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INTER-SOCIETY COLOR COUNCIL

NEWS LETTER NO. 68

JANUARY, 1947

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

1947 ANNUAL MEETING
CALENDAR OF EVENTS

Place: The Hotel Pennsylvania, New York City. (Make your reservations promptly; Feb. 21-25!) February 21 at 7:00 P. M. Banquet of Optical Society of America. February 22. O. S. A. session of contributed papers on light and color, with an invited paper at 2 P.M. (changed from 11:00 A. M.) on Saturday afternoon by Individual Council member Frank J. Reilly on the subject: Light and Shadow and Its Representation. February 23 (Sunday). Several committee meetings, including the Executive Committee, at 7:00 P. M. February 24 at 9:00 A. M. ISCC registration. 9:30 A. M. Discussion Session, based on reports of problems under investigation by Council committees. This session is a new departure in Council activity; it is planned so that delegates and members not actively engaged in the work of the several committees may hear full reports of committee activities, and have opportunity to discuss various phases of the work. There are five problems on which subcommittees of the Problems Committee are actively engaged:

Problem 6: Color Terms - Sidney M. Newhall, Ch.
Problem 10: Color Aptitude Test - Forrest Dimmick and C. E. Foss, Co-ch.
Problem 11: Color Blindness Studies - Deane B. Judd and LeG. Hardy, Co-ch.
Problem 12: Illuminating and Viewing Conditions for Colorimetry - - Deane B. Judd, Ch.
Problem 13: The Illuminant in Textile Color Matching - - Dorothy Nickerson, Chr.

The final report of the last-named committee will be presented in detail by several committee members who took part actively in this work. February 24, at 2:00 P.M. Continuation of Discussion Session, followed by a brief Business Session which all delegates and members are urged to attend; this will be very brief. Chairmen of delegates and of regular committees are requested to have their annual reports in the secretary's hands before the meeting. It is intended that adjournment will be not later than 4:00 P.M. An evening session will be arranged by the New York Colorists. Topic: "What Do You Know About Color - or Color Information Please," with M. Rea Paul, interlocutor. Dinner will be arranged if possible. February 25. At the Commodore Hotel, headquarters of TAPPI meetings. At 9:30 A.M. Technical Session on Color held jointly with Tappi:

The Paper Man's Interest in Color - A. H. Croup
Colorimetric Standardization in Industry - Ralph M. Evans
Color-order Systems - Carl E. Foss
(From material standards in like media to systems that represent increasing definitions of a useful color space.)

At 2:00 P. M.

Spectrophotometry - Norman Barnes
I.C.I. Standard Observer and Coordinate System - J. A. Van Den Akker
Inter-relation of Color Specifications - Dorothy Nickerson
Color Engineering - Frederic H. Rahr

All who are interested are cordially invited to attend any or all of these sessions.

THE COLORISTS OF WASHINGTON AND BALTIMORE

The third meeting of the fourteenth season of the Washington and Baltimore Colorists was held jointly with the local I.E.S. group at the PEPCO Auditorium, tenth and E Streets, N.W., at 8 P.M. January 17th. The meeting followed dinner at the Y.W.C.A. Cafeteria, which is nearby. Many members of local photographic and camera clubs attended.

The Colorists were fortunate in having as speaker Ralph M. Evans, Chairman of the I.S.C.C. and superintendent in charge of color quality control for all color processes at Eastman Kodak, Rochester. We repeat here the subject announced in News Letter No. 67; it was "Lighting a Subject For Color Photography." The physical nature of a light source is an important part of the photographer's problem when he begins to work in color. Mr. Evans discussed and demonstrated the problems encountered when a photographer sets up a simple object in the studio and attempts to make a picture that will look like the object. The size, shape and position of the light source all have their effect; there are advantages and problems in using polarized light. The appearance of shadows must be considered from photographic and psychological points of view, and techniques considered for handling the lighting in this regard. This lecture presented, with full demonstrations, results of research in practical color problems that were discussed for the first time last May before a joint meeting of the Inter-Society Color Council and the Society of Motion Picture Engineers.

BOSTON COLOR GROUP

The January meeting of the Boston Color Group was held on the evening of January 21. The group met for dinner at 6:30 P.M. in Pritchard Hall of Walker Memorial on the M. I. T. campus. Following the dinner the group adjourned to Huntington Hall at the Massachusetts Institute of Technology for a lecture by Mr. Carl E. Foss, of Princeton, N. J. Mr. Foss' topic was "A Colorant Gamut System."

The speaker, a widely known consultant in the field of color, was formerly Assistant to the Director of the Research Laboratories of The Interchemical Corporation, New York. He is recognized for his researches in the Ostwald color system, and for his production of many types of color standards, including the chips contained in the Color Harmony Manual. His lecture before the Boston Color Group was concerned with a new system for pigment mixtures which he developed for the Martin-Senour Company. As may be noted on page 1 of this issue, he is also one of the editors of this News Letter.

Because Carl Foss' lecture is of such general interest to all those concerned with problems of pigment mixture, the Boston Color Group invited the New England Federation of Paint and Varnish Production Clubs to attend the lecture in Huntington Hall.

DEATH OF ROSE BAIRD

Through her sister we learn with sorrow of the death of former ISCC individual member, Miss Rose A. Baird, early in October. Miss Baird, a retired teacher of the McDowell School of Costume Design, was greatly interested in color, and a few years ago had considerable discussion with several members of the Council on portions of her manuscript of a book on color for teaching classes in costume and fashion.

An item in Woman's Wear Daily, December 2, indicates that Kate Lewis, personnel director of Namm's Department Store, has appointed Miss Sue West of Spool Cotton Company and Mrs. Jacob Christman, formerly a teacher in the Vocational High School of Elizabeth, N. J., as a committee to decide what disposition is to be made of Miss Baird's manuscript.

Miss Baird was a sprightly and colorful member of the Council. Her absence at the impending and subsequent meetings will be noted with great regret.

COLOR-PREFERENCE STUDY BY FP&VPC

The Louisville Club of the Federation of Paint and Varnish Production Clubs has presented the first report as preliminary to a series they expect to complete on the subject of color preferences. The report is published in detail in their Official Digest for November 1946. (This number also contains the announcement that John C. Moore, first chairman of the Federation's delegation to the ISCC, is the newly elected president of the Federation. Congratulations, Mr. Moore, and our best wishes!)

The report states that the change in color of organic coatings with time may or may not be in the direction of the customer's preference. In order to insure satisfaction after the change it should be in the direction of preference. Therefore the Louisville Club is concerned with the determination of color preferences by polling the public at large.

For a start three colors were chosen as follows: Munsell G 6/4, R 4/8 and YR 6/6. Each was mounted as the center of a series of three constant-hue panels in which adjacent chips varied by one step of value, two steps of chroma. The green series were mounted as follows, the red and yellow-red series being similarly treated.

2.5 G		
7/6	7/4	7/2
6/6	6/4	6/2
5/6	5/4	5/2

5G		
7/6	7/4	7/2
6/6	6/4	6/2
5/6	5/4	5/2

7.5 G		
7/6	7/4	7/2
6/6	6/4	6/2
5/6	5/4	5/2

The observer was asked to assume that the standard color is desired but obtainable, then requested to choose between two unmasked colors corresponding in value and chroma, but varying in hue; second, corresponding in hue and chroma, but varying in value; and third, corresponding in hue and value, but varying in chroma, all chips being masked except those under consideration.

Results are summarized for 134-205 observations on each color as follows:

Standard Color	Colorchange Preference							
	Male				Female			
	No.	H	V	C	No.	H	V	C
5 R 4/8	62	Bluer	Dark	Strong	72	Bluer	Medium	Strong
5 G 6/4	90	Bluer	Medium	Weak	48	Bluer	Light	Fairly Strong
5 YR 6/6	112	Redder	Light	Strong	93	Redder	Light	Weak

A detailed breakdown of this summary is given in pages 549 - 563 of the report. This work is good work; and we are glad to know that it presages further work to come.

HEARINGS ON COLOR TELEVISION

During the week of December 9th hearings began before the Federal Trade Commission on a petition of the Columbia Broadcasting Company that the F.C.C. immediately set standards for commercial broadcasts in color television. The direct testimony of CBS and thirteen representatives of other broadcasting and set-manufacturing companies was completed during the week. The following week the commissioners went to New York to witness additional broadcasts, having already witnessed demonstrations by CBS and other companies who had requested it. Because of the technical nature of the material, cross-examination was deferred until there could be time for study of the direct testimony.

Technical men were star witnesses. Dr. Peter C. Goldmark, whose outstanding achievements in this field brought him the Television Broadcasting Association's Award of Merit in Engineering in 1944, was chief spokesman for CBS, proposing use of the sequential method of broadcasting by successive use of red, green and blue filters. Technical data regarding the sequential method now being used in experimental broadcast by CBS were presented in 74 pages of direct testimony, with five pages of additional remarks to call attention to the greater importance of high contrast compared to high maximum brightness which was often urged during the hearings. The CBS television pictures may be shown in a room with about twenty foot candles illumination or less. (NOTE: Excluding direct sunlight, this is probably more than most rooms have except near the window in daylight, and much more than night-time illumination in any home living room we know about. -D.N.) Dr. Goldmark called attention to the fact that it is more important to have a good contrast ratio in which the black reflects only about 1/30th as much as the white than it is to have high maximum brightness which does not allow the contrast ratio to be kept. Ordinarily we view pictures and objects that are not brighter than the surrounding fields but the contrast ratio is maintained. Because it is built in, black looks black, white looks white. When the screen in a color receiver is turned off it appears black under room illumination, not white, as it does in black and white television receivers, or in a movie screen.

The case for simultaneous all-electronic color television was presented by Dr. R. D. Kell on behalf of RCA and NBC in 45 pages of direct testimony. The system which they propose, and in which much of the rest of the industry is interested, has been developed to fit into the present black-and-white system so that one could work with the others and avoid obsolescence of black-and-white receiver sets. Three pictures, a red, a green, and a blue, are produced simultaneously on three different tubes in the receiver and are combined optically. The system is developed far

enough for demonstration, but while RCA outlined details in their testimony that gave a picture of the concept of research and development necessary to provide solutions to the remaining problems, they are not ready to go, as is CBS. They estimate that the work and testing necessary, and industry's consideration for color television, will require a minimum of four to five years. Therefore, while CBS petitions for immediate adoption of standards for color television, RCA, speaking for NBC, and several of the other broadcasters and manufacturers, do not wish to have standards adopted until after further research and testing.

During the week of December 16 the Commission attended CBS demonstrations in and around New York. Hearings will be resumed in a New York court room on January 27, at which time similar demonstrations will be made a part of the court record. Following this, there will be a demonstration at Princeton, after which hearings will be resumed in Washington. Later in these pages we list under "bibliography" reference to a paper by Dr. Goldmark and his associates.

NOURATHAR: THE SIXTH ART

Nourathar: The Fine Art of Light-Color Playing (Westbrook, $15) is the latest work by Mary Elizabeth Hallock Greenewalt, who has been adjudged by some inventor of the indicated art. The popularly-written book of 400 pages is in six parts, containing 150 illustrations covering auditorium arrangement for light-color play, instrument, the playing, instructions for recording, techniques and composition. The book reaches into manufacturing and related fields - chemical, electrical, physical and plastic, as well as the theatrical and entertainment world. A new kind of printing, applicable to the recording on paper of the progressions of light-color playing, is described.

"Nourathar," the author's coined name for the Sixth Art, is derived from the Arabic roots "nour" meaning light, and "athar," the essence of. Mrs. Greenewalt, concert pianist and lecturer, has devoted practically her entire life to the development of artistic expression by means of light and its color. In 1926 she was awarded a gold medal at the Philadelphia Sesqui-Centennial Exposition for her work. Mrs. Greenewalt is the author of "Light - Fine Art the Sixth," and several magazine articles representing original research on the subject of light-color play.

To the above statement, which came to our secretary through routine channels, the editor may add that Mrs. Greenewalt has other books to her credit, some of them being easily located in available "Who's Who"s. In one of these was found also: "Originator and developer and patentee of the method and apparatus claims covering the fine art of light-color play used as a means of human expression and in combination with rhythmic sound; patentee of the means of producing least visible increments of darkness, brightness and light-color, the fundamental for a definite measure for color shade, color-tint; first to conduct a class in light-color play ..." Though the Editor has had only the slightest acquaintance with Mrs. Greenewalt since meeting her many years ago, through his friends in the Du Pont company (she is related to one or more persons very high in Du Pont affairs) he frequently heard of her continuing serious interest in color, her erudition and her indefatigability and resourcefulness. Her erudition is attested by her electrical knowledge, for example, and her recourse to Arabic roots (in the same situation, the Editor would have managed only some such lame combination as "luciousian" or "photousian"). For anyone interested in the new book, the address of the Westbrook Publ. Co. is 5800 North Mervine St., Philadelphia, Pa.; or perhaps one can write to Mrs. M. Hallock Greenewalt, Hotel Du Pont, Wilmington 99, Del. We greatly regret that we do not have available more space to reproduce Mrs. Greenewalt's interesting description of her new book and its background.

COLOR FILTERS

Most ISCC members are well acquainted with the Wratten filters put out by Eastman Kodak Company for photographic and scientific use, and with the catalog giving spectral-transmission data which they publish (see October 1945 J. Opt. Soc. Amer., pp. 670-675, Colorimetric Specifications of Wratten Light Filters).

Recently the Dufay people in England have forwarded to the ISCC secretary copy of a 47-page catalog giving data on their Chromex Cellulose Acetate Filters. Curves are given for 64 filters. It is of interest that the background of the spectral curve graph they show is in color covering the spectrum range; density is shown with a dot screen over the colors, transmission in clear printed colors. A point the Editor believes worth mentioning here is the fact that the use of cellulose acetate permits the use of a goodly number of fast-to-light dyes. The address of Dufray-Chromex, Ltd. is Elstree, Herts, England.

BRITISH-COLOUR GROUP REPORT

Through courtesy of the Color Group of the Physical Society (London), several copies of their recent report on Defective Colour Vision in Industry are available on request from the ISCC secretary (address Box 155, Benjamin Franklin Station, Washington 4, D. C.). This 52-page report is the work of a committee appointed in 1942 "to obtain as complete information as possible as to the techniques and processes in which deficiencies of colourvision are a handicap, to report on existing methods of testing such deficiencies in Industry and in Schools, and to make recommendations regarding the improvement and coordination of these tests." Committee members are: Dr. J. H. Shaxby, Chairman; G. H. Giles, G. E. Graves-Peirce, F. H. G. Pitt, J. W. Strange, W. H. Taylor, W. D. Wright and H. M. Cartwright. Twenty meetings of the committee were held.

The report contains five chapters. The first, on the Nature and Incidence of Defective Colour Vision, omits all reference to theories of color vision, confines attention strictly to experimental facts and symptoms of the defect. Chapter II, Colour Vision Tests, lists a great many of the tests under several heads: Confusion chart tests, lantern tests, wool tests, matching tests and miscellaneous tests. In assessing the relative merits of the tests, it is concluded that confusion chart tests must come high on the list of recommendation, not only because of their effectiveness but their cost, availability and complexity; lantern tests are relatively expensive and demand greater skill on the part of the examiner. Among the matching tests it is difficult to give a general appreciation, but attention is drawn to the Nagel Anomaloscope, the Shaxby and Kodak tests, and the Farnsworth-Munsell test. Chapter III discusses Colour Vision in Industry and the Services. While testing for the services and the railroads is usual, there was no agreed technique in industry. Textiles, the drapery trades, electrical industries, illuminating engineering, paper, photographic industries, printing and photo-engraving, printing-ink manufacture, paints, pottery, the building trades, mining and metallurgical industries, fruit-growing and agriculture, oil, the "professions" -- all were investigated, being covered by 17 sections in this chapter. Chapter IV, the Case for Pre-Vocational and School Testing of Colour Vision, reports that there is no doubt of the urgency of instituting tests of school children, especially boys, and discusses the present position and practicability of school testing. Committee Recommendations, in Chapter V, refer to two tests, one to be used at school to discover those who are seriously defective, the other, pre-vocational tests for all those who propose to enter trades or professions in which normal vision is important. In the first case, it is recommended that all children be tested at school at the age of 13 years or over, using one of the approved confusion-chart tests. For pre-

vocational tests, the confusion-chart type of test is recommended as a good all-purpose test, but it should be supplemented by a trade test designed for the particular kind of task to be undertaken under normal working conditions.

This report of our British colleagues is an important one. Color-vision deficiencies of one sort or another are so widespread that it is good news to hear that more and more school systems are regularly employing a color-vision test. A child with defective color vision should know this early enough in life to avoid setting his heart on a vocation in which normal color vision is a requirement. Not only would it save many a later heartbreak, but undoubtedly could save industry from much mediocre work. The fact that several industries report that they never knew of a color blind to get into their profession, shows how little attention industry sometimes pays to the subject, for with an incidence of one out of every 8 or 10 males, color defective to some extent, it is not probable that any industry lacks many such persons. Color defectives need not be ruled out of many color jobs, but they themselves and their employers would be protected from much wasted effort if the defects were known. When a color-blind boss says: "This is it," it generally is so taken, for no one knows he is color blind. It is his judgment, not his vision, that is suspected.

We congratulate the British committee and thank them for their generosity in supplying us with a dozen reprints. When these are exhausted, copies may be purchased from the Physical Society, 1 Lowther Gardens, Prince Consort Road, London S. W. 7. The price is 3s. 6d. Effort is being made to have the sale of this report handled directly in this country. You will be kept advised. D.N.

RESEARCHES ON COLOR VISION

Researches on Normal and Defective Colour Vision, by W. D. Wright, 1946, 383 pp., 233 figs; published in London by Henry Kempton, will be handled in this country by C. V. Mosby, 3207 Washington Blvd., St. Louis 3, Mo. A letter from the Mosby Company dated November 26 states that the book should be ready about the first of the year, the price to be about $6.00.

This new book by Dr. Wright, one copy of which reached us in November, is an outstanding contribution to the literature of color vision, for in it are collected and rewritten reports of the last twenty years work in this field by Dr. Wright and his colleagues. The investigations described date from 1926, when the Medical Research Council first awarded a grant for experiments on the re-determination of the spectral mixture-curves. The special colorimeter designed for this work has been useful ever since in attacking problems of color perception that are reported. These researches are divided into five groups: luminosity, color mixture, discrimination, adaptation and defective color vision, and are discussed in that order. Some hitherto unpublished material is included.

The book's 30 chapters are divided into eight sections. Part 1 introduces the reader to the visual organs and processes and to visual perception. Part 2 covers a description of the colorimetric equipment used. Parts 3 through 7 cover the five research subjects already listed. Part 8 discusses the role of the fundamental response curves in visual theory. A brief introductory statement precedes each of the sections 2 to 7, with references to the papers by Wright or associates that are the basis for presentation.

Dr. Wright's work and that of his colleagues is so well known and esteemed, yet so widely scattered into a number of separate reports, that we believe he has done a

real service in collecting them for publication in a single well-planned book. It should be at hand for ready reference by each worker in color who has even the slightest interest in problems of color vision. The author states that first and foremost this book should be regarded as a record of experimental data, with theoretical discussion and speculation occupying a very secondary position. "So little is known about so much that the distinction between theory and guesswork is decidedly blurred....the number of experiments awaiting experimenters is very great. It may be hoped that this book will serve both as a useful pointer to some of the more profitable lines to be followed and as a stimulus to get on with the job."

Dr. Wright is to be congratulated on a fine job. While we thought his "Measurement of Colour" a good book, the new one has superior value, though of course entirely different in intent, for this book summarizes twenty years of fine work in the field with which the author's name is most closely associated. We are glad to see that the price of this volume will be in line with that of similar-quality American scientific and text books.

RESONANCE AND COLOR

We have received L. G. S. Brooker's monograph, "Resonance and Organic Chemistry," which is part IV, pages 63-136 of "Advances in Nuclear Chemistry and Theoretical Organic Chemistry," edited by R. E. Burk and O. Grummitt (Interscience Publishers, New York, 1945). This is an elaboration of an excellent earlier treatment of the same subject by the same author, though now somewhat broader in scope, in keeping with the broad title; see Reviews of Modern Physics 14, 275-93 (1942). In both treatments, the relation of absorption spectra, rather than color, to chemical structure is treated in a lucid and masterly fashion. The revision has an improved value because of certain additions.

In part I of the 1945 paper, after a brief resume of classical chemical structural theory, the resonance theory is introduced. After giving the theory for the relatively simple case of hydrogen, it is extended to more complex molecules, including benzene and its reduction products, and to dyes. There are also included brief treatments of the relation of resonance theory to the orienting or directing influence of substituents in the benzene ring, to the strengths of acids and bases, and to dipole moments.

In part II, the resonance theory is applied to the problem of "color" (absorption spectra) and chemical structure. After brief remarks on absorption in general, and on the Witt chromophore-auxochrome theory (1876), which was a great ~~great~~ guiding light in the development of dye-stuff chemistry, the latter is interpreted in terms of the resonance theory, and important "auxochromophoric" systems are discussed. From here on many rules are developed regarding the wave-length position of absorption bands resulting from various dye structures; and the data for these correlations come very largely from the excellent and extensive work done on various series of dyes, especially sensitizing dyes, in the Kodak laboratories under Brooker's direction. Whereas Remick in his fine "Electronic Interpretations of Organic Chemistry" (1943), sets up explicitly 29 "Basic Principles," many of which serve to outline the resonance theory, and one of which is: "Other things being equal, the most stable resonance form will have the greatest number of covalent bonds," Brooker treats at some length the "additional-double-bond stabilization" conferred on certain cyclic dye structures. This is an important factor, as are factors of symmetry. The more stable a structure among possible resonating structures, the more it "contributes" to the actual state of the resonating molecule. Resonance is most complete in those symmetrical molecules in which the end structures produced by resonance are wholly or nearly identical (see the 1937 papers of G. S. Chwarzenbach in Helv. Chim. Acta).

Brooker's 1942 treatment, fine though it was, suffered from certain defects which are maintained in the more recent and broader treatment: (1) His rules relate structure differences to wave-length of maximum absorption, and changes in the latter; but this correlates with only one of the three variables of color; (2) little was said about intensities of absorption, which correlate to some extent with a second variable of color (see Mulliken and Rieke, Repts. Progr. Physics 8, 231-73; 1941); (3) in the proper sense, the whole treatment stopped short of color, for it really correlated only chemical structure and the parameters of absorption spectra; (4) Brooker preserves the Schutze (1892) definition of "depth" of color (that we have discussed in these pages), which is inadequate in several particulars; and (5) his rules correlate chemical differences with wave-length changes; but a wave-length change of 5 to 10 mu. in one range (say the yellow) may produce more color (hue) change than a 50 mu. change in another range (say blue-green), at least when dealing with the idealized absorption bands such as those utilized by MacAdam.

It may be mentioned that the theoretical necessity for the rules which Brooker arrives at empirically, was pointed out by K. Herzfeld and A. L. Sklar, Rev. Mod. Physics 14, 294-302 (1942); see also J. Chem. Physics 10, 508-20, 521-31 (1942). Turning to some detail, Brooker stresses the importance of the "degeneracy" or non-degeneracy of the extreme resonance structures of dyes resulting from the symmetry state due to identical or non-identical terminal groups. When comparing the wave-length of maximum absorption of an asymmetrical dye with the mean of the corresponding wave-lengths of the symmetrical ones, the greater the inbalance of basicity in the two halves, the greater the deviation from the mean (the Beilenson, Fisher and Hamer rule, 1937). In the series of dyes of similar structure but of increasing chain length, Hewitt's Rule (J. T. Hewitt and H V. Mitchell, J. Chem. Soc. 91, 1251-66 (1907) is not followed. According to Hewitt, the longer the conjugated chain, the "deeper" the hue; but, according to Brooker, the wave-lengths tend to converge, with increasing chain length, when the extreme resonance structures are not identical, and tend to be non-convergent when they are identical. Some series contradict the general impression that "the greater the resonance, the deeper the color"; the restrictions to this generalization were pointed out by G. N. Lewis and M. Calvin, Chem. Reviews 25, 273-328 (1939).

To the reviewer, it seems regrettable that Brooker, who has done such masterly work in his special field and who can write so lucidly, has stopped short of a final synthesis of chemical structure and color by way of absorption spectra, when the last step can be made so readily from the results and methods of Brooker's own colleagues at Kodak Park, men such as Loyd Jones, MacAdams and Evans. But the steps which Brooker has taken are important, far-reaching, sound, and beautifully illuminated by his exposition of their course.

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BIBLIOGRAPHY AND PATENTS

P. G. Goldmark, J. N. Dyer, E. R. Piore & J. M. Hollywood; Proc. Inst. Radio Engin. 30, 162-82 (part I); 31 465-78 (part II); this is a brief history of color television, and the research leading up to the CBS color television system have been presented; a general theory for television, including color, flicker, and electrical characteristics, is also given; equipment for color television transmission and reception has been designed and constructed by utilizing these principles. Part II deals with improved receiver-tube phosphors and the changes in transmission color characteristics; the color reproduction theory is extended to include changes in gamma and the action of the color mixer.

P. C. Goldmark & R. Serrell; Proc. First Natl. Electronics Conf., Chicago, Oct. 5-7, 1944; 1, 169-89 (1944); through Monthly Abstr. Bull, Kodak Res. Labs. 32, 10 (Jan. 1946); color and ultrahigh-frequency television

H. Gordon; Brit. J. Photog. 93, 138, 147-9 (April 26, 1946); dominant colours in integral tripack films and their correction by chemical means

P. L. Gordon; Amer. Paint J. 29, No. 40, 62, 64, 66, 68, 72 (1945); phthalocyanine pigments

M. M. Gourevich; J. Opt. Soc. Amer. 35, 196-8 (1945); the geometrical solutions of some color-mixture problems

R. Granit; Nature 155, 750 (June 23, 1945); electrophysiological analysis of the fundamental problem of colour reception (14th Thomas Young Oration of the Physical Society before the Royal Institution)

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R. Granit; Proc. Phys. Soc. 57, 447-63 (1945); electrophysiological analysis of the fundamental problem of colour reception

W. Granville; Interchemical Rev. 4, No. 1, 3-12 (Spring 1945); specification of color

E. L. Green & L. L. Sloan; J. Opt. Soc. Amer. 35, 723-30 (1945); two criteria for the selection of color-vision test plates

K. M. Greenland; J. Sci. Instr. 23, 48 (March 1946); high-reflection films

J. Grieve; Nature 157, 376 (March 23, 1946); incidence of defective color vision

S. K. Guha; J. Indian Chem. Soc. 21, 391-6 (1944); through Chem. Abstr. 39, 4489 (1945); (absorption spectra of) indigoid dyes

N. H. Haddock; J. Soc. Dyers Col. 61, 68-73 (March 1945); phthalocyanine colouring matters - their chemistry and use

A. Haddow, L. A. Elson, E.M.F. Roe, K.M. Rudall & G. M. Timmis; Nature 155, 379-81 (March 31, 1945); artificial production of coat colour in the albino rat

R. M. Haff; Nat. Lithographer 52, 20-2, 24, 64 (Aug. 1945); application of Ansco Color paper to map making and reproduction

L. A. Hamilton, R. C. Moran & A. R. Cattell (to Socony-Vacuum Oil Co.); U. S. Pat. 2,371,289 (1945); prevention of discoloration of wax

R. J. Hannay; J. Soc. Dyers Col. 61, 88-9 'April 1945); some problems in the application of pigments for the coloration of textiles (part of the Symposium on the Application of Pigments to Textiles held at Manchester, Eng. on Nov. 17, 1944; discussion, pp. 89-90

H. G. W. Harding; Proc. Phys. Soc. 57, 222-38 (May 1945); illuminants for colorimetry and the colours of total radiators

H. G. W. Harding; Proc. Phys. Soc. 58, 1-21 (Jan. 1946); colours of total radiators expressed on the C.I.E. trichromatic system for the temperature range 0-1-660 mireds (C_2 = 14384.8)

A. C. Hardy; J. Opt. Soc. Amer. 35, 289-92 (April 1945); illuminating and viewing conditions for spectrophotometry and colorimetry

LeG. H. Hardy, G. Rand & M. C. Rittler; J. Opt. Soc. Amer. 35, 268-75 (April 1945); tests for the detection and analysis of color blindness; I, the Ishihara test: an evaluation; II, J. Opt. Soc. Amer. 35, 350-56 (1945); the Ishihara test: comparison of editions; III, J. Opt. Soc. Amer. 35, 481-91 (July 1945); the Rabkin test

LeG. H. Hardy, G. Rand & M. C. Rittler; J. Opt. Soc. Amer. 36, 86-94 (Feb. 1946); effect of quality of illumination on the results of the Ishihara test

G. B. Harrison; Photog. J. 85 B, 57-62 (May-June 1945); the scattering of light in the atmosphere

V. G. W. Harrison; Proc. Phys. Soc. 58, 408-19 (July 1946); light-diffusing properties of magnesium oxide (deviations from Lambert's law)

H. Hartridge; Nature 155, 391-2 (March 31, 1945); colour vision of the fovea centralis

H. Hartridge; Nature 157, 482 (April 13, 1946); micro-stimulation of the human retina (areal distribution of red, green and blue receptors)

J. H. Haworth, I. M. Heilbron, D. H. Hey, R. Wilkinson & E. F. Bradbrook; J. Chem. Soc. 1945, 409-12; some green pigments of the phthalocyanine series

S. Hecht & Yun Hsia; J. Opt. Soc. Amer. 35, 261-7 (April 1945); dark adaptation following light adaptation to red and white lights

A. C. S. van Heel; J. Opt. Soc. Amer. 36, 237-9 (April 1946); correcting the spherical and chromatic aberrations of the eye

L. J. Heffernan; Movie Makers 20, 92, 108 (1945); through Eastman Kodak Monthly Abstr. Bull. 31, 67 (1945); painting with light (use of "Hollywood lighting")

L. J. Heffernan; Movie Makers 20, 53, 64 (1945); through Kodak Monthly Abstr. Bull. 31, 37 (1945); painting with lights (moods created by four types of lighting)

M. Héros; Compt. rend 211, 203-5 (1940); fluorescence resulting from some mixtures of fluorescent substances

B. W. Herzka; U. S. Pat. 2,362,818; two-color filter for cine cameras (taking through red and blue filters and projecting the slightly yellowed print through alternating red and green filters)

W. E. Higham; "Birds in Colour"; Collins, London; review in Brit. J. Photog. 93, 115 (March 29, 1946)

C. G. A. Hill; Science 103, 155-8 (1946); uniform luminescent materials (review)

T. L. Hill, G. E. K. Branch & M. Patapoff; J. Amer. Chem. Soc. 67, 454-63 (1945); a spectrophotometric study of the anhydro-base of viridine green

A. E. Hirst; Cotton (U.S.) 109, No. 5, 101-3 (1945); pad-steam continuous dyeing range: application

C. Hobday; J. Soc. Dyers Col. 61, 87-8 (1945); fixation of pigments on textiles from aqueous media (part of the Symposium on the Application of Pigments to Textiles held at Manchester, Eng. on Nov. 17, 1944); discussion, pp. 89-90

H. H Hodgson; J. Soc. Dyers Col. 62, 237-40 (Aug. 1946); colour and constitution; VIII, some colour problems from the view-point of resonance theory

H. H. Hodgson & D. E Hathway; Trans. Faraday Soc. 41, 115-21 (1945); absorption spectra of some mononitro-naphthylamines, with observations on their structures (220-400 mu)

H. H. Hodgson & D. E. Hathway; J. Soc. Dyers Col. 61, 283-5 (1945); theoretical discussion of further substitution in homonuclear mononitro-naphthylamines (this paper included, though not directly on color, because of its close relation to other papers by Hodgson dealing with the electronic and resonance theory of color production)

H. H. Hodgson and E. Marsden; J. Soc. Dyers Col. 60, 210-14 (1944); an electronic interpretation of substantivity based on dye structure; part I, azo dyes and their intermediates; review by I. H. Godlove in ISCC News Letter No. 56 (Nov. 1944), 8-10 under title "dye substantivity and color"

W. A. Holst; Amer. Dyestuff Rptr. 34, P 500-1 (1945); a new tool (AATCC-Munsell chart) for evaluating color transference (24 color chips: gray, red, yellow, green, blue and purple in four depths each)

H. H. Hopkins; Nature 155, 275 (1945); resolving power of the microscope using polarized light

W. Horback (to Celanese Corp. of Amer.); U.S. Pat. 2,386,855 (1945); articles transparent to visible light but opaque to ultra-violet and fluorescing under the latter (see same patentee, U.S.P. 2,356,849 in News Letter No. 63)

C. W. Horton; Geophysics 10, 186-206 (1945); analysis of oblique reflection data

E. O. Hulburt; J. Opt. Soc. Amer. 35, 698-705 (1945); optics of distilled and natural water

W. J. Humphreys; Science 102, 130-31 (1945); why the rainbow and the corona never are seen in the same cloud

R. S. Hunter; J. Research Natl. Bur. Stand. 36, 385-91 (April 1946); J. Opt. Soc. Amer. 36, 178-81 (March 1946); a glossmeter for smoothness comparisons of machine-finished surfaces

T. F. Hurley & E. T. Wilkins; Brit. Pat. 578,369 (1946); camouflaged water surfaces

T. C. Hutchins; Amer. Dyestuff Rptr. 34, 344-6 (1945); some causes of uneven dyeing

J. W. Iliff & L. B. Darrall; Proc. Amer. Soc. Test. Mat. 44, 905-9 (1944); measurement of fading resistance of camouflage-type finishes by accelerated weathering

I. G.; Belgian Pat. 444,416; fluorescent pictures

Imperial Chemical Industries Ltd.; Brit. Pat. 571,181 (1945); colorimetric indicator sheet

Inter-Society Color Council News Letter editors; ISCC News Letter No. 58 (March 1945), 3-5; color terminology

Institute of Paper Chemistry; Report No. 34, Part II; "Progress report on the study of color blindness by means of a monochromatic colorimeter"; Feb. 15, 1945

S. Isermann & E. Ohlsson; U. S Pat. 2,395,665 (1946); ultraviolet-absorbing filters

R. L. Ives; J. Opt. Soc. Amer. 35, 736-7 (1945); sunset shadow bands

A. H. Jackson; Indus. Finishing 21, No. 8, 52, 54 (1945); luminous paint

D. H. Jacobs (to Celanese Corp. of Amer.); U.S. Pat. 2,370,244 (1945); ultraviolet-absorbing filters including a compound having a bluish fluorescence