Inter-Society Color Council *Newsletter*

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1973 ISCC ANNUAL MEETING TO FEATURE EDUCATION ON COLOR

The 1973 Annual Meeting to be held in New York, April 30 to May 1 will deal with the present state of education for color and related appearance attributes in both art and science. Mr. Hunter, President of the ISCC, announces that committees are now being formed and speakers assembled to provide an overview of present-day color education.

Broadly the program will deal with four subjects:

1. Color education in fine arts

2. Education in applied color arts (design, architecture, etc.)

3. Color education in science

4. Education in applied color science (food, textile, graphic arts, and other technologies)

In order to cover the present state of this broad

Speakers and panelists of The Williamsburg Conference on Fluorescence and The Colorimetry of Fluorescent Materials, February 6-9, 1972. Standing from left to right: F. W. Billmeyer, Jr., RPI; A. R. Robertson (Canada), NRC; E. Allen, Lehigh University; Ake Stenius (Sweden); J. Donnelly, Jr., Westvaco; H. Aach, Queens College; H. Terstiege (Germany); C. J. Bartleson, Macbeth; J. Schanda (Hungary). Sitting from left to right: F. Grum, Eastman Kadak Company; E. Ganz (Switzerland), Ciba-Geigy; H. Hemmendinger, HCL; A. Berger (Germany), Bayer; F. Simon, Clemson University; W. D. Wright (England), Imperial College. Missing in the picture are two speakers: G. Wyszecki and R. A. Ward.

subject, papers will feature what is now being taught, rather than what theorists propose to teach.

OMISSION

In the January-February (216) issue of the Newsletter, an impression by John Maul of the artistic achievements of Joseph Townsend Funk was presented on pages 7 and 8. I neglected to mention that Mr. Funk has been a member of the Council for some years. Sorry, Ed.

INTER-SOCIETY COLOR COUNCIL BOARD OF DIRECTORS MEETING, JUNE 1, 1972

Applicants for Individual Membership

Applicant	Member-Bodies and Interests
Dr. Charleston C. Bard Photographic Technology Div. Eastman Kodak Co., Bldg. 69 Rochester, N.Y. 14650	Chemistry of Color
Dr. Robert J. Capwell P.O. Box 420 N L Industries, Inc. Hightstown, N.J. 08520	AChS
Miss Joyce S. Davenport 300 N. State Street Marina City #5505 Chicago, Ill. 60610	Paint Formulation
Mr. S. Leonard Davidson N L Industries Inc. P.O. Box 520 Hightstown, N.J. 08520	AChS, ASTM, FSPT, OSA, SPE -- Color measurement and education
Mr. Leonard R. Dearth The Institute of Paper Chemistry, PO Box 1048 Appleton, Wisc. 54911	TAPPI -- Measurement of color of paper products
Mrs. Gisela Hees Coburn Coating Corp. 256 E. Third St. Mt. Vernon, N.Y. 10550	SPE -- Dyeing of polyester and related material
Mr. Richard S. Hunter Hunter Associates Lab. 9529 Lee Highway Fairfax, Va. 22030	ASTM, FSPT, IFT, OSA, TAPPI -- Color and appearance science, instrument designs and uses
Mr. Harold H. Kanter 1112 Hinman Ave. Evanston, Ill. 60202	Perceptual phenomena of human vision such as Trichromacy, Color Contrast, Complementary Afterimages, Adaptation. Theories of color vision including Goethe and Land experiments. Analog electronic models of opponent process theories
Mr. Harry Loeb 42 Mc Geory Ave. Bronxville, N.Y. 10708	AATCC, ASTM, OSA -- Analytical techniques and instrumentation
Mrs. Patricia O. Milley Allied Chemical Corp. Box 1069 Buffalo, N.Y. 14240	Instrumental quality control
Mr. Arturo Molina Luis Pereira 1585 Casilla 3240 Santiago, Chile	Color theory, color science, color organization, perception, color psychology
Mr. David A. Neubrech P.O. Box 5728 (5521 Landy Lane) Bethesda, Md. 20014	ASTM -- Measurement of color (psychophysical)
Mr. Donald E. Wersinger 2149 Gateway Terr. Easton, Pa. 18042	Setting up a computer color matching program
Miss Rose Pace Rust-Oleum Corp. 2301 Oakton St. Evanston, Ill. 60204	FSPT -- Computerized color matching and formulation of industrial coatings
Mr. Wayne L. St. John 7325 Thumbelina Lane Cincinnati, Ohio 45242	AATCC, AChS, ASTM -- Measurement of whiteness and understanding of its parameters as seen by consumers in the laundry situation
Mr. John T. Smith, Jr. 2321 Pa. Ave., N.W. Washington, D.C. 20037	ASP, OSA, SMPTE, SPSE
Miss Lynn E. Wolfram Standard Oil Co. (Ohio) 4440 Warrensville Center Cleveland, Ohio 44128	ACeS -- Problem solving -- color matching -- plastics pigmenting
Dr. Kermit B. Whetsel 1501 Dobyns Drive Kingsport, Tenn. 37664	AChS, ASTM -- Quality control of textile dyes
Mr. Humphrey C. Yorke Dept. of Ophthalmic Optics University of Aston Gosta Green, Birmingham B.4. 7.E.T England	Physiology and defective colour vision.

For Information Only -- New Delegates

Mr. Robert B. Bernstorf (ACeS)
Commercial Decal, Inc.
P.O. Box 747
East Liverpool, Ohio 43920

Mr. Gary S. Davis (ACeS) ASTM -- Color control and specifications
3810 Ingersoll Ave.
Des Moines, Iowa 50312

Mr. John E. Flynn (AIA) -- IES -- The behavioral and psychological influence of light and color in architectural space
School of Architecture
Kent State University
Kent, Ohio 44242

Mr. Earle M. Knibiehly (ASP) SPSE -- Image quality analysis, processing, and printing of color imagery
4437 Sleaford Rd.
Annandale, Va. 22003

Mr. Anthony E. Salerno (ASP) AChS, SMPTE, SPSE -- Mapping, color aerial photography, earth resources, pollution, lithography
1340 Old Chain Bridge Rd.
McLean, Va. 22101

Dr. Philip C. Thomas (ACP) Relation with crowns, bridges and other prosthetic appliances, and in seeking a common color language with my colleagues and the ISCC
10701 Lakewood
El Paso, Texas 79935

Dr. Frank J. Wobber (ASP) Application of color photography whether aerial or orbital to practical problems of resources and environment. Interpretation of color imagery. Studies related to color/false color imagery
14 Goshen Ct.
Gaithersburg, Md. 20760

ENCLOSURES

Report of ISCC Problem Committee 25 (Dyes) "A General Procedure for the Determination of Relative Dye Strength by Spectrophotometric Transmittance Measurement"

(2) Brochure "Color Metrics" and order form. AIC/ Holland.

CANADIAN SOCIETY FOR COLOR

Inquiries about the new Canadian Society for Color may be made to:

Dr. Gunter Wyszecki
Division of Applied Physics
National Research Council
Ottawa, Ontario, Canada

NEW MEMBER GROUP

I am inserting here a very interesting letter that was written to Walter Granville, Chairman of the Membership Committee. The letter describes the color background and interests of the American College of Prosthodontists, newest member-group of the Council.

Ed.

LETTER TO: WALTER C. GRANVILLE, CHAIRMAN, ISCC MEMBERSHIP COMMITTEE

Dear Walter:

The American College of Prosthodontists is a young group, but we're extremely proud of it and today it has over 600 members, Until it was founded there was no organization to which the individual becoming certified by the American Board of Prosthodontists could automatically become eligible to join. All members, Fellows (diplomates) and Affiliates, have had at least two years of specialty training in prosthodontics.

There are three main groups of prosthodontists in the College. The Fixed Prosthodontists (my group) deal in bridges and crowns which are permanently cemented to place in the mouth. The removable Prosthodontists are involved in restoring partially edentulous or fully edentulous mouths with removable appliances. The maxillo-facial prosthodontists are more involved in cleft palate cases or cases requiring replacement of facial tissues as well as the missing teeth. All three are closely inter-related and usually the specialist in one of the three groups is competent in the other two as well.

I was fortunate to be included as one of the ten founding members of the College and stated at the first meeting that I would do anything possible to have the group join the Inter-Society Color Council. We were doubly fortunate in being chosen as Chairman of the Education and Advancement Committee and were able to get favorable action at our meeting in Cherry Hill, N.J. last October. Fred Billmeyer and Henry Hemmendinger have both been aware of our past efforts to get the American Dental Association to join.

I have made no pretense at being anything but absolutely elated at the culmination of an effort that covered over five years and we are really looking forward to the meeting in New York.

We will try to give you a brief run down on our interests in color and the color matching problems of dentistry in general that you requested. Our interest began six years ago when we confidently attempted to exactly duplicate the colors of six extracted natural teeth in porcelain. Four months later we finally realized it was a color matching problem and I knew nothing about color. It undoubtedly sounds strange to you, but it is unfortunately a fact that dentists do not get an education that includes meaningful information concerning color. We confirmed this in a world wide survey of Color Education in Dentistry in 1967. A color course at Rensselaer with Billmeyer and Saltzman in 1968 was our first formal education. We received a research grant from the Army that over the next three years was a tremendous help. Henry Hemmendinger has worked with us continuously during this period and thanks to him we were able to view for the first time the spectrophotometric curve of natural tooth enamel and our restorative materials. With his help we have documented the complete inadequacy of all available tooth shade guides and hope the work will eventually lead to a well organized one based on the Munsell System.

The problems of matching natural teeth is a difficult one, but the problems of the maxillo-facial prosthodontists in trying to match natural skin is an even more formidable one. Here, as in the matching of natural teeth, little meaningful scientifically organized research has been done. Henry has done some preliminary work with some of my friends at Walter Reed and pointed out that the spectral absorption of the pigments used in the artificial "skins" is sufficiently different from that of natural skin to lead to real problems in matching for all illuminants. In addition there is a difference in the opacity of the natural and artificial skins that spells trouble.

Our problems are so gross and have received so little scientific effort that we probably don't as yet have sufficient information to ask intelligent questions. Membership in the Council is certainly a first step that has been long overdue, and we are most grateful for being accepted.

We hope the above has not been unduly long but we do get a little overenthusiastic when anyone brings up the subject of color and hope you will understand.

Robert C. Spraull, COL, DC
Chairman, Education & Advancement Cte
American College of Prosthodontists

HUMAN COLOR RESPONSE

The Board of Directors of the Council has recently considered the formation of a new sub-committee on the problem of "Human Response to Color." Any member interested in the subject area is cordially invited to participate in a planning meeting on November 21 at the Cosmos Club, 2121 Massachusetts Avenue, N.W., Washington, D.C. The meeting will begin promptly at 10:00 A.M., Dutch treat lunch is scheduled for 12:30 P.M., and the meeting will continue at 2:00 in the afternoon. Adjournment is set for approximately 4:00 P.M. If you wish to participate write to Alexander F. Styne, AID, IDSA, 15206 Northeast 8th Avenue, Miami, Florida 33162.

SPSE TUTORIAL SEMINAR, "COLOR: THEORY AND IMAGING SYSTEMS"

The Society of Photographic Scientists and Engineers, in cooperation with Lowry Technical Training Center, Lowry AFB, Denver, will conduct a two-and-one-half-day Tutorial Seminar on November 2-4 entitled "COLOR: THEORY AND IMAGING SYSTEMS." Governmental, academic, and industrial participation includes the National Research Council of Canada, U.S. Army Topographic Command, Houston Manned Space Craft Center, Rochester Institute of Technology, and research laboratories of major U.S. organizations.

The first day will be devoted to "Theory," i.e., perception, colorimetry, densitometry, sensitometry, image structure, masking for optimum reproduction, and the chemistry of color development. "Silver Halide Color Photographic Materials and Processes," including discussion of negative and positive systems, reversal systems, quality control, and diffusion transfer systems will engage speakers in the morning of the second day; "Aerial Photography" will be covered in the afternoon as it relates to color films, silver dye bleach systems, TOPOCOM's readiness program, APOLLO and SKYLAB programs. The final session, "Color Microfilm," encompasses color hard copy, including a review of techniques and materials and an overview of "Rapid Access," xerography, and "Color-in-Color."

A preliminary program is available from SPSE, 1330 Massachusetts Avenue, N.W., Washington, D.C. 20005.

EDGERTON, FIRST SPSE VISITING LECTURER

Harold E. Edgerton has agreed to serve as the Society of Photographic Scientists and Engineers' first Visiting Lecturer in a new program which will enable Society chapters to host a meeting with an exceptional guest speaker. The occasion of hearing Dr. Edgerton in various parts of the country this year is expected to be well received by a varied group of scientists and engineers.

The international and interdisciplinary reputation of Professor Edgerton is based on undertakings and accomplishments too numerous and varied to describe briefly. An admittedly superficial enumeration would begin with the calibre of his scientific inventions and developmental activities in ultra high-speed and multiple-action photography and cinematography and continue with his literary contributions in articles, technical journals and books. It would take note of his design of specialized instruments in many fields including underwater photography and research, high-resolution sonar equipment, photography of shock waves set off by rockets and aircraft in flight, night aerial reconnaissance, and nuclear-test measurement, as well as the rare distinction of his being Institute Professor Emeritus at MIT, Honorary Chairman of the Board of EG&G, the international corporation he co-founded, and a recipient of many international honors and awards.

For further information, contact: Mr. Russell P. Cook, Polaroid Corporation, 730 Main St., Cambridge, Mass. 02139. Telephone: 617--864-6000, extension 2614.

BRITISH COLOUR GROUP

Report on the 87th Meeting Held in May 1972

The first part of the meeting was devoted to a lecture "Colour Vision in Daphnia" by Dr. S. Young (Imperial College). Dr. Young's first act was to produce a greatly enlarged demonstration model of one of the two compound eyes of Daphnia, a species which is known more familiarly to countless generations of small boys as the water flea. Each compound eye has only 22 ommatidia, each consisting of a primitive lens -- receptor unit; compound eyes usually have hundreds or even thousands of ommatidia. These 22 are arranged to cover most of the maximum 4 π steradians of solid angle available, and their individual receptive fields just about overlap. A film was shown which demonstrated the extreme mobility of the compound eyes and their rapid scanning motions under most conditions.

Daphnia has characteristic patterns of behaviour which prove the existence of colour discrimination; it was the first crustacean shown to have colour vision. Under red light Daphnia dances up and down in the same position, whereas under blue light Daphnia executes a combined up-and-down and sideways saw-tooth motion, which results in a net horizontal movement. Daphnia also reacts differently to the removal of either blue or yellow filters from a white light source: Daphnia usually moves away from light with a blue component, but not from a light without a blue component. Further, increment threshold experiments with $\Delta I/I$ determined as functions of illuminance and dominant wavelength also reveal colour discrimination, and one can conclude that there are at least two, possibly three, photopigments involved. Other experiments quoted involved measurement of velocity of translation and frequency of up-down oscillation, again showing colour dependence.

Daphnia also possesses a simple primitive eye, and some controversy has raged over the interpretation of several experiments involving illumination or occlusion or extirpation of this extra eye. One school of thought suggests that the extra clues provided in addition to those given by the compound eyes result from a dermoptic (skin-light) reaction. Daphnia cannot "see" infra-red light (no eye tracking movements are seen, and there are no responses from microelectrode insertions), and some of Dr. Young's experiments depended on this to make them practicable. Using band-pass filters, action spectra for eye movement frequency were measured, and in addition to colour and illuminance, direction was also found to be an important parameter. An experiment involving a fibre-optic-coupled pseudo-autokinetic display derived from CRO established the relationship between eye position in relation to the stimulus position, while a very difficult microelectrode study established a blue-sensitive reaction to light incident on the top of the head.

In the discussion, Mr. Jaeckel asked how the receptors were distributed for red and blue reception. Dr. Young thought that each ommatidium was probably responsive to both red and blue light. As there is a directional difference, the precise way the light travels down the ommatidium is probably important, and this also links up with a known polarisation dependence. Dr. Clarke asked what the use of its colour vision was to Daphnia, in relation to its life cycle. Dr. Young thought that it might only be useful in selection of females for mating under conditions of a pond drying up (under normal conditions parthenogenesis was the preferred method of reproduction): the colour vision might be regarded as a residual trait from its deep-sea crustacean origins. Dr. Clarke suggested that the blue avoidance reaction might help Daphnia travel to the sides of a pond, away from the relatively bluish open sky, and the "red dance" would then retain them in the vicinity of the banks due to the interreflected component of illuminance being loaded towards the longwave end of the spectrum due to the mud bottom and banks being typically yellowish or brownish. Dr. Young thought this quite plausible as Daphnia are always found clustered near the sides or shallows and their algae food is probably more plentiful there. Prof. Wright enquired about the size of the eye-elements in relation to possible waveguide effects, and Dr. Young gave the diameter of the ommatidia as about 30μm, implying that the lenses would indeed act as focussing elements. Dr. Kalmus suggested displaying a large spectrum to test avoidance, attraction or orientation effects. Dr. Padgham wondered why the compound eyes moved so vigorously and extensively, and Drs. Young and

Clarke suggested (a) effective coverage of the visual field, (b) counteraction of local adaptation and (c) improvement of acuity and perception by signal averaging, assuming that there is proprioceptive tagging of the information in the brain. Prof. Wright wondered whether the brain was adequate for this, and Dr. Young stated that Daphnia had an effective brain suitably organised to permit this as judged by histological and anatomical evidence.

F.J.J.C.

In the second part of the meeting, Dr. J. B. Harborne described the nature of the pigments which are found in flowers. Chemically all flower pigments contain a conjugated system of alternating double and single carbon-carbon bonds, usually with one or more chromophoric groupings. The most important are the anthocyanins (red to blue), carotenoids (yellow) and flavones (cream) but nitrogenous and quinonoid pigments are also known.

Usually a type of flower contains one type of pigment and Dr. Harborne showed a number of excellent coloured slides of flowers and plants illustrating the wide variety of coloured pigments which exist in nature. He also showed a few examples of flowers, such as the wall-flower which contain two types of pigment.

The relationship between flower colour, structure and pollination by insects was discussed with the aid of further beautiful slides.

Finally Dr. Harborne discussed the factors which modify flower colour in vivo and the reasons why certain flower colours are not available to the horticulturalist.

M.B.H.

ASTM SYMPOSIUM ON SENSORY EVALUATION OF APPEARANCE OF MATERIALS

A Symposium on Sensory Evaluation of Appearance of Materials will be held October 24-25 (1972) beginning at 9:30 a.m. at the Sheraton Hotel, Philadelphia, Pa. The Symposium is sponsored by the American Society for Testing and Materials' (ASTM) Committee E-12 on Appearance of Materials and E-18 on Sensory Evaluation of Materials and Products, with the cooperation of the Inter-Society Color Council.

The Symposium will review the state-of-the-art in the sensory evaluation of appearance of materials along with recent developments and proposals.

Symposium topics will include: (1) Mechanism of Vision, (2) Psychology of Appearance of Materials, (3) Estimation of Subjective Impressions, (4) Correlation of Objective Facts with Subjective Impressions, and (5) Anomalies, Pitfalls, Problems, and a Look at the Future. Instrumental assessment and correlation with observer assessment will be discussed.

The Symposium should be of interest and value to anyone concerned with color and other aspects of appearance of foods, beverages, textiles and fabrics for clothing and furnishings, plastics, paint and other finishes, architectural surfaces, paper, and a variety of other products. Psychologists, educators, scientists and persons in the advertising, marketing, and market research fields and others involved in consumer preference studies and consumer satisfaction should also be interested.

All persons interested in this Symposium are invited to attend.

Advance registration is required and the registration is limited to the first 300 applicants.

For registration forms and hotel reservations forms contact J. H. Bystrom and R. M. Sherwood, ASTM, 1916 Race St., Philadelphia, Pa. 19103 (Phone 215--569-4200).

JOINT COLOR CONFERENCE HELD

A Conference on Color, jointly sponsored by the Inter-Society Color Council and the American Ceramic Society, was held in conjunction with the 74th Annual Meeting of the ACeS in Washington, D.C., May 10, 1972.

Speakers representing the ISCC were: Dr. Randall M. Hanes, William N. Hale, Jr., Richard S. Hunter, Ruth M. Johnston and Kenneth L. Kelly. The ACeS was represented by Dr. Clarence A. Seabright and F. Joseph Von Tury. The various presentations were well received by the audience which included representatives of management, research and production, and ceramic engineers, from the glass, enamel, tile, sanitaryware, structural clay and tableware industries. The proceedings will be published in the ACeS Ceramic Bulletin. The program was coordinated by F. J. Von Tury, chairman of the ACeS delegation to the ISCC.

GATF TO CELEBRATE 50TH ANNIVERSARY IN 1974

A year-long, 50th anniversary celebration, highlighted by an international conference on graphic communications technology, will be sponsored by the Graphic Arts Technical Foundation in 1974.

Focal point of the 50th anniversary celebration will be an international conference on the rapidly changing technology of printing and its allied processes. The conference will be held in Pittsburgh on Nov. 12-14, 1974.

Foundation activities and programs cover a wide gamut, ranging from technical consulting and textbook publishing to environmental control programs and scholarships and fellowships. Over the past decade, the Foundation has become, in effect, a common meeting ground for all in graphic communications. It numbers over 1,000 corporate members in countries throughout the world.

GATF TO PRESENT TORONTO COLOR CONFERENCE

The Graphic Arts Technical Foundation, Pittsburgh, Pa., will present a Color Conference in Toronto, Canada, on November 15-16, 1972, Roderick Carruthers, GATF special programs director announced recently.

The Color Conference is scheduled to be held at the Park Plaza Hotel in Toronto.

Mr. Carruthers outlined the Conference as follows: The first conference session will be entitled "The Creation and Handling of Color Copy." In the second session, entitled "Graphic Arts Photography Techniques," the areas of discussion will include cover duplicating and direct screening.

"The Reproduction of Color -- New Concepts and Methods" will be the topic for the third session and the fourth session will cover "Color Printing and Production." In this fourth session the sub topics will include color printing concepts, proving and quality controls.

A summary and forum will conclude the Conference.

For further information concerning the GATF Color Conference, contact: Special Programs Department, Graphic Arts Technical Foundation, 4615 Forbes Ave., Pittsburgh, Pa. 15213.

DESIGN CONFERENCE IN MEXICO CITY

The first design congress in this hemisphere, "Design in the Americas," Congress I will take place in Mexico City on October 30, 31 and November 1.

The Congress is being co-sponsored by the Industrial Designers Society of America, and the following sponsors on behalf of Mexico: the Instituto Nacional para el Desarrollo de la Comunidad Rural y la Vivienda Popular (INDECO), the Instituto Mexicano de Comercio Exterior (IMCE), the Instituto Nacional de Bellas Artes (INBA), and the Diseñadores Mexicanos, A. C. (DIMAC).

The theme of the Congress is "The Effect of Change: the Use and Preservation of the Hemisphere's Resources and the Development of the Community through Design." It is expected that at least eight countries will present papers for discussion.

James F. Fulton of Fulton and Partners, Inc., New York City, and Chairman of the 1972 IDSA Annual Meeting, announced the Society's annual meeting would precede the Congress and be held on Sunday, October 29th at the Camino Real Hotel, Mexico City, headquarters for the Congress.

Advance registration for the Congress can be made through the IDSA National Office, 60 West 55th St., N.Y. N.Y. 10019 and further information may be obtained from this source.

The Industrial Designers Society of America is the nation's only professional industrial design society. Its membership includes leading consultants, industrial designers employed by major corporations, and educators and students. The Society's objectives include the maintenance of high standards of design and professional integrity, the encouragement of sound design education and research, creative experiment and cooperation with Industry and Government.

THE COLOR SCIENCE ASSOCIATION OF JAPAN

Japanese scientists are currently contributing some of the most useful work being done in the field of color science. Among their many publications ACTA CHROMATICA is now published in English as an annual volume, edited by Nihon Shikisai Gakukai (Color Science Association of Japan), Vol. 2, No. 2, October, 1971 -- recently received -- contains eight reports of considerable interest. Authors, titles, and abstracts of these several papers are listed as follows:

p. 49 Hasegawa, Takashi (NHK -- Japan Broadcasting Corporation), Effects of spatio-temporal interaction on Fechner color.

In this paper, the well-known phenomenon of Fechner color is newly taken up in connection with sensory mechanism concerning color perception. First, previous studies on this problem and its related theories are reviewed. Then our experiments using a rotating disk and cathode ray tube display are reported. Results are epitomized into three points:

1. induced colors appear around the stripes starting at the edges,

2. identical colors would be perceived if the intermittent stimuli have the same temporal composition,

3. achromatic perception would be observed unless spatial factors are added besides temporal ones.

These results suggest the need of further experiments in the direction of establishing a model of sensory mechanism with the spatio-temporal interaction in the neural network.

p. 58 Oshima, Masamitsu and Kato, Tokiko (Institute of Medical Electronics, Faculty of Medicine, University of Tokyo), A study on the deviation of color sensation by background colors.

The concept of physiologically based, subjective color deviation caused by a chromatic background is fundamental to the induction-phenomenon in the retina. A continued development of this concept to account for the color perception and its deviation under various conditions has brought the need for a more systematic quantification of the phenomenon, which is desired to be tested more precisely, for example, by the use of color matching technique as used in this study. Here in this study, then, the results are analyzed in terms of hue deviation as a function of difference between the figure- and background-color under several conditions of the size of the test ptaches and illumination. It is found that the figure color tends to deviate toward the complementary hue of the background and it is expressible by a simple formula as,

$$f(\theta) = \underline{a} \sin \theta + \underline{b} \sin 2\theta$$

where θ is the angular interval between the figure and the background color in degrees on a hue circle, and $\underline{a}$ and $\underline{b}$ are the parameters determined by the observing conditions, $\underline{a}$ ranging from -1.23 to -0.59 and $\underline{b}$ from -0.41 to -0.12.

p. 63 Yamasaki, Katsuhiro (Rey Kawai Design Institute, Kyoto), A method to calculate conversion of colors in color arrangement.

The conversion of appearance of colors in color arrangement was supposed to be a mixture of the proper positive sensation of a target color itself and the complementary color which was induced by any interacting color in the arrangement. The resultant color should be changed in hue as well as in chroma, the chroma being decreased due to the negative subtracting effect of the complementary. The mixture was theoretically treated on a Munsell color circle. A simple trigonometric law was used. The change in hue and chroma was found to be a function of angular distance between the target color and the background color on the Munsell circle. Maximal conversion was predicted to occur in the region which was usually known as the second ambiguity region in the Moon-Spencer color harmony theory. The significance of the results for color arrangement in textile and interior designs was discussed.

p. 69 Sugiyama, Yoshio (Electrotechnical Laboratory, Tokyo), Statistical tests for the triad-ratio comparisons on the color difference.

Two methods of the triad-ratio comparison are used for scaling the color difference. The linearity of the scaling results is judged by testing the deviation from subtractivity of Scheffe's paired comparison. The judgment shows that linearity does not hold, and it suggests that a power law may exist between the scaled color differences and their colorimetric value. The triad-ratio judgment of color differences seems to need a careful consideration of the linearity. (This paper was reported at Lucerne in 1965.)

p. 73 Yasuda, Yoshizuma and Emori, Yasufumi (Institute of Color Technology, Chiba University), Combinative color of superimposing two inks.

In order to calculate the chromaticity and the spectral reflectance of the combinative color by superimposing two inks, Kubelka-Munk analysis is applied by regarding the colorant layer of the ink as the light scattering medium.

The scattering coefficients of the color inks are measured. The scattering coefficient of the ink is varying little by little after thickness variation especially at a very thin layer like 1 micron.

The spectral reflectance and the chromaticity coordinate of the combinative color of superimposing two inks are obtained by means of calculating the reflectance of upper layer by regarding the reflectance of under layer as the reflectance of the background color of upper layer. The chromaticity coordinates by the calculation coincide with those by the actual printing.

p. 79 Nayatani, Y., Kurioka, Y., and Sobagaki, H. (Electrotechnical Laboratory, Osaka Branch), Studies on color rendering and illuminant metamerism.

Part 1: Spectral power distribution of illuminants with CIE General Color-rendering Index of 100 and its application to color matching.

The present paper describes a general method to derive spectral power distributions of illuminants whose CIE general color-rendering index is 100 with respect to a given reference illuminant.

Test illuminants are shown, which are metameric with respect to CIE standard illuminant C and the CIE

1931 standard observer. Their spectral power distributions show relatively large deviations from those of the illuminant C in spite of the fact that their general color-rendering index is equal to 100.

These calculated test illuminants were applied to 12 gray object colors which were metameric with respect to the CIE standard illuminant C and the CIE 1931 standard observer.

However, we found that the chromaticity differences between the 12 gray samples were relatively small under the test illuminants and the metamerism of the 12 samples was practically retained with respect to any of the illuminants.

p. 86 Part 2: On the possibility to derive the test illuminant with general color-rendering index of R_a = 100, whose spectral power distribution has a line spectrum similar to ordinary fluorescent lamps.

Based on the spectral power distributions of actual fluorescent lamps (about 6500 K in correlated color temperature), the relative radiant powers of the emission lines were pre-assigned to be 80.0 at 405 nm, 200.0 at 436 nm, 100.0 at 546 nm and 30.0 at 578 nm, respectively.

The existence of the spectral power distributions of the test illuminant with these emission lines was examined, which fulfill the following additional requirements:

1. With respect to any of the reference illuminants, the test illuminants have the same chromaticity coordinates and the general color-rendering index of R_a = 100, provided that the spectral power distributions of the reference illuminants are normalized to 100 or near 100 at 560 nm.

2. In addition to requirement 1., the value of the sum of the squares of the deviations of the spectral power distributions between the reference and the test illuminant is to be a minimum.

These conditions are reduced to solve the linear equations derived by applying the Lagrange method. The spectral power distribution $J_t(\lambda)$ of the test illuminant was obtained with respect to the CIE standard illuminant C as the reference. This test illuminant $J_t(\lambda)$ of course satisfies the above two requirements.

However, the computed results give a spectral power distribution with negative radiant powers in some of the visible spectrum. This suggests the impossibility to realize fluorescent lamps with a general color-rendering index of R_a = 100 and with the pre-assigned emission lines given above.

p. 97 Nayatani, Y. and Takahama, K. (Electrotechnical Laboratory, Osaka Branch), Supplement to Part 2: A general consideration of possibility to derive the illuminant with general color-rendering index of R_a = 100 whose spectral power distribution has line spectra similar to ordinary fluorescent lamps.

The study of Part 2 showed that the possibility was very small of realizing the fluorescent lamps with a general color-rendering index of R_a = 100, whose spectral power distributions have line spectral similar to ordinary fluorescent lamps.

This conclusion was based on results obtained for a special solution of R_a = 100 with the constraint of minimum deviation between both spectral power distributions of the test illuminant and the reference.

However, it was felt that there may be other methods of optimization leading to spectral power distributions with positive powers everywhere in the spectrum. In order to discuss this problem, the characteristics of a general solution of equations (10) and (11) in Part 2 are discussed in the present paper.

Examination of a general solution shows the impossibility to have the expected illuminant for any other method of optimization which permits the use of "constraints" on the solution.

Correspondence regarding ACTA CHROMATICA may be addressed to:

Nihon Shikisai Gakukai (Color Science Association of Japan)
c/o Department of Opthalmology
Tokyo Medical College Hospital
7-1, Nishishinjuku 6 chome, Shinjuku-ku
TOKYO, JAPAN

Dorothy Nickerson

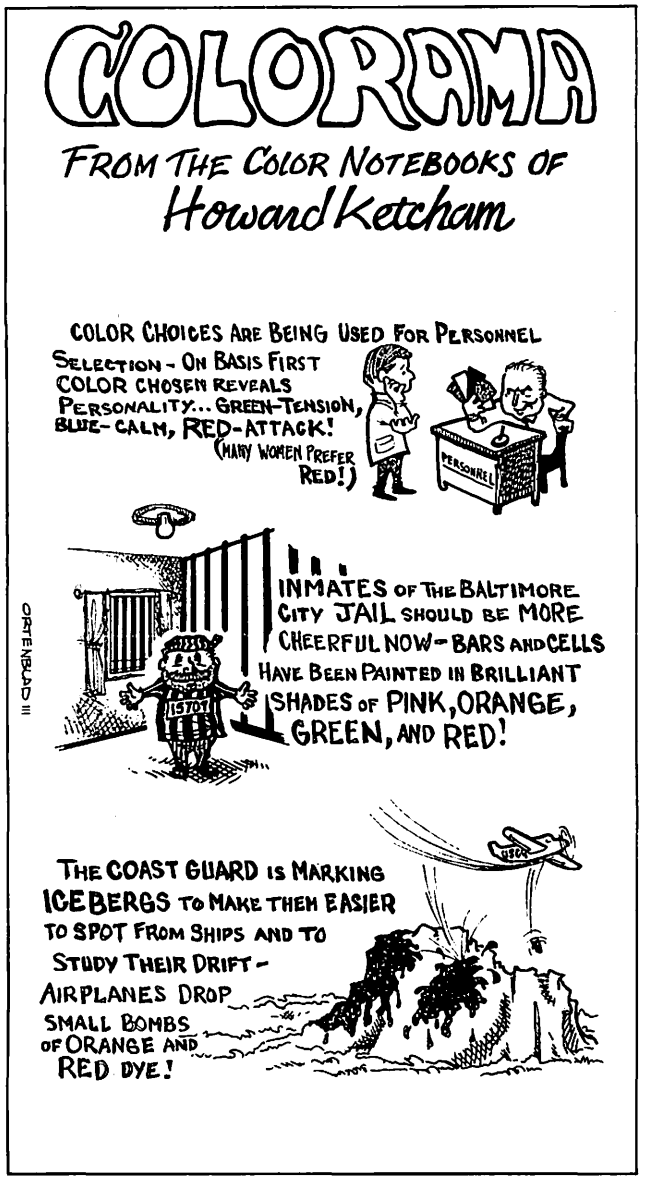
NEW CANADIAN VISUAL LABORATORY

Dr. R. Lakowski, formerly of the Visual Laboratory of the Psychology Department of the University of Edinburgh, is now at the Psychology Department in Vancouver, at the University of British Columbia, Canada.

With his departure from Edinburgh (1969) the Visual Laboratory, founded by Dr. Lakowski in 1962, came to an end. A similar laboratory has been established at U.B.C. dealing with studies on colour and vision, and especially on acquired dyschromatopsias, colour measurement, and standardization of tests.

DESIGN STUDENTS ATTEND SEMINAR

Twelve outstanding students from leading art schools across the country participated in a two-week Graphic Communications Orientation Program at the Graphic Arts Technical Foundation in Pittsburgh, Pa.



Reproduced with permission of American Cyanamid Company, Dyes and Textiles Chemical Department.

The students attended the GATF program, an intensive orientation in the processes of printing production and technology, as recipients of Imagination Scholarships, established in 1968 by Champion Papers, a division of U.S. Plywood-Champion Papers, Inc., New York, N.Y.

The program, supervised by GATF's Education Department, included presentations on art and copy preparation, methods and processes of composition, the process camera, imposition and planning, stripping and platemaking, copy specifications -- manuscript to galley proofs, printing processes, papers and printing inks, color separation photography, binding methods, economic considerations in planning, effective merchandising, the communicative skill of the artist and the future of the artist in the graphic communications industries.

The basic criterion for the awarding of the Imagination Scholarships is the artist's imaginative use of paper in relation to design, graphic technique and the unique, though realistic, utilization of the reproduction processes.

Participating in this year's program were students from Kansas City Art Institute, Art Academy of Cincinnati, Pratt Institute, Rochester Institute of Technology, Rochester, N.Y., Illinois Institute of Technology, Chicago, Ill., School of Visual Arts, New York, N.Y., Princeton University, Cooper Union, Rhode Island School of Design, Providence, R.I., Philadelphia College of Art, Philadelphia, Pa., Carnegie-Mellon University, Pittsburgh, Pa., and Art Center School of Design, Los Angeles, Calif.

CLASSIC RESEARCH COLORIMETER WELCOMED ON RPI CAMPUS

A complex wide-field binocular colorimeter, built nearly a quarter of a century ago for Eastman Kodak Company at a cost -- at that time -- of $25,000, is the exciting focus this spring of students on the Rensselaer Polytechnic Institute campus. The Kodak Research Laboratories in Rochester, N.Y., donated the instrument to RPI's Color Research Laboratories for their ongoing research in color vision.

"No commercial instrument approaches the precision of this colorimeter," Prof. Fred W. Billmeyer, Jr., director of RPI's color lab, said. "Cost today of constructing a duplicate, with its accuracy of adjustment down to 2-1/2 thousandths of an inch, would easily be double," he concluded.

In many ways rivaling the sensitivity of the human eye to small color differences, the colorimeter makes precision measurements of the amounts of colors required to match hues. The classic series of researches by Dr. David L. MacAdam of Kodak, the designer of the colorimeter, and his Kodak associates, has been credited with producing the world's most extensive and accurate data on visual perception of color.

Benefits of these experiments have included better appreciation of the importance of colors and lighting surrounding theater and television screens; reproduction and viewing illuminations; careful, consistent, sequential planning of color and lighting levels in motion-picture and TV scenes to avoid unwanted, disturbing visual adaptation effects on the part of the viewer, and of the need for automatic gain controls on the three camera channels of color TV transmitters to make them equivalent to the natural chromatic adaptation.

The Rensselaer Color Measurement Laboratory expects to use the colorimeter initially in several ongoing research areas including the scaling of color

differences larger than threshold sizes, and the effect of simultaneous contrast on color-difference perception.

LEAD PAINT POISONING

The Lead Paint Poisoning Prevention Act (PL 91-695) gave the Department of Housing and Urban Development responsibility for developing and carrying out a research and demonstration program to evaluate methods by which the lead paint poisoning hazard could most effectively be eliminated. The National Bureau of Standards is providing technical assistance to the Department of Housing and Urban Development in the performance of this mission.

We believe that there are many innovative materials and techniques available that could be used to solve the problem. Although we are familiar with currently available building materials and implementation techniques, we feel that many products and systems presently being developed could be of use.

In the near future, we hope to evaluate the applicability of current technology for the detoxification and rehabilitation of deteriorated housing that contains lead paint; preferably through the use of demonstration projects.

We would appreciate whatever information your association or its members could supply us about potentially innovative materials and techniques that could qualify as candidates for a demonstration program. Information about the in-use performance properties of these systems would also be a great use to us, as would costs of materials and installation.

Kindly send responses to:

Dr. David Waksman
Lead Paint Poisoning Project
Building 220, Room B66
National Bureau of Standards
U.S. Department of Commerce
Washington, D.C. 20234

BOOK REVIEWS

Architecture and Color, Waldron Faulkner xiv + 146 pgs. 8 color plates, Wiley-Interscience, N.Y. 1972

Waldron Faulkner, who has the unique combination of distinctions of being a Fellow of the American Institute of Architects and a past president of the Inter-Society Color Council, as well as recipient of a National Honor Award from the AIA, is perhaps the best qualified man in the country to understand the problems and opportunities which color presents to the architect.

As an active participant in Council affairs for many years, Waldron has done more than anyone else to call the attention of delegates to the problems involved and, as head of a problem sub-committee on the subject has attracted remarkably large groups to his meetings.

While he has been careful not to say so in his book, I have the impression that he feels that the architectural profession as a whole is afraid of color and that one of the major contributions he can make is to explain the subject in such a way that their fears will be allayed. Perhaps this is presumptuous on my part but certainly, whether or not I am right, his book should go far in this direction. I guess I also feel that if architects are not afraid of color, they should be and that before they try to use color at all, at least on exteriors, they should have at least the knowledge that he has set forth. Color is such a curious mixture of tremendous aesthetic importance and difficult technical problems, that only a person aware of the latter can really be successful at the former. There are, literally, no rules for the aesthetics of applied color and it is not too much to say that every rule that has ever been proposed has been broken successfully by some artist. There are just as many cases, however, where attempts at using color have been foiled more or less completely by lack of knowledge of the subject. Thus the too great uniformity of carefully controlled machine made brick can be just as detrimental to the appearance of a brick wall (unless this uniformity was the actual intention) as the unwanted and uncontrolled variations between slabs of marble used for a facade where the only wanted variation was that within each slab. Thus specifications and controls are needed, quite aside from such decisions as whether the bricks are to be orange, red or brown and so on.

The book addresses itself to both aspects of the problem. In the first section he reviews briefly and interestingly the history and importance of color in architecture, noting the happy fact that there has been a tendency toward greatly increased knowledge and use of color in recent years. In the second section he gives an excellent exposition of the whole subject of color order systems with specific information which is often difficult for a newcomer to the subject to find. For many readers this section of the book can be recommended quite aside from any interest they may or may not have in architecture. Perhaps the Council may also take some pride in the fact that its members and committees have been instrumental in developing the subject to the point where such a presentation is possible.

The author is to be congratulated on the very high standard of color reproduction that he has been able to obtain to illustrate the appearance of a few building

materials. They go far toward demonstrating the need for quality of this high level if illustrations are to be successful guides for the actual choice of materials by the architect. Merchants of such materials should take careful note!

I, personally, very much enjoyed the quotes interspersed at the foot of many of the pages, as much for the reflection they give of the delightfully scholarly approach of the author to the subject, as for their own sake. I congratulate him particularly for his success in finding an apposite quotation from Burton's "Anatomy of Melancholy" which I have searched in vain for a direct reference to color.

We welcome Waldron's book into the increasing list of books which have been helped into existence by the fruitful atmosphere of the Council and wish it a merited success.

Ralph M. Evans

Architecture and Color, Waldron Faulkner, FAIA. New York: Wiley-Interscience, 1972 146 pp. $12.75 members, $14.95 non-members

This is a concise, interesting and informative book about a part of architecture that is all too often neglected by the profession. The author, developing his thoughts on the matter from simple to complex, has done a thorough job. He is aware of the problems confronting the practicing architect in the selection and coordination of colors. He stresses the importance of fully developing the color possibilities of a building. As he states frankly in his discussion of the manner in which final colors are often selected, "All this must usually be done under great pressure to meet fixed deadlines."

It is obvious that a great deal of time was spent in the preparation of the book. The completeness of the coverage of all aspects of color reflects Faulkner's years of work with The American Institute of Architects and the Inter-Society Color Council. The insertion of many appropriate quotations at the bottom of various pages, often poetic, adds insight and gives the reader an understanding of the text. They are a welcome innovation.

The first section of Architecture and Color explores the many asthetic aspects of color. A discussion of symbolic color is well justified. The part of "functional color" explains such uses of color as identification, visibility, emotional effect, etc.

In a part of the book entitled "The Selection of Building Materials," the author describes the types of samples available from manufacturers and distributors and points out the advantages of these samples. He makes a plea for industrywide color standards with reasonable tolerances and for better control in manufacture. As a rebuttal to the argument that color standards would limit manufacturers, he claims that in addition to the standard industrywide colors, each manufacturer would be free and able to produce any special colors that he might wish to or which he might be requested to do.

Faulkner describes his work on ISCC Sub-committee Problem 17, Color in the Building Industry, which set up standards for the color classification of limestone. He also cites the success of work done in England by the Royal Institute of British Architects and the Paint Industry Committee in establishing standards for a specific number of house paints.

In the discussion of colored building materials, Faulkner gives a brief but accurate description of most of the materials in use today. One wishes for many more color plates, however. There are eight of them of various materials that are intended to indicate to manufacturers the high quality reproduction necessary to make photographic samples useful to the architect.

The second part of the volume is devoted to an illustrated discussion of the technical aspects of color, color definition and color measurement. Colorimetry and spectrophotometry are closely examined. In addition, several systems of scientific color arrangement in use today are outlined and their advantages and disadvantages noted.

In the section on "A Universal Color Language," the author explains the method used for six levels of color description and categorization. The method was originally published in a paper by Kenneth L. Kelly called "A Universal Color Language" (Color Engineering, March/April 1965). This system was endorsed by the AIA Board of Directors in 1970. At the first level, a color may be described by using one of 13 designations, such as "brown carpet." At the second level, there are 29 designations, i.e., "yellowish brown carpet," while at the fifth level, there are 100,000 divisions with the color described in terms of the Munsell System.

The final chapter of the book is devoted to a discussion of color harmony. Faulkner describes this as a matter of likes and dislikes which result from the juxtaposition of colors selected according to an orderly plan that can be recognized and emotionally appreciated. This relation between harmony and the selection of color "according to an orderly plan" is based upon the Munsell Color Solid and, according to the author, should appeal to architects. It means that the selections are not left to pure chance. For example, in the Munsell Color Solid, colors having one attribute in common lie in the same plane or surface. Colors with the hue lie in the same vertical plane. Colors of constant lightness lie in the same horizontal plane and colors with constant saturation

lie in the same surface of a cylinder whose axis is centered on the neutral pole of the color solid.

The book contains valuable and helpful information for architects, builders and manufacturers of building materials. It is required reading for those who are interested in color.

Albert O. Halse, AIA
From AIA Journal/August 1972

The Lüscher Colour Test

The reviewer became acquainted with the Lüscher Colour Test about 20 years ago, when he bought Psychologie der Farben, Textband zum Lüscher-Test, by Max Lüscher, Test-Verlag, Basel. An English version of this test was produced in 1969, under the title The Lüscher Colour Test, translated and edited by Ian A. Scott, London: Jonathan Cape, Ltd., 185 pp., with eight coloured cards for conducting the test.

The author advises his reader to begin by carrying out the test on himself. The test material consists of eight cards, coloured and numbered; the essential steps are to choose the cards one by one by colour; the most liked first and the least liked last, and to record their numbers in order of choice; then the process is repeated as a retest. The book contains detailed and explicit instructions for giving and interpreting the test, and the reader will find it intriguing to work out its application to himself and to his friends.

The colours are: 1, dark blue; 2, blue-green; 3, orange-red; 4, bright-yellow; 5, violet; 6, brown; 7, black; and 0 neutral grey. The first four colours are called basic, or psychological primaries, and the second four are called auxiliary colours. We are told that dark blue represents 'depth of feeling'; blue-green, 'elasticity of will'; orange-red, 'force of will', while bright yellow represents 'spontaneity'. Each is said to have certain qualities or attributes such as being 'concentric', 'passive' or 'ex-centric', 'active', etc., and also 'affective aspects', such as 'tranquility', 'persistence', 'desire' or 'variability'. Some explanations of the scheme are given in cultural-behavioural terms, and some in terms of a rather sketchy physiology; the scheme is called the 'colour-coding', but no detailed experimental evidence for the coding is brought to the attention of the reader for his consideration.

The presence of the auxiliary colours is explained by saying that black is the negation of colour, while grey is strictly neutral or colourless; violet is a mixture of blue and red, while brown is a mixture of orange-red and black. They are said to increase the overall utility of the test.

It is claimed that a healthy and normally balanced individual, who is free from conflicts and repressions, will include the four basic colours in his first four or five choices. The reviewer was reassured to find that in his case they did all occur in the first five places, but not all in the first four.

The text, with its psychological and physiological explanations, and its special approach to the problems of testing personality and/or temperament and possible abnormal traits by a colour preference test, is open to grave criticisms. The general approach is dogmatic and uncritical, while the psychology and physiology are sketchy and inadequate. Although there is a liberal number of references, almost all of them are in German or French. Many may be extremely difficult for an English reader to get, even if he is sufficiently fluent in the languages to read them. It is odd that some of the references in English, which were given in the original German version, are not given again in this English version, though they deal with quite relevant material; and, although there is a large literature of important researches on the relationships of colour preference to other factors, such as personality differences, little or no mention is made of it. It is glibly asserted that the physiological 'structure' (or meaning) of the eight colours is the same the world over, to young and old alike, to men and women, to the educated and the backward, to the 'civilised' and the 'uncivilised'. But detailed scientific researches have been carried out on colour preferences, often showing cross-cultural differences, sex and age differences, and differences associated with variations of personality and temperament, normal and abnormal; so dogmatism of this kind can only do the test harm in the eyes of any informed critic.

Experimental work on colour preferences would probably support some of the claims for the test; other known facts should make the tester guarded and discriminating in its application. As it stands, little confidence can be placed on interpretations based on it; indeed, there is risk of harm from its unskilled use.

There is a surprising passage on pp. 15-16, in which we are told that a research by Steinke, using normal controls and individuals suffering from both partial and total red-green colour blindness, showed that "colour vision need not be considered in the Lüscher Test at all". (L. Steinke, Confin. Psychiat., 3, 97-116, 1960.) Are we to accept it as a fact that the Lüscher Test, which is dependent on colour preferences, does not involve colour vision? In view of this problem it is interesting to see what was actually said by Steinke in the paper referred to; the summary of it in Lüscher's book is far from clear.

Steinke's study

Steinke compared 200 men with partial or complete 'green blindness' with 200 whose colour vision was

normal, and showed that statistically significant differences between them did not lie in the choice of green, "as expected", but in other choices of colours. He concluded that "green vision does not play a role in the Lüscher-Test because colour in respect of psychological effect, plays a role inferior to the roles of lucidity value and degree of satiation" (does lucidity = brightness; and satiation = saturation?). "The same reason allows to surmise that colour vision need not be considered in the Lüscher-Test at all". "A physiological explanation being impossible, the results are interpreted psychologically. This interpretation has led to the clear cut conclusion that people with congenital colour blindness are distinct from the other population along the lines of increased autocentricity" (egocentrism?).

Some of these are extremely difficult conclusions, relating to a matter of some importance, and they deserve comment. Steinke's research, on some 3,000 men, 265 of whom had congenital colour blindness, was most thorough and painstaking. Why, however, did he single out only the deutans or 'green-blind' for study with the Lüscher Test, when he had 49 protans ('red-blind') available as well? His statement that green vision does not play a role in the Lüscher Test is irrelevant, because the blue-green of this test is not a confusion colour for the deutan. Steinke proceeds to generalise about the irrelevance of colours in general for the test; this cannot be justified when he did not deal with protans. If it is true that colour plays a less important role in the test than brightness and saturation, why should the Lüscher Test be based on colour at all? But saturation and brightness as well as hue are both affected in certain ways by colour vision defects. Again, on what grounds can it be concluded that a physiological explanation of differences in the Lüscher Test is impossible? And in what sense can we have a psychological explanation based on colours, which, like green for the 'totally green blind', are not experienced? Steinke's conclusions seem to be riddled with insoluble difficulties.

The colours in the Lüscher Test are not likely to cause much confusion to most red-green defectives. The orange-red and brown, however, might be almost indistinguishable both in hue and brightness to some protanopes, and violet and grey to some deuteranopes, a rather rare class. Although the blue-green would not cause any difficulty to the 'green-blind', no red-green defective would receive the same sensations as a normal person from all the colours, and to a totally colour blind person all eight colours would appear simply as shades from light grey or almost white, to black. No doubt the choices of the colour vision defectives would be meaningful to themselves; and this would also apply to choices of what would be the achromatic shades seen by the totally colour blind. Although the choices of the colour vision defectives in Steinke's research led him to conclude that they were more autocentric than the persons with normal colour vision, further research is desirable.

Statistical shortcomings

If we return to the book itself, some interesting statistical data are provided. Interpretation tables give the percentage frequencies for all the first and second choices, taken in pairs, and for all the seventh and eighth, also taken in pairs. These percentages are calculated from "36,892 tests administered to male students ranging in age from twenty to thirty years". Appendix A gives the frequencies for anxiety indications in a sample of 1,000 'normal' adults of both sexes, but no attempt has been made to distinguish the influence of sex or age. If the test has been carried out on so many subjects, it is unfortunate that more adequate statistical data are not given, comparing age groups, sexes, occupational groups, different levels of intelligence, and so on; and that no comparisons are given with results of other personality tests. If these points were to be dealt with, however, the technique of handling the results of the Lüscher Test might have to be revised and put into a form more suitable for statistical analysis.

It is the reviewer's belief that a test of personality based on colour preferences might be useful, if it were critically and scientifically constructed, standardized and validated, and especially if it were presented with adequate tables of comparative data. The present example does not meet these criteria.

R. W. Pickford, Department of Psychology, University of Glasgow

Reprinted from British Occupational Psychology, 1971, 45, 151-154

Shades of Meaning

In the last issue, I raised some questions about the Lüscher Color Test, "the remarkable test that reveals personality through color" according to the description on the cover of the book. Although, at this moment, that column has not yet appeared in print, I have had ample evidence since writing it that interest in Lüscher's book has been mounting. The subject has come up in conversation with increasing frequency of late, but of even greater significance is the announcement by the Book-of-the-Month Club of a "fascinating new book-dividend," namely -- The Lüscher Color Test." It seems inevitable that this offer will increase enormously the number of 'instant psychologists' who will now know how to diagnose exactly what is wrong with friend, foe, and family alike.

I have in front of me the Book-of-the-Month Club write-up in which we are told that "for more than twenty years, psychiatrists, psychologists, and physicians have been able to evaluate color preferences with remarkable accuracy by means of a com-

paratively simple but deep psychological testing device known as the Lüscher Color Test."

An excerpt from Marcia Seligson's "Book Buzz" column in Book World is reprinted in the brochure in which she compares the Lüscher test to the Rorschach ink blot test in its "deadly accuracy." She goes on to state: "The premise here is that colors have inherent psychological associations: dark blue, for example, signifies quiet and passivity, bright yellow, hope and activity. Experiments are detailed in which individuals contemplating the color red for a period of time will show an increase in blood pressure, respiration rate and heartbeat." She found the Lüscher test to be the deepest and most revealing psychological test that she had ever been exposed to, and although she concedes that the author warns that this is not to be used as a parlor game, she thinks it likely that it may replace charades!

How, one wonders, did she determine the deadly accuracy of the test, or, for that matter, recognize it as the "deepest and most revealing psychological test" of her experience? All right, let us dismiss these remarks as literary hyperbole. But, what about the experiments which she tells us are detailed in the book? I immediately thumbed through the book again, hoping to find what I may have missed first time through. Alas, all I could find (page 12) is the following: "Experiments in which individuals are required to contemplate pure-red for varying lengths of time have shown that this color has a decidedly stimulating effect on the nervous system -- blood pressure increases, respiration rate and heartbeat both speed up. Red is, therefore 'exciting' in its effect on the nervous system, especially on the sympathetic branch of the autonomic nervous system." And later on page 60: "The red of the test -- represents an energy-expanding physiological condition. It speeds up the pulse, raises blood pressure and increases the respiration rate." That is all, no documentation of the experiments, no quantitative data, just the statements. Once again I am left with the nagging questions; where? when? by whom? where documented? In any case, certainly not in Lüscher's book.

Charades anyone?

Angela Little
Reprinted from Color Engineering, February 1971

Glass Limit Standards Deposited at NBS for Railway, Highway and Airway Traffic Signal Colors -- History, Permanence and Colorimetric Properties. Geraldine W. Haupt. NBS-TN-564, 1971

Signal glass limit standards for railway, highway, and aviation colors, selected by user-organizations, are on deposit at the National Bureau of Standards. Many duplicates of these standards have been issued by NBS.

The first standards were selected in 1931 for railway use. Highway standards were adopted in 1940, and selection of aviation standards began in 1942. At the present time the NBS is custodian of 63 standards for these signal colors.

Permanence of the filters is examined, based on colorimetric conversions for CIE standard illuminant A derived from spectrophotometric measurements made on different instruments over periods of years.

Spectral transmittance data and the resulting colorimetric data are given for 9 illuminants ranging in distribution temperature from 1500 to 3250 kelvins and for CIE standard illuminants B and C. Figures show, for several filters of each color, the shifts occurring both in chromaticity (x, y) and in redness and brightness index (u, W*) with changes in illuminant.

The Ideal Lovibond Color System for CIE Standard Illuminants A and C Shown in Three Colorimetric Systems. Geraldine W. Haupt, John C. Schleter, and Kenneth L. Eckerle. NBS-TN-716, 1972

Tables are given which list luminous internal transmittances, luminous transmittances, and chromaticity coordinates of the ideal Lovibond color system for CIE standard illuminants A and C according to (1) the CIE 1931 (x, y)-system, (2) the CIE 1960 uniform-chromaticity-scale (UCS) (u, v)-system, and (3) the CIE 1964 (U*, V*, W*,)-system. Chromaticity diagrams for the (x, y)- and (u, v)-systems are shown together with horizontal and vertical cross-sections of the (U*, V*, W*) color solid for the entire ideal Lovibond color system produced by single-color units and two-color combinations of units for each illuminant. In addition, chromaticity diagrams and cross-sections are shown indicating the single-color units of red, yellow, and blue for each CIE system and illuminant.

Lighting for Plant Growth by Elwood D. Bickford and Stuart Dunn. The Kent State University Press, Kent, Ohio 44242. x + 222 pages, 8-1/2x11, illustrated, references, index, $16.00

A lighting physicist and a plant physiologist pool their knowledge to describe the nature of light and light sources and how light is used for plant growth. The resulting book provides a broad background on the photochemical effects of light on plants, as well as information on modern techniques in plant lighting, light measurement, and controls. Biologists, plant

scientists, lighting engineers, and commercial plant growers -- as well as some amateur horticultural enthusiasts -- will find it a valuable reference work.

Working from theoretical considerations through practical applications, generously aided by references, tables, graphs, and illustrations, Lighting for Plant Growth is the most comprehensive and up-to-date treatment of its subject available. Such topics as growth room lighting, phytotronics, and controlled environment plant growth facilities, treated elsewhere in scattered and fragmentary fashion, are here given complete and modern treatment. The concise explanation of the principles involved in light measurement and controls for plant growth should do much to bring order to an area hitherto confused by divergence of practice. And recent advances in the whole area of light and plant response have been given special attention.

As the Table of Contents indicates, the later sections of the book deal with applications of plant growth lighting in horticulture, both commercial and in the home, as well as with aesthetic considerations of plant lighting. A final chapter discusses such potential uses of lighting for plant growth as industrial photosyntheses (as for sewage treatment plants), biochemical fuel cells, aquaculture, and life-support systems for space travel.

Throughout, the treatment is such that the biologist can readily understand the physical and engineering principles related to light and lighting, and the lighting engineer can fathom the photobiological and the photochemical responses of plants and their light requirements as they relate to the requisites of equipment design.

Elwood D. Bickford is head of the Biological Research Department at the Sylvania Lighting Center and has developed several special instruments and fixtures for plant growth lighting problems. Stuart Dunn is Professor of Botany at the University of New Hampshire and is well known for his pioneering work in the effects of light on plant growth and his work at the University of California with America's first phytotron.

Marketing Guide to the Paint Industry, Third Edition, 1972, 87 pp. $30. C. H. Kline, Fairfield, N.J.

The third edition is a complete revision of the two earlier studies published in 1965 and 1969. As in previous editions, the book attempts to provide a single-volume reference to marketing and economic data on the entire industry from purchases of raw materials to distribution on the retail shelf and industrial application. It also discusses in detail such timely topics as recent government legislation, the rapid adoption of new application and curing techniques, and the industry's deteriorating profits.

New CIE Report, "A Unified Framework of Methods for Evaluating Visual Performance Aspects of Lighting

The report, CIE Publication No. 19, represents the combined activity of experts, consultants and correspondents from 27 countries.

The Committee has developed the structure of a general method which it recommends for use in evaluation of the visual performance of illuminance levels appropriate for use with various visual tasks. Currently available visual performance data are fitted into the structure and numerical examples are presented for lighting installations in current use.

Two procedures are described. The first expresses visual performance potential in terms of the task luminance required under reference lighting conditions to achieve the same potential as will be provided by a real lighting installation. The second procedure expresses visual performance potential in terms of the extent to which a task in a given luminous environment exceeds the threshold visibility of a standard visibility reference task.

The illuminance level appropriate for use with a given visual task will depend upon the intrinsic visibility of the task and the visual performance criterion selected.

The method is described in terms of standard data for average observers in the 20-30 year age group. Sample data are included illustrating the variance among observers of the 20-30 year age group, and systematic effects of average age.

Copies of CIE Publication No. 19 may be obtained at $6.00 each from Mr. B. J. Hartmann, U.S. National Committee CIE Publications Committee, c/o Flasco, 1635 Flower Street, Glendale, California 91201. Payment should accompany the order.

PRODUCTS AND SERVICES

The Lovibond Colour Vision Analyser

In industry, and in the Public Services and Armed Forces, the selection of operatives for specific tasks for which normal colour vision is needed calls for reliable and easily operated equipment which can give an unequivocal analysis of any possible defect. In medicine, the careful charting of any change in colour vision performance can have diagnostic possibilities in many diseases.

A new apparatus, the Lovibond Colour Vision Analyser (patent applied for), works on the principle of a complete hue circle of 26 permanent Lovibond glass

filters which can be presented at any degree of saturation, and the subject is required to identify which, if any, of these match a central achromatic colour filter. The normal subject can quickly identify the only pair, while any other choice reveals the relevant deficiency, which is diagnosed according to the choice, and quantified in terms of the degree of saturation of the colour required before recognition of the mistake.

The test takes very little time, and does not call for a skilled operator. The colour filters are closely specified and can never change, and the apparatus is robust and portable. As there are no figures or letters to read, literacy does not enter into the test.

Full instructions for use and interpretation are supplied.

The Tintometer Limited
Waterloo Road, Salisbury, England
Telephone 0722-27242

Kollmorgen's Tristimulus Radiometer

The Color Systems Division of Kollmorgen Corporation has introduced a significantly improved version of the well-known TRIRAD Automatic Tristimulus Radiometer which is used for automatic 20-second measurement and digital display of CIE chromaticity coordinates (x and y values) and illuminance (Y) in lumens/sq. ft. of light sources in the 400-700 nanometer range.

For complete information, contact: Color Systems Division, Kollmorgen Corporation, 67 Mechanic Street, Attleboro, Massachusetts 02703.

Interlaboratory Color Program

The Manufacturers Council on Color and Appearance (MCCA), a non-profit organization, is sponsoring a collaborative reference program on color and appearance test methods, which is being administered by and under the guidance of the National Bureau of Standards (NBS).

The immediate objectives of the program are twofold: (1) to provide a means whereby a participating laboratory may periodically check the level and uniformity of its testing in comparison with that of other laboratories and (2) to improve the reliability of test results both within and among laboratories.

In the program, each participating laboratory selects one or more color and appearance tests from those offered. Currently, the program includes a color and/or difference test, and a 60° ASTM gloss test. It is anticipated that additional test methods (e.g. 20° and 85° ASTM gloss, haze) will be added as needed provided there is sufficient number of participants to cover costs and obtain satisfactory statistical information.

Performance criteria for instruments are often of major economical importance, particularly where it is essential that different organizations and companies must communicate confidently about colors and other aspects of appearance. For applications and more information interested participants can contact either:

Dr. T. W. Lashof
Collaborative Reference Programs
National Bureau of Standards
Polymer Building, Rm. B362
Washington, D.C. 20234
(301) 921-2983

or:

Mr. Charles G. Leete
Executive Director
Manufacturers Council on Color and Appearance
9416 Gamba Court
Vienna, Virginia 22180
(703) 938-4345

Color Ecology

A new publication, the result of an unusual survey of the effect of colored wastes on the environment has just been released by the American Dye Manufacturers Institute, Inc.

This study, titled "A Literature Survey of Colored Wastes," possibly unique in the dye industry, is the first of a series sponsored by the ADMI. It was conducted at North Carolina State University, a six month project, under the direction of Dr. Henry A. Rutherford, Head of the Department of Textile Chemistry.

Overall supervision of this study and three others, is under the direction of Mr. Harry F. Clapham, Chairman of the Ecology Committee for the ADMI. This first publication of 233 pages, is now available through the ADMI, 5210 Wapakoneta Road, Washington, D.C. 20016. Cost is $10.00 per copy and checks should be made payable to the Institute.

The other three universities which are also conducting environmental studies are: The University of North Carolina, Rutgers University, and Purdue University. Their reports will also be published upon completion.

Carol Sheets

A new group of specialized business services is being offered to the consumer product, and home fashions and furnishings industries.

The unique yearly publication DESIGN FORECAST is planned as an aid to manufacturers, designers, advertisers, retailers, and other marketers. Based upon trend research findings, DESIGN FORECAST provides guidance on colors, materials, motifs and concepts most likely to succeed within the next year.

For those desiring more specific professional services, there is provision for product design, product packaging, and complete color services, such as styling, research, merchandising techniques, palette establishment, and color sales analyses. The objective is to use color and design effectively in order to increase sales and profits.

Carol Sheets Research, 2615 Mitchell Drive, Woodridge, Ill. 60515, (312) 852-6969

Optronic Laboratories New Product

The Model 730 Radiometer/Photometer is specifically designed to make accurate radiometric and photometric measurements in the lab, on the production line or in the field. The unit is particularly useful in accurately measuring the radiant flux output of monochromator systems over the wavelength region of 250 to 1100 nm. The NEP at 700 nm is 10^{-12} watts. When used in the photometric mode, the digital display reads directly in footcandles. The noise equivalent illuminance is 10^{-5} fc. With the optional input optics, the Model 730 also measures radiance and photometric luminance.

Optronic Laboratories, Inc. 7676 Fenton Street, Silver Spring, Maryland 20910 (301) 587-2255

Optronic Laboratories New Product

In an effort to accommodate the requirements for lower wattage radiometric standards, Optronic Laboratories has recently set up 200-watt and 45-watt tungsten-halogen lamps as standards of both total and spectral irradiance.

In many applications, the 1000-watt and one solar constant standards produce too much energy to calibrate very sensitive radiometers and spectroradiometers. Also, the use of dc power to operate the higher wattage standards as recommended by NBS, requires fairly elaborate power supplies and current monitoring equipment. The new standards, accordingly, produce from 5 to 20 times less irradiance than the 1000-watt standards and are less expensive to operate.

Diano Assumes Service Responsibility for Color Spectrophotometer

The General Electric Instrumentation Service Shop has decided to discontinue service for the Color Spectrophotometer and has turned complete service responsibility over to Diano Corporation. Diano has been manufacturing the Color Spectrophotometer under license from G.E. since May 1970. Diano has a staff of field engineers ready to handle spectrophotometer service problems.

Diano's new headquarters are at 75 Forbes Boulevard, Mansfield, Massachusetts 02048. Phone (617) 339-3701.

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NOTE:

The Council promotes color education by its association with the Cooper-Hewitt Museum. It recommends that intended gifts of historical significance, past or present, related to the artistic or scientific usage of color be brought to the attention of Christian Rohlfing, Cooper-Hewitt Museum, 9 East 90th Street, New York, New York 10028.