOR BY IFT

Gordon Mackinney, chairman of the delegation from the Institute of Food Technologists, has announced the formulation of a questionnaire to be circulated to the membership of the Institute. Responses are expected to pin-point the numerous problems which face individual members of the Institute who have to deal with the colors of foods.

THE COLOUR COUNCIL OF CANADA

"Colour Your World" was the subject of the first meeting, on Oct. 22, of the 1968-69 season. The meeting was in the nature of a field trip to the new Sinclair and Valentine ink plant, said to be one of the most modern in North America. The plant is color-coded and air-conditioned, with special lighting throughout for comparison and control of color.

Tentative plans for the rest of the year include trips to a stained-glass window plant, a color telecasting studio, and possibly a color-print processing plant. In addition, talks are planned on interior decorating, lighting and merchandising, and make-up; and a film on color and pigments is scheduled.

THE COLOUR GROUP (GREAT BRITAIN)

The first Science Meeting of the Group for 1968/69 was held on Oct. 9 at the Imperial College of Science and Technology in London. The program featured Derek Lightbody, speaking on "Lighting design for television", and Clifford R. Hatts, whose subject was "The designer's part in a television production".

At a meeting held during the recent Scottish Symposium, two new Local Sections were formed, to be known as the Northern Section and the Midland Section. The Inaugural meeting of the Northern Section was held on Oct. 9, with W. D. Wright speaking on "The perception of colour".

The next science meeting of the Group will be held on November 6 at Imperial College. S. B. Novick and K. H. Ruddock will describe and evaluate "Some recent experiments on anomalous trichromacy".

A conference on "Optical Instruments and Techniques", arranged by the British National Committee for Physics under the auspices of the International Commission for Optics will be held at Reading University from July 14 to 19, 1969. Further information can be obtained from:

Dr. A. Thetford
New Applied Physical Science Buildings
The University
Whiteknights
Reading

COLOR AT NINTH FATIPEC CONGRESS

The ninth Congress of the Federation d'Associations de Techniciens des Industries des Peintures, Emaux, Vernis et Encres d'Imprimerie de l'Europe Continentale was held from May 12 to 18, 1968, in Brussels. About 800 technologists of the paint and allied industries of 23 countries from five continents discussed the testing of their products.

Color played a leading role in the discussions, according to a report on the Congress by M. L. Ellinger in the July 1968 issue of Paint Manufacture. The opening session ended with "a most spectacular colour film presentation by the Belgian Shell Co., an artistic illustration of the 'History of paint through the ages'". One of the plenary lectures was given by G. Putti (Italy) on color matching with a tristimulus colorimeter. In the session dealing with tests for specific raw materials, A. Brockes (West Germany) discussed "Evaluation of colour deviations in colour matching under various illuminants using a metamerism index". "Colorimetry in the U.S.A." was presented by M.A. Cattaro (U.S.A.), and "Calculation of tint formulae by considering the absorption and scattering coefficients of the pigments" was the subject of a paper by D. Strocka (West Germany). P. Matter (Switzerland) described the "Gloss determination of transparent colours".

NBS SEMINAR ON COLORIMETRY AND SPECTROPHOTOMETRY

One of the 1968-1969 series of NBS Measurement Seminars and Workshops will be a three-day seminar on colorimetry and spectrophotometry to be held at the Bureau's laboratories in Gaithersburg, Md., in May 1969.

The seminar will deal with color measurement in its psychological and physical aspects. Subjects to be treated are: The psychophysics of color vision, uniform color space, color-order systems, spectrophotometry, photodetector response, photoelectric colorimeters, automation of colorimetry, metamerism, variability of color measurement. The seminar will consist of lectures, discussions, and visits to NBS colorimetry and spectrophotometry laboratories.

Candidates must have college-level training in physics, chemistry, engineering, or psychology, and be involved in experimental colorimetry or spectrophotometry, either in a direct or supervisory capacity. Prior to the seminar, candidates will be furnished with a list of references and copies of selected articles.

The group will be limited to 50, selected on the basis of academic qualifications and experience. Fee: $150. Dates: May 5, 6, 7, 1969. Apply to: I. Nimeroff, NBS Metrology Division, Washington, D.C. 20234.

KOLLMORGEN AGREES IN PRINCIPLE TO ACQUIRE MUNSELL COLOR COMPANY

Norman Macbeth, Chairman, and Richard Rachals, President, of Kollmorgen Corporation, Holyoke, Mass. and Dr. Deane B. Judd, President of the Munsell Color Foundation, Inc. of Baltimore, Md., announce that agreement in principle has been reached for Kollmorgen to acquire for cash the Munsell Color Company Inc. subject to certain final arrangements, and the approval of the Internal Revenue Service.

Munsell produces standards and renders services used in industry for visual control and standardization of color. Sales in 1967 were approximately $250,000.

Munsell Color Company Inc. would be continued with its present employees and as an active part of the Kollmorgen Photometry and Color Systems Group.

BETTER COLOR COMMUNICATION NEEDED

Is there a need for better color communication? The answer is clearly "Yes!" according to a survey made at the Merchandise Mart Apparel Month program in Chicago in April. The October 1968 issue of Dispersions, an informal (and highly entertaining) monthly edited by Stewart Hoagland for Interchemical Corporation, reports that the vote was 536 to 88. "Yet there are numerical ways of designating colors", the article continues, "but who wants or uses them? Just about everybody wants to think of Watermelon Green or Apricot Orange, instead of 24/62/51. The use of color has to be an emotional thing."

The last paragraph of the short article raises an interesting question about the prediction of color trends. "Many prophets, especially in the fashion field, confidently talk about what the popular colors will be a few months hence. Do they really know what they are talking about, or are these colors popular because all of a sudden they seem to be about the only colors available in the stores?"

Perhaps some reader will be inspired to comment.

COLOR CODING USED IN NEW NURSING HOME

(From Pittsburgh Paints P/M News, Oct. 1968)

As many as 28 different colors and coordinated color tones have been used in the Troy Hills House, a new nursing home in Parsippany, N. J. The "vivid color-coded corridors, and modern lighting concepts" are said to be part of a master plan to make the patient's transition to home life easier.

To assist patients who may be apprehensive about losing their way from the dining area to their rooms, because of poor eyesight, for example, a system of color-coded halls has been devised. A blue, a gray, a yellow, and a red-walled corridor lead off from a central rotunda.

To help patients in finding and entering their rooms, each door is a different color from that of its neighbors, each door frame is edged in a deep color that accents the doorway, and all furniture and bedding is "color-selected" for contrast with the floors and walls. Closet and bathroom doors are painted a harmonizing but deeper shade of the room color.

KRÓMSKÓP REVISITED

The article (The "Gay Nineties" in Color, N. L. #195) by Lawrence Wineburgh, describing the Ives Krómskóp, a color stereoviewer patented in the 1890's, elicited interesting additional information from readers.

D. L. MacAdam wrote to point out that the inventor of the Krómskóp is the Frederick Eugene Ives who is honored in the premier medal of the Optical Society of America. Dr. MacAdam's tribute to Ives appeared in the Journal of Photographic Science, Vol. 14, p. 229 (1966).

W. T. Wintringham, who was at one time associated with H. E. Ives, son of F. E. Ives, reported that he is well aware of the stereoviewer and included an interesting quotation from his article on "Color Television and Colorimetry" in the Proceedings of The Institute of Radio Engineers, Vol. 39 (1951):

"Actually, F. E. Ives, using photographic emulsions which were sensitive over the entire visible spectrum, repeated Maxwell's demonstration in 1888. Later in the same year, he realized that spectral sensitivity characteristics in the camera channels should be related to certain characteristics of color mixture that Maxwell had measured, and he corrected his techniques accordingly. Later he arranged to market 3-color cameras, projectors, viewers, and stereoviewers for additive color photography. However, the apparatus was complicated, the care required in the photographic steps was great, and each set of positives had to be registered to view the resulting color pictures. Consequently, this process never became a success commercially..."

Mr. Wintringham indicates that he was greatly impressed by the high quality of the color pictures made more than sixty years prior to the 1951 article.

Apparently prompted by the same N. L. article, W. J. Kiernan sent a notice concerning an exhibition of paintings by H. E. Ives at the Bell Telephone Laboratories during the week of Oct. 7, 1968. H. E. Ives was apparently a talented painter as well as an outstanding physicist. It was he who was in charge of the work that resulted in the first successful TV broadcast, in 1927. As an artist, he drew upon his background in color research to develop a three-color process of painting that is said to have taken the guesswork out of mixing paints.

L. I. R. R. GATES IN NEW COLORS

Bright yellow and "high-visibility" red have replaced the traditional black and white diagonal stripes on the gate arms at two busy Long Island Rail Road crossings. In a pilot program aimed at increasing traffic safety, safety engineers and representatives of government agencies will study the effects of the paints.

At one of the intersections, a southbound driver will see (hopefully) a black and yellow diagonal pattern, while a northbound driver will be faced with a solid yellow barrier. At the other intersection, the same plan--solid color on one side and a striped effect on the other--will be used, but the hue will be red. Highly reflective paint will be used for greater visibility at night.

(Adapted from an article in the N. Y. Times of August 22, 1967.)

MEDICAL COLOR STANDARD: PART I - SKIN

There has been received from the Japan Color Research Institute an exemplar of the skin color scales developed under the direction of the Committee of the Medical Color Standard promoted by that Institute. The sampling of the gamut of skin colors follows closely

the plan used in the Manual of Skin Color issued by the same Institute about 10 years ago. (See Newsletter No. 149-150, September-December 1960, page 18.) The sampling is based on JIS Z 8721, Specification of Colours According to their Three Attributes. The three attributes are hue, value, and chroma, better known here as comprising the Munsell renotation. Neighboring chips defining the chroma scales differ by one chroma step for the most part; those for the value scale, by 0.5 value step; and those for the hue scales, by 2.5 hue steps. The skin-color gamut is covered in this way by a total of 507 chips. The chips are displayed twice. First the chips are mounted on a mat gray ground (N 6.5/) in a size of 11 by 15 mm to form a series of 11 constant-value charts ranging from 3/ to 8/, with hues ranging from 2.5R to 2.5Y, and with chromas ranging from /2 to /8 with an extra set of /1.5 chromas. Second, the chips in a size of 16 x 17.5 mm are mounted on a series of flexible strips of clear plastic, each strip showing a hue scale at constant value and chroma, and all strips of the same value bound by a pivot at one end so as to form a fan of hue scales with increasing chroma. The mounting of the chips is well adapted to comparison with skin at various body locations, and the regularity of the scales formed by the chips is superb. The tolerances for departures of the color of each chip from its nominal color are stated to be $C^* \Delta H = 2.60$, $\Delta V = 0.08$, and $\Delta C = 0.3$; these tolerances are slightly better than Munsell AA. Furthermore, a table is given showing the measured notation for each chip.

Bound with the table is a 38-page collection of reports in Japanese, with English summaries. The first three reports describe the use of a trial set of the skin color scales to establish a correlation between skin color and tooth color, to determine the range and distribution of color in scar, skin graft, and donor among Japanese, and for comparison of skin reaction caused by different qualities of radiation (electrons and X-rays). There is also a report on determination of the skin-color gamut covering the combined ranges of the normal skin, the plastic surgery field, the radiological field, and the "make-up" field. The gamut of the final version of the skin color scales was extended so as to cover these combined ranges. Finally there is a report on the method of manufacturing the skin color scales, including a description of the method of controlling gloss by adjusting the percent of flat base to be added to the seven pigments used (white, grey, black, permanent red, light scarlet, permanent yellow, and cincacia violet). If I could read Japanese I suspect that I would find a statement to the effect that the formulation of colorants was by systematic variation of pigment proportions rather than by independent adjustment of each color by trial and error. The superb regularity of the scales seems to require this explanation.

Two of the three advantages stressed for the Manual of Skin Color patented in 1958 have been allowed to lapse in the development of the present skin color scales. These advantages are detachable chips and use of soft, translucent plastic for the chips simulating skin texture. The third advantage, that of choice of pigments to simulate skin pigments in spectral characteristics, may have been essentially retained, though no graphs to demonstrate the degree of this simulation are included. A spot check of a few chips against the nearest match from the Manual of Skin Color revealed only a slight degree of metamerism; that is, the shift of the match from daylight to incandescent-lamp light was in each case less than one step of the scales.

In a letter of 16 September 1968 to Walter Granville, Mr. Shiro Yamaguchi, Chairman, Japan Color Research Institute, 1 Akasaka-Fukuyoschicho Minato-ku, Tokyo, Japan, quoted the prices of Medical Color Standards as follows: I. Skin at 59,500 yen (about $200), and V. Tooth Crown at 37,600 yen (about $100).

D.B. Judd

REVIEW

Colorimetry, by I. Nimeroff, NBS Monograph 104, U.S. Dept. of Commerce, Jan. 1968.

This monograph was issued in January 1968 as an up-to-date version of Deane Judd's NBS Circular 478, issued in March 1950. The purpose of the original circular was to summarize the then-available information on color measurement, color standards, and color tolerances.

In modernizing this popular booklet, Mr. Nimeroff has retained most of the original material while adding data on recent CIE recommendations and deleting material on obsolete or infrequently used methods (e.g. CIE standard source B). The logic of the presentation remains the same with the following main sections:

1. General Considerations
2. The 1931 CIE Standard Colorimetric System and 1964 Supplement
3. Colorimetry by Difference
4. Color Specification by Material Standards
5. One-Dimensional Color Scales
6. Limitations of the Methods
7. References

The weakest part of the new monograph is in the section on Colorimetry by Difference. The author has devoted very little space (much less than in the original) to transformation of CIE to uniform color space and use of color difference calculations. No definition

is given of the NBS unit of color difference. As imperfect as the various color difference equations are, it is a fact that they are widely used in industry today.

Section 6 on limitations of the various methods has been added in the new monograph. This section serves a valuable function but the discussion of the errors in spectrophotometric colorimetry is primarily statistical. It might have been more useful to point out how recent ISCC studies have shown that the largest error in spectrophotometric colorimetry arises from failure to properly standardize the instrument.

Existing copies of the original circular will probably remain in the libraries of those who presently possess them, but more recent arrivals to the field will find the new monograph to be a very useful summary of present-day colorimetry, especially regarding material standards of color (Section 4).

Walter Henry Foster, Jr.

BOOK REVIEWS:

Principles of Color Reproduction, by J. A. C. Yule, New York, Wiley, 1967, 411 pages, $15.00.

Review by W. L. Rhodes

I am delighted that John Yule has written this book! It has been clear to me for many years that John should write a book on photomechanical color reproduction. He is that rare combination of man who not only has keen insights into the theory, but who also has an understanding and feel for the practice. Many serious practitioners have benefited from consulting with John. He had a major influence on the development of the first commercial color scanner--both at Kodak and later at Time and Life research laboratories. Some would argue with my point that J. A. C. Yule is practical. They feel that his world is technical--apart from the problems and difficulties of daily production. But I have observed him in many situations when he patiently and thoughtfully considered production problems and offered sound advice. Many who practice the art have consulted him, and many still do in his new position in the Graphic Arts Research Center at Rochester Institute of Technology. Now many more workers will have access to John's ideas and insights through this book, which is also a rare mixture of theoretical and practical.

According to the preface, the book is directed to production men, researchers and students. "...to all who are interested in understanding the scientific principles of color reproduction." The first four chapters are treated in a "...rather elementary manner." Later chapters deal with the subject in greater depth.

The first two chapters should have been treated in greater detail. In ten pages Yule describes letterpress, offset, and gravure, and many methods of color separation and platemaking. Like road signs, it is helpful to one who already knows the route, but confusing or misleading for those unfamiliar with the territory.

In chapter two, in only 12 pages, he explains additive and subtractive mixture (without using the words "additive" and "subtractive"), trichromatic color vision, color classification and description, spectrophotometry, CIE, Munsell, and special problems of color measurement in printing, and unfortunately without color illustrations. This cursory treatment may do more to confuse than enlighten one new to the subject, while adding little for the experienced colorist.

John really begins to hit his stride in chapters four and five on masking and tone reproduction. His descriptions of masking methods and his explanations of the reasons for masking are as clear as any I have read. No other book or periodical treats the subject as thoroughly, e.g., (available inks) "...be regarded as pure magenta ink contaminated with a small amount of yellow ink. The obvious remedy for this is to print a little less yellow wherever magenta is printed..." Another example: "Another persistent fallacy is that deficiencies in filter characteristics need correction. Actually any reasonable spectral characteristics can be obtained with available filter dyes..."

Chapter 4 is beautifully illustrated with reproductions printed at Kodak. Unfortunately John used a painting rather than a photograph to illustrate the influence of ink color and masking. All of the reproductions look good, including those which are supposed to illustrate inferior technique. I suppose this is so because, unlike photographs, we do not know what the painting is supposed to look like. Yule might have made a stronger point of relative lightness reproduction and of saturation control by masking. These are discussed, but relegated to the subheading "Single Silver Masks". These deficiencies of unmasked or incorrectly masked reproductions are not well understood in the trade, and they might well have occupied a more prominent place in the text. Since photomechanical color reproduction literature has emphasized masking and color correction, it is not surprising that most workers assume that color correction is a primary concern. Yule, however, is aware that tone reproduction plays an equally important role, and he devotes an appropriate amount of space and thought to the subject.

Beginning with chapter 6, Mr. Yule shifts gears. At this point the worker interested only in practical ideas may want to get off. The serious worker who wants to know why some filters work better than others, or why some inks or papers should be selected in preference to others will find the remainder of the book gratifying.

Several years ago Neugebauer pointed out that spectral sensitivities for color separation should correspond to visual color mixture functions. He devised a means for determining the correspondence. Later Yule and co-

workers extended the method. This method for determining the colorimetric quality factor has greatly simplified the complex task of selecting filters and films.

The color committee of the Technical Association of the Graphic Arts argued for many years about ways to evaluate ink sets for color reproduction. One faction favored methods proposed by Frank Prencil of Graphic Arts Technical Foundation because the tools and methods are simple, and they correlate with masking and color separation. Another faction preferred more rigorous colorimetric methods, which presumably correspond more closely to the appearance of colors produced by the set. Yule explores both positions and proposes a third which is probably better than either.

John understands as well as anybody the value and difficulty of developing a mathematical model of photomechanical color reproduction. His prolific contributions have done much to elucidate the mechanism of subtractive mixture, screening effects, multiple internal reflections, and scattering. His chapter "Mathematical Analysis of Color Correction" is the only available definitive treatment of the subject.

This book is a much needed and important contribution. It will be read and studied "...by all who are interested in understanding the scientific principles of color reproduction..."

My thanks to Walter Clark, who encouraged Yule to add to the Wiley Series on Photographic Science and Technology and the Graphic Arts. John's book, a new science of an old art, is a welcome addition to the literature.

Review by Don F. Hill

Principles of Color Reproduction is a book which will appeal primarily to photographers and printers, although anyone who ever intends to "write a book" ought to read this if he intends to have his book illustrated, particularly if he is a perfectionist who is highly critical of color reproduction, for John Yule explains what is and what is not possible, as well as the differences in simple and complex processes that increase the cost of books or other printed materials with illustrations. Here one can see examples of varying improvement with the use of additional steps of photography and color correction. A series of repeated illustrations, for instance, shows noticeable improvement with each added step of photographic correction or with the use of slightly different color inks. Many people might be willing to settle for less than the best reproduction, but for those who are discriminating this book is a revelation which will help one to appreciate the difficulty of achieving near perfection. It is admitted that the best that can be achieved is limited by our imperfect pigments used in printing inks more than the limitations of photographic color correction. Few people notice the lack of perfection until the flaws are pointed out as they are here, although some of us in the field of color have realized it, perhaps. It is simply impossible to photograph certain colors and reproduce them accurately with three imperfect color-inks (plus black) but what can be done with color-correction processes is truly amazing.

This book of 411 pages is well-written and thorough. Those who enjoy graphs, formulas, and technical information will be able to delve as deeply as they like, while those of us who prefer to skip the heavy details can do so and read without loss of understanding.

Color pages actually occur only at two places in the book in the form of dual fold-out pages. A third place has dual fold-out plates in black and white.

Chapter two is the one which deals specifically with the "Elementary Principles of Color". What is written is sufficient for understanding color except that it is all without illustration or demonstration. Presumably, it would not be as easy for a layman to learn about color from the book and, in fact, the book refers the reader to three well-known texts for more detailed information on the subject. The lack of illustration is motivated, no doubt, by economy so that what color plates are included in the book can be devoted to illustration of color reproduction. This economy, of course, does make a good book available at a lower price and perhaps we should be thankful. Those who want to read about color may be slightly disappointed not to find the book complete in itself; however, why duplicate what can be found in other books? This book is highly recommended.

BOOK REVIEW

Hermann von Helmholtz. Leo Koenigsberger. Dover Publications, Inc., New York, 1965, 440 pp. $2.25.

Review by Deane B. Judd

(From Applied Optics by permission of the Optical Society of America)

The German edition of this biography of Hermann von Helmholtz (1821-1894) appeared in 1902; the English translation by F. A. Welby, slightly abridged, came out in 1906. The present edition is an unaltered republication of that English translation. My interest in reviewing this work, which was published when I was six years old, stems from the fact that, in the Helmholtz Treatise on Physiological Optics, translated into English by J. P. C. Southall and published by the Optical Society of America in 1924, I still find the most lucid description and explanation of many of the phenomena of vision. What kind of man is this whose scientific writings are authoritative after the lapse of nearly one hundred years? Leo Koenigsberger, mathematician and long a friend and scientific collaborator with the great investigator, aided by letters and other communications supplied by Helmholtz' widow and

daughter and by a vast number of distinguished scholars and friends, and with access to the official papers relating to the career of Helmholtz, was uniquely qualified to tell us what kind of man Helmholtz was. The biography produced by Leo Koenigsberger makes clear that Helmholtz was a giant among giants, and does much more. It details the unlikely steps by which Helmholtz achieved his ambition to become an investigator in physics, and it attempts "to present the epoch-making contributions of von Helmholtz to the most various departments of human knowledge in a form that shall be universally intelligible". It lays the background which led Helmholtz to undertake his researches in anatomy, physiology, acoustics, hearing, optics, vision, electrodynamics, electrochemistry, thermodynamics, psychology, meteorology, and mathematics. And for each of one hundred and forty of Helmholtz' papers it attempts--with a considerable degree of success--to express in a few nontechnical sentences both what Helmholtz had communicated and the impact of those results on contemporary scientific work.

We learn that, at the age of sixteen, Helmholtz was told by his father that he, with four children to educate, could not afford to provide him with instruction in physics unless he took up the study of medicine as well. But for his father's insistence that he prepare himself for the more practical career of medicine, the Treatise on Physiological Optics might never have been written. Helmholtz was admitted in 1838 to the Royal Friederich-Wilhelm Institute for Medicine and Surgery in Berlin, and after a year's work demonstrated in his preliminary examinations a reading knowledge of Greek and a writing knowledge of French and Latin. Furthermore, "the Hebrew professor gave him the highest praise for his Latin commentary on Deut. ix. 1-3, which was not a compulsory item for the medical student". Previously, at the Potsdam Gymnasium, Helmholtz had already taken up English and Italian privately, as well as Hebrew. He even began Arabic, and read the Fables of Lokman in the original in his leisure moments. Later on he learned to read Dutch. Greatly interested in art and music, he had installed in his quarters in Berlin a piano brought with him from Potsdam. That Helmholtz could take courses in botany, zoology, anatomy, and physiology and still maintain his activity in the study of physics is a measure of his intellectual capacity. He took his doctor's degree at the age of 21, and because, after his five years' education at the King's expense, he was bound to serve as army surgeon for eight consecutive years, he became hussar-surgeon at Potsdam, his home town. How he managed to rise from army surgeon in 1843 to become the first president of the Physikalisch-Technische Reichsanstalt in 1888 is a fantastic success story. The intermediate posts were lecturer to the Academy of Arts, and assistant in the Anatomical Museum in Berlin (1848-1849), professor of physiology at Königsberg (1849-1855), professor of anatomy and physiology at Bonn (1855-1858), professor of physiology at Heidelberg (1858-1871), and professor of physics at Berlin (1871-1888). The salary, the facilities for research, and the fringe benefits negotiated for each post are all chronicled, as well as the behind-the-scenes activities of his friends on his behalf.

Helmholtz' increasing reputation was built upon his research papers. He was in the habit of writing and rewriting many parts of his papers four or even six times, altering the arrangement before he was satisfied, and never holding an investigation to be finished till it presented itself to him in logical completeness, correctly formulated. He contended brilliantly against the scientific prejudices of his day--the phlogiston theory of heat, the vital-force theory of physiology, the reliance on observation rather than controlled experiment, and the view that metaphysics and philosophy provide shortcuts to scientific truth. Helmholtz established the law of conservation of energy not only for exchanges of energy involving inanimate matter, but also for living matter. He was the first to state that electricity consists of elementary particles. He supplied his brilliant pupil, Hertz, with apparatus and appliances to study the electric waves implied by Maxwell's equations, and inspired him to a successful quest for experimental proof of them. He developed the theory of vortex rings in the dynamics of incompressible fluids, and the thermodynamics of chemical processes on the basis that electrochemical processes are an ordered motion of atoms and molecules, while heat is a similar process, but unordered.

Yes, there were giants in those days. Helmholtz argued, collaborated, and contended with the physiologist, du Bois-Reymond, his classmate; with Johannes Muller, his mentor; and with Fick, Graefe, Donders, Fechner, and A. König, his pupil. His relations with the physicists, Joule, Kundt, Bunsen, and Lord Kelvin, his life-long friend who wrote the preface to this biography, are all chronicled, as well as those with the mathematicians, Jacobi, Riemann, and Weierstrass; the physical chemists, Clausius, Nernst and Ostwald; and finally the optical physicists, Brewster, Kirchhoff, Maxwell, Tyndall, Lippman, Hamilton, and Lord Rayleigh. Helmholtz followed the works of these giants with thorough comprehension, and in spite of frequent periods of ill-health involving fainting spells from what were called heart attacks, in spite of constant suffering from hay fever, and from the tragedies of his children's illnesses and his first wife's early death, he found the creative drive required to design and carry out crucial experiments illuminating all of the various fields to which his attention was drawn.

It is perhaps appropriate to close this review by mentioning specifically Helmholtz' contributions to optics. He was the inventor of the ophthalmoscope. To fill in gaps in his Treatise on Physiological Optics, he carried out definitive studies of accommodation, the horopter, eye motions, stereoscopic vision, self-light of the retina, rise time of visual sensations, after-

images, perception of luster, depth perception, color mixture, color geodesics, and color contrast, and worked out theories of color blindness and the perceived size of color differences. He computed the diffraction limits on resolution by the microscope, and developed an electromagnetic theory of dispersion, including anomalous dispersion, which incidentally implied that an electric charge on any substance in which there is strong absorption in the uv will be dissipated by the incidence of those rays on that substance. Optics thus owes a great debt to Helmholtz. Koenigsberger's biography of the great man gives insight into one of the most fruitful periods in scientific history.

Ed. note. Dorothy Nickerson has supplied an interesting footnote to the above biography. The 2nd ed. (1896) of Helmholtz' Handbuch der Physiologischen Optik, Vol. II, contains a tremendous bibliography of the literature to 1894 -- 7,833 references in 33 subject sections, all presented in order by date, then author, title, and source, where available. Sections 19 and 20 concern color and color vision, with a total of 1,540 references. The latter begin with Aristotle, 384-322 B.C., and end with an article on color blindness in the mercantile marine, published in 1893 in the British Medical Journal.

Dover has recently reprinted the Southall translation, referred to in Judd's review, of the 3rd German edition: three volumes bound as two, 1749 pp., $15.00, Dover Publications, Inc., N.Y.

COLOR COMES TO INCOME TAX FORMS

Americans (U.S.) will not only "see red" when they get their U.S. income tax forms this year--they will also see blue and white. Phil Casey, in The Washington Post of Oct. 11, 1968, reports that 30 million of the 1968 forms (1040) will have the "prose" in blue. In all those places in which mistakes are common, the instructions will appear in "vivid red". If, as is hoped, the extra color helps reduce mistakes, everyone will receive the red, white, and blue forms in the future.

(The extra cost in producing the red, white, and blue was said to be only $2,000.)

COLOR ON THE COURTS

While many U.S. tennis clubs continue to support the longstanding tradition that "whites are right", there apparently is a widespread move toward what a recent Time article (Feb. 16, 1968) described as "Technicolor togs". The U.S. Lawn Tennis Association has apparently endorsed "Match Blue" ("snazzy powder-blue") and "Trophy Yellow". Furthermore, members of Dave Dixon's World Championship Tennis, Inc., began a six-month tour in "gaudy green, yellow, blue and red shirts, some with socks to match." Dixon is quoted as stating that "today white looks washed out and bush league."

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