D A L T O N I A N A

NEWSLETTERS

OF THE INTERNATIONAL RESEARCH GROUP ON COLOUR VISION DEFICIENCIES

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Tweemaandelijks Tijdschrift Nr. 38 - 1st february 1980.

RESULTS OF THE ELECTION OF THE NEW IRGCVD DIRECTORIAL COMMITTEE

I received 74 filled in ballot forms, of which 70 indicated 11 names as prescribed, one 12 names, one 10 names, one 5 names and one only 1 name. I did not discard these irregular answers, all the more they barely influenced the final results.

The 11 candidates who received the most votes and who accordingly become surely members of the new directorial committee are : 1) G. Verriest (Belgium) (70 votes), 2) R. Lakowski (Canada) (65), 3) M. Marré (GDR) (62), 4) W.D. Wright (UK) (57), 5) Y. Ohta (Japan) (56), 6) J. Birch-Cox (UK) (51), 7 and 8) V. Pokorny-Smith (USA) and L. Went (The Netherlands) (each 48), 9) H. Sperling (USA) (46), 10) A. Hedin (Sweden) (45), 11) P. Grützner (FRG) (43).

The next are P. Lanthony (France) and M. Maione (Italy), each with 42 votes.

I now contact the 11 chosen members in order to become that the latin countries should be also represented, to elect the officers, to discuss the 1981 international symposium, etc.

Guy Verriest

LITERATURE SURVEY

Luminous efficiency functions determined by successive brightness matching, by M. IKEDA and H. SHIMOZONO (Dept. of Information Processing, Graduate School, Tokyo Institute of Technology, Nagatsuta, Midoziku, Yokohama 227, Japan), J. opt. Soc. Amer. 68/12, 1767-1771, 1978.

In a "successive brightness matching experiment" the luminous efficiency of a monochromatic light was established by using a modified heterochromatic brightness matching technique of flicker photometry. The subject compared the brightness of a monochromatic and a standard white stimulus which appeared in turn on extremely low flicker frequency, well below CFF. Using a frequency of 0.5 Hz the results showed a favorable agreement with the normal direct brightness matching, when applying the equal brightness criterion. With a 2 Hz frequency and by using the criterion of minimum flicker perception at the transition point of one light to another the function agreed perfectly with flicker photometry. Increasing the frequency, at about 4 to 6 Hz, the successive brightness matching converges to the normal flicker photometry. The transient 4 to 6 Hz indicated the cutoff frequency of the chromatic channel of the visual system. - Ingeborg Schmidt.

Opponent chromatic mechnisms : relation to photopigments and hue naming, by J.S. WERNER and B.R. WOOTEN (Walter S. Hunter Laboratory of Psychology, Brown University, Providence, Rhode Island 02912, USA) J. opt. Soc. Amer. 69/3, 422-434, 1979.

The observers were three young color-normal females. All sessions began with 15 minutes dark adaptation. Monochromatic stimuli between 400 and 700 nm (in 10 nm steps), equated for retinal illuminance of 2.5 log tr, were presented in random order as 1 s flashes with at least 20 s intervals between flashes. No background was used. The observers were instructed to describe the percentage of red, green, yellow or blue in each stimulus. From the hue naming data the loci for unique hues of blue, green and yellow could be determined within approximately 10 nm. - In opponent hue cancellation tests a monochromatic stimulus to be cancelled was superimposed on the cancelling monochromatic beqm. The stimuli were 1 s monochromatic flashes at 2.5 log tr. Test and cancelling stimulus went on and off together. The cancelling stimuli were chromatically opponent to the stimulus to be cancelled. They were the observers unique blue, green and yellow and a 670 nm spectral light. The energy of the cancelling stimulus was increased or decreased by a neutral density wedge until it just cancelled out the opponent hue. - The results showed that the hue scaling was accurately predicted from the cancellation functions using the model of Hurvich and Jameson (J. opt. Soc. Amer. 58, 429, 1968).
Theoretical curves were generated to fit the chromatic response functions with a linear combination of three theoretical cone photopigments (μ_{max} α = 435, β = 530, γ = 562 nm). Good linear fits were obtained for the red-green curves but not for the yellow-blue curves. A nonlinear model was used to fit the yellow-blue response functions with the three theoretical photopigments. - Ingeborg Schmidt.

Additivity failures in heterochromatic brightness matching, by P.K. KAISER and G. WYSZECKI (Department of Psychology, York University, Downsview, Ontario, Canada, M3J1 P3) Color Research and Application 3/4, 177-182, 1978.

The paper concerns the often poor correlation between luminance and perceived brightness. By means of a variation of the traditional experimental procedures, Guth (S.L. Guth, Photometric and colorimetric additivity at various intensities, in : AIC Proc. Color 69, Muster-Schmidt Verlag Göttingen, 1970, p. 172) has shown that two types of additivity failure can occur in heterochromatic brightness matching : 1) of the enhancement type 2) of the cancellation type. The authors found that these two types of failure can also be deduced by calculation from brightness-matching data obtained by the traditional experimental procedure. The results seem to depend strongly upon the individual observer. Guth observed additivity failure of the cancellation type between 500 and 600 nm whereas the new data of the authors suggest that in that region additivity holds fairly well. - Ingeborg Schmidt.

Enhancement of luminance flicker by color-opponent mechanisms, by P. GOURAS (Columbia University, College of Physicians and Surgeons, 630 West 168th Street, New York 10032, USA) and E. ZRENNER (Max-Planck-Institute for Physiological and Clinical Research, W.G. Kerkchoff Institute, Parkstrasse 1, D-6330 Bad Nauheim, West Germany), Science 205, 587-589, 10.8.1979.

Color-opponent ganglion cells in the monkey retina respond to luminance flicker at high temporal frequencies. Color opponency, which makes these cells so selective of wavelength at low temporal frequencies, is progressively lost at high frequencies. This loss is due to a frequency -dependent phase shift between the responses of spectrally different center and surround mechanisms in the receptive field of each of these cells. Center and surround responses, which are antagonistic at low temporal frequencies, become synergistic at high ones, making these cells most responsive at high frequencies to those wavelengths to which they are least responsive at low frequencies. This phenomenon can explain the differences between chromatic and luminance flicker in human vision. - The Authors.

Luminance, not brightness, determines temporal brightness enhancement with chromatic stimuli, by R.W. BOWEN and M.J. NISSEN (Department of Psychology, Loyola University of Chicago, Ill. 60626, USA), J. opt. Soc. Amer. 69/4, 581-584, 1979.

The relation between brightness and duration for spectral lights was studied using chromatic equal luminance pulses (32 cd/m^2) : 1) presented as increments of 0.3 or 1.0 lg units above a lower luminance achromatic background 2) presented in hue substitution, equated in luminance to the achromatic background. The incremental pulses produced temporal brightness enhancement (Broca-Sulzer phenomenon), hue substitution pulses did not. Temporal brightness enhancement thus depends upon the occurence of luminance transients. - Ingeborg Schmidt.

Line elements and physiological models of color vision, by J.J. VOS (Institute for Perception TNO, Soesterberg, The Netherlands) Color Research and Application 4, 208-216, 1979.

A survey is given of the development of line elements describing color discrimination, in conjunction with the development of physiological models of color vision. It is shown that the cross fertilization between both developments has sharpened our view on color vision mechanisms, rather than improved the accuracy of predicting color discrimination data - the latter having been rather satisfactory throughout. - The Authors.

Detection threshold for lights of varying purity, by Th.J. GAST and St.A BURNS (Institute for Research in Vision and Department of Biophysics, The Ohio State University, Columbus, Ohio 43210, USA), J. opt. Soc. Amer. 69/4, 632-637, 1979.

By manipulating the time during which a substitution stimulus is presented, it can be made visible (for long duration) or invisible (short duration). Duration thresholds for hue substitution stimuli of various wavelengths and colorimetric purity were determined. The color-normal observer viewed a 10° white field of 8 td in Maxwellian view. The central 1.2° field could be exchanged for a chromatic field. The subject controlled the duration of the pulsed change in chromaticity. Stimulus durations as low as 5ms could be achieved. Chromatic stimuli were mixtures of white (matched to the 10° field) and various monochromatic wavelengths. Four levels of colorimetric purity were used. All chromatic stimuli were matched in luminance to the 10° field. It was found that the duration thresholds were inversely related to the colorimetric purity and also that short wavelength sensitive cones can contribute to the detection of low purity, short duration (5ms) stimuli. A figure shows the difference between the functions at short wavelenghts of normals and a theoretical tritanopic purity detection. - Ingeborg Schmidt.

Factors affecting the detection of simple coloured stimuli, A review of psychophysical research, by J. VOKE (King Faisal University, Dammam, Saudi Arabia), The Ophthalmic Optician, 526-528, 7.7.1979.

A number of studies have been devoted to investigating the effect of specific variables involved in the detection and recognition of simple coloured lights; the obvious stimulus parameters of duration, luminance, area and simultaneous colour contrast have received most attention, observer variations such as state of adaptation have received less attention. This paper reviews some of these studies. - The Author.

Binocular color fusion limit, by M. IKEDA and K. SAGAWA (Department of Information Processing, Graduate School, Tokyo Institute of Technology, Nagatsuta, Midori-ku, Yokohama 227, Japan), J. opt. Soc. Amer. 69/2, 316-321, 1979.

The purpose of the study is to find the maximum magnitude of wavelength difference that ensures binocular color fusion. A haploscope was used with two identical optical pathways to the left and right eye. Binocular fusion was obtained by an annular aperture of 2° with a central circular aperture of 1° for the test stimuli. In a first experiment 17 interference filters in the wavelength range from 500 to 660 nm in about

10 nm steps were paired with a colored light to establish the binocular color fusion limit $\Delta\lambda$ at various wavelengths. In experiment 2 a white light was presented to the right eye and colors of various purities produced by Wratten filters to the left eye. A purity difference ΔP_e was determined. The criterion for the limit was the wavelengths difference beyond which no homogenous color was obtained. The duration of a test light was 15 s, the luminance level 0.4 cd/m^2. $\Delta\lambda$ varied from about 10 to 50 nm depending on wavelength region investigated; also in experiment 2 the value was quite large. The results suggest that the tolerance for color difference is fairly lenient as far as binocular color fusion is concerned. - Ingeborg Schmidt.

Evaluation of color difference equations : a new approach, by R. Ch. ZELLER and H. HEMMENDINGER (Hemmendinger Color Laboratory, Belvidere, New Jersey 07823, USA), Color, Research and Application 4/2, 71-77, 1979.

The evaluation of various color-difference equations was approached by directing the attention to specific regions of color space in which there are substantial anomalies in the differences predicted by some formulas. The authors deduce from their findings that evaluations of color difference equations should include a consideration of observer differences, even for observers with normal color vision. The studies indicate that in some cases improper weighting of lightness may be more serious than determining the optimum equation for calculating chromaticness differences. - Ingeborg Schmidt.

A study of the Stiles-Crawford(S-C) function at 35° in the temporal field and the stability of the foveal S-C function peak over time, by H.E. BEDELL and J.M. ENOCH (Department of Ophthalmology and Center for Sensory Studies, University of Florida College of Medicine, Box J-284 JHMHC, Gainesville, Florida 32610) J. opt. Soc. Amer. 69/3, 435-442, 1979.

On 3 normal observers the directional sensitivity of the retina (Stiles-Crawford function of the first kind) was measured at the point of fixation and 35° peripherally, between optic nerve head and ora serrata. Directionality at the two points was rather similar. Obviously the retinal receptors align approximately with the center of the exit pupil of the eye (i.e. the aperture of the eye). The comparison between S-C peak loci in the entrance pupil over years (observed for appr. 17 years) shows little shift in the position of the peak. - Ingeborg Schmidt.

Using color substitution pupil response to expose chromatic mechanisms, by V.D. SAINI and G.H. COHEN (Dept. of Electrical Engineering and Center for Visual Science, Hopeman Bldg., University of Rochester, Rochester, N.Y. 14627, USA) J. opt. Soc. Amer. 69/7, 1029-1035, 1979.

When two scotopically balanced fields at different wavelengths are alternated, the pupil shows a constriction response at each transition. This indicates pupillary innervation from chromatic mechanisms. Using a suitable model for pupillary innervation this substitution response was studied for different wavelengths and radiant power levels to yield spectral threshold curves for the chromatic mechanisms. The spectral peaks found were near 450, 525, 580 and 495 nm. The authors propose that these represent the blue, green, red and scotopic mechanisms as manifested before the level of the lateral geniculate body. The spectral peaks do not agree exactly with those obtained by other researchers. However it must be remembered that the mechanisms in question are defined in terms of pupil response. - Ingeborg Schmidt.

The color evoked potential and comparison of monocular and binocular effects, by T. WHITE, Ch.L. WHITE and R.W.HINTZE (Dept. of Ophthalm. a. Pediatrics, University of California Medical Center, San Diego, California 92103, USA), Intern. J. Neuroscience 8, 205-217, 1979.

Evoked potentials (EP) elicited by the three basic colors show markedly different temporal characteristics. This effect is shown in new data together with a review and some replications of earlier studies. Under moderately light-adapted conditions the three color specific components of the response are 20 msec apart : red, green and then blue. There are also marked interactions among these components, being manifested in our studies by significant variations in the latencies of the later components (green and blue). Color specific components of the EP are enhanced by both binocular summation and by unusual electrode montage. The latter suggest that the color EP may be in part a record of subcortical processes. Monocular and binocular comparisons were made under a variety of stimulus conditions. This approach is a highly sensitive measure of individual differences in color strength and weaknesses, even among color-normal individuals. - The Authors.

Color identification and nomenclature : a history, by F. BIRREN (184 Redford Str., Stamford, Conn. 0690, USA) Color, Research and Application, 4/11, 14-18, 1979.

A brief description of some of the more important collections of colors assembled to establish graphic records of color identities and color names, from the oldest collection by Antonius Thylesius, Libellus de coloribus, Paris 1524 to "Color : universal language and dictionary of names" by K.L. Kelly and D.B. Judd (US Dept. of Commerce, National Bureau of Standards), 1976. Also listed are color standards in various countries. - Ingeborg Schmidt.

New Japanese color system: Chroma Cosmos 5000

To celebrate the 50th anniversary of the founding of the Japan Color Research Institute (1928-1978), a remarkable color system has been developed. It probably is - and will remain for some time - the most elaborate collection of mounted color samples ever put together in orderly fashion : 5000 individually coated and individually mounted chips!

In explanation of the name Chroma Cosmos 5000, an introduction to the System states, "Cosmos means the universe as a complete system; it is the antonym of chaos... We have confidence that it will be an ideal system of color which brings order and harmony into its abundance of various colors."

The Munsell System of notations has been followed for the most part, and the ISCC-NBS Method of Designating Colors has been used (in transparent overlays) to name colors and groups of colors in simple English terms.

Let me describe the physical format of Chroma Cosmos 5000.

There are 23 double charts measuring 10 1/4 x 29 inches (26 x 74 cm), or 10 1/4 x 14 1/2 inches folded (26 x 37 cm). Plus a 24th chart having an introduction and explanation. The charts are bound in blue plastic and are contained in a blue, cloth-bound case.

5,000 individually mounted chips measure about 1/2 x 1 inch (11 x 22 mm) each.

In organization there are 18 value steps, 1.0 to 9.5, having intervals of 0.5.

There are 14 chroma steps, 1 to 14, with intervals of 1.0.

Each chart (or double chart) contains a full array of colors of different value but equal chroma.

In general 48 key hues are represented. Chart I, of weak chroma, however, has 20 key hues; chart 2 has 40. Most other charts have 48 key hues. Then as chromas grow stronger, the number of key hues diminishes as blue-greens, greens and blues are dropped. The last chart, devoted to red, orange, yellow, of vived chroma, has 16 key hues.

All these steps and sequences are subtly and beautifully ordered, and perceptable differences are remarkably uniform in any direction -up or down in value, across in chroma, or around in hue.

How does Chroma Cosmos 5000 compare with other well known systems? Among those having individual chips (not printing ink screens or halftone overlaps), Munsell in the gloss edition has about 1,550. Ostwald in the Container Corporation edition had about 900. Plochere has about 1,250; the Muller Swiss Atlas has about 1,300.

Where printing inks are involved in which a minimum number of basic impressions are used and these combined in halftone screens, large numbers are possible, but never precise or distinct. The Maerz and Paul Dictionary of Color has about 7,000 such tones; the Villalobos Color Atlas has about 7,300; but in neither system are the individual colors clearly defined.

To this writer, the new Japanese Chroma Cosmos 5000 system has a number of excellent merits.

Those who designed and executed it under the direction of Takashi Hosono, Chairman of the Board of Directors of the Japan Color Research Institute, were quite knowledgable of previous efforts in the field of color organization. In a comprehensive introduction, references are made to Munsell Renolations, the efforts of the Optical Society of America, The Inter-Society Color Council, the U.S. National Bureau of Standards, the CIE. As mentioned, all notations are in Munsell designations, and the English terms on the overlays respect the widely accepted ISCC-NBS method. All this holds international interest and gives the System international application.

The visual organization of Chroma Cosmos 5000 is beautiful to behold. Whereas the charts of most color systems feature variations of individual hues, their tints, shades, tones, the charts of Chroma Cosmos 5000 run the full gamut of the spectrum from red to violet and purple, but on each chart chroma is uniform.

The new Japanese System thus lends itself to infinite color harmonies of ideal balance.

It allows for the accurate designations (numbers and letters only) to identify 5000 different colors, and all these in Munsell terms so well known and highly regarded in the world of color.

For further information about the System and its cost in any currency, write Japan Color Research Institute, 1-19, Nishiazabu 3 Chome, Minato-Ku, Tokyo 106, Japan. - Faber Birren. From Inter- Society Color Council News 257, p. 7, Nov.-Dec. 1978.

Color vision of children : Studies on development of the color discrimination ability and blue vision. Discussion on hue arrangement test, by K. OHTANI (Department of Ophthalmology, Tokyo Medical College), Acta Soc. ophthal. jap. 82, 724-735, 1978.

The color discrimination ability was tested on 489 children from 6 to 12 years of age who had normal color vision. In the experiment were used Farnsworth Panel D-15 and 100 hue test (developed in Japan) consisting of 96 hues and the principle being based on F-M 100 hue test. The following results were obtained.

1) Panel D-15 test revealed that the color discrimination ability of the child reached at the same level of the adult after 10 years of age. 4.70% of the children were doubted blue perception decrement. When dividing the color into two groups, i.e., the cold color group from reference cap to chip number 7 and the warm color group from chip number 8 to 15, and comparing the results between these groups, the error was frequently found in the warm color group.

2) In the 100 hue test, the color discrimination ability remarkedly increased following the increase of age. The results were tested as to the variance and the mean in every age group and the results were found to be significant with a level of 1%. Also, the results were tested as to the variance and the mean in the same age group, as dividing into three hue regions of green, blue and purple-blue; the results were not said to be significant with a level of 5%. According to the 100 hue test, the level of the child is estimated to reach at the same

level of the adult after 12 years of age.
3) The fact that children who were doubted blue perception decrement decreased following the increase of age in Panel D-15 test is coincident with the fact that the color discrimination ability increased following the increase of age in the 100 hue test. - Yasuo Ohta.

Screening of red-green defects of colour vision with pseudoisochromatic plates, by E. AARNISALD (Dept. of Ophthalmology, University Hospital, Turku, Finland), Acta ophthal. (Kbh) 57/3, 397-407, 1979.

Fifty red-green colour defectives and 100 colour normals were studied with four series of pseudoisochromatic plates : Boström-Kugelberg first and second edition, Ishihara 38 plates edition 1976, and Boström II B. Diagnosis was achieved with the aid of Nagel's anomaloscope. No colour normals were misdiagnosed as defectives but some (most with the Boström II B series) erroneously classified as borderline cases. Among the defectives, some anomalous trichromats were falsely classified as borderline cases or normals with each of the series. Results in best accordance with the anomaloscope were obtained with the Boström II B series. The combination of two series did not approve diagnosis. Qualitative diagnosis was possible in 64% using the Ishihara plates. Results obtained with the single plates of the four series are presented; data shows that in the second edition of the Boström-Kugelberg series five plates are less efficient and two plates more efficient than the corresponding plates of the first edition. Comment : The first edition of the Boström-Kugelberg plates and the Boström II B are low-saturated. Owing to this fact and the long exposure time allowed, testing is tedious and the number of misdiagnosed normals high in older age-groups (age range was 19-36 years in the present study). None of the Swedish series are presently available from the publisher. A new printing of Boström-Kugelberg's plates is planned, hopefully including a colorimetric study of the plates. - Anders Hedin.

New pseudoisochromatic plates for congenital color vision defects, by S. TANABE (Department of Ophthalmology, Nagoya First Red Cross Hospital), H. ICHIKAWA (Department of Ophthalmology, Nagoya University School of Medicine), K. HUKAMI (Department of Ophthalmology, Kyoto Prefectural University of Medicine) and G. KAWAKAMI (Japan Color Research Institute), Jap. J. clin. Ophthal. 32, 479-487, 1978.

New pseudoisochromatic plates were designed in order to facilitate the detection of color vision defects and the determination of the type of the defet.

Our set consists of 6 plates. Four of the 6 plates are intended for screening-detection and the other two for classification. For each group there are two kinds of plates composed of different sets of colors which would cover possible individual variations of the defective color vision. Numeral characters, as are currently used in digital instruments, are used as figures of the plates. 369 proven color defective and 58 normal subjects were examined with the plates. With the use of the 4 plates for screening-detection, all the color defective subjects, including those with minimal defects, were sharply separated from the normal subjects. Classification into protan and deutan was correctly made for 92% of the color defective subjects.

These preliminary results are highly encouraging. - Yasuo Ohta.

Evaluation of the Ishihara-Okuma's test plates in congenital color defectives, by H. KATO and R. SEKI (Department of Ophthalmology, Dokkyo University School of Medicine), Jap. J. clin. Ophthal. 32, 1134-1137, 1978.

A critical evaluation of the new Ishihara-Okuma's test plates (1974) through clinical studies of 167 subjects with congenital color defects. The subjects were also examined by means of Nagel's anomaloscope, Ishihara's Color Test Plates (international edition), Okuma's Color Test Plates, TMC Color test plates and Panel D-15 test.

Regarding the accuracy in determining the type of the defect of color vision, the Ishihara-Okuma's test plates were as useful as Okuma's test plates but was inferior to the TMC test plates.

In respect to determination of the degree of the defect, the Ishihara-Okuma's plates tended to underestimulation than Okuma's or TMC test plates. Only 9.1% of protanopes and 39.6% of deuteranopes were assigned to the category of severe color vision defect by the new test plates. For the determination of degree of milder defect, on the other hand, the Ishihara-Okuma's test plates gave more reliable values than other test plates. These findings indicate that it is advisable to use more than one test method in the clinical evaluation of color defects in order to minimize misclassification of the degree of the defect. - Yasuo Ohta.

Inter-eye comparison on the 100 hue test, by P.A. ASPINALL (Dept. of Architecture, Heriot Watt University, Lauriston Place, Edinburgh EH3 9DF, Scotland), Acta ophthal. 52, 307, 1974.

This paper illustrates the considerable effect of non-visual factors on 100 hue test scores within normal population limits, and establishes norms of inter-eye comparison in clinical situations for error scores below 200. Test administration was designed to ensure that learning or fatigue effects did not disproportionately affect the scores for either eye. A square root tranformation normalised the data and the criteria for normality were :

$\sqrt{\text{Eye 1}} - \sqrt{\text{Eye 2}} \geq 2.99$ for $p < .01$; and

$\sqrt{\text{Eye 1}} - \sqrt{\text{Eye 2}} \geq 2.27$ for $p < .05$.

Thus for example if Eye 1 produces 49 errors, Eye 2 must exceed 100 errors before it can be considered to have significantly poorer colour discrimination at p .01. - The Author.

The 40-hue test (Le test 40-hue), by P. LANTHONY (15 bis boulevard du 14 juillet, F-10000 TROYES, France), Bull. Socs Ophtal. France 78, 339-341, 1978.

Presentation of the 40-hue test, abbreviated version of the Farnsworth 100-hue test. Comparison of the two tests. The 40-hue is quick, sufficiently sensitive for clinical purpose, and don't require calculation. - The Author.

The Color Aptitude Test -1978 vs. 1964.

The ISCC delegation from the Federation of Societies for Coatings Technology is in the process of comparing the 1978 version of the Color Aptitude Test with the 1964 version. To date 49 observers have been tested, 45 with normal vision and 4 with color defective vision.

Ten observers at CIBA-GEIGY and ten at PPG took the same two tests. Ten observers at Sherwin Williams continued with the same 1978 version but a different 1964 version. Likewise, the last 19 observers at DeSoto also took the same 1978 version with a different 1964 version. An effort will be made to obtain 30 more observers this fall and winter. Although the overall scores for the first 20 observers resulted in a sum of the differences (1978 score-1964 score) of -1, the next 25 normal color vision observers weighted the sum of the differences to a +89 which is an average increase almost two for the 1978 test. Twenty-four observers achieved higher scores on the 1978 version; 19 had higher scores on the 1964 version and two observers scored the same on both versions. Those results do not show an overwhelming trend in favor of higher scores in the 1978 version. However, when the individual scores for each color row are examined, definite trends are observed. Seventy-three percent of the observers had high scores on the 1979 test for both the blue and the tan (yellow) chips while 62 percent scored higher on the 1964 tests for the red and 67 percent were higher on the green on 1964 tests.

While the trends "cancel" for the overall effect, questions remain as to the origin of the trends and their effects on the original validations. Hopefully these questions will be answered as more observers take these tests. - From Inter Society Color Council News 262, p. 7, sept-oct. 1979.

Studies on colour naming test for congenital colour defectives. Report 3. Examinations on a black background, by K. HUKAMI (Department of Ophthalmology, Kyoto Prefectural University of Medicine, Japan), Jap. J. Ophthal. 32, 649-653, 1978.

In the previous paper, colour naming tests using pigment colours on a white background were applied to congenital colour defectives. In this paper, the same tests on a black background were attempted to 15 deuteranopes, 10 protanopes, 31 deuteranomals and 6 protanomals. Test targets made of coloured papers were 1.5 mm, 4.0 mm and 26.0 mm in diameters. Hues using this test were yellow, blue, red, green, orange, purple, brown and gray. Test distance was 75 cm.

Results of these experiments were compared with those of the previous experiments. Yellow was slightly mistaken by congenital colour defectives, especially lesser on the black background. Blue was also slightly mistaken. Noteworthy, on the black background it was mistaken for purple. Red was relatively lesser mistaken. But by protanopes the smallest target (1.5 mm in diameter) was mistaken for black or gray on the white background. On the black background, however, it was not mistaken. This fact is interpreted that protans have a low sensitivity for long wavelength lights. Green was mistaken for orange on the white background and for yellow on the black. Orange was more mistaken on the black background than on the white. Purple was mistaken for blue. Brown was frequently mistaken, especially on the black background. Incorrect answers by dichromats were not related with the size of targets. Gray was also frequently mistaken to all size of targets, for green on the white background and for orange or pink on the black. - Yasuo Ohta.

<u>On the fundamental data-base of normal and dichromatic color vision</u>, by O. ESTEVEZ (Laboratorium voor Medische Fysica, Universiteit van Amsterdam, Herengracht 196, Amsterdam, The Netherlands), Doctorate Thesis in Mathematics and Natural Sciences presented on 19.12.1979 at the University of Amsterdam, published by Krips Repro Meppel, Amsterdam, 1979, 147 p.

The validity of the 1931 CIE Standard Observer as representative of average normal trichromatic color vision is investigated. The most serious problem concerns the synthesis of colorimetric with photometric data to obtain the Standard Observer color-matching functions. It is argued that the hypothesis that links photometry to colorimetry is false : the photometric function V_λ is not a linear combination of the color-matching functions.

The modification of the Standard Observer proposed by Judd (1951) intended only to improve the adequacy of the V_λ function as a photometric standard and did not succeed in removing the basic faults of the CIE colorimetric system.

From a comparison of the chromaticity coordinates of spectrum colors measured by Wright (1928-1929) and by Guild (1931), upon which the Standard Observer was based, with those of Stiles and Burch (1955), it is concluded that the three studies are in reasonable agreement. Since the data of the Stiles and Burch (1952) 2° study are the only complete set of color-matching functions, it is recommended that these data should be preferred as representative of average normal trichromatic color vision.

The question of dichromacy as a reduced form of normal trichromatic color vision is also examined. It is shown that a number of problems that has been interpreted in the literature as evidence against the reduction hypothesis of tritanopia are in fact consequences of the inaccuracies of the CIE Standard Observer; a re-interpretation of tritanopic data in terms of the Stiles and Burch 2° data does not contradict the reduction hypothesis of tritanopia.

Another problem, the controversial data on the deuteranopic confusion point, is also examined in detail. The results of the analysis suggest that it is the structure of the chromaticity diagram itself that is responsible to a large extent for the larger spread of deuteranopic confusion points.

Careful consideration is given, under the reduction hypothesis, to the ways in which passive eye pigments can affect the color-matches of normal and dichromatic subjects. The results suggest that the reduction hypothesis is tenable, and also help to identify the ways in which dichromatic color-matching data can be legitimately averaged.

Finally, the data of a number of studies are used to derive the average confusion points of protanopes, deuteranopes and tritanopes. These values are used to obtain, from the data of Stiles and Burch, the sensitivity functions (for light incident at the cornea) of the receptors of normal and dichromatic color vision! These functions are also corrected for preretinal losses and converted to spectral absorption coefficients of the human cone pigments. - The Author.

<u>Typical and atypical monochromacy studied by specific quantitative perimetry</u>, by E. HANSEN (Dept. of Ophthalmology, Rikshospitalet, University of Oslo, Oslo, Norway), <u>Acta Ophthal. (Kbh)</u> <u>57</u>/2, 211-224, 1979.

Two blue cone monochromats and four rod monochromats were studied using a battery of colour vision pigment tests, the Nagel anomaloscope type I, and a calibrated Nagel anomaloscope type II. Further, the relative spectral sensitivity was measured centrally and peripherally with neutral and coloured backgrounds, and static perimetry was performed with the same types of backgrounds. The typical rod monochromats only showed evidence of receptors with peak sensitivity around 500 nm. The blue cone monochromats also showed a short wavelength receptor with peak sensitivity at about 440 nm. This receptor was only possible to disclose using coloured backgrounds; is was shown to exist as far peripherally as in normals. It is concluded that differentiation between the two types of monochromats is possible by using the two-colour threshold method, either in spectral sensitivity measurements or in perimetry. There was dichromatic colour vision in one of the blue cone monochromats. Evidence of rhodopsin-containing cones (π_0 cones) in both types of subjects is presented. - Anders Hedin.

Vitamin E deficiency and the retina : photoreceptor and pigment epithelial changes, by W.G. ROBISON, T. KUWABARA and J.C. BIERI (National Eye Institute, National Institute of Health, Bethesda Md. 20205, USA), Invest. Ophthal. 18/7, 683-695, 1979.

In the retina of weanling female Sprague-Dawley rats vitamin E deficiency shows damaging effect on rods and cones. The vitamin A status has significant influence on the extent of the damage induced by the vitamin E deficiency. - Ingeborg Schmidt.

Histologic analysis of photochemical lesions produced in rhesus retina by short-wavelength light, by W.T. HAM jr., J.J. RUFFOLO jr., H.A. MUELLER, A.M. CLARKE and M.E. MOON (Dept. of Biophysics, Box 877, Virginia Commonwealth Univ. Richmond, Va 23298, USA), Invest. Ophthalm. a. Visual Sciences 17/10, 1029-1035, 1978.

Extended exposure (1000 sec) of 20 rhesus eyes to low corneal power levels (62 µL) of blue light (441 nm) observed over an interval ranging from 1 hr to 90 days after exposure) resulted in a nonthermal type of photochemical lesion in the retinal pigment epithelium (RPE) and choroid leading to cellular proliferation, mitotic figures and to hypopigmentation of the RPS. The photochemical type of retinal lesion by short wavelength light helps to explain solar retinitis and eclipse blindness, as well as aging and degenerative changes in the retina. Protective filters for blue light and near UV radiation are recommended for those chronically exposed to bright light environment. This is especially important for aphakic persons. - Ingeborg Schmidt.

Sunlight and human cataracts, by S. ZIGMAN, M. DATILES and E. TORCZYNSKI (Department of Ophthalmology, University of Rochester School of Medicine and Dentistry, Rochester N.Y., 14642, USA), Invest. Ophthal. 18/5, 462-467, 1979.

Lenses of humans (40 to 89 years of age) with cortical, nuclear, mixed and brunescent cataracts were studied at three different geographical locations (Manila in the Philippines, Tampa in Florida, and Rochester, N.Y.). The findings support the concept that the brunescent variety of human cataracts results more frequently in outdoor active individuals, especially in locations where the long-wave ultraviolet radiation of sunlight is more prevalent. - Ingeborg Schmidt.

Cone-rod dystrophy : a case report, by L.C. NORDEN, J.F. AMOS and R.D. NEWCOMB (School of Optometry, University of Alabama, Birmingham, Alabama, USA), Amer. J. Optom. 55/12, 824-835, 1978.

A white woman had normal v.a. until approximately 35 years of age. Then she began to notice difficulties in seeing at bright light (photophobia) and in judging colors in addition to a loss of v.a. She was examined at age 45. The result of testing her color vision was as follows : missed all Dvorine and HRR plates, had no specific axis on the D-15 test. The total error score on the 100 hue test was O.D. 748, O.S. 650 and no specific pattern, width of the Rayleigh equation on the Nagel anomaloscope was 73. Based primarly on case history, low v.a. : O.D. 10/100, O.S. 10/180, absolute central scotomas, peripheral scotomatous areas, color vision tests, electroretinography and the pedigree (no manifest cases in the family) the diagnosis was : moderately advanced form of autosomal recessive inherited cone-rod dystrophy. Dense sun glasses and low vision aids were recommended to the patient. - Ingeborg Schmidt.

The differential diagnosis of juvenile hereditary macular degeneration, by S. MERIN, E. AUERBACH and M. IVRY, Metabolic Ophthal. 2, No. 2-4, 191-192, 1978.

Based on anamnesis, clinical examination and a battery of tests which included color vision (Ishihara pseudoisochromatic plates and Farnsworth panel D-15) 75 patients, clinically diagnosed as suffering from juvenile hereditary macular degeneration, were classified into several separate clinical and genetic entities including : Stargardt's disease of early and late onset, progressive cone-rod degeneration, congenital cone deficiency, Best's disease, retinitis pigmentosa and familial dominant drusen. In Stargardt's disease of early onset color vision was defective in the central area, usually along the line of deuteranopia. Results of color vision examination on other patients are not mentioned. - Ingeborg Schmidt.

Cone imputs to ganglion cells in hereditary retinal degeneration, by C.M. CICERONE, D.G. GREEN and L.J. FISCHER (Department of Psychology, University of Michigan, Ann Arbor 48109, USA) Science 203 No. 4385, 1113-1115, 1979.

In rats with progressive degeneration of the retina, of the Royal College of Surgeons strain, the photoreceptor cell layer degenerated but cone nuclei apparently devoid of outer segments were retained. The spectral sensitivities of the single ganglion cell axons recorded in the optic tract do not match that of rhodopsin but rather implicate a cone photopigment (peak at 520 nm). Surviving cone remnants with a store of visual pigment may be the photoreceptive elements in these retinas. - Ingeborg Schmidt.

Drug-induced side effects and drug interactions, by F.T. FRAUNFELDER (Department of Ophthalmology, University of Arkansas Medical Center, Little Rock, Arkansas, 72201, USA). 368 pages, eo & Febiger, Philadelphia, Pa, USA, 1976).

The drugs are classified according to their primary actions. In each category the drugs are arranged alphabetically. Their generic and proprietary names, primary and ocular side effects (including those on color vision), clinical significance and interaction with other drugs are listed. Details of the action of drugs are not given, but numerous references may be helpful. - Ingeborg Schmidt.