DALTONIANA

NEWSLETTER
OF THE INTERNATIONAL RESEARCH GROUP ON COLOUR VISION DEFICIENCIES

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(Verantw. uitg.)

Tweemaandelijks Tijdschrift

Nr. 16 - 1st september 1974

* DO'NT FORGET TO RETURN THE AMSTERDAM 1975 SYMPOSIUM AND AO-HRR ACTION FORMS

* FURTHERMORE ALL MEMBERS ARE ASKED TO SEND MATTERS FOR DALTONIANA (literature abstracts, lists of papers, of colour vision requirements, of commercial colour vision tests, notes, suggestions etc.)

LITERATURE SURVEY

Mechanisms of color vision, by B.V. GRAHAM (Univ. of Alabama School of Optometry, Birmingham, Alabama 35924) J. amer. optom. Ass. 45, 25-30, 1974.

A derivation of modern color vision theory from the Young-Helmholtz and Hering theories with emphasis on Guth's trichromatic opponent colors theory (S.L. Guth, Vision Res. 8, 912, 1968). Discussion of color vision mechanisms involved in wavelength discrimination, hue concellation and hue and saturation sensation both in normal and color deficient observers. As the author has shown in his Ph. D. Dissertation (B.V. Graham, Indiana University, 1972), certain color deficiencies of the peripheral visual field can also be explained within the framework of this theory. - Ingeborg Schmidt.

Three pigments in normal and anomalous color vision, by D.I.A. MAC LEOD and M. HAYHOE (Psychol. Labor., Univ. of Cambridge CB2 3EB, England), J. opt. Soc. Amer. 64, 92-96, 1974.

Color matches of normal and anomalous trichromatic observers, taken together, uniquely determine the spectral sensitivities of the normal red- and green-sensitive pigments for wavelengths longer than about 530 nm. The key assumptions are (1) that a visual match is a match for the pigment; and (2) that one pig-

ment is common to normal and deutan observers, another to normal and protan observers. Calculated spectral sensitivities for these two pigments agree closely with the luminosity curves of protanopes and deuteranopes. Simple (that is with good wavelength discrimination) protanomalous and deuteranomalous observers may share a third (anomalous) pigment. The spectral sensitivity calculated for this pigment is reasonably consistent with recent measurements on anomalous vision. - The Authors.

Behavioral and neurophysiological studies on cat color vision, by A.L. PEARLMAN and N.W. DAW, In "From Nerve to Mind", edited by R.G. GRENELL, Gordon and Breach, New York, 1972, 74-78.

An expositional paper demonstrating the ability of cats to distinguish colors in the photopic range, above the level of rod saturation. Microelectrode study of lateral geniculate and optic tract reveals units having input from two cone types in opponent-color manner. (Paper indicated as originally published in International Journal of Neuroscience. Latter results were published in Science 167, 84-86, 1970). From the Rev. Sens. Dis.

The influence of polarization by electric current on the behavior of ERG curve and behavior of colour discrimination, by O. PALACZ and U. KURPIANOWICZ, Klin. Oczna, 81-85, 1972.

Electroretinographic examinations were carried out in 5 normal persons of both sexes before and during polarization by electric current (in both directions). In the same conditions colour discrimination was examined by means of Nagel's anomaloscope in 19 healthy persons. All cases showed an increase of the b wave and a decrease of the a wave when the change was positive in the anterior pole and negative in the posterior pole. By opposite polarization one observed a diminution of the b wave and a tendency to elongation of the a wave. During the increase of intensity of the current, flowing through the eye from rear to the anterior part, one observed a tendency to deuteranomalia and in inverse conditions to protanomalia.- Felicia Jakubik.

Color deficiency. Optometry and education, by J.N. ZABA (O.D., Norfolk, Virginia) J. amer. optom. Ass. 45/1, 94-95, 1974.

New progressive teaching programs and techniques appear to utilize more color in educational materials, therefore screening for color deficiency, especially with the young child, is very important. If color deficiency is found, not only the parents but also the classroom teacher should be advised. - Ingeborg Schmidt.

Color vision testing, by G.A. FISHMAN. In : The Yearbook of Ophthalmology. Ed. W.F. Hughes, Yearbook Med. Publ.,Chicago, Chpt. The retina p. 227-231, 1973.

On color vision testing in acquired retinal and optic nerve diseases. - Ingeborg Schmidt.

Demarcation of normal from colour defective individuals in examinations by the ophthalmologist (Die Abgrenzung der Farbentüchtigen und Farbenuntüchtigen bei der Untersuchung durch den Augenarzt), by E. HEINSIUS, Klin. Mbl. Augenheilk. 162, 75-80, 1973.

The examiner should exactly follow the directions of use of the anomaloscope and always apply in addition two valuable pigment colour tests. - Marion Marré.

The source of light of the anomaloscope, with a nomogram to calculate the green-red-quotient, by U. HALLDEN (Eye Clinic, Malmö Allmänna Sjukhus, University of Lund, Sweden), Acta ophthal. (Kbh.) 52, 260-265, 1974.

It is shown that the mean reading of the red-green knob of the anomaloscope varies linearly with log lamp voltage. Unexpectedly, the variance of the readings is significantly reduced at voltages lower than the rated (minimum at about 75%). Owing to the changes of colour temperature, it is recommended that the lamp is burned 24 hours before being used and discarded as soon as it darkens. A practical nomogram for calculating the anomalous quotient is presented. - Anders Hedin.

The problem of the practical value of Ishihara's test and of anomaloscopic examination on the basis of the results of examinations of right and left eye in the normal subject, by O. PALACZ, J. GLINSKI and W. KURPIANOWICZ, Klin. Oczna, 1972.

Using the test of Ishihara and Nagel's anomaloscope the authors examined 100 subjects of both sexes. The colour vision was tested separately in each eye in order to detect any possible difference between the eyes in the same subject. In 31% of the cases Ishihara's test disclosed small differences between both eyes which were, however, still within the range of error tolerance. The quotient of anomaly ranged within normal limits in all cases (0.65-1.3). In 50% of the cases the quotient had the same value in both eyes (being exactly 1.0 in 35% of the cases), while in 50% a slight difference existed between both eyes (still between the normal limits). From the practical point of view these small differences are not sufficiently great that one could assume the presence of significant differences in colour vision between the right and the left eye in normal subjects. - Felicia Jakubik.

The value of Farnsworth's 100 hue test for examination of colour discrimination, by Z. JACZYNOWSKA, Klin. Oczna, 87-93, 1972.

It was found on the basis of the performed examinations that the Farnsworth's 100 hue test is valuable as an additional testing method for the early detection of acquired defects and for the differentiation with congenital defects. - Felicia Jakubi

Examination by means of the chronoanomalometer as a method of quantitative determination of congenital colour blindness, by A. MACIEJASZ, Klin. Oczna, 95-98, 1972.

The results of the examination of 202 defectives by means of a chronoanomalometer are presented. The device is a combination of a photographic shutter with a set of 4 colour filters illuminated to 0.25 lx. Anomalous trichromatism was divided in 3 degrees. The suitability of a time parameter in the quantitative evaluation of congenital colour discrimination defects is emphasized. - Felicia Jakubik.

Color vision testing in optometric practice, by A.J. ADAMS (School of Optometry, Univ. of California, Berkeley, California, 94720) J. amer. optom. Ass. 45, 35-42, 1974.

The paper starts with a brief review of acquired and hereditary color vision defects. Detection of a blue-yellow defect should alert the optometrist to the possibility of an acquired color vision deficiency with ocular pathology. Explanation how a red filter improves color discrimination of a red-green defective. The X-chrom contact lens is mentioned. General guidelines for patients testing are recommended, namely to test : (1) all children at an early age since color is used a great deal as an aid to learning mathematics and English (2) all patients on their first office visit, in order to establish a baseline from which acquired color vision defects may occur : each eye should be tested separately (3) all patients with an undiagnosed low visual acuity and all patients who report recent color disturbances or differences between the two eyes. An excellent test battery in the optometric office is provided by the combination of a pseudoisochromatic plate test and the Farnsworth D-15 test. - Ingeborg Schmidt.

Part I. Drugs and chemicals. Drugs and conditions which may affect color vision, by W.M. LYLE (Univ. of Waterloo School of Optometry, Waterloo, Ontario, Canada), J. amer. optom. Ass. 45, 47-60, 1974.

A useful survey not only for optometrists but for everybody who is interested in acquired color deficiencies. The first part consists of some explanatory text. Age-related changes in color vision are reviewed. Reduced illumination, may it be caused by a decrease in general illumination or by a small pupil, produced greater distortions of color perception in persons with any type of color vision defect than in

normals. The same is true for colored filters. Some possible mechanisms of action of drugs are discussed including noxious influences affecting color vision by mechanisms other than by their action on the retinal receptors; optic nerve and visual cortex. The second part consists of 3 tables : table 1 lists drugs and other chemicals that cause toxic amblyopia and/or optic neuritis, optic atrophy and related conditions; typically there is a central scotoma and a red-green type defect. Table 2 includes non-proprietary and trade names of drugs, some possible uses, type of change in color vision and references. Table 3 lists drugs and disease conditions producing chromatopsia. - Ingeborg Schmidt.

Part II, Diseases and conditions, by W.M. LYLE (University of Waterloo School of Optometry, Waterloo, Ontario, Canada), J. amer. optom. Ass. 45, 173-182, 1974.

A through characterization of acquired color vision defects in comparison to congenital forms. The four principal types of acquired color vision defects identified by Verriest are reviewed. The types of defective color vision can be further classified in terms of the severity of the defect. Whether associated with drugs or pathological processes, not all acquired color vision defects can be classified in any simple scheme. Table 4 lists acquired color vision defects associated with diseases, namely : systemic conditions with ocular involvement, conditions principally involving the choroid, cataract and aphakia, retinal vascular conditions, pigmentary disorders of the retina, macular degeneration, other retinal conditions, conditions affecting the optic nerve, chiasma and tract and other ocular conditions. Table 5 lists some disease conditions that cause amblyopia, optic neuritis, optic atrophy, central scotomas and related conditions which generally impair color vision. - Ingeborg Sc midt.

Evolutive aspects of central serous choroiditis (Aspects évolutifs de la choroïdite séreuse centrale), by J.Cl. HACHE, G. CONSTANTINIDES and P. TURUT, Bull. Socs Ophtal. Fr. 72, 257-260, 1972.

A study of the visual functions in central serous chorioretinitis shows that the impairment of colour vision is always important. The score is above 150 at the 100 hue test and a blue-yellow axis is found. Despite the recovery of a good visual acuity, colour vision remains disturbed.- Jean Vola.

Fundus flavimaculatus and vitelliform macular degeneration (Fundus flavimaculatus et dégénérescence vitelliforme de la macula), by P. TURUT, J. Cl. HACHE and M. WOILLIEZ, Bull. Socs Ophtal. Fr. 72, 265-267, 1972.

One observation of fundus flavimaculatus in a family with 13 cases of macular degeneration. Acquired red-green defect. Visual acuity is 20/20. - Jean Vola.

Fluoangiographic aspects of atypical angioid streaks (Aspects fluorescéiniguesdes stries angioïdes atypiques), by P. SOLE, Y. MARTIN, G. SERPIN and F. ROUHER, Bull. Socs Ophtal. Fr. 72, 291-294, 1972.

One case of angioid streaks recognized by coloured fluorescein angiography. Colour vision was normal. - Jean Vola.

Early impairment of macular function in vitelliform macular degeneration (L'altération précoce de la fonction maculaire dans la dégénérescence vitelliforme de la macula), by P. TURUT, Cl. HACHE and P. FRANCOIS, Bull. Socs Ophtal. Fr. 72, 1121-1124, 1972.

In 29 cases colour vision was studied by means of the 100 hue test. In 2 cases colour vision was normal; in the 27 other cases colour vision was impaired (score above 200 even is visual acuity is normal). No specific axis could be detected. - Jean Vola.

Tobacco amblyopia and acquired dyschromatopsia anomaloscope tests, by S.K. BHARGAVA (Manchester Royal Eye Hospital and Department of Ophthalmology, University of Manchester, England), Acta ophthal. (Kbh) 51, 822-828, 1973.

Twelve subjects with tobacco amblyopia were studied with the Pickford-Nicolson anomaloscope and the Farnsworth-Munsell 100 hue test and the results compared to those of a control group. Statisticially significant differences were found for MMP and MR of the red-green anomaloscope equation. The MMP was shifted towards red out of 3 s.d. for the controls and no MR was less than 18 scale units. Error scores of the 100-hue test were also significantly different; the profile being either anarchic, red-green or deutan. High MR was correlated to high error score. The colour vision impairment is judged to be due not only to reduced visual acuity as there was no correlation between visual acuity on one hand and error score or MR on the other hand. - Anders Hedin.

Dominant inherited optic atrophy with color vision defects (Dominant erbliche Optikusatrophie mit Farbeinnstörungen), by E. AULHORN (Tübingen), Klin. Mbl. Augenheilk. 163, 248-249, 1973.

Nine families with dominant inherited optic atrophy are described. Three of these families showed a deutan deficiency, 4 of them a protan deficiency and 1 of them a tritan deficiency. - Marion Marré.

Estimation of gene frequency for dyschromatopsia in a genetic isolate with the Pickford-Nicolson anomaloscope (Estimacion de la frecuencia de los genes de discromatopsia en un aislado étnico con el uso del anomaloscopio de Pickford-Nicolson), by A. RODRIGUEZ and S. ARIAS (Instituto Venezolano de Investigaciones Cientificas, Apartado 1827, Caracas, Venezuela), Acta Cient. Venezolana 22, 199-206, 1971.

Among 574 subjects of both sexes in two different generations studied for the genes of color vision, 64 were found affected with some kind of dyschromatopsia. The frequencies of abnormal genes for males in the parental generation were : 0.113 for DA; 0.014 for EDA; 0.014 for EPA and 0.007 for D, and for males in the offspring generation : 0.13 for DA; 0.016 for EPA; 0.012 for D and 0.007 for EDA. Frequency of dyschromatopsics in the whole population is 0.156, perhaps the highest known for any human population.

The frequency of dyschromatopsic homozygous and/or double heterozygous women was 0.044 for the of spring generation.

Some physical measurements which define main features of the Pickford-Nicolson anomaloscope are presented.

A description is given on the peculiar behavior of deuteranopes, extreme deuteranomals and a few simple deuteranomals regarding yellow brightness with this apparatus. - The Authors.

New families, one with two recombinants for estimation of recombination between the deutan and protan loci, by S. ARIAS and A. RODRIGUEZ (Instituto Venezolano de Investigaciones Cientificas, Caracas, Venezuela), Humangenetik 14, 264-268, 1972.

Using the simplified Edward's maximum likelihood method applied to 35 sons of 9 new families, one of which shows 2 recombinants, 1 normal and 1 compound hemizygotes from a population of German ancestry, an estimate of the recombination fraction between the protan and deutan loci has been attempted, including previous data from the literature.

The new $\hat{r}$ is 0.114 $\pm$ 0.05 from the new data alone and 0.095 $\pm$0.03 from the combined data, which are a little higher than former estimates based on families of smaller size. The distance between the deutan and protan loci might be, within its close proximity, farther apart than previously supposed. - The Authors.

An informative large pedigree with four compound hemizygotes of three combinations of deutan and protan genes, by S. ARIAS and A. RODRIGUEZ (Instituto Venezolano de Investigaciones Cientificas, Caracas, Venezuela), Acta Cient. Venezolana 24, 44-52, 1973.

A large pedigree sampled from an inbred group of German ancestry shows a single gene for extreme protanomaly, in combination with three deutan genes : those for deuteranopia, deuteranomaly and possibly extreme deuteranomaly. Four compound hemizygotes of three combinations, three compound heterozygous mothers of the combination DA/EPA and one mother with the combination D/EPA are briefly described. Three of the compound hemizygotes are recombinants in fairly large individual kindreds; the remaining is a non-recombinant. As much information as possible was included to give a basis for future reference in a progressing research within the same isolate. - The Authors.

Description of three different phenotypes for compound hemizygotes in various combinations of deutan alleles with an identical gene of the protan locus, by S. ARIAS and RODRIGUEZ (Instituto Venezolano de Investigaciones Cientificas, Caracas, Venezuela), Bol. I.N.D.I.O. (Ven.) 1, 97-118, 1973.

The phenotypic features of four compound hemizygotes of genotypes DA/EPA, D/EPA and deutan/EPA (deutan=probably EDA) from three related pedigrees are described and the genetic arguments are laid down to discuss their probable genotypes. Their phenotypic behavior is discussed from the point of view of the interpretation in physiological genetics. The conclusion is that the identical protan gene in all of them is responsible for the phenotype, as the autonomous mutual interaction between itself and the different deutan alleles is manifested in each case, thus denying any epistasis-hypostasis type of phenomenon as has been suggested by other authors. For the first time in man, an EPA gene interaction with several deutan alleles has been unquestionably demonstrated. - The Authors.

Entrainment of the body temperature rhythm in rats : effect of color and intensity of environmental light, by R.A. M GUIRE, W.M. RAND and R.J. WURTMAN (Dept. of Nutrition and Food Science, Massachussets Institute of Technology, Cambridge 02139), Science 181, 956-957, 1973.

The spectral dependence of the systems mediating the photic entrainment of body temperature rhythm in rats was studied. In the rat the onset of darkness is accompanied by a 1° to 2° rise in body temperature which is reversed with the onset of light. A green light (530±45 nm) was most potent and red (660±19 nm) and ultraviolet (360±34 nm) were least potent in entraining the temperature rhythm. The results are compared with the relative spectral sensitivity of rat rhodopsin. - Ingeborg Schmidt.

Visibility of fire fighters, by S.G. SOLOMON (O.D., Owego, New York 13827), J. amer. optom. Ass. 45/2, 137-147, 1974.

Visibility of firemen is not only crucial to their safety but also to the efficiency of the fire fighting organization. The best material to be used for firemen's clothing is fluorescent greenish yellow by daylight and reflex reflective white or silver at night. Such a material is commercially available. Fluorescent colors are brightest under daylight condition but totally ineffective in the dark. Retroreflective material achieves maximum brightness contrast at night and in dark buildings. It can be seen only when viewed along the light beam. It does not glow in the dark, therefore it does not make the fireman more visible to a sniper. The general pattern should be markings on the hands or wrists and feet where motion is maximum combined with vertical and horizontal stripes on the coat and including a job indentification symbol. - Ingeborg Schmidt.

LISTS OF THE PUBLICATIONS ON COLOUR VISION DEFICIENCIES OF MEMBERS OF THE RESEARCH GROUP

52. Papers of Prof. R. LAKOWSKI (Dept. of Psychology, University of British Columbia, Vancouver 8 B.C., Canada)

LAKOWSKI, R. - Age and Colour Vision. Advanc. Sci. 59, 231-237, 1958.

PICKFORD, R.W. & LAKOWSKI, R. - The Pickford-Nicolson Anomaloscope. Brit. J. phys. Opt. 17, 131-150, 1960.

LAKOWSKI, R. - Is the Deterioration of Colour Discrimination with Age due to Lens or Retinal Changes? Farbe, 11, 69-86, 1962. Also in : Tagungsber. int. Farbtag., Düsseldorf, 1961, 2, 293-316, Mu sterschmidt Verlag, Göttingen, 1964.

LAKOWSKI, R. - Colorimetric and Photometric Data for the 10th Edition of the Ishihara Plates. Brit. J. physiol. Opt. 11, 195-207, 1965. Also in : Proc. Colour Congr. Lucerne, 1965, 1, 241-253, Musterschmidt Verlag, Göttingen, 1966.

LAKOWSKI, R. - La Vision des Couleurs. Couleurs, Revue officielle du centre d'information de la couleur et de l'association francaise de colorimétrie, 58, 11-25, 1965.

LAKOWSKI, R. - A Critical Evaluation of Colour Vision Tests. Brit. J. physiol. Opt. 23, 186-209, 1966.

LAKOWSKI, R., HAINING, W.M. & R. PATRIDGE. - Colour Vision Losses in Arthritic Patients in early Stages of Chloroquine Therapy. Visual Laboratory, No. 2 1/2, 1-55, 1968.

LAKOWSKI, R. - The Farnsworth-Munsell 100 Hue Test. Ophthal. Opt. 8, 862-872, 1968. Also in : Austral. Optom., 347-355, 1971.

LAKOWSKI, R. - Theory and Practice of Colour Vision Testing. Brit. J. industr. Med. 26, 173-189, 265-288, 1969.

LAKOWSKI, R. - Psychological Variables in Colour Vision Testing. Proc. Colour 69, 239-250, Musterschmidt Verlag Göttingen, 1970.

LAKOWSKI, R. - Psychological variables in colour vision testing. Proc. Colour 69, 679-686, Mu sterschmidt Verlag, Göttingen, 1970.

LAKOWSKI, R. - Calibration, validation and population norms for the Pickford-Nicolson anomaloscope. Brit. J. physiol. Opt., 26, 166-182, 1971.

LAKOWSKI, R. - The Pickford-Nicolson anomaloscope as a test for acquired dyschromatopsias. Mod. Probl. Ophthal. 11, 25-33, 1972.

LAKOWSKI, R. & ASPINALL, P.A.-Transformation of arbitrary anomaloscope data to the CIE system of specifications. Opt. Acta, 19, 399-403, 1972.

LAKOWSKI, R., BRYETT, J. & DRANCE, S. - Study of Color Vision in Ocular Hypertensives. Canad. J. Ophthal. 7, 86-95, 1972.

LAKOWSKI, R., ASPINALL, P.A. & KINNEAR, P.R. Association between colour vision losses and diabetes mellitus. Ophthal. Res. 4, 145-159, 1973.

LAKOWSKI, R. & DE BECK, J.A. - Age effect in the Burnham-Clarke Munsell Colour Memory test (BCMT). Proc. Colour 73, 406-409, Ad. Hilger, London, 1973.

LAKOWSKI, R. & MELHUISH, P. - Objective analysis of the Luscher colour test. Proc. Colour 73, 486-489, Ad. Hilger, London, 1973.

LAKOWSKI, R. & TANSLEY, B.W. - Energy modification of the Pickford-Nicolson anomaloscope. Mod. Probl. Ophthal. 13, 42-46, 1974.

LAKOWSKI, R. - Effects of age on the 100-hue scores of red-green deficient subjects. Mod. Probl. Ophthal., 13, 124-129, 1974.

LAKOWSKI, R. & OLIVER, K. - Effects of pupil diameter on colour vision test performance. Mod. Probl. Ophthal., 13, 307-311, 1974.

LAKOWSKI, R. & KINNEAR, P.R. - Diagnosis of congenital red-green anomalies in patients with clinical conditions. Mod. Probl. Ophthal., 13, 369-374, 1974.