INTER-SOCIETY COLOR COUNCIL

NEWS LETTER NO. 58

MARCH, 1945

News Letter Committee:

I. H. Godlove, Editor-in-chief
Research Laboratory
General Aniline and Film Corp.,
Easton, Pennsylvania

Faber Birren
Charles Bittinger, Editor for Art
Carl E. Foss, Editor for Industry
H. Phelps Gage
Deane B. Judd, Editor for Science

Dorothy Nickerson, Circulation Manager
P. O. Box 155, Benjamin Franklin Station
Washington, District of Columbia

For matters of business,
Address the Circulation Manager
Subscription price to non-members: $3.00 annually.

EXECUTIVE COMMITTEE MEETS

While the February meetings of the Council were cancelled, in accordance with the request of the War Committee on Conventions, there was no objection to a meeting of the Executive Committee. It was therefore held as scheduled; and in addition to regular business the committee received the annual reports from officers, committee chairmen, and chairmen of delegations that would usually have been presented at the annual Council meeting. These annual reports are being compiled for circulation, for together with the News Letter they will serve this year as the chief means of keeping us informed of Council activities. The Executive Committee went on record that no attempt be made to hold general meetings by the Council while the present ban on conventions is in force, that such committee work as can be should be handled by mail, but that when necessary to the completion of projects meetings of committee groups will be encouraged, keeping always in mind that travel be kept to a minimum.

One of the most important pieces of work completed by the Executive Committee this year was a statement concerning the organization and functions of the Council. This has been incorporated in the committee's annual report to the Council. This report was initiated by the 1942-1943 committee and completed by the present committee. In order that this statement may be brought to the attention of all delegates and members of the Inter-Society Color Council and to any member of a member-body who is interested, this report has been printed for distribution. The booklet in which it appears contains also the Council's Articles of Organization and Procedure; a list of I-S.C.C. Problems, 1931-45; a list of reports published, 1931-45; and a list of member-bodies, 1945. Copies have been mailed to delegates and members together with the annual reports.

WASHINGTON AND BALTIMORE COLORISTS

Mr. William H. Peacock, who is associated with the Calco Chemical Division of the American Cyanamid Company, will address the Monday, April 2 meeting of the Washington and Baltimore Colorists on "Color in Plastics." Mr. Peacock will bring along with him a number of exhibits of colored plastics to illustrate the talk. Any ISCC delegate or member who may be in Washington and wishes to make a reservation should do so promptly with Mr. Kenneth L. Kelly, Chairman of the

Program Committee, at 2215 Constitution Avenue, Washington 7, D.C. The meeting will begin with dinner at 6:30 P.M. at the Y.W.C.A. Cafeteria, 614 E Street, N.W., Washington, D.C. Mr. Peacock will be remembered as the author of the extensive series of articles on the "Practical Art of Color Matching" which ran in the Rayon Textile Monthly during 1940 and 1941; these articles contain an interesting general discussion of color phenomena of a very practical nature.

The February meeting was devoted to a discussion of "Color in Stamps" ably led by Mr. William H. Beck, individual member of the Council. After a short talk which was beautifully illustrated with a large exhibit of stamps arranged according to color, the meeting was opened for discussion. A number of well known philatelists present contributed to the discussion, which made this meeting one of the liveliest the Colorists ever held.

NOTES ON ILLUMINATION

The gloom-chaser is one who can make great grins grow where only a grouch has gone before.

Question: Who invented electricity; Edison? No, Noah. Why? Well, when he unloaded his animals it made the arc light.

OUR SECRETARY SPEAKS

Too late for insertion before the date of presentation, we received notice that Dorothy Nickerson, color technologist of the U.S. Department of Agriculture, and ISCC Secretary, spoke on March 2 to the joint meeting of the Washington and Baltimore Colorists and the Illuminating Engineering Society, Baltimore-Washington Chapter, held in the auditorium of the Potomac Electric Power Company. Miss Nickerson's subject title was not announced, but it was stated that she would discuss the coordination of colorimetric methods to which the 1942 American Standards Association emergency war-standard for color (Z44) points the way. She expected to lay particular emphasis upon the considerable research completed in recent years on the Munsell system, and to point out certain applications of this work in the lighting field. In all of these fields as in problems of illumination relating to them, our capable Secretary is an outstanding expert, so that the joint meeting was assured of an authentic presentation. IHG

DISTRIBUTION OF MATERIAL

As has been our custom in past years, we list here the distribution of types of material in the 1944 News Letters:

Strictly news	39.8	pages
Reviews	16.8	"
Light color news in verse and prose	4.0	"
Special-feature articles		
Color in Painting through the Ages	1.6	"
Outline History of Color	10.3	"
Bibliography	10.1	"
Total	82.6	pages

The number of (single-spaced) pages amounts to a little less than 14 pages per issue. Compared with previous years, there was a falling off in amount of bibliography. A new policy, announced during the year, was the sale of subscriptions to non-members.

1945 FALL COLORS FOR MEN'S HATS

In consideration of our Government's wartime conservation requirements, it was explained by Margaret Hayden Rorke, managing director of The Textile Color Card Association of the U.S., Inc., the Association again shows only three colors in its seasonal collection of men's felt-hat-body colors. These colors are: Fog Grey,

described as a "hazy smoke tone," Stone Green, a "muted autumn green," and Plaza Brown, a "greyed neutral brown." These autumn and winter colors, portrayed in large swatches of fur felt, with a sample of matching hat band, have been chosen for their fashion value as well as for their adaptability for dyeing on both fur and wool felt stocks. Leading firms in the industry are represented on the committee which cooperated in the choice of these colors.

1945 SPRING HOSIERY CARD - The Regular Edition of the 1945 Spring Hosiery Card has recently been issued by the Textile Color Card Association in cooperation with the National Association of Hosiery Manufacturers. According to Margaret Hayden Rorke, managing director of TCCA, this edition presents "Sunlit Shades," highlighting "three lively tones" called Joytan, Sunniblush, and Cheerglo. A new and interesting format is used this season for presenting the colors in the regular hosiery card. A separate page is devoted to each color, which is portrayed in a large sample of hosiery material approximately three times the size used in previous years. Fashion and merchandising notes are given for each color, linking it with the smartest costume and shoe colors for the coming spring and summer.

DYEING AND COLOR NOTES

A vest as admired Voltiger had on,
Which from this Island's foes his grandsire won,
Whose artful colour pass'd the Tyrian dye,
Obliged to triumph in this legacy.
Edward Howard - The British Princess (1669)

The oldest known dye, a scarlet, was found in the tomb of a king of Asia Minor on the garments of the sixty-eight wives who were sealed up in his tomb with him. One theory is that the king died (and perhaps dyed) while trying to manage sixty-eight scarlet women in a hot country.

COLOR TERMINOLOGY

In a recent discussion with a number of artist members of the American Artists Professional League the question of color terminology was raised. The present Committee on Color Terminology would like to call attention to the fact that the task of the original committee, set up many years ago, was to assemble all of the terms standardized or used regularly to describe color in the various member bodies. In 1939, under Dr. Dimmick's direction, a 42-page mimeographed report on this subject was published (and is still available). Since the Colorimetry Committee of the Optical Society of America was then at work writing its report, OSA terms were not included. The OSA committee, however, published in June of 1937 in the JOSA, pages 207-213, a number of definitions relating to color, particularly to radiometric vs. photometric names and units. It remained for publication of the report itself, which has been coming out chapter by chapter, to carry further this important work. It may be some time after the war before Dr. Dimmick's report can be brought up to date. Meanwhile, your present committee wishes to call attention to figure 3 of Chapter II of the OSA report published under the title "The Concept of Color," October 1943 JOSA, page 552. This figure contains a tabular arrangement which shows the correspondence between the terms that apply to color in the fields of physics, psychology, and psychophysics. This table is based on the considered judgment of colorimetric experts in this country who have met in committee over a period of eleven years and the report will undoubtedly become standard for color terminology in all fields in which standard color terminology is important. If the terms in this particular table are clearly understood, and if the relationship between them is also understood, there should be little difficulty in defining as synonyms color terms that other

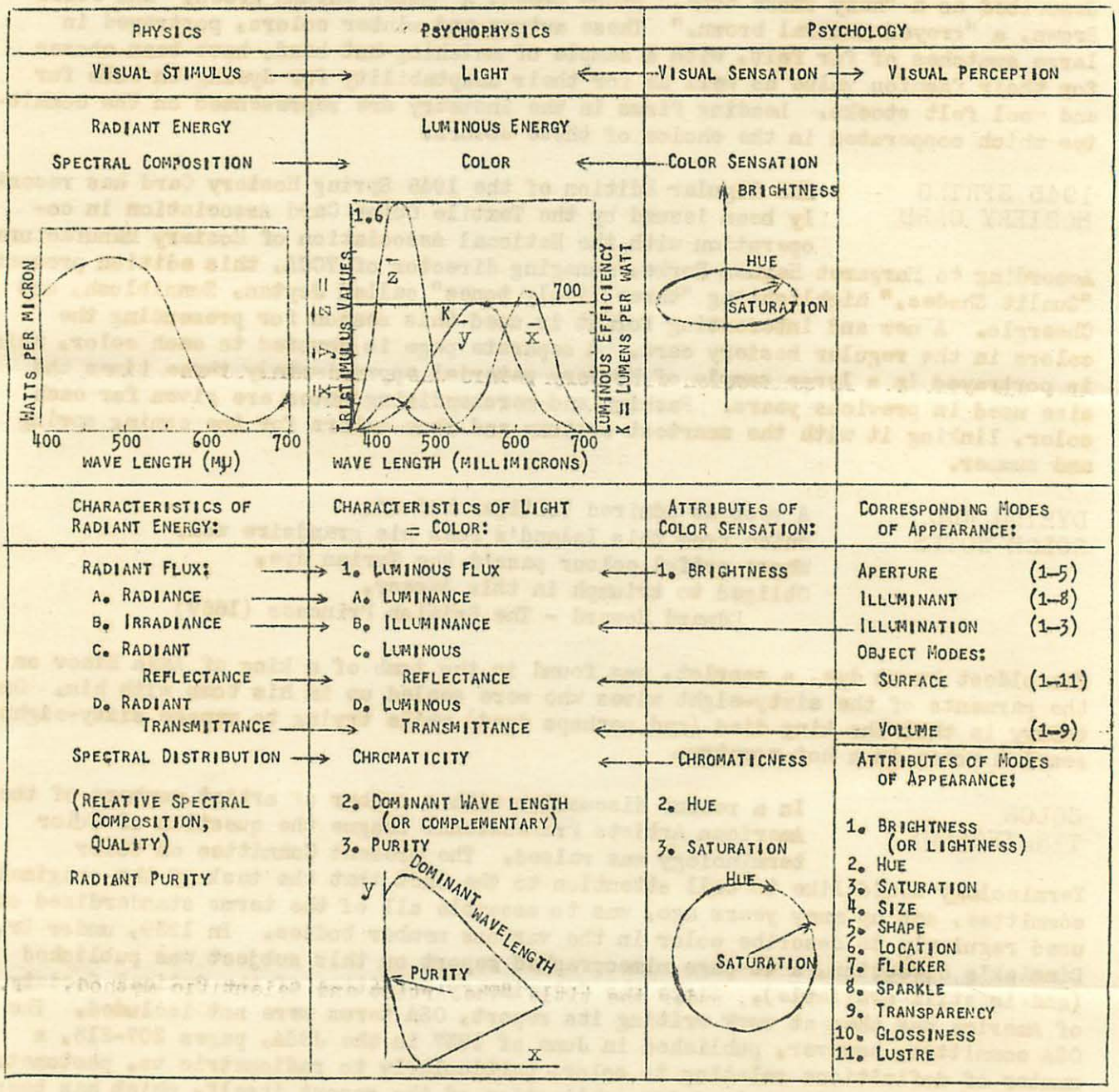

Fig. 3 from The Concept of Color, Chapter II of the forthcoming Colorimetry Report, Jour. Opt. Soc. Amer., 33, p. 552. Correspondence between attributes of radiant energy, light, visual sensation and perception.

groups may wish to define to cover the same color attributes. It is of considerable interest that during the discussion with AAPL delegates, Prof. Arthur Pope indicated that in the art field he is already using the OSA report as a basis for terminology and that he expects, when any of his books are republished, to revise the terminology to agree with that of the Colorimetry Committee. It is not necessary that all color terms other than those in the OSA report be eliminated, but it is highly desirable that other terms should be defined in terms of this standard

terminology. For example, the term "value," widely used by artists and in a more specialized sense by all who use the Munsell system, is a synonym applying to related colors for the term "lightness" as used in the Colorimetry Committee report. The term "lightness" in the report applies not only to colors perceived as belonging to surfaces, but to volume colors as well. Unrelated colors and illuminant colors have brightness varying from "dim" to "very bright," while related colors have lightness varying from "black" to "white." A complete set of definitions is to appear in Chapter IX of this report. Since all Council members may not have easy access to the Journal of the Optical Society of America, your Committee on Color Terms has asked the News Letter Editors to reproduce from the OSA report this table relating to color terminology.

ORGANOLEPTIC — If as a colorist you were asked to make an "organoleptic" examination of a series of food products, would you know what was wanted? In connection with color, this was a new term to an editor; yet well known in the food industries where organoleptic examinations are more often made than examinations by objective tests. For color grading it means visual examination, as contrasted with colorimetric tests. Examination by use of the senso organs - organoleptic!

AAPL DELEGATES DISCUSS COLOR — As you were informed in the preceding issue, the meeting which was to be sponsored by the American Artists Professional League, acting for the whole Council, was called off in accordance with the advice of the Government Committee on Conventions. However, many members of the League living in New York, as well as a number of officers and members of the Council, met on February 24 in the Pennsylvania Hotel in what may be considered an informal local session. Here were read papers by Wilford S. Conrow, John Scott Williams and William Churchill. Printed copies of a paper by Hilaire Hiler were also distributed; and mimeographed copies of the other addresses were made available. Undoubtedly much more discussion would have followed if more time had been available. It was the general belief, voiced by Dr. Judd at the meeting, that the color scientists present caught at least a glimpse of the way the artist thinks and works. This is a desideratum, and indeed in a sense fosters the fundamental aim of the ISCC, which is to coordinate the color efforts of science, art and industry. That the scientists were left puzzled and somewhat aghast by two of the three papers may perhaps be taken as a first step in mutual education. The Editor was asked to discuss the paper by Hilaire Hiler but had no opportunity to do so at the meeting. There, under the title "The Artist and Scientific Method," Mr. Hiler pleads for help for the artist from the physicist; and suggests concretly that artists employ more the scientific attitude of mind and scientific methods. But the fundamental aims of the ISCC recognize that this aid and cooperation is not a one-way street. Scientists have also much to learn by travelling the direction of the artists, who are keenly sensitive observers and often great technicians, as John Scott Williams' illustrations so clearly showed. And did not Lord Kelvin, a great physicist, make a stirring plea for the "scientific use of the imagination." In another place we shall review Hilaire Hiler's paper, as we were asked to do, for it, like the other addresses, stimulated interesting lines of thought.

Some one in the meeting raised the question whether the approach to art of the speakers was truly representative; and indeed Mr. Conrow's approach was less scientific and more mystical than would be expressed by many other artists. To us, in retrospect, however, this question does not seem of great importance. If the papers were capable of provoking thought and discussion, it is not important whether they voiced the predominant or orthodox approach. Mr. Conrow and Mr. Williams are men

of prominent positions in the world of art, masters of their profession. Mr. Conrow has long been known for studies of exactly the sort he presented, and Mr. Williams demonstrated his mastery of many new techniques beyond the ken of many practicing artists. Indeed, the Editor has never left any meeting with Mr. Williams without being greatly stimulated. Dr. Churchill is a former chemist of competence whose interests have gone over into the field of art, hence could be expected to present the stimulus of a fresh point of view more to the artist members than to the scientist members. He made an eloquent plea for giving heed to the wisdom of the ancients, which often made use of a symbolism involving ratios of numbers. In this field he has many illustrious forerunners among scientists: Pythagoras, Newton, Kepler, Eddington and others named in our "Outline History of Color." Frankly, we have never been able to go along with Dr. Churchill's line of thought; but this presentation filled in a few of the gaps in his argument. Without doubt we were prejudiced by the failure of repeated attempts to draw analogies between musical and color scales and harmonies. But Churchill strenuously rejected such restricted analogies, stating a much more deeply seated origin. The keynote of his philosophy was stated in his typed copy as: "It was the firm conviction of ancient wisdom that the ratios of least numbers are nature's most fundamental laws." It is his conviction that the primes are of prime importance; and according to him, we must follow the ancients.

Dr. Churchill illustrated the application of ratios to the prediction of two scales, those of hue and "value," two concepts in the color field. We have said little about Mr. Conrow's paper, for his theories deal largely with the mathematics and consequent esthetics of form, which we feel much less competent to discuss than the concepts of colors. Finally, in this connection, we may say that although John Scott Williams in his talk very properly showed us the artists' methods, in his written paper he discussed in a most interesting way ideas relating to the harmony of color. Indeed, we hope to have the temerity to bring these ideas to your attention and discuss them.

We do not feel competent to comment as Editor on the feeling expressed by some other members of the AAPL that the papers of Messrs. Churchill and Conrow were somewhat too far afield from color and not completely representative of the artists' or the Association's viewpoint. This meeting is a first step by our newest member-body toward bringing color problems, as they apply in the field of art, to the attention of other delegates and members. We are sure there will be further steps.

I.H.G.

COLOR IN THE APPEALS COURT

According to the January 25 "Evening Star" of Washington, D.C., the U. S. Court of Appeals, in a patent case heard experts testify that fish are "incapable of distinguishing variations of color or design." The jurist proved himself not only a Daniel of judgment but a diplomat as well. Refusing to enter a quarrel with fishermen, the higher court declined to confirm such a "revolutionary finding of fact," refusing to rule that fish have no appreciation of color and design in the bait. The controversy arose when the commissioner of patents ruled that the firm which appealed was not entitled to a trademark on a bait design which seemed to shadow the fish's skeleton. The point at issue was whether the design served a "useful function," or was merely an identifying mark. The higher court did not agree with the lower court's holding of a "useful purpose." The higher court added, "We would be reluctant indeed to undermine the folklore of fishing by making such a revolutionary finding of fact. It would constitute such a serious reflection on the intelligence and discrimination of fish that no angler with a spark of loyalty could fail to resent it." "Fortunately the facts here do not require us to decide that issue..... The design of a fish bait is no more subject to registration as a trade-mark than the pattern of a garment."

Attempting to be diplomatic too, we merely refer our readers to the facts cited in G. L. Walls' "The Vertebrate Eye," published by the Cranbrook Institute of Science, Bloomfield Hills, Mich., in 1942. Pages 368 to 417 deal with "Aquatic Vision," while pages 555 to 588 deal with the synoptic aspect of color vision in fishes. Perhaps someone may come forth with the suggestion to anglers that they try out their pets on the ISCC Color-aptitude test.

OPACITY

He that useth many words for the explaining any subject, doth, like the cuttle fish, hide himself for the most part in his own ink. JOHN RAY -- On Creation.

ORANGE A SHADE OF YELLOW?

An argument in a New Jersey Court as to the identity or non-identity of orange and yellow, reported not long ago in a New York paper, seems to have escaped the attention of the Council. The Yellow Cab Company, it appears, sued a rival company which had painted its cabs orange for infringing on their rights and the goodwill they had built up. The second company declared that "the color of an orange is distinct from the color of a lemon." But the Court ruled that "orange is a shade of yellow." Query: shouldn't some member of the committee on color names have invited the judges to take a color test? Or at least have offered the loan of a Munsell Manual?

Ed. Note. In News Letter No. 53, pp. 1-2, we mentioned this item about orange and yellow. We added a quotation from Goethe of which we were reminded, but the reference was not so complete as we have it from our psychologist member, Elsie Murray, from whom we received the above item.

TEST COACHING

Since Pearl Harbor, divers methods of coaching (alias "training") applicants to pass the preliminary color tests for military service or commissions have sprung up over the country. One of these has now come out in the open in an expensive two-volume edition. The designer, an optometrist whose experience in muscle training in strabismus, and whose unfamiliarity with the general experimental field of color vision and color deficiency lead him to ignore the retina, and to affiliate with the school of wishful thinking, claims that all visual functioning is a matter of learning. The so-called color-blind, he infers on somewhat flimsy evidence, sense individual colors accurately enough. "Color ignorance" can be dispelled by a little training in nomenclature, using both light and dark tints. The only difficulty lies in the "visual confusion" aroused by the juxtaposition of colors!

A volume of plates is therefore provided to determine which pairs give most trouble. The printing inks used, however, are arbitrarily chosen, omitting the most significant ranges in color deficiency. Short-cuts in design -- use of the same dot pattern throughout, of two degrees only of saturation for each hue instead of the customary four, in pseudo-isochromatic tests -- render conclusions based on this set of charts dubious. Three plates only with reversible or alternative readings are used. The sampling of color combinations is unscientific and inadequate. No "diagnosis" in terms of the usual categories or of any new ones, and no reliable quantitative rating is effected.

The second volume is designed for "training." Clues as to the color of the digit to be read are furnished with each plate. The subject is allowed to use a dry brush to trace the digit in a series growing progressively harder. In three of the five groups of color pairs employed the brightness value of figures and ground is not equated, perhaps accidentally.

The author's claim that improvement in this test with ten to a dozen repetitions signifies improvement in color discrimination, lacks validity. Since in three of the groups legibility of the digit by brightness contrast independent of hue is possible (except in the relatively rare case of scotoerythrous vision, i.e., with darkening in the red); since an untimed tracing technique is employed, and since no proof of general improvement in color discrimination by outside tests or of its permanence is offered, it seems probable that improvement in perception of digit contour on a dot mosaic is all that is effected by this method, i.e., the term "trained" is not for color but for form discrimination. Further, since digit patterns alone are utilized in this set of plates, there is no proof and little likelihood that the practice effect obtained is transferable to other types of contours.

While one assumes, in the absence of evidence to the contrary, that the plates were designed with a bona fide intent to benefit the human race, lack of familiarity with the experimental facts, concepts, technique and literature of the field of color, and of the means of safeguarding scientific inference, has led to a waste of effort. The spread of such devices or of such wishful thinking will inevitably prove extremely costly both to the country at large, and in the end to the trainee himself. One fact comes out clearly. The sooner tests discarding entirely the use of the digit as a vanishing pattern come into use, with a timed exposure shutter obligatory, the better.

Incidentally, this is not the first diagnostic set of pseudo-isochromatic charts developed by an American. In 1936 Milton Jensen issued a four-chart practice-proof color test offering to diagnose four types of color deficiency. Owing to the unhandy distance prescribed (ten feet) this never came into general use.

E. M.

O. S. A. COLORIMETRY REPORT

The annual report from the Optical Society of America includes reference to the fact that all portions of the report of its Committee on Colorimetry which seemed suitable for publication prior to issuance after the war of the entire report in book form (to be illustrated in color), have now appeared in the journal:

October 1943; Preface. The Historical Background and Evolution of the Colorimetry Report; L. A. Jones, Ch. (pp. 534-43, including ref. 1-16).

October 1943; Chapter II. The Concept of Color (pp. 544-54, ref. 201-8).

April 1944; Chapter V. Physical Concepts: Radiant Energy and its Measurement (pp. 183-218, incl. ref. 501-73).

May 1944; Chapter VI. The Psychophysics of Color (pp. 245-66, incl. ref. 601-30).

November 1944: Chapter VII. Quantitative Data and Methods for Colorimetry (pp. 633-88, incl. ref. 701-60).

January 1945; Chapter IX. Colorimeters and Color Standards (pp. 1-25, incl. ref. 801-99)

This leaves four chapters for which it will probably be necessary to wait until publication of the report in book form:

Chapter I. From the Art of Color to the Science of Color;
Chapter III. The Human Eye: Anatomy, Neurology and Physiology;

Chapter IV. Psychological Concepts: Color Sensations and Perceptions;
Chapter IX. Summaries of Definitions, Nomenclature, Symbols and Units.

Although all technical color workers will await the completion of the report with keen interest, the portion already published provides them with an authoritative handbook that has long been needed. Separate copies of the journals containing these chapters are available by purchase from American Institute of Physics, 57 East 55th St., New York 22, N.Y., at 70 cents each.

W. D. WRIGHT'S NEW BOOK

W. D. Wright of the Imperial College of Science, present secretary of the British Colour Group is well known in this country as a top man in the color field. Hilger made a wise choice when they asked Dr. Wright to write the book on present day practice in the measurement of color, published November 1944, "The Measurement of Colour," 223 pages, obtainable in this country through Jarrell-Ash Company, 165 Newbury Street, Boston, Mass., at $9.75.

The purpose of the book is to describe the principles, methods, and applications of the trichromatic system of color measurement, particularly as it is referred to the I.C.I. system, and it should prove of value to those who want to know what can and what cannot be done in the way of measuring color. Dr. Wright also intends the book to help "as an introduction and guide to the great variety of original papers which have been appearing since 1931; some such foundation seems to be required, since so many of these papers assume that the reader is familiar with the elements of the subject."

Seven chapters cover radiation and its modification by emission, absorption, and reflection; radiation and its reception in the eye; the trichromatic system of measurement; colorimeters, their design and use; spectrophotometry of color measurement; and practical applications of colorimetry. None of these subjects can be treated exhaustively in the space of this book but Dr. Wright has succeeded by a clear and logical presentation and well-selected series of literature references, in providing the student with an introduction to the color measurement field that includes references to work as late as the Munsell papers published in the July 1943 Journal of the Optical Society of America.

The chapter on the trichromatic system of colour measurement may clear up for many students the meaning and importance of the I.C.I. (or C.I.E.) method in relation to the "trichromatic" system. Two fundamental observations on which trichromatic colorimetry depend are emphasized, first that with exceptions duly taken into account, a color can be matched by a suitable selection of three selected radiations, and second that if two colors are matched in turn by mixtures of three radiations, then these two colors, when additively mixed, will be matched by the sum of the two mixtures. The problem is illustrated diagrammatically, and transformation equations given that illustrate how one may transfer from one set of reference stimuli to another. The position and shape of the spectrum locus is discussed, and the derivation of the trichromatic equation from the energy distribution curve. This leads logically to a description of the establishment of the I.C.I. system, and a discussion of the reasons for adopting it in its present form. The basic tables are included, and a discussion and tabulation of the data for the three standard I.C.I. illuminants.

The book is primarily concerned with methods of measurement potentially capable of yielding an I.C.I. specification, and this includes color matching with colorimeters

of both the additive and subtractive type, measurements with photoelectric instruments employing three photocell systems (corresponding to the X, Y, Z distributions), spectrophotometric measurements both visual and photoelectric, and lastly, comparison of samples with standard chips in a color atlas. In the chapter on colorimeters American readers will find few instruments with which they are familiar in the laboratory, but the principles are clearly explained. The chapter on spectrophotometry is a good one, for although the author is very optimistic about the increasing role that he believes spectrophotometry will play in colorimetry, he devotes much of this chapter to underlining the many precautions required before a reliable energy curve can be recorded.

The chapter on the place of a color atlas in color measurement is well presented. Two conditions for a successful atlas are imposed — the arrangement of the chips must be systematic, and the spacing should be uniform. Further, the chips should be reproducible, and this implies a master standard that should be standardized on the I.C.I. system to provide a permanent record. Several color charts are mentioned, the Munsell system being described in detail, with reference to the work carried out in recent years by colorimetrists and psychologists in the United States. A section on disk colorimetry indicates the use of this method when visual reference to charts is not sufficient, and the statement is made that in the United States there seems every reason to believe that disk colorimetry, used in conjunction with the Munsell system, will form an important side of color measurement, and that with the continued standardization of the Munsell chips, it may in some cases prove an adequate substitute for the other types of visual colorimeters at present more widely used in Great Britain.

The chapter on applications is an interesting one; it includes discussions of coloring power of chemicals and their mixture, lighting, agriculture (reference is made to ISCC-NBS names), chemical and clinical tests, pulp and paper, paint, signal glasses, color difference specifications on the I.C.I. chart, color reproduction, analysis of optical phenomena as in photoelectric experiments, meteorology, and dichroism as in the color of blood. Unfortunately, in connection with small color differences, reference is not included to the recent ISCC symposium on Small Color Differences, which gives several formulas useful for applying tristimulus measurements to practical color-difference problems. From the book's present discussion, the reader will get the idea that the job is done when the points are plotted on the I.C.I. mixture diagram.

To ISCC readers the matter of terminology should be mentioned. As Dr. Wright explains in the preface, he could not anticipate the formal definitions of the Colour Group of the Physical Society, nor could he adopt wholly American usage where it differed from the British. His solution was to avoid giving formal definitions, trying instead to bring out the meaning from the contexts in which they appear. Undoubtedly this is the best that could be done under the circumstances. The discussion of this matter in the preface points to its importance, and leads the reader to hope that American and British work in this field may finally be standardized on a common basis. Publication of the final chapter of the O.S.A. Colorimetry Report and of the British Colour Group's report on terminology are awaited with interest.

The Wright book is recommended. It is brief, clear, logical, and the sole book of its kind in the field today. It is a good introduction to the subject for the beginner and goes as far as many will wish. The expert will need the O.S.A. colorimetry reports in addition.

COLOR HARMONY AND COLOR SPACE

The recent criticism by Professor Pope (J. Opt. Soc. Amer. 34, 759-65; Dec. 1944) of the theory of Moon and Spencer, and the brief reply by them (p. 765), is of interest not only to our artist members but to a much broader field of interests. For Moon and Spencer, Pope, and many others all agree in relating color-harmony principles to some form of color space which must be adequately conceived to be of any lasting value. The Editor has made many comments on the subject in these pages (see News Letters No. 16, Jan. 1937, pp. 22-4; No. 25, June 1939, 6; No. 33, Jan. 1941,10-11; No. 36, July 1941, 2-3; No. 49, Sept. 1943, 8; No. 53, May 1944, 5-9; No. 54, July 1944, 6-9), and has published a series of papers on the subject, which, however, said little which was new. Though the Editor stated that his opinion, and more importantly his experimental results, were sometimes in violent disagreement with elements of the Moon-Spencer theory, and now finds agreement with some of Professor Pope's criticisms, he believes that the latter has, in at least one aspect of the problem, overstated the case against Moon and Spencer. These authors state, in their reply to Professor Pope (J. Opt. Soc. Amer. 34, 765; Dec. 1944): "Professor Pope feels that color harmony is too complex a subject to allow mathematical treatment. We are more optimistic."

They regard Pope's attitude as defeatist. But the spirit of Pope's writings seems far from antipathetic to the formulation of mathematical principles in the esthetic domain. What Pope really objects to, apparently, is the imputation of great precision in the predictions of a theory involving a large number of variables difficult of control and assay; and the building up of an elaborate mathematical structure on experimental grounds believed inadequate. The Editor has had some objections of the same nature; but he credits both Moon and Spencer, and Pope, with a sincere desire to arrive at truth. The experimental observations of at least one of the Editor's three groups of observers (work of 1934 to 1945), which were made available to Moon and Spencer and were rejected by them, as well as experiments which we understood have been made under Professor Pope's direction, and some of Moon and Spencer's, are still available for some one to use in arriving at a workable theory. The Editor is not seriously concerned over who makes the final synthesis; he would attempt it himself if he had the time. But the demands of wartime and his bread-and-butter interests seem now too far afield. He suggested ideas which he hoped Moon and Spencer would use. In large part they did; but in specific elaborations and in going beyond these concepts they went in ways and to a degree with which Pope (and in part the Editor) disagrees.

Besides the criticism already indicated, Pope took issue with Moon and Spencer in several particular elements of their theory. The first is embodied in Pope's statement that ".... by no possible chance .... can contrast be properly considered as an element of order." Also, ".... contrast means unlikeness, or disorder (diversity)." The opposed positions of the theoriests and critic would be only a "semantic difficulty," a question of the meaning of words, if it were not for the mathematical form of Birkhoff's equation, which Moon and Spencer adopt. The very nature of the opposition, or opposed attractions, of order and disorder, makes their exact relation of prime importance; and that relation is not the one embodied in any equation of the Birkhoff form. The Editor has already stated that in effect he agrees with Pope, and has given an argument (News Letter No. 53, pp. 6-7) to show the inadequacy of the Birkhoff type of equation. This argument need not be reproduced here. Pope cites still other directions, perhaps more important ones, in which the Birkhoff equation falls down. Moon and Spencer agreed that "Other equations would express the principle equally well." Pope's assertion: ".... it must be suggested that the dazzling effect produced by the ability to put philosophical ideas into mathematical terms is no guarantee of accuracy of thought," puts us in

mind of a remark of Mrs. Ladd-Franklin (Colour and Colour Theories; 1929; p. 206) that "No application of (a certain mathematical) formula will make anything but nonsense out of an idea like this." For careful consideration of Birkhoff's equation shows it to be a bit of nonsense.

Pope decries the tendency, common to Moon and Spencer and earlier authors (including the Editor), "to attribute particular virtues ... to certain hue intervals...." In so doing, he accuses Moon and Spencer, somewhat unjustly we believe, of being swayed too much by analogies to musical chords and discords. The Editor has been able to find no direct evidence for this accusation in the Moon-Spencer papers. Moreover, there is a considerable mass of experimental evidence, as well as weighty opinions based on broad experience, for a strong preference of most observers, under special conditions, for contrasting and similar hues over "intermediate" hues. Against the great experience and well-known abilities of Professor Pope are aligned the experimentally-based opinions of many authorities (Leonardo da Vinci, 1651; Rumford, 1797; v. Goethe, 1810; Chevreul, 1859; Brücke, 1866; v. Bezold, 1874; Church, 1887; Rood, 1890; Vanderpoel, 1902; Munsell, 1905; Jorgenson, 1906; Andrews, 1911; Ward, 1913; Rosenstiehl, 1913; Hatt, 1913; Cleland, 1921; Ostwald, 1922; Goldstein & Goldstein, 1926; F. L. Sargent, 1927; and Birren, 1934, 1937, and 1941), of whom a number were artists; and the experiments of the Editor and many others. While Guilford (1931-1940, in part with E.C. Allen, 1936) may, like Moon and Spencer, have gone too far in setting up an elaborate mathematical formulation of the results of his observer's experimental observations on individual hue preferences, his careful work certainly proved certain hues more preferred than others, whether or not other attributes of color varied simultaneously. Geissler (1917) stated the law that the feeling-value of a combination of colors is proportional to the values of the components; and Guilford (1931) and Allen and Guilford (1936) verified the law. The law had been verified, at least with qualifications by Cohn in 1894, Kirschmann (1900), Poffenberger from N. Collins' data (1932), Eysenck (1941), and Metcalf (in the case of brightness, 1927) and others. If the Geissler component-integration law is valid and the Guilford type of preference finding be accepted, we have proof of preference for some color-combinations over others, wholly apart from the experiments of the "authorities." Then the only uncertain question is whether a population prefers a hue combination because of its pleasantness, because of felicitous psychological association, or because of appropriateness to the job in hand (the last two of which may in turn enhance the pleasantness), or combinations of these. Although Pope (p. 761) properly cautions us against drawing general conclusions from the "very special" conditions like ours (simple pairs on neutral backgrounds, etc.), and Birren (1944) says that "people are not essentially interested in color schemes as such," scientific exploration must begin with simple experiments.

We may add that the Dutch and Turner contrasted browns and autumn hues with blue skies, while contrasting reds and blues were much used by the Tuscan painters, Titian, Tintoretto, Orcagna, Correggio and frequently Rubens. Professor Pope will correct us if we are wrong in this.

Though Pope believes there is no "visual significance" and therefore no virtue in any special color intervals, a footnote (on p. 760) suggests that his chief objection is to "exact" intervals. The Moon-Spencer intervals would have to be rather precise; otherwise there would be little sense in their elaborate classification. Pope argues (p. 761) that certain relations between attributes cannot be of very special significance, for improvement can be so easily obtained by simple changes in these relations. This too is a quantitative, rather than a qualitative, argument. It is a strong argument against precision.

Pope points out very aptly that painters are forever making subtle distinctions with good results by utilizing the Moon-Spencer region of "first ambiguity." Though the latter's theory stigmatizes this range, their coefficients are neutral (zero), except in the case of "value." Pope cites a case of uniform value, which Moon and Spencer call very bad, and "lavender" with "scarlet" hues, which tradition decries; but he rates the combination "delightful." He takes particular exception to the attribution of virtue to certain "value" intervals, and lack of it to others. He is "sure that the attribution of ambiguity as a negative factor to certain value intervals is mistaken." The stress on equally spaced intervals in omega space is overdone.

Pope applauds the emphasis on area. The Editor learned the necessity of this in his 1934 experiments, took careful account of area (after experiments isolating this factor), and notified Moon and Spencer of the result. But Pope likes neither the Munsell-Cleland rule nor the Moon-Spencer "scalar-moment" principle. He would utilize instead an interesting theory of "uniformity of attractions." The Editor sensed this principle many years ago, but was unable to formulate a good working rule for evaluation of the principle. Pope quotes M. C. Bradley (1933), who suggested that two colors have equal attractions if their areas are inversely proportional to about the cube of the contrasts (distances in color space) with the background color (again cautioning against precision). Against the three general principles (Munsell-Cleland, Moon-Spencer and Pope-Bradley), the Editor may cite an astonishing result of nine of his twenty-five 1943 observers and five of his 1944 observers. In many cases of 2-color combinations of rectangular areas (each of fairly pleasing form), they had slight preference for one color over the other for the smaller (or larger) area, provided one color predominated to the extent of representing 2/3 to 4/5 of the total area; but the preference for either one such predominance or the reverse, was very strong. Our data definitely rejected the first two of the above-listed three rules; we shall examine the reversibility principle as possibly insufficiently established experimentally because discovered under too specialized conditions.

At this place we must point out, what is too frequently forgotten, that Munsell did not accept the Field (1845) balance-in-neutral-gray principle (Moon and Spencer did not make this mistake in either sense). Munsell frequently used the restricted principle, but to be convinced that his principle was broader, see his examples of balance at 5 G 5/5 (page 28) and 5 R 5/5 (p. 33) in his "A Color Notation," 8th Ed. (1936). Balance at other values than five is admitted.

There is no justification whatever for Moon and Spencer's statement (J. Opt. Soc. Amer. 34, 93; 1944) that "The effect of area in color harmony has been hardly more than mentioned in the literature." In view of their later detailed review of Munsell's exact (too ?) quantitative statement of the Munsell-Cleland-Ostwald rule, it was a gross inaccuracy to state (p. 93) that this principle "has scarcely advanced beyond the qualitative stage." Moreover, Pope, Bradley and the Editor's experiments all find that principle and theirs crystallized too quantitatively in the wrong shape. A careful reading of their paper, just referred to (p. 94), may have yielded the reasons. Their 2 observers -- we found not even 9 enough -- slid one color-chip over the other until the exposed areas "seemed to have equal prominence." The underlining of "prominence," which appears in two places, is ours. Although their answer to our criticism protested that they did not, here as frequently elsewhere, they stated interest in a "pleasing sense of balance," yielded by equal prominence. Now prominence is not very far afield from Pope's "attraction." Though the maximum chroma in their 16 examples is four, unlike Pope they believed such determinations of pleasing (or equally prominent) ratios of areas so precise

that even the multiples and sub-multiples, the progeny of the scalar moments, are truly virtuous! Here we believe Pope has tempered theory more with practicality.

Finally, among his criticisms, Pope adds: "They might possibly have given more attention to work that has already been done along somewhat the same line." In previous issues, we have already said enough in the same vein.

On the positive side, besides his principle of attractions, or rather underlying it, is Pope's use of a simplified Munsell color-space which he calls a "working tone (or color) solid, and in which the pigment-mixture relations are relatively simple. He finds, as the Editor pointed out to Miss Spencer in an Optical Society discussion, that even Ostwald's "isotone" and "shadow" series can be easily traced in this (or the Munsell) space. Also, he says "The great disadvantage of the Ostwald solid is that geometrical distances have no relation to color contrasts." This from an artist, who as a group are supposed to like the Ostwald arrangement! Nota bene, Birren!

Going further, Pope states what may be called a Golden Mean theory of harmonious combination of colors. It is a theory of securing unity in the midst of variety; of the avoidance, on the one hand, of monotony (all the three color-attributes of pairs coalescing), and on the other hand, of three-ring-circus variety, one of the spices (like saturation) of color-life, whose substantial food is rhythm, equality of attractions, and so on. It was a theory stated in 1934 by the Editor; ours was taken from the Greeks. Possibly Professor Pope could show us subtle distinctions between his theory and the Greeks' wherein he has advanced beyond them. But we guess that he, like us, rather admired the perspicacity of the classical Greeks. Pope says little about the virtue of Simplicity, a Golden Mean stopping-point or direction on the road to monotony, though it seems to us that Moon and Spencer, in a sincere attempt to secure simplicity by formulation and classification, actually introduced complexity. In future revisions of his theories, we hope Pope will pay more attention to the virtues of color simplicity. When we first suggested, in the March 1943, OSA-ISCC meeting, in discussion of a paper of Miss Spencer's on her new color metric, this class of virtues, - then we failed utterly to make our point clear, as is evident from the Moon-Spencer papers. We stated then that she "had taken something away from us, and in justice ought to give back something new" in a specified direction. Since she made difficultly-comprehended, variable-sized, variable-oriented, conics of equal discriminability on an ICI color-mixture diagram into beautifully simple circles, she ought to perform miracles in another direction. Her mathematics ought to transform the Birren-lauded Ostwald rules, easily comprehended by some, therefore esthetically valuable, into simple paths, and therefore virtuous, in the Munsell system we love so well.

Now, Moon-Spencer and Pope-Bradley, not to mention Guilford and Birren and we lesser lights, can you not get together, M-S with your precision tools and P-B with your artists' feeling and practicality, and build us a beautifully simple, therefore esthetically satisfying, theory of color-combination neatly draped in a livable color-space? We neophytes, especially we ISCC people who are professional get-togetherors, will sit on the side-lines, applauding, throwing in pennies' worth of thought, or Bronx-cheering as befits our sovereign rights as American citizens.

I.H.S.

OUTLINE HISTORY OF COLOR (CONT.)

1614 C. Scheiner probably built the first astronomical telescope; in 1615 he invented the terrestial microscope; in 1619, his book, see News Letter No. 49

1619-25 Francis Bacon, W. Snell and Scheiner; see New Letter No. 49

1628 The painter Rubens visited Velasquez in Madrid. Rubens, flamboyant master of intense composition and swirling line, changed the red-and-gold mists of Titian into a reddish suffusion and added the smoky grayish blues of Veronese and original vivid scarlets and blues of his own. His color was organic and structural. Velasquez, great master of subtle, simplified painting, used color which was cooler, often suggesting hues through subtle value relations.

1630-40 Rembrandt, Claude Lorrain, Van Dyke, Poussin and Frans Hals flourished. Rembrandt, realistic painter whose chief means was chiaroscuro (value relations), used color limited in range and usually dark and of low saturation, but with subtle variations of brown, yellow and gray with only occasional touches of greens, violets or reds in draperies. Claude Lorrain, father of classical landscape, put color secondary to the romantic quality of nature; it had little sensuous appeal, but gave his landscapes a fine sense of spaciousness. Van Dyke's style was elegant and decorative, but less robust than Rubens'. His color was more delicate and subtle, but more superficial; it often included a golden yellow, rich brown, gray and silver. Poussin, father of the classical system which stressed the use of architectronic features, employed color which was always organic and delicately structural, but not achieving solidity. It was the color of Tintoretto and Veronese, refined into a cool, dry style, with bright blues and greens stressed. Frans Hals, noted, like Velasquez, for his great technical skill, had an eye for the picturesque, but produced paintings sometimes theatrical. He contrasted bright colors in textures with backgrounds; but the color was often either drab or too vivid. Other painters of the period were Adrian Brouwer, Jan van Goyen, Francisco de Zurbaran, Saloman van Ruysdael and the three le Nain brothers. The Baroque in art, which began with Rubens, was developed by the sculptor Bernini and the architect Inigo Jones.

1639 J. M. Marci de Kronland published his "De Proportione Motus;" see 1648 in News Letter No. 49

1645-8 The Royal Society, A. Kircher and J. M. Marci; see News Letter No. 49

1647 F. B. Cavalieri developed a formula for the focal length of lenses in terms of the radii of curvature

1648 The Académie royale de peinture et sculpture was founded. It began to function with authority in 1661, when Colbert gave it official powers. Under Le Brun it tried to formulate Rules for Great Art (published 1675). Louis XIV considered Le Brun "the greatest of men." Le Brun's dictum that drawing imitates all real things, whereas color represents only what is accidental, followed arguments in which Raphael and Poussin were cited for their drawing, Titian and Rubens for their color.

1650-56 Period of the Gobelins tapestries, the chemist Glauber, of Otto von Guericke, B. Pascal and P. de Fermat; for C. Huygens and A. Van Leeuwenhoeck, see 1653 and 1656, in News Letter No. 49

INDEX OF SPECIAL ARTICLES

Previous indices may be found in News Letters Nos. 34 (March 1941), 44 (November 1942), and 50 (November 1943).

NO. 51 (January 1944)

Color story, color and illumination notes (Godlove)
"This Is Fashion" (Burris-Meyer)
Fashion notes (Godlove)
Dr. Barnes' "The Art in Painting"
Munsell Color Foundation (Lt. Farnsworth)
Color and chemical structure (Reynolds)
Color in painting through the ages XVII (Godlove)
Outline history of color (Godlove)

NO. 52 (March 1944)

Color notes (Godlove)
Early individual members
Who's Who (In Color) in the East
So said the painters
Color terminology (Lt. Farnsworth)
Color Eye-Q (Ivan)
Note on eyes
ASTM color standard
Paint-color terminology (Wells)
Interaction of dyes in solution (Neale and Stringfellow)
New after-image study technique (Karwoski and Perry)
Outline history of color (Godlove)
Bibliography

NO. 53 (May 1944)

Arthur S. Allen
Color Notes (Godlove)
Bibliography on color-blindness (Judd)
Color space and Color harmony (Moon and Spencer)
Color in industry (Pittsburgh Plate Glass Co. and DuPont Co.)
Outline history of color (Godlove)
Bibliography (4 Pages)

NO. 54 (July 1944)

Notes on Color terms (Godlove)
Munsell diagrams
Notes on color charts
TCCA expansion
Color Eye-Q
Notes on eyes and vision (Godlove)
Color space and color harmony (Moon and Spencer, and Godlove)
Outline history of color (Godlove)
Bibliography (3 pages)

NO. 55 (September 1944)

Diffuse reflections (Gibson)
Color in industry (Fawcett)
Lobster red
Color-preference test (Birren)
Color: The Master's Touch (Sherman)
Sixty years of colorimetry (Fawcett)
Illuminant for paper grading (Macbeth)
Notes on color and illumination
Physics of painting (Rawlins)
Geometric design (Blake)
Bibliography (2 1/2 pages)

NO. 56 (November 1944)

Harmony in two fields (Kreidl)
Song of color and light (Baird)
Chromaticity classification of types of color vision (Farnsworth)
Dye substantivity and color (Hodgson and Marsden)
Monograph on colored glass (Weyl; Kreidl)
No job for the color-blind (Times-Herald)
Color and the artist (Conrow)
Modern color theory at Kodak (Brooker)
Bibliography (2/3 page)