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INTER-SOCIETY COLOR COUNCIL

NEWS LETTER No. 24

APRIL 1939

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Charles Bittinger, Editor for Art
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ASSOCIATION FOR COLOR RESEARCH

While our News Letter No. 23, carrying a brief item entitled "Chicago Please Note", was in press, we received a letter from Mr. J. C. Copeland, president of this enterprising Chicago group. Mr. Copeland enclosed a brief resume of the activities of the Association for Color Research since September, 1938. In the interval previous to the February meeting, these included the following four talks by the speakers noted:

Dr. Bernard Vodney, O.D., staff of Northern Illinois College of Optometry, Chicago, Illinois; subject: Color Physiology.

Mr. John Forrest, the Scientific Department, Bausch & Lomb Optical Company, Rochester, New York; subject: Colored Filters.

Mr. Frederic Rahr, Inventor of the yellow baseball, New York City, subject: Color The Salesman.

Messrs. W. E. Katzenbach and John Murphy, The Katzenbach and Warren Wallpaper Company, Chicago, Illinois; subject: Color in the Home (a symposium on Color Trends in Draperies and Decoration.

At the February meeting, the Association had the pleasure of viewing a motion picture film in color, entitled "Color Harmony", shown through the courtesy of Chevrolet Motors, followed by a lecture by Mr. Norman Hickox, Incandescent Lamp Department, General Electric Company, on the subject "Colored Light and the New Fluorescent Tubes."

BOSTON COLOR GROUP

April meeting will be held April 25 at Madam Bourguet's, 45 St. Botolth Street, Boston, Mass. Professor Arthur C. Hardy will talk on "Color Photography." The talk will be illustrated with both still pictures and movies, including an unusual collection of slides illustrating the historical development of the art and its modern theory.

THE LOVIBOND TINTOMETER AND ICI SPECIFICATIONS

We are informed in a letter from Mr. G. S. Fawcett, Managing Director, The Tintometer Ltd., through the National Bureau of Standards, that a method of expressing on the standard ICI colorimetric system readings taken with Lovibond glasses was introduced at the (London) Physical Society's exhibit early in January. This method is called the Lovibond-Schofield system of colorimetry; it makes use of the existing Lovibond color scales, provides a means of varying the relative brightness of the two fields of view by independent means, reduces the number of Lovibond slides required to make a match and entirely eliminates the use of neutral tint slides, and provides a means of ascertaining dominant wave length and purity of any color. A preliminary pamphlet on this system is obtainable from The Tintometer Ltd., The Colour Laboratory, Milford, Salisbury, England, and a technical description by Dr. Schofield is to appear in an early issue of the Journal of Scientific Instruments. A further descriptive brochure and ultimately a text book are also planned. The translation of color specifications from Lovibond terms to standard ICI terms is to be accomplished by special graphs supplied with the instrument.

WASHINGTON COLORISTS

It is reported that the Washington Colorists had an unexpected pleasure on Wednesday evening, March 8, when they had as their guest Mr. Herbert Thompson Strong, color lecturer, and color consultant for the New York Museum of Science and Industry, Rockefeller Plaza. Although arrangements were made only four days before the meeting, there were 34 in the group who gathered for dinner, with several coming in afterwards. Mr. Strong's lecture, The Magic World of Color, was thoroughly enjoyed by all who were present.

AWARD OF MEDAL TO PROFESSOR HARDY

In the February, 1939, number of the Journal of the Franklin Institute, p. 268, we find the following notice: Committee on Science and the Arts (Abstract of Proceedings of Stated Meeting held Wednesday, January 11, 1939.) Hall of the Committee; Mr. Edward L. Forstall in the Chair. The following report was presented for final action: No. 3059: Recording Spectrophotometer. This report recommended the award of an Edward Longstreth Medal to Arthur C. Hardy, of Cambridge, Massachusetts, "In consideration of the development of an accurate and reliable instrument which has greatly expedited research in the field of color, both in theory and in its commercial applications." John Frazer, Secretary to Committee.

PITTSBURGH LECTURE

Our attention has been called to the afternoon lecture by our Editor for Industry at the Third Conference on Industrial Physics sponsored by the Department of Physics, University of Pittsburgh, given on Friday, March 24, 1939, at Mellon Institute Auditorium, Pittsburgh, Pa., by Carl E. Foss, The Interchemical Corporation.

NEW DELEGATE OF THE ILLUMINATING ENGINEERING SOCIETY

Mr. Norman Macbeth, Macbeth Daylighting Corporation, 432 West 45th Street, New York City, has been appointed by the Illuminating Engineering Society to represent it along with the present delegates: Messrs. Gage, Little, Slauer and Taylor. We are glad to welcome Mr. Macbeth and hope that he will take an active part in Council activities.

WHEN IS RED NOT RED?

This is not our Colorquery and Visionnaire section; but perhaps you can favor us with an answer. Would you reply; When it's not going to a fire or When the officer doesn't see red. The question arose upon reading a letter of March 17, 1939, from one of our associate members, Mr. Vincent C. Vesce, Vice president, Harmon Color Works, Inc., Paterson, N. J., to our secretary. The letter is accompanied by a certified copy of Local Law No. 16 of the City of New York for the year 1939. We reproduce Mr. Vesce's letter only, for we find it more interesting reading than the law.

"Dear Miss Nickerson:

"I am attaching hereto a copy of a local law which the City of New York recently passed, making it unlawful for any motor vehicle, passenger car, truck, etc., to be painted a bright red taking on the appearance of the apparatus of the fire department or fire patrol. While we appreciate the good motive of the City of New York in passing such a law, the idea being to limit this banned color to fire engines, etc., in order to afford easy identification, it is believed that this will inevitably lead to some confusion and hardship on those whose advertising theme embodies colors possessing this hue.

"This will especially be true, because on further investigation in an attempt to find where the line was drawn, it was discovered that 'red' in its broadest sense will be prohibited, but the use of maroons whether light or dark will be allowed. And - we understand, 'orange' will be permitted as a color.

"It appears to me that one of the functions of the Inter-Society Color Council should be to make known its existence to the various legislatures in this country for the purpose of advising, consulting and even instructing those concerned on any pending legislation involving 'color' regulations.

"It will be amusing to watch the enforcement of this new law and we might yet have the pleasure of witnessing police officers consulting a Munsell scale before issuing a warrant to a possible offender.

"Hoping you will give this due consideration, etc., etc."

The Editor wishes to add that Miss Nickerson forwarded the letter to Dr. Judd as chairman of the Problems Committee. It may prove quite a problem, so perhaps you may care to forward suggestions.

"COLOR MEASURING MACHINE IN WALT DISNEY STUDIO" We have received a recent letter from Delegate William F. Little the totality of which reads: "You may be interested in the enclosed for your news letter; not that it is news to you but it may be to us." An enclosure was the theater leaflet "Uptown Newsette", dated March 16, 1939. Under the title quoted in our heading we read:

"Mainly because Walt Disney is a perfectionist, the Disney studios have just installed a spectrophotometer.

"Although it looks merely like a neat black contraption somewhat out of the gadget class in size, the spectrophotometer takes on a certain amount of glamour when you realize that there are only twenty others in the world.

"The spectrophotometer is a color measuring machine invented by Professor Arthur G. Hardy of the Massachusetts Institute of Technology. After a hue is measured on the spectrophotometer, it doesn't matter how it fades in years to come, for it can be reproduced exactly by following the original.

"In less than three minutes a permanent record can be obtained which would otherwise require at least two days of intensive experimentation and calculation. The record is obtained by inserting a sample of color under a lamp on the machine and pressing a button. The button sets into action a series of electric eyes, revolving prisms and lenses, which connect with a fountain pen. As the color reacts on the delicate parts of the machine, the pen makes a graph on a chart."

The Editor has taken the liberty of spelling the name of the instrument without an <u>a</u> in place of the first <u>o</u> in four places. He also begs leave to inform Mr. Little that some of the above is news to him. Under an alias, the Editor was instructed in the use of the instrument by Dr. Judd over a period terminating at the Annual Meeting. A month later he received the Newsette item. He was impressed with the sage advise that a color can be reproduced exactly by following the original. A few days later his company ordered the Hardy G. E. spectrophotometer to try to put all this instruction into effect.

COLORIST WINS

We are informed by the Council secretary that "Colorist" paid $97.30 in the third race on March 30 at Oaklawn Park. We hope that she or some of her fellow Washington Colorists played the hunch.

NEW YORK WORLD'S FAIR 1939 OFFICIAL COLORS

We have been informed that a booklet of this title has been prepared by The Interchemical Corporation, New York City. In addition to samples, the spectrophotometric curves, dominant wavelength, brightness, and purity, and Munsell notations for hue, value and chroma, are given for the official blue and orange colors chosen for the New York World's Fair. The matches in the booklet were approved by Mr. Julian Garnsey, Color Consultant for the Fair, who is a member of the Council.

BIOLOGICAL EFFECTS OF LIGHT

We reproduce here a review, prepared by Dr. Forrest Lee Dimmick, of two papers by medical men which were received just too late to insert in our November News Letter.

(1) Vollmer, Hermann, M. D., Studies on Biologic Effect of Colored Light, Archiv. of Phys. Therapy, 19, 1938, pp. 197-211, 252.
(2) Deutsch, Felix, M. D., Psycho-physical Reactions of the Vascular System to Influence of Light and to Impressions Gained through Light, Folia clin. orient., 1937, 1, Fasc. 3-4.

Dr. Hermann Vollmer published recently a survey of the experimental literature dealing with the effects of light of various wavelengths upon such physiological functions as growth, tonicity, blood sugar, etc. Basing his experiments upon the preceding work, he improved the experimental controls and eliminated numerous sources of error. With his more careful procedures, all evidence for any "biologic effect" of a particular wave-length disappeared. In the few cases in which a color is correlated with a specific biological result, he showed that the effect is not a color effect; for example, ants prefer red illumination not because it is red but because it approximates darkness; "the red light treatment of variola .... depends upon the exclusion of chemically active light, and by no means on the specific effect of red light." Dr. Vollmer's findings answer negatively most of the claims for bizarre psycho-biological effects of specific colors. His experiments seem to be clear-cut and decisive, though they might be more extensive. His interpretations do not carry him away from the established facts of the biological effects of light in general. Such conclusions may be disappointing, but rigorous scientific thinking is often so, though in the end, it carries its own justification.

There is another side of the picture, however. Dr. Felix Deutsch attacked the question from a clinical angle and reported a number of cases in which patients suffering from pathological states reflected in a heightened blood pressure, were in some measure relieved by a period of time spent in a room lighted with red or green windows. Conditions of "anguinal fear" (fear of snakes? - Ed.) were similarly alleviated. It appeared, however, that while one patient was benefited by red light and made worse by green light, another was affected in precisely the opposite manner. The observations were not subject to experimental control, so that although colored light and change of blood pressure seem to be concommitant, no causal relation between them has been or can be domonstrated. Such, unfortunately, is often the case with pathological material. The color of the illuminant formed only a part of the treatment. "The patient was asked to free-associate about the existing situation and to mention incidences and remembrances that might have come to his mind." Such changes as occurred in blood pressure, pulse, etc., should be attributed to the whole method of treatment, including the analysis, rather than to the specific effect of a color. If Dr. Deutsch finds it profitable to use color as a factor in his treatment, as the starting point of a free-association analysis, this is a point of clinical importance but we cannot expect another clinician to find color equally useful.

Dr. Deutsch's conclusions lack precision. He claims for colored light "a reflex influence" "by a way of psychic effects." This seems to be a contradiction in terms, and is still further obscured by the statement that "the effect is not specific for a color." We have left, then, the associative effects which he seems to have shown may be clinically useful but certainly are not new. Deutsch discusses the question of "a general light-tonus" that has been reported in the literature but offers no new evidence. Vollmer was unable to obtain any such response to light under well controlled experimental conditions. It is a question now of accepting Vollmer's results or of repeating the experiments.

A NEW GENERAL PRINCIPLE IN COLOR SCIENCE

We have received a paper by Professor Harry Helson of Bryn Mawr College, which appears to be of such importance to the science of color that, in spite of the fact that much of the content ~~will be~~ has given ~~repeated~~ been by the author at the 8th annual meeting, we give herewith in some detail an outline of its findings. This paper is: Fundamental Problems in Color Vision. I. The Principle Governing Changes in Hue, Saturation and Lightness of Non-Selective Samples in Chromatic Illumination; Jour. Exper. Psych. 23, 439-76 (Nov., 1938). The principle was formulated from work extending over a period of five years which sought to answer the question: Given any object as stimulus, what will be its hue, saturation and lightness when viewed on any background under any illuminant? The principle which describes the experimental results, embraces the important phenomenon of "color constancy" and the related problems of contrast, adaptation and mode of appearance. It has important implications; thus, color constancy has emerged as a special case of what the author has called "color conversion" (any change in color due to any circumstance whatever, as, change in spectral character of the illuminant, or reflectance of the background); and, it is concluded, from the appearance of illuminant color, complementary color and constancy under one set of conditions, that a single physiological mechanism is responsible for all. Heretofore, assumptions have been made that contrast is peripheral and constancy central, that there is both a peripheral and a central contrast, and that aperture colors are peripheral and other colors central. It was found that aperture colors are subject to the principle as well as surface colors.

Among the conditions which must be controlled for a study of color conversion are the composition and intensity of the illumination, reflectances of all objects and background, and state of the eye and mode of viewing stimuli. In this experimental work these were all accurately known. Several observers were used after being trained to report accurately hue, saturation and lightness of each of 19 samples seen in 4 illuminations on 3 different backgrounds, by means of preliminary work with Munsell standard scales. Analysis of the results showed that samples of high reflectance have the hue of the illuminant (red, yellow, green or blue); samples of low reflectance have the hue of the after-image complementary to the illuminant hue, and samples of intermediate reflectance are achromatic. The background reflectance appeared to be most important in determining the adaptation level and hence the colors of the samples appearing on it. While adaptation did not render all non-selective samples achromatic in homogeneous illumination, it did result in the establishment of an "adaptation reflectance" such that samples whose reflectance coincided were seen as achromatic. This also determined whether the sample took on the illuminant hue or its complementary. The principle governing conversion, constancy, adaptation and contrast in chromatic illumination is: Samples above the adaptation reflectance take the hue of the illuminant color; samples below it, the hue complementary to the illuminant hue; while samples near the adaptation reflectance are either achromatic or greatly reduced in saturation. The principle depends on only one assumption: that in every act of vision, provided the eye is subjected to a single illumination, there is established an adaptation reflectance or achromatic point such that there exists at least one sample whose reflectance is such that it will be seen as achromatic. The findings indicate (and the theory assumes) that the achromatic point is a function of the weighted average reflectances of samples and background; and that the adaptation reflectance is about (4/5) that given by a quoted formula due to D. B. Judd. Other findings are: that samples having the lowest saturation are those nearest the adaptation reflectance (the lightest and the darkest having the greatest saturation); that on the white ground, samples darker than the achromatic ones have a red or blue component in addition to the mixture complementary component, the red often appearing before the blue; and that a mere change in background is sufficient to change the hues of practically all the samples. The black ground induces the hue of the illuminant on all samples; the white ground "calls forth a color tending to neutralize itself" (Kravkov, 1927, 1932), giving mostly complementary hues; and on a gray ground are seen illuminant hues, achromatic colors and complementary hues. When departing from the achromatic point, both increase and decrease of lightness is accompanied by increase in saturation, in the former case of the illuminant hue and in the latter case of the complementary hue. Contrary to the usual view based on the color pyramid, maximum saturations occur with lightest and darkest samples, depending on the background. The color pyramid therefore does not represent the facts in strongly chromatic illumination. "Brightness constancy" was substantiated; i.e., large changes in intensity of illumination have comparatively little effect on the hues, saturations and lightnesses of non-selective samples.

Finally, the Editor wishes to say that, though he cannot presume to pass judgment on the scientific validity of the author's findings, he feels it not improper to remark on the clarity and lucidity of the author's style of presentation of fact and implication.

COLORIMETRIC DYEHOUSE PROBLEMS

A paper of considerable interest to applied color science in the dyestuff industry is by M. O. Pelton, of the British Cotton Industry Research Association, entitled: "Colorimetric Changes Resulting from Variations in the Concentration of Dye Solutions: Jour. Textile Inst.; Nov., 1938, pp. T 227-38. The work consisted in making spectrophotometric determinations on 24 dyestuff solutions, each at 4 concentrations (except 3 in 2 cases), computing dominant wavelength, purity and relative brightness by means of the 1931 I. C. I. data and assumed standard illuminant B, and, through the use of certain differential limen data, applying the results to three practical problems of interest in dyehouse practice. These problems were: (1) The apparent existence of two roughly differentiated classes of dyeings with respect to fastness to light; (2) the fact that "certain colors seem to show up the unlevel (non-uniform) dyeing to a greater extent than others"; and (3) the different size of the concentration steps necessary for examining delivered lots of, say, yellow dyes as compared to blue dyes by the usual method of making in each case several dyeings differing in concentration from each other by successive small differences for comparison with a standard, in the hope that one will come very close to the standard in strength.

The current but tacit assumption is that these facts are inherent physico-chemical properties of the dyes. The author attempts to show that they are at least in part psycho-physical or colorimetric phenomena. Turning to the first problem, we note a general belief that dyed materials of certain colors are more likely to fade than others; roughly, yellows, reds and oranges are thought faster than blues, greens and drabs. Three possible explanations are: (1) the red-yellow class are more stable chemically than the blue-green class; (2) the light absorbed by the former class may be more efficiently destructive than that absorbed by the latter; and (3) similar physical or chemical changes may result from irradiation, but these changes are less apparent for the former class than for the latter. The first explanation is very unlikely, for of the enormous number of dyes embraced in the generalization, many of the red-yellow group are chemically similar to the less-fast ones of the blue-green group, and conversely, many are very dissimilar to others in their own group. The second explanation is also unlikely, for the red and yellow dyes absorb larger light quanta than the blue and green dyes, and experience teaches that large quanta are more efficient than small ones in decomposing molecules. On the other hand, the author mentions, what is usually forgot in such explanations, that through a given window come more of the small (near ultra-violet) quanta than the larger (red and yellow) ones: but this factor we know to be less important than the former one. To examine the third explanation, the author assumes Beer's Law and that fading is a mere decrease of concentration, which is equivalent to assuming that no decomposition products have any effect on the color. Graphs of colorimetric purity and relative brightness against concentration are shown for solutions of 5 red, 6 orange, 5 yellow, 3 green and 5 blue dyes; also the hue-discrimination data of Wright and Pitt (1934) and "saturation"-discrimination data of Martin, Warburton and Morgan (1933). By means of this data the author shows that, for a given small change of dye concentration: (1) the hue change is "much less than the smallest perceptible hue difference"; (2) the smallest perceptible changes of "saturation" (purity) are, for a particular yellow, red and green, for example, 0.1, 0.05 and 0.04 steps, respectively, which correspond to 32-73, 13-27 and 15-61 percent changes in concentration; whereas an assumed least perceptible difference of one percent in relative brightness corresponds, respectively, to only 5.4-53, 1.6-4.2 and 1.1-3.6 percent changes in concentration. The double concentration figures give extreme ranges, since averages would depend materially on the method of averaging. The conclusion is that "a small change in concentration of a dye will first be apparent to the eye through the change that is produced in brightness factor, and that a larger concentration change must be made before there is any noticeable change in the saturation of the color". The slopes of the brightness vs. concentration curves show that, when they are compared at a given lightness or darkness, the change of brightness resulting from a given change of concentration for varying hue increases in the order: yellow, orange, red, green, blue. These results give the answers to the second and third practical problems; and in this connection it may be said: (1) that the dyes commonly used for "dyeing-index tests" to show up varying and unlevel dyeing are Sky Blues FF and 6B; and (2) in examining dye lots, dye testers may make up for comparison with standards, yellows of strengths 90%, 100% and 110%, whereas blues may be made up 95%, 100% and 105%.

Some of the conclusions are verified by an independent experimental procedure involving the comparison of two dye solutions, chosen on the basis of the indications of the above-mentioned calculations, at slightly different depths in the two cups of a chemical colorimeter, set by an independent operator at levels unknown to the observer. Statistical examination of the differential data (not given by the author) was combined with certain assumptions to confirm, for example, the greater uncertainty for yellow, as compared to blue, dyes. In conclusion, it may be said that the paper is somewhat marred by a confusion of psycho-physical and perceptual terms, which must make it difficult reading for any but a specialist. Also, that the assumption underlined above is certainly not true for a great proportion of dyes; and that the author's application of his calculations involve other tacit and unstated assumptions. Nevertheless, it seems probable that the general conclusions are more or less valid; and withal the method of application of the spectrophotometer and of colorimetric data to the problems of the dyestuff industry is praiseworthy. It is to be hoped that the author's work will stimulate some one to make a similar study with dyeings instead of solutions, which would make the work free from a further and serious difficulty. By using acid dyes on silk, it is possible to be assured that none of the dye remains in the bath; and it would be unnecessary to assume that conclusions obtained from the volume colors of transparent solutions are valid for the surface colors of dyeings.

COLOR-MUSIC

A study of a nature very different from the foregoing one, since its practical applications lie not in a physico-chemical industry but in an art form, is a paper, "Color-Music", by T. F. Karwoski and H. S. Odbert, of Dartmouth College; Psychol. Monographs 50, No. 2 (1938). It is very difficult for any one who does not combine many of the trained qualities of the color expert, the artist and the psychologist to review adequately a 60 page monograph on a subject so foreign to common experience; and this the Editor does not hope to do. It seems possible, however, for even a layman to find much of interest in the general conclusions and specific findings as well as the practical implications of this study. Chromesthesia, or "colored hearing", is a phenomenon in which individuals see, or seem to see, or associate, different colors with musical sounds or compositions. The authors made a survey of the frequency of color response to music, the nature of the responses, their consistency when repeated, and the universality of their forms. 274 college students were used; they were divided into two nearly equal groups, one of which had studied the general subject, the other not having done so, the study being arranged to guard against suggestion. A record was played which gave short phrases of popular music and single measures and notes taken from those phrases. The students answered a questionnaire which inquired into their introspective responses to the music. The more positive cases (37) later listened to the same and other records, drawing what they saw when possible; finally some drew photisms again after 8 months.

Admitting that there are reasons for taking their figures with some caution, the authors find for the combined groups that 39% "seem to see a color or colors", 53% "associate" a color, 31% "feel a color response", and 60% give at least one positive answer, for at least one of five selections, while under some circumstances 90% responded colorfully. This leads to the most general conclusion of the study, namely, that a good majority of the population in one way or another relates colors to music. An analysis of the different patterns of response showed them to fall into three classes, revealing considerable uniformity. The uniformities are typical forms of colored hearing. Four distinct forms frequently appearing were called "simple band", "multiple band", "sound track" (oscillograph-like) and "full design form". The band structure of the color patterns is linked with analytic tendencies in the color-hearers; shapes and geometrical figures, which tend to reproduce symbolically the melodic shape of the music, with synthetic tendencies. Extroverts tend to respond to music with meaningful imagery modified by colored photism; introverts with abstract patterns in color. The latter distinction parallels a broad distinction in art generally; some artists and schools tend to be largely story-tellers and literal, others abstract, as the Editor pointed out in the early articles on "Color in Painting". The success of "Silly Symphonies" and animated cartoons, wherein color and music are combined with humor, shows that consistently pleasing, striking effects, remote from reality, may be achieved. Retests of 8 subjects after 8 months indicated appreciable consistency. All these results offer much encouragement for color music as an art. Lack of success of early "color-organs" can be attributed to the blending of crude color effects with highly developed musical compositions having back of them a long and complex tradition, which, incidentally, would entail much resistance in those who are musically tutored.

The authors modestly relegate to a mere footnote practical suggestions which result from their study. After observing that practical matters of projection and commercial development may be quite as important as clues taken from the uniformities observed in their study and those of others, they suggest that the visual ground usually correlates with the prevailing harmonies, the figure with the melody. In representative patterns, landscape could be related to the former, living creatures or active objects to the latter; while in more abstract patterns, figure might be used to represent sensory aspects of the music or empathic responses to it. For sensory aspects, bands of color might be used; for empathic responses, shapes of color. Conventions might be established; the horizontal dimension related to the development of the music in time, the vertical to changes in pitch. Depth might eventually be available (Dr. H. E. Ives please note) to denote volume or intensity. Certain color conventions will also be established, such as the use of "bright" colors for higher pitches, and "thick" colors for voluminous music. In this connection, the Editor may remark that eight years ago he got a number of persons to record at rapid intervals their responses, such as "joyous", "depressing", etc., to some musical records and to colors independently thrown on a monks-cloth screen by means of foot-lights, head-lights and theatrical resistances. These were then synchronized to produce the common but enhanced mood in a large audience; and the general response was apparently quite favorable. The modest and cautious suggestions of the present authors are forecasted by their discussion of colored hearing, for the details of which, and for certain other conclusions, their original monograph should be consulted.

The following abstracts were received from the Editor for Industry just a day or two too late for incorporation in the November issue. He has done somewhat better than his promise, which was merely title references with just enough abstract material to make it possible to amplify titles where necessary to make the content of subject matter clearer to the uninitiated reader. We are taking the liberty, however, of giving the abstracts practically in full. The title references without abstract, which follow these, were gathered by the Secretary and by us. Delegates and members, will you help by sending us references which come to your attention?

A REFLECTANCE METHOD for the Study of Discoloration of Artificially Aged Papers. J. C. Tongren; Paper Trade J. 107, #8, 34-42 1938. The discoloration of sized and unsized papers from chemical wood pulps has been studied quantitatively with the General Electric Reflection Meter. Reflectivity measurements on handsheets after successive intervals of oven aging at a definite temperature were found to be most advantageously expressed as the K/S number, according to optical relationships developed by Kubelka and Munk. A linear relation was found between the K/S number and the square root of the hours of aging. The numerical value of the slope of this graph was taken as a measure of rate of discoloration upon aging. With the aid of this method the influence of rosin size in discoloring hand-sheets has been measured. The effect of natural resin, the degree of bleaching and bleach residues in discoloring sheets of the unsized pulp have been similarly studied. The influence of the relative humidity of the aging atmosphere on the rate of discoloration of unsized sheets has also been investigated.

The Measurement of Whiteness. G. Hansen; Zellstoff u. Papier 18, #7, 393-9 (1938); Inst. Paper Chem. Bull. 8, #12, 487-8 (1938). Descriptions of the G. E. and the P. F. I. reflection meters and the Zeiss Leukometer are given. The works of MacAdam and of Judd on "whiteness" are reviewed in some detail. The author obtains correlations of the brightness orderings of samples by 8 observers, inexperienced in the judgment of "whiteness," with red, green, blue and daylight reflectances and "Weisse P.F.I." The maximum correlation coefficient (0.88) was obtained for the relation green reflectance vs. brightness ordering. In view of the influence, on the observer's judgment of whiteness, of his profession and experience, it is stated that a satisfactory numerical measure of whiteness is a matter of general agreement and its standardization.

A Particular Application of the Luther Condition to Color Measurement. M. Richter; Z. wiss. Phot. 37, #1-2, 36-41 (1938); Kodak Abstr. Bull. 24, #7, 335 (1938). In Luther's method of color measurement, a photometric comparison of the sample with a white surface is made through three suitably selected filters, these being designed to analyze the luminosity curve into the three color-stimulus mixture curves, so that the three brightness readings taken through these filters, placed in the eyepiece, are automatically the tristimulus values of the color. The difficulties with this method are: (1) The required filters are not easily secured; (2) the colors of the sample and white comparison field are rarely the same, even as seen through the chromatic filters, which introduces all the uncertainties of heterochromatic photometry. M. Schmidt ("Ein verbessertes Farbenmessverfahren," Diss., Dresden, 1935) suggested the use of more than three filters, each transmitting a sufficiently narrow spectral region so that all significant color differences are eliminated from the photometric observations. The readings are then combined to give the tristimulus values. The Luther condition for the selection of filters was extended to this case by Schmidt and further extended by Richter to allow for the choice of basic stimuli other than those recommended in 1931 by the I.C.I. The normal equations which are commonly encountered in statistical discussions are applied to the selection of filters for use in this method.

Light Reflection from Painted Surfaces. J. A. Meacham; Paint Chem. Rev. 100, #19, 24-5 (1938). The author discusses improved methods for the determination of the hiding power of paint by means of the Pfund Cryptometer, the relationship of opacity to resistance to the passage of light (by means of Hanstock's "transmeter"), and light reflection tests on paints.

Color Measurement and Specification. J. Razek; Paint Varn. Prod. Man. 18, 332, 334-6 (1938). A general discussion of spectrophotometry and colorimetry with special reference to spectrophotometric curves obtained with the Razek-Mulder color analyzer. get

Color Matching in the Paper Industry. E. L. Deeter; Electronics 11, 18-19 (1938). There is described and illustrated an instrument for the colorimetric measurement of printing inks and paper to designate with high precision color matches of dyed papers, using reflection or transmission methods.

The Objective Measurement of Color. J. W. Perry, J. Sci. Instruments 15, #8, 270-7 (1938); I. P. C. B. 9, #1, 14 (1938). The general principles of direct photoelectric color measurement, and their application to Blancometers, are considered. Two categories of such color determinations are distinguished. A description is given of Blancometers and the method employed in their application to the measurement of color difference. get

Artificial White Light. Mr. Luckiesh et al; Gen. Elec. Rev. 41, 89-93 (1938); Kodak Abstr. Rev. 24, #8, 384 (1938). Spectrophotometric curves, energy data, and location in a color-stimulus mixture diagram of certain "daylight" units and combinations of mercury lamps with incandescent lamps are given. Some combinations approach a spectral match with daylight, whereas others merely approximate it.

Methemoglobinemia and Its Measurement. D. O. Hamblin and A. F. Mangelscorff; J. Ind. Hygiene and Toxicol. 20, #8 (1938). Application of spectrophotometric information obtained with the General Electric recording spectrophotometer in industrial toxicology is discussed.

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